SUFFOLK, a county of Maffachufetts, fo named from that in England, in which governor Winthrop lived, before he emigrated to America. It contained in 1790, 23 townfhips, 6,335 houfes, 13,038 families, 44,875 inhabitants. In 1793, the county was divided; and now the new county, Norfolk, comprehends all the towns except Bofton, Chelfea, Hull, and Hingham. Suffolk was conftituted a county, May 10, 1643.—*ib.*

SUFFOLK, a county of New-York, L. Ifland, is about 100 miles long, and 10 broad, and comprehends all that part of the State bounded eafterly and foutherly by the Atlantic Ocean, northerly by the Sound, and wefterly by Lloyd's Neck, or Queen's Village, Cold Spring harbour, and the eaft bounds of the townfhip of Oyfter Bay; the line continued fouth to the Atlantic Ocean, including the Ifle of Wight, now called Gardner's Ifland, Shelter Ifland, Plumb Iflands, Robin's Ifland, and the Gull Iflands. Fifher's Ifland alfo belongs to it. It contains 16,440 inhabitants, of whom 1,098 are flaves. There are 9 townfhips, and 2,609 of the inhabitants are electors. Suffolk county court-houfe, is 15 miles from Southampton, 27 from Sagg Harbour, and 80 from New-York city.—*ib.*

SUFFOLK, a poft-town of Virginia, in Nanfemond county, on the eaft fide of the river Nanfemond. It contains a court-houfe, gaol, and about 40 houfes. The river is thus far navigable for veffels of 250 tons. It is 28 miles weft by fouth of Portfmouth, 83 E. S. E. of Peterfburg, 110 fouth-eaft of Richmond, and 386 from Philadelphia.—*ib.*

SUFFRAGE, a townfhip of New-York, fituated in Otfego county, on the north fide of Sufquehannah river; taken from Unadilla, and incorporated in 1796.—*ib.*

SUGAR *Creek*, or *Cæfar's Creek*, a confiderable branch of Little Miami river.—*ib.*

SUGAR *Hill*, a ragged eminence the top of which overlooks and commands the whole works of Ticonderoga, where the waters of Lake George empty into Lake Champlain, and oppofite to Fort Independence, in the State of Vermont. Gen. Burgoyne made a lodgement on this hill, which the Americans efteemed inacceffible; and thus forced Gen. St Clair to abandon the fort in June, 1777.—*ib.*

SUGAR *River*, in Chefhire county, New-Hampfhire, rifes in Sunapee lake, and, after a fhort courfe wefterly, empties into Connecticut river, at Clermont, and oppofite to Afhcutney mountain in Vermont. There is a ftrong expectation of uniting this river, by a fhort canal, with Contocook, which falls into Merrimack river at Bofcawen.—*ib.*

SUGAR-LOAF *Bay*, on the north-eaft fide of Juan Fernandes Ifland; 100 leagues to the weft of the coaft of Chili.—*ib.*

SUGAR, a river of Veragua, which empties into the Bay of Honduras.—*ib.*

SULLIVAN, a townfhip of Chefhire county, New-Hampfhire, containing 220 inhabitants.—*ib.*

SULLIVAN, a poft-town of the Diftrict of Maine, Hancock county, and on Frenchman's Bay, 12 miles north-weft of Goldfborough, 38 W. S. W. of Penobfcot, 310 north-eaft of Bofton, and 645 north-eaft of Philadelphia. The townfhip contains 504 inhabitants.—*ib.*

SULLIVAN, a county of Tenneffee, in Wafhington diftrict. In 1795, it contained according to the State cenfus, 8,457 inhabitants, of whom 777 were flaves.—*ib.*

SULLIVAN'S *Ifland*, one of the three iflands which form the north part of Charlefton harbour, in S. Carolina. It is about 7 miles fouth-eaft of Charlefton.—*ib.*

SULPHUR *Creek, Little*, one of the fouthern upper branches of Green river in Kentucky; and lies fouth-weft of another branch called Bryant's Lick creek. Near this is a fulphur fpring.—*ib.*

SULPHUR *Mountain*, a noted mountain in the ifland of Guadaloupe, famous for exhalations of fulphur, and eruptions of afhes. On the E. fide are two mouths of an enormous fulphur pit; one of thefe mouths is 100 feet in diameter; the depth is unknown.—*ib.*

SULPHURET OF LIME having lately been recommended by an eminent chemift* as a fubftitute for *pot-afh* in the new method of bleaching, which, if it anfwer, may certainly be afforded at lefs expenfe, we fhall here give the method of preparing the fulphuret.

* *W. Higgins, M. R. I. A.*

Take of fulphur, or brimftone in fine powder, four pounds; lime, well flaked and fifted, twenty pounds; water, fixteen gallons:—thefe are all to be well mixed and boiled for about half an hour in an iron veffel, ftirring them brifkly from time to time. Soon after the agitation of boiling is over, the folution of the fulphuret of lime clears, and may be drawn off free from the infoluble matter, which is confiderable, and which refts upon the bottom of the boiler (A). The liquor in this ftate is pretty nearly of the colour of fmall beer, but not quite fo tranfparent.

Sixteen gallons of frefh water are afterwards to be poured upon the infoluble dregs in the boiler, in order to feparate the whole of the fulphuret from them. When this clears (being previoufly well agitated), it is alfo to be drawn off and mixed with the firft liquor; to thefe again thirty-three gallons more of water may be added, which will reduce the liquor to a proper ftandard for fteeping the cloth.

Here we have (an allowance being made for evaporation, and for the quantity retained in the dregs) fixty gallons of liquor from four pounds of brimftone.

Although fulphur by itfelf is not in any fenfible degree foluble in water, and lime but very fparingly fo, water diffolving but about one feven-hundredth part of its weight of lime; yet the fulphuret of lime is highly foluble.

When the above proportion of lime and fulphur is boiled with only twelve gallons of water, the fulphuret partly cryftallizes upon cooling; and when once cryftallized it is not eafy of folution.

SUMANYSTOWN, a village of Pennfylvania, in Montgomery county, fituated on the E. fide of Great Swamp creek, which empties into the Schuylkill above Norriton. It is 33 miles N. W. by N. of Philadelphia.—*Morse.*

(A) Although lime is one of the conftituent principles of the fulphuret, yet being fo intimately united to the fulphur, it has no longer the property of lime; upon the fame principle that fulphuric acid in fulphat of potafh has not the property of that acid.

SUMNER, a county of Tenneſſee, in Mero diſtrict. According to the State cenſus of 1795, it contained 6,370 inhabitants, of whom 1,076 were ſlaves.—*ib.*

SUN (See Astronomy-*Index*, Encycl.) is certainly that celeſtial body which, of all others, ſhould moſt attract our attention. It has accordingly employed much of the time and meditation, not only of the aſtronomer, but alſo of the ſpeculative philoſopher, in all ages of the world; and many hypotheſes have been formed, and ſome diſcoveries made, reſpecting the nature and the uſes of this vaſt luminary.

Sir Iſaac Newton has ſhewn, that the ſun, by its attractive power, retains the planets of our ſyſtem in their orbits; he has alſo pointed out the method whereby the quantity of matter which it contains may be accurately determined. Dr Bradly has aſſigned the velocity of the ſolar light with a degree of preciſion exceeding our utmoſt expectation. Gallileo, Scheiner, Hevelius, Caſſini, and others, have aſcertained the rotation of the ſun upon its axis, and determined the poſition of its equator. By means of the tranſit of Venus over the diſk of the ſun, our mathematicians have calculated its diſtance from the earth, its real diameter and magnitude, the denſity of the matter of which it is compoſed, and the fall of heavy bodies on its ſurface. We have therefore a very clear notion of the vaſt importance and powerful influence of the ſun on its planetary ſyſtem; but with regard to its internal conſtruction, we are yet extremely ignorant. Many ingenious conjectures have indeed been formed on the ſubject; a few of which we ſhall mention as an introduction to Dr Herſchel's, of which, as it is the lateſt, and perhaps the moſt plauſible, we ſhall give a pretty full account nearly in his own words.

The dark ſpots in the ſun, for inſtance, have been ſuppoſed to be ſolid bodies revolving very near its ſurface. They have been conjectured to be the ſmoke of volcanoes, or the ſcum floating upon an ocean of fluid matter. They have alſo been taken for clouds. They were explained to be opaque maſſes ſwimming on the fluid matter of the ſun, dipping down occaſionally. It has been ſuppoſed that a fiery liquid ſurrounded the ſun, and that by its ebbing and flowing the higheſt parts of it were occaſionally uncovered, and appeared under the ſhape of dark ſpots; and that by the return of the fiery liquid, they were again covered, and in that manner ſucceſſively aſſumed different phaſes. The ſun itſelf has been called a globe of fire, though perhaps metaphorically. The waſte it would undergo by a gradual conſumption, on the ſuppoſition of its being ignited, has been ingeniouſly calculated; and in the ſame point of view its immenſe power of heating the bodies of ſuch comets as draw very near to it has been aſſigned.

In the year 1779 there was a ſpot on the ſun which was large enough to be ſeen with the naked eye. By a view of it with a ſeven feet reflector, charged with a very high power, it appeared to be divided into two parts. The largeſt of the two on the 19th of April, meaſured 1′ 8″.06 in diameter, which is equal in length to more than 31,000 miles. Both together muſt certainly have extended above 50,000. The idea of its being occaſioned by a volcanic exploſion violently driving away a fiery fluid, ought to be rejected (ſays Dr Herſchel) on many accounts. "To mention only one, the great extent of the ſpot is very unfavourable to ſuch a ſuppoſition. Indeed a much leſs violent and leſs pernicious cauſe may account for all the appearances of the ſpot. When we ſee a dark belt near the equator of the planet Jupiter, we do not recur to earthquakes and volcanoes for its origin. An atmoſphere, with its natural changes, will explain ſuch belts. Our ſpot on the ſun may be accounted for on the ſame principles. The earth is ſurrounded by an atmoſphere compoſed of various elaſtic fluids. The ſun alſo has its atmoſphere; and if ſome of the fluids which enter into its compoſition ſhould be of a ſhining brilliancy, in the manner that will be explained hereafter, while others are merely tranſparent, any temporary cauſe which may remove the lucid fluid will permit us to ſee the body of the ſun through the tranſparent ones. If an obſerver were placed on the moon, he would ſee the ſolid body of the earth only in thoſe places where the tranſparent fluids of our atmoſphere would permit him. In others, the opaque vapours would reflect the light of the ſun without permitting his view to penetrate to the ſurface of our globe. He would probably alſo find, that our planet had occaſionally ſome ſhining fluids in its atmoſphere; as, not unlikely, ſome of our northern lights might not eſcape his notice, if they happened in the unenlightened part of the earth, and were ſeen by him in his long dark night. Nay, we have pretty good reaſon to believe, that probably all the planets emit light in ſome degree; for the illumination which remains on the moon in a total eclipſe cannot be entirely aſcribed to the light which may reach it by the refraction of the earth's atmoſphere. For inſtance, in the eclipſe of the moon October 22. 1790, the rays of the ſun refracted by the atmoſphere of the earth towards the moon, admitting the mean horizontal refraction to be 30′ 50″.8, would meet in a focus 189,000 miles beyond the moon; ſo that conſequently there could be no illumination from rays refracted by our atmoſphere. It is, however, not improbable, that about the polar regions of the earth there may be refraction enough to bring ſome of the ſolar rays to a ſhorter focus. The diſtance of the moon at the time of the eclipſe would require a refraction of 54′ 6″, equal to its horizontal parallax at that time, to bring them to a focus ſo as to throw light on the moon.

The unenlightened part of the planet Venus has alſo been ſeen by different perſons; and not having a ſatellite, thoſe regions that are turned from the ſun cannot poſſibly ſhine by a borrowed light; ſo that this faint illumination muſt denote ſome phoſphoric quality of the atmoſphere of Venus.

In the inſtance of the large ſpot on the ſun already mentioned, Dr Herſchel concludes, from appearances, that he viewed the real body of the ſun itſelf, of which we rarely ſee more than its ſhining atmoſphere. In the year 1783 he obſerved a fine large ſpot, and followed it up to the edge of the ſun's limb. Here he took notice that the ſpot was plainly depreſſed below the ſurface of the ſun, and that it had very broad ſhelving ſides. He alſo ſuſpected ſome part, at leaſt, of the ſhelving ſides to be elevated above the ſurface of the ſun; and obſerved that, contrary to what uſually happens, the margin of that ſide of the ſpot which was fartheſt from the limb was the broadeſt.

The luminous ſhelving ſide of a ſpot may be explained

Sun. ed by a gentle and gradual removal of the ſhining fluid, which permits us to ſee the globe of the ſun. As to the uncommon appearance of the broadeſt margin being on that ſide of the ſpot which was fartheſt from the limb when the ſpot came near the edge of it, we may ſurmiſe that the ſun has inequalities on its ſurface, which may poſſibly be the cauſe of it. For when mountainous countries are expoſed, if it ſhould chance that the higheſt parts of the landſcape are ſituated ſo as to be near that ſide of the margin or penumbra of the ſpot which is towards the limb, they may partly intercept our view of it when the ſpot is ſeen very obliquely. This would require elevations at leaſt five or ſix hundred miles high; but conſidering the great attraction exerted by the ſun upon bodies at its ſurface, and the ſlow revolution it has upon its axis, we may readily admit inequalities to that amount. From the centrifugal force at the ſun's equator, and the weight of bodies at its ſurface, he computes, that the power of throwing down a mountain by the exertion of the former, balanced by the ſuperior force of keeping it in its place of the latter, is near $6\frac{1}{2}$ times leſs on the ſun than on our equatorial regions; and as an elevation ſimilar to one of three miles on the earth would not be leſs than 334 miles on the ſun, there can be no doubt but that a mountain much higher would ſtand very firmly. The little denſity of the ſolar body ſeems alſo to be in favour of the height of its mountains; for, *cæteris paribus*, denſe bodies will ſooner come to their level than rare ones. The difference in the vaniſhing of the ſhelving ſide, inſtead of explaining it by mountains, may alſo, and perhaps more ſatisfactorily be accounted for from the real difference of the extent, the arrangement, the height, and the intenſity of the ſhining fluid, added to the occaſional changes that may happen in theſe particulars during the time in which the ſpot approaches to the edge of the diſk. However, by admitting large mountains on the face of the ſun, we ſhall account for the different opinions of two eminent aſtronomers; one of whom believed the ſpots depreſſed below the ſurface of the ſun, while the other believed them elevated above it. For it is not impoſſible that ſome of the ſolar mountains may be high enough occaſionally to project above the ſhining elaſtic fluid, when, by ſome agitation or other cauſe, it is not of the uſual height; and this opinion is much ſtrengthened by the return of ſome remarkable ſpots which ſerved Caſſini to aſcertain the period of the ſun's rotation. A very high country, or chain of mountains, may oftener become viſible, by the removal of the obſtructing fluid, than the lower regions, on account of its not being ſo deeply covered with it.

In 1791 the Doctor examined a large ſpot on the ſun, and found it evidently depreſſed below the level of the ſurface. In 1792 he examined the ſun with ſeveral powers from 90 to 500, when it appeared evidently, that the black ſpots are the opaque ground, or body of the ſun; and that the luminous part is an atmoſphere, which, being interrupted or broken, gives us a tranſient glimpſe of the ſun itſelf. He perceived likewiſe, that the ſhining ſurface of the ſun is unequal, many parts of it being elevated and others depreſſed; and that the elevations, to which Hevelius gave the name of *faculæ*, ſo far from reſembling torches, were rather like the ſhrivelled elevations upon a dried apple, extended in length, and moſt of them joined together, making waves or waving lines. The faculæ being elevations, very ſatisfactorily explains the reaſon why they diſappear towards the middle of the ſun, and reappear on the other margin; for about the place where we loſe them, they begin to be edgewiſe to our view; and if between the faculæ ſhould lie dark ſpots, they will moſt frequently break out in the middle of the ſun, becauſe they are no longer covered by the ſide-views of theſe faculæ.

The Doctor gives a very particular account of all his obſervations, which ſeem to have been accurately made, and we need not ſcarcely add with excellent teleſcopes. For that account, however, we muſt refer to the memoir itſelf, and haſten to lay before our readers the reſult of his obſervations. "That the ſun (ſays he) has a very extenſive atmoſphere, cannot be doubted; and that this atmoſphere, conſiſts of various elaſtic fluids, that are more or leſs lucid and tranſparent, and of which the lucid one is that which furniſhes us with light, ſeems alſo to be fully eſtabliſhed by all the phenomena of its ſpots, of the faculæ, and of the lucid ſurface itſelf. There is no kind of variety in theſe appearances but what may be accounted for with the greateſt facility, from the continual agitation which, we may eaſily conceive, muſt take place in the regions of ſuch extenſive elaſtic fluids.

"It will be neceſſary, however, to be a little more particular as to the manner in which I ſuppoſe the lucid fluid of the ſun to be generated in its atmoſphere. An analogy that may be drawn from the generation of clouds in our own atmoſphere, ſeems to be a very proper one, and full of inſtruction. Our clouds are probably decompoſitions of ſome of the elaſtic fluids of the atmoſphere itſelf, when ſuch natural cauſes, as in this grand chemical laboratory are generally at work, act upon them; we may therefore admit, that in the very extenſive atmoſphere of the ſun, from cauſes of the ſame nature, ſimilar phenomena will take place; but with this difference, that the continual and very extenſive decompoſitions of the elaſtic fluids of the ſun are of a phoſphoric nature, and attended with lucid appearances, by giving out light.

"If it ſhould be objected, that ſuch violent and unremitting decompoſitions would exhauſt the ſun, we may recur again to our analogy, which will furniſh us with the following reflections. The extent of our own atmoſphere, we ſee, is ſtill preſerved, notwithſtanding the copious decompoſitions of its fluids in clouds and falling rain; in flaſhes of lightning, in meteors, and other luminous phenomena; becauſe there are freſh ſupplies of elaſtic vapours continually aſcending to make good the waſte occaſioned by thoſe decompoſitions. But it may be urged, that the caſe with the decompoſition of the elaſtic fluids in the ſolar atmoſphere would be very different, ſince light is emitted, and does not return to the ſun, as clouds do to the earth when they deſcend in ſhowers of rain. To which I anſwer, that, in the decompoſition of phoſphoric fluids, every other ingredient but light may alſo return to the body of the ſun. And that the emiſſion of light muſt waſte the ſun, is not a difficulty that can be oppoſed to our hypotheſis: for as it is an evident fact that the ſun does emit light, the ſame objection, if it could be one, would equally militate againſt every other aſſignable way to account for the phenomenon.

"There are, moreover, conſiderations that may leſſen

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the preſſure of this alleged difficulty. We know the exceeding ſubtilty of light to be ſuch, that in ages of time its emanation from the ſun cannot very ſenſibly leſſen the ſize of this great body. To this may be added, that very poſſibly there may always be ways of reſtoration to compenſate for what is loſt by the emiſſion of light, though the manner in which this can be brought about ſhould not appear to us. Many of the operations of Nature are carried on in her great laboratory which we cannot comprehend, but now and then we ſee ſome of the tools with which ſhe is at work. We need not wonder that their conſtruction ſhould be ſo ſingular as to induce us to confeſs our ignorance of the method of employing them; but we may reſt aſſured that they are not a mere *luſus naturæ*." Here he alludes to the great number of ſmall teleſcopic comets; which he ſuppoſes, as others had done before him, may be employed to reſtore to the ſun what had been loſt by the emiſſion of light. "My hypotheſis, however, (continues he) does not lay me under any obligation to explain how the ſun can ſuſtain the waſte of light, nor to ſhew that it will ſuſtain it for ever; and I ſhould alſo remark that, as in the analogy of generating clouds, I merely allude to their production as owing to a decompoſition of ſome of the elaſtic fluids of our atmoſphere, that analogy, which firmly reſts upon the fact, will not be leſs to my purpoſe, to whatever cauſe theſe clouds may owe their origin. It is the ſame with the lucid clouds, if I may ſo call them, of the ſun. They plainly exiſt, becauſe we ſee them; the manner of their being generated may remain an hypotheſis—and mine, till a better can be propoſed, may ſtand good; but whether it does or not, the conſequences I am going to draw from what has been ſaid will not be affected by it."

Before he proceeds to draw theſe conſequences, he informs us that, according to the above theory, a dark ſpot in the ſun is a place in its atmoſphere, which happens to be free from luminous decompoſitions; that faculæ are, on the contrary, more copious mixtures of ſuch fluids as decompoſe each other; and that the regions, in which the luminous ſolar clouds are formed, adding thereto the elevation of the faculæ, cannot be leſs than 1843, nor much more than 2765 miles in depth. It is true, continues he, that in our atmoſphere the extent of the clouds is limited to a very narrow compaſs; but we ought rather to compare the ſolar ones to the luminous decompoſitions which take place in our *aurora borealis*, or luminous arches, which extend much farther than the cloudy regions. The denſity of the luminous ſolar clouds though very great, may not be exceedingly more ſo than that of our *aurora borealis*. For if we conſider what would be the brilliancy of a ſpace two or three thouſand miles deep, filled with ſuch corruſcations as we ſee now and then in our atmoſphere, their apparent intenſity, when viewed at the diſtance of the ſun, might not be much inferior to that of the lucid ſolar fluid.

From the luminous atmoſphere of the ſun, he proceeds to its opaque body; which, by calculation from the power it exerts upon the planets, we know to be of great ſolidity; and from the phenomena of the dark ſpots, many of which, probably on account of their high ſituations, have been repeatedly ſeen, and otherwiſe denote inequalities in their level, we ſurmiſe that its ſurface is diverſified with mountains and valleys.

What has been ſaid, enables us to come to ſome very important concluſions, by remarking, that this way of conſidering the ſun and its atmoſphere removes the great diſſimilarity we have hitherto been uſed to find between its condition and that of the reſt of the great bodies of the ſolar ſyſtem.

The ſun, viewed in this light, appears to be nothing elſe than a very eminent, large, and lucid planet, evidently the firſt, or, in ſtrictneſs of ſpeaking, the only primary one of our ſyſtem, all others being truly ſecondary to it. Its ſimilarity to the other globes of the ſolar ſyſtem with regard to its ſolidity, its atmoſphere, and its diverſified ſurface, the rotation upon its axis, and the fall of heavy bodies, leads us on to ſuppoſe that it is moſt probably alſo inhabited, like the reſt of the planets, by beings whoſe organs are adapted to the peculiar circumſtances of that vaſt globe.

It may, however, not be amiſs to remove a certain difficulty, which ariſes from the effect of the ſun's rays upon our globe. The heat which is here, at the diſtance of 95 millions of miles, produced by theſe rays, is ſo conſiderable, that it may be objected, that the ſurface of the globe of the ſun itſelf muſt be ſcorched up beyond all conception.

This may be very ſubſtantially anſwered by many proofs drawn from natural philoſophy, which ſhew that heat is produced by the ſun's rays only when they act upon a calorific medium; they are the cauſe of the production of heat, by uniting with the matter of fire which is contained in the ſubſtances that are heated; as the colliſion of flint and ſteel will inflame a magazine of gunpowder, by putting all the latent fire it contains into action. But an inſtance or two of the manner in which the ſolar rays produce their effect, will bring this home to our moſt common experience.

On the tops of mountains of a ſufficient height, at an altitude where clouds can very ſeldom reach to ſhelter them from the direct rays of the ſun, we always find regions of ice and ſnow. Now if the ſolar rays themſelves conveyed all the heat we find on this globe, it ought to be hotteſt where their courſe is leaſt interrupted. Again, our aëronauts all confirm the coldneſs of the upper regions of the atmoſphere; and ſince, therefore, even on our earth, the heat of any ſituation depends upon the aptneſs of the medium to yield to the impreſſion of the ſolar rays, we have only to admit, that on the ſun itſelf, the elaſtic fluids compoſing its atmoſphere, and the matter on its ſurface, are of ſuch a nature as not to be capable of any exceſſive affection from its own rays: and indeed this ſeems to be proved by the copious emiſſion of them; for if the elaſtic fluids of the atmoſphere, or the matter contained on the ſurface of the ſun, were of ſuch a nature as to admit of an eaſy chemical combination with its rays, their emiſſion would be much impeded.

Our author then proceeds to ſupport his theory by analogical reaſoning; but as theſe will occur to ſuch of our readers as are converſant with the ſpeculations of aſtronomers, we paſs on to his reflections upon the conſequences of this theory. "That the ſtars are ſuns can hardly admit of a doubt. Their immenſe diſtance would perfectly exclude them from our view, if the light they ſend

send us were not of the solar kind. Besides, the analogy may be traced much farther. The sun turns on its axis; so does the star Algol; so do the stars called β Lyræ, δ Cephei, η Antinoi, ο Ceti, and many more; most probably all. From what other cause can we so probably account for their periodical changes? Again, our sun has spots on its surface; so has the star Algol, and so have the stars already named, and probably every star in the heavens. On our sun these spots are changeable; so they are on the star ο Ceti, as evidently appears from the irregularity of its changeable lustre, which is often broken in upon by accidental changes while the general period continues unaltered. The same little deviations have been observed in other periodical stars, and ought to be ascribed to the same cause. But if stars are suns, and suns are inhabitable, we see at once what an extensive field for animation opens itself to our view.

"It is true, that analogy may induce us to conclude, that since stars appear to be suns, and suns, according to the common opinion, are bodies that serve to enlighten, warm, and sustain a system of planets, we may have an idea of numberless globes that serve for the habitation of living creatures. But if these suns themselves are primary planets, we may see some thousands of them with our own eyes, and millions by the help of telescopes, when at the same time the same analogical reasoning still remains in full force with regard to the planets which these suns may support."

The Doctor then observes, that from other considerations, the idea of suns or stars being *merely* the supporters of systems of planets, is not absolutely to be admitted as a general one. "Among the great number of very compressed clusters of stars I have given (says he) in my catalogues, there are some which open a different view of the heavens to us. The stars in them are so very close together, that, notwithstanding the great distance at which we may suppose the cluster itself to be, it will hardly be possible to assign any sufficient mutual distance to the stars composing the cluster, to leave room for crowding in those planets, for whose support these stars have been, or might be, supposed to exist. It should seem, therefore, highly probable, that they exist for themselves; and are, in fact, only very capital, *lucid*, primary planets, connected together in one great system of mutual support.

"The same remark may be made with regard to the number of very close double stars, whose apparent diameters being alike, and not very small, do not indicate any very great mutual distance: from which, however, must be deducted all those where the different distances may be compensated by the real difference in their respective magnitudes.

"To what has been said may be added, that, in some parts of the milky way, where yet the stars are not very small, they are so crowded, that in the year 1792, Aug. 22. I found by the gauges that, in 41 minutes of time, no less than 258,000 of them had passed through the field of view of my telescope.

"It seems, therefore, upon the whole, not improbable, that in many cases stars are united in such close systems as not to leave much room for the orbits of planets or comets; and that consequently, upon this account also, many stars, unless we would make them mere useless brilliant points, may themselves be lucid planets, perhaps unattended by satellites."

What a magnificent idea does this theory give of the universe, and of the goodness, as well as power, of its Author? And how cold must be that heart, and clouded that understanding, who, after the contemplation of it, can for one moment listen to the atheistical doctrines of those men who presume to account for all the phenomena of nature by chemical affinities and mechanical attraction? The man who, even in his heart, can say, that such an immense system, differing so widely in the structure of the different parts of it, but everywhere crowded with life, is the effect of unintelligent agency, is indeed, to use the emphatic language of an ancient astronomer—*a fool*.

SUNAPEE, a lake and mountain in Cheshire county, New-Hampshire. The lake is about 8 or 9 miles long, and 3 broad, and sends its waters through Sugar river west, 14 miles to Connecticut river. The mountain stands at the south end of the lake.—*Morse*.

SUNBURY, a county of the British province of New-Brunswick. It is situated on the river St John, at the head of the Bay of Fundy; and contains 8 townships, viz. Conway, Gage-Town, Burton, Sunbury, St Annes, Wilmot, Newton, and Maugerville. The three last of these were settled from Massachusetts, Connecticut, &c. The lands are generally pretty level, and tolerably fertile, abounding with variety of timber.—*ib*.

SUNBURY, the chief town of Northumberland county, Pennsylvania; situated near where Fort Augusta was erected, on the E. side of Susquehannah river, just below the junction of the E. and W. branches of that river, in lat. about 40 52 N. It is regularly laid out, and contains a court-house, brick gaol, a Presbyterian and German Lutheran church, and about 100 dwelling-houses. Here the river is about half a mile broad, and at the ferry opposite Northumberland, about a mile higher, is $\frac{3}{4}$ths of a mile. It is about 76 miles above Reading, and 120 N. W. of Philadelphia.—*ib*.

SUNBURY, a port of entry and post-town of Georgia, beautifully situated in Liberty county, at the head of St Catherine's Sound, on the main, between Medway and Newport rivers, about 15 miles S. of Great Ogeeche river. The town and harbour are defended from the fury of the sea by the N. and S. points of St Helena and St Catherine's Islands; between is the bar and entrance into the sound: the harbour is capacious and safe, and has water enough for ships of great burden. It is a very pleasant healthy town, and is the resort of the planters from the adjacent country, during the sickly months. It was burnt during the late war, but has since been rebuilt. An academy was established here in 1788, which has been under an able instructor, and proved a very useful institution. It is 40 miles S. of Savannah, and 974 from Philadelphia.—*ib*.

SUNCOOK, a small plantation in York county, District of Maine, which with Bromfield contains 250 inhabitants.—*ib*.

SUNDA, STRAITS OF, are formed by the approach of the south-east extremity of the island of SUMATRA to the north-west extremity of the island of JAVA (See these islands, *Encycl.*). The straits are interspersed with a number of ſmall iſles; the whole diſplaying a ſcenery ſcarcely to be exceeded in the ſoftneſs, richneſs, and gaiety of its appearance. The two great iſlands, which are low, and in ſome places marſhy near the ſhore, riſe afterwards, in a gradual ſlope, towards the interior of the country, admitting in their aſcent every variety of ſituation, and all the different tints of verdure. Of the ſmaller iſlands, a few have ſteep and naked ſides, ſuch as one in the middle of the ſtrait, which the Engliſh navigators have diſtinguiſhed, on that account, by the name of Thwart-the-way, and two very ſmall round ones, called, from their figures, the Cap and Button (ſee theſe iſlands, *Suppl.*); but moſt of the others are entirely level, founded upon beds of coral, and covered with trees. Some of theſe iſlands are ſurrounded with a white ſandy beach, viſited frequently by turtle; but moſt of them are adorned with thick ſhrubbery to the water's edge, the roots being waſhed by the ſea, or the branches dipping into it; and on the outſide are ſhoals, in which a multitude of little aquatic animals are buſied in framing calcarious habitations for their reſidence and protection. Thoſe fabrics gradually emerge above the ſurface of the water, and at length, by the adventitious adheſion of vegetable matter, giving birth to plants and trees, become new iſlands, or add to the ſize of thoſe already produced by the ſame means. It is impoſſible not to be ſtruck with the diverſified operations of Nature for obtaining the ſame end, whether employed in originally fixing the granite foundation of the Brazils, or in throwing up, by ſome ſudden and ſubſequent convulſion, the iſland of Amſterdam, or in continuing to this hour, through the means of animated beings, the formation of new lands in the Straits of Sunda.—*Sir George Staunton's Account of the Britiſh Embaſſy to China.*

SUNDERLAND, a townſhip of Vermont, Bennington county, 16 miles N. E. of Bennington, and contains 414 inhabitants. A lead mine has been lately diſcovered in this townſhip.—*Morſe.*

Sunderland, a townſhip of Maſſachuſetts, ſituated in Hampſhire county, on the E. ſide of Connecticut river, about 10 miles N. of Hadley and 100 W. of Boſton. There is here a handſome Congregational church, and 73 houſes, lying chiefly on one ſtreet. It was incorporated in 1718, and contains 462 inhabitants.—*ib.*

SUNNUD, a grant, patent, or charter, in Bengal.

SUPAY URCO, or *Devil's Hill*, a remarkable eminence in the province of Quito, in Peru, between the vallies of Chugui-pata, and thoſe of Paute. It has its name from a fabulous ſtory of enchantment, propagated by a ſuperſtitious Spaniard. It is thought to contain rich mines.—*Morſe.*

SUPERIOR, *Lake*, formerly termed the Upper Lake, from its northern ſituation. It may juſtly be termed the Caſpian Sea of America, and is ſuppoſed to be the largeſt body of freſh water on the globe. According to the French charts it is 1,500 miles in circumference. A great part of the coaſt is bounded by rocks and uneven ground. It is ſituated between 46 and 50 N. lat. and between 84 30 and 92 W. long. The water is very clear, and tranſparent. If the ſun ſhines bright, it is impoſſible through this medium to look at the rocks at the bottom, above a minute or two. Although the water, at the ſurface, is much warmed by the heat of the ſun, yet, when drawn up at about a fathom depth, it is very cold. Storms are more dreadful here than on the ocean. There are many iſlands in this lake; two of them have each land enough, if proper for cultivation, to form a conſiderable province; eſpecially Iſle Royal, which is not leſs than 100 miles long, and in many places 40 broad. The natives ſuppoſe theſe iſlands to be the reſidence of the Great Spirit. Many rivers empty their waters into this mighty reſervoir; of theſe, one is called *Nipegon*, another *Michipicooton.* This lake diſcharges its waters from the S. E. corner through the Straits of St Marie, which are about 40 miles long, into Lake Huron. Lake Superior, although about 40 rivers empty into it, many of which are large, yet it does not appear that one-tenth part of the waters which it receives, is diſcharged by the above mentioned ſtrait: great part of the waters evaporate; and Providence doubtleſs makes uſe of this inland ſea to furniſh the interior parts of the country with that ſupply of vapours, without which, like the interior parts of Africa, they muſt have been a mere deſert. A number of tribes live around Lake Superior, but little is known reſpecting them. The following extract from the journal of a late traveller will be acceptable to the curious.

"Mr M—— about the year 1790, departed from Montreal with a company of about 100 men, under his direction, for the purpoſe of making a tour through the Indian country, to collect furs, and to make ſuch remarks on its ſoil, waters, lakes, mountains, manners and cuſtoms of its inhabitants as might come within his knowledge and obſervation. He purſued his route from Montreal, entered the Indian country, and coaſted about 300 leagues along the banks of Lake Superior, from thence to the *Lake of the Woods*, of which he took an actual ſurvey, and found it to be 36 leagues in length; from thence to the lake *Ounipique*, of which he has alſo a deſcription. The tribes of the Indians which he paſſed through, were called the *Maſkego* tribe, *Shepeweyau*, *Cithiniſtinee*, *Great Belly Indians*, *Beaver Indians*, *Blood Indians*, the *Black-feet Tribe*, the *Snake Indians*, *Oſſnobians*, *Shiveytoon Tribe*, *Mandon Tribe*, *Paunees*, and ſeveral others, who in general were very pacific and friendly towards him, and are great admirers of the beſt hunting horſes, in which the country abounds. The horſes prepared by them for hunters, have large holes cut above their natural noſtrils, for which they give as a reaſon, that thoſe prepared in this manner will keep their breath longer than the others, which are not thus prepared: From experience, knowledge is gained, and the long practice of this cuſtom, conſequently on theſe trials, muſt have convinced them of the truth and utility of the experiment; otherwiſe we can hardly ſuppoſe they would torture their beſt horſes in this manner, if ſome advantage was not derived from the meaſure. In purſuing his route, he found no difficulty in obtaining a guide to accompany him from one nation to the other, until he came to the *Shining Mountains* or *Mountains of Bright Stones*, where, in attempting to paſs, he was fruſtrated by the hoſtile appearance of the Indians who inhabit that part of the country. The conſequence of which was, he was diſappointed in his intention and obliged to turn his back upon them. Having collected a number of Indians he went forward again, with an intention to force his way over thofe mountains, if neceffary and practicable, and to make his way to Cook's river, on the N. W. coaft of America, fuppofed by him to be about 300 leagues from the mountains; but the inhabitants of the mountains again met him with their bows and arrows, and fo fuperior were they in numbers to his little force, that he was obliged to flee before them. Finding himfelf thus totally difappointed in the information he was in hopes to obtain, he was obliged to turn his back upon that part of the country for which his thirfting heart had long panted. Cold weather coming on, he built huts for himfelf and party in the *Offnobian* country, and near the fource of a large river, called the *Offnobian river*, where they tarried during the continuance of the cold feafon, and until fome time in the warmer months. Previous to his departure from Montreal, he had fupplied himfelf with feveral kinds of feeds, and before his huts he laid out a fmall garden, which the natives obferving, called them flaves, for digging up the ground, nothing of that kind being done by them, they living wholly on animal food; bread is unknown to them; to fome he gave fome remnants of hard bread, which they chewed and fpit out again, calling it rotten wood. When his onions, &c. were fomewhat advanced in their growth, he was often furprized to find them pulled up; determining therefore to know from what caufe it proceeded, he directed his men to keep watch, who found that the Indian children, induced by motives of curiofity, came with fticks, thruft them through the poles of his fence, to afcertain and fatisfy themfelves, what the things of the white men were, and in what manner they grew, &c. The natives of this country have no fixed or permanent place of abode, but live wholly in tents made of buffaloe and other hides, and with which they travel from one place to another like the Arabs; and fo foon as the feed for their horfes is expended, they remove their tents to another fertile fpot, and fo on continually, fcarcely ever returning to the fame fpots again."—*ib.*

SUPERPARTICULAR PROPORTION, or RATIO, is that in which the greater term exceeds the lefs by unit or 1. As the ratio of 1 to 2, or 2 to 3, or 3 to 4, &c.

SUPERPARTIENT PROPORTION, or RATIO, is when the greater term contains the lefs term once, and leaves fome number greater than 1 remaining. As the ratio

of 3 to 5, which is equal to that of 1 to $1\frac{2}{3}$;

of 7 to 10, which is equal to that of 1 to $1\frac{3}{7}$; &c.

SUPPLEMENT, OF AN ARCH OR ANGLE, in geometry or trigonometry, is what it wants of a femicircle, or of 180°; as the *compliment* is what it wants of a quadrant, or of 90°. So, the fupplement of 50° is 130°; as the compliment of it is 40°.

SURINAM, a province or diftrict in South-America, belonging to the Dutch.—*Morse.*

SURINAM, a beautiful river of South-America, and in Dutch Guiana; three-quarters of a mile wide at its mouth; navigable for the largeft veffels 12 miles, and for fmaller veffels 60 or 70 miles further. Its banks, quite to the water's edge, are covered with evergreen mangrove trees, which render the profpect very delightful. The entrance is guarded by a fort and two redoubts, but not of any great ftrength. At 6 miles up, the Commanwine falls into it, and on the point of land between the two rivers are the forts. The town of Surinam is in lat. 6 10 N. and long. 55 22 W. The beft anchorage is under Zelandia Fort.—*ib.*

SURRY, a county of N. Carolina, in Salifbury diftrict; bounded eaft by Stokes, and weft by Wilkes. It contains 7,191 inhabitants, including 698 flaves. The Moravian fettlements of Wachovia are in this county. Near the river Yadkin is a forge, which manufactures bar-iron. The Ararat or Pilot Mountain, about 16 miles north-weft of Salem, draws the attention of every curious traveller in this part of the State. It is difcernible at the diftance of 60 or 70 miles, overlooking the country below. It was anciently called the Pilot, by the Indians, as it ferved them for a beacon, to conduct their routes in the northern and fouthern wars. On approaching it, a grand difplay of nature's workmanfhip in rude drefs, is exhibited. From its broad bafe, the mountain rifes in eafy afcent, like a pyramid, near a mile high, to where it is not more than the area of an acre broad; when, on a fudden, a vaft ftupendous rock, having the appearance of a large caftle, with its battlements, erects its perpendicular height to upwards of 300 feet, and terminates in a flat, which is generally as level as a floor. To afcend this precipice, there is only one way, which, through cavities and fiffures of the rock, is with fome difficulty and danger effected. When on the fummit, the eye is entertained with a vaft, delightful profpect of the Apalachian mountains, on the north, and a wide, extended level country below, on the fouth; while the ftreams of the Yadkin and Dan, on the right and left hand, are difcovered at feveral diftant places, winding their way, through the fertile low grounds, towards the ocean.—*ib.*

SURRY, a county of Virginia, bounded north by James river which feparates it from Charles City county, eaft by Ifle of Wight, and weft by Prince George's county. It contains 6,227 inhabitants, of whom 3,097 are flaves.—*ib.*

SURRY, a townfhip of New-Hampfhire, in Chefhire county, containing 448 inhabitants. It lies eaft of Walpole, adjoining, and was incorporated in 1769.—*ib.*

SUSQUEHANNAH *River*, rifes in Lake Uftayantho, in the State of New-York, and runs in fuch a ferpentine courfe that it croffes the boundary line between the States of Pennfylvania and New-York, three times. It receives the Tyoga river in N. lat. 41 57. Afterwards it proceeds fouth-eaft to Wyoming, without any obftruction by falls, and then fouth-weft over Wyoming falls, till, at Sunbury, in lat. 41 it meets the weft branch of Sufquehannah, which is navigable 90 miles from its mouth. From Sunbury the river is paffable with boats to Harrifburg and Middleton on the Swatara. About 15 miles above Harrifburg, it receives the Juniatta, from the north-weft, proceeding from the Alleghany mountains and flowing through a broken country. Hence it takes its courfe about fouth-eaft, until it falls into the head of Chefapeak Bay, juft below Havre de Grace. It is about a mile wide at its mouth, and navigable only 20 miles, the navigation being obftructed beyond that by the Rapids. The inland navigation between Schuylkill and Sufquehannah, will bring by water to Philadelphia, the trade of a moft fertile country of about 1000 miles fquare, or 6,000,000 acres of land. If this can be accomplifhed, an inland navigation may be eafily made to the Ohio and to Lake Erie, which would at once open a communication with above 2,000 miles extent of weftern country, viz. with all the great lakes, together with the countries which lie on the waters of Miffiffippi, Miffouri, and all their branches. The water communication between Schuylkill and Sufquehannah, which is the foul of all this, will be about 60 miles, as the navigation muft go, although the diftance on a line is only 40 miles. This tract is cut by two creeks, the Quitapahilla and the Tulpehoken. Thefe two creeks lead within 4 miles of each other; the level of their head waters is nearly the fame, and the fpace between them makes the height of land, or, as it is commonly called, the *crown land* between the two rivers which is nearly on a plain, and the bottom of the canal, through which the navigation muft pafs, will no where rife more than 30 feet above the level of the head waters of the two creeks above-mentioned, nor fo much as 200 feet above the level of the waters of Sufquehannah or Schuylkill. The Company, inftituted the 29th of Sept. 1791, has a capital of 1000 fhares at 400 dollars each, payable at fuch time as the Company fhall direct. The work is already commenced. Coal of an excellent quality is found on feveral parts of this river, particularly at Wyoming.—*ib.*

SUSSEX, the north-wefternmoft county of New-Jerfey. It is mountainous and healthy, and has feveral iron mines; and works have been erected for the manufacture of bar and pig iron. It produces excellent crops of wheat; and in no part of the State are greater herds of cattle. The produce is floated down the Delaware in boats and rafts. Here are 5 Prefbyterian churches, 2 for Anabaptifts, 1 for German Lutherans, and 1 for Quakers. It contains 12 townfhips; the chief of which are Newton, Greenwich, Hardyfton, Knowltown, and Oxford. The population is 19,500 including 439 flaves. It is bounded N. E. by the State of New-York, N. W. by Delaware river, which feparates it from Northampton county, in Pennfylvania, and fouth-eaft and fouth by Morris and Hunterdon counties. Paulin's Kill is here navigable for fmall craft 15 miles. The Mufconetcony, which divides the county from Hunterdon, is capable of beneficial improvements, as is the Pequeft or Pequafet, between the above-mentioned rivers. The court-houfe in this county is 13 miles fouth-weft of Hamburg; 38 N. E. of Eafton, in Pennfylvania; 41 fouth-weft of Gofhen, in New-York; and 108 N. by E. of Philadelphia. The village at this place is called Newton.—*ib.*

Sussex, a county of Virginia; bounded N. E. by Surry, and fouth-weft by Dinwiddie. It contains 10,554 inhabitants, including 5,387 flaves.—*ib.*

Sussex, a maritime county of Delaware State, bounded weft and fouth by the State of Maryland, north-eaft by Delaware Bay, eaft by the Atlantic Ocean, and north by Kent county. It contains 20,488 inhabitants, including 4,025 flaves. Cape Henlopen is in the north eaftern part of the county. Chief town, Georgetown.—*ib.*

SUTTON (Thomas Efq;), founder of the charter-houfe, was born at Knaith in Lincolnfhire in 1532, of an ancient and genteel family. He was educated at Eton-fchool, and probably at Cambridge, and ftudied the law in Lincoln's Inn; but this profeffion not fuiting his difpofition, he travelled into foreign countries, and made fo long a ftay in Holland, France, Spain, and Italy, as to acquire the languages of thofe various nations. During his abfence, his father died, and left him a confiderable fortune. On his return home, being a very accomplifhed gentleman, he became fecretary to the earl of Warwick and his brother the earl of Leicefter. By the former of thefe noblemen, in 1569, he was appointed mafter of the ordnance at Berwick; and diftinguifhing himfelf greatly in that fituation, on the rebellion which at that time broke out in the north, he obtained a patent for the office of mafter-general of the ordnance for that diftrict for life. He is named as one of the chiefs of thofe 1500 men who marched into Scotland, by the order of Queen Elizabeth, to the affiftance of the regent, the earl of Morton, in 1573; and he commanded one of the five batteries which obliged the ftrong caftle of Edinburg to furrender to the Englifh. He purchafed of the bifhop of Durham the manors of Gatefhead and Wickham; which, producing coal mines, became to him a fource of extraordinary wealth. In 1580, he was reputed to be worth L. 50,000.

Soon after this, he married a rich widow, who brought him a confiderable eftate; and taking up the bufinefs of a merchant, riches flowed in to him with every tide. He is faid to have had no lefs than thirty agents abroad. He was likewife one of the chief victuallers of the navy; and feems to have been mafter of the barque called Sutton, in the lift of volunteers attending the Englifh fleet againft the Spanifh armada. It is probable, alfo, that he was a principal inftrument in the defeat of it, by draining the bank of Genoa of that money with which Philip intended to equip his fleet, and thereby hindering the invafion for a whole year. He is likewife faid to have been a commiffioner for prizes under Lord Charles Howard, High Admiral of England; and going to fea with letters of marque, he took a Spanifh fhip worth L. 20,000. His whole fortune, at his death, appears to have been in land L. 5,000 *per annum*; in money, upwards of L. 60,000; the greateft eftate in the poffeffion of any private gentleman till much later times. He lived with great munificence and hofpitality; but lofing his lady in 1602, he retired from the world, leffened his family, and lived in a private frugal manner; and, having no iffue, refolved to diftinguifh his name by fome important charity. Accordingly, he purchafed of the Earl of Suffolk, Howard-Houfe, or the late diffolved charter-houfe, near Smithfield, for the fum of L. 13,000, where he founded the prefent hofpital, in 1611, for the relief of poor men and children. Before he had fixed upon this defign, the court endeavoured to divert him from his purpofe, and to engage him to make Charles I. then Duke of York, his heir, by conferring on him a peerage; but being free from ambition, and now near his grave, the luftre of the coronet could not tempt him to change his plan. He died the 11th of December, 1611, at Hackney, aged 79. His body was conveyed, with the moft folemn proceffion, to Chrift-church in London, and there depofited, till 1614, when it was removed to the charter-houfe, and interred in a vault on the north fide of the chapel, under a magnificent tomb.

Sutton, a townfhip of New-Hampfhire, Hillfborough

Sutton, || Suworow.

rough county, containing 520 inhabitants. It was firſt called Perryſtown, and was incorporated in 1784. —*Morse.*

Sutton, a townſhip in Worceſter county, Maſſachuſetts, 46 miles W. S. W. of Boſton, and 10 miles S. by E. of Worceſter. It was incorporated in 1718, and contains 2,642 inhabitants. Here are 10 griſt-mills, 6 ſaw-mills, 3 fulling-mills, a paper-mill, an oil-mill, and 7 trip-hammers. There are 5 ſcythe and ax-makers, one hoe-maker, ſeveral who work at nail-making, and 6 works for making pot-aſh. Here are found ginſeng and the cohuſh-root. The cavern, commonly called *Purgatory*, in the ſouth-eaſtern part of the town, is a natural curioſity. Bodies of ice are found here in June, although the deſcent is to the ſouth.—*ib.*

SUWOROW (A) Rimnikski (Count Alexander), was a man ſo eminent in his profeſſion, that, if war be an art founded on ſcience, it would be improper not to give ſome account of his life in a Work of this nature. Various accounts of him, indeed, are already in the hands of the public; but they differ ſo much from one another in the pictures which they preſent of the *man*, that it is not eaſy, if it be always poſſible, to diſtinguiſh truth from falſehood. With reſpect to the talents of the *General*, there is not room for the ſame difference of repreſentation; becauſe a train of military ſucceſſes, almoſt unrivalled, has rendered theſe conſpicuous to all Europe. In the ſhort detail that our limits permit us to give of the life of this ſingular man, we ſhall avail ourſelves of all the information, public and private, which we have been able to obtain, and believe to be authentic; and we hope to make our readers acquainted with ſome particulars reſpecting his perſon and domeſtic habits which are not yet generally known.

The family of Suworow is ſaid to have been from Sweden, and of a noble deſcent. The firſt of this name ſettled in Ruſſia about the latter end of the laſt century; and having engaged in the wars againſt the Tartars and the Poles, were rewarded by the Czars of that period with lands and peaſants. Baſil, the father of our hero, is ſaid to have been the godſon of Peter the Great; to have been held in high eſtimation for his political knowledge and extenſive erudition; and to have enjoyed, at his death, the two-fold rank of General and Senator*.

* See *the Hiſtory of the Campaigns of Count Alexander Suworow, by Frederick Anthing.*

As this account is given by a man who profeſſes to have formed an intimate acquaintance with Suworow himſelf, it ought to be correct; and yet we cannot help entertaining ſome doubts of its truth, or at leaſt of its accuracy. It is well known that extenſive erudition was in no eſteem in Ruſſia at the period when Baſil Suworow is here ſaid to have been ſo learned; and it is likewiſe known, that if, by erudition, be meant a knowledge of ancient literature, it was even deſpiſed, at a much later period, by all who were at once noble, and poſſeſſed of lands and peaſants (See Russia, *Encycl.*) The truth is, as we have learned from unqueſtionable authority, that the family of Suworow was ancient and reſpectable; but being far from affluent, and their little property lying at the very extremity of the empire, we have reaſon to believe, that the ſubject of this memoir was the firſt of the family that ever was at court. Baſil, however, if his anceſtors were from Sweden, may have been free from the Ruſſian prejudices againſt Greek and Latin; and this is the more probable, that he certainly gave a learned education to his ſon.

That ſon, Alexander Baſilowitch Suworow, was, according to the author already quoted, born in the year 1730; we have ſome reaſon to believe, that he was not born before 1732. His father had deſtined him, we are told, for the robe; but his early inclinations impelled him to the profeſſion of a ſoldier; and in 1742 he was enrolled as a fuſilier in the guards of Seimonow. He was afterwards a corporal, then a ſerjeant, and, in 1754, he quitted the guards with the brevet of Lieutenant in the army. He made his firſt campaign in the ſeven years war againſt the Pruſſians, in the year 1759, entering upon actual ſervice under Prince Wolgonſki. As ſenior officer on duty, he attended on the commander in chief Count Fermor, who, admiring the conſummate reſolution which he appeared to poſſeſs, favoured him with his particular confidence. In 1761, he was ordered on ſervice in the light troops under General Berg; and with the rank of a field officer (we think that of Lieutenant-colonel) he performed prodigies of valour, and exhibited much of that character which was afterwards ſo fully developed and diſplayed. Even then he ſeems to have formed the reſolution of dying on the field of battle rather than ſuffer himſelf to be taken priſoner; for when, with a handful of troops, he was once ſurrounded by a large detachment of Pruſſians, he determined to cut his way through them, or periſh in the attempt. In this daring enterpriſe he was not only ſucceſsful, but contrived to carry off with him twenty priſoners, though he was obliged to abandon two field-pieces, which he had a little before taken from a ſmaller detachment.

At the peace of 1762, he received from the Empreſs a colonel's commiſſion, written with her own hand; and being advanced, in 1768, to the rank of brigadier, he was, in the month of November, ordered to repair, with all poſſible ſpeed, to the frontiers of Poland. At that unfavourable ſeaſon, he croſſed rivers and moraſſes, whoſe paſſage was rendered more difficult by ſlight froſts: and, in the courſe of a month, traverſed 500 Engliſh miles, with the loſs of only a few men in the environs of Smolenſko.

The object of the Empreſs, at this time, was to ſubdue the Poliſh confederates, and to poſſeſs herſelf of certain provinces of that ill-fated kingdom. How completely ſhe and her two allies, the Emperor of Germany and the King of Pruſſia, ſucceeded in their enterpriſe, has been related elſewhere (ſee Poland, *Encycl.*). It is ſufficient, in this memoir, to obſerve, that the ſucceſſes of the Ruſſians were chiefly owing to the military ſkill and intrepidity of Suworow, who was their only active General, and was indeed, for four years, almoſt conſtantly employed in offenſive operations againſt

(A) This name is ſpelled ſometimes as we have ſpelled it, ſometimes Suwarrow, and ſometimes Suvoroff. This laſt is according to the pronunciation; but we have adopted the orthography of the General himſelf, in his letter to Charette, the hero of Vendee.

Suworow. against the confederates. Not to mention the numerous actions and skirmishes of an inferior kind, in which his conduct and courage were always displayed, the victory at Staloviz, over a superior force, ably commanded, and the capture of Cracow, were alone sufficient to intitle him to the character which he ever afterwards so well supported. The former of these drew the highest encomiums from the great Frederick of Prussia; and the latter decided the fate of Poland. It is proper to add, that Suworow, on these occasions, did not tarnish his laurels by unnecessary cruelty. When a French officer, who surrendered at Cracow, offered him his sword, according to the custom of war, he refused it, saying, that he would not take the sword of a brave man, whose master was not at war with his sovereign; and, even to the leaders of the confederates, he granted better terms of capitulation than they had the presumption to ask.

In the year 1770, he had been promoted to the rank of Major general; and for his exploits in the Polish war, the Empress conferred upon him at different times, the orders of St Ann, St George, and Alexander Newsky.

After performing some important services on the frontiers of Sweden, Suworow received orders in the beginning of 1773, to join the army in Moldavia, under the command of Field-marshal Romanzow; and there he began that glorious career, which soon made his name a terror to the Turks. His first exploit was the taking of Turtukey; of which he wrote the following laconic account to the commander in chief:

"Honour and glory to God! Glory to you, Romanzow! We are in possession of Turtukey, and I am in it! "Suworow."

During the remainder of the war, which was of short continuance, Suworow was constantly engaged, and constantly successful. In the beginning of the year 1774, he was promoted to the rank of Lieutenant-general; and on the 11th of June of the same year, he defeated the Turks in a great battle, in which they lost 3000 men killed, some hundreds of prisoners, 40 pieces of artillery, and 80 standards, with their superb camp. Soon after this victory, peace was concluded between the two courts; and Lieutenant-general Suworow was ordered to proceed with all possible haste to Moscow, to assist in appeasing the interior troubles of that part of the empire.

These troubles were occasioned by a Cossac rebel, of the name of *Pugatchew*, or *Pugatcheff*, who, at the head of a party of his discontented countrymen, had long eluded the vigilance of Count Panin, the commander in chief in Muscovy, and frequently cut off detachments of the army which were sent out in quest of him. The chace of Pugatcheff, for such it may be called, was now wholly entrusted to the well-known activity of Suworow; and that General, after pursuing the rebel with inconceivable rapidity, through woods and deserts, came up with him at a place called Urlask, and carried him prisoner to Count Panin, who sent him to Moscow, where he suffered the punishment due to his crimes. This insurgent, it is said, had at one time collected such a force, and was followed with such enthusiasm, that, if his understanding had been equal to his courage, and his moderation had kept pace with his power, he might have possessed himself of Moscow, and made the Imperial Catharine tremble on her throne. Suworow.

For several years after the taking of Pugatcheff, Suworow was employed in the Crimea, on the Cuban, and against the Nogay Tartars, in a kind of service which, though it was of the utmost importance to the Empress, and required all the address of the Lieutenant-general, furnished no opportunities for that wonderful display of promptitude and resource which had characterised his more active campaigns. One incident, however, must be mentioned, even in this short memoir, because it shews the natural disposition of the man. During the winter that Suworow passed among the Tartars, he was frequently visited by the chiefs of that nation; and at one of these visits, Mechmed Bey, the chief of the Gedissens, often joked with Mussa Bey, another chief, on his inclination to marry. Mussa Bey was so extremely old, that Suworow thought the conversation ridiculous; and one day asked him, What ground Mechmed could have for such idle talk? Mussa replied, that Mechmed Bey was right; that he wished to marry; and that he hoped the General would make him a present of a beautiful Tartar girl of sixteen! Suworow immediately bought a young Tartar slave of a Cossac for 100 rubles, and sent her to Mussa Bey; who married her, lived with her a very few years, and died at the age of one hundred and eight! regretted, we are told, by the Lieutenant-general, who regarded him with great esteem and attachment.

In the end of the year 1786, Suworow was promoted to the rank of General in Chief; and, at the breaking out of the war with the Turks in 1787, he shewed how well he was intitled to that rank, by his masterly defence of Kinburn; a place of no strength, but of great importance, as it is situated at the mouth of the Dneiper, opposite to Oczakow. For the zeal and abilities which he displayed on this occasion, the Empress decorated him with the order of St Andrew; gave him six crosses of the order of St George, to be distributed, according to his judgment, among such of his officers as had most distinguished themselves; and, in a very flattering letter, regretted the wounds which he had received in defending the place.

At the siege of Oczakow, Suworow, who commanded the left wing of the army under Prince Potemkin, received a dangerous wound in the nape of the neck, which was followed by so smart a fever, that, for some time, his life was despaired of; but he persevered in his long accustomed practice of preferring regimen to medicine, and his health was gradually re established. In the year 1789, he was appointed to the command of the army which was to co-operate with the Prince of Saxe Cobourg in Walachia; and, by marches of inconceivable rapidity, he twice, in the space of two months, preserved the army of that Prince from inevitable destruction. Putting himself at the head of 8000 Russians, and literally running to the aid of his ally, he came up with the Turks in time to change the fate of the day at the battle of Forhani, which was fought on the 21st of July; and again at Rymnik, which, with 7000 men, he had reached with equal celerity, he gained, on the 22d of September, in conjunction with the Prince, one of the greatest victories that have ever been atchieved. According to the least exaggerated account, Suworow. count, the Turkish army, commanded by the Grand Visier in person, amounted to 90,000 or 100,000 men; of which 70,000 were chosen troops: whilst the army of the allies exceeded not 25,000. At the commencement of the attack, Suworow, who had reconnoitred the country, and formed the plan of the battle, called out to his Russians, "My friends, look not at the eyes of your enemies, but at their breasts; it is there that you must thrust your bayonets." No quarter was given to the Turks; and on this account the Russian General has been charged with savage ferocity: but the charge, if not groundless, must be shared equally between him and the Prince of Cobourg. The commanders of the allied army, aware of the immense superiority of their enemies, had resolved, before the engagement, not to encumber themselves with prisoners, whom they could not secure without more than hazarding the fate of the day: And where is the man, who admits the lawfulness of war, that will condemn such conduct in such critical circumstances?

The taking of Bender and Belgrade were the immediate consequences of the victory of Rymnik; and so sensible was the Emperor Joseph how much the rapid movements and military skill of Suworow had contributed to that victory, that he immediately created him a Count of the Roman empire, and accompanied the diploma with a very flattering letter. Similar honours were conferred upon him by his own sovereign, who sent him the diploma of Count of the empire of Russia, with the title of Rymnikski, and the order of St Andrew of the first class.

In the autumn of 1790, Prince Potemkin wrote to Count Suworow, requesting a particular conference. The General, who conjectured the object of it, sent him the following answer: "The flotilla of row-boats will get possession of the mouths of the Danube; Tulcia and Isaccia will fall into our power; our troops, supported by the vessels, will take Ismailow and Brahilow, and make Tchistow tremble." He was perfectly right in his conjecture: it was to concert with him measures for the taking of Ismailow that the Prince had requested the conference. He did not, however, receive orders to undertake that desperate enterprise till the beginning of November, when he rapidly approached towards that fortress. His army, by sea and land, consisted of 23,000 men; of whom one-half were Cossacs, and of these many were sick. The troops of the garrison, which were under the orders of seven Sultans, amounted to 43,000 men, of whom nearly one half were Janissaries; the fortress was by much the strongest of any on the Turkish frontier: it was under the command of an old warrior, who had twice refused the dignity of Grand Visier, and had displayed against the Austrians considerable abilities, as well as the most intrepid courage; and the Grand Seignior had published a firman, forbidding the garrison, on pain of death without trial, to surrender on any terms whatever.

Potemkin, knowing that Suworow had with him no battering cannon, and dreading the consequences of a repulse, wrote to the General, that if he was not certain of success, he would do well not to risk an assault. The laconic reply was; "My plan is fixed. The Russian army has already been twice at the gates of Ismailow; and it would be shameful to retreat from them the third time without entering the place." To spare the effusion of blood, however, if possible, he sent a note to the Seraskier who commanded in Ismailow, to assure him, upon Count Suworow's word of honour, that if he did not hang out a white flag that very day, the place would be taken by assault, and all the garrison put to the sword. The Seraskier returned no answer to the note; but another commander was pleased to say, that "The Danube would cease to flow, or the heavens bow down to the earth, before Ismailow would surrender to the Russians!"

Having concerted with the Admiral proper measures for the assault, Suworow passed the night, with some officers of his suite, in impatient vigilance for the appointed hour when the signals were to be given. These were the firing of a musket at three, four, and five in the morning, when the army rushed upon the place; and notwithstanding the desperate opposition of the Turks, the depth of the moat, and the height of the ramparts, they were completely masters of Ismailow by four o'clock P. M. In this one dreadful day the Ottomans lost 33,000 men killed or dangerously wounded; 10,000 who were taken prisoners; besides 6000 women and children, and 2000 Christians of Moldavia, who fell in the general massacre. The place was given up to plunder for three days, according to agreement with the army before the assault; but we have authority to say, that no person was murdered in cold blood, who did not prefer his property to his life.

The Russians found in Ismailow 232 pieces of cannon, many large and small magazines of gunpowder, an immense quantity of bombs and balls, 345 standards almost all stained with blood, provisions for the Turkish army for six months, and about 10,000 horses, of which many were extremely beautiful. Suworow, who was inaccessible to any views of private interest, did not appropriate to himself a single article, not so much as a horse; but having, according to his custom, rendered solemn thanks to God for his victory, wrote to Prince Potemkin the following Spartan letter: "The Russian colours wave on the ramparts of Ismailow."

Peace being concluded with the Turks in December 1791, no political events occurred from that period to call forth the military talents of Suworow till 1794. In the beginning of that year mutinies having broken out among the Polish troops in the service of Russia, and the Empress, with her two potent allies, having digested the plan for the partition of Poland, Count Suworow received orders, in the month of May, to proceed, by forced marches, into Red Russia, with a corps of 15,000 men, and to disarm all the Polish troops in that province. This service he performed without the effusion of blood, disarming in less than a fortnight 8000 men, dispersed over a country of 150 miles in circuit. Soon afterwards he was ordered to march into the interior of Poland; the King of Prussia having been obliged to raise the siege of Warsaw, and the Empress perceiving that more vigorous measures than had hitherto been pursued, were necessary to accomplish her designs.

To give a detailed account of his route to Warsaw, would be to write the history of the Polish war, and not the memoirs of Count Suworow. It has been rashly supposed, that he had to contend only with raw troops, commanded by inexperienced leaders, who were not cordially united among themselves; but the fact is

 otherwise,

otherwife, and Suworow never difplayed greater refource in the day of danger, than in the numerous battles and fkirmifhes in which he was engaged on his march to the capital of Poland. At laft, after furmounting every obftacle, he fat down, on the 22d of October, before Praga, a ftrongly fortified fuburb of Warfaw, defended by a formidable artillery, and a garrifon of 30,000 men, rendered defperate by their fituation. The Ruffian army exceeded not 22,000; and with that comparatively fmall force he refolved to ftorm Praga, as he had ftormed Ifmail. Having erected fome batteries to deceive the garrifon into a belief that they were to be regularly befieged, he concerted with the other Generals the mode of affault; and when every thing was ready, he gave his orders in thefe words: "Storm, and take the batteries, and cut down all who refift; but fpare the inhabitants, unarmed perfons, and all who fhall afk for quarter."

There are but few examples of a military operation fo boldly conceived, fo fkilfully performed, or fo important in its confequences, as the taking of Praga. The affault was made at once in feven different places at five in the morning; and at nine the Ruffians were mafters of the place, having penetrated by pure force a triple entrenchment. Of the Poles 13,000 lay dead on the field of battle, one-third of whom were the flower of the youth of Warfaw; above 2000 were drowned in the Viftula; and 14,680 were taken prifoners, of whom 8000 were difarmed and immediately fet at liberty, and the remainder the next day. We mention thefe circumftances, becaufe they completely refute the tales of thofe Jacobin fcribblers, who have fo ftrenuoufly endeavoured to tarnifh the laurels of the Ruffian hero, by reprefenting him as having ordered a general maffacre of men, women, and children. The artillery taken from the enemy confifted of 104 pieces of cannon and mortars, chiefly of large calibre. The Ruffians had 580 men killed, of whom eight were fuperior and ftaff-officers, and 900 wounded, of whom 23 were officers.

Soon after the ftorming of Praga, Warfaw capitulated, and Suworow was received into the city by the magiftrates in a body, and in their ceremonial habits. When the prefident prefented to him the keys of the city, he preffed them to his lips, and then, holding them up towards heaven, he faid, "Almighty God, I render thee thanks, that I have not been compelled to purchafe the keys of this place as dear as ....." Turning his face towards Praga, his voice failed him, and his cheeks were inftantly bathed with tears. As he rode through the ftreets, the windows were filled with fpectators, who were delighted with the return of order, and the affurance of peace; and the air refounded with the exulting exclamations of "Long live Catharine! Long live Suworow!"

Thus did Count Suworow, in the courfe of a very few months, overturn the kingdom and republic of Poland. It is not our bufinefs, in this article, to decide on the juftice of the caufe in which he was embarked. Of the Polifh revolution, which gave rife to the war that fubverted the republic, and fwept it from the number of fovereign ftates, the reader will find fome account under the title Poland in the *Encyclopædia*; but it is here proper to acknowledge, that we do not now think fo favourably, as when we wrote that article, of the views and principles of thofe who framed the conftitution, which brought upon them the Ruffian and Pruffian arms. Subfequent events feem to have proved completely, that if Poland had not been conquered by the allied powers, it would foon have been involved, under Kofkiufko and his Jacobinical adherents, in all the horrors of revolutionary France; and the unhappy king, inftead of being carried captive into Ruffia, would probably have finifhed his courfe on a fcaffold. Suworow, who never concerned himfelf with the intrigues of courts, and expreffed on all occafions the moft fovereign contempt of thofe Generals who affected to poffefs the fecrets of ftatefmen, probably never enquired into the final object of the war, but thought it his duty to execute, in his own fphere, the orders of his Imperial miftrefs. So fenfible was Catharine of the propriety of this conduct, and of the zeal and abilities which he had difplayed in the Polifh campaign, that immediately on receiving accounts of the ftorming of Praga and the fubmiffion of Warfaw, fhe announced to him, in a letter written with her own hand, his well-earned advancement to the rank of Field-marfhal General. Nor did her munificence ftop there: She loaded him with jewels, and prefented him with an eftate of 7000 peafants, in the diftrict of Kubin, which had been the fcene of his firft battle in the courfe of the campaign.

From the fubjugation of Poland we hear little more of Field-marfhal Suworow till he entered upon his glorious career in Italy. He is faid, indeed, to have given offence to the Emperor Paul foon after his acceffion to the throne, by affording protection to fome meritorious officers, whom his Majefty had in an arbitrary manner difmiffed from the fervice; but that offence was overlooked, and Suworow called again into action, when Paul joined the coalition againft France.

Of the exploits of the Field-marfhal in Italy, where, to ufe his own words, he deftroyed armies and overturned ftates, we have given a full account under the title Revolution in this *Supplement*. In his former campaigns, the wifdom of his meafures, the diftribution of his forces, the undaunted character of his operations, and the progreffive continuance of his fucceffes, furnifh proofs of the fuperiority of his talents hardly to be paralleled in the annals of modern war; but, animated by the noblenefs of his caufe, and confiding, as he faid, in the God of battles, he feems in his laft campaign to have furpaffed himfelf (b). It would appear, however, that

(b) Were any other proof than a fimple narrative of his fuccefs neceffary to evince the abilities difplayed by Marfhal Suworow in the laft campaign, that proof might be found in the fad reverfes of the prefent. At the opening of the campaign of 1800, the allies poffeffed infinitely greater advantages over the enemy than at the beginning of the campaign of 1799; and we ventured to fay, towards the end of the article Revolution, in this *Supplement*, that the affairs of the French feemed in Italy to be defperate. But how egregioufly have we been miftaken? By the moft unaccountable infatuation, the Auftrian commander in Italy would not *believe* that the French army of referve, which was advancing upon him with the ufual celerity of the

Suworow. that his own Sovereign thought otherwife; and if he did, he was certainly as fingular in that opinion as he is faid to be in many others. Confidering the Field-marfhal as the conqueror of Italy, he had indeed created him a Prince by the ftyle and title of Prince Suworow-*Italifki;* but how did he receive him, when he returned into the Ruffian dominions at the head of his veteran and victorious bands?

Though the old warrior thought himfelf almoft betrayed at the end of the campaign by the crooked policy of the court of Vienna, he doubtlefs hoped to be received at the court of St Peterfburg, if not with triumphal arches, at leaft with the moft public teftimonies of his Sovereign's approbation. It is faid, that he expected to be fent back at the head of a large army, with full powers to act as he fhould judge proper for bringing the war to a happy termination, and reftoring peace and order to Europe; and he certainly expreffed, in letters to different correfpondents, his earneft wifh to conclude his military career with contributing to the accomplifhment of fo defirable an object. What then muft have been his difappointment, when the Ruffian Emperor would not fee him, and pofitively forbad his appearance at court? To the meffenger who brought the order, the Field-marfhal gave a purfe of money, turned his carriage another way, and drove to a wooden houfe, at a diftance from the court, and from his former friends, "where burft his mighty heart;" and the conqueror of the Turks, the Poles, and the French republicans, died, almoft unattended, on the 18th of May 1800. The fovereign, who thus difgraced him at the end of his life, gave him a magnificent funeral! Suworow.

In his perfon Suworow was tall, confiderably exceeding fix feet, and full chefted. His countenance was ftern; but among his friends his manners were pleafant, and his difpofitions were kind. His temper was naturally violent; but that violence he conftantly laboured to moderate, though he was never able completely to extinguifh it. According to M. Anthing, an effervefcent fpirit of impatience predominated in his character; and it perhaps never happened (fays that author) that the execution of his orders equalled the rapidity of his wifhes. Though he difliked all public entertainments, yet when circumftances led him to any of them, he appeared to partake, and endeavoured to promote, the general pleafure. Sometimes he condefcended even to dance and play at cards, though very rarely, and merely that he might not interrupt the etiquette of public manners, to which, when not in the field, he was very attentive. In the field he may be faid to have fpent the whole of his life from the period at which he firft joined the army in the feven years war; for during the time that he was not engaged in actual warfare, and that time, taken altogether, did not exceed twelve years, he was always placed at the head of armies ftationed on the frontier of fome enemy's country. He was therefore a mere warrior, and as fuch had no fixed habitation. With refpect to his table and lodging, he contented

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Firft Conful's movements, confifted of more than *fix thoufand men!* Inftead therefore of marching rapidly to meet them before they could be wholly difentangled from the paffes over the Alps, he waited patiently for them in the plains of Marengo. If we may judge of the future by the paft, we may furely fay that fuch would not have been the conduct of Suworow. Even after the two hoftile armies met, and fought, on the 10th of July, one of the bloodieft battles of the prefent war, the fuccefs of the French was not fuch as to intitle them to the acquifitions which were the confequence of their dear-bought victory. The fate of the day was long doubtful; and it was at laft decided, not by any extraordinary exertions of the Conful, but partly by the provident conduct of General Deffaix, who, with the aid of frefh troops, erected a new battery at a critical point, and at a critical period; and ftill more by the fituation of General Melas, whofe faculties, though frequently fupported by wine and fpirits, are faid to have wholly forfaken him in the latter part of the day. When he was in this ftate, one falfe movement, which weakened his centre, afforded an opportunity to Deffaix to make a vigorous and fuccefsful charge with a body of cavalry that had not yet been engaged.

But even after this defeat, what was the ftate of the two armies? The Auftrians had loft 9000 men, and the French from 12,000 to 14,000: the former, enraged at having had the victory fo wrefted out of their hands, were eager to renew the conteft on the following day; and the latter had obtained only the barren advantage of keeping poffeffion of the field of battle. In fuch a fituation, Suworow would certainly have encouraged the ardour of his men; but the Auftrian commander, who complained laft year of the Field-marfhal for being too little fparing of blood, inftead of following the example which he had fet him at the battle of Trebia, concluded a capitulation unparalleled, we believe, in the annals of war; a capitulation by which he voluntarily furrendered into the hands of the enemy nearly all the fruits of one of the moft glorious campaigns recorded in hiftory. We wifh not to throw any undue afperfion upon the character of General Melas: We believe him to be a brave man, and fuch he has been reprefented to us in various accounts which we have had directly from Germany; but all thefe accounts agree in reprefenting him likewife as fit, not to have the fupreme command of a great army, but only to execute the orders of a fuperior mind.

In Germany, the gallant Kray has been obliged to retreat before the equally gallant Moreau; but he has wifely not hazarded the confequences of a general action. We fay *wifely;* becaufe we have learned from authority which we cannot queftion, that his army is in a ftate little better than that of mutiny. To his officers he is in a great meafure a ftranger; and therefore thefe gentlemen think themfelves at liberty to difobey his orders! What the confequence of all this will be, it becomes not us to conjecture. An armiftice has in the mean time* taken place both in Italy and in Germany; and it is not impoffible that the Aulic Council, aided by the mob of Vienna, may induce the Emperor to make a feparate peace.—Since this note was written the changes which have taken place are well known—and the peace which has at laft been definitively concluded at Amiens, will at leaft give a refpite to almoft exhaufted Europe.

* September the 4th 1800.

contented himself with whatever he found, requiring nothing but what absolute necessity demands, and what might be transported with ease from one place to another. His couch consisted of a heap of fresh hay sufficiently elevated, and scattered into considerable breadth, with a white sheet spread over it, with a cushion for his pillow, and with a cloak for his coverlid. He has been represented as dirty (c); but the representation is false. M. Anthing assures, that he was clean in his person, and that, when not on actual service, he washed himself frequently during the course of the day. It is among the singular, though unimportant circumstances of his life (says the same author), that, for the last twenty years, he had not made use of a looking-glass, or incumbered his person with either watch or money.

He was sincerely religious; took every opportunity of attending the offices of public devotion; and has been known, on Sundays and festivals, to deliver lectures on piety to those whom duty called to attend on him. We are told by an anonymous writer, in a miscellany not very forward to praise such men as Suworow, or indeed to praise piety in men of any description, that chancing one evening to overhear a captain abridge the prayer which his duty required him to repeat at the guard, the Field-marshal called out to him, "Thou unconscionable, abominable, impious man, thou wouldst cheat Heaven! Thou wouldst, no doubt, cheat likewise the Empress and me! I shall dismiss thee." His regard for sacred things is indeed very apparent in the elegant letter which, on the 1st of October 1795, he wrote to Charette, the hero of Vendee, whom he congratulates upon taking up arms to restore the temples of the God of his fathers. Alluding to this trait of his character, and to his detestation of Jacobinism under every form, a late writer in a most respectable miscellany has well characterized him as the

"Foe to religion's foe; of Russia's throne
The prop, th' avenger, and the pride in one;
Whose conquering arms, in bold defiance hurl'd,
Crushed the rude monster of the western world."

We have already, when we thought not that we should so soon be called upon to write his life, observed, that he was a scholar, a man of science, and a poet. M. Anthing assures us, that from his earliest years he was enamoured of the sciences, and improved himself in them; but that as the military science was the sole object of his regard, those authors of every nation who investigate, illustrate, or improve it, engrossed his literary leisure. Hence Cornelius Nepos was with him a favourite classic; and he read, with great avidity and attention, the histories of Montecuculi and Turenne. Cæsar, however, and Charles XII. (says the same author) were the heroes whom he most admired, and whose activity and courage became the favourite objects of his imitation.

With respect to his moral character, we have every reason to believe that he was a man of the most incorruptible probity, immoveable in his purposes, and inviolable in his promises; that the cruelties of which he has been accused were the cruelties of Potemkin, and that by those who knew him he was considered as a man of unquestionable humanity. The love of his country, and the ambition to contend in arms for its glory, were the predominant passions of his active life; and to them, like the ancient Romans, he sacrificed every inferior sentiment, and consecrated, without reserve, all the powers of his body and mind. His military career was one long and uniform course of success and triumph, produced by his enterprising courage and extraordinary presence of mind; by his personal intrepidity and promptitude of execution; by the rapid and unparalleled movements of his armies; and by their perfect assurance of victory when fighting under his banners. Such was Alexander Basilowitch Count Suworow. In the year 1774 he married a daughter of the General Prince Iwan Proforowski, by whom he had two children, now living: Natalia, married to General Count Nicolai Zubow; and Arcadius Count Suworow, a youth of great promise, who accompanied his father in his unparalleled march from Italy to Switzerland.

SWALLOW *Island*, in the Pacific Ocean, S. lat. 10, E. long. from Paris, 162 30; discovered by Roggewins, 1722.—*Morse.*

SWALLOW's-Tail, in fortification, is a single tenaille, which is narrower towards the place than towards the country.

SWAMSCOT, or *Great River*, to distinguish it from another much less, also called *Exeter River*, rises in Chester, in New-Hampshire, and after running through Sandown, Poplin, Brentwood, and a considerable part of Exeter, affording many excellent mill-seats, tumbles over a fall 20 or 30 rods in length, and meets the tide from Piscataqua harbour, in the centre of the township of Exeter. The smaller river rises in Brentwood and joins Great river about a third of a mile above Exeter. Here are caught plenty of alewives and some oysters. Swamscot is the Indian name of Exeter.—*Morse.*

SWAN (See Anas, *Encycl.*). It is now ascertained, beyond the possibility of doubt, that there are *black* swans, of equal size, and the same habitudes, with the common white swan of Britain. These fowls have been seen chiefly in New Holland; and Captain Vancouver, when there, saw several of them in very stately attitudes, swimming on the water; and, when flying, discovering the under part of their wings and breasts to be white. Black swans were likewise seen in New Holland by Governor Philips, Captain White, and by a Dutch navigator, so long ago as in 1697. Governor Philips describes the black swan as a very noble bird, larger than the common swan, and equally beautiful in form. Mr White indeed says, that its size is not quite equal to that of the European swan; but both these authors agree with Captain Vancouver in mentioning some white feathers in its wings.

Swan *Island*, in the District of Maine, divides the waters of Kennebeck river, three miles from the Chops of Merry-Meeting Bay. It is 7 miles long, and has a navigable channel on both sides, but that to the east is mostly used. It was the seat of the sachem *Kenebis.* The river itself probably took its name from the race of Sagamores of the name of Kenebis.—*Morse.*

SWAN-

(c) By the anonymous author of the life of Catharine II.

SWANNANO, the east head water of French Broad river, in Tennessee. Also the name of a settlement within about 60 miles of the Cherokee nation.—*ib.*

SWANNSBOROUGH, the chief town of Onslow county, Wilmington district, N. Carolina.—*ib.*

SWANSEY, a township in Cheshire county, New-Hampshire, adjoining Chesterfield on the E. 97 miles westerly of Portsmouth. It was incorporated in 1753, and contains 1157 inhabitants.—*ib.*

SWANSEY, a township in Bristol county, Massachusetts, containing 1784 inhabitants. It was incorporated in 1667, and lies 51 miles southerly of Boston.—*ib.*

SWANTON, a township of Vermont, Franklin county, on the E. bank of Lake Champlain, on the south side of Mischiscoui river. This township has a cedar swamp in the N. W. part of it, towards Hog Island. The Mischiscoui is navigable for the largest boats 7 miles, to the falls in this town.—*ib.*

SWANTOWN, in Kent county, Maryland, is about 3 miles S. easterly of Georgetown.—*ib.*

SWEDESBOROUGH, a small post-town of New-Jersey, Gloucester county, on Racoon Creek, 3 miles from its mouth, in Delaware river, 11 S. by W. of Woodbury, 17 N. by E. of Salem, and 20 southerly of Philadelphia.—*ib.*

SWEET SPRINGS, in Virginia, 30 miles E. by N. of Greenbriar, 93 west of Staunton, and 380 S. W. of Philadelphia. In the settlement around these springs, a post-office is kept.—*ib.*

SWETARA, or *Swatara*, a river of Pennsylvania, which falls into the Susquehannah from the N. E. about 7 miles S. E. of Harrisburg.—*ib.*

SWINTON (John), a very celebrated English antiquary, was a native of the county of Chester, the son of John Swinton of Bexton in that county, gent. He was born in 1703. The circumstances of his parents were probably not affluent, as he was entered at Oxford in the rank of a servitor at Wadham college. This was in October 1719. It may be presumed, that he recommended himself in that society by his talents and behaviour, as on June 30. 1723, he was elected a scholar on a Cheshire foundation in the college. In the December following, he took his first degree in arts. Before he became master of arts (which was on December 1. 1726), he had chosen the church for his profession, and was ordained deacon by the bishop of Oxford, May 30. 1725; and was afterwards admitted to priest's orders on May 28. 1727. He was not long without some preferment, being admitted to the rectory of St Peter le Bailey in Oxford (a living in the gift of the crown), under a sequestration, and instituted to it in February 1728. In June, the same year, he was elected a fellow of his college; but, desirous probably to take a wider view of the world, he accepted, not long after, the appointment of chaplain to the English factory at Leghorn, to which he had been chosen. In this situation he did not long enjoy his health; and leaving it on that account, he was at Florence in April 1733, where he attended Mr Coleman, the English envoy, in his last moments. Mr Swinton returned thro' Venice and Vienna; and, in company with some English gentlemen of fortune, visited Presburgh in Hungary, and was present at one of their assemblies.

Biog. Dictionary.

It is possible that he had not quitted England in the summer of 1730, for he was elected a Fellow of the Royal Society in June that year, and admitted about three months later. It was probably while he was abroad that he was admitted into some foreign societies; namely, the academy *degli Apatisti* at Florence, and the *Etruscan Academy* of Cortona. On his return, he seems to have taken up his abode at Oxford, where he resided all the latter part of his life, and was for many years chaplain to the gaol in that city. It may be presumed that he married in 1743; it was then, at least, that he gave up his fellowship. In 1759 he became bachelor of divinity: in 1767, he was elected *Custos Archivorum*, or keeper of the university records: and, on April 4. 1777, he died; leaving no children. His wife survived till 1784, and both were buried, with a very short and plain inscription, in the chapel of Wadham college.

It remains to take notice of the most important monuments of a literary man's life, his publications. These were numerous and learned, but not of great magnitude. He published, 1. "De Linguæ Etruriæ Regalis vernacula Dissertatio," 4to, 19 pages, Oxon. 1738. 2. "A critical essay concerning the words Δαιμων and Δαιμονιον, occasioned by two late inquiries into the meaning of the demoniacs in the New Testament," 8vo, London, 1739. 3. "De priscis Romanorum literis dissertatio," 4to, 20 pages; Oxon. 1746. 4. "De Primogenio Etruscorum Alphabeto, dissertatio," Oxon. 1746. 5. "Inscriptiones Citieæ: sive in binas Inscriptiones Phœnicias, inter rudera Citii nuper repertas, conjecturæ. Accedit de nummis quibusdam Samaritanis et Phœniciis, vel insolitam præ se literaturam ferentibus, vel in lucem hactenus non editis, dissertatio," 4to, 87 pages, Oxon. 1750. 6. "Inscriptiones Citieæ: sive in binas alias Inscriptiones Phœnicias, inter rudera Citii nuper repertas, conjecturæ," 4to, 19 pages. 7. "De nummis quibusdam Samaritanis et Phœniciis, vel insolitam præ se literaturam ferentibus, vel in lucem hactenus non editis, dissertatio secunda," 4to, 36 pages. 8. "Metilia: sive de quinario Gentis Metiliæ, è nummis vetustis cæteroquin minimum notæ, dissertatio," 4to, 22 pages, Oxon. 1750. 9. Several dissertations published in the Philosophical Transactions of the Royal Society. As, "A dissertation upon a Parthian Coin; with characters on the reverse resembling those of the Palmyrenes," vol. xlix. p. 593. "Some remarks on a Parthian Coin, with a Greek and Parthian legend, never before published," vol. l. p. 16. "A dissertation upon the Phœnician numeral characters anciently used at Sidon," vol. l. p. 791. "In nummum Parthicum hactenus ineditum conjecturæ," vol. li. p. 683. "A dissertation upon a Samnite Denarius, never before published," vol. lii. p. 28. "An account of a subærated Denarius of the Plætorian family, adorned with an Etruscan inscription on the reverse, never before published or explained," vol. lxii. p. 60. "Observations upon five ancient Persian Coins, struck in Palestine or Phœnicia before the dissolution of the Persian empire," vol. lxii. p. 345. Other papers by him may be found in the general-index to the Philosophical Transactions. 10. A part of the Ancient Universal History, contained in the sixth and seventh volumes of that great work. The particulars of this piece of literary history were communicated by Dr Johnson to Mr Nichols, in a paper printed in the Gentleman's Magazine for December 1784, p. 892. The original of that paper, which affords a strong proof of the

Swinton. the ſteady attachment of Johnſon to the intereſts of literature, has been, according to his deſire, depoſited in the Britiſh Muſeum. The letter is as follows:

"To Mr Nichols.

"The late learned Mr Swinton of Oxford having one day remarked, that one man, meaning, I ſuppoſe, no man but himſelf, could aſſign all the parts of the Univerſal Hiſtory to their proper authors, at the requeſt of Sir Robert Chambers, or of myſelf, gave the account which I now tranſmit to you in his own hand, being willing, that of ſo great a work the hiſtory ſhould be known, and that each writer ſhould receive his due proportion of praiſe from poſterity. I recommend to you to preſerve this ſcrap of literary intelligence, in Mr Swinton's own hand, or to depoſite it in the Muſeum, that the veracity of the account may never be doubted.—I am, Sir, your moſt humble ſervant,

Dec. 6, 1784. SAM. JOHNSON."

The paper alluded to, beſides ſpecifying ſome parts written by other perſons, aſſigns the following diviſions of the hiſtory to Mr Swinton himſelf. "The hiſtory of the Carthaginians, Numidians, Mauritanians, Gætulians, Garamantes, Melano Gætulians, Nigritæ, Cyrenaica, Marmarica, the Regio Syrtica, Turks, Tartars, and Moguls, Indians, and Chineſe, a diſſertation on the peopling of America, and one on the independency of the Arabs.

In the year 1740, Mr Swinton was involved in a law-ſuit, in conſequence of a letter he had publiſhed. It appears from a paper of the time,* that a letter from the Rev. Mr Swinton, highly reflecting on Mr George Baker, having fallen into the hands of the latter, the court of King's Bench made the rule abſolute for an information againſt Mr Swinton. Theſe two gentlemen were alſo engaged for ſome time in a controverſy at Oxford; which took its riſe from a matter relative to Dr Thiſtlethwaite, ſome time warden of Wadham, which then attracted much attention. Mr Swinton had the manners, and ſome of the peculiarities, often ſeen in very recluſe ſcholars, which gave riſe to many whimſical ſtories. Among the reſt, there is one mentioned by Mr Boſwell, in the Life of Johnſon, as having happened in the year 1754. Johnſon was then on a viſit in the univerſity of Oxford. "About this time (he ſays) there had been an execution of two or three criminals at Oxford, on a Monday. Soon afterwards, one day at dinner, I was ſaying that Mr Swinton, the chaplain of the gaol, and alſo a frequent preacher before the univerſity, a learned man, but often thoughtleſs and abſent, preached the condemnation ſermon on repentance, before the convicts, on the preceding day, Sunday; and that, in the cloſe, he told his audience, that he ſhould give them the remainder of what he had to ſay on the ſubject the next Lord's day. Upon which, one of our company, a doctor of divinity, and a plain matter-of-fact man, by way of offering an apology for Mr Swinton, gravely remarked, that he had probably preached the ſame ſermon before the univerſity. Yes, Sir (ſays Johnſon); but the univerſity were not to be hanged the next morning!"

* *The Champions, or Evening Advertiſer*, June 17th 1740.

Swinton, ‖ Sypomba.

SYDNEY, in Lincoln county, Diſtrict of Maine, is 37 miles from Pownalborough, 98 from Hallowell, and 203 from Boſton.—*Morse.*

SYPOMBA, an iſland on the coaſt of Brazil, in S. America, about 7 leagues N. E. of St John's Iſland, and N. W. from a range of iſlands which form the great Bay of Para.—*ib.*

T.

Taawirry, ‖ Tabaſco.

TAAWIRRY, one of the two ſmall iſlands within the reef of the iſland of Otaheite, in the South Pacific Ocean. Theſe iſlands have anchorage within the reef that ſurrounds them.—*Morse.*

TABAGO, an iſland in the bay of Panama, about 4 miles long, and 3 broad. It is mountainous, and abounds with fruit trees. N. lat. 7 50, W. long. 60 16.—*ib.*

TABASCO, an iſland in the S. W. part of the Gulf of Mexico, and at the bottom of the Gulf of Campeachy, is about 36 miles long, and about 7 broad; and on it is built the town of Tabaſco, in lat. 17 40 N. and long. 93 39 W. It is the capital of a rich province of its name, and is ſituated at the mouth of the river Grijalva, 90 miles E. of Eſpirito Santo, and 160 S. E. of Mexico. It is not large, but is well built, and is conſiderably enriched by a conſtant reſort of merchants and tradeſmen at Chriſtmas. The river Grijalva divides itſelf near the ſea into two branches, of which the weſtern falls into the river Tabaſco, which riſes in the mountains of Chiapa, and the other continues its courſe till within 4 leagues of the ſea, where it ſubdivides, and ſeparates the iſland from the continent. Near it are plains which abound with cattle and other animals, particularly the mountain cow, ſo called from its reſembling that creature, and feeding on a ſort of moſs found on the trees near great rivers.—*ib.*

Taboguilla, ‖ Tacquet.

TABOGUILLA, or *Little Tabago*, in the bay of Panama, a ſmaller iſland than Tabago, and near it. The channel between them is narrow but good, through which ſhips paſs to Point Chama or Nata.—*ib.*

TABOOYAMANOO, a ſmall iſland in the South Pacific Ocean, ſubject to Huaheine, one of the Society Iſlands.—*ib.*

TACAMES, a bay on the coaſt of Peru, in lat. about 1 6 N. and 3 leagues to the N. E. of Point Galera.—*ib.*

TACHIFI *Point*, on the coaſt of New Mexico, is 18 miles from the town of Pomaro —*ib.*

TACQUET (Andrew), a Jeſuit of Antwerp, who died in 1660. He was a moſt laborious and voluminous writer in mathematics. His works were collected, and printed at Antwerp, in one large volume in folio, 1669.

TADOUSAC,

TADOUSAC, a fmall place in Lower Canada, at the mouth of the river Saguenay, or Sagaenai, on the north fhore of the river St Lawrence. Here a confiderable trade has been carried on with the Indians, they bringing their furs and exchanging them for European cloths, utenfils and trinkets. It is 98 miles below Quebec. N. lat. 48, W. long. 67 35.—*Morse.*

TAENSA, a fettlement in Weft-Florida, on the eaftern channel of the great Mobile river, on a high bluff, and on the fcite of an ancient Indian town, which is apparent from many artificial mounds of earth and other ruins. It is about 30 miles above Fort Conde, or city of Mobile, at the head of the bay. Here is a delightful and extenfive profpect of fome flourifhing plantations. The inhabitants are moftly of French extraction, and are chiefly tenants. The *myrica inodora*, or wax-tree, grows here to the height of 9 or 10 feet, and produces excellent wax for candles.—*ib.*

TAGAPIPE, a caftle erected on a point of land in the Bay of All Saints, in Brazil. It is pretty confiderable, and adds greatly to the ftrength of St Salvadore.—*ib.*

TAGO, *Sant*, or *Tiago Point*, on the weft coaft of New-Mexico, is between Salagua and the White Rock. —*ib.*

TAHOORA, or *Tahoorowa*, one of the fmalleft of the Sandwich Iflands, 3 leagues from the fouth-weft part of Mowee. N. lat. 20 38, W. long. 156 33 —*ib.*

TALAHASOCHTE, a confiderable town of the Seminole Indians, fituated on the elevated eaft banks of the Little river St John, near the bay of Apalache, in the Gulf of Mexico, about 75 miles from the Alachua favanna. Here are near 30 habitations conftructed of frame work, and covered with the bark of the cyprefs tree, after the mode of Cufcowilla, and a fpacious and neat council-houfe. Thefe Indians have large handfome canoes, which they form out of the trunks of cyprefs trees, fome capacious enough to hold 20 or 30 warriors. In thefe they defcend the river on trading and hunting expeditions on the fea-coaft, iflands, and keys, quite to the Point of Florida; and fometimes crofs the Gulf and go to the Bahama Iflands, and even to Cuba, and bring returns of fpirituous liquors, coffee, fugar, and tobacco.—*ib.*

TALAPOOSEE, or *Tallapoofe*, the great north-eaft branch of the Alabama or Mobile river, in Florida. It rifes in the high lands near the Cherokees, and runs through the high country of the Oakfufkee tribes in a weftwardly direction, and is full of rocks, falls, and fhoals, until it reaches the Tuckabatches, where it becomes deep and quiet; from thence the courfe is weft about 30 miles to Little Tallafie, where it unites with the Coofa, or Coofa Hatcha. At Coolfome, near Otaffe, a Mufcogulge town, this river is 300 yards broad, and about 15 or 20 feet deep. The water is clear and falubrious. In moft maps the lower part of this river is called *Oakfufkie*.—*ib.*

TALASSEE, or *Tallaffee*, a county confifting of a tract of land bounded by Eaft-Florida on the fouth, from which the head water of St Mary's river partly feparates it; north by Alatamaha river, eaft by Glynn and Camden counties, and wefterly by a line which extends from the weftern part of Ekanfanoka Swamp, in a N. E. direction till it ftrikes the Alatamaha river, at the mouth of the Oakmulgee. It is faid that the State of Georgia had extinguifhed the Indian claim to this tract of land, but it has been given up to the Indians as the price of peace; for which that State makes a claim for 50,000l. with intereft, fince the treaty, upon the United States.—*ib.*

TALASSEE, a town of the Upper Creeks, in the Georgia weftern territory, on the fouth fide of Talapoofe river, diftant about 3 days journey from Apalachicola on Chata Uche river. It is alfo called Big Talaffee.—*ib.*

TALBERT's *Ifland*, on the coaft of Georgia, the north point of which is in lat. about 30 44 N. where St Mary's river empties into the ocean between this ifland and Amelia Ifland on the N.—*ib.*

TALBOT, an ifland on the coaft of Eaft-Florida. The fands at the entrance of Naffau lie three miles off the fouth-eaft point of Amelia Ifland, and from the N. E. point of Talbot Ifland.—*ib.*

TALBOT, a county of Maryland, on the eaftern fhore of Chefapeak Bay, bounded E. by Choptank river, which divides it from Caroline county, and fouth by the fame river, which feparates it from Dorcefter. It contains 13,084 inhabitants, of whom 4,777 are flaves. The foil is rich and fertile.—*ib.*

TALCAGUAMA, a cape on the coaft of Chili, 11 leagues N. E. of the ifland of St Mary, and 2 northward of Port St Vincent.—*ib.*

TALCAGUAMA *Port*, is 6 miles within the above point of its name, and is one of two good roads in the bay of Conception.—*ib.*

TALLOW *Point*, a mark for anchoring in the harbour of Port Royal, on the fouth coaft of the ifland of Jamaica.—*ib.*

TALLOW-TREE. See CROTON (*Encycl.*), where, however, we have fallen into a miftake, which it is here our duty to correct. We learn from Sir George Staunton, that the candles made of the vegetable tallow are firmer than thofe made of animal tallow, and free from all offenfive fmell, contrary to what was rafhly faid in the article referred to. They are not, however, equal to thofe of wax or fpermaceti; but the latter of thefe fubftances is not within the reach of the Chinefe, and the art of blanching the former is little known to them. The tallow tree is faid to have been tranfplanted to Carolina, and to flourifh there as well as in China.

TALOO *Harbour*, on the N. fide of the ifland of Eimeo, in the South Pacific Ocean. S. lat. 17 30, W. long. 150.—*Morse.*

TALOOK, an Arabic word, which fignifies literally attachment, connection, dependence. In Bengal, however, where it occurs perpetually in the enumeration of the diftricts and fubdivifions of that province contained in the inftitutes of Akber, it fignifies a tenure of land. Hence the *talook* of Cafhinat, the *talook* of Meheys the headman, the *talook* of Ahmed Khan, &c. See *A Differtation concerning the Landed Property of Bengal*, by Sir Charles Roufe Boughton.

TALOOKDAR, the poffeffor of a talook.

TALOOKDARY, tenure of a talookdar.

TALUS, or TALUD, in architecture, the inclination or flope of a work; as of the outfide of a wall, when its thicknefs is diminifhed by degrees, as it rifes in height, to make it the firmer.

TALUS, in fortification, means alfo the flope of a work, whether of earth or mafonry.

TAMALEQUE, an inland city, in the province of St Martha, on the coaſt of Terra Firma. It is ſituated on the banks of Magdalena river, and carries on a trade on that river from New Granada to Carthagena, from whence it is diſtant above 150 miles.—*Morse.*

TAMAR, *Cape*, is the N. W. point of a large bay and harbour on the N. ſhore of the Straits of Magellan, within the cape. The ſouth-eaſt point of the bay is named Providence. S. lat. 52 51, W. long. 75 40.—*ib.*

TAMARIKA, an iſland on the coaſt of Brazil, northward of Pernambuco, and about 24 miles in length. It is 2 miles N. of Pornovello, and has a harbour and good freſh water. S. lat. 7 56, W. long. 35 5.—*ib.*

TAMASCAL, the name given in California to a kind of ſand bath employed by the natives in the cure of the venereal diſeaſe. It is prepared by ſcooping a trench in the ſand, two feet wide, one foot deep, and of a length proportioned to the ſize of the patient; a fire is then made through the whole extent of it, as well as upon the ſand which was dug out of the hollow. When the whole is thoroughly heated, the fire is removed, and the ſand ſtirred about, that the warmth may be equally diffuſed. The ſick perſon is then ſtripped, laid down in the trench, and covered up to his chin with heated ſand. In this poſition a very profuſe ſweat ſoon breaks out, which gradually diminiſhes according as the ſand cools. The patient then riſes and bathes in the ſea, or the neareſt river. This proceſs is repeated till a complete cure is obtained. While the patient is undergoing the operation of the tamaſcal, he drinks a conſiderable quantity of a warm ſudorific, prepared by the decoction of certain herbs, chiefly of the ſhrub called by the Spaniards GOUVERNANTE, which ſee in this *Supplement*.

TAMATAMQUE, called by the Spaniards, *Villa de las Pulmas*, a town of Santa Martha, in Terra Firma, S. America; ſituated on the eaſtern bank of Santa Martha river, about 28 miles above Teneriffe.—*Morse.*

TAMBO *Land*, on the coaſt of Peru, extends about 9 miles from Cape Remate to Playa de los Perdrices, or the Partridge Strand, about 9 miles. There is clear and good anchorage upon this ſtrand, under a row of high, ridgy, and ſandy hills. On making them from the ſea, they reſemble a covey of partridges juſt riſing; hence the name of the coaſt.—*ib.*

TAMMANY's, *St*, a village on Dan river, in Virginia, 15 miles from Gill's Bridge, 7 from Mecklenburg court-houſe, 42 from Halifax court-houſe, in North-Carolina, and 398 from Philadelphia.—*ib.*

TAMMANY, *Fort St*, or *St Mary's*, at the mouth of St Mary's river, on the S. line of Georgia.—*ib.*

TAMMATA-PAPPA, a low iſland of the N. Pacific Ocean, ſaid to be near the Sandwich Iſlands.—*ib.*

TAMOU *Iſland*, one of the ſmall iſlets which form part of the reef on the E. ſide of Ulietea Iſland, one of the Society Iſlands.—*ib.*

TAMWORTH, a townſhip in the northern part of Strafford county, New-Hampſhire. It was incorporated in 1766, and contains 266 inhabitants.—*ib.*

TAN is a ſubſtance found in moſt vegetables, which, not having hitherto been reſolved into component parts, is therefore conſidered as ſimple. See *Vegetable and Animal* SUBSTANCES in this *Suppl.*

TANBANTY *Bay*, on the coaſt of Brazil, has a good road, ſheltered by the ſands that lie off within 3 miles of the ſhore. It is one of thoſe places between Point Negro and Point Luena.—*Morse.*

TANEYTOWN, a ſmall poſt-town of Maryland, in Frederick county, between Piney Run and Pine Creek, on which are a number of mills and ſome ironworks. It lies 27 miles N. by E. of Frederickſtown, and 121 W. S. W. of Philadelphia.—*ib.*

TANELA, or *Tonela*, a tract of ſhore on the weſt coaſt of Mexico, on the N. Pacific Ocean, commencing near the Sugar Loaf Hill, about 6 miles within the land, bearing N. E. and S. W. with the burning mountain of Lacatecolula, about 18 miles up the river Limpa.—*ib.*

TANGOLA, an iſland in the N. Pacific Ocean, and on the weſt coaſt of New Mexico; affording good anchorage and plenty of wood and water. It is about 60 miles weſtward of Guatimala. It is alſo named *Tangolatango*.—*ib.*

TANGUEY, or *Tonguey*, on the coaſt of Chili, in the S. Pacific Ocean, is 30 miles from Limari, and in lat. 30 30 S.—*ib.*

TANNING is an art, of which a full account, according to the general practice in London and its vicinity, has been given under the proper title in the *Encyclopædia*. But ſince that article was written, the ſuperior knowledge which has been obtained of the tanning principle, as well as of the compoſition of the ſkins of animals (See *Vegetable and Animal* SUBSTANCES, *Suppl.*), has ſuggeſted to ſcientific artiſts various methods of ſhortening the proceſs by which leather is manufactured. M. Seguin is ſaid to have thrown much light upon the art of the tanner as it is practiſed in France; and in 1795 Mr William Deſmond obtained a patent for practiſing Seguin's method in England. He obtains the tanning principle by digeſting oak-bark, or other proper material, in cold water, in an apparatus nearly ſimilar to that uſed in the ſaltpetre works. That is to ſay, the water which has remained upon the powdered bark for a certain time, in one veſſel, is drawn off by a cock, and poured upon freſh tan. This is again to be drawn off, and poured upon other freſh tan; and in this way the proceſs is to be continued to the fifth veſſel. The liquor is then highly coloured, and marks, as Mr Deſmond ſays, from ſix to eight degrees on the hydrometer for ſalts. He calls this the tanning lixivium. The criterion to diſtinguiſh its preſence is, that it precipitates glue from its aqueous ſolution, and is alſo uſeful to examine how far other vegetable ſubſtances, as well as oak bark, may be ſuitable to the purpoſe of tanning. The ſtrong tanning liquor is to be kept by itſelf. It is found by trials with the glue, that the tanning principle of the firſt digeſter which receives the clear water, is, of courſe, firſt exhauſted. But the ſame tan will ſtill give a certain portion of the aſtringent principle, or gallic lixivium, to water. The preſence of this principle is aſcertained by its ſtriking a black colour when added to a ſmall quantity of the ſolution of vitriol of iron or green copperas. As ſoon as the water from the digeſter ceaſes to exhibit this ſign, the tan is exhauſted, and muſt be replaced with new. The gallic lixivium is reſerved for the purpoſe of taking the hair off from hides.

Strong hides, after waſhing, cleaning, and fleſhing, in

Tanning. in the ufual way, are to be immerfed for two or three days in a mixture of gallic lixivium and one thoufandth part by meafure of denfe vitriolic acid. By this means the hair is detached from the hides, fo that it may be fcraped off with a round knife. When fwelling or raifing is required, the hides are to be immerfed for ten or twelve hours in another vat filled with water and one five-hundredth part of the fame vitriolic acid. The hides being then repeatedly wafhed and dreffed, are ready for tanning; for which purpofe they are to be immerfed for fome hours in a weak tanning lixivium of only one or two degrees; to obtain which, the latter portions of the infufions are fet apart; or elfe fome of that which has been partly exhaufted by ufe in tanning. The hides are then to be put into a ftronger lixivium, where in a few days they will be brought to the fame degree of faturation with the liquor in which they are immerfed. The ftrength of the liquor will by this means be confiderably diminifhed, and muft therefore be renewed. When the hides are by this means completely faturated, that is to fay, perfectly tanned, they are to be removed, and flowly dried in the fhade.

Calf fkins, goat-fkins, and the like, are to be fteeped in lime-water after the ufual flefhing and wafhing. Thefe are to remain in the lime water, which contains more lime than it can diffolve, and requires to be ftirred feveral times a day. After two or three days, the fkins are to be removed, and perfectly cleared of their lime by wafhing and preffing in water. The tanning procefs is then to be accomplifhed in the fame manner as for the ftrong hides, but the lixivium muft be confiderably weaker. Mr Defmond remarks, that lime is ufed inftead of the gallic lixivium for fuch hides as are required to have a clofe grain; becaufe the acid mixed with that lixivium always fwells the fkins more or lefs; but that it cannot with the fame convenience be ufed with thick fkins, on account of the confiderable labour required to clear them of the lime; any part of which, if left, would render them harfh and liable to crack. He recommends, likewife, as the beft method to bring the whole furface of the hides in contact with the lixivium, that they fhould be fufpended vertically in the fluid by means of tranfverfe rods or bars, at fuch a diftance as not to touch each other. By this practice much of the labour of turning and handling may be faved.

Mr Defmond concludes his fpecification, by obferving, that in fome cafes it will be expedient to mix frefh tan with the lixivium; and that various modifications of ftrength, and other circumftances, will prefent themfelves to the operator. He affirms that, in addition to the great faving of time and labour in this method, the leather, being more completely tanned, will weigh heavier, wear better, and be lefs fufceptible of moifture than leather tanned in the ufual way; that cords, ropes, and cables, made of hemp or fpeartery, impregnated with the tanning principle, will fupport much greater weights without breaking, be lefs liable to be worn out by friction, and will run more fmoothly on pulleys; infomuch that, in his opinion, it will render the ufe of tar in many cafes, particularly in the rigging of fhips, unneceffary; and, laftly, that it may be fubftituted for the prefervation of animal food inftead of falt.

Mr Nicholfon, from whofe Philofophical Journal we have taken this account of Mr Defmond's method of tanning, made fome very proper enquiries at one of the firft manufacturing houfes in the borough of Southwark, concerning its value. He was told by one of the partners, that the principle upon which the new procefs is founded had been long known to them; but that they preferred the old and flower method, becaufe the hides are found to feed and improve in their quality by remaining in the pit. He could gain no fatisfactory information of what is meant by this feeding and improving; and, without taking upon us to decide between the advantages peculiar to Defmond's method and thofe of the common practice, we cannot help faying that this objection of the tanner at Southwark appears to us to be that of a man who either underftands not the principles of his own art, or has fome reafon for oppofing the progrefs of improvement, if it do not originate in his own houfe.

Tanfa, || Tappan.

TANSA, a branch of the river Mobile, 3 leagues below the Alabama branch.—*Morse.*

TAOO, the moft foutherly of the Friendly Iflands, in the South Pacific Ocean, is about 10 leagues in circuit, and fo elevated as to be feen at the diftance of 12 leagues.—*ib.*

TAOUKA, an ifland in the S. Pacific Ocean, one of the Society Iflands. S. lat. 14 30, W. long. 145 9.—*ib.*

TAPANATEPEQUE, a town of Guaxaca, and audience of Mexico. It ftands at the foot of the mountains Quelenos, at the bottom of a bay in the South Sea; and is reprefented as one of the pleafanteft places in this country, and the beft furnifhed with flefh, fowl and fifh, being contiguous both to the fea and a river, amidft rich farms, each of which being ftocked with between 1000 and 4000 head of cattle. Here are delightful walks of orange, lemon, citron, fig and other fruit trees.—*ib.*

TAPARICA, a long ifland on the weft fide of the entrance into the Bay of All Saints, in Brazil.—*ib.*

TAPAYO, a town of S. America, on the fouth bank of Amazon river, eafterly from the mouth of Madeira river.—*ib.*

TAPPAHANNOCK, a poft-town and port of entry of Virginia, in Effex county, between Dangerfield on the north and Hofkin's creek on the fouth, and on the fouth-weft bank of Rappahannock river, 54 miles from Richmond, 67 from Williamfburg, and 263 from Philadelphia. It is alfo called *Hobbes' Hole.* It is laid out regularly, on a rich plain, and contains about 100 houfes, an epifcopal church, a court-houfe, and gaol; but is rather unhealthy. The exports for one year, ending Sept. 30, 1794, amounted to the value of 160,673 dollars.—*ib.*

TAPPAN, a town of New-York, in the fouth-eaft part of Orange county, about 4 miles from the north bank of Hudfon's river, and at the fouth end of the Tappan fea. Here is a reformed Proteftant Dutch church. Major Andre, adjutant-general of the Britifh army fuffered here as a fpy, Oct. 2, 1780; having been taken on his way to New-York, after concerting a plan with major-general Arnold for the delivering up Weft Point to the Britifh.—*ib.*

TAPPAN *Sea*, or *Bay*, a dilatation of Hudfon's river, in the State of New-York, oppofite the town of Tappan, and 35 miles north of New-York city; immediately fouth of and adjoining Haverftraw Bay. It is 10 miles long and 4 wide; and has on the north fide fine quarries of a reddifh free-ftone, ufed for buildings and grave-ftones; which are a fource of great wealth to the proprietors.—*ib.*

TAPUYES, or *Tapayos*, the moft confiderable nation of the native Brazilians, in S. America, that have not yet been conquered by the Portuguefe. They fpread themfelves a great way inland to the weft, and are divided into a great number of tribes or cantons, all governed by their own kings.—*ib.*

TARAHUMARY, a province of New Spain, 1200 miles diftant from the capital.—*ib.*

TARBOROUGH, a poft-town of N. Carolina; fituated on the weft fide of Tar river, about 85 miles from its mouth, 140 from Ocrecock Inlet, 110 north by eaft of Fayetteville, 37 fouth of Halifax, 112 fouth by weft of Peterfburg in Virginia, and 420 fouth-weft of Philadelphia. It contains about 50 houfes, a court-houfe and gaol. Large quantities of tobacco, of the Peterfburg quality, pork, beef, and Indian corn are collected here for exportation.—*ib.*

TARIJA, or *Chichas*, one of the fourteen jurifdictions belonging to the archbifhopric of Plata, in Peru. It lies about 90 miles fouth of Plata; and its greateft extent being about 105 miles. The temperature of the air is various: in fome parts hot, and in others cold; fo that it has the advantage of corn, fruits and cattle. This country abounds every where in mines of gold and filver; but efpecially that part called Chocayas. Between this province and the country inhabited by the wild Indians, runs the large river Tipuanys, the fands of which being mixed with gold, are wafhed, in order to feparate the grains of that metal.—*ib.*

TAR, or *Pamlico River*, a confiderable river of N. Carolina, which purfues a fouth-eaft courfe, and paffing by Wafhington, Tarborough and Greenville, enters Pamlico Sound in lat. 35 22 N. It is navigable for veffels drawing 9 feet water to the town of Wafhington, 40 miles from its mouth; and for fcows or flats carrying 30 or 40 hhds. 50 miles farther to the town of Tarborough. According to the report of a committee, appointed by the legiflature of N. Carolina, to inquire into the practicability of improving the inland navigation of the State, it is fuppofed that this river, and Fifhy Creek, a branch of it, may be made navigable 40 miles above Tarborough.—*ib.*

TARPAULIN *Cove*, on the coaft of Maffachufetts, lies about 3 leagues N. N. W. of Holmes's Hole, in Martha's Vineyard. It is high water here, at full and change, two minutes after 10 o'clock; 5 fathoms water.—*ib.*

TARRYTOWN, a confiderable village in Phillips's Manor, New-York, on the eaft fide of Hudfon's river, 30 miles N. of New-York city. Under a large tree, which is fhewn to travellers as they pafs the river, is the fpot where the unfortunate Major Andre was taken; who was afterwards executed at Tappan.—*ib.*

TARTE's *Rapids*, *La*, on the river Ohio, lie 40 miles above the mouth of the Great Kanhaway.—*ib.*

TASSIE (James) modeller, whofe hiftory is intimately connected with a branch of the fine arts in Britain, was born in the neighbourhood of Glafgow of obfcure parents; and began his life as a country ftone mafon, without the expectation of ever rifing higher. Going to Glafgow on a fair day, to enjoy himfelf with his companions, at the time when the Foulis's were attempting to eftablifh an academy for the fine arts in that city, he faw their collection of paintings, and felt an irrefiftible impulfe to become a painter. He removed to Glafgow; and in the academy acquired a knowledge of drawing, which unfolded and improved his natural tafte. He was frugal, induftrious, and perfevering; but he was poor, and was under the neceffity of devoting himfelf to ftone-cutting for his fupport: not without the hopes that he might one day be a ftatuary if he could not be a painter. Reforting to Dublin for employment, he became known to Dr Quin, who was amufing himfelf in his leifure hours with endeavouring to imitate the precious ftones in coloured paftes, and take accurate impreffions of the engravings that were on them.

That art was known to the ancients; and many fpecimens from them are now in the cabinets of the curious. It feems to have been loft in the middle ages; was revived in Italy under Leo X. and the Medici family at Florence; became more perfect in France under the regency of the Duke of Orleans, by his labours and thofe of Homberg. By thofe whom they inftructed as affiftants in the laboratory it continued to be practifed in Paris, and was carried to Rome. Their art was kept a fecret, and their collections were fmall. It is owing to Quin and to Taffie that it has been carried to fuch high perfection in Britain, and attracted the attention of Europe.

Dr Quin, in looking out for an affiftant, foon difcovered Taffie to be one in whom he could place perfect confidence. He was endowed with fine tafte: he was modeft and unaffuming: he was patient; and poffeffed the higheft integrity. The Doctor committed his laboratory and experiments to his care. The affociates were fully fuccefsful; and found themfelves able to imitate all the gems, and take accurate impreffions of the engravings.

As the Doctor had followed the fubject only for his amufement, when the difcovery was completed, he encouraged Mr Taffie to repair to London, and to devote himfelf to the preparation and fale of thofe paftes as his profeffion.

In 1766 he arrived in the Capital. But he was diffident and modeft to excefs; very unfit to introduce himfelf to the attention of perfons of rank and of affluence: befides, the number of engraved gems in Britain was fmall; and thofe few were little noticed. He long ftruggled under difficulties which would have difcouraged any one who was not poffeffed of the greateft patience, and the warmeft attachment to the fubject. He gradually emerged from obfcurity, obtained competence; and what to him was much more, he was able to increafe his collection, and add higher degrees of perfection to his art. His name foon became refpected, and the firft cabinets in Europe were open for his ufe; and he uniformly preferved the greateft attention to the exactnefs of the imitation and accuracy of the engraving, fo that many of his paftes were fold on the Continent by the fraudulent for real gems. His fine tafte led him to be peculiarly careful of the impreffion; and he uniformly deftroyed thofe with which he was in the leaft diffatisfied. The art has been practifed of late by others; and many thoufands of paftes have been fold as Taffie's, which he would have confidered as injurious to his fame. Of the fame of others he was not envious; for

for he uniformly fpake with franknefs in praife of thofe who executed them well, though they were endeavouring to rival himfelf.

To the ancient engravings he added a numerous collection of the moft eminent modern ones; many of which approach in excellence of workmanfhip, if not in fimplicity of defign and chaftity of expreffion, to the moft celebrated of the ancient. Many years before he died he executed a commiffion for the late Emprefs of Ruffia, confifting of about 15,000 different engravings (See Gem, *Encycl.*). At his death, in 1799, they amounted to near 20,000; a collection of engravings unequalled in the world. Every lover of the fine arts muft be fenfible of the advantage of it for improvement in knowledge and in tafte. The collection of Feloix at Paris confifted of 1800 articles; and that of Dehn at Rome of 2500.

For a number of years, Mr Taffie practifed the modelling of portraits in wax, which he afterwards moulded and caft in pafte. By this, the exact likenefs of many eminent men of the prefent age will be tranfmitted to pofterity as accurately as thofe of the philofophers and great men have been by the ancient ftatuaries. In taking likeneffes he was, in general, uncommonly happy; and it is remarkable, that he believed there was a certain kind of infpiration (like that mentioned by the poets) neceffary to give him full fuccefs. The writer of this article, in converfing with him repeatedly on the fubject, always found him fully perfuaded of it. He mentioned many inftances in which he had been directed by it; and even fome, in which, after he had laboured in vain to realize his ideas on the wax, he had been able, by a fudden flafh of imagination, to pleafe himfelf in the likenefs feveral days after he had laft feen the original.

He poffeffed alfo an uncommonly fine tafte in architecture, and would have been eminent in that branch if he had followed it.

In private life Mr Taffie was univerfally efteemed for his uniform piety, and for the fimplicity, the modefty, and benevolence, that fhone in the whole of his character.

TASTELESS Earth (*aguft erde*), the name given by Profeffor Trommfdorff to a new fimple earth, which he difcovered in the Saxon beryl. It is diftinguifhed (he fays) from other earths by the following properties: It is white, and totally infoluble in water. In a frefh ftate, when moiftened with water, it is fomewhat ductile. In the fire it becomes tranfparent and very hard, fo as to fcratch glafs, but remains infipid and infoluble in water. The burnt earth diffolves very eafily in acids, and produces with them peculiar falts, which are entirely devoid of tafte; and hence he gave it the name of *taftelefs earth*. Fixed alkalies do not diffolve this earth either in the dry or in the wet way; and it is equally infoluble with the carbonic acid and with cauftic ammonia. It has a greater affinity to the oxalic than to other acids. Profeffor Trommfdorff informs us, that a full account of this earth, accompanied with an accurate defcription, by Dr Bernhardi, of the foffil in which it is found, will appear in the firft part of the eighth volume of his *Journal of Pharmacy*.

TATMAGOUCHE, or *Tatamagouche*, a place in Nova-Scotia, on a fhort bay which fets up foutherly from the Straits of Northumberland; about 25 miles from Onflow, and 21 from the ifland of St John's. It has a very good road for veffels, and is known alfo under the name *Tatamaganabou.—Morse*.

TATNAM *Cape*, the eaftern point of Haye's river, in Hudfon's Bay. N. lat. 57 35, W. long. 91 30.—*ib.*

TATOO-E-TEE, an ifland in the S. Pacific Ocean, one of the Ingraham Ifles, called by Capt. Ingraham, *Franklin*, and by Capt. Roberts, *Blake*. It lies 7 or 8 leagues W. by N. of Nooheeva.—*ib.*

TAUMACO, an ifland about 1250 leagues from Mexico, where De Quiros ftayed ten days. One of the natives named above 60 iflands round it. Some of the names follow, viz. Manicola, Chicayano, larger than Taumaco, and about 300 miles from it; Guatopo, 150 miles from Taumaco; Tucopia, at 100, where the country of Manicola lay. The natives had, in general, lank hair; fome were white, with red hair; fome mulattoes, with curled hair; and fome woolly like negroes. De Quiros obferves that in the bay of Philip and James, were many black ftones, very heavy, fome of which he carried to Mexico, and upon affaying them, they found filver.—*ib.*

TAUNTON, a river which empties into Narraganfet Bay, at Tiverton, oppofite the N. end of Rhode-Ifland. It is formed by feveral ftreams which rife in Plymouth county, Maffachufetts. Its courfe is about 50 miles from N. E. to S. W. and it is navigable for fmall veffels to Taunton.—*ib.*

Taunton, a poft-town of Maffachufetts, and the capital of Briftol county, fituated on the W. fide of Taunton river, and contains 40 or 50 houfes, compactly built, a church, court-houfe, gaol, and an academy, which was incorporated in 1792. It is 36 miles S. by E. of Bofton, 21 E. of Providence, 21 northerly of Bedford, and 312 N. E. of Philadelphia. The townfhip of Taunton was taken from Raynham, and incorporated in 1639, and contains 3,804 inhabitants. A flitting-mill was erected here in 1776, and for a confiderable time the only one in Maffachufetts, and was then the beft ever built in America. The annual production of 3 mills now in this townfhip is not lefs than 800 tons of iron; about 50 tons are cut, and 300 hammered into nails, and the remainder is wrought into fpades and fhovels; of which laft article 200 dozen are rolled annually. Mr Samuel Leonard rolled the firft fhovel ever done in America. This invention reduces the price one half. Wire drawing, and rolling fheet-iron for the tin manufacture, are executed here. There is alfo a manufactory of a fpecies of ochre, found here, into a pigment of a dark yellow colour.—*ib.*

Taunton *Bay*, in the Diftrict of Maine, is fix miles from Frenchman's Bay.—*ib.*

TAVERNIER *Key*, a fmall ifle, one of the Tortugas, 2 miles from the S. W. end of Key Largo, and 5 N. E. of Old Matacombe. To the northward of this laft ifland is a very good road.—*ib.*

TAWANDEE *Creek*, in Northumberland county, Pennfylvania, runs N. E. into the eaft branch of Sufquehannah, 12 miles fouth eaft of Tioga Point.—*ib.*

TAWAS, an Indian tribe in the N. W. Territory, 18 miles up the Miami of the Lake. Another tribe of this name, inhabit higher up the fame river, at a place called the Rapids.—*ib.*

TAWIXTWI, *The Englifh*, or *Pique-Town*, in the N. W. Territory, is fituated on the N. W. bank of the

Great

Great Miami, 35 miles below the 5 mile portage, to the Miami of the Lake, and 68 S. W. by S. of Miami Fort. It was taken in 1752, by the French. N. lat. 40 41, W. long. 84 48.—*ib.*

TEACHES, a ſmall iſland cloſe to the eaſt ſhore of Northampton county, Virginia, and N. by E. of Parramore Iſland.—*ib.*

TECOANTEPEC, or *Tecuantepeque*, or *Teguantepeque*, a large bay on the weſt coaſt of New-Mexico, on the ſouth ſide of the Iſthmus from the Bay or Gulf of Campeachy, in the S. W. part of the Gulf of Mexico; and bounded weſt by Point Angelos. The port town of its name, lies in lat. 15 28 N. and long. 96 15 W.—*ib.*

TEETH, of various ſorts of machines, as of mill wheels, &c. Theſe are often called cogs by the workmen; and by working in the pinions, rounds, or trundles, the wheels are made to turn one another. Mr Emerſon (in his Mechanics, prop. 25.) treats of the theory of teeth, and ſhews that they ought to have the figure of epicycloids, for properly working in one another.

TEHUACAN, a city of New-Spain, 120 miles S. E. of Mexico.—*Morse.*

TEKAWY, in Bengal, money advanced by government to the proprietors or cultivators of land to aſſiſt them under circumſtances of diſtreſs.

TEKY *Sound*, on the coaſt of Georgia, to the ſouth of Savannah river, is a capacious road, where a large fleet may anchor in from 10 to 14 fathoms water, and be land-locked, and have a ſafe entrance over the bar of the river. The flood tide is generally 7 feet.—*Morse.*

TELESCOPE, is an inſtrument which has been ſo completely deſcribed in the *Encyclopædia*, that it is introduced into this place merely to notice an ingenious ſuggeſtion of Mr Nicholſon's for improving the achromatic teleſcope, by adding an artificial iris to the object glaſs. Suppoſe (ſays he) a braſs ring to ſurround the object end of the teleſcope, and upon this let eight or more triangular ſlips of braſs be fixed, ſo as to revolve on equi-diſtant pins paſſing through each triangle near one of its corners. If the triangles be ſlided inwards upon each other, it may readily be apprehended that they will cloſe the aperture; and if they be all made to revolve or ſlide backwards alike, it is clear that their edges will leave an octagonal aperture, greater or leſs according to circumſtances. The equable motion of all the triangles may be produced either by pinions and one concave toothed wheel, or by what is called ſnail-work. Another kind of iris, more compact, may be made, by cauſing thin elaſtic ſlips of braſs to ſlide along parallel to the tube, and be conducted each through a ſlit in a braſs cap which ſhall lead them acroſs the aperture in a radical direction. It is probable alſo that the artiſt, who ſhall carry theſe hints into effect, may alſo think of ſeveral other methods.

This thought occurred to the author, from contemplating the contraction and dilatation of the iris of the eye, according as we look at an object more or leſs luminous. Theſe variations are ſo great, that in the obſervable variations of the human eye, the aperture is thirty times as large at one time as at another, whilſt in the cat the proportion is greater than a hundred to one.

TELICA, a burning mountain on the weſt coaſt of New-Mexico, ſeen at N. N. E. over the ridge of Toſta. It is one of the range of volcanoes which are ſeen along the coaſt from Fort St John's to Tecaantepeck, and is 18 miles from Volcano del Vejo, or Old Man's Burning Mountain; and there are two others between them, but not ſo eaſily diſcerned, as they do not often emit ſmoke.—*Morse.*

TELLICO *Block-Houſe*, in Tenneſſee, ſtands on the north bank of Tenneſſee river, immediately oppoſite the remains of Fort Loudon; and is computed to be 900 miles, according to the courſe of the river, from its mouth, and 32 miles ſouth of Knoxville in Tenneſſee. It was erected in 1794, and has proved a very advantageous military poſt. It has lately been eſtabliſhed, by the United States, as a trading poſt with the Indians.—*ib.*

TELLIGUO, *Great*, in the State of Tenneſſee, was ſituated on the eaſt ſide of the Chota branch of Tenneſſee river, about 25 miles N. E. of the mouth of Holſton river, and 5 ſouth of the line which marked Lord Granville's limits of Carolina. This was a Britiſh factory, eſtabliſhed after the treaty of Weſtminſter, in 1729.—*ib.*

TELLIGUO *Mountains*, lie ſouth of the above place, and ſeem to be part of what are now called the Great Iron Mountains, in the lateſt maps.—*ib.*

TEMPERAMENT OF THE SCALE OF MUSIC. When the conſiderate reader reflects on the large and almoſt numberleſs diſſertations on this ſubject, by the moſt eminent philoſophers, mathematicians, and artiſts, both of ancient and modern times, and the important points which divided, and ſtill divide, their opinions, he will not ſurely expect, in a Work like our's, the deciſion of a queſtion which has hitherto eluded their reſearches. He will rather be diſpoſed, perhaps, to wonder how a ſubject of this nature ever acquired ſuch importance in the minds of perſons of acknowledged talents (for ſurely no perſon will refuſe this claim to Pythagoras, to Ariſtotle, Euclid, Ptolemy, Galileo, Wallis, Euler, and many others, who have written elaborate treatiſes on the ſubject); and his ſurpriſe will increaſe, when he knows that the treatiſes on the ſcale of muſic are as numerous and voluminous in China, without any appearance of their being borrowed from the ingenious and ſpeculative Greeks. 1 Introduction.

The ingenious, in all cultivated nations, have remarked the great influence of muſic; and they found no difficulty in perſuading the nations that it was a gift of the gods. Apollo and his ſacred choir are perhaps the moſt reſpectable inhabitants of the mythological heavens of the Greeks. Therefore all nations have conſidered muſic as a proper part of their religious worſhip. We doubt not but that they found it fit for exciting or ſupporting thoſe emotions and ſentiments which were ſuited to adoration, thanks, or petition. Nor would the Greeks have admitted muſic into their ſerious dramas, if they had not perceived that it heightened the effect. The ſame experience made them employ it as an aid to military enthuſiaſm; and it is recorded as one of the reſpectable accompliſhments of Epaminondas, that he had the muſical inſtructions of the firſt maſters, and was eminent as a performer.

Thus was the ſtudy of muſic ennobled, and recommended to the attention of the greateſt philoſophers. Its cultivation was held an object of national concern, and its profeſſors were not allowed to corrupt it in order

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der to gratify the faſtidious taſte of the luxurious or the ſenſualiſt, who ſought from it nothing but amuſement. But its influence was not confined to theſe public purpoſes; and, while the men of ſpeculation found in muſic an inexhauſtible fund of employment for their genius and penetration, and their poets felt its aid in their compoſitions, it was hailed by perſons of all ranks as the ſoother of the cares and anxieties, and ſweetener of the labours of life. *O Phœbi decus!—laborum dulce lenimen.* Poor Ovid, the victim of what remained of good in the cold heart of Octavius, found its balm.

Exul eram (ſays he): *requieſque mihi, non fama petita eſt.*
Mens intenta ſuis ne foret uſque malis.
Hoc eſt cur cantet vinctus quoque compede foſſor,
Indocili numero cum grave mollit opus.
Cantet et innitens limoſæ pronus arenæ
Adverſo tardam qui trahit amne ratem,
Quique ferens pariter lentos ad pectora remos,
In numerum pulſâ brachia verſat aquâ.
Feſſus ut incubuit baculo, ſaxove reſedit
Paſtor; arundineo carmine mulcet oves.
Cantantis pariter, pariter data penſa trahentis
Fallitur ancillæ, decipiturque labor.

2
Scale of muſic. It requires tempera-ment.

It is chiefly in this humble department of muſical influence that we propoſe at preſent to lend our aid. What has been ſaid in the article Music, *Encycl.* is ſufficient for informing the reader of what is received as the ſcale of muſic, and the inequality of its different ſteps, the tones major and minor, ſemitone, comma, &c. We ſhall only obſerve, that what is there delivered on temperament by M. d'Alembert, after Rameau, bears the evident mark of uncertainty or want of confidence in the principle adopted as the rule of temperament; and we have learned, ſince the printing of that article, that the inſtructions there delivered have not that perſpicuity and preciſion that are neceſſary for enabling a perſon to execute the temperament recommended by Rameau; that is, to tune a keyed inſtrument with certainty, according to that ſyſtem or conſtruction of the ſcale.

If ſuch be the caſe, we are in ſome meaſure diſappointed; becauſe we ſelected that treatiſe of D'Alembert as the performance of a man of great eminence as a mathematician and philoſopher, aiming at public inſtruction more than his own fame, by this elementary abſtract of the great work of the moſt eminent muſician in France.

Few can tune a harpſichord;

To be able to tune a harpſichord with certainty and accuracy, ſeems an indiſpenſable qualification of any perſon worthy of the name of a *muſician*. It would certainly be thought an unpardonable deficiency in a violin performer if he could not tune his inſtrument; yet we are well informed, that many profeſſional performers on the harpſichord cannot do it, or cannot do it any other way than by uncertain and painful trial, and, as it were, groping in the dark; and that the tuning of harpſichords and organs is committed entirely to tuners by profeſſion. This is a great inconvenience to perſons reſiding in the country; and therefore many take leſſons from the profeſſed harpſichord tuners, who alſo profeſs to teach this art. We have been preſent during ſome of theſe leſſons; but it did not appear to us that the inſtructions were ſuch as could enable the ſcholar to tune an inſtrument when alone, unleſs the leſſons had been ſo frequent as to form the ear to an inſtantaneous judgment of tune by the ſame habit that had inſtructed the teacher. There ſeemed to be little principle that could be treaſured up and recollected when wanted.

3
Yet Nature furniſhes abundant means of doing this.

Yet we cannot help thinking that there are phenomena or facts in muſic, ſufficiently preciſe to furniſh principles of abſolute certainty for enabling us to produce temperaments of the ſcale which ſhall have determined characters, and among which we may chooſe ſuch a one as ſhall be preferable to the others, according to the purpoſes we have in view; and we think that theſe principles are of ſuch eaſy application, that any perſon, of a moderate ſenſibility to juſt intonation, may, without much knowledge or practice in muſic, tune his harpſichord with all deſirable accuracy. We propoſe to lay theſe before the reader. We might content ourſelves with ſimply giving the practical rules deduced from the principles; but it is ſurely more deſirable to perceive the validity of the principles. This will give us confidence in the deduced rules of practice. In the employment of ſacred muſic, an inſpired writer counſels us to ſing, not only "with the heart, but with the underſtanding alſo." We may, without irreverence, recommend the ſame thing here. Let us therefore attend a little to the dictate of untutored Nature, and ſee how ſhe teaches all mankind to form the ſcale of melody.

4
All nations ſing by one ſcale.

It is a moſt remarkable fact, that, in all nations, however they may differ in the ſtructure of that chaunt which we call the accent, or tone, or twang, in the colloquial language of a particular nation, or in the favourite phraſes or paſſages which are moſt frequent in their ſongs, all men make uſe of the ſame riſes and falls, or inflections of voice, in their muſical language or airs. We have heard the ſongs of the Iroquois, the Cherokee, and the Eſquimaux, of the Carib, and the inhabitant of Paraguay; of the African of Negroland and of the Cape, and of the Hindoo, the Malay, and the native of Otaheite—and we found none that made uſe of a different ſcale from our own, although ſeveral ſeemed to be very ſorry performers by any ſcale. There muſt be ſome natural foundation for this uniformity. We may never diſcover this; but we may be fortunate enough to diſcover facts in the phenomena of ſound which invariably accompany certain modifications of muſical ſentiment. If we ſucceed, we are intitled to ſuppoſe that ſuch inſeparable companions are naturally connected; and to conclude, that if we can inſure the appearance of thoſe facts in ſound, we ſhall alſo give occaſion to thoſe muſical ſentiments or impreſſions.

5
Muſical pitch, what?

There is a quality in lengthened or continued ſound which we call its pitch or note, by which it may be accounted ſhrill or hoarſe. It may be very hoarſe in the beginning, and during its continuance it may grow more and more ſhrill by imperceptible gradations. In this caſe we are ſenſible of a kind of progreſs from the one ſtate of ſound to the other. Thus, while we gently draw the bow acroſs the ſtring of a baſs viol, if we at the ſame time ſlide the finger ſlowly along the ſtring, from the nut towards the bridge, the ſound, from being hoarſe, becomes gradually acute or ſhrill. Hoarſe and ſhrill therefore are not different qualities, although they have different names, but are different ſtates or degrees of the ſame quality, like cold and heat, near and far,

early

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early and late, or, what is common to all theſe, little and great. A certain ſtate of the air is accounted neither hot nor cold. All ſtates on one ſide of this are called warm, or hot; and all on the other are cold. In like manner, a certain ſound is the boundary between thoſe that are called hoarſe and thoſe called ſhrill. The chemiſt is accuſtomed to ſay, that the temperature of a body is higher when it is warmer, and lower when colder. In like manner, we are accuſtomed to ſay, that a perſon raiſes or depreſſes the pitch of his voice when it becomes more ſhrill or more hoarſe. The ancient Greeks, however, called the ſhriller ſounds *low*, and the hoarſer ſounds *high;* probably becauſe the hoarſer ſounds are generally ſtronger or louder, which we are alſo accuſtomed to conſider as higher. In common language, a low pitch of voice means a faint ſound, but in muſical language it means a hoarſer ſound. The ſound that is neither hoarſe nor ſhrill is ſome ordinary pitch of voice, but without any preciſe criterion.

6 The change obſerved in the pitch of a violin ſtring, when the finger is carried along the finger-board with a continued motion, is alſo continuous; that is, not by ſtarts: we call it gradual, for want of a better term, although gradual properly means *gradatim*, by degrees, ſteps, or ſtarts, which are not to be diſtinguiſhed in this experiment. But we may make the experiment in another way. After ſounding the open ſtring, and while the bow is yet moving acroſs it, we may put down the finger about $1\frac{2}{3}$ inches from the nut. This will change the ſound into one which is *ſenſibly* ſhriller than the former, and there is a manifeſt ſtart from the one to the other. Or we may put down the finger $2\frac{1}{2}$ inches from the nut; the ſound of the open ſtring will change to a ſhriller ſound, and we are ſenſible that this change or ſtep is greater than the former. Moreover, we may, while drawing the bow acroſs the ſtring, put down one finger at $1\frac{2}{3}$ inches, and, immediately after, put down another finger at $2\frac{1}{2}$ inches from the nut. We ſhall have three ſounds in ſucceſſion, each more ſhrill than the preceding, with two manifeſt ſteps, or ſubſultory changes of pitch.

7 Now ſince the laſt ſound is the ſame as if the ſecond had not been ſounded, we muſt conceive the ſum of the two ſucceſſive changes as equivalent or equal to the change from the firſt to the third. This change ſeems ſomehow to include the other two, and to be made up of them, as a whole is made up of its parts, or as $2\frac{1}{2}$ inches are made up of $1\frac{2}{3}$ and $\frac{5}{6}$ of an inch, or as the ſum 15 is made up of 10 and 5.

8 We have a notion of ſomething like an interval between the notes of muſic.

Thus it happens that thinking perſons conceive ſomething like or analogous to a diſtance, or interval, between theſe ſounds. It is plain, however, that there can be no real diſtance or ſpace interpoſed between them; and it is not eaſy to acquire a diſtinct notion of the bulk or magnitude of theſe intervals. This conception is purely figurative and analogical; but the analogy is very good, and the obſervation of it, or conjecture about it, has been of great ſervice in the ſcience of muſic, by making us ſearch for ſome preciſe meaſure of thoſe manifeſt intervals of muſical ſounds.

9 It muſt now be remarked, that it is in this reſpect alone that ſounds are ſuſceptible of muſic. Nor are all ſounds poſſeſſed of this quality. The ſmack of a whip, the exploſion of a muſket, the ruſhing of water or wind, the ſcream of ſome animals, and many other ſounds, both momentary and continuous, are mere noiſes; and can neither be called hoarſe nor ſhrill. But, on the other hand, many ſounds, which differ in a thouſand circumſtances of loudneſs, ſmoothneſs, mellowneſs, &c. which make them pleaſant or diſagreeable, have this quality of muſical pitch, and may thus be compared. The voice of a man or woman, the ſound of a pipe, a bell, a ſtring, the voice of an animal, nay, the ſingle blow on an empty caſk—may all have one pitch, or we may be ſenſible of the interval between them. We can, in all caſes, tighten or ſlacken the ſtring of a violin, till the moſt uninformed hearer can pronounce with certainty that the pitch is the ſame. We are indebted to the celebrated Galileo for the diſcovery of that phyſical circumſtance in all thoſe ſounds which communicates this remarkable quality to them, and even enables us to induce it on any noiſe whatever, and to determine, with the utmoſt preciſion, the muſical pitch of the ſound, and the interval between any two ſuch ſounds. Of this we ſhall ſpeak fully hereafter; and at preſent we only obſerve, that two ſounds, having the ſame pitch, are called UNISONS by muſicians, or are ſaid to be in *uniſon* to one another.

When two untaught men attempt to ſing the ſame air together, they always ſing in uniſon, unleſs they expreſſly mean to ſing in different pitches of voice. Nay, it is an extremely difficult thing to do otherwiſe, except in a few very peculiar caſes. Alſo, when a man and woman, wholly uninſtructed in muſic, attempt to ſing the ſame air, they alſo *mean* to ſing the ſame muſical notes through the whole air; and they generally imagine that they do ſo. But there is a manifeſt difference in the ſounds which they utter, and the woman is ſaid to ſing more SHRILL, and the man more HOARSE. A very plain experiment, however, will convince them that they are miſtaken. *N. B.* We are now ſuppoſing that the performers have ſo much of a muſical ear, and flexible voice, as to be able to ſing a common ballad, or a pſalm tune, with tolerable exactneſs, and that they can prolong or dwell upon any particular note when deſired. 10

Let them ſing the common pſalm tune called St David's, in the ſame way that they practiſe at church; and when they have done it two or three times, in order to fix their voices in tune, and to feel the general impreſſion of the tune, let the woman hold on in the firſt note of the tune, which we ſuppoſe to be *g*, while the man ſings the firſt three in ſucceſſion, namely *g, d,* $\bar{g}$. He will now perceive, that the laſt note ſung by himſelf is the ſame with that ſung by the woman, and which ſhe thinks that ſhe is ſtill holding on in the firſt note of the tune. Let this be repeated till the performance becomes eaſy. They will then perceive the perfect ſameneſs, in reſpect of muſical pitch, of the woman's firſt note of this tune and the man's third note. Some difference, however, will ſtill be perceived; but it will not be in the pitch, but in the ſmoothneſs, or clearneſs, or other agreeable quality of the woman's note.

11 There are ſeven ſteps in the natural ſcale, and eight notes.

When this is plainly perceived, let the man try by what continued ſteps he muſt raiſe his pitch, in order to arrive at the woman's note from his own. If he is accuſtomed to common ballad ſinging, he will have no great difficulty in doing this; and will find that, beginning with his own note, and ſinging gradually up, his eighth note will be the woman's note. In ſhort, if two flutes be taken, one of which is twice as long as the

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the other, and if the man fing in unifon with the large flute, the woman, while finging, as fhe thinks, the fame notes with the man, will be found to be finging in unifon with the fmaller flute.

12 Octave.

This is a remarkable and moft important fact in the phenomena of mufic. This interval, comprehending and made up of feven fmaller intervals, and requiring eight founds to mark its fteps, is therefore called an OCTAVE. Now, fince the female performer follows the fame dictates of natural ear in finging her tune that the man follows in finging his, and all hearers are fenfible that they are finging the fame tune, it neceffarily follows, that the two feriefes of notes are perfectly fimilar, though not the fame: For there muft be the fame interval of an octave between any ftep of the lower octave and the fame ftep of the upper one. In whatever way, therefore, we conceive one of thefe octaves to be parcelled out by the different fteps, the partition of both muft be fimilar. If we reprefent both by lines, thefe lines muft be fimilarly divided. Each partial interval of the one muft bear the fame relation to the whole, or to any other interval, as its fimilar interval in the other octave bears to the whole of that octave, or to the other correfponding interval in it.

13 All octaves are fimilar.

Farther, we muft now obferve, that although this fimilarity of the octaves was firft obferved or difcovered by means of the ordinary voices of man and woman, and is a legitimate inference from the perfect fatisfaction that each feels in finging what they think the fame notes, this is not the only foundation or proof of the fimilarity. Having acquired the knowledge of that phyfical circumftance, on which the pitch of mufical founds depends, we can demonftrate, with all the rigour of geometry, that the feveral notes in the man and woman's octave *muft* have the fame relation to their refpective commencements, and that thefe two great intervals are fimilarly divided. But farther ftill, we can demonftrate that this fimilarity is not confined to thefe two octaves. This may even be proved, to a certain extent, by the fame original experiment. Many men can fing two octaves in fucceffion, and there are fome rare examples of perfons who can fing three. This is more common in the female voice. This being the cafe, it is plain that there will be two octaves common to both voices; and therefore four octaves in fucceffion, all fimilar to each other. The fame fimilarity may be obferved in the founds of inftruments which differ only by an octave. And thus we demonftrate that all octaves are fimilar to each other. This fimilarity does not confift merely in the fimilarity of its divifion. The found of a note and its octave are fo like each other, that if the ftrength or loudnefs be properly adjufted, and there be no difference in kind, or other circumftances of clearnefs, fmoothnefs, &c. the two notes, when founded together, are indiftinguifhable, and appear only like a more brilliant note. They coalefce into one found. Nay, moft clear mellow notes, fuch as thefe of a fine human voice, really contain each two notes, one of which is octave to the other.

14 All mufic contained in the octave; hence called DIAPASON.

We faid that this refemblance of octaves is an important fact in the fcience of mufic. We now fee why it is fo. The whole fcale of mufic is contained in one octave, and all the reft are only repetitions of this fcale. And thus is the doctrine of the fcale of melody brought within a very moderate compafs, and the problem is reduced to that of the repartition of a fingle octave, and fome attention to the junction with the fimilar fcales of the adjoining octaves. This partition is now to be the fubject of difcuffion.

15 Melodies, or tunes or airs, were the firft mufic.

In the infancy of fociety and cultivation, it is probable that the melodies or tunes, which delighted the fimple inhabitants were equally fimple. Being the fpontaneous effufions of individuals, perhaps only occafional, and never repeated, they would perifh as faft as produced. The airs were probably connected with fome of the rude rhimes, or gingles of words, which were bandied about at their feftivals; or they were affociated with dancing. In all thefe cafes they muft have been very fhort, confifting of a few favourite paffages or mufical phrafes. This is the cafe with the common airs of all fimple people to this day. They feldom extend beyond a fhort ftanza of poetry, or a fhort movement of dancing. The artift who could compofe and keep in mind a piece of confiderable length, muft have been a great rarity, and a minftrel fit for the entertainment of princes; and therefore much admired, and highly rewarded: his excellencies were almoft incommunicable, and could not be preferved in any other way but by repeated performance to an attentive hearer, who muft alfo be an artift, and muft patiently liften, and try to imitate; or, in fhort, to get the tune by heart. It muft have been a long time before any diftinct notion was formed of the relation of the notes to each other. It was perhaps impoffible to recollect to day the precife notes of yefterday. There was nothing in which they were fixed till inftrumental mufic was invented. This has been found in all nations; but it appears that long continued cultivation is neceffary for raifing this from a very fimple and imperfect ftate. The moft refined inftrument of the Greek muficians was very far below our very ordinary inftruments. And, till fome method of notation was invented, we can fcarcely conceive how any determined partition of the octave could be made generally known.

16 Key-note or Fundamental.

Accordingly, we find that it was not till after a long while, and by very rude and awkward fteps, that the Greeks perceived that the whole of mufic was comprifed in the octave. The firft improved lyre had but four ftrings, and was therefore called a TETRACHORD; and the firft flutes had but three holes, and four notes; and when more were added to the fcale, it was done by joining two lyres and two flutes together. Even this is an inftructive ftep in the hiftory of mufical fcience: For the four founds of the inftrument have a natural fyftem, and the awkward and groping attempts to extend the mufic, by joining two inftruments, the fcale of the one following, or being a continuation of that of the other, pointed out the DIAPASON or *totality* of the octave, and the relation of the whole to a principal found, which we now call the *fundamental* or *key*, it being the loweft note of our fcale, and the one to which the other notes bear a continual reference. It would far exceed the limits of this Work to narrate the fucceffive changes and additions made by the Greeks in their lyre; yet would this be a very fure way of learning the natural formation of our mufical fcale. We muft refer our readers to Dr Wallis's Appendix to his edition of the Commentary of Porphyrius in Ptolemy's Harmonics, as by far the moft perfpicuous account that is extant of the Greek mufic. We fhall pick out from among their different

ent attempts ſuch plain obſervations as will be obvious to the feelings of any perſon who can ſing a common tune.

Let ſuch a perſon firſt ſing over ſome plain and cheerful, or at leaſt not mournful, tune, ſeveral times,

17 The octave is naturally divided into two TETRACHORDS.

ſo as to retain a laſting impreſſion of the chief note of the tune, which is generally the laſt. Then let him begin, on the ſame note, to ſing in ſucceſſion the riſing ſteps of the ſcale, pronouncing the ſyllables *do*, *re*, *mi*, *fa*, *ſol*, *la*, *ſi*, *do*. He will perhaps obſerve, that this chaunt naturally divides itſelf into two parts or phraſes, as the muſicians term it. If he does not, of himſelf, make this remark, let him ſing it, however, in that manner, pauſing a little after the note *fa*. Thus, *do*, *re*, *mi*, *fa*; *ſol*, *la*, *ſi*, *do*.—*Do*, *re*, *mi*, *fa*; *ſol*, *la*, *ſi*, *do*.

Having done this ſeveral times, and then repeated it without a pauſe, he will become very ſenſible of the propriety of the pauſe, and of this natural diviſion of the octave. He will even obſerve a conſiderable ſimilarity between theſe two muſical phraſes, without being able, at firſt, to ſay in what it conſiſts.

18 The ſteps of the ſcale are unequal, and the two tetrachords are ſimilar.

Let him now ſtudy each phraſe apart, and try to compare the magnitude of the changes of ſound; or ſteps which he makes in riſing from *do* to *re*, from *re* to *mi*, and from *mi* to *fa*. We apprehend that he will have no difficulty in perceiving, after a few trials, that the ſteps *do re*, and *re mi*, are ſenſibly greater than the ſtep *mi fa*. We feel the laſt ſtep as a ſort of ſlide; as an attempt to make as little change of pitch as we can. Once this is perceived, it will never be forgotten. This will be ſtill more clearly perceived, if, inſtead of theſe ſyllables, he uſe only the vowel *a*, pronounced as in the word *hall*, and if he ſing the ſteps, ſliding or ſlurring from the one to the other. Taking this method, he cannot fail to notice the ſmallneſs of the third ſtep.

19 Let the ſinger farther conſider, whether he does not feel this phraſe muſical or agreeable, making a ſort of tune or chaunt, and ending or cloſing agreeably after this ſlide of a ſmall, or, as it were, half ſtep. It is generally thought ſo; and is therefore called a CLOSE, a CADENCE, when we end with a half ſtep aſcending.

20. Let the ſinger now reſume the whole ſcale, ſinging the four laſt notes *ſol*, *la*, *ſi*, *do*, louder than the other four, and calling off his attention from the low phraſe, and fixing it on the upper one. He will now be able to perceive that this, like the other, has two conſiderable ſteps; namely, *ſol la* and *la ſi*, and then a ſmaller ſtep, *ſi do*. A few repetitions will make this clear, and he will then be ſenſible of the nature of the ſimilarity between theſe two phraſes, and the propriety of this great diviſion of the ſcale into the intervals *do*, *fa*, and *ſol*, *do*, with an interval *fa*, *ſol* between them.

This was the foundation of the tetrachords or lyres of four ſtrings, of the Greeks. Their earlieſt muſic or modulation ſeems to have extended no farther than this phraſe. It pleaſed them, as a ring of four bells pleaſes many country pariſhes.

21 CLOSE OR CADENCE.

The ſinger will perceive the ſame ſatiſfaction with the cloſe of this ſecond phraſe as with that of the former: and if he now ſing them both, in immediate ſucceſſion, with a ſlight pauſe between, we imagine that he will think the cloſe or cadence on the upper *do* even more ſatiſfactory than that on the *fa*. It ſeems to us to complete a tune. And this impreſſion will be greatly heightened, if another perſon, or an inſtrument, ſhould ſound the lower *do*, while he cloſes on the upper *do* its octave. *Do* ſeems to be expected, or looked for, or ſought after. We take *ſi* as a ſtep to *do*, and there we reſt.

22 The third and ſeventh ſtep are the ſmalleſt.

Thus does the octave appear to be naturally compoſed of ſeven ſteps, of which the firſt, ſecond, fourth, fifth, and ſixth, are more conſiderable, and the third and ſeventh very ſenſibly ſmaller. Having no direct meaſures of their quantity, nor even a very diſtinct notion of what we mean by their quantity, magnitude, or bulk, we cannot pronounce with any certainty, whether the greater ſteps are equal or unequal; and we preſume them to be equal. Nor have we any diſtinct notion of the proportion between the larger and ſmaller ſteps. In a looſe way we call them half notes, or ſuppoſe the riſe from *mi* to *fa*, or from *ſi* to *do*, to be one-half of that from *do* to *re*, or from *re* to *mi*.

23 The Pythagorean diſcoveries did not improve the Greek muſic.

Accordingly, this ſeems to have been all the muſical ſcience attained by the Greek artiſts, or thoſe who did not profeſs to ſpeak philoſophically on the ſubject. And even after Pythagoras publiſhed the diſcovery which he had made, or more probably had picked up among the Chaldeans or Egyptians, by which it appeared, that accurate meaſures of ſounds, in reſpect to gravity and acuteneſs, were attainable, it was affirmed by Ariſtoxenus, a ſcholar of Ariſtotle, and other eminent philoſophers, that theſe meaſures were altogether artificial, had no connection with muſic, and that the ear alone was the judge of muſical intervals. The artiſt had no other guide in tuning his inſtrument; becauſe the ratios, which were ſaid to be inherent in the ſounds (though no perſon could ſay how), were never perceived by the ear. The juſtice of this opinion is abundantly confirmed by the awkward attempt of the Greeks to improve the lyre by means of theſe boaſted ratios. Inſtead of illuſtrating the ſubject, they ſeem rather to have brought an additional obſcurity upon it, and threw it into ſuch confuſion, that although many voluminous diſſertations were written on it, and on the compoſition of their muſical ſcale, the account is ſo perplexed and confuſed, that the firſt mathematicians and artiſts of Europe acknowledge, that the whole is an impenetrable myſtery. Had the philoſophers never meddled with it, had they allowed the practical muſicians to conſtruct and tune their inſtruments in their own way, ſo as to pleaſe their ear, it is ſcarcely poſſible that they ſhould not have hit on what they wanted, without all the embarraſſment of the chromatic and enharmonic ſcales of the lyre. It is ſcarcely poſſible to contrive a more cumberſome method of extending the ſimple ſcale of Nature to every caſe that could occur in their muſical compoſitions, than what aroſe from the employment of the muſical ratios. This ſeems a bold aſſertion; but we apprehend that it will appear to be juſt as we proceed.

24 The tranſpoſition of muſic made intercalary notes neceſſary in the octave.

The practical muſicians could not be long of finding the want of ſomething more than the mere diatonic ſcale of their inſtruments. As they were always accompanied by the voice, it would often happen that a lyre or flute, perfectly tuned, was too low or too high for the voice that was to accompany it. A ſinger can pitch his tune on any ſound as a key; and if this be too high for the ſinger who is to accompany him, he can take it on a lower note. But a lyriſt cannot do this. Suppoſe his inſtrument two notes too low, and that his accompanyiſt can only ſing it on the key which

is

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is the *ſi* of the lyre. Should the lyriſt begin it on that key, his very firſt ſtep is wrong, being but a half ſtep, whereas it ſhould be a whole one. In ſhort, all the ſteps but one will be found wrong, and the lyriſt and finger will be perpetually jarring. This is an evident conſequence of the inequality of the fourth and ſeventh ſteps to the reſt. And if the other ſteps, which we imagine to be equal, be not exactly ſo, the diſcordance will be ſtill greater.

Diſputes of the Pythagoreans and Ariſtoxeneans about muſical ratios.

The method of remedying this is very obvious. If the intervals *mi fa* and *ſi do*, are half notes, we need only to interpoſe other ſounds in the middle between each of the whole notes; and then, in place of ſeven unequal ſteps, we ſhall have twelve equal ones, or twelve intervals, each of them equal to a ſemitone. The lyre thus conſtructed will now ſuit any voice whatever. It will perfectly reſemble our keyed inſtruments, the harpſichord, or organ, which have twelve ſeemingly equal intervals in the octave. Accordingly, it appears that ſuch additions were practiſed by the muſicians of Greece, and approved of by Ariſtoxenus, and by all thoſe who referred every thing to the judgment of the ear. And we are confident that this method would have been adopted, if the philoſophers had had leſs influence, and if the Greeks had not borrowed their religious ceremonies along with their muſical ſcience. Both of theſe came from the ſame quarter; they came united; and it was ſacrilegious to attempt innovations. The doctrine of muſical ratios was an occupation only for the refined, the philoſophers; and by ſubjecting muſic to this myſterious ſcience, it became myſterious alſo, and ſo much the more venerable. The philoſophers ſaw, that there was in Nature a certain inſcrutable connection between mathematical ratios and thoſe intervals which the ear reliſhed and required in melody: but they were ignorant of the nature and extent of this connection.

Ratios of octave, diapente, and diateſſaron.

What is this connection, or what is meant when we ſpeak of the ratios of ſounds? Simply this:—Pythagoras is ſaid to have found, that if two muſical cords be ſtrained by equal weights, and one of them be twice the length of the other, the ſhort one will ſound the octave to the note of the other. If it be two-thirds of the length of the long ſtring, it will ſound the fifth to it. If the long ſtring ſound *do*, the ſhort one will ſound *ſol*. If it be three-fourths of the length, it will ſound the fourth or *fa*. Thus the ratio of 2 : 1 was called the ratio of the DIAPASON; that of 3 : 2 was called the DIAPENTE; and that of 4 : 3 the DIATESSARON. Moreover, if we now take all the four ſtrings, and make that which ſounds the graveſt note, and is the longeſt, twelve inches in length; the ſhort or octave ſtring muſt be ſix inches long, or one-half of twelve; the diapente muſt be eight inches, or two-thirds of twelve; and the diateſſaron muſt be nine inches, which is three-fourths of twelve. If we now compare the diapente, not with the graveſt ſtring, but with the octave of ſix inches, we ſee that they are in the ratio of 4 to 3, or the ratio of diateſſaron. And if we compare the diateſſaron with the octave, we ſee that their ratio is that of 9 : 6, or of 3 : 2, or the ratio of diapente. Thus is the octave divided into a fifth and a fourth *do ſol*, and *ſol do*, in ſucceſſion. Alſo the fourth *do fa*, and the fifth *fa do*, make up the octave. The note which ſtands as a fifth to one of the extreme ſounds of the octave, ſtands as a fourth to the other. And, laſtly, the two fourths *do fa*, and *ſol do*, leave an interval *fa ſol* between them; which is alſo determined by nature, and the ratio correſponding to it is evidently that of 9 to 8.

25 The diſcovery of Pythagoras is either a fable, or falſely narrated.

This is all that was known of the connection of muſic with mathematical ratios. It is indeed ſaid by Iamblicus, that Pythagoras did not make this diſcovery by means of ſtrings, but by the ſounds made by the hammers on the anvil in a ſmith's ſhop. He obſerved the ſounds to be the key, the diateſſaron, and the diapente of muſic; and he found, that the weights of the hammers were in this proportion; and as ſoon as he went home, he tried the ſounds made by cords, when weights, in the proportions above-mentioned, were appended to them. But the whole ſtory has the air of a fable, and of ignorance. The ſounds given by a ſmith's anvil have little or no dependance on the weight of the hammers; and the weights which are in the proportions of the numbers mentioned above will by no means produce the ſounds alleged. It requires *four* times the weight to make a ſtring ſound the octave, and *twice and a quarter* will produce the diapente, and *one and ſeven-ninths* will produce the diateſſaron. It is plain, therefore that they knew not of what they were ſpeaking: yet, on this ſlight foundation, they erected a vaſt fabric of ſpeculation; and in the courſe of their reſearches, theſe ratios were found to contain all that was excellent. The attributes of the Divinity, the ſymmetry of the univerſe, and the principles of morality, were all reſolvable into the harmonic ratios.

26 Conjoined and disjoined tetrachords.

In the attempts to explain, by means of the myſterious properties of the ratios 2 : 1, 3 : 2, 4 : 3, and 9 : 8, which were thus defined by Nature, it was obſerved, that their favourite lyres of four ſtrings could be combined in two principal manners, ſo as to produce an extenſive ſcale. One lyre may contain the notes *do, re, mi, fa;* and the acuter lyre may contain the notes *ſol, la, ſi, do;* and being ſet in ſucceſſion, having the interval *fa ſol* between the higheſt note of the one and the loweſt of the other, they make a complete octave. Theſe were called *disjoined tetrachords.* Again, a third tetrachord may be joined with the upper tetrachord laſt mentioned, in ſuch ſort, that the loweſt note of the third tetrachord may be the ſame with the higheſt of the ſecond. Theſe were called *conjoined* tetrachords (A).

27 The lyres were tuned entirely by the ear,

By thus conſidering the ſcale as made up of tetrachords, the tuning of the lyre was reduced to great ſimplicity. The muſician had only to make himſelf perfect in the ſhort chaunt *do, re, mi, fa,* or to get it by heart, and to ſing it exactly. This intonation would apply equally to the other *ſol, la, ſi, do.* We are well informed that this was really the practice. The directions given by Ariſtoxenus, Nicanor, and others, for

Ss 2 varying

(A) This is the *principle*, but not the preciſe *form*, of the disjoined and conjunct tetrachords. The Greeks did not begin the tetrachord with what we make the firſt note of our chaunt of four notes, but began one of them with *mi*, and the other with *ſi;* to which they afterwards added a note below. This beginning ſeems to have been directed by ſome of their favourite cadences; but it would be tedious to explain it.

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varying the tuning, according to certain occaſional accommodations, ſhew diſtinctly that they did not tune as we do, ſounding the two ſtrings together, except in the caſe of the diapaſon or octave. It was all done by the judgment of the ear in melody. The moſt valuable circumſtance in the diſcovery of Pythagoras was the determination of the interval between the fourth and the fifth, by which the tetrachords were ſeparated. The filling up of each tetrachord was left entirely to the ear; and when the doctrine of the mathematical ratios ſhewed that the large intervals *do re, re mi, fa ſol, ſol la, la ſi,* ſhould not be preciſely equal, Ariſtoxenus refuſed the authority of the reaſons alleged for this inequality, becauſe the ear perceived none of the ratios as ratios, and could judge only of ſounds. He farther aſſerted that the inequalities which the Pythagoreans enjoined, were ſo trifling, that no ear could poſſibly perceive them. And accordingly, the theoriſts diſputed about the reſpective ſituations of the greater and ſmaller tones (ſo they named the great ſteps) ſo much ſpoken of, and had different ſyſtems on the ſubject.

28 And by melody alone:

But the ſtrongeſt proof of the indiſtinct notion that the theoriſts entertained about the influence of theſe ratios in muſic is, that they would admit no more but thoſe introduced by Pythagoras; and their reaſons for the rejection of the ratio of 5 to 4, and of 6 to 5, were either the moſt whimſical fancies about the perfections of the ſacred ratios, or aſſumptions expreſsly founded on the ſuppoſition, that the ear perceives and judges of the ratios as ratios; than which nothing can be more falſe. Had they admitted the ratio of 5 to 4, they would have obtained the third note of the ſcale, and would at once have gotten the whole ſcale of our muſic. The ratios of 6 : 5, and 16 : 15, follow of courſe; and every ſound of the tetrachords would have been determined. For 5 : 4 being the ratio of the major third, which is perfectly pleaſing to the ear, as the *mi* to the note *do,* and 3 : 2 being the ratio of the fifth *do ſol,* there is another interval *mi ſol* determined; and this ratio being the difference between *do ſol* and *do mi,* or between 3 : 2 and 5 : 4, is evidently 6 : 5. In like manner, the interval *mi fa* is determined, and its ratio, being 4 : 3—5 : 4, is 16 : 15.

But farther; we ſhall find, upon trial, that if we put in a ſound above *ſol,* having the relation 5 : 4 to *fa,* it will be perfectly ſatisfactory to the ear if ſung as the note *la.* And if, in like manner, we put in a note above *la,* having the relation 5 : 4 to *ſol,* we find it ſatisfactory to the ear when uſed as *ſi.* If we now examine the ratios of theſe artificial notes, we ſhall find the ratio of the notes *ſol la* to be 10 : 9, and that of *la ſi* to be 9 : 8, the ſame with that *fa ſol;* alſo *ſi do* will appear to be 16 : 15, like that of *mi fa.*

We have no remains of the muſic of the Greeks, by which we can learn what were their favourite paſſages or muſical phraſes; and we cannot ſee what cauſed them to prefer the fourth to the major third. Few muſicians of our times think the fourth in any degree comparable with the major third for melodiouſneſs, and ſtill fewer for harmoniouſneſs. The piece or tune publiſhed by Kircher from Alypius is very ſuſpicious, as no other perſon had ſeen the MS; and the collection found at Buda is too much disfigured, and probably of too late a date, to give us any ſolid help. In all probability, the common melodies of the Greeks abounded in eaſy leaps up and down on the third and fifth, and on the fourth and ſixth, juſt as we obſerve in the airs for dancing among all ſimple people. Their accompliſhed performers had certainly great powers both of invention and execution; and the chromatic and enharmonic diviſions of the ſcale were certainly practiſed by them, and not merely the ſpeculations of mathematicians. To us, the enharmonic ſcale appears the moſt jarring diſcord; but this is certainly owing to our not ſeeing any pieces of the muſic ſo compoſed, and becauſe we cannot in the leaſt judge by harmony what the effect of enharmonic melody would be. But we have ſufficient evidence, from the writings of the ancient Greeks, that the enharmonic muſic fell into diſuſe even before the time of Ptolemy, and was totally and irrecoverably loſt before the 5th century. Even the chromatic was little practiſed, and was chiefly employed for extending the common ſcale to keys which were ſeldom uſed. The uncertainties reſpecting even the common ſcale remained the ſame as ever; and although Ptolemy gives (among others) the very ſame that is now admitted as the only perfect one, namely, his *diatonicum intenſum,* his reaſons of preference, though good, are not urged with ſtrong marks of his confidence in them, nor do they ſeem to have prevailed.

These obſervations ſhew clearly, that the perception of melody alone is not ſufficiently preciſe for enabling us to acquire exact conceptions of the ſcale of muſic. The whole of the practicable ſcience of the ancients ſeems to amount to no more than this, that the octave contained five greater and two ſmaller intervals, which the voice employed, and the ear reliſhed. The greater intervals ſeemed all of one magnitude; and the ſmaller intervals appeared alſo equal, but the ear cannot judge what proportion they bear to the larger ones. The muſicians thought them larger than one-half of the great intervals (and indeed the ratio 16 : 15 of the artificial *mi fa* and *ſi do,* is greater than the half of 9 : 8 or 10 : 9). Therefore they allowed the theoriſts to call them *limmas* inſtead of *hemitones,* but they, as well as the theoriſts, differed exceedingly in the magnitudes which they aſſigned them. 29 But melody is quite insufficient.

30 Circular repreſentation of the ſcale. Plate XLIV.

The beſt way that we can think of for expreſſing the ſcale of the octave is, by dividing the circumference of a circle in the points C, D, E, F, G, A, and B (fig. 1.), in the proportion we think moſt ſuitable to the natural ſcale of melody. According to the practical notion now under our conſideration, the arches CD, DE, FG, GA, and AB, are equal, containing nearly 59°; and the arches EF and BC are alſo equal, but ſmaller than the others, containing about $33\frac{1}{2}$. Now, ſuppoſe another circle, on a piece of card paper, divided in the ſame manner, to move round their common centre, but inſtead of having its points of diviſion marked C, D, E, &c. let them be marked *do, re, mi, fa, ſol, la, ſi.* It is plain, that to whatever point of the outer circle we ſet the point *do* of the inner one, the other points of the outer circle will ſhew the common notes which are fit for thoſe ſteps of the ſcale. The ſimilarity of all octaves makes this ſimple octave equivalent to a rectilineal ſcale ſimilarly divided, and repeated as often as we pleaſe. Fig. 1. repreſents this inſtrument, and will be often referred to. A ſort of ſymmetry may be obſerved in it. The point D ſeems to occupy the middle of the ſcale, and *re* ſeems to be the middle note of

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of the octave. The oppoſite arch GA, and the correſponding interval *ſol la*, ſeems to be the middle interval of the octave. The other notes and intervals are ſimilarly diſpoſed on each ſide of theſe. This circumſtance ſeems to have been obſerved by the Greeks, by the inhabitants of India, by the Chineſe, and even by the Mexicans. The note *re*, and the interval *ſol la*, have gotten diſtinguiſhed ſituations in their inſtruments and ſcales of muſic.

31 Ariſtoxenean ſcale of mean tones and limmas,

With reſpect to the diviſion of the circles, we ſhall only obſerve at preſent, that the dotted lines are conformable to the principles of Ariſtoxenus, the whole octave being portioned out into five larger and equal intervals, and two ſmaller, alſo equal. The larger are called *mean* or *medium tones ;* and the ſmaller are called *limmas* or *ſemitones*. The full lines, to which the letters and names are affixed, divide the octave into the artificial portions, determined by means of the muſical ratios, the arches being made proportional to the meaſures of thoſe ratios. Thus the arches CD, FG, AB, are proportional to the meaſure or logarithm of the ratio 9 : 8 ; GA and DE are proportional to the logarithm of 10 : 9 ; and the arches EF and BC are proportional to the logarithm of 16 : 15. We have already mentioned the way in which thoſe ratios were applied, and the authority on which they were ſelected. We ſhall have occaſion to return to this again. The only farther remark that is to be made with propriety in this place is, that the diviſion on the Ariſtoxenean principles, which is expreſſed in this figure, is one of an indefinite number of the ſame kind. The only principle adopted in it is, that there ſhall be five mean tones, and two ſmall equal ſemitones ; but the magnitude of theſe is arbitrary. We have choſen ſuch, that two mean tones are exactly equal to the arch CE, determined by the ratio 5 : 4. The reaſons for this preference will appear as we proceed (B).

By this little inſtrument (the invention, we believe, of a Mr D'Ormiſſon, about the beginning of laſt century), we ſee clearly the inſufficiency of the ſeven notes of the octave for performing muſic on different keys. Set the flower de luce at the Ariſtoxenean B, and we ſhall ſee that E is the only note of our lyre which will do for one of the ſteps of the octave in which we intend to ſing and accompany. We have no ſounds in the lyre for *re, mi, ſol, la, ſi*. The remedy is as clearly pointed out. Let a ſet of ſtrings be made, having the ſame relation to *ſi* which thoſe of the preſent lyre have to *do*, and inſert them in the places pointed out by the Ariſtoxenean diviſions of the moveable octave. We need only five of them, becauſe the *ſi* and *fa* of the preſent lyre will anſwer. Theſe new ſounds are marked by a +.

32 Found imperfect, and required TEMPERAMENT.

But it was ſoon found, that theſe new notes gave but indifferent melody, and that either the ear could not determine the equality of the tones and ſemitones exactly enough, or that no ſuch partition of the octave would anſwer. The Pythagoreans, or partiſans of the muſical ratios, had told them this before. But they were in no better condition themſelves ; for they found, that if a ſeries of ſounds, in perfect relation to the octave, be inſerted in the manner propoſed, the melody will be no better. They put the matter to a very fair trial. It is eaſy to ſee, that no ſyſtem of mean tones and limmas will give the ſame muſic on every key, unleſs the tones be increaſed, and the limmas diminiſhed, till the limma becomes juſt half a tone. Then all the intervals will be perfectly equal. The mathematicians computed the ratios which would produce this equality, and deſired the Ariſtoxeneans to pronounce on the muſic. It is ſaid, that they allowed it to be very bad in all their moſt favourite paſſages. Nothing now remained to the Ariſtoxeneans but to attempt occaſional methods of tuning. They ſaw clearly, that they were making the notes unequal which Nature made equal. The Pythagoreans, in like manner, pointed out many alterations or corrections of intervals which ſuited one tetrachord, or one part of the octave, but did not ſuit another. Both parties ſaw that they were obliged to deviate from what they thought natural and perfect : therefore they called theſe alterations of the natural or perfect ſcale a *temperament*.

The accompliſhed performers were the beſt judges of the whole matter, and they derived very little aſſiſtance from the mathematicians : For although the rigid rules delivered by them be acknowledged to be perfectly exact, the execution of thoſe rules is not ſuſceptible of the ſame exactneſs. Their lyres are tuned, not by mathematical operations, but by the ear. It does not appear that they had muſical inſtruments with divided finger-boards, like our baſs viols and guitars ; and even on theſe, it is well known that the preſſure and touch of the finger may vary ſo much, that the moſt exact placing of the frets will not inſure the nice degrees of the ſounds. The flutes are the only inſtruments of the ancients that are capable of accurate ſounds. But flutemakers know very well, that they cannot be tuned by mathematical operations, but by the ear alone. This accounts for the great prices paid for a well tuned flute. Some have coſt L. 700, and L. 50 was a very common price.

33 The Greeks did not cultivate the harmony of ſimultaneous ſounds.

Such ſeems to have been the ſtate of the ancient muſic. There was little or no ſcience in it. There was, indeed, a moſt abſtruſe and refined ſcience coupled with it; but by a very ſlight connection ; and it ſeems to have been nothing more than an amuſement for the ingenious and ſpeculative Greeks. Nor could it, in our opinion, be better, ſo long as they had no guide in tuning but the judgment of the ear in melody. Many writers inſiſt that the Greeks had a knowledge of what *we* call *harmony* alſo. The word ἁρμονια is conſtantly uſed by them : but it does not mean what we call harmony, the pleaſant coaleſcence of ſimultaneous ſounds. It comes from ἁρμος, or from ἁρμοζω, and ſignifies *aptitude*, *fitneſs*, and would, in general, be better tranſlated by *ſymmetry*. But we cannot conceive that they paid any marked attention to the effect of ſimultaneous ſounds, ſo as to enjoy the pleaſure of certain conſonances, and employ them in their compoſitions. We judge in this way from the rank which they gave them in their ſcale. To prefer the fourth to the major third ſeems to us to be impoſſible, if it be meant of ſimultaneous

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(B) We ſhall be abundantly exact, if we make CD=61°,72 ; CE=115°,9 ; CF=149°,42 ; CG=210°,58 ; CA=265°,3 ; and CB=326°,48, neous ſounds. And the reaſon which is aſſigned for the preference can have no value in the opinion of a muſician. It is becauſe the ratio of 4 : 3 is ſimpler than that of 5 : 4. For the ſame reaſon, the fifth is preferred to both, and the octave to all the three, and uniſon to every other conſonance. They would not allow the major third 5 : 4 to be a concord at all. We have made numberleſs trials of the different concords with perſons altogether ignorant of muſic. We never ſaw an inſtance of one who thought that mere uniſon gave any poſitive pleaſure. None of all whom we examined had much pleaſure from an octave. All, without exception, were delighted with a fifth, and with a major third; and many of them preferred the latter. All of them agreed in calling the pleaſure from the fifth a *ſweetneſs*, and that from the major third a *cheerfulneſs*, or *ſmartneſs*, or by names of ſimilar import. The greater part preferred even the major ſixth to the fourth, and ſome felt no pleaſure at all from the fourth. Few had much pleaſure from the minor third or minor ſixth. *N. B.* Care was taken to ſound theſe concords without any preparation—merely as ſounds—but not as making part of any muſical paſſage. This circumſtance has a great effect on the mind. When the minor third and ſixth were heard as making part of the minor mode, all were delighted with it, and called it ſweet and mournful. In like manner, the chord $\frac{6}{4}$ never failed to give pleaſure. Nothing can be a ſtronger proof of the ignorance of the ancients of the pleaſures of harmony.

34 The pleaſures of harmony ſeem to be a modern diſcovery.

We do not profeſs to know when this was diſcovered. We think it not unlikely that the Greeks and Italians got it from ſome of the northern nations whom they called *Barbarians*. We cannot otherwiſe account for its prevalence through the whole of the Ruſſian empire—the ancient Slavi had little commerce with the empire of Rome or of Conſtantinople; yet they ſung in parts in the moſt remote periods of their hiſtory of which we have any account; and to this day, the moſt uncultivated boor in the Ruſſian empire would be aſhamed to ſing in uniſon. He liſtens a little while to a new tune, holding his chin to his breaſt; and as ſoon as he has got a notion of it, he burſts out in concert, throwing in the harmonic notes by a certain rule which he feels, but cannot explain. His harmonics are generally alternate major and minor thirds, and he ſeldom miſſes the proper cadences on the fifth and key. Perhaps the invention of the organ produced the diſcovery. We know that this was as early as the ſecond century (c). It was hardly poſſible to make much uſe of that inſtrument without perceiving the pleaſure of concordant ſounds.

35 Harmony made a great change in the ſcience of muſic.

The diſcovery of the pleaſures of harmony occaſioned a total change in the ſcience of muſic. During the dark ages of Europe, it was cultivated chiefly by the monks: the organ was ſoon introduced into the churches, and the choral ſervice was their chief and almoſt their only occupation. The very conſtruction of this inſtrument muſt have contributed to the improvement of muſic, and inſtructed men in the nature of the ſcale. The pipes are all tuned by their lengths; and theſe lengths are in the ratios of the ſtrings which give the ſame notes, when all are equally ſtretched. This muſt have revived the ſtudy of the muſical ratios. The tuning of the organ was performed by conſonance, and no longer depended on the nice judgment of ſounds in ſucceſſion. The dulleſt ear, even with total ignorance of muſic, can judge, without the ſmalleſt error, of an exact octave, fifth, third, or other concord; and a very mean muſician could now tune an organ more accurately than Timotheus could tune his lyre. Other keyed inſtruments, reſembling our harpſichord, were invented, and inſtruments with fretted finger-boards. Theſe ſoon ſupplanted the lyres and harps, being much more compendious, and allowing a much greater variety and rapidity of modulation. All theſe inſtruments were the fruits of harmony, in the modern ſenſe of that word. The deficiencies of the old diatonic ſcale were now more apparent, and the neceſſity of a number of intercalary notes. The finger-board of an organ or harpſichord, running through a ſeries of octaves, and admitting much more than the accompanyment of one note, pointed out new ſources of muſical pleaſure ariſing from the fulneſs of the harmony; and, above all, the practice of choral ſinging ſuggeſted the poſſibility of a pleaſure altogether new. While a certain number of the choir performed the Cantus or Air of the muſic, it was irkſome to the others to utter mere ſounds, ſupporting or compoſing the harmony of the Cantus, without any melody or air in their own parts. It was thought probable that the harmonic notes might be ſo portioned out among the reſt of the choir, that the ſucceſſion of ſounds uttered by each individual might alſo conſtitute a melody not unpleaſant, and perhaps highly grateful. On trial, it was found very practicable. Canons, motets, fugues, and other harmonies, were compoſed, where the airs performed by the different parts were not inferior in beauty to the principal. The notes which could not be thrown into this agreeable ſucceſſion, were left to the organiſt, and by him thrown into the baſs.

By all theſe practices, the imperfections of the ſcale of *fixed* ſounds became every day more ſenſible, eſpe- 36.
cially in full harmony. Scientific muſic, or the properties of the ratios, now recovered the high eſtimation in which they were held by the ancient theoriſts; and as the muſicians were now very frequently men of letters, chiefly monks, of ſober characters and decent manners, muſic again became a reſpectable ſtudy. The organiſt was generally a man of ſcience, as well as a performer. At the firſt revival of learning in Europe, we find muſic ſtudied and honoured with degrees in the univerſities, and very ſoon we have learned and excellent diſſertations on the principles of the ſcience. The inventions of Guido, and the diſſertations of Salinas, Zarlino, and Xoni, are among the moſt valuable publications that are extant on muſic. The improvements introduced by Guido are founded on a very refined examination

(c) It is ſaid that the Chineſe had an inſtrument of this kind long before the Europeans. Cauſeus ſays, that it was brought from China by a native, and was ſo ſmall as to be carried in the hand. It is certain that the Emperor Conſtantine Copronymus ſent one to Pepin king of France in 757, and that his ſon, Charlemagne got another from the Emperor Michael Paleologus. But they appear to have been known in the Engliſh churches before that time.

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examination of the ſcale; and the temperaments propoſed by the other two have ſcarcely been improved by any labours of modern date. Both theſe authors had ſtudied the Greek writers with great care, and their improvements proceed on a complete knowledge of the doctrines of Pythagoras and Ptolemy.

37.
Galileo diſcovered that muſical pitch conſiſted in the frequency of the aëreal undulations.

At laſt the celebrated Galileo Galilei put the finiſhing hand to the doctrines of thoſe ancient philoſophers, by the diſcovery of the connection which ſubſiſts in nature between the ratios of numbers and the muſical intervals of ſounds. He diſcovered, that theſe numbers expreſs the frequency of the recurring pulſes or undulations of air which excite in us the ſenſation of ſound. He demonſtrated that if two ſtrings, of the ſame matter and thickneſs, be ſtretched by equal weights, and be twanged or pinched ſo as to vibrate, the times of their vibrations will be as their lengths, and the frequency or number of oſcillations made in a given time will be inverſely as their lengths. The frequency of the ſonorous undulations of the air is therefore inverſely as the length of the ſtring. When therefore we ſay that 2 : 1 is the ratio of the octave, we mean, that the undulations which produce the upper ſound of this interval are twice as frequent as thoſe which produce its fundamental ſound. And the ratio 3 : 2 of the diapente or fifth, indicates, that in the ſame time that the ear receives three undulations from the upper ſound, it receives only two from the lower. Here we have a natural connection, not peculiar to the ſounds produced by ſtrings; for we are now able to demonſtrate, that the ſounds produced by bells are regulated by the ſame law. Nay, the improvements which have been made in the ſcience of motion ſince the days of Galileo, ſhew us that the undulations of the air in pipes, where the air is the *only* ſubſtance moved, is regulated by the ſame law. It ſeems to be the general property of ſounds which renders them ſuſceptible of muſical pitch, of acuteneſs, or gravity; and that a certain frequency of the ſonorous undulations gives a determined and unalterable muſical note. The writer of this article has verified this by many experiments. He finds, that *any noiſe whatever*, if repeated 240 times in a ſecond, at equal intervals, produces the note C *ſol fa ut* of the Gindonian gamut. If it be repeated 360 times, it produces the G *ſol re ut*, &c. It was imagined, that only certain regular agitations of the air, ſuch as are produced by the tremor or vibration of elaſtic bodies, are fitted for exciting in us the ſenſation of a muſical note. But he found, by the moſt diſtinct experiments, that any noiſe whatever will have the ſame effect, if repeated with due frequency, not leſs than 30 or 40 times in a ſecond. Nothing ſurely can have leſs pretenſion to the name of a muſical ſound than the ſolitary ſnap which a quill makes when drawn from one tooth of a comb to another: but when the quill is held to the teeth of a wheel, whirling at ſuch a rate, that 720 teeth paſs under it in a ſecond, the ſound of *g in alt.* is heard moſt diſtinctly; and if the rate of the wheel's motion be varied in any proportion, the noiſe made by the quill is mixed in the moſt diſtinct manner with the muſical note correſponding to the frequency of the ſnaps. The *kind* of the original noiſe determines the kind of the continuous ſound produced by it, making it harſh and fretful, or ſmooth and mellow, according as the original noiſe is abrupt or gradual: but even the moſt abrupt noiſe produces a tolerably ſmooth ſound when ſufficiently frequent. Nothing can be more abrupt than the ſnap juſt now mentioned; yet the *g* produced by it has the ſmoothneſs of a bird's chirrup. An experiment was made, which was leſs promiſing of a ſound than any that can be thought of. A ſtop cock was ſo conſtructed, that it opened and ſhut the paſſage through a pipe 720 times in a ſecond. This apparatus was fitted to the pipe of a conduit leading from the bellows to the wind cheſt of an organ. The air was ſimply allowed to paſs gently along this pipe by the opening of the cock. When this was repeated 720 times in a ſecond, the ſound *g in alt.* was moſt ſmoothly uttered, equal in ſweetneſs to a clear female voice. When the frequency was reduced to 360, the ſound was that of a clear but rather harſh man's voice. The cock was now altered in ſuch a manner, that it never ſhut the hole entirely, but left about one-third of it open. When this was repeated 720 times in a ſecond, the ſound was uncommonly ſmooth and ſweet. When reduced to 360, the ſound was more mellow than any man's voice at the ſame pitch. Various changes were made in the form of the cock, with the intention of rendering the primitive noiſe more analogous to that produced by a vibrating ſtring. Sounds were produced which were pleaſant in the extreme. The intelligent reader will ſee here an opening made to great additions to practical muſic, and the means of producing muſical ſounds, of which we have at preſent ſcarcely any conception; and this manner of producing them is attended with the peculiar advantage, that an inſtrument ſo conſtructed can never go out of tune in the ſmalleſt degree. But of this enough at preſent.

38
This frequency is expreſſed by the muſical ratios of Pythagoras.

This diſcovery of Galileo's completed the Pythagorean theories, by ſupplying the only thing wanted for procuring confidence in them. We now ſee that the muſic of ſounds depends on principles as certain and as plain as the elements of Euclid, and that every thing relating to the ſcale of muſic is attainable by mathematics. It is very true that we do not perceive the ratio 3 : 2 in the diapente, as having any relation to the numbers 3 and 2. But we perceive the ſweetneſs of ſound which characteriſes this concord. This is undoubtedly the perception of a certain phyſical fact involving this ratio, as much as the ſweetneſs on our tongue is the perception of a certain manner of acting of the particles of ſugar during their diſſolution in the ſaliva.

Concord, discord, are properties of particular ratios of frequency.

The pleaſure ariſing from certain conſonances, ſuch as *do ſol*, is not more diſtinctly perceived than is the diſagreeable feeling which other conſonances produce, ſuch as *do re;* and it was a fair field of diſquiſition to diſcover why the one pleaſed and the other diſpleaſed. We cannot ſay that this queſtion has been completely decided. It has been aſcribed to the coincidence of vibrations. In the octave, every ſecond vibration of the treble note may be made to coincide with every vibration of the baſs. But the pleaſure ariſing from the different conſonances does by no means follow the proportions of thoſe coincidences of vibrations; for when two notes are infinitely near to the ſtate which would produce a complete coincidence, the actual coincidence is then exceedingly rare; and yet we know that ſuch ſounds yield very fine harmony. In tuning any concord, when the two notes are very diſcordant, the coinciding vibrations recur very frequently; and as we approach

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proach nearer and nearer to perfect concord, these coincidences become rarer and rarer; and if it be infinitely near to perfect concord, the coincidences of vibration will be infinitely distant from each other. This, and many other irrefragable arguments, demonstrate that coalescence of sound, which makes the pleasing harmony of a fifth, for example, does not arise from the coincidence of vibration; and the only thing which we can demonstrate to obtain in all the cases where we enjoy this pleasure, is a certain arrangement of the component pulses, and a certain law of succession of the dislocations or intervals between the non-coinciding pulses. We are perfectly able to demonstrate that when, by continually screwing up one of the notes of a consonance, we render the real coincidence of pulses less frequent; the dislocations, or deviations from perfect coincidence, approach nearer and nearer to a certain definable law of succession; and that this law obtains completely, when the perfect ratio of the duration of the pulse is attained, although perhaps at that time not one pulse of the one sound coincides with a pulse of the other. Suppose two organ pipes, sounding the note C *sol fa ut*, at the distance of ten feet from each other, and that their pulses begin and end at the same instants, making the most perfect coincidence of pulses—there is no doubt but that there will be the most perfect harmony; and we learn by experience that this harmony is perfectly the same, from whatever part of the room we hear it. This is an unquestionable fact. A person situated exactly in the middle between them will receive coincident pulses. But let him approach one foot nearer to one of the pipes, it is now demonstrable that the pulses, at their arrival at his ear, will be the most distant from coincidence that is possible; for every pulse of one pipe will bisect the pulse from the other; but the law of succession of the deviations from coincidence will then obtain in the most perfect manner. A musical sound is the sensation of a certain form of the aerial undulation which agitates the auditory organ. The perception of harmonious sound is the sensation produced by another definite form of the agitation. This is the composition of two other agitations; but it is the compound agitation only that affects the ear, and it is its form or kind which determines the sensation, making it pleasant or unpleasant.

39 Hence arises the great use of mathematics in music.

Our knowledge of mechanics enables us to describe this form, and every circumstance in which one agitation can differ from another, and to discover general features or circumstances of resemblance, which, in fact, accompany all perceptions of harmony. We are surely intitled to say that these circumstances are sure tests of harmony; and that when we have ensured their presence, we have ensured the hearing of harmony in the adjusted sounds. We can even go farther in some cases: We can explain some appearances which accompany imperfect harmony, and perceive the connection between certain distinct results of imperfect coincidences, and the magnitude of the deviations from perfect harmony which are then heard. Thus, we can make use of these phenomena, in order to ascertain and measure those deviations; and if any rules of temperament should require a certain determinate deviation from perfect harmony in the tuning of an instrument, we can secure the appearance of that phenomenon which corresponds to the deviation, and thus can produce the precise temperament suggested by our rules. We can, for example, destroy the perfect harmony of the fifth C *g*, and flatten the note *g* till it deviates from a perfect fifth in the exact ratio of 320 to 321, which the musicians call the one-fourth of a comma. The most exquisite ear for melody is almost insensible of a deviation four times greater than this; and yet a person who has no musical ear at all, can execute this temperament by the rules of harmony without the error of the fortieth part of a comma.

40 Beatings of imperfect consonances.

For this most valuable piece of knowledge we are indebted to the late Dr Robert Smith of Cambridge, a very eminent geometer and philosopher, and a good judge of music, and very pleasing performer on the organ and harpsichord. This gentleman, in his dissertation on the Principles of Harmonics, published for the first time in 1749, has paid particular attention to a phenomenon in coexistent sounds, called a *beating*. This is an alternate enforcement and diminution of the strength of sound, something like what is called a close shake, but differing from it in having no variation in the pitch of the sounds. It is a sort of undulation of the sound, in which it becomes alternately louder and fainter. It may be often perceived in the sound of bells and musical glasses, and also in the sounds of particular strings. It is produced in this way: Suppose two unisons quite perfect; the vibrations of each are either perfectly coincident, or each pulse of one sound is interposed in the same situation between each pulse of the other. In either case they succeed each other with such rapidity, that we cannot perceive them, and the whole appears an uniform sound. But suppose that one of the sounds has 240 pulses in a second, which is the undulation that is produced in a pipe of 24 inches long; suppose that the other pipe is only 23 inches and $\frac{7}{10}$ths long. It will give 243 pulses in a second. Therefore the 1st the 80th, the 160th, and the 240th pulse of the first pipe will coincide with the 1st, the 81st, the 162d, and the 243d pulse of the other. In the instants of coincidence, the agitation produced by one pulse is increased by that produced by the other. The commencement of the next two pulses is separated a little, and that of the next is separated still more, and so on continually: the *dislocations* of the pulses, or their deviations from perfect coincidence, continually increasing, till we come to the 40th pulse of the one pipe, which will commence in the middle of the 41st pulse of the other pipe; and the pulses will now bisect each other, so that the agitations of the one will counteract or weaken those of the other. Thus the compounded sound will be stronger at the coincidences of the pulses, and fainter when they bisect each other. This reinforcement of sound will therefore recur thrice in every second. The frequency of the pulses are in the ratio of a comma, or 81 : 80. Therefore this constitutes an *unison imperfect by a comma*. If therefore any circumstance should require that these two pulses should form an unison imperfect by a comma, we have only to alter one of the pipes, till the two, when sounded together, beat thrice in a second. Nothing can be plainer than this. Now let us suppose a third pipe tuned an exact fifth to the first of these two. There will be no beating observable; because the recurrence of coincident pulses is so rapid as to appear a continued sound. They recur at every second vibration of the bass, or 120 times in a second.

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But now, instead of sounding the third pipe along with the first, let it sound along with the second. Dr Smith demonstrates, that they will beat in the same manner as the unisons did, but thrice as often, or nine times in a second. When therefore the fifth C g beats nine times in a second, we know that it is too sharp or too flat (very nearly) by a comma.

41 Dr Smith applies them to the science and practice of music with great effect Pulses of.


=240.

* *Mem. Acad. Par.* 1701, 1702, 1707, and 1713.

Dr Smith shews, in like manner, what number of beats are made in any given time by any concord, imperfect or tempered, in any assigned degree. We humbly think that the most inattentive person must be sensible of the very great value of this discovery. We are obliged to call it *his* discovery. Mersennus, indeed, had taken particular notice of this undulation of imperfect consonances, and had offered conjectures as to their cause; conjectures not unworthy of his great ingenuity. Mr Sauveur also takes a still more particular notice of this phenomenon*, and makes a most ingenious use of it for the solution of a very important musical problem; namely, to determine the precise number of pulses which produce any given note of the gamut. His method is indeed operose and delicate, even as simplified and improved by Dr Smith. The following may be substituted for it, founded on the mechanism of sounding cords. Let a violin, guitar, or any such instrument be fixed up against a wall, with the finger-board downward, and in such a manner, that a violin string, strained by a weight, may press on the bridge, but hang free of the lower end of the finger-board. Let another string be strained by one of the turning pins till it be in unison with some note (suppose C) of the harpsichord. Then hang weights on the other string, till, upon drawing the bow across both strings, at a small distance below the bridge, they are perfect unisons, without the smallest beating or undulation, and taking care that the pressure of the bow on that string which is tuned by the pin be so moderate as not to affect its tension sensibly. Note exactly the weight that is now appended to it. Now increase this weight in the proportion of the square of 80 to the square of 81; that is, add to it its 40th part very nearly. Now draw the bow again across the strings with the same caution as before. The sounds will now beat remarkably; for the vibrations of the loaded string are now accelerated in the proportion of 80 to 81. Count the number of undulations made in some small number (suppose 10) of seconds. This will give the number of beats in a second; 80 times this number are the single pulses of the lowest sound; and 81 times the same number gives the pulses of the highest of these imperfect unisons.

If this experiment be tried for the C in the middle of our harpsichords, it will be found to contain 240 pulses very nearly; for the strings will beat thrice in a second. The beats are best counted by means of a little ball hung to a thread, and made to keep time with the beats.

42 They afford exact measures of the temperament of concords,

Here, then, is a phenomenon of the most easy observation, and requiring no skill in music, by which the pitch of any sound, and the imperfection of any concord, may be discovered with the utmost precision; and by this method may concordant sounds be produced, which are absolutely perfect in their harmony, or having any degree of imperfection or temperament that we please. An instrument may generally be tuned to perfect harmony, in some of its notes, without any difficulty, as we see done by every blind Crouder. But if a certain determinate degree of imperfection, different perhaps in the different concords, be necessary for the proper performance of musical compositions on instruments of fixed sounds, such as those of the organ or harpsichord kind, we do not see how it can be disputed, that Dr Smith's theory of the beating of imperfect consonances is one of the most important discoveries, both for the practice and the science of music, that have been offered to the public. We are inclined to consider it as the most important that has been made since the days of Galileo. The only rivals are Dr Brook Taylor's mechanical demonstration of the vibrations of an elastic cord, and its companion, and of the undulations of the air in an organ pipe, and the beautiful investigations of Daniel Bernoulli of the harmonic sounds which frequently accompany the fundamental note. The musical theory of Rameau we consider as a mere whim, not founded in any natural law; and the theory of the grave harmonics by Tartini or Romieu is included in Dr Smith's theory of the beating of imperfect consonances. This theory enables us to execute any harmonic system of temperament with precision, and certainty, and ease, and to decide on its merit when done.

We are therefore surprised to see this work of Dr Smith greatly undervalued, by a most ingenious gentleman in the Philosophical Transactions for 1800, and called a large and obscure volume, which leaves the matter just as it was, and its results useless and impracticable. We are sorry to see this; because we have great expectations from the future labours of this gentleman in the field of harmonics, and his late work is rich in refined and valuable matter. We presume humbly to recommend to him attention to his own admonitions to a very young and ingenious gentleman, who, he thinks, proceeded too far in animadverting on the writings of Newton, Barrow, and other eminent mathematicians. We also beg his leave to observe, that Dr Smith's application of his theory may be very erroneous (we do not say that it is perfect), in consequence of his notion of the proportional effects produced on the general harmony by equal temperaments of the different concords. But the theory is untouched by this improper use, and stands as firmly as any proposition in Euclid's Elements. We are bound to add to these remarks, that we have oftener than once heard music performed on the harpsichord described in the second edition of Dr Smith's Harmonics, both before it was sent home by the maker (the first in his profession), and afterwards by the author himself, who was a very pleasing performer, and we thought its harmony the finest we ever heard. Mr Watt, the celebrated engineer, and not less eminent philosopher, built a handsome organ for a public society, and, without the least ear or relish for music, tuned three octaves of the open diapason by one of Dr Smith's tables of beats, with the help of a variable pendulum. Signior Doria, leader of the Edinburgh concert, tried it in presence of the writer of this article, and said, " Bellissima—sopra modo bellissima!" Signiora Doria attempted to sing along with it, but would not continue, declaring it impossible, because the organ was ill tuned. The truth was, that, on the major key of E^b, the tuning was exceedingly different from what she was accustomed to, and she would not try another key. We mention this particular, to shew how accurately

Temperament of the Scale of Music.

Mr Watt had been able to execute the temperament he intended.

43
And accurate methods of temperament.

This theory is valuable, therefore, by giving us the management of a phenomenon intimately connected with harmony, and affording us precise and practicable measures of all deviations from it. It bids fair, for this reason, to give us a method of executing any system of temperament which we may find reason to prefer. But we have another ground of estimation of this theory. By its assistance, we are able to ascertain with certainty and precision the true untempered scale of music, which eluded all the attempts of the ingenious Greeks; and we determine it in a way suited to the favourite music of modern times, of which almost all the excellencies and pleasures are derived from harmony. We do not say that this *total* innovation in the principle of musical pleasure is unexceptionable; we rather think it very defective, believing that the thrilling pleasures of music depend more upon the melody or air. We appeal even to instructed musicians, whether the heart and affections are not more affected *(and with much more distinct variety of emotion)* by a fine melody, supported, but not observed, by harmonies judiciously chosen? It appears to us that the effect of harmony, always filled up, is more uniformly the same, and less touching to the soul, than some simple air sung or played by a performer of sensibility and powers of utterance. We do not wonder, then, that the ingenious Greeks deduced all their rules from this department of music, nor at their being so satisfied with the pleasures which it yielded, that they were not solicitous of the additional support of harmony. We see that melody has suffered by the change in every country. There is no Scotchman, Irishman, Pole, or Russian, who does not lament that the skill in composing heart-touching airs is degenerated in his respective nation; and all admire the productions of their muse of "the days that are past." They are "pleasant and mournful to the soul."

But we still prefer the harmonical method of forming the scale, on account of its precision and facility: and we prefer the theory of beats, *because it also gives us the most satisfactory scale of melody;* and this, not by repeated corrections and recorrections, but by a direct process. By a table of beats, every note may be fixed at once, and we have no occasion to return to it and try new combinations; for the beatings of the different concords to one bass being once determined, every beating of any one note with any other is also fixed.

44
Fundamental experiment.

We therefore request the reader's patient attention to the experiment which we have now to propose. This experiment is best made with two organ pipes equally voiced, and pitched to the note C in the middle of our harpsichords. Let one of them at least be a stopped pipe, its piston being made extremely accurate, and at the same time easily moved along the pipe. Let the shank of it be divided into 240 equal parts. The advantage of this form of the experiment is, that the sounds can be continued, with perfect uniformity, for any length of time, if the bellows be properly constructed. In default of this apparatus, the experiment may be made with two harpsichord wires in perfect unison, and touched by a wheel rubbed with rosin instead of a bow, in the way the sounds of the vielle or hurdygurdy are produced. This contrivance also will continue the sounds uniformly at pleasure. A scale of 240 parts must be adapted to one string, and numbered from that end of the string where the wheel or bow is applied to it. Great care must be taken that the shifting of the moveable bridge do not alter the strain on the wire. We may even do pretty well with a bow in place of the wheel; but the sound cannot be long held on in any pitch. In describing the phenomena, we shall rather abide by the string, because the numbers of the scale, or length of the sounding part of the wire, correspond, in fact, much more exactly with the sounds. The deviations of the scale of the pipe do not in the least affect the conclusions we mean to draw, but would require to be mentioned in every instance, which would greatly complicate the process.

Having brought the two open strings into perfect unison, so that no beating whatever is observed in the consonance, slide the moveable bridge slowly along the string while the wheel is turning, beginning the motion from the end most remote from the bow. All the notes of the octave, and all kinds of concords and discords, will be heard; each of the concords being preceded and followed by a ruffling beating, and that succeeded by a grating discord. After this general view of the whole, let the particular harmonious stations of the bridge be more carefully examined as follows.

45
Determination of the octave, and character of concord.

I. Shift the moveable bridge to the division 120. If it has been exactly placed, we shall hear a perfect octave without any beating. It is, however, seldom so exactly set, and we generally hear some beating. By gently shifting the bridge to either side, this beating becomes more or less rapid; and when we have found in which direction the bridge must be moved, we can then slide it along till the beating cease entirely, and the sounds coalesce into one sound. We can scarcely hear the treble or octave note as distinguishable from the bass or fundamental afforded by the other string. If the notes are duly proportioned in loudness, we cannot hear the two as distinct sounds, but a note seemingly the same with the fundamental, only more brilliant. (*N. B.* It would be a great improvement of the apparatus to have a micrometer screw for producing those small motions of the bridge.)

Having thus produced a fine octave, we can now perceive that, as we continue to shift the bridge from its proper place, in either direction, the beating becomes more and more rapid, changes to a violent rattling flutter, and then degenerates into a most disagreeable jar. This phenomenon is observed in the deviation of every concord whatever from perfect harmony, and must be carefully kept in remembrance.

46
Harmony is more strict than melody.

Before we quit this concord, the octave, produced by the bisection of the pipe or string, we must observe, that, with respect to ourselves, the octave $c\,\bar{c}$ must beat almost twice in a second, before we can observe clearly any mis-tune in it, by sounding the notes in succession, or as steps in the scale of melody. We never knew any ear so nice as to discover a mis-tuning when it beats but once in three seconds. We think ourselves intitled therefore to say, that we are insensible of a temperament in melody amounting to one-third of a comma; and we never knew a person sensible of a temperament half this bulk.

When the imperfection of the octave is clearly sensible by sounding the notes in succession, it is extremely disagreeable, feeling like a struggle or endeavour to attain

tain a certain note, and a failure in the attempt. This ſeems owing to the familiar ſimilarity of octaves, in the habitual talking and ſinging of men and women together. But when the notes are ſounded together, although we are not much more ſenſible of the imperfection of the harmony directly, as a failure in the ſweetneſs of the concord, we are very ſenſible of this phenomenon of beating; and any perſon who can diſtinguiſh a weak ſound from a ſtronger one, can eaſily perceive, in this indirect manner, any fraction of a comma, however minute. This makes the tuning by harmony much more exact than by melody alone. It is alſo much more accommodated to the genius of modern muſic. The ancients had favourite paſſages, which were frequently introduced into their airs, and they were ſolicitous to have theſe in good tune. It appears from paſſages in the writings of Galen, that different performers excelled chiefly in their ſkill in making thoſe occaſional temperaments which their muſic required. Our muſic is much more ſtrict, by reaſon of our harmonic accompaniments, which are an abominable noiſe when mis-tuned in a degree, which would have paſſed with the ancients for very good melody. Ariſtoxenus ſays, that the ear cannot diſcover the error of a comma. This would now be intolerable.

47 It gives the beſt ſcale for melody. But another advantage attends our method. We obtain by its aſſiſtance, the moſt perfect ſcale of melody; perfect in a degree attainable only by chance by the Greeks. This is now to be our buſineſs to unfold.

48 Determination of the Vth. II. Set the moveable bridge at 158, and ſound the two ſtrings. They will beat very diſagreeably, being plainly out of tune. Slide it gradually toward 160, and the beats will grow ſlower and ſlower; will change to a gentle and not unpleaſant undulation; and at laſt, when the bridge is at 160, will vaniſh entirely, and the two ſounds will coaleſce into one ſweet concord, in which neither of the component ſounds can be diſtinguiſhed. If the ſound given by the ſhort ſtring be now examined as a ſtep in the ſcale of melody, it will be found a fifth to the ſound of the long ſtring or fundamental note, perfectly ſatiſfactory to the niceſt ear. Thus one ſtep of the ſcale has been aſcertained.

III. Slide the bridge ſlowly along the ſtring. The beating will recommence, and will become a flutter, and then a jarring noiſe; and will again change to an angry flutter, beating about eight times in a ſecond, when the bridge ſtands at 169 nearly. Puſhing it ſtill on, but very ſlowly, the flutter will become an indiſtinct jarring noiſe; which, by continuing the motion, will again become a flutter, or beat about ſix in the ſecond. The bridge is now about 171.

49 Determination of the 4th. IV. Still continuing the motion, the flutter becomes a jarring noiſe, which continues till the bridge is near to 180, when the rapid flutter will again be heard. This will become ſlower and ſlower as we approach to 180: and when the bridge reaches that point, all beating vaniſhes, and we have a ſoft and agreeable concord, but far inferior to the former concord in that cheering ſweetneſs which characteriſes the fifth. When this note is compared with that of the fundamental ſtring as a ſtep in the ſcale of melody, it is found to correſpond to the note *fa*, or the fourth ſtep in the ſcale, and in that employment to give complete ſatiſfaction to the ear.

V. Still advancing the moveable bridge toward the nut, we ſhall hear the beatings return again; and after fluttering and degenerating to a jarring noiſe, by a very ſmall motion of the bridge, they will again be heard, will grow ſlower, accompanied with a ſort of angry expreſſion, and will ceaſe entirely when the bridge reaches the 192d diviſion of our ſcale. Here we have another concord of very peculiar character, being remarkably enlivening and gay. This ſound gives perfect ſatiſfaction to the ear, if employed as the third ſtep in the ſcale of melody, being the note *mi* of that ſeries, at leaſt in all gay or cheerful airs. 50 Determination of the IIId.

VI. As we move the bridge from 192 to 200, we hear again the ſame beatings, which, in the immediate vicinity to 192, have a peeviſh fretful expreſſion, inſtead of the angry waſpiſh expreſſion before mentioned. When the bridge has paſſed that ſituation which produces only grating diſcordance, we hear the beatings again, and they become ſlower, and ceaſe altogether when the bridge arrives at 200. Here we have another conſonance, which muſt be called a *concord*, becauſe it is rather agreeable than otherwiſe, but ſtrongly marked by a mournful melancholy in the expreſſion. In the ſcale of melody, it forms the third ſtep in thoſe airs which expreſs lamentation or grief. It is called the *minor third*, to diſtinguiſh it from the laſt enlivening concord, which, being a larger interval, is called the *major third*. 51.

It is well known, that theſe two thirds give the diſtinguiſhing characters to the only two modes of melodious compoſition that are admitted into modern muſic. The ſeries containing the major third is called the *major*, and that containing the minor third is called the *minor mode*. It is worthy of remark, that the fanatical preachers, in their conventicles and field ſermons, affect this mode in their harangues, which are often diſtinctly muſical, modulating entirely by muſical intervals, and keeping the whole of their chaunt in ſubordination to a fundamental or key note. This is not unnatural, when we conſider the general ſcope of their diſcourſes, namely, to inſpire melancholy and humiliating thoughts, awakening ſorrow, and the like. It is not ſo eaſy to account for the uſual whine of a beggar, who generally craves charity in the major third. This is the caſe, at leaſt, in the northern parts of this iſland. 52 Determination of the 3d.

If we continue to ſhift the bridge ſtill nearer to the end of the ſtring, we ſhall hear nothing but a ſucceſſion of vile diſcordant noiſes, ſomewhat leſs offenſive when the bridge is about the diviſions 213 and 216, but even there very unpleaſant. 53.

VII. Let us therefore change our manner of proceeding a little, and again place the bridge at 160, which will give us the pleaſing concord of the fifth. Inſtead of puſhing it from that place towards the nut, let it be moved towards the wheel or bow. Without repeating what we have ſaid of the reappearance of the beatings, their acceleration, and their degenerating into a jarring diſcord, to be afterwards ſucceeded by another beating, &c. &c. we ſhall only obſerve, that when we place the bridge at 150, we have no beatings, and we hear a conſonance, which is in a ſlight degree pleaſant, and may therefore be called a *concord*. It has the other marks of a concord which we have been making ſo much uſe of; for the beatings recommence when we ſhift the bridge to either ſide of 150. This note makes the ſixth ſtep in the deſcending ſcale of mournful melody; 54 Determination of the 6th.

Temperament of the Scale of Muſic.

lody; that is, when we are paſſing from the acute to the graver notes, with the intention of putting an emphaſis on the third and the fundamental. Although not eminent as a concord with the fundamental alone, it has a moſt pleaſing effect when liſtened to in ſubordination to the whole ſeries, or when ſounded along with other proper accompaniments of the fundamental.

55 Determination of the VIth.

VIII. Placing the bridge at 144, we obtain another very pleaſing concord, differing in its expreſſion from any of the foregoing. We find it difficult to expreſs its character. It is greatly inferior to the fifth in ſweetneſs, and to the major third in gaiety, but ſeems to poſſeſs, in a lower degree, both of thoſe qualities. In the ſcale of cheerful melody, it is the ſixth note, which we have diſtinguiſhed by the ſyllable *la*. It is alſo uſed even in mournful melody, when we are aſcending, with the intention of cloſing with the octave.

56 Scale of the upper octave.

In ſhifting the bridge from 144 to 120, we obtain nothing but diſcordant, or leaſt diſagreeable conſonances. And, laſtly, if we move the bridge beyond 120, to diviſions which are reſpectively the halves of thoſe numbers which produced the concords already treated of, we obtain the ſame ſteps in the ſcale of the upper octave. Thus if the bridge be at 80, we have the fifth to the octave note, or twelfth to the fundamental. If it be at 60, we obtain the double octave, &c. &c. &c.

57 Characters of the different concords.

We have perhaps been raſh in affixing certain moral or ſentimental characters to certain concords; for we have ſeen inſtances of perſons who gave them different denominations; but theſe were never contradictory to ours, but always expreſſed ſome ſentiment allied to that which we have aſſigned. We never met with an inſtance of a perſon capable of a little diſcriminating reflection, who did not acknowledge a manifeſt ſentimental diſtinction among the different concords which could not be confounded. We doubt not but that the Greeks, a people of exquiſite ſenſibility to all the beauties of taſte and ſentiment, paid much attention to theſe characters, and availed themſelves of them in their compoſitions. We do not think it at all unlikely, that greater effects have been produced by their muſic, which was ſtudied with this expreſs view, than have ever been produced by the modern muſic, with all the addition of harmony. We have allowed too great a ſhare of our attention to mere harmony. Our great authors are much leſs ſolicitous to compoſe an enchanting air, than to conſtruct a full ſcore of rich and well conducted harmony. We do not profeſs to be nice judges in muſical compoſition, but we may tell what we ourſelves experience. We find our minds worked up by a continuance of fine harmony into a *general* ſenſibility; into a frame of mind which would prepare and fit us for receiving ſtrong impreſſions of moral ſentiment, if theſe were diſtinctly made. But we have ſeldom felt any diſtinct emotions excited by mere inſtrumental muſic. And when the harmonies have been merely to ſupport the performance of a voice, the words have been either ſo frittered by muſical diviſions, as to become in ſome meaſure ludicrous—or have been ſo indiſtinct, and made ſo trifling a part of the muſic, that there was nothing done to give a particular ſhape to the moral impreſſion on our mind. We have generally been ſtrongly affected by ſome of the anthems which were in vogue in former times; and we think that we perceived the cauſe of this difference: There was a great ſimplicity in the voice parts: the ſyllables were not drawled out into long muſical phraſes, but pronounced nearly according to their proper quantities; ſo that the ſentiment of the ſpeaker was expreſſed with all the force of good declamation, and the harmony of the accompaniment then ſtrengthened the appropriate effect of the melody. We mean not to offer theſe obſervations as of much authority, but merely to mention ſome facts, and to aſſign what we felt to be their cauſes, in order to promote, in ſome degree, however inſignificant, the cultivation of muſical ſcience. With this view, we venture to ſay, that ſome of the beſt compoſitions of Knapp of York *uniformly* affect us more than the more admired anthems of Bird and Tallis. A cadence, which Knapp gives almoſt entirely to the melody, is laboured by Bird or Tallis with all the rules of art; and you have its characters of perfect or imperfect, full or diſappointed, cadences, and ſuch an apparatus of preparation and reſolution of diſcords, that you foreſee it at the diſtance of ſeveral bars, and then the part aſſigned to the voice ſeems a very trifle, and merely to fill up a blank in the harmony. Such compoſitions ſmell of the lamp, and fail of their purpoſe, that of charming the *learned* ear. But enough of this digreſſion.

58.

Thus have we found a natural relation between certain ſounds ſtrongly marked by very preciſe characters. The concordance of ſound is marked by the abſence of all undulation, and the deviations from this harmony are ſhewn to be meaſurable by the frequency of thoſe undulations. We have alſo found, that the notes, which are thus harmonious along with the fundamental, are ſteps in the ſcale of natural muſic (for we muſt acknowledge melody to be the primitive muſic, dictated by nature). We have got the notes *do*—*mi*, *fa*, *ſol*, *la*—*do*, aſcertained in a way that can no longer be miſtaken.

59 Ratios belonging to the concords, &c.

Let us now examine what phyſical or mechanical relations theſe ſounds ſtand in to each other. Our monochord gives us the lengths of the ſtrings; and the diſcovery of Galileo ſhews us, that theſe are alſo the durations of the aëreal pulſes which produce the ſenſations of muſical notes. Their ratios may therefore be truly called the ratios of the ſounds. Now we ſee that the ſtrings which produce the ſounds *do ſol* are 240 and 160. Theſe are in the ratio of 3 to 2. In this manner we may ſtate all the ratios obſerved in our experiment, *viz.*

Do : *mi* have the ratio of	240 to 192,	or of	5 to 4
Do : *fa*	240 : 180		4 : 3
Do : *ſol*	240 : 160		3 : 2
Do : *la*	240 : 144		5 : 3
Mi : *ſol*	192 : 160		6 : 5, = *do* : *mi*^{b}
Fa : *ſol*	180 : 160		9 : 8
Sol : *la*	160 : 144		10 : 9
Mi : *fa*	192 : 180		16 : 15

Here we get the ſight of all the ratios which the ingenious and unwearied ſpeculations of the Greek mathematicians enliſted into the ſervice of muſic, without being able to give a good reaſon why. The ratio 5 : 4, which their faſtidious metaphyſicians rejected, and which others wiſhed to introduce from motives of mere neceſſity to fill up a blank, is pointed out to us by one of the fineſt concords. The interval between the fourth and the fifth is, *very fortunately*, a ſtep of the ſcale.

The next ſtep *ſol la* is more important. For the ear

for

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for melody would have been very well ſatisfied with an interval equal to *fa ſol*, or 9 : 8; but if the moveable bridge be ſet at the diviſion $142\frac{2}{9}$, correſponding to ſuch a ſtep, we ſhould have a very offenſive flutter-

60 Obſervations on the ſtep *ſol la*.

ing. It is reaſonable therefore to conclude, *from analogy*, that the interval *ſol la* does not correſpond to the ratio 9 : 8; and that 10 : 9, which is, at leaſt, equally ſatisfactory to the ear, is the proper ſtep, even in the ſcale of melody. If we conſider what may be called the ſcale of harmony, there is no room left for doubt. To enjoy the greateſt poſſible pleaſure of harmony, we muſt not only take each note as it is related to the fundamental, but alſo as it is related to other notes of the ſcale. It may chance to be convenient to aſſume, for the fundamental of our occaſional ſcale of modulation, the ſtring of the lyre which is tuned as *fa* to its proper fundamental; or it may increaſe the harmony (and we know that it does), if we accompany the note *do* with both of the notes *fa* and *la*. To have the fine concord of the major third, it is neceſſary that the interval *fa la* be equivalent to the ratio 5 : 4. Now *fa* is 180, and 5 : 4 = 180 : 144. Therefore, by making the ſtep *ſol la* equal to 9 : 8, we ſhould loſe this agreeable concord, and get diſcord in its place.

And thus is evinced, in oppoſition to Ariſtoxenus, the propriety of having both a major and a minor tone; the firſt expreſſed by 9 : 8, and the laſt by 10 : 9. The difference between theſe ſteps is the ratio 81 : 80, called a comma by the Greek theoriſts.

61 Determination of the VIIth.

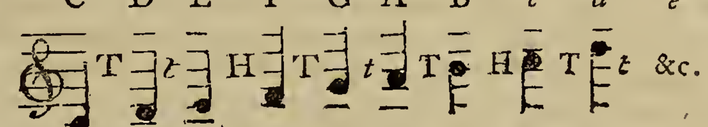
We ſtill want two ſteps of the ſcale, and two ſounds or notes correſponding to them, namely *re* and *ſi*; and we wiſh to eſtabliſh them on the ſame authority with the reſt. We ſee that this cannot be done by a concordance with the fundamental *do*. The ear ſufficiently informs us that the ſteps *do re* and *la ſi* muſt be tones, and not ſemitones, like *mi fa*. The ſenſible ſimilarity of the two tetrachords *do re mi fa* and *ſol la ſi do*, alſo teaches us that the ſtep *ſi do* ſhould be a ſemitone like *mi fa*. This ſeems to be all that mere melody can teach us. But we have little information whether we ſhall make *la ſi* a major or a minor tone. If we copy the tetrachord *do re mi fa* exactly, we ſhall make the ſtep *ſi do* like *mi fa*, and equivalent to the ratio 16 : 15. This requires the moveable bridge to be placed at 128. The ſound produced by this diviſion is perfectly ſatisfactory to the ear as a ſtep of the ſcale of melody. Moreover, our ſatisfaction is not confined to the compariſon of it with the note *do*, into which we ſlide by this gentle ſtep. It makes agreeable melody when uſed as the third to the note *ſol*. If we examine it mathematically, we find it a perfect major third to *ſol*; for *ſol* requires the 160th diviſion. Now 160 : 128 = 5 : 4, which is the ratio of the pulſes of a major third. All theſe reaſons ſeem enough to make us adopt this determination of the note *ſi*.

62 Determination of the IId.

It remains to conſider how we ſhall divide the interval *do—mi*. It is a perfect major third. So is *fa la*, and ſo is *ſol ſi*. But in the firſt of theſe two, we have ſeen that it muſt be compoſed of a major tone with a minor tone above it; and in the ſecond we have a minor tone followed by a major tone above. We are left uncertain therefore whether *do re* ſhall reſemble *fa la* or *ſol ſi* in the poſition of its two parts. Ariſtoxenus and his followers declared the ear to be equally pleaſed with both. Ptolemy's *Syſtema Diatonicum Intenſum* makes *do re* a major tone, and other ſyſtems make it a minor. Even in modern times it has been conſidered as uncertain; and the only reaſon which we have to offer for a preference of the major tone for the firſt ſtep is, that, ſo far as we can judge by our own feelings, the ſounds in the relation of 9 : 8 are leſs diſcordant than ſounds in the relation of 10 : 9, and becauſe all the other ſteps have been determined by means of concords with the key. We refer, for a more particular examination of the principles on which theſe arrangements are valued, to *Dr Smith's Harmonics*, Prop. I. where he ſhews how one is preferable to another, in proportion as it affords a greater number of perfect concords among the neighbouring notes, which is the favourite object in all modern muſic. Upon this principle our arrangement is by far the beſt, becauſe it admits five more concords in the octave than the other. But we have conſidered the ſubject in a different manner, merely to avail ourſelves of the phenomenon by which all the ſteps, except one, ſeem to be naturally aſcertained, and by which the connection between harmony and melody ſeems to be pointed out to us.

It will be convenient to repreſent the tones major and minor and the hemitone, by the ſymbols T, *t*, and H. Alſo to mark the notes by the Roman numerals, or by cyphers, according as they are the extremes of major or minor intervals. By this notation the octave may be repreſented thus: 63.

C D E F G A B *c* *d* *e*



$\frac{8}{9}$ $\frac{9}{10}$ $\frac{15}{16}$ $\frac{8}{9}$ $\frac{9}{10}$ $\frac{8}{9}$ $\frac{15}{16}$ $\frac{8}{9}$ &c.

K II III 4 V VI VII VIII IX X &c.

The reader will remark, that the primary diviſions which we aſſigned to the repreſentation of an octave in fig. 1. by the circumference of a circle, are in conformity to this Ptolemaic partition of the octave. He will alſo be ſenſible, that the diviſion into five equal mean tones and two equal hemitones, which is expreſſed by the dotted lines, agreeing with the Ptolemaic diviſion only at C and E, is effected by biſecting the arch CE; and therefore the deviation of the ſound ſubſtituted for the Ptolemaic D is half the difference of CD and DE, that is, half a comma. The deviations therefore at F, G, A, and B, are each a quarter of a comma.

Logarithmic meaſures of the muſical intervals.

It is well known, that if the logarithm of the length of one ſtring be ſubtracted from that of another, the difference is a meaſure of the ratio between them. Therefore 30103 is the meaſure of the muſical interval called the octave, and then the meaſures of the

Comma - -	540 or	54
Hemitone -	2803	280
Minor tone - -	4576	458
Major tone -	5115	512
3d - - -	7918	792
IIId - -	9691	969
4th - - -	12494	1249
Vth - - -	17609	1761
6th - - -	20412	2041
VIth - -	22185	2219
VIIth - - -	27300	2730
VIIIth - -	30103	3010

This

This is a very convenient circumſtance. If we take only the four firſt figures as integers, and make the octave conſiſt of 3010 parts, we have a ſcale more exact than the niceſt harmony requires. The circumference of a circle may be ſo divided into 301 degrees, and the moveable circle have a nonius, ſubdividing each into 10. Or it may be divided into 55,8 degrees, each of which will be a comma. Either of theſe diviſions will make it a moſt convenient inſtrument for expeditiouſly examining all temperaments of the ſcale that can be propoſed. Or a ſtraight line may be ſo divided, and repeated thrice. Then a ſliding ruler, divided in the ſame manner, and applied to it, will anſwer the ſame purpoſe. We ſhall ſee many uſeful employments of theſe inſtruments by and by.

64. Having thus endeavoured to communicate ſome plain notion of the formation and ſingular nature of that gradation of ſounds which produces all the pleaſures of muſic, and of the manner of obtaining the ſteps of this gradation with certainty and preciſion, we proceed to conſider how thoſe muſical paſſages may be performed on ſuch keyed inſtruments as the organs and harpſichords, as they are now conſtructed. Theſe inſtruments have twelve ſounds and intervals in every octave, in order that an air may be performed in any pitch; that is, taking any one of the ſounds as a key note. It is plain that this cannot be done with accuracy; for we have now ſeen that the interval *mi fa* is bigger than half of *do re* or *re mi*, &c. and therefore the intercalary ſound formerly mentioned to be inſerted between C and D, D and E, &c. will not do indiſcriminately for the ſharp of the ſound below and the flat of the ſound above it. When the tones are reduced to a mean ſize, the ear is ſcarcely ſenſible of the change in melody, and the harmony of the fifths and fourths is not greatly hurt. But when the half notes are inſerted, and employed to make up harmonious intervals, as recommended by Zarlino, the harmony is very coarſe indeed.

65 Why temperament neceſſary.

But we muſt make the reader ſenſible of the neceſſity of ſome temperament, even independent of thoſe artificial notes. Therefore

Let the ſcholar tune upwards the four Vths $c\,g$, $g\,\bar{d}$, $\bar{d}\,\bar{a}$, $\bar{a}\,\bar{\bar{e}}$, all perfect, admitting no beating whatever. This is eaſily done, either with the organ or the wheel monochord already deſcribed. Then tune downwards the perfect octaves $\bar{\bar{e}}\,\bar{e}$, $\bar{e}\,e$. Now examine the IIId $c\,e$ which reſults from this proceſs. If the inſtrument be of the pitch hitherto ſuppoſed (c making 240 pulſes in a ſecond), this IIId will be heard beating 15 times in a ſecond, which is a diſcordance altogether intolerable, the note e being too ſharp in the ratio of 81 to 80, which makes a comma. It is eaſily found, by calculation, that e makes $303\frac{3}{4}$ pulſes, inſtead of 300, required for the IIId to c.

N. B. It may not be amiſs to inform our readers, that if any concord, whoſe perfect ratio is $\frac{m}{n}$ (m being the greateſt term of the ſmalleſt integers expreſſing that ratio), be tempered ſharp by the fraction $\frac{p}{q}$ of a comma, and if M and N be the pulſes made by the acute and grave notes of the concord during any number of ſeconds, the number b of beats made in the ſame time by this concord will be $= \frac{2\,q\,m\,N}{161\,p - q}$, or $\frac{2\,q\,n\,M}{161\,p + q}$; and if it be tempered flat, then $b = \frac{2\,q\,m\,N}{161\,p + q}$, or $\frac{2\,q\,n\,M}{161\,p - q}$ (*Smith's Harm.* 2d edit. p. 82, &c.)

66 It is impoſſible, therefore, to have perfect Vths and perfect IIIds at the ſame time. And it will be found, that the 3d $e\,g$ reſulting from this proceſs, and the VIth $c\,a$, are ſtill more diſcordant, rattling at an intolerable rate. Now the major and minor thirds, alternately ſucceeding each other, form the greateſt part of our harmonies; and the VIth is alſo a very frequent accompaniment. It is neceſſary therefore to ſacrifice ſomewhat of the perfect harmony of the Vths, in order that we may not be diſguſted with the diſcord of thoſe other harmonies: and it is this mutual accommodation, and not the changes made neceſſary by the introduction of intercalary notes, which is properly called TEMPERAMENT. It will greatly aſſiſt us in underſtanding the effects of the temperaments of the different concords, if we examine all the diviſions of the circular repreſentation of the octave and muſical ſcale given in fig. 1. by placing the index of the moveable circle on that note of the outer circle for which we want the proper harmonies, or accompaniments, which are either the IIId and Vth, or the 4th and VIth. We ſhall thus learn, in the *firſt* place, the deviations of the different perfect notes of the ſcale from the notes required for this new fundamental; and we muſt then ſtudy what effect the ſame temperament produces on the agreeableneſs of the harmony of different concords having the ſame baſs or the ſame treble, taking it for granted that the hurt to the harmony of any individual concord is proportional to its temperament.

67 How this may be obtained by the beats.

It is in this delicate department of muſical ſcience that we think the great merit of Dr Smith's work conſiſts. We ſee that the deviation from perfect harmony is always accompanied with beats, and increaſes when they increaſe in frequency—whether it increaſes in the ſame proportion may be a queſtion. We think that Dr Smith's determination of the equality of imperfect harmony in his 13th propoſition includes every mathematical or phyſical circumſtance that appears to have any concern in it. What relates immediately to our ſenſations is, as yet, an impenetrable ſecret. The theory of beats, as delivered by this author, affords very eaſy, though ſometimes tedious, methods of meaſuring and of enſuring all the varieties which can obtain in the beating of imperfect conſonances. It appears to us therefore very unjuſt to ſay, with the late writer in the Philoſophical Tranſactions, that this obſcure volume has left the matter where it found it. The author has give us *effective* principles, although he may have been miſtaken in the application; which however we are far from affirming. Our limits will not allow us to give any account of that theory; and indeed our chief aim in the preſent article is to give a method of temperament which requires no ſcientific knowledge of the ſubject. But we could not think of loſing the opportunity of communicating, by the way, to unlearned perſons, ſome more diſtinct notions of the ſcale of muſical ſounds, and of its foundation in nature, than ſcholars uſually receive from the greater number

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number of mere mufic mafters. The acknowledged connection of the mufical ratios with the pleafures of harmony and melody, has (we hope) been employed in an eafy and not obfcure manner; and the phenomena which we have faithfully narrated, fhew plainly that, by diminifhing the rattling undulations of tempered concords, we are certain of improving the harmony of our inftruments. We fhall proceed therefore on this principle for the ufe of the mere performer, but at the fame time introducing fome very fimple deductions from Smith's theory, for which we expect the thanks of all fuch readers as wifh to fee a little of the reafons on which they are to proceed.

68 Method in practice.

The experiment, of which we have juft now given an account, fhews that four confecutive fifths compofe a greater interval than two octaves and a major third. Yet, in the conftruction of our mufical inftruments of fixed founds, they muft be confidered as of equal extent; fince we have 7 half intervals in the Vth, and 12 in the octave, and four in the IIId, four Vths contain 28, and two octaves contain 24; and thefe, with the four which compofe a IIId, make alfo 28. It is plain, therefore, that whatever we do with the IIIds, we muft leffen the Vths. If therefore we keep the IIId perfect, we muft leffen each of the Vths by $\frac{1}{4}$th of a comma; for we learned, by the beating of the imperfect IIId *c e*, that the whole excefs of the four Vths was a comma. Therefore the Vth *c g* muft be flattened $\frac{1}{4}$th of a comma. But how is this to be done with accuracy? Recollect the formula given a little ago, where the number of beats *b* in any number of feconds is $= \frac{2qmN}{161 \times p + q}$. In the prefent cafe $q = 1$, $m = 3$, $N = 240$ per fecond, and $p = 4$. Therefore the formula is $= \frac{2 \times 3 \times 240}{161 \times 4 + 1} = \frac{1440}{645} = 2{,}25$ in a fecond, or 9 beats in four feconds very nearly.

In like manner, the next Vth $g\,\bar{d}$ muft be flattened $\frac{1}{4}$th of a comma, by making it beat half as faft again, or $13\frac{1}{2}$ beats in four feconds (becaufe in this Vth $N = 360$). But as this beating is rather too quick to be eafily counted, it will be better to tune downwards the perfect octave *g* G, which will reduce N to 180 for the Vth G *d*. This will give us 1,68 per fecond, or 10 beats in 6 feconds very nearly.

There is another way of avoiding the employment of too quick beats. Inftead of tuning the octave *g* G, make *c* G beat as often as *c g*. This is even more exactly an octave to *g* than can be eftimated by a good ear. Dr Smith has demonftrated, that when a note makes a minor concord with another note below it, and therefore a major concord with the octave to that note, it beats equally with both; but if the major concord be below, it beats twice as faft with the octave above. Now, in the prefent cafe, *c g* is a Vth, and *c* G a 4th. For the fame reafon *c f* would beat twice as faft as *c* F.

In the next place, the Vth $d\,\bar{a}$ muft be made to beat flat 15 times in 6 feconds.

In like manner, inftead of tuning upward the Vth $\bar{a}\,\bar{\bar{e}}$, tune downward the octave $\bar{a}\,a$, and then tune upward the Vth *a e*, and flatten it till it beat 15 times in 8 feconds.

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If we take 15 feconds for the common period of all thefe beats, we fhall have

The beats of $c\,g = 34$.
$G\,d = 25$.
$\bar{d}\,a = 37\frac{1}{2}$.
$a\,e = 28$.

We fhall now find *c e* to be a fine IIId, without any 69
fenfible beating; and then we proceed in the fame way, always tuning upward a perfect Vth; and when this would lead us too high, and therefore produce too quick beating, we fhould tune downward an octave. Do this till we reach *b* ♯, which fhould be the fame with $\bar{c}$, or a perfect octave above *c*. This will be a full proof of our accurate performance. But the beft procefs of tuning is to ftop when we get to *g* ♯. Then we tune Vths downward from *c*, and octaves upward when the Vths would lead us too low. Thus we get *c* F, F *f*, *f b*♭, *b*♭, $\bar{b}$♭, $\bar{b}$♭ *e*♭, and thus complete the tuning of an octave. We take this method, inftead of proceeding upwards to $\bar{b}$ ♯; becaufe thofe notes marked fharp or flat are, when tuned in this way, in the beft relation to thofe with which they are moft frequently ufed as IIIds.

70 Ufe of a variable pendulum.

The procefs of temperament will be greatly expedited by employing a little pendulum, made of a ball of about two ounces weight, fliding on a light deal rod, having at one end a pin hole through it. To prepare this rod, hang it up on a pin ftuck into the wainfcoting, and flide the ball downward, till it makes 20 vibrations in 15″, by comparing it with a houfe clock. In this condition mark the rod at the upper edge of the ball. In like manner, adjuft it for 24, 28, 32, 36, 40, 44, 48, vibrations, making marks for each, and dividing the fpaces between them by the eye, noticing their gradual diminution. Then, having calculated the beats of the different Vths, fet the ball at the mark fuited to the particular concord, and temper the found till the beats keep pace exactly with the pendulum.

71 Abfolute number of pulfes how known.

But, previous to all this, we muft know the number of pulfes made in a fecond by the C of our inftrument. For this purpofe we muft learn the pulfes of our tuning fork. To learn this, a harpfichord wire muft be ftretched by a weight till it be unifon or octave below our fork: then, by adding $\frac{1}{40}$th of the weight to what is now appended, it will be tempered by a comma, and will beat, when it is founded along with the fork; and we muft multiply the beats by 80: The product is the number of pulfes required. And hence we calculate the pulfes of the C of our inftrument when it is tuned in perfect concord with the fork.

The ufual concert pitch and the tuning forks are fo nearly confonant to 240 pulfes for C, that this procefs is fcarcely neceffary, a quarter of a tone never occafioning the change of an entire beat in any of our numbers.

72 Syftem of temperament with perfect IIIds.

The intelligent reader cannot but obferve, that this fyftem of tuning with perfect IIIds, which is preferred to all others by many great mafters, is the one reprefented by our circular figure of the octave. The IIId is there perfect, and the Vth C G is deficient by a quarter of a comma. We cannot here omit taking notice of a moft valuable obfervation of Dr Smith's on this temperament, and, in general, on any divifion of the octave into mean tones and equal limmas.

The octave being made up of five mean tones and two limmas, it is plain that by enlarging the tones,

we

Temperament of the Scale of Music.

73 Proportional variations of temperament.

we diminish the limmas, and that the increment of the tone is two-fifths of the contemporaneous diminution of the limma. If, therefore, we employ the symbol v to express any minute variation of this temperament, and make the increment of a mean tone $= 2\ v$, the contemporaneous variation which thus induces on a limma will be $= -5\ v$; and if the tone be diminished by the same quantity $- 2\ v$, the limma will increase by the quantity $5\ v$. Let us see what are the contemporaneous changes made on all the intervals of the octave when the tone is diminished by $2\ v$.

1. A Vth is made up of three tones and a limma. Therefore the variation of its temperament is $= -6\ v + 5\ v$, or is $= -v$. That is, the Vth is flattened from its former temperament, whatever that may have been, by the quantity $-v$. Consequently the 4th, which is always the complement of the Vth to the octave, has its temperament sharpened by the quantity v.

2. A IId, being a tone distant from the fundamental, has its temperament changed by $-2\ v$.

Therefore a minor 7th is raised by $2\ v$.

3. A minor 3d is made up of a tone and a limma: therefore its variation is $= -2\ v + 5\ v$, or $= 3\ v$.

Therefore a major VIth (its complement) loses $- 3\ v$.

4. A maj. IIId, or two tones, has its variation $= -4\ v$.

Therefore a minor 6th has its variation $= 4\ v$.

5. A maj. VIIth, the complement of a limma has $-5\ v$.

6. A tritone, or IVth, must have the variation $= -6\ v$.

Therefore the false 5th must have - - $6\ v$.

74 Geometrical construction founded on this.

From this observation, Dr Smith deduces the following simple mathematical construction: In the strait line CE (fig. 2.) take the six equal parts C*g*, *g d*, *d a*, *a* E, E *b*, *b t*, and draw through the points of division the six parallel lines *g* G, *d* D, &c. Let these lines represent so many scales of the octave, so placed that the points C, *g*, *d*, &c. may represent the points C, *g*, *d*, &c. of the circular scale in fig. 1. where it is cut by the dotted lines representing the system of mean tones and limmas. Then, 1*st*, take a certain length *d* G on the first line, to the right hand of the line CE, to represent a quarter of a comma. G will mark the place of the perfect Vth, while *g* represents that of the mean or tempered Vth. 2*dly*, Set off *d* D, double of *g* G, in like manner, to the right hand on the second parallel. This will be the place of the perfect IId to the key note C. 3*dly*, Also set off *a* A, on third parallel, to the left hand, equal to *g* G. This will mark the place of A, the VIth to the key note C. 4*thly*, Place E on the point *e*, because, in the system of mean tones represented in fig. 1. the IIIds were kept perfect. 5*thly*, Make *b* B, to the right hand on the fifth line, equal to *g* G, to mark the place of the perfect VIIth to the key note C. And, 6*thly*, make *t* T, to the right hand on the sixth line, equal to twice *g* G. This will serve for shewing the contemporaneous temperament of the tritone, or IVth, contained between F and B, as also of its complement, the false 5th in fig. 1.

It is evident that the temperament of all the notes of the octave, according to the above mentioned system, are properly represented in this figure. The Vth is tempered flat by the quarter comma G *g*; the IId is tempered flat by the half comma D *d*; the VIth is tempered sharp by a quarter comma A *a*; the IIId is perfect; the VIIth is flat by a quarter comma B *b*; and the 4th is sharp by a quarter comma G *g*.

Now, let any other straight line C *t'* be drawn from C across these parallels. This will mark, by the intervals *g'*G, *d'*D, &c. the temperaments of another system of mean tones and limmas. For it is evident, that the contemporaneous variations *gg'*, *dd'*, &c. from the former temperament, are in the just proportions to each other; *gg'* being $= -v$, the variation proper for the Vth, and the opposite temperament for its complement or 4th. In like manner, *a a'* is $= 3\ v$, the variation competent to the VIth; and E *e'* is $= 4\ v$, the proper variation for the IIId.

75 The TEMPERER.

In like manner, *b b'* is $= 5\ v$, the variation of the VIIth and 2d. And, lastly, *t t'* is the variation $6\ v$ of the tritone, and its complement, the false fifth.

For all these reasons, any straight line C *e'* or C *e''*, drawn from C across the parallels, may justly be called the TEMPERER.

76

This is a very useful construction: For it is plain, that the sounds which can be placed in our organs and harpsichords, which have only twelve keys for an octave, must approach to a system of mean tones. The division of the octave into twelve equal intervals is such a system of mean tones exactly. Now, in such systems, when a line is drawn from C across the parallels, we see, at one glance, not only all the temperaments of the notes with the key note, but also the temperaments of those concords which the notes employed in full harmony make with each other. Thus, in the harmony of K — III — V, the III and V make a minor 3d with each other; and in the harmony of K — 4 — VI, the 4 and VI make a major 3d with each other. Now the reader will easily see, that the first of these concords has its interval diminished on both sides, when the III is tempered sharp, but only on one side when it is tempered flat. The mathematical reader will also easily see, that the contemporaneous temperament A *a'* of the VIth is always equal to the sum *g'*G and E*e'*, and that A *a''* is equal to the difference of *g''*G and E*e''*. Therefore the temperament of this subordinate concord, in the full harmony K — III — V, is in all cases, the same with the contemporaneous temperament of the VIth.

In like manner, he will perceive that the temperament of the subordinate IIId, in the harmony of K — 4 — VI, is equal to the contemporaneous temperament of the III.

We also see, in general, that the whole harmony is more hurt when the temperer lies in the angle ECK, with the IIId tempered sharp, than when it is in the angle ACE, when the IIId is flat; and that the sum of all the temperaments of the concords with the key is the smallest when the IIIds are perfect. This system of mean tones, with perfect IIIds, would therefore be the best, if the harmony of different concords were equally hurt by the same temperament.

77 Certain scales of great use.

We do not know any thing that has been published on the science of music that gives more general and speedy instruction than this simple figure. If it be drawn of such a size as to allow the comma EK to be divided into a number of equal parts, sufficiently sensible, all trouble of calculation will be saved.

We would therefore propose to accompany this figure with proper scales.

The *first* scale should have G *g* divided into $13\frac{1}{2}$ parts. This will express the logarithmic measures of the temperaments mentioned in n° 63. a comma being $= 54$.

The *second* scale should have *g*G divided into 36 parts.

This

Temperament of the Scale of Muſic.

This gives the beats made in 16 ſeconds by the notes *c*, *g*, when tempered by any quantity G*g*′.

The *third* ſcale ſhould have *g*G divided into 60 parts, for the beats made by the notes *c*, *e*, or the notes *c*, *ā*.

The *fourth* ſcale ſhould have *g*G divided into 72 parts. This gives the beats made by the key note C, with its minor third e^b.

The *fifth* ſcale ſhould have *g*G divided into 48 parts, for the beats made by the notes *c*, *f*.

The *ſixth* ſcale ſhould have *g*G divided into 89 parts, on which A*a*′ is meaſured, to get the beats of the ſubordinate concord formed by *g* and *e* in the harmony of K — III — V.

And, *laſtly*, *g* G, divided into 80 parts, will give the beats made by *f* and *ā* in the harmony of K — 4 — VI.

78 Harmonioufneſs, what? We are ignorant of the immediate efficient cauſes of the pleaſure we receive from certain conſonances, and ſhould therefore receive, with ſatisfaction, any thing that can help us to approximate to a meaſure of its degrees. We know that, in fact, the pleaſantneſs of any individual concord increaſes as the undulations called *beats* diminiſh in frequency. It is probable that we ſhall not deviate very far from the truth, if we ſuppoſe the harmonioufneſs of an individual tempered concord to be proportional to the ſlowneſs of theſe undulations. But it by no means follows, that a tempered Vth and a IId are equally pleaſant, each in its kind, when they beat equally ſlow. There is a difference *in kind* in the pleaſures of theſe concords: and this muſt ariſe from the peculiar manner in which the component pulſes of each concord divide each other. We are certain that this is all the difference that obtains between them in Nature. But the harmonioufneſs here ſpoken of is the arrangement which produces this pleaſure. We are intitled to ſay, that this is equal in two given inſtances, when the arrangements are preciſely ſimilar; and when the things arranged are the ſame, nothing ſeems to remain in which the inſtances can differ.

At any rate, it is of conſequence to be able to proportion and diſtribute theſe undulations at pleaſure. They are unpleaſant; and when reinforced by uniting, muſt be more ſo. The theory puts it in our power to prevent this union: perhaps by making them very unequal; or, if this ſhould give a chance of periodical accumulation, we may find it better to make them all equal. Surely to have all this in our power is very deſirable; and this is obtained by the theory of the beats of imperfect conſonances.

79 Temperament of a whole octave by beats. But we are forgetting the proceſs of tuning, and have only tuned three or four notes of our octave. We muſt tune the reſt by conſidering their relation to notes already tuned. Thus, if *g c* makes 36 beats in 16 ſeconds, F *c* ſhould make one third leſs, or about 24 in the ſame time; becauſe N in the formula is now 160 inſtead of 240. Proceeding in this way, we ſhall tune the octave C *c̿* moſt accurately as a ſyſtem of mean tones with perfect IIIds, by making the notes beat as follows. A point is put over the note that is to be tuned from the other, and *a* +, or *a* —, means that the concord is to be tempered ſharp or flat. Thus *g* is tuned from *c*,

Make	*c ġ*	beat —	36 times in 16 ſeconds
	Ġ *c*	+	36
	G *ḋ*	—	27, *i. e.* ¾ths of *g c*
Make	*c ḟ*		— 48
	c ā̇	beat	+ 60 times in 16 ſeconds
	c ė		o, *i. e.* a perfect IIId
	d ḟ♯		o
	e g♯		o
	a c♯		o
	b^b *f* downward		— 24, *i. e.* $\frac{5}{9}$ths of *c g*
	b^b $\bar{b}^b$		o, *i. e.* a perfect octave
	$\bar{b}^b$ e^b downward		— 43, *i. e.* $\frac{6}{7}$ths of *c g*
	C *c̄*		o an octave.

Other proceſſes may be followed, and perhaps ſome of them better than the proceſs here propoſed. Thus, b^b and e^b may be tuned as perfect IIIds to *d* and *g* downwards. Alſo, as we proceed in tuning, we can prove the notes, by comparing them with other notes already tuned, &c. &c. &c.

We have directed to tune the two notes b^b and e^b by taking the leading Vth downwards. We ſhould have come at the ſame pipes in the character of *a*♯ and *d*♯ in the proceſs of tuning upwards by Vths. But this would not have produced preciſely the ſame ſounds, although, in our imperfect inſtruments, one key muſt ſerve for *a*♯ and b^b. By tuning them as here directed, they are better fitted for the places in which they will be moſt frequently employed in our uſual modulations.

It may reaſonably be aſked, Why ſo much is ſacrificed in order to preſerve the IIIds perfect? Were they allowed to retain ſome part of the ſharp temperament that is neceſſary for preſerving the Vths perfect, we ſhould perhaps improve the harmony. And ſince enlarging the fifth makes the tone greater, and therefore the limma *mi fa* much ſmaller, it will bring it nearer to the magnitude of a half tone; and this will be better ſuited for its double ſervice of the ſharp of the note below, and the flat of the note above. Accordingly, ſuch a temperament is in great repute, and indeed is generally practiſed, although the VIth and the ſubordinate chords of full harmony are evidently hurt by it. Even Dr Smith recommends it as well ſuited to our defective inſtruments, and gives an extremely eaſy method of executing it by means of the beats. His method is to make the Vth and IIId beat equally faſt, along with the key, the Vth flat, and the IIId ſharp. He demonſtrates (on another occaſion), that concords beat equally faſt with the ſame baſs when their temperaments are inverſely as the major terms of their perfect ratios. Therefore draw EG, and divide it in *p*, ſo that E*p* may be to *p*G as 3 to 5. Then draw C*p*, cutting *g*G in *g*′, and EK in *e*′; and this temperer will produce the temperament we want. It will be found, that E *e*′ and G *g*′ are each of them 32 of their reſpective ſcales. — 80 Another ſyſtem very fit for our inſtruments. — Fig. 2.

Therefore make	*c g*	beat 32 times in 16 ſeconds
	G *c*	32
	G *d*	24
	G *b*	24, and tune *b* $\bar{b}$
	d ā	36, and tune *a ā*
	d f♯	36
	a e	27
	a c♯	27
	e b	40½, proving *b* $\bar{b}$
	e g♯	40½

Therefore

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Therefore make F c $21\frac{1}{3}$, and tune F f
F a beat $21\frac{1}{3}$, proving a
$b^b f$ $28\frac{1}{2}$, and tune $b^b\ \overline{b^b}$
$e^b\ \overline{b}b$ $38\frac{1}{2}$,
$c\ \overline{c}$ 0.

It may be proper to add to all these instructions a caution about the manner of counting the clock while the tuner is counting the beats. If this is to continue for 16 seconds, let the person who counts the clock say *one* at the beat he begins with, and then telling them over *to himself*, let him say *done* instead of 17. Thus 16 intervals will elapse while the tuner is counting the beats. Were he to begin to count at *one*, and stop when he hears sixteen, he would get the number of beats in 15 seconds only.

81. We do not hesitate to say, that this method of tuning by beats is incomparably more exact than by the mere judgment of the ear. We cannot mistake more than one beat. This mistake in the concord of the Vth amounts to no more than $\frac{1}{108}$th of a comma; and in the IIId it is only $\frac{1}{180}$.

82 Practical instructions. It may be objected that it is fit only for the organ and instruments of continued sounds, but will not do for the quickly perishing sounds of the harpsichord. True, it is the only method worthy of that noble instrument, and this alone is a title to high regard. But farther; the accuracy attainable by it, renders it the only method fit for the examination of systems of temperament. Even for the harpsichord it is much more exact, and more certain in its process, than any other. It does not proceed by a random trial of a flattened series of Vths, and a comparison with the resulting IIId, and a second trial, if the first be unsatisfactory. It says at once, let the Vth beat so many times in 16 seconds. Even in the second method, without counting, and merely by the quality of the beats of the Vth and IIId, the progress is easy. Both are tuned perfect. The Vth is then flattened a little, and the IIId sharpened;—if the Vth beat faster than the IIId, alter it first.

All difficulty is obviated by the simple contrivance of a variable pendulum, already described. This may be made exact by any person that will take a little pains; and when once made will serve for every trial. When the ball is set to the proper number, and the pendulum set a swinging, we can come very near the truth by a very few trials.

N. B. In tuning a piano forte, which has always two strings to a key, we must never attempt tuning them both at once; the back unison of both notes of the concord must be damped, by sticking in a bit of soft paper behind it.

We hope that the instructions now given, and the application of them to two very respectable systems of temperament, are sufficient for enabling the attentive reader to put this method of tuning successfully in practice, and that he perceives the efficiency of it for attaining the desired end. But before we take leave of it, we beg leave to mention another circumstance, which evinces the just value of the general theory of the beats of imperfect consonances as delivered by Dr Smith.

83 Origin of the Tartinian sounds. These reinforcements of sound, which are called *beatings*, are noises. If any noise whatever be repeated, with sufficient frequency, at equal intervals, it becomes a musical note, of a certain determinate pitch. If it recur 60 times in a second, it becomes the note C *fa ut*, or the double octave below the middle C of our harpsichords, or the note of an open pipe eight feet long. Now there is a similar (we may call it the very same) reinforcement of sound in every concord. Where the pulse of one sound of the concord bisects the pulse of the other, the two sounds are more uniformly spread: but where they coincide, or almost coincide, the condensation of one undulation combines with that of the other, and there comes on the ear a stronger condensation, and a louder sound. This may be called a *noise*; and the equable and frequent recurrence of this noise should produce a musical note. If, for instance, c and a are sounded together: There is this noise at every third pulse of c, and every fifth pulse of a; that is, 80 times in a second. This should produce a note which is a 12th below c, and a 17th major below a; that is, the double octave below f, which makes 320 vibrations in a second. That is to say, along with the two notes c and a of the concord, and the compound sound, which we call the *concord of the VIth*, we should hear a third note FF in the bass. Now this is known to be a fact, and it is the grave harmonic observed by Romieu and Tartini about the year 1754, and verified by all musicians since that time. Tartini prized this observation as a most important discovery, and considered it as affording a foundation for the whole science of music. We see that it is all included in the theory of beats published five years before, namely, in 1749; and every one of these grave harmonics, or Tartinian sounds, as they have been called, are immediate consequences of this theory. The system of harmonious composition which Tartini has, with wonderful labour and address, founded on it, has therefore no solidity. It is, however, preferable to Rameau's, because it proceeds on a fact founded on the nature of musical sounds; whereas Rameau's is a mere whim, proceeding on a false assumption; namely, "that a musical sound is essentially accompanied by its octave, 12th, and 17th *in alto*."—This is not true, though such accompaniment be very frequent, and it be very difficult to prevent it. Mr Rameau ought to have seen this. Are these acute harmonics musical sounds or not? He surely will not deny this. Therefore they, too, are essentially accompanied by *their* harmonics, and this absolutely and necessarily *ad infinitum*; which is certainly absurd. We shall have a better occasion for considering this point when we describe the TRUMPET *Marigni* in a future article.

We have taken notice of only two systems of temperament; both of them are systems of mean tones, and are in good repute as practicable methods. It would be almost an endless task to mention all the systems of temperament which have been proposed. Dr Smith, after having, with great ingenuity, appreciated the changes of harmoniousness that are induced on the different concords by the same temperament, and having assigned that proportion of temperament which renders them equally harmonious, each in its kind, gives a system of temperament, which he calls EQUAL HARMONY. Each concord (excepting the octave) is tempered in the inverse proportion of the product of the terms of its perfect ratio. It is very nearly equivalent to a division of the octave into 50 equal parts. We do not give any farther account of it here, although we think its harmony 84 Dr Smith's system of EQUAL HARMONY.

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harmony preferable to any thing that we have ever heard. We heard it, as executed for him, and under his inſpection, by the celebrated harpſichord-maker Kirkmann, both when the inſtrument was yet in the hands of the maker, and afterwards by the ingenious author. We have alſo heard ſome excellent muſicians declare, that the organ of Trinity college chapel at Cambridge was greatly improved in its harmony by the change made on its temperament under the inſpection of Dr Smith. When we name Stanley, we preſume that the authority will not be diſputed. We mention this, becauſe the writer in the Philoſophical Tranſactions ſpeaks of this ſyſtem, with flattened major thirds, as of no value. But we do not give any farther account of it, becauſe it is not ſuited to our inſtruments, which have but twelve ſounds in the octave.

85 The reader will pleaſe to recollect, that the great object of temperament is twofold. Firſt, to enable us to tranſpoſe muſic from one pitch to another, ſo that we may make any note of the organ the fundamental of the piece. This undoubtedly requires a ſyſtem approaching to one of mean tones, becauſe the harmony muſt be the ſame in every key. This requires temperament, becauſe a ſound muſt be occaſionally conſidered, either as the ſharp of the note below it, or the flat of the one above. This cannot produce perfect harmony, becauſe the limma of the perfect diatonic ſcale is greater than a half tone. Thus a temperament is neceſſary merely for the ſake of the melody. But, *ſecondly*, the nature of modern muſic requires every note to be accompanied, or conſidered as accompanied, with full harmony. This is, in fact, the ſame thing with modulating on every different note as a fundamental; but it requires a much cloſer attention to the perfection of the intervals, becauſe a defect or exceſs in an interval that would ſcarcely offend the ear, if the notes were heard in ſucceſſion, is quite intolerable when they are ſounded together. Here the difference between the major and minor tone is of almoſt as great moment as the difference of the limma from a ſemitone. The ſecond object, therefore, is to obtain, in the compaſs of three octaves, as many good concords of full harmony; that is, conſiſting of a fundamental with its major third and its fifth, erect or inverted, as poſſible. There is no other harmony, although our notes have frequently a different ſituation and appearance.

86 Maxims of temperament very gratuitous.

It is no wonder that, in a ſubject where we are yet to ſeek for a principle, the attempts to attain this object have been very various, and very gratuitous. The mathematicians, even in modern times, have allowed themſelves to be led away by fancies about the ſimplicity and conſequent perfection of ratios; and having no clear principle, it is no wonder that ſome of their deductions are contrary to experience. According to Euler, thoſe ratios which are moſt perfect, that is, moſt ſimple, admit of leaſt temperament. The octave is therefore infinitely perfect; for it is allowed by all, that it muſt not have the ſmalleſt temperament. A Vth muſt be leſs tempered than a IIId. Even the practical muſician thinks that he has tempered theſe two concords equally, when the offenſive quality of each is made equally ſo; but in this caſe it is demonſtrable, that the Vth has been much more tempered than the IIId. But this could not be diſcovered till we got the theory of beats.

Moſt of the mathematical muſicians adhered to ſyſtems of mean tones; or, which are equivalent to ſuch ſyſtems, giving ſimilar harmonies on every key of the harpſichord. This is ſurely the moſt natural, and is peculiarly ſuggeſted by the tranſpoſing of muſic from one pitch to another: but they differ exceedingly, and without giving any convincing arguments, in their eſtimation of the effects of the ſame temperament on different concords. Much of this, we apprehend, ariſes from diſpoſition. Perſons of a gay diſpoſition reliſh the harmony of the IIId, and prefer a ſharp to a flat temperament of this concord. Perſons of a more penſive diſpoſition, prefer ſuch temperaments as allow the minor thirds to be more perfect.

87 Equal harmony rejected

But there are many, eminent both as performers and as theoriſts, who reject any ſyſtem which gives the ſame harmonies on every note of the octave. They obſerve, that in the progreſs of the cultivation of muſic in Europe, the melodies of all nations have gradually approached to a certain uniformity. Certain cadences, cloſes, ſtrains, and phraſes, are becoming every day more common; and even in the conduct of a conſiderable piece of muſic, and the gradual but ſlow paſſage of the modulation from one key into another, there is a certain regularity. Nay, they add, that this cannot be greatly deviated from without becoming very offenſive. We may remain ignorant of the cauſe of this uniformity; but its exiſtence ſeems to prove that it ariſes from ſome natural principle; and therefore it ought to be complied with, and our temperaments ſhould be accommodated to it. The reſult of this uniformity in the muſic of our times is, that the modulation on ſome keys is much leſs frequent than on others, and this frequency decreaſes in a certain order. Suppoſing that we begin on C. A piece of plain muſic ſeldom goes farther than G and F. A little more fancy and refinement leads the compoſer into D, or into B♭, &c. &c. It would therefore be deſirable to adjuſt our temperaments ſo, that the harmonies in C ſhall be the beſt poſſible, and gradually leſs perfect in the order of modulation. Thus we ſhall, in our general practice, have finer harmony than if it were made equal throughout the octave; becauſe the unavoidable imperfections are thrown into the leaſt frequented places of the ſcale. The practical muſicians add to this, that by ſuch a temperament the different keys acquire characters, which fit each of them more particularly for the expreſſion of different ſentiments, and for exciting different emotions. This is very perceptible in our harpſichords as they are generally tuned. The major key of A is remarkably brilliant; that of F is as remarkably ſimple, &c.

We cannot ſay that we are altogether convinced by theſe arguments. The violin is unqueſtionably the inſtrument of the greateſt powers. A concert of inſtruments of this kind, unembarraſſed by the harpſichord, or any inſtruments incapable of occaſional temperament, is the fineſt muſic we have. The performers make no ſuch degradations of harmony, but keep it as perfect as poſſible throughout; and a violin performer is ſenſible of violence and conſtraint when he accompanies a keyed inſtrument into theſe unfrequented paths. Let him play the ſame muſic alone, and he will play it quite differently, and much more to his own ſatisfaction. We imagine, too, that much of the uniformity ſpoken of is the reſult of imitation and faſhion, and even of the tem-

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peraments that we have preferred. There is an evident diftinction in the native mufic of different nations. An experienced mufician will know, from a few bars, whether an air is Irifh, Scotch, or Polifh. This diftinction is in the modulation; which, in thofe nations, follows different courfes, and fhould therefore, on the fame principle, lead to different temperaments.

With refpect to the variety of characters given to the different keys, we muft acknowledge the fact. We have tuned a piano forte in the ufual manner; but inftead of beginning the procefs with C, we began it with D. An excellent performer of voluntaries fat down to the inftrument, and began to indulge his rich fancy; but he was confounded at every ftep; he thought the inftrument quite out of tune. But when he was informed how it had been tuned, and then tried a known plain air on it, he declared it to be perfectly in tune. It is ftill very doubtful, however, whether we fhould not have much finer mufic, by equalifing the harmony in the different keys, and trufting for the different expreffion fo much fpoken of to a judicious mixture of other notes called *difcords*.

88 Caufe of this uncertainty now removed by Dr Smith's theory.

After all, the great uncertainty about the moft proper temperament has remained fo long undetermined, becaufe we had no method of executing with certainty any temperament that was offered to the public. What fignifies it on what principle it may be proper ro flatten a Vth one-fifth of a comma, and fharpen a VIth one-feventh of a comma, unlefs we are able to do both the one and the other? Till Dr Smith publifhed the theory of beats, the monochord was the only affiftance we had: but however nicely it may be divided, it is fcarcely poffible to make the moveable bridge fo fteady and fo accurate in its motion, that it will not fenfibly derange the tenfion of the ftring. We have feen fome very nice and coftly monochords; but not one of them could be depended on to one-eighth of a comma. Even if perfect, they give but momentary founds by pinching. The bow cannot be trufted, becanfe its preffure changes the tenfion. Mr Watt's experiments with his monochord of continued found fhewed this evidently. A pitch-pipe with a fliding pifton promifes the greateft accuracy; bnt we are fadly difappointed, becaufe the gradation of the pifton cannot be performed by any mathematical rule. It muft be pufhed more than half way down to produce, the octave more than one-third to produce the Vth, &c. and this without any rule yet difcovered. Thanks to Dr Smith we can now produce an inftrument tuned exactly, according to any propofed fyftem, and then fubmit it to the fair examination of muficians. Even the fpeculatift may now form a pretty juft opinion of the merits of a fyftem, by calculating, or meafuring by fuch fcales as we have propofed, the beats produced by the tempered concords in all parts of the octave. No one who has liftened with attention to the rattling beats of a full organ, with its twelfth and fefquialter ftops all founding, will deny that they are hoftile to all harmony or good mufic. We cannot be much miftaken in preferring any temperament in proportion as it diminifhes the number of thofe beats. We fhould therefore examine them on this principle alone; attending more particularly to the beats of the third major, becaufe thefe are in fact the loudeft and moft difagreeable; and we muft not content ourfelves with the beats of each concord with the fundamental of the full harmony, whether K—III—V, or K—4—VI, or K—3—V, or K—4—6, which fometimes occurs. We muft attend equally to the beats of the two notes of accompaniment with each other: thefe are generally the moft faulty.

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This examination is neither difficult nor tedious.
1. Write down, in one column, the lengths of the ftrings 89.
or divifions of the monochord; in another write their logarithms; in a third the remainders, after fubtracting each from the logarithm of the fundamental. 3. Have at hand a fimilar table for the perfect diatonic fcale. 4. Compare thefe, one by one, and note the difference, + or —, in a 4th column. Thefe are the temperaments of each note of the fcale. 5. Compare every couple of notes which will compofe a major or minor third, or a fifth, by fubtracting the logarithm of the one note from that of the other. The differences are the intervals tempered. 6. Compare thefe with the perfect intervals of the diatonic fcale, and note the differences, + or —, and fet them down in a fifth column. Thefe are all the temperaments in the fyftem. 7. If we have ufed logarithms confifting of five decimal places, which is even more than fufficient, confider thefe numeral temperaments as the q of the formula given in n° 65. for calculating the beats, and then p is always $= 540$. Or we may make another column, in which the temperaments are reduced to fome eafy fraction of a comma.

We fhall content ourfelves with giving one example; 90 Syftem of Dr Young.
the temperament propofed by Mr Young in the Philofophical Tranfactions for 1800. It is contained in the following table.

1.	2.	3.	4.	5.		
				IIIds upward on		
C	100000	5.00000		C	135	Sharp.
C♯	94723	4.97645	2355	G. F.	190	Sharp.
D	89304	4.95087	4913	D. B♭	245	Sharp.
E♭	83810	4.92330	7670	A. E♭	346	Sharp.
E	79752	4.90174	9826	E. A♭	448	Sharp.
F	74921	4.87461	12539	B. C♯	494	Sharp.
F♯	71041	4.85151	14849	F♯	540	Sharp.
G	66822	4.82492	17508	3ds upward on		
G♯	63148	4.80036	19964	A. E.	236	Flat.
A	59676	4.77580	22420	D. B.	291	Flat.
B♭	56131	4.74921	25079	G. F♯	346	Flat.
B	53224	4.72610	27390	C. C♯	448	Flat.
C	50000	4.69897	30103	F. G♯	494	Flat.
				B♭. E♭	540	Flat.

Vths upward on

E♭. G♯. C♯. F♯	perfect	Flat.
F. B♭ E. B	46	Flat.
C. G. D. A	116	Flat.

Interval of a comma	540
minor third	7918
major third	9691
fifth	17609

The firft column of the above table contains the ordinary defignations of the notes. The fecond contains the correfponding lengths of the monochord. The third contains the logarithms of column fecond. The fourth contains the difference of each logarithm from the firft. The next column contains, firft, the temperaments of all the

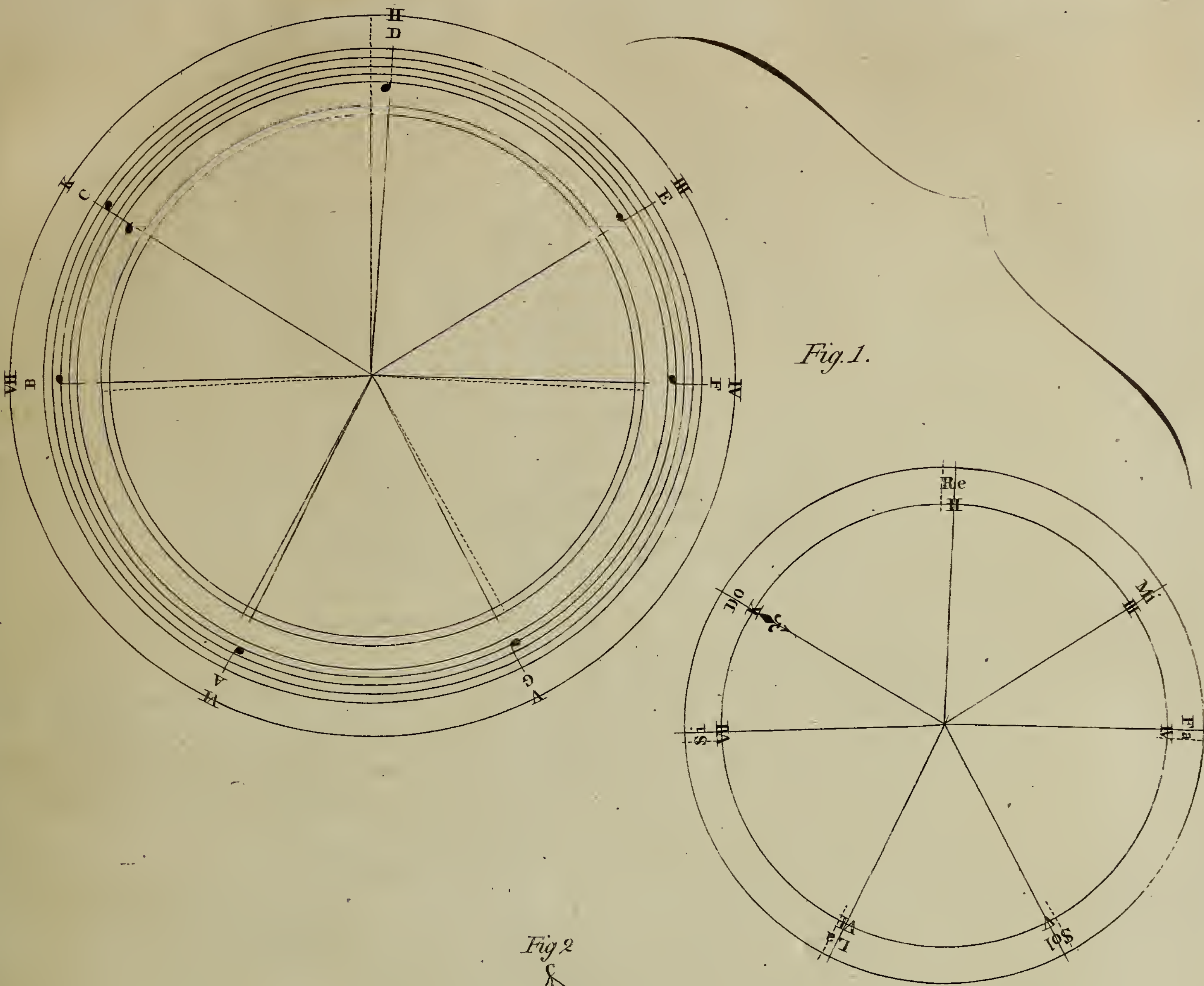
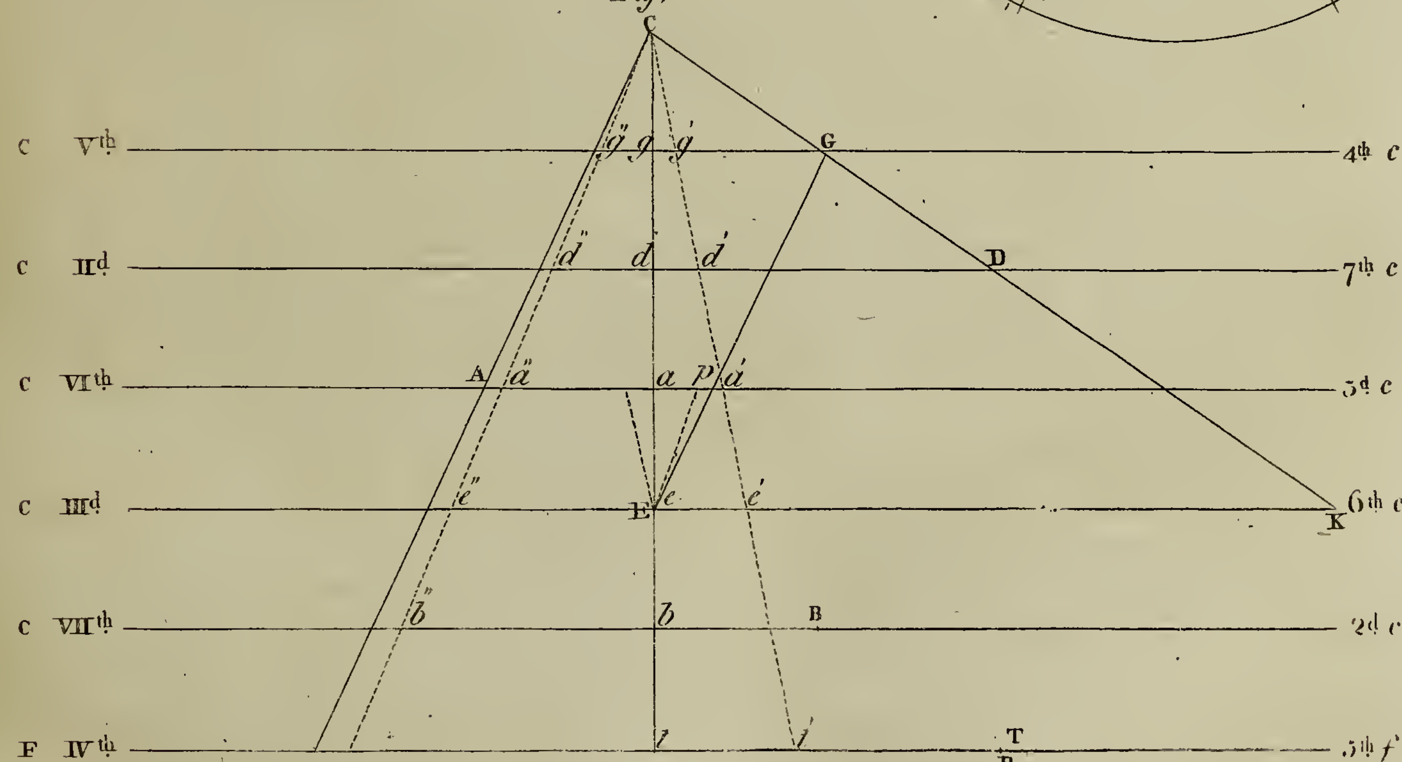


Fig. 1.

Fig. 2


c Vth
c IId
c VIth
c IIId
c VIIth
F IVth
4th c
7th c
3d c
6th c
2d c
5th f

Temperament of the Scale of Music, || Templars.

the major thirds, having for their lowest note the found corresponding to the letter. Thus 494, or $\frac{494}{540}$ of a comma, is the temperament of the IIId, B — D♯, and C♯ — F. Secondly, it contains all the minor thirds formed on the notes represented by the letters. The column below contains the temperaments of the Vths. *N. B.* These temperaments are calculated by the author. We have found some of them a little different. Thus we make the temperament of C — G only 108. Below this we have set down the measures of the perfect intervals, which are to be compared with the differences of the logarithms in column third.

91 System of Kirnbergher.

We presume not to decide on the merits of this temperament: Only we think that the temperaments of several thirds, which occur very frequently, are much too great; and many instances of the 6th, which is frequent in the flat key, are still more strongly tempered. A temperament, however, which very nearly coincides with Dr Young's, has great reputation on the continent. This is the temperament by Mr Kirnbergher, published at Berlin in 1771, in his book called *Die Kunst des reinen Satzes in der Musik*. The eminent mathematician Major Templehoff has made some important observations on this temperament, and on the subject in general, in an essay published in 1775, Berlin. Dr Young's is certainly preferable.

The monochord is thus divided by Kirnbergher:

C =	1,0000	F =	7500	B♭ =	5625
C♯	9492	F♯	7111	B	5313
D	8889	G	6667	c	5000
E♭	8437	G♯	6328		
E	8000	A	5963		

We conclude this article (perhaps too long) by earnestly recommending to persons who are not mathematically disposed, the sliding scales, either circular or rectilineal, containing the octave divided into 301 parts; and a drawing of fig. 2. on card paper, of proper size, having the quarter comma about two inches, and a series of scales corresponding to it. This will save almost the whole of the calculation that is required for calculating the beats, and for examining temperaments by this test. To readers of more information, we earnestly recommend a careful perusal of Smith's Harmonics, second edition. We acknowledge a great partiality for this work, having got more information from it than from all our patient study of the most celebrated writings of Ptolemy, Huyghens, Euler, &c. It is our duty also to say, that we have got more information concerning the music of the Greeks from Dr Wallis's appendix to his edition of Porphyrius's Commentary on Ptolemy's Harmonics, than from any other work.

TEMPIE, a place in New Galicia, 200 leagues N. W. of the city of Mexico.—*Morse.*

TEMPLARS. In the account of this order, which is published in the *Encyclopædia*, we have, with many others, supposed that the guilt of which they were accused at the suppression of the order was less enormous than their enemies alleged. For the honour of human nature, we are still unwilling to believe that this was not the case. Justice, however, compels us to admit, that the Abbé Barruel has brought together such a cloud of witnesses against the Templars, that we know not how to resist their evidence; and that he has completely proved, that *Philip le Bel* was not influenced by avarice when he suppressed that order in France. "It has been said, that he and Clement V. had concerted between them the dissolution of the Templars. The falsity of such an assertion is evident on the inspection of their letters. Clement V. at first will give no credit to the accusations against the Templars; and even when he receives incontestable proofs from Philip le Bel, he had still so little concerted the plan with that Prince, that every step taken by the one or the other occasions disputes on the rights of the church or of the throne.

"It was also said, that the king wished to seize on the great riches of these knights: but at the very commencement of his proceedings against the order, he solemnly renounced all share in their riches; and perhaps no Prince in Christendom was truer to his engagement. Not a single estate was annexed to his domain; and all history bears testimony to the fact.

"We next hear of a spirit of revenge which actuated this Prince; and during the whole course of this long trial, we do not hear of a single personal offence that he had to revenge on the Templars. In their defence, not the most distant hint, either at the revengeful spirit, or at any personal offence against the king, is given; so far from it, until the period of this great catastrophe, the grand master of the order had been a particular friend of the king's, who had made him godfather to one of his children.

"In fine, the rack and torture is supposed to have forced confessions from them which otherwise they never would have made; and in the minutes, we find the avowal of at least 200 knights all made with the greatest freedom, and without any coercion. Compulsion is mentioned but in the case of one person; and he makes exactly the same avowal as 12 other knights, his companions, freely made (A). Many of these avowals were made in councils where the bishops begin by declaring, that all who had confessed through fear of the torture should be looked upon as innocent, and that no Knight Templar should be subjected to it (B). The Pope Clement V. was so far from favouring the king's prosecutions, that he began by declaring them all to be void and null. He suspended the archbishops, bishops, and prelates, who had acted as inquisitors in France. The king accuses the Pope in vain of favouring the Templars; and Clement is only convinced after having been present at the interrogatories of 72 knights at Poictiers, in presence of many bishops, cardinals, and legates. He interrogated them, not like a judge who sought for criminals, but like one who wished to find innocent men, and thus exculpate himself from the charge of having favoured them. He hears them repeat the same avowals, and they are freely confirmed. He desired that these avowals should be read to them after an interval of some days, to see if they would still freely persevere in their depositions. He hears them all confirmed. *Qui perseverantes in illis, eas expresse et sponte prout recitatæ fuerant approbárunt.* He wished still further to interrogate

(A) *Layette*, N° 20. *Interrog. made at Caen.*
(B) See the *Council of Ravenna. Rubeus Hist. Raven.* lib. vi.

Templars.

gate the grand master and the principal superiors, *præceptores majores*, of the divers provinces of France, Normandy, Poitou, and of the Transmarine countries. He sent the most venerable persons to interrogate those of the superiors, whose age or infirmities hindered them from appearing before him. He ordered the depositions of their brethren to be read to them, to know if they acknowledged the truth of them. He required no other oath from them than to answer freely and without compulsion; and both the grand master and the superiors of these divers provinces depose and confess the same things, confirm them some days after, and approve of the minutes of their depositions taken down by public notaries. Nothing less than such precautions could convince him of his error: it was then only that he revoked his menaces and his suspension of the French bishops, and that he allows the king to proceed in the trials of the Templars.

"Let such pretexts be forgotten, and let us only dwell on the avowals which truth alone forced from these criminal knights.

"Their depositions declare, that the Knights Templars, on their reception, denied Christ, trampled on the cross, and spit upon it; that Good Friday was a day which was particularly consecrated to such outrages; that they promised to prostitute themselves to each other for the most unnatural crimes; that every child begotten by a Templar was cast into the fire; that they bound themselves by oath to obey, without exception, every order coming from the grand master; to spare neither sacred nor prophane; to look upon every thing as lawful when the good of the order was in question; and, above all, never to violate the horrible secrets of their nocturnal mysteries, under pain of the most terrible chastisements (c).

"In making their depositions, many of them declared they had only been forced into these horrors by imprisonment and the most cruel usage; that they wished, after the example of many of their brethren, to pass into other orders, but that they did not dare, fearing the power and vengeance of their order; that they had secretly confessed their crimes, and had craved absolution. In this public declaration, they testified, by their tears, the most ardent desire of being reconciled to the church.

"All repeat the same deposition, except three, who declare they have no knowledge of the crimes imputed to their order. The Pope, not content with this information taken by men of religious orders and by French noblemen, requires that a new trial should take place in Poitou before cardinals and others whom he himself nominates: Again, with the same freedom, and for the third time, the grand master and other chiefs, in presence of Clement V. repeat their depositions. Molay even requested, that one of the lay brothers, who was about his person, should be heard, and this brother confirms the declaration. During many years these informations were continued and renewed at Paris, in Champagne, in Normandy, in Quercy, in Languedoc, in Provence. In France alone, above 200 avowals of the same nature are to be found: nor did they vary in England, where, at the synod of London held in 1311, 78 English knights were heard, and two whole months were spent in taking informations and in verifying their declarations. Fifty-four Irish were also heard, and many Scotch, in their respective countries. It was in consequence of these declarations that the order of the Templars was abolished in those kingdoms, and that the parliament disposed of their goods (d). The same declarations were taken and proved in Italy, at Ravenna, at Bologna, at Pisa, and at Florence, though in all these councils the prelates were very ready to absolve all those knights who could succeed in their justifications.

Templars, || Templeman.

"I would willingly assert (continues the Abbé), that it was the smaller part of the Templars who suffered themselves to be carried away by such abominations. Some even at Paris were declared innocent. In Italy a still greater number were absolved; of all those who were judged at the councils of Mayence and Salamanca none were condemned: and hence we may conclude, that of the 9000 houses belonging to the order, many had not been tainted, and that whole provinces were to be excepted from the general stain of infamy. But the condemnations, the juridical depositions, the method of initiating the knights, almost became general; the secrecy of their receptions, where neither prince, nor king, nor any person whatever, could be present during the last half century, are so many testimonies which corroborate the divers accusations contained in the articles sent to the judges; that is to say, that at least two thirds of the order knew of the abominations practised without taking any steps to extirpate them. *Quod omnes, vel quasi duæ partes ordinis scientes dictos errores corrigere neglexerint.*

"This certainly cannot mean that two thirds of the knights had equally partaken of these abominations. It is evident, on the contrary, that many detested them as soon as they were acquainted with them; and that others only submitted to them, though initiated, after the harshest treatment and most terrible threats. Nevertheless, this proves, that the greatest part of these knights were criminal, some through corruption, others through weakness or connivance; and hence the dissolution of the order became necessary."

TEMPLE, a township of New-Hampshire, Hillsborough county, N. of New-Ipswich, and 70 miles westerly of Portsmouth. It was incorporated in 1768, and contains 520 inhabitants.—*Morse.*

Temple *Bay*, on the Labrador coast, opposite Belle Isle. A British settlement of this name was destroyed by the French, in October, 1796.—*ib.*

TEMPLEMAN (Peter), M. D. the son of an eminent attorney at Dorchester in the county of Dorset, by Mary daughter of Robert Haynes, was born March 17, 1711, and was educated at the Charter-house (not on the foundation), whence he proceeded to Trinity-college, Cambridge, and there took his degree of B. A. with distinguished reputation. During his residence at Cambridge, by his own inclination, in conformity with that of his parents, he applied himself to the study of divinity, with a design to enter into holy orders; but after some time, from what cause we know not, he altered

Biog. Dict.

(c) See the *Vouchers brought by Dupuy*, and *Extract of the Registers*.

(d) Vide *Valsinger in Edvardum* II. *et Ypodigma Neustriæ apud Dupuy.—Essai de Fred. Nicolai.*

tered his plan, and applied himfelf to the ftudy of phyfic. In the year 1736, he went to Leyden, where he attended the lectures of Boerhaave, and the profeffors of the other branches of medicine in that celebrated univerfity, for the fpace of two years or more. About the beginning of 1739, he returned to London, with a view to enter on the practice of his profeffion, fupported by a handfome allowance from his father. Why he did not fucceed in that line was eafy to be accounted for by thofe who knew him. He was a man of a very liberal turn of mind, of general erudition, with a large acquaintance among the learned of different profeffions, but of an indolent, inactive difpofition; he could not enter into juntos with people that were not to his liking; nor cultivate the acquaintance to be met with at tea-tables; but rather chofe to employ his time at home in the perufal of an ingenious author, or to fpend an attic evening in a felect company of men of fenfe and learning. In this he refembled Dr Armftrong, whofe limited practice in his profeffion was owing to the fame caufe. In the latter end of the year 1750 he was introduced to Dr Fothergill by Dr Cumming, with a view of inftituting a Medical Society, in order to procure the earlieft intelligence of every improvement in phyfic from every part of Europe. At the fame period he tells his friend, "Dr Mead has very generoufly offered to affift me with all his intereft for fucceeding Dr Hall at the Charter-houfe, whofe death has been for fome time expected. Infpired with gratitude, I have ventured out of my element (as you will plainly perceive), and fent him an ode." Dr Templeman's epitaph on Lady Lucy Meyrick (the only Englifh copy of verfes of his writing that we know of), is printed in the eighth volume of the "Select Collection of Mifcellany Poems, 1781." In 1753 he publifhed the firft volume of "Curious Remarks and Obfervations in Phyfic Anatomy, Chirurgery, Chemiftry, Botany, and Medicine; extracted from the Hiftory and Memoirs of the Royal Academy of Sciences at Paris;" and the fecond volume in the fucceeding year. A third was promifed, but we believe never printed. It appears, indeed, that if he had met with proper encouragement from the public, it was his intention to have extended the work to twelve volumes, with an additional one of index, and that he was prepared to publifh two fuch volumes every year. His tranflation of "Norden's Travels" appeared in the beginning of the year 1757; and in that year he was editor of "Select Cafes and Confultations in Phyfic, by Dr Woodward," 8vo. On the eftablifhment of the Britifh Mufeum, in 1753, he was appointed to the office of keeper of the reading room, which he refigned on being chofen, in 1760, fecretary to the then newly inftituted Society of Arts, Manufactures, and Commerce. In 1762, he was elected a correfponding member of the Royal Academy of Science of Paris, and alfo of the Œconomical Society at Berne. Very early in life Dr Templeman was afflicted with fevere paroxyfms of an afthma, which eluded the force of all that either his own fkill, or that of the moft eminent phyficians then living, could fuggeft to him; and it continued to harafs him till his death, which happened September 23, 1769. He was efteemed a man of great learning, particularly with refpect to languages; fpoke French with great fluency, and left the character of a humane, generous, and polite member of fociety.

TEMPLETON, a townfhip in the N. W. part of Worcefter county, Maffachufetts, containing 950 inhabitants. It was granted as a bounty to the foldiers in king Philip's war, and was called Narraganfet Nº 6, until its incorporation in 1762. It is 63 miles W. by N. W. of Bofton, and 28 N. by W. of Worcefter.—*Morse.*

TENCH'S *Ifland*, in the South Pacific Ocean, was difcovered in 1790, by Lieut. Ball, and lies in lat. 1 39 S. and long. 151 31 W. It is low, and only about 2 miles in circuit, but is entirely covered with trees, including many of the cocoa-nut kind. It abounds with inhabitants, and the men appear to be remarkably ftout and healthy.—*ib.*

TENERIFFE, a town of Santa Martha and Terra Firma, in S. America, fituated on the eaftern bank of the great river Santa Martha, below its confluence with Madalena, about 135 miles from the city of Santa Martha, towards the fouth, the road from which capital to Teneriffe is very difficult by land, but one may go very eafily and agreeably from one to the other partly by fea, and partly by the above mentioned river.—*ib.*

TENNANT'S *Harbour*, on the coaft of the Diftrict of Maine, lies about three leagues from George's Iflands.—*ib.*

TENNESSEE, a large, beautiful, and navigable river of the State of Tenneffee, called by the French *Cherokee*, and abfurdly by others, Hogohegee river, is the largeft branch of the Ohio. It rifes in the mountains of S. Carolina, in about lat. 37, and purfues a courfe of about 1000 miles, fouth and fouth-weft nearly to lat. 34, receiving from both fides a number of large tributary ftreams. It then wheels about to the north in a circuitous courfe, and mingles with the Ohio, nearly 60 miles from its mouth. It is navigable for veffels of great burden to the *Mufcle Shoals*, 250 miles from its mouth. It is there about three miles broad, full of fmall ifles, and only paffable in fmall boats or batteaux. From thefe fhoals to the *Whirl*, or *Suck*, the place where the river is contracted to the breadth of 70 yards, and breaks through the Great Ridge, or Cumberland Mountain, is 250 miles, and the navigation for large boats all the way excellent. The higheft point of navigation upon this river is Tellico Block-Houfe, 900 miles from its mouth according to its meanders. It receives Holfton river 22 miles below Knoxville, and then running weft 15 miles receives the Clinch. The other waters which empty into Tenneffee, are Duck and Elk rivers, and Cow Creek on the one fide; and the Occachappo, Chickamauga and Hiwaffee rivers on the fouth and fouth-eaftern fides. In the Tenneffee and its upper branches are great numbers of fifh, fome of which are very large and of an excellent flavour. The river to which the name Tenneffee was formerly confined, is that part of it which runs northerly, and receives Holfton river 20 miles below Knoxville. The Coyeta, Chota, and Chilhawee Indian towns are on the weft fide of the river; and the Talaffee town on the eaft fide.—*ib.*

TENNESSEE, one of the United States of America, and, until 1796, called the *Tenneffee Government*, or *Territory of the United States South of the Ohio.* It is in length 400 miles, and in breadth 104; between lat. 35 and 36 30 N. and long. 81 28 and 91 38 W. It is bounded N. by Kentucky and parts of Virginia; E. by North-Carolina; S. by Georgia; W. by the Miffiffippi. It is divided

Tenneffee. divided into 3 diftricts, viz. Wafhington, Hamilton, and Mero, which are fubdivided into 13 counties, viz. Wafhington, Sullivan, Greene, Carter, Hawkins, Knox, Jefferfon, Sevier, Blount, Grainger, Davidfon, Sumner, Robertfon, and Montgomery. The firft four belonging to Wafhington diftrict, the next five to that of Hamilton, and the four latter to Mero diftrict. The two former diftricts are divided from the latter, by an uninhabited country of 91 miles in extent; that is from the block-houfes, at the point formed by the junction of the river Clinch with the Tenneffee, called South-Weft Point, to Fort Blount upon Cumberland river, through which there is a waggon road, opened in the fummer of 1795. There are few countries fo well watered with rivers and creeks. The principal rivers are the Miffiffippi, Tenneffee, Cumberland, Holfton, and Clinch. The tract called the Broken Ground, fends immediately into the Miffiffippi, the Wolf, Hatchee, Forked-Deer, Obian or Obean, and Reelfoot; which are from 30 to 80 yards wide at their mouths; moft of the rivers have exceedingly rich low grounds, at the extremity of which is a fecond bank, as on moft of the lands of the Miffiffippi. Befides thefe rivers, there are feveral fmaller ones, and innumerable creeks, fome of which are navigable. In fhort, there is hardly a fpot in this country, which is upwards of 20 miles diftant from a navigable ftream. The chief mountains are Stone, Yellow, Iron, Bald, and Unaka, adjoining to one another, from the eaftern boundary of the State, and feparate it from N. Carolina; their direction is nearly from N. E. to S. W. The other mountains are Clinch and Cumberland. It would require a volume to defcribe the mountains of this ftate, above half of which is covered with thofe that are uninhabitable. Some of thefe mountains, particularly the Cumberland or Great Laurel Ridge, are the moft ftupendous piles in the United States. They abound with ginfeng and coal. The caverns and cafcades in thefe mountains are innumerable. The *Enchanted Mountain*, about two miles fouth of Brafs-Town, is famed for the curiofities on its rocks. There are on feveral rocks a number of impreffions refembling the tracks of turkies, bears, horfes, and human beings, as vifible and perfect as they could be made on fnow or fand. The latter were remarkable for having uniformly fix toes each; one only excepted, which appeared to be the print of a negro's foot. By this we muft fuppofe the originals to have been the progeny of Titan or Anak. One of thefe tracks was very large, the length of the foot 16 inches, the diftance of the extremes of the outer toes 13 inches, the proximate breadth behind the toes 7 inches, the diameter of the heel-ball 5. One of the horfe tracks was likewife of an uncommon fize, the tranfverfe and conjugate diameters, were 8 by 10 inches; perhaps the horfe which the Great Warrior rode. What appears the moft in favour of their being the real tracks of the animals they reprefent, is the circumftance of a horfe's foot having apparently flipped feveral inches, and recovered again, and the figures having all the fame direction, like the trail of a company on a journey. If it be a *lufus naturæ*, the old dame never fported more ferioufly. If the operation of chance, perhaps there was never more apparent defign. If it were done by art, it might be to perpetuate the remembrance of fome remarkable event of war, or engagement fought on the ground. The vaft heaps of ftones near the place, faid to be tombs of warriors flain in battle, feem to favour the fuppofition. The texture of the rocks is foft. The part on which the fun had the greateft influence, and which was the moft indurated, could eafily be cut with a knife, and appeared to be of the nature of the pipe ftone. Some of the Cherokees entertain an opinion that it always rains when any perfon vifits the place, as if fympathetic nature wept at the recollection of the dreadful cataftrophe which thofe figures were intended to commemorate. The principal towns are Knoxville, the feat of government, Nafhville, and Jonefborough, befides 8 other towns, which are as yet of little importance. In 1791, the number of inhabitants was eftimated at 35,691. In November, 1795, the number had increafed to 77,262 perfons. The foil is luxuriant, and will afford every production, the growth of any of the United States. The ufual crop of cotton is 800lbs. to the acre, of a long and fine ftaple; and of corn, from 60 to 80 bufhels. It is afferted, however, that the lands on the fmall rivers, that empty into the Miffiffippi, have a decided preference to thofe on Cumberland river, for the production of cotton, rice, and indigo. Of trees, the general growth is poplar, hickory, black and white walnut, all kind of oaks, buck-eye, beech, fycamore, black and honey locuft, afh, horn-beam, elm, mulberry, cherry, dogwood, faffafras, poppaw, cucumber-tree, and the fugar-tree. The undergrowth, efpecially on low lands, is cane; fome of which are upwards of 20 feet high, and fo thick as to prevent any other plant from growing. Of herbs, roots, and fhrubs, there are Virginia and Seneca fnakeroot, ginfeng, and angelica, fpice-wood, wild plum, crab-apple, fweet annife, red-bud, ginger, fpikenard, wild hop and grape vines. The glades are covered with wild rye, wild oats, clover, buffaloe grafs, ftrawberries and pea-vines. On the hills, at the head of rivers, and in fome high cliffs of Cumberland, are found majeftic red cedars; many of thefe are four feet in diameter, and 40 feet clear of limbs. The animals are fuch as are found in the neighbouring States. The rivers are well ftocked with all kinds of frefh water fifh; among which are trout, perch, cat-fifh, buffaloe-fifh, red-horfe, eels, &c. Some cat-fifh have been caught which weighed upwards of 100 pounds: the weftern waters being more clear and pure than the eaftern rivers, the fifh are in the fame degree more firm and favory to the tafte. The climate is temperate and healthful; the fummers are very cool and pleafant in that part which is contiguous to the mountains that divide this ftate from N. Carolina; but on the weftern fide of the Cumberland Mountain the heat is more intenfe, which renders that part better calculated for the production of tobacco, cotton and indigo. Lime-ftone is common on both fides of the Cumberland Mountain. There are no ftagnant waters; and this is certainly one of the reafons why the inhabitants are not afflicted with thofe bilious and intermitting fevers, which are fo frequent, and often fatal, near the fame latitude on the coaft of the fouthern States. Whatever may be the caufes, the inhabitants have been remarkable healthy fince they fettled on the waters of Cumberland river. The country abounds with mineral fprings. Salt licks are found in many parts of the country. Iron ore abounds in the diftricts of Wafhington and Hamilton, and fine ftreams to put iron-works in operation. Iron ore was lately difcovered upon the fouth of Cumberland

berland river, about 30 miles below Nafhville, and a furnace is now erecting. Several lead mines have been difcovered, and one on French Broad has been worked; the ore produced 75 per cent. in pure lead. The Indians fay that there are rich filver mines in Cumberland Mountain, but cannot be tempted to difcover any of them to the white people. It is faid that gold has been found here; but the mine from which that metal was extracted is now unknown to the white people. Ores and fprings ftrongly impregnated with fulphur are found in various parts. Saltpetre caves are numerous; and in the courfe of the year 1796, feveral tons of faltpetre were fent to the Atlantic markets. This country furnifhes all the valuable articles of the fouthern States. Fine waggon and faddle horfes, beef cattle, ginfeng, deer-fkins, and furs, cotton, hemp, and flax, may be tranfported by land; alfo iron, lumber, pork and flour may be exported in great quantities, now that the navigation of the Miffiffippi is opened to the citizens of the United States. But few of the inhabitants underftand commerce, or are poffeffed of proper capitals; of courfe it is as yet but badly managed. However, being now an independent State, it is to be hoped that the eyes of the people will foon be opened to their true intereft, and agriculture, commerce, and manufactures will each receive proper attention. The Prefbyterians are the prevailing denomination of Chriftians; in 1788, they had 23 large congregations, who were then fupplied by only 6 minifters. There are alfo fome Baptifts and Methodifts. The inhabitants have paid great attention to the interefts of fcience; befides private fchools, there are 3 colleges eftablifhed by law; Greenville in Green's county, Blount at Knoxville, and Wafhington in the county of that name. Here is likewife a "Society for promoting Ufeful Knowledge." A tafte for literature is daily increafing. The inhabitants chiefly emigrated from Pennfylvania, and that part of Virginia that lies weft of the Blue Ridge. The anceftors of thefe people were generally of the Scotch nation; fome of whom emigrated firft to Ireland, and from thence to America. A few Germans and Englifh are intermixed. In 1788, it was thought there were 20 white perfons to one negro; and the difproportion is thought to be far greater now. This country was included in the 2d charter of king Charles II. to the proprietors of Carolina. In a fubfequent divifion, it made a part of N. Carolina. It was explored about the year 1745, and fettled by about 50 families in 1754; who were foon after driven off or deftroyed by the Indians. Its fettlement re-commenced in 1765. The firft permanent fettlement took place near Long-Ifland of Holfton, and upon Watauga, about 1774; and the firft appearance of any perfons from it, in the public councils of N. Carolina, was in the convention of that State in 1776. In the year 1780, a party of about 40 families, under the guidance and direction of James Robertfon, (fince Brig. Gen. Robertfon of Mero diftrict) paffed through a wildernefs of at leaft 300 miles to the French Lick, and there founded Nafhville. Their neareft neighbours were the fettlers of the infant State of Kentucky, between whom and them, was a wildernefs of 200 miles. From the year 1784, to 1788, the government of N. Carolina over this country was interrupted by the affumed State of Frankland; but in the year 1789, the people returned to their allegiance. In 1789, N. Carolina ceded this territory to the United States, on certain conditions, and Congrefs provided for its government. A convention was held at Knoxville, in 1796, and on the 6th of February the conftitution of the State of Tenneffee was figned by every member of it. Its principles promife to enfure the happinefs and profperity of the people. The following are the diftances on the new road from Nafhville in Davidfon county, to Fort Campbell, near the junction of Holfton with the Tenneffee.

	Miles.
From Nafhville to Stoney river	9
Big Spring	6
Cedar Lick	4
Little Spring	6
Barton's Creek	4
Spring Creek	5
Martin's Spring	5
Blair's Spring	5
Buck Spring	12
Fountaines	8
Smith's Creek	6
Coney River	11
Mine Lick	9
Falling Creek	9
War Path	7
Bear Creek	18
Camp Creek	8
King's Spring	16
Grovet's Creek	7
The foot of Cumberland Mountain	2
Through the mountain to Emmery's river, a branch of the Pelefon	11
To the Pappa Ford of the Pelefon or Clinch river	12
To Campbell's Station, near Holftein	10
To the Great Ifland	100
To Abingdon in Wafhington county	35
To Richmond in Virginia	310
Total	635

By this new road, a pleafant paffage may be had to the weftern country with carriages, as there will be only the Cumberland mountain to pafs, and that is eafy of afcent; and beyond it, the road is generally level and firm, abounding with fine fprings of water. The Indian tribes within and in the vicinity of this State are the Cherokees and Chickafaws.—*ib.*

TENSAW, a fettlement near Mobile Bay, inhabited by 90 American families, that have been Spanifh fubjects fince 1783.—*ib.*

TEOWENISTA *Creek*, runs foutherly about 28 miles, then wefterly 6 miles, and empties into Alleghany river about 18 miles from its mouth, and nearly 5 below the Hickory town.—*ib.*

TEQUAJO, or *Tiquas*, a province of Mexico; according to fome Spanifh travellers, being about lat. 37, where they found 16 villages.—*ib.*

TEQUEPA, a part of the coaft of New Mexico, about 18 leagues N. W. of Acapulco.—*ib.*

TEQUERY *Bay*, on the fouth-eaft part of the coaft of the ifland of Cuba, between Cape Cruiz, and Cape Maizi, at the eaft end. It affords good anchorage and fhelter for fhips, but is not much frequented.—*ib.*

TERANE', a town in Egypt, fituated on what Mr Browne

Browne calls the *left* of the moſt weſtern mouth of the Nile, at a very ſmall diſtance from the river. Its latitude is 30° 24'. The buildings are chiefly unburned brick, though there are alſo ſome of ſtone. The town and diſtrict containing ſeveral villages, belonged, before the French invaſion, to Murad Bey, who uſually entruſted its government, and the collection of its revenue, to one of his Caſhefs. That revenue ariſes principally from natrôn (See NATRUM, *Encycl.*), found in great quantities in certain lakes about thirty-five miles from Terané; and it is on account of theſe lakes only that the town is worthy of notice in this work; for though there are many columns in its neighbourhood, which indicate the ſcite of ancient ſtructures, none of them have inſcriptions aſcertaining their antiquity.

The eaſtern extremity of the moſt weſtern lake Mr Browne found to be 30° 31' North. No vegetation appears, except reeds, on the margin of the lake, which is very irregular in its form; ſo that it is not eaſy to ſay what may be the quantity of ground covered with water. It is higher in winter than in ſummer; and when it was viſited by our author, its breadth did not exceed a mile, though its length was nearly four. Towards the end of the ſummer, it is ſaid, theſe lakes are almoſt dry; and the ſpace that the water has retired from is then occupied by a thick depoſition of ſalt. Not far removed from the eaſtern extremity, a ſpring riſes with ſome force, which much agitates the reſt of the water. Cloſe to that ſpring the depth was far greater than Mr Browne's height; in other parts it was obſervable that it did not generally exceed three feet. The thermometer near this ſpring ſtood at 76, while in the open air it was 87. The more weſtern lake differs not materially from the eaſtern in ſize, form, or productions. The colour of the water in both is an imperfect red; and where the bottom is viſible, it appears almoſt as if covered with blood. Salt, to the thickneſs of five or ſix inches, lies conſtantly in the more ſhallow parts. The ſurface of the earth, near the lake, partakes more or leſs generally of the character of natrôn, and, in the parts fartheſt removed, offers to the foot the ſlight reſiſtance of ploughed ground after a ſlight froſt. The ſoil is coarſe ſand. The water of the lake, on the ſlighteſt evaporation, immediately depoſits ſalt. There is a mountain not far from the lakes, where natrôn is found in inſulated bodies, near the ſurface, of a much lighter colour than that produced in the lake, and containing a greater portion of alkali. How thick the ſubſtance of natrôn commonly is in the lake, our author did not accurately determine; but thoſe employed to collect it report, that it never exceeds a cubit, or common pike; but it appears to be regenerated as it is carried away. If ever it ſhould be brought to ſuperſede the uſe of barilla, the quantity obtainable ſeems likely to anſwer every poſſible demand.

TEREBRATULÆ (ANOMIÆ, *Lin.* ſee that article *Encycl.*) have been ſuppoſed not to exiſt now but as petrified ſhells. This, however is a miſtake. The anomia is an inhabitant of every region, and has exiſted in every age. As many terebratulæ were caught by Perouſe's people during his voyage of diſcovery, and as Lamanon the naturaliſt thought they ſhould be conſidered as a genus by themſelves, he has given us the following deſcription of the *anomia*, or, as he calls it, *terebratula*, on the coaſt of Tartary:

The length of the ſhell varies from ſix to twenty lines, and its breadth from five to eighteen; there are, however, conſiderable varieties of proportion between different individuals, beſides thoſe ariſing from the different ages of the animal. It would be improper, therefore, to diſtinguiſh the various ſpecies of anomiæ by the proportion of their ſhells. The waving lines on the edges of the ſhell are equally defective, as diſtinctive characters; for our author obſerved in the ſame ſpecies the ſhell approaching or receding indifferently from the circular form, and in ſome the edges of the valves are on the ſame plane; whereas in others, one of the valves forms a ſalient angle in the middle of its curve, and the other a re entering angle.

The ſhell is of a moderate thickneſs, about that of a common muſcle; it is ſomewhat tranſparent, convex like the cockle: neither of the ſhells is more ſenſibly arched than the other; that, however, which has the ſpur, is rather the moſt ſo, eſpecially in the ſuperior part.

On the ſurface of the ſhell are ſeen a number of ſlight tranſverſe depreſſions, of a ſemicircular waved form, which reach the part where the ſhell ceaſes to be circular, in order to form the angle which ſupports the ſummit.

Theſe ſtriæ are covered with a very thin and ſlightly-adhering perioſteum; in ſome ſpecimens there are from one to three ſhallow broad depreſſions, radiating inſenſibly from the centre of the ſhell, and becoming more marked as they approach the edges, where they form, with the correſponding parts of the other ſhell, thoſe ſalient and re-entering angles which have been mentioned. The perioſteum is rather more firmly fixed on the latter angles than on the former.

The ſhells are equal in the rounded part of their edge, and cloſe very exactly; however, towards the ſummit, the ſpur of one of the ſhells reaches conſiderably beyond the other ſhell, conſequently they are unequal, as in oyſters.

The ſpur, or ſummit, is formed by the folding from within of the edge of the ſhell, and the elongation of its upper part. The folded edges form an oval aperture of a moderate ſize, through which the animal extends the muſcle, by means of which it attaches itſelf to other ſubſtances. This ſhell is not, therefore, perforated, as its name of terebratula would ſeem to imply, the opening not being worked in one of the ſhells, but formed by the elongation of one ſhell, the folding in of its edges, and the approach of the other ſhell. The ſummit is not pointed, but round.

The ligament, as in the oyſter, is placed between the ſummits, and does not appear on the outſide; it adapts itſelf to the pedicle of the animal. As the ſummit takes up a conſiderable part of the ſhell, the valves are only capable of opening a very little without running the riſk of being broken. It is very firm, though ſlender, and not eaſily to be diſcovered, being fixed in a ſmall groove, which is filled up when the ſhell is ſhut by the correſponding part of the oppoſite ſhell. This ligament preſerves its texture, even for a conſiderable time after the ſhell is emptied and become dry.

Oyſters are without a hinge, the teeth which form it

Terebratulæ.

it in many other fhells not exifting in them. The anomia has been confidered as an oyfter, becaufe its hinge or teeth have not been examined: they are not vifible indeed in the foffile fpecimens; but in opening them when alive, the teeth compofing the hinge are fufficiently vifible, being even much larger than in the greater part of bivalve fhells. The foffil terebratulæ are almoft always found with their fhells clofed; whereas the other bivalves have ufually theirs either open or feparated: the reafon of this feems to arife from the nature of the hinge, that of the anomia not allowing it to feparate, and the ligament, which is very tight, contributing to keep the two fhells united. The teeth which form the hinge of the anomia approach very near to thofe of the *fpondyle*, defcribed by M. Adanfon. In this laft they are formed by two rounded projections, and in the anomia by the fame a little elongated. It is above thefe teeth that the ligament is placed in the larger fhell: there are between it and the teeth two cavities, one on each fide which ferve to receive the teeth of the other valve. The teeth of the larger fhell have, befides, a flight projection, which fits into a longitudinal furrow in the other fhell in front of the teeth.

The fubftance which covers the infide of the fhell holds, as in oyfters, a middle place between *nacre* and the interior fubftance of fhells, which are deftitute of it. The degree of its luftre, polifh and thicknefs, varies with the age and circumftances of individuals.

The colour of the teeth is always white; that of the outer furface of the fhell verges more or lefs to the ochry red, efpecially on the border. The infide has alfo a very flight tint of this colour, on a varying greyifh-white ground.

There is vifible on each fide of the fhell the impreffion of two very diftinct tendons; a circumftance which forms a very effential difference between this genus and that of the oyfter: this latter having only one tendon arifing from the middle of the body. The impreffions of the tendon in the largeft fhell are oblong, fituate near the fummit, and hollowed; each of them has curved tranfverfe ridges, divided into two parts by a longitudinal furrow, reprefenting the wings of certain infects. In the other valve the infertions have a different form; their fituation is the fame, but they are very irregularly rounded and encompaffed by two fulcations, which are feparated from each other by an intervening ridge, and then are continued in a right line towards the opening of the fhell as far as about two thirds of its length. That part of the fummit of the fhell along which the pedicle of the animal paffes, is longitudinally ftriated in the larger fhell, of which the middle ftria is the deepeft: the longitudinal ftriæ are divided into equal parts by a tranfverfe depreffion. There are no fimilar marks on the other fhell.

Our author diffected the animal itfelf, and found what he calls the *manteau* of the anomia, formed of a very fine membrane, lining the infide of both fhells, and containing the body of the animal. Its origin is of the fame breadth as the hinge of the fhell, whence it divides into two lobes, lining both the fhells: it forms, therefore, only a fingle aperture, terminating at each end of the hinge, and of the fame breadth with the interior furface of the fhell: it appears to have only one trachea, which is formed by the two lobes of the manteau.

Our naturalift having opened the fhell, divided the ligament as delicately as poffible, unfixed the hinge, and detaching from the larger fhell the lobe of the manteau, turned over the body of the animal. This operation expofed to view the large mufcles which adhered to the fhell; they are foft, membranous, and, as it were, flefhy on the infide, being covered with fmall fanguiferous glands. From the lower part of each mufcle there proceeds a pretty ftrong tendon, which reaches to the extremity of the manteau; they run parallel to the edge of the fhell, and at a confiderable diftance from each other; and are each enclofed in a fort of flatted fac, of the fhape of a ribbon, which is filled with a red vifcid matter. It appears that the place of infertion of the mufcles, as well as the mufcles themfelves, which extend along the lobe of the manteau, furnifh real blood, which is contained in three fmall flefhy red glandular bodies of unequal fize, which are vifible after having taken off the mufcles; perhaps thefe conftitute the heart of the animal.

The mufcles which are inferted into the other fhell are alfo divided into feveral parts: fome are feen extending along the correfponding lobe of the manteau; many others rife up in a kind of tuft, which is fixed into the fhell above: fome again fubdivide into fuch minute ramifications as not to allow of tracing their courfe, even with the affiftance of a microfcope; but others, more apparent, contribute to the formation of the pedicle which paffes through the opening left between the two fhells, is connected to each of them by feveral fibres, and fixes itfelf to fome external body, principally to other bivalves. The mufcles of the anomia have therefore three attachments, namely, to the inner furface of each fhell, and to fome external body.

The form of the pedicle is cylindrical, being enclofed in a mufcular fubftance, which contain feveral fibres; it is from a line to a line and a half long, and two thirds in diameter. It adheres fo forcibly to different fubftances, as that the animal, and all the mufcles which contribute to the formation of the pedicle, may more eafily be torn through than the pedicle detached from the place of its adhefion. The glutinous fubftance which connects them to each other, refifts even the heat of boiling water. It is by means of this pedicle that the animal raifes its fhell fo as to be, while in the water, in a pofition inclined to the horizon. The fmalleft valve is always the loweft, being that upon which the animal refts; the fuperior one being the larger, and ferving as a covering. Our author thinks the animal has the power of loco-motion.

After raifing the lobe of the manteau he obferved the ears. They are large, compofed of two membranaceous laminæ on each fide, of which the fuperior is the narrower. Thefe laminæ are connected to each other by a thin membrane, fo as to form only a fingle pouch. They have on their edges long fringes, which hang loofe upon the manteau; but a very remarkable circumftance is, that their ears are fupported by little bones like thofe of fifh. The form of the ears is that of an arch; they are feparated from each other on their lower part, where the fringes are the longeft; fo that the two ears on one fide are perfectly diftinct from thofe on the other fide. The commencement of the ears is at the teeth of the hinge.

Between the ears are fituate the ftomach, œfophagus, and mouth; the whole forming a triangle, of which the

mouth

mouth is the bafe. It is placed at the fide of the hinge, and confifts of a large tranfverfe opening without lips or jaw-bone. The œfophagus is very fhort, but is capable of elongation when the animal opens its mouth. The ftomach, which is of the fhape of a pointed fac, is connected by a membrane to the bones of the ear. On opening the ftomach, he found a fmall fhrimp half digefted.

At the bottom of the ftomach is feen the inteftine, of which it is, as it were, a continuation. It is extremely fhort, not exceeding half a line in a fhell fifteen lines acrofs, and is compofed of a very flender membrane. The excrements are difcharged upon the lobes of the manteau, but they are eafily thrown out by the motions of the two lobes.

The little bones of the ears, already mentioned, had not formerly been obferved in any of the teftaceous animals; whence the terebratulæ approach nearer to fifh than the inhabitants of any other fhell. In the anomiæ which are preferved in cabinets, there is found only a very fmall portion of thefe bones, whence they have obtained the improper appellation of *tongue* or *fork*, which indicate only the form of the fragments, and not their ufe.

The fmall bones of the ears are compofed of feveral pieces, the principal of which is of an oval form; it fprings from the fide of the hinge, of which it appears to be a continuation; thence it extends about two-thirds of the breadth of the fhell, where it is reflected, and refts againft the upper part of the fork, to the branches of which it is united by a fimple fuperpofition; a kind of articulation very common among the numerous fmall bones that compofe the heads of fifh. The fork extends from the the fummit a little more than one-third of the breadth of the fhell: it is formed by a pivot which divides into two long and pointed branches; thefe are remarkably brittle, and fupport the extremities of the bones of the larger ears. The lamina, which compofes a fecond fet of ears, refts upon a curved bone, which on one fide is attached to the inferior internal part of the bone of the larger ears, and on the other reaches to the fide of the mouth of the animal, where it is united to another flat little bone, which is applied to a fimilar bone on the other fide. Thefe laft little bones are exactly below the membrane which forms the mouth. All thefe bones are flat, very brittle, and furrounded with fibres and membranes. By their articulations the ears are enabled to move; they alfo fupport the body of the animal, which touches neither of the fhells, but remains between them as upon treffels. The fpace between the branches of the bones of the ears is filled up with a tranfparent firm membrane; at the bafe of the fork is a fimilar one, and a perpendicular partition dividing the fpace occupied by the body of the animal from the reft of the fhell. There are two orifices in this membrane communicating with the fpace between the two lobes of the manteau, and which ferves as a trachea; for we have remarked, in the defcription of the manteau, that the two lobes are entirely feparated from each other, and therefore do not form a real trachea.

From this defcription, it follows that the anomia ought to be feparated from the genus oyfter, fince it has a toothed hinge, feveral ligaments, and an interior organization wholly different; neither ought it to be confounded with the cockle, the fhells of which are both equal, and are deftitute of any fenfible periofteum, without reckoning other differences. It has ftill lefs analogy with the other bivalves, and therefore ought to conftitute a peculiar genus; the fpecies of which, both foffil and living, are very numerous.

See Plate XLIII. where fig 1. is a front view of a terebratula of middle fize. Fig. 2. is a view of the internal ftructure.—A A, laminæ of the fuperior ears—B B, laminæ of the inferior—C, the ftomach—D, the anus—E E, the manteau—F, the œfophagus.

TERMINA, *Laguna*, or *Lake of Tides*, lies at the bottom of the Gulf of Campeachy, in the fouth-weft part of the Gulf of Mexico. It is within Triefte and Beef Ifland, and Port Royal Ifland. The tide runs very hard in, at moft of the channels between the iflands; hence the name.—*Morse.*

TERNAI, the name given by Peroufe to a very fine bay which he difcovered on the coaft of Tartary, in Lat. 45° 13′ North, and in Long. 135° 9′ Eaft from Paris. The bottom is fandy, and diminifhes gradually to fix fathoms within a cable's length of the fhore. The tide rifes five feet; it is high water at 8^h 15^m at full and change; and the flux and reflux do not alter the direction of the current at half a league from the fhore. "Five fmall creeks (fays La Peroufe,) fimilar to the fides of a regular polygon, from the outline of this roadftead; thefe are feparated from each other by hills, which are covered to the fummit with trees. Never did France, in the frefheft fpring, offer gradations of colour of fo varied and ftrong a green; and though we had not feen, fince we began to run along the coaft, either a fingle fire or canoe, we could not imagine that a country fo near to China, and which appeared fo fertile, fhould be entirely uninhabited. Before our boats had landed, our glaffes were turned towards the fhore, but we faw only bears and ftags, which paffed very quietly along the fea fide. The fame plants which grow in our climates carpeted the whole foil, but they were ftronger, and of a deeper green; the greater part were in flower. Rofes, red and yellow lilies, lilies of the valley, and all our meadow flowers in general, were met with at every ftep. Pine trees covered the tops of the mountains; oaks began only half way down, and diminifhed in ftrength and fize in proportion as they came nearer the fea; the banks of the rivers and rivulets were bordered with willow, birch, and maple trees, and on the fkirts of the forefts we faw apple and medlar trees in flower, with clumps of hazle nut trees, the fruit of which already made its appearance. Our furprife was redoubled, when we reflected on the population which overburdens the extenfive empire of China, fo that the laws do not punifh fathers barbarous enough to drown and deftroy their children, and that this people, whofe polity is fo highly boafted of, dares not extend itfelf beyond its wall, to draw its fubfiftence from a land, the vegetation of which it would be neceffary rather to check than to encourage. At every ftep after we had landed, we perceived traces of men by the deftruction they had made; feveral trees, cut with fharp-edged inftruments; the remains of ravages by fire were to be feen in feveral places, and we obferved fome fheds, which had been erected by hunters in a corner of the woods. We alfo found fome fmall bafkets, made of the bark of birch trees, fewed with thread, and fimilar to thofe of the Canadian Indians;

rackets for walking on the ſnow; in a word, every thing induced us to think that the Tartars approach the borders of the ſea in the ſeaſon for hunting and fiſhing; that they aſſemble in colonies at that period along the rivers; and that the bulk of the nation live in the interior of the country on a ſoil perhaps better calculated for the multiplication of their immenſe flocks and herds."

Our navigators caught in the bay vaſt quantities of fine fiſh, ſuch as cod, harp-fiſh, trout, ſalmon, herrings, and plaice; but though game was plenty on ſhore, they had no ſucceſs in hunting. The meadows, ſo delightful to the ſight, could ſcarce be croſſed; the thick graſs was three or four feet high, ſo that they found themſelves in a manner buried in it, and they were under the perpetual dread of being bitten by ſerpents, of which they ſaw a great number on the banks of the rivulets. They found, however, immenſe quantities of ſmall onions, ſorrel, and celery; which, together with the freſh fiſh, ſerved as antidotes againſt the ſcurvy.

TERRA *de Latraton*, that is, the *Ploughman* or *Labourer's Land*, the name given by the Spaniards to Labrador or New-Britain, inhabited by the Eſquimaux.—*Morse*.

TERRA *del Fuego Iſland*, or *Land of Fire*, at the ſouth extremity of S. America, is ſeparated from the main on the N. by the Straits of Magellan, and contains about 42,000 ſquare miles. This is the largeſt of the iſlands ſouth of the Straits, and they receive this name on account of the vaſt fires and ſmoke which the firſt diſcoverers of them perceived. The iſland of Staten Land lies on the eaſt. They are all barren and mountainous; but there have been found ſeveral ſorts of trees and plants, and a variety of birds on the lower grounds and iſlands that are ſheltered by the hills. Here are found Winter's bark, and a ſpecies of arbutus which has a very well taſted red fruit of the ſize of ſmall cherries. Plenty of celery is found in ſome places, and the rocks are covered with very fine muſcles. A ſpecies of duck as large as a gooſe, and called the loggerhead duck at the Falkland Iſlands, is here met with, which beats the water with its wings and feet, and runs along the ſea with inconceivable velocity; and there are alſo geeſe and falcons.—*ib.*

TERRA FIRMA, or *Caſtile del Oro*, the moſt northern province of S. America, 1,400 miles in length, and 700 in breadth; ſituated between the eqator and 12 N. lat. and between 60 and 82 W. long. bounded N. by the N. Atlantic Ocean, here called the North Sea, E. by the ſame ocean and Surinam, S. by Amazonia and Peru, and W. by the N. Pacific Ocean. It is called Terra Firma from being the firſt part of the continent diſcovered by the Spaniards, and is divided into Terra Firma Proper, or Darien, Carthagena, St Martha, Venezuela, Comana, Paria, New Granada, and Popayan. The chief towns are Porto Bello, Panama, Carthagena, and Popayan. The principal bays of this province in the Pacific Ocean, are thoſe of Panama and St Michael, in the North Sea, Porto Bello, Sino, Guiara, &c. The chief rivers are the Darien, Chagre, Santa Maria, Conception, and Oronoko. The climate here, eſpecially in the northern parts, is extremely hot and ſultry during the whole year. From the month of May, to the end of November, the ſeaſon called winter by the inhabitants, is almoſt a continual ſucceſſion of thunder, rain and tempeſts, the clouds precipitating the rain with ſuch impetuoſity, that the low lands exhibit the appearance of an ocean. Great part of the country is conſequently flooded; and this, together with the exceſſive heat, ſo impregnates the earth with vapours, that in many provinces, particularly about Popayan and Porto Bello, the air is extremely unwholeſome. The ſoil of this country is very different, the inland parts being very rich and fertile, and the coaſts ſandy and barren. It is impoſſible to view without admiration, the perpetual verdure of the woods, the luxuriancy of the plains, and the towering height of the mountains. This country produces corn, ſugar, tobacco, &c. and fruits of all kinds. This part of S. America was diſcovered by Columbus in his third voyage to America. It was ſubdued and ſettled by the Spaniards about the year 1514, after deſtroying, with great inhumanity, ſeveral millions of the natives. —*ib.*

TERRA FIRMA *Proper*, or *Darien*, a ſubdiviſion of Terra Firma. Chief towns, Porto Bello, and Panama.—*ib.*

TERRA *Nueva*, near Hudſon's Straits, is in lat. 62 4 N. and long. 67 W. high water, at full and change, a little before 10 o'clock.—*ib.*

TERRE PLEIN, or TERRE-PLAIN, in fortification, the top, platform, or horizontal ſurface of the rampart, upon which the cannon are placed, and where the defenders perform their office. It is ſo called becauſe it lies level, having only a little ſlope outwardly to counteract the recoil of the cannon. Its breadth is from 24 to 30 feet; being terminated by the parapet on the outer ſide, and inwardly by the inner talus.

TERRELLA, or little earth, is a magnet turned of a ſpherical figure, and placed ſo as that its poles, equator, &c. do exactly correſpond with thoſe of the world. It was ſo firſt called by Gilbert, as being a juſt repreſentation of the great magnetic globe we inhabit. Such a terrella, it was ſuppoſed, if nicely poiſed, and hung in a meridian like a globe, would be turned round like the earth in 24 hours by the magnetic particles pervading it; but experience has ſhewn that this is a miſtake.

TERRITORY *North-Weſt of the Ohio*, or *North-Weſtern Territory*, a large part of the United States, is ſituated between 37 and 50 N. lat. and between 81 8 and 98 8 W. long. Its greateſt length is about 900 miles, and its breadth 700. This extenſive tract of country is bounded north by part of the northern boundary line of the United States; eaſt by the lakes and Pennſylvania; ſouth by the Ohio river; weſt by the Miſſiſſippi. Mr Hutchins, the late geographer of the United States, eſtimates that this tract contains 263,040,000 acres, of which 43,040,000 are water; this deducted, there will remain 220,000,000 of acres, belonging to the Federal Government, to be ſold for the diſcharge of the national debt; except a narrow ſtrip of land bordering on the ſouth of Lake Erie, and ſtretching 120 miles weſt of the weſtern limit of Pennſylvania, which belongs to Connecticut. But a ſmall portion of theſe lands is yet purchaſed of the natives, and to be diſpoſed of by Congreſs. Beginning on the meridian line, which forms the weſtern boundary of Pennſylvania, ſeven ranges of townſhips have been ſurveyed and laid off by order of Congreſs. As a north

Territory. and south line strikes the Ohio in an oblique direction, the termination of the 7th range falls upon that river, 9 miles above the Muskingum, which is the first large river that falls into the Ohio. It forms this junction 172 miles below Fort Pitt, including the windings of the Ohio, though, in a direct line, it is but 90 miles. That part of this territory in which the Indian title is extinguished, and which is settling under the government of the United States, is divided into five counties as follows:

Counties.	When erected.
Washington, - -	1788 July 26th.
Hamilton, - - -	1790 Jan. 2d.
St Clair, - - -	1790 April 27th.
Knox, - - -	1790 June 20th.
Wayne, - - -	1796.

These counties have been organized with the proper civil and military officers. The county of St Clair is divided into three districts, viz. the district of Cahokia, the district of Prairie-du-rochers, and the district of Kaskaskias. Courts of general quarter sessions of the peace, county courts of common pleas, and courts of probate, to be held in each of these districts, as if each was a distinct county; the officers of the county to act by deputy, except in the district where they reside. The principal rivers in this territory are Muskingum, Hockhocking, Sciota, Great and Little Miami, Blue and Wabash, which empty into the Ohio; Au Vase, Illinois, Ouisconsing, and Chippeway, which pay tribute to the Mississippi, besides a number of smaller ones. St Lewis, Kennomic, St Joseph's, Barbue, Grand, Miami of the Lakes, Sandusky, Cayahoga, and many others which pass to the lakes. Between the Kaskaskias and Illinois rivers, which are 84 miles apart, is an extensive tract of level, rich land, which terminates in a high ridge, about 15 miles before you reach the Illinois river. In this delightful vale are a number of French villages, which, together with those of St Genevieve, and St Louis, on the western side of the Mississippi, contained, in 1771, 1273 fencible men. The number of souls in this large tract of country, has not been ascertained. From the best data the author has received, the population may be estimated, five years ago, as follows:

Indians, (suppose) - -	65,000	1792.
Ohio Company purchase, -	2,500	do.
Col. Symmes' settlements, -	2,000	do.
Galliopolis, (French settlements) opposite the Kanhaway river,	1,000	do.
Vincennes and its vicinity, on the Wabash,	1,500	do.
Kaskaskias and Cahokia, -	680	1790.
At Grand Ruisseau, village of St Philip, and Prairie-du-rochers,	240	do.
Total	72,820	

In 1790, there were in the town of Vincennes, about 40 American families and 31 slaves, and on the Mississippi, 40 American families and 73 slaves, all included in the above estimate. On the Spanish or western side of the Mississippi, there were, in 1790, about 1800 souls, principally at Genevieve, and St Louis. The lands on the various rivers which water this territory, are interspersed with all the variety of soil which conduces to pleasantness of situation, and lays the foundation for the wealth of an agricultural and manufacturing people. Large level bottoms, or natural meadows, from 20 to 50 miles in circuit, are found bordering the rivers, and variegating the country in the interior parts. These afford as rich a soil as can be imagined, and may be reduced to proper cultivation with very little labour. The prevailing growth of timber, and the more useful trees, are maple or sugar-tree, sycamore, black and white mulberry, black and white walnut, butternut, chesnut; white, black, Spanish, and chesnut oaks, hickory, cherry, buckwood or horse chesnut, honey-locust, elm, cucumber tree, lynn tree, gum tree, iron wood, ash, aspin, sassafras, crab-apple tree, paupaw or custard apple, a variety of plum trees, nine bark spice, and leather wood bushes. White and black oak, and chesnut, with most of the above-mentioned timbers, grow large and plenty upon the high grounds. Both the high and low lands produce great quantities of natural grapes of various kinds, of which the settlers universally make a sufficiency for their own consumption, of rich red wine. It is asserted in the old settlement of St Vincent, where they have had opportunity to try it, that age will render this wine preferable to most of the European wines. Cotton is said to be the natural production of this country, and to grow in great perfection. The sugar maple is the most valuable tree, for an inland country. Any number of inhabitants may be forever supplied with a sufficiency of sugar, by preserving a few trees for the use of each family. A tree will yield about ten pounds of sugar a year, and the labour is very trifling. Springs of excellent water abound in this territory; and small and large streams, for mills and other purposes, are actually interspersed, as if by art, that there be no deficiency in any of the conveniencies of life. Very little waste land is to be found in any part of this tract of country. There are no swamps but such as may be readily drained, and made into arable and meadow land; and though the hills are frequent, they are gentle, and swelling no where high or incapable of tillage. They are of a deep rich soil, covered with a heavy growth of timber, and well adapted to the production of wheat, rye, indigo, tobacco, &c. The communication between this country and the sea, will be principally in the 4 following directions: 1. The route through the Scioto and Muskingum to Lake Erie, and so to the river Hudson. 2. The passage up the Ohio and Monongahela to the portage above mentioned, which leads to the navigable waters of the Patowmack. This portage is 30 miles, and will probably be rendered much less by the execution of the plans now on foot for opening the navigation of those waters. 3. The Great Kanhaway, which falls into the Ohio from the Virginia shore, between the Hockhocking and the Scioto, opens an extensive navigation from the south-east, and leaves but 18 miles portage from the navigable waters of James' river, in Virginia. This communication, for the country between Muskingum and Scioto, will probably be more used than any other for the exportation of manufactures, and other light and valuable articles, and especially, for the importation of foreign commodities, which may be brought from the Chesapeak to the Ohio much cheaper than they are now carried from Philadelphia to Carlisle, and the other thick settled back counties of Pennsyl-

Territory.

Pennfylvania (A). 4. But the current down the Ohio and Miffiffippi, for heavy articles that fuit the Florida and Weft-India markets, fuch as corn, flour, beef, lumber, &c. will be more frequently loaded than any ftreams on earth. The diftance from the Scioto to the Miffiffippi, is 800 miles; from thence to the fea, is 900. This whole courfe is eafily run in 15 days; and the paffage up thofe rivers is not fo difficult as has ufually been reprefented. It is found, by late experiments, that fails are ufed to great advantage againft the current of the Ohio; and it is worthy of obfervation, that in all probability fteam boats will be found to do infinite fervice in all our extenfive river navigation. No country is better ftocked with wild game of every kind. The rivers are well ftored with fifh of various kinds, and many of them are of an excellent quality. They are generally large, though of different fizes; the catfifh, which is the largeft, and of a delicious flavour, weighs from 6 to 80 pounds. The number of old forts, found in this weftern country, are the admiration of the curious, and a matter of much fpeculation. They are moftly of an oblong form, fituated on ftrong, well chofen ground, and contiguous to water. When, by whom, and for what purpofe, thefe were thrown up, is uncertain. They are undoubtedly very ancient, as there is not the leaft vifible difference in the age or fize of the timber growing on or within thefe forts, and that which grows without; and the oldeft natives have loft all tradition refpecting them. The pofts eftablifhed for the protection of the frontiers, and their fituation, may be feen on the map. By an ordinance of Congrefs, paffed on the 13th of July, 1787, this country, for the purpofes of temporary government, was erected into one diftrict, fubject, however, to a divifion, when circumftances fhall make it expedient. The ordinance of Congrefs, of July 13th, 1787, article 5th, provides that there fhall be formed in this territory, not lefs than three, nor more than five States; and the boundaries of the States fhall become fixed and eftablifhed as follows, viz. the weftern State in the faid territory fhall be bounded on the Miffiffippi, the Ohio and Wabafh rivers; a direct line drawn from the Wabafh and Poft Vincents due north to the territorial line between the United States and Canada, and by the faid territorial line to the Lake of the Woods and Miffiffippi. The middle State fhall be bounded by the faid direct line, the Wabafh from Poft Vincents to the Ohio; by the Ohio by a direct line drawn due north from the mouth of the Great Miami to the faid territorial line, and by the faid territorial line. The eaftern State fhall be bounded by the laft mentioned direct line, the Ohio, Pennfylvania, and the faid territorial line: Provided however, and it is further underftood and declared, that the boundaries of thefe 3 States fhall be fubject fo far to be altered, that if Congrefs hereafter fhall find it expedient, they fhall have authority to form 1 or 2 States, in that part of the faid territory which lies N. of an E. and W. line drawn through the foutherly bend or extreme of Lake Michigan; and when any of the faid States fhall have 60,000 free inhabitants therein, fuch State fhall be admitted by its delegates into the Congrefs of the United States, on an equal footing with the original States in all refpects whatever; and fhall be at liberty to form a permanent conftitution and State government; provided the conftitution and government fo to be formed fhall be republican, and in conformity to the principles contained in thefe articles, and fo far as it can be confiftent with the general intereft of the confederacy, fuch admiffion fhall be allowed at an earlier period, and when there may be a lefs number of free inhabitants in the State, than 60,000. The fettlement of this country has been checked, for feveral years paft, by the unhappy Indian war, an amicable termination of which took place on the 3d of Auguft, 1795, when a treaty was formed at Grenville, between Major Gen. Anthony Wayne, on the part of the United States, and the Chiefs of the following tribes of Indians, viz. Wyandots, Delawares, Shawanoes, Ottawas, Chippewas, Putawatimes, Miamis, Eel river, Weeas, Kickapoos, Pian-Kafhaws and Kafkafkias. By the third article of this treaty, the Indians cede to the United States, for a valuable confideration, all lands lying eaftward and fouthward of a line "beginning at the mouth of Cayahoga river, and running thence up the fame to the portage between that and the Tufcarawas branch of the Mufkingum; thence down that branch to the croffing place above Fort Lawrence; thence wefterly to a fork of that branch of the Great Miami river, running into the Ohio, where commences the portage between the Miami of the Ohio, and St Mary's river, which is a branch of the Miami of the lake; thence a wefterly courfe to Fort Recovery, which ftands on a branch of the Wabafh, then fouth-wefterly in a direct line to the Ohio, fo as to interfect that river oppofite the mouth of Kentucky or Catawa river." Sixteen tracts of land of 6 and 12 miles fquare, interfperfed at convenient diftances in the Indian country, were, by the fame treaty, ceded to the United States, for the convenience of keeping up a friendly and beneficial intercourfe between the parties. The United States, on their part, "relinquifh their claims to all other Indians lands northward of the river Ohio, eaftward of the Miffiffippi, and weftward and fouthward of the Great Lakes and the waters uniting them, according to the boundary line agreed on by the United States and the king of Great Britain, in the treaty of peace made between them in the year 1783. But from this relinquifhment, by the United States, the following tracts of land are explicitly excepted. 1ft. The tract of 150,000 acres near the rapids of the Ohio river, which has been affigned to Gen. Clark, for the ufe of himfelf and his warriors. 2d. The poft of St Vincents on the river Wabafh, and the lands adjacent; of which the Indian title has been extinguifhed. 3d. The land at all other places in poffeffion of the French people and other white fettlers among them, of which the Indian title has been extinguifhed, as mentioned in the third article; and 4th. The poft of Fort Maffac, towards the mouth of the Ohio. To which feveral parcels of land fo excepted, the faid tribes relinquifh all the title and claim which they or any of them may have." Goods to the value of 20,000 dolls. were delivered

(A) A gentleman of much obfervation, and a great traveller in this country, is of opinion that this communication, or route, is chimerical.

delivered the Indians at the time this treaty was made; and goods to the amount of 9,500 dollars, at firſt coſt in the United States, are to be delivered annually to the Indians at ſome convenient place northward of the Ohio. A trade has been opened, ſince this treaty, by a law of Congreſs, with the forementioned tribes of Indians, on a liberal footing, which promiſes to give permanency to this treaty, and ſecurity to the frontier inhabitants.—*Morſe.*

TESTIGOS, iſlands near the coaſt of New Andaluſia, in Terra Firma, on the ſouth coaſt of the Caribbean Sea, in the Weſt-Indies. Several ſmall iſlands at the eaſt end of the iſland of Margarita lie between that iſland, and thoſe called Teſtigos. N. lat. 11 6, W. long. 61 48.—*ib.*

TETEROA *Harbour*, on the W. ſide of the iſland of Ulietea, one of the Society Iſlands. S. lat. 16 51, W. long. 151 27.—*ib.*

TETHUROA, an iſland in the S. Pacific Ocean, about 24 miles from Point Venus in the iſland of Otaheite. S. lat. 17 4, W. long. 149 30.—*ib.*

TETRAEDRON, or TETRAHEDRON, in geometry, is one of the five Platonic or regular bodies or ſolids, comprehended under four equilateral and equal triangles. Or it is a triangular pyramid of four equal and equilateral faces.

TETRAGON, in geometry, a quadrangle, or a figure having four angles. Such as a ſquare, a parallelogram, a rhombus, and a trapezium. It ſometimes alſo means peculiarly a ſquare.

TETRAGON, in aſtrology, denotes an aſpect of two planets with regard to the earth, when they are diſtant from each other a fourth part of a circle, or 90 degrees. The tetragon is expreſſed by the character □, and is otherwiſe called a ſquare or quartile aſpect.

TETZEUCO, a brackiſh lake in Mexico.—*Morſe.*

TEUSHANUSHSONG-GOGHTA, an Indian village on the northern bank of Alleghany river, in Pennſylvania, 5 miles north of the ſouth line of the ſtate, and 14 E. S. E. of Chatoughque Lake.—*ib.*

TEWKSBURY, called by the Indians, *Wameſit* or *Pawtukett*, a townſhip of Maſſachuſetts, Middleſex county, on Concord river, near its junction with Merrimack river, 24 miles northerly of Boſton. It was incorporated in 1734, and contains 958 inhabitants.—*ib.*

TEWKSBURY, a townſhip of New Jerſey, Hunterdon county. The townſhip of Lebanon, Readington, and Tewkſbury contain 4,370 inhabitants, including 268 ſlaves.—*ib.*

THAMES *River*, in Connecticut, is formed by the union of Shetucket and Little, or Norwich rivers, at Norwich Landing, to which place it is navigable for veſſels of conſiderable burden; and thus far the tide flows. From this place the Thames purſues a ſoutherly courſe 14 miles, paſſing by New-London on its weſt bank, and empties into Long-Iſland Sound; forming the fine harbour of New-London.—*ib.*

THATCHER's *Iſland*, lies about a mile eaſt of the ſouth-eaſt point of Cape Ann, on the coaſt of Maſſachuſetts, and forms the northern limit of Maſſachuſetts Bay; and has two light-houſes. Cape Ann light-houſe lies in lat. 43 36 north, and long. 70 47 weſt. —*ib.*

THEAKIKI, the eaſtern head water of Illinois river, riſes about 8 miles S. of Fort St Joſeph. After running through rich and level lands, about 112 miles, it receives Plein river in lat. 41 48 N. and from thence the confluent ſtream aſſumes the name of Illinois. In ſome maps it is called *Huakita.*—*ib.*

THEBES, in Egypt. Having in the *Encyclopædia* given Mr Bruce's account of this ancient city, which repreſents it as having been a paltry place, ſo contrary to the deſcription of Homer, juſtice to the father of poetry requires that we here notice what has been ſaid of it by a ſubſequent traveller, who remained three days among its ruins. According to Mr Browne, "the maſſy and magnificent forms of the ruins that remain of ancient Thebes, the capital of Egypt, the city of Jove, the city with 100 gates, muſt inſpire every intelligent ſpectator with awe and admiration. Diffuſed on both ſides of the Nile, their extent confirms the claſſical obſervations, and Homer's animated deſcription ruſhes into the memory:

'Egyptian Thebes, in whoſe palaces vaſt wealth is ſtored; from each of whoſe hundred gates iſſue two hundred warriors, with their horſes and chariots.'

"These venerable ruins, probably the moſt ancient in the world, extend for about three leagues in length along the Nile. Eaſt and weſt they reach to the mountains, a breadth of about two leagues and a half. The river is here about three hundred yards broad. The circumference of the ancient city muſt therefore have been about twenty-ſeven miles.

"In ſailing up the Nile, the firſt village you come to within the precincts is Kourna, on the weſt, where there are few houſes, the people living moſtly in the caverns. Next is Abuhadjadj, a village, and Karnac, a ſmall diſtrict, both on the eaſt. Far the largeſt portion of the city ſtood on the eaſtern ſide of the river. On the ſouth-weſt Medinet-Abu marks the extremity of the ruins; for Arment, which is about two leagues to the ſouth, cannot be conſidered as a part.

"In deſcribing the ruins, we ſhall begin with the moſt conſiderable, which are on the eaſt of the Nile. The chief is the Great Temple, an oblong ſquare building of vaſt extent, with a double colonnade, one at each extremity. The maſſy columns and walls are covered with hieroglyphics; a labour truly ſtupendous. 1. The Great Temple ſtands in the diſtrict called *Karnac.* 2. Next in importance is the temple at *Abuhadjadj.* 3. Numerous ruins, avenues marked with remains of ſphinxes, &c. On the weſt ſide of the Nile appear, 1. Two coloſſal figures, apparently of a man and woman, formed of a calcareous ſtone like the reſt of the ruins. 2. Remains of a large temple, with caverns excavated in the rock. 3. The magnificent edifice ſtyled the *palace of Memnon.* Some of the columns are about forty feet high, and about nine and a half in diameter. The columns and walls are covered with hieroglyphics. This ſtands at *Kourna.* 4. Behind the palace is the paſſage ſtyled *Bibân-el-Moluk*, leading up the mountain. At the extremity of this paſſage, in the ſides of the rock, are the celebrated caverns known as the ſepulchres of the ancient kings."

Though Mr Browne agrees with Pococke and Bruce, that the paſſage in Homer refers not to the gates of the city, he is yet of opinion, contrary to them, that Thebes had been a walled town. He ſays, indeed, that ſome faint remains of its ſurrounding wall are viſible at this day; and he thinks that he diſcovered the ruins of three of its gates, though he does not affirm this with abfolute confidence.

THEODOSIUS, a celebrated mathematician, flourifhed in the times of Cicero and Pompey; but the time and place of his death are unknown. This Theodofius, the Tripolite, as mentioned by Suidas, is probably the fame with Theodofius the philofopher of Bythinia, who, Strabo fays, excelled in the mathematical fciences, as alfo his fons; for the fame perfon might have travelled from the one of thofe places to the other, and fpent part of his life in each of them; like as Hipparchus was called by Strabo the Bythinian, but by Ptolemy and others the Rhodian.

Biog. Dict.

Theodofius chiefly cultivated that part of geometry which relates to the doctrine of the fphere, concerning which he publifhed three books. The firft of thefe contains 22 propofitions; the fecond, 23; and the third, 14; all demonftrated in the pure geometrical manner of the ancients. Ptolemy made great ufe of thefe propofitions, as well as all fucceeding writers. Thefe books were tranflated by the Arabians, out of the original Greek, into their own language. From the Arabic the work was again tranflated into Latin, and printed at Venice. But the Arabic verfion being very defective, a more complete edition was publifhed, in Greek and Latin, at Paris 1558, by John Pena, Regius Profeffor of aftronomy. And Vitello acquired reputation by tranflating Theodofius into Latin. This author's works were alfo commented on and illuftrated by Clavius, Heleganius, and Guarinus, and laftly by De Chales, in his Curfus Mathematicus. But that edition of Theodofius's Spherics, which is now moft in ufe, was tranflated and publifhed by our countryman the learned Dr Barrow, in the year 1675, illuftrated and demonftrated in a new and concife method. By this author's account, Theodofius appears, not only to be a great mafter in this more difficult part of geometry, but the firft confiderable author of antiquity who has written on that fubject.

Theodofius, too, wrote concerning the Celeftial Houfes; alfo of Days and Nights; copies of which, in Greek, were in the King's library at Paris. Of which there was a Latin edition, publifhed by Peter Dafypody, in the year 1572.

THEON, of Alexandria, a celebrated Greek philofopher and mathematician, who flourifhed in the 4th century, about the year 380, in the time of Theodofius the Great; but the time and manner of his death are unknown. His genius and difpofition for the ftudy of philofophy were very early improved by clofe application to all its branches; fo that he acquired fuch a proficiency in the fciences as to render his name venerable in hiftory, and to procure him the honour of being prefident of the famous Alexandrian fchool. One of his pupils was the admirable Hypatia, his daughter, who fucceeded him in the prefidency of the fchool; a truft which, like himfelf, fhe difcharged with the greateft honour and ufefulnefs. See her life, *Encycl.*

The ftudy of Nature led Theon to many juft conceptions concerning God, and to many ufeful reflections in the fcience of moral philofophy. Hence, it is faid, he wrote with great accuracy on Divine Providence. And he feems to have made it his ftanding rule, to judge the truth of certain principles, or fentiments, from their natural or neceffary tendency. Thus, he fays, that a full perfuafion that the Deity fees every thing we do, is the ftrongeft incentive to virtue; for he infifts, that the moft profligate have power to refrain their hands, and hold their tongues, when they think they are obferved, or overheard, by fome perfon whom they fear or refpect. With how much more reafon then, fays he, fhould the apprehenfion and belief, that God fees all things, reftrain men from fin, and conftantly excite them to their duty? He alfo reprefents this belief concerning the Deity as productive of the greateft pleafure imaginable, efpecially to the virtuous, who might depend with greater confidence on the favour and protection of Providence. For this reafon, he recommends nothing fo much as meditation on the prefence of God: and he recommended it to the civil magiftrate as a reftraint on fuch as were profane and wicked, to have the following infcription written, in large characters, at the corner of every ftreet—God sees thee, O Sinner.

Theon wrote notes and commentaries on fome of the ancient mathematicians. He compofed alfo a book, intitled *Progymnofmata*, a rhetorical work, written with great judgment and elegance; in which he criticifed on the writings of fome illuftrious orators and hiftorians; pointing out, with great propriety and judgment, their beauties and imperfections; and laying down proper rules for propriety of ftyle. He recommends concifenefs of expreffion, and perfpicuity, as the principal ornaments. This book was printed at Bafle in the year 1541; but the beft edition is that of Leyden, in 1626, in 8vo.

THEOPHILANTHROPISTS, a fect of deifts, who, in September 1796, publifhed at Paris a fort of catechifm or directory for focial worfhip, under the title of *Manuel des Theanthrophiles*. This religious breviary found favour: the congregation became numerous; and in the fecond edition of their manual they affumed the lefs harfh denomination of *Theophilanthropes*, *i. e.* lovers of God and man. A book of hymns, a liturgy for every decade of the French year, and an homiletical felection of moral leffons, are announced, or publifhed, by their unknown fynod. Thus they poffefs a fyftem of pious fervices adapted to all occafions, which fome one of the individuals who attend reads aloud; for they object to the employment of a regular lecturer, in confequence of their hoftility to priefts.—This novel fect was countenanced by Lareveillere Lepaux, one of the Directory, and, foon after its formation, opened temples of its own in Dijon, and in other provincial towns. They had declamations, in the fpirit of fermons, which abounded with fuch phrafes as *l'eternal geometre*, and the like, and which have long fince been familiar to thofe who frequent the lodges of free mafonry. Whether the fect now exifts, or fell at the laft revolution which annihilated the directory, we have not learned; but a tranflation of its *Manuel* into Englifh, for the ufe, we fuppofe, of our Jacobins, was made fo early as the year 1797. From this contemptible performance, we learn that the creed of the Theophilanthropifts is comprifed in the four following propofitions:

The Theophilanthropifts believe in the exiftence of God, and the immortality of the foul.

The fpectacle of the univerfe attefts the exiftence of the Firft Being.

The faculty which we poffefs of thinking, affures us, that

that we have, within ourfelves, a principle which is fuperior to matter, and which furvives the diffolution of the body.

The exiftence of God, and the immortality of the foul, do not need long demonftrations; they are fentimental truths, which every one may find written in his heart, if he confult it with fincerity.

Thus a fort of religious inftinct is fet up as the fole foundation of piety, which every one has as much right to difavow as another to affert; and the obligations of which, therefore, can in no way be fhewn to be incumbent on thofe to whom this novel illumination is not vouchfafed. Society, under fuch a fyftem, gains no means of influencing the conduct of refractory members.

The morality of the Theophilanthropifts is founded on one fingle precept: *Worfhip God, cherifh your kind, render yourfelves ufeful to your country!*

Among the duties comprehended under the denomination of cherifhing our kind, we find that of *not lending for ufury:* the others are chiefly extracted from the gofpels, and do not interfere with the province of the civil magiftrate. The queftion of monogamy is not difcuffed.

Among the duties to our country are placed thofe of fighting in its defence, and of paying the taxes. It was certainly prudent in the ftatefman to flide thefe duties into the catalogue of his eftablifhed maxims of morality; and he ran thereby little rifk of provoking heretical animadverfions on his creed in France.

The following infcriptions are ordered to be placed above the altars in the feveral temples or fynagogues of the Theophilanthropifts; but for what reafon altars are admitted into fuch fynagogues we are not informed:

Firft infcription, "We believe in the Exiftence of God, in the immortality of the foul."

Second infcription, "Worfhip God, cherifh your kind, render yourfelves ufeful to the country."

Third infcription, "Good is every thing which tends to the prefervation or the perfection of man.—Evil is every thing which tends to deftroy or to deteriorate him."

Fourth infcription, "Children, honour your fathers and mothers. Obey them with affection. Comfort their old age.—Fathers and mothers, inftruct your children."

Fifth infcription, "Wives, regard in your hufbands the chiefs of your houfes.—Hufbands, love your wives, and render yourfelves reciprocally happy."

This pentalogue is chiefly objectionable on account of the vague drift of the fifth commandment: the whole has too general a turn for obvious practical application. The introduction of ceremonies of fculpture, of painting, and of engraving, is forbidden. If poetry and mufic may concur to render the worfhip impreffive, why not the other fine arts? The fine arts have never illuftrated a country which excluded them from the public temples. Are they to be extinguifhed in France by Theophilanthropic iconoclafts?

At p. 28. of the Manuel, this furprifing maxim occurs: *Avoid innovations!* A fect fifteen months old grown as tefty as the church of Rome! They acknowledge, that perhaps better infcriptions may be found: yet they forbid the exchange? They prefer *mumpfimus* to the *fumpfimus* of genuine Chriftianity!

THEOPHILUS, a writer and bifhop of the primitive church, was educated a Heathen, and afterwards converted to Chriftianity. Some have imagined that he is the perfon to whom St Luke dedicates the Acts of the Apoftles; but they are grofsly miftaken; for this Theophilus was fo far from being contemporary with St Luke and the apoftles, that he was not ordained bifhop of Antioch till *anno* 170; and he governed this church twelve or thirteen years. He was a vigorous oppofer of certain heretics of his time, and compofed a great number of works; all of which are loft, except three books to Autolycus, a learned Heathen of his acquaintance, who had undertaken to vindicate his own religion againft that of the Chriftians. The firft book is properly a difcourfe between him and Autolycus, in anfwer to what this Heathen had faid againft Chriftianity. The fecond is to convince him of the falfehood of his own, and the truth of the Chriftian religion. In the third, after having proved that the writings of the Heathens are full of abfurdities and contradictions, he vindicates the doctrine and the lives of the Chriftians from thofe falfe and fcandalous imputations which were then brought againft them. Laftly, at the end of his work, he adds an hiftorical chronology from the beginning of the world to his own time, to prove that the hiftory of Mofes is at once the moft ancient and the trueft; and it appears from this little epitome, how well this author was acquainted with profane hiftory. Thefe three books are filled with a great variety of curious difquifitions concerning the opinions of the poets and philofophers, and there are but few things in them relating immediately to the doctrines of the Chriftian religion. Not that Theophilus was ignorant of thefe doctrines, but, having compofed his works for the converfion of a Pagan, he infifted rather on the external evidence or proofs from without, as better adapted, in his opinion, to the purpofe. His ftyle is elegant, and the turn of his thoughts very agreeable; and this little fpecimen is fufficient to fhew that he was indeed a very eloquent man. *Biog. Dict.*

The piece is entitled, in the Greek manufcripts, "The books of Theophilus to Autolycus, concerning the Faith of the Chriftians, againft the malicious detractors of their religion." They were publifhed, with a Latin verfion, by Conradus Gefner, at Zurich, in 1546. They were afterwards fubjoined to Juftin Martyr's works, printed at Paris in 1615 and 1636; then publifhed at Oxford, 1684, in 12mo. under the infpection of Dr Fell; and, laftly, by Jo. Chrift. Wolfius, at Hamburgh, 1723, in 8vo.

It is remarkable, that this patriarch of Antioch was the firft who applied the term *Trinity* to exprefs the Three Perfons in the Godhead.

THERAPEUTÆ, fo called from the extraordinary purity of their religious worfhip, were a Jewifh fect, who, with a kind of religious phrenzy, placed their whole felicity in the contemplation of the Divine nature. Detaching themfelves wholly from fecular affairs, they transferred their property to their relations or friends, and withdrew into folitary places, where they devoted themfelves to a holy life. The principal fociety of this kind was formed near Alexandria, where they lived, not far from each other, in feparate cottages, each of which had its own facred apartment, to which the inhabitant retired for the purpofes of devotion. After their morning prayers, they fpent the day in in ſtudying the law and the prophets, endeavouring by the help of the commentaries of their anceſtors, to diſcover ſome allegorical meaning in every part. Beſides this, they entertained themſelves with compoſing ſacred hymns in various kinds of metre. Six days of the week were, in this manner, paſſed in ſolitude. On the ſeventh day they met, clothed in a decent habit, in a public aſſembly; where, taking their places according to their age, they ſat, with the right hand between the breaſt and the chin, and the left at the ſide. Then ſome one of the elders, ſtepping forth into the middle of the aſſembly, diſcourſed, with a grave countenance and a calm tone of voice, on the doctrines of the ſect; the audience in the mean time, remaining in perfect ſilence, and occaſionally expreſſing their attention and approbation by a nod. The chapel where they met was divided into two apartments; one for the men, the other for the women. So ſtrict a regard was paid to ſilence in theſe aſſemblies, that no one was permitted to whiſper, or even to breathe aloud; but when the diſcourſe was finiſhed, if the queſtion which had been propoſed for ſolution had been treated to the ſatisfaction of the audience, they expreſſed their approbation by a murmur of applauſe. Then the ſpeaker, riſing, ſung a hymn of praiſe to God, in the laſt verſe of which the whole aſſembly joined. On great feſtivals, the meeting was cloſed with a vigil, in which ſacred muſic was performed, accompanied with ſolemn dancing; and theſe vigils were continued till morning, when the aſſembly, after a morning prayer, in which their faces were directed towards the riſing ſun, was broken up. So abſtemious were theſe aſcetics, that they commonly ate nothing before the ſetting ſun, and often faſted two or three days. They abſtained from wine, and their ordinary food was bread and herbs.

Much diſpute has ariſen among the learned concerning this ſect. Some have imagined them to have been Judaizing Gentiles, but Philo ſuppoſes them to be Jews, by ſpeaking of them as a branch of the ſect of Eſſenes, and expreſsly claſſes them among the followers of Moſes. Others have maintained, that the Therapeutæ were an Alexandrian ſect of Jewiſh converts to the Chriſtian faith, who devoted themſelves to a monaſtic life. But this is impoſſible; for Philo, who wrote before Chriſtianity appeared in Egypt, ſpeaks of this as an eſtabliſhed ſect. From comparing Philo's account of this ſect with the ſtate of philoſophy in the country where it flouriſhed, we conclude, that the Therapeutæ were a body of Jewiſh fanatics, who ſuffered themſelves to be drawn aſide from the ſimplicity of their ancient religion by the example of the Egyptians and Pythagoreans. How long this ſect continued is uncertain: But it is not improbable that, after the appearance of Chriſtianity in Egypt, it ſoon became extinct.

THERMOMETRIC SPECTRUM, is a name given to the ſpace in which a thermometer may be placed, ſo that it ſhall be affected by the ſun's rays refracted by a priſm. It is, in part, the ſame with the PRISMATIC SPECTRUM, which exhibits the different colours produced by the ſolar light.

The philoſophical inſtrument now called a *thermometer*, was firſt named THERMOSCOPE; and was prized by the naturaliſt, becauſe it gave him indications of the preſence and agency of fire in many caſes where our ſenſation of warmth or heat was unable to diſcover it. It was not long before it was obſerved that it alſo affords us meaſures of the changes which take place either in the quantity or the activity of the cauſe of heat, and of many other important phenomena uſually accompanied by heat. They were then called *thermometers*. But in both of theſe offices, it is ſtill a doubt whether it indicates and meaſures any real ſubſtance, a being *ſui generis*, to which we may give the name *fire*, *phlogiſton*, *caloric*, *heat*, or any other; or only indicates and meaſures certain ſtates or conditions, in which all bodies may be found, without the addition or abſtraction of any material ſubſtance.

We think that this queſtion has a greater chance now of being decided than in any former time, in conſequence of a recent and very important diſcovery made by that unwearied obſerver of the works of God, the celebrated Dr Herſchel. Being greatly incommoded when looking at the ſun, by the great heats produced in the eye-pieces of his teleſcopes, he thought that the laws of refraction enabled him to diminiſh them by a proper conſtruction of his eye-pieces. He began his attempts like a philoſopher, by examining the heat produced in the various parts of the priſmatic ſpectrum. Comparing the gradations of heat with that of illumination, he found that they did not, by any means, follow the ſame law. The illumination increaſed gradually from the violet end of the ſpectrum, where it was exceedingly faint, to the boundary of the green and yellow, where it was the moſt remarkable; and after this, it decreaſed as the illuminated object approached the red extremity of the ſpectrum. But the calorific power of the refracted light increaſed all the way from the extreme violet to the extreme red; and its laſt augmentations were conſiderable, and therefore unlike the uſual approaches of a quantity to its maximum ſtate. This made him think of placing the thermometer a little way beyond the extremity of the viſible ſpectrum. To his great aſtoniſhment, he found that the thermometer was more affected there than in the hotteſt part of the *illuminated* ſpectrum. Expoſing the thermometer at various diſtances beyond the extreme red, but in the plane of refraction, he found that it was moſt ſtrongly affected when placed beyond that extremity, about one-fifth of the whole length of the ſpectrum; from thence the calorific influence of the ſun gradually diminiſhed, but was ſtill very conſiderable at a diſtance from the extreme red equal to three-fifths of the length of the luminous ſpectrum. Theſe firſt ſuggeſted modes of trial appeared to Dr Herſchel to be too rude to intitle him to ſay that the warming influence did not extend ſtill farther. Indeed the inſtrument ſcarcely performed the part of a thermometer, but merely that of an indicator of heat, or a thermoſcope.

Here is a very new, and wonderful, and important, piece of information. We apprehend that all the philoſophers of Europe, as well as the unlearned of all nations, believe that the *warming* influence of the ſun, and of other luminous bodies, is conjoined with their power of *illumination*. Moſt of the philoſophers admitted the emiſſion of a matter called *light*, projected from the ſhining body, and moving with aſtoniſhing velocity, in thoſe lines which the mathematicians called *rays*, becauſe they diverged from the ſhining point, as the *radii* or ſpokes of a wheel diverge from the nave. This notion ſeems to be the ſimple ſuggeſtion of Nature; and it it alfo feems to be the opinion entertained by Sir Ifaac Newton. His demonftration of the laws of reflection and refraction proceeds on this fuppofition alone, and the particles of light are held by him to be affected by accelerating and deflecting forces, in the fame way as a ftone thrown from the hand is affected by gravity. Huyghens, indeed, Dr Hooke, and Euler, imagined that vifion and illumination were effected in the fame way that hearing, and refonance, and echo, are effected—that there is no matter projected from the fhining body; but that we are furrounded by an elaftic fluid, which is thrown into vibrations by certain tremors of the vifible object—and that thofe vibrations of this fluid affect our eye in the fame way as the undulation of elaftic air, produced by the tremors of a ftring or a bell, affect our ear. According to thefe philofophers, a ray of vifion is merely the line which paffes through all thefe undulations at right angles.

Thefe two opinions ftill divide the mathematical philofophers of Europe; but the majority, and particularly the moft eminent for mathematical and mechanical fcience, are (with the exception of Huyghens and Euler) on the fide of the vulgar. This opinion has been greatly ftrengthened of late years by the difcoveries in chemiftry. The influence of light on the growth of plants, the total want of aromatic oils in fuch as grow in the dark, and their formation and appearance in the very fame plant, along with the green colour, as foon as the plant is placed in the light (even that of open day without funfhine, or in the light of a candle,) is a ftrong indication of fome fubftance being obtained from the light, abforbed by the plant, and combined with its other ingredients. The fame conclufion is drawn from the effects of the fun's light on vegetable colours, on the nitric and nitrous acids, on manganefe, on the calces or oxyds of metals, and numberlefs other inftances, which all concur in rendering it almoft unqueftionable that the fun's rays, and thofe of other fhining bodies, may be, and daily are, combined with the other fubftances of which bodies are compofed, and may be again feparated from them. And, fhould any doubts remain, it would feem that the theory of combuftion, firft conceived and imperfectly publifhed by Dr Hooke in his *Micrography*, p. 103. and in his *Lampas*, p. 1. &c. adopted by Mayow (fee Hooke and Mayow in this *Suppl.*), forgotten, and lately revived and confirmed by Mr Lavoifier, remove them entirely. In the beautiful and well-contrived experiments of the laft gentleman, the light, accompanied by its heat, which had been abforbed in the procefs of growth or other natural operations, re-appeared in their primitive form, and might again be abforbed and made to undergo the fame round of changes.

Scheele, not inferior to Newton in caution, patience, and accuracy, and attentive to every thing that occurred in his experiments, difcovered the feparability of the illuminating and the warming influences of fhining bodies. He remarked, that a plate of glafs, the moft colourlefs and pellucid that can be procured, when fuddenly interpofed between a glowing fire and the face, inftantly cuts off the warming power of the fire, without caufing any fenfible diminution of its brilliancy. He followed this difcovery into many obvious confequences, and found them all fully confirmed by obfervation and experiment. The writer of this article, immediately on hearing of Scheele's experiments, repeated them with complete fuccefs: but he found, that when the glafs plate had acquired the higheft temperature which it could acquire in that fituation, it did not any longer intercept the heat, or at leaft in a very fmall and almoft infenfible degree. It feemed to abforb the heat, till faturated, without abforbing any confiderable portion of the light.

This feparability of heat from light does not feem to have met with the attention it deferved. Dr Scheele's untenable theories on thefe fubjects turned away the attention of the chemifts from this difcovery, and the mathematical philofophers feem not to have heard of it at all. The late Dr Hutton of Edinburgh was more fenfible of its importance; and in his laft endeavours to fupport the falling caufe of phlogifton, makes frequent allufions to it. But in his attempts to explain the curious obfervations of Meffrs Sauffure and Pictet, in which there are unqueftionable appearances of radiated heat, he reafons fo unconfequentially, that few readers proceed farther, fo as to notice feveral obfervations of facts where the illuminating and warming influences are plainly feparated. In all thefe inftances, however, Dr Hutton confiders the invifible rays as light, but not as heat; maintaining that they are invifible, or do not render bodies vifible, only becaufe our eyes are infenfible to their feeble action.

It was referved for Dr Herfchel to put this matter beyond difpute by thefe valuable experiments. For did the invifibility of any of the light beyond the extreme red of the prifmatic fpectrum arife from the infenfibility of our organs, the fpectrum would gradually fade away beyond the red; but it ceafes abruptly. Thefe thoughts could not efcape this attentive obferver. He therefore examined more particularly thofe invifible rays, caufing them to be reflected by mirrors, and refracted through lenfes; and, in fhort, he fubjected them to all the fubfequent treatments which Newton applied to the colouring rays. He found them retain their fpecific refrangibilities and reflexibilities with as much uniformity and obftinacy as Newton had obferved in the colour-making rays. They were made to pafs through lenfes while the illuminating rays were intercepted by an opaque body, and the invifible rays were then collected into a focus. They were reflected, both by the anterior and pofterior furfaces of tranfparent bodies. In all thefe trials they retained their power of expanding the liquor of a thermometer, and exciting the fenfation of heat.

Thefe trials were not confined to the folar light or the folar rays: They were alfo made on the emanations from a candle, from an open fire, and from red hot iron; then they were made with bodies not hot enough to fhine; with the heat of a common ftove, and the heat from iron which was not vifible in the dark. The event was the fame in all; and it was clearly proved that heat, or the caufe of heat, is as fufceptible of radiation as light is; and that this radiation is performed in both according to the fame laws.

We look with impatience for the fubfequent experiments of this celebrated philofopher on this fubject; for we confider them as of the greateft and moft extenfive importance for explaining the operations of Nature. We fee, with indifputable evidence, that there are rays from the fun, and other bodies, which do not illuminate. It does not follow, however, that there are

rays

rays which do not warm; for the thermometer was affected in every part of the coloured fpectrum. Dr Herfchel feems to think that the power of affecting the organ of fight depends on the particular degrees of mechanical momentum which are indicated by the different degrees of refrangibility. We confefs that we think it unlikely that fuch a power fhould terminate abruptly. We do not obferve this in analogous phenomena: the evanefcence of our fenfations of found, of mufical pitch, of heat, &c. are all gradual. We think it more likely that illuminating and warming are fpecific effects of different things. We fhould have entertained this opinion independent of all other experience; and we think it ftrongly confirmed by the experiments of Dr Scheele already mentioned. We are difpofed therefore to believe that there are rays which illuminate, but which do not warm; and rays which warm without illuminating. We have experiments in profpect, by which we hope to put this to the teft.

Thefe experiments of Dr Herfchel afford another good argument for the common opinion concerning light, namely, that *it is a matter emitted from the fhining body*, and not merely the undulations of an elaftic medium; for if it were undulation, then, fince there is heat in the yellow light, it would follow that a certain frequency of undulation produces, both the fenfation of heat and the fenfation of a yellow colour. In this cafe they fhould be infeparable.

This follows, in the ftricteft manner, from the principles or affumptions adopted by Euler in his mechanical theory of undulations. The chromatic differences in the rays of light are affirmed to arife entirely from the different frequencies of the aethereal undulations; and he endeavours to fhew that thefe differences in frequency produces a difference in refrangibility. It is evident that this reafoning is equally conclufive with refpect to the calorific or heating power of the rays. The light and the heat are both undulations: thefe differ only in frequency; and this frequency is indicated (according to Euler) by the refrangibility. There is a certain frequency therefore which excites the fenfation of yellow. The fame frequency, indicated by the fame refrangibility, produces heat; therefore the frequency which produces this degree of heat alfo produces the fenfation of yellow. We muft not fay that the momentum of the undulation may produce heat, but is infufficient for the production of light, as a ftring may vibrate too feebly for being heard; for we fee, by Dr Herfchel's experiments, that, with a momentum fufficient for making the moft brilliant fpectrum, there are rays (and thofe which have the greateft momentum) which produce heat, and yet are invifible.

It does not follow, from any of Dr Herfchel's experiments, that the rays emitted by iron, which is not hot enough to fhine in a dark room, have *all* the different degrees of refrangibility obferved by him. Perhaps none of them would fall on the chromatic fpectrum. We think, however, that this is not probable. It may be tried by collecting them to a focus by a lenfe, intercepting, however, all thofe which are lefs refrangible than the red-making rays. We truft that the thermometer in the focus will ftill be affected.

This is but a very imperfect account of this important difcovery; but we thought that it would be highly interefting to our readers. The prefs was employed on this very fheet when we received the information from a friend, who had feen Dr Herfchel's Differtation, which will appear in the firft volume publifhed by the Royal Society. We truft that the ingenious author will foon follow it up with the inveftigation of the fubject in all its confequences.

We hope that he will examine what will refult from mixing fome of the invifible rays with fome of the coloured ones. We know that the yellow and the blue, when mixed, produce the fenfation of green. Perhaps the invifible rays may alfo change the appearance. We do not, however, expect this.

We alfo hope that Dr Herfchel will examine whether the invifible rays of the fun produce any effect on vegetable colours; whether they blacken the calces of filver and bifmuth, luna cornea, and decompofe the nitrous and the oxygenated muriatic acid, &c. &c. We fhould thus get more infight into the nature of caloric and of combuftion. Combuftion may perhaps be reftored to its rank in the phenomena of Nature, and no longer be funk in the general gulph of oxygenation, and thus obliterated from the memory of chemifts. It is perhaps the moft remarkable phenomenon of material Nature; and *fire* and burning will never go out of the language of plain men. Fire, and all its concomitants, have, in all times, been confidered as even the *chief* objects of chemical attention; and an unlearned perfon will ftare, when a chemift tells him that there is no fuch thing, and that what he calls the burning of a piece of coal is only the making it four. He will perhaps fmile; but it will not be a fmile of affent.

It was one darling object of the Revolutionary Committee of Chemifts, affembled at Paris in 1787, to banifh from our minds, *by means of a new language*, all remembrance of any thing which we did not derive from the philofophers of France. We think ourfelves in a condition to prove this by letters to this country from the fcene of action; in which the expected victory is fpoken of in terms of exultation, and with fo little reftraint, that the writer forgets that it is Dr Black whom he is informing that *l'air fixe* and *la pauvre phlogiftique* will foon be forgotten; and yet the writer was a gentleman of uncommon modefty and worth, and fincerely attached to Dr Black. We give this as a remarkable inftance of the *efprit de corps*, and of the nature and towering ambition of that nation. From this they have not fwerved; and they hope to gain this fummit of fcientific dominion in the fame way as *the fame philofophers* hope to banifh Chriftianity by means of their new kalendar. It may, however, turn out that both Dr Hooke and Mr Lavoifier are miftaken, when they make the oxygen gas the fole fource of both the light and the heat which accompany combuftion. One of them may perhaps be furnifhed by the body which all, except the new philofophers, call combuftible.

The objections which may be made to the theory of Huyghens and Euler, on the acknowledged principles of mechanics, appear to us unanfwerable. Euler has never attempted to anfwer thofe taken from the different difperfing powers of different fubftances. The objections made to the Newtonian, or vulgar theory of emiffion, are not fuch as imply abfurdity; they are only difficulties. The chief of them, *viz.* the famenefs of velocity in all lights whatever, is of this kind. It is merely an improbability. But the objections to the theory

theory of undulation, deduced from the chemical effects of light, are not lefs ftrong than thofe deduced from mechanical principles. It is quite inconceivable that the undulation of a medium, which pervades all bodies, fhall produce aromatic oils in fome, a green fæcula in others, fhall change fulphuric acid into fulphur, &c. &c. No effects are produced by the undulations of air, or the tremors of elaftic bodies, which have the moft diftant analogy or refemblance to thefe.

That the fun and other fhining bodies emit the matter of light and heat, feems therefore to merit the general reception which it meets with from the philofophers. But even of this clafs there are differences in opinion. Some imagine that light only is emitted, and that the heat which we feel is occafioned by the action of the luminous rays on our atmofphere, or on the ground. Were the fun's calorific rays as denfe at the furface of the fun as his luminous rays are, the heat there muft exceed (fay they) all that we can form any conception of. Yet we fee, that when the nucleus of the fun is laid bare by fome natural operation, which, like a volcanic explofion, throws afide the luminous ocean which covers it to a prodigious depth, the naked parts of this nucleus are black. Therefore the intenfe heat in that place is not able to make it fhining hot, as it does in all our experiments with intenfe heats, giving a dazzling glare. This is thought highly improbable; and it is therefore fuppofed that there is, primitively, no heat in the fun's rays, but that they act on our air, or other terreftrial matter, combining with it, and difengaging heat from it, or producing that particular ftate and condition which we call *heat*.

We think that Dr Herfchel's difcovery militates ftrongly and irrefiftibly againft this opinion; and fhews, that whatever reafon we have for faying that the fun's rays bring light from the fun we have the fame authority for faying, that they bring heat, fire, caloric, phlogifton, or by whatever other name we choofe to diftinguifh the caufe of warmth, expanfion, liquefaction, ebullition, &c.

We muft either fay that light and heat are not fubftances of a peculiar kind, fufceptible of union with the other ingredients of bodies, but merely a ftate of undulation of an elaftic medium, as found is the undulation of air; or we muft fay that the fun's rays contain light and heat, in a detached ftate, fit for appearing in their fimpleft form, producing illumination and expanfion, and for uniting chemically with other matter. Whichever of thefe opinions we adopt, it is pretty clear that all attempts to difcover a difference in the weight of hot and cold bodies may be given over. In the firft cafe, it is felf-evident; in the fecond, we have abundant evidence, that if light and heat, being gravitating matter like all other bodies, were added to, or abftracted from bodies, in fufficient quantity to be fenfibly heavy, the rays of the fun, or even the light of a candle, would occafion inftant deftruction by its mere momentum; fince every particle of radiated light and heat moves at the rate of 200,000 miles in a fecond.

This difcovery of Dr Herfchel's adds greatly to the probability of the opinion which we expreffed on another occafion, that the forces of powers of natural fubftances, which are the immediate caufes of the chemical phenomena, are no way different from the mechanical forces which render bodies heavy, coherent, elaftic, expanfive, &c.; in fhort, that they are what we call *accelerating forces*. We deduced this from the fact, that mechanical force can be oppofed to them, fo as to prevent their action in circumftances where it would otherwife certainly take place. Thus, by external preffure, we can prevent that union of water and caloric which would convert it into elaftic fteam. We can even difunite them again, when fteam is already produced, by forcibly condenfing it into a fmaller fpace. Now, the refraction and reflection of heat are performed according to the fame precife laws which we obferve in the refraction and reflection of light; and Sir Ifaac Newton has demonftrated that thofe phenomena arife from the action of accelerating forces, whofe direction is perpendicular to the acting furfaces. The matter of heat, therefore, is like other matter in its mechanical properties; and, in the motion of refraction, it is acted on and deflected, juft as a projectile is acted on and deflected by gravity. It continues in motion till its velocity and direction are changed by deflecting forces, exerted by the particles of the tranfparent medium or the reflecting furface. It would take up too much room, but it is a very eafy procefs, to demonftrate that this regular refraction of heat is altogether incompatible with the ufually fuppofed notion of caloric; namely, that it is an expanfive fluid like air, but incomparably more elaftic; from which property very plaufible explanations have been given of the elafticity of gafes, fteams, and fuch like fluids. Every intelligent mechanician will be fenfible that all this fort of chemical fcience falls to the ground, when it is proved, by exhibition of the fact, that radiated heat is refracted in the fame way with radiated light. We muft look for the explanation of the immenfe explofive force of fulminating filver, gold, &c. in fome very different principles from thofe which are now in vogue. We apprehend, too, that the very phenomenon of this refraction gives indication of forces which are fufficiently powerful for this explanation: For when we reflect on the aftonifhing velocity of the ray of heat; on the minute fpace along which it is deflected, and confequently the time of this action, minute beyond all imagination; and when we compare thofe circumftances with a deflection produced by gravity in the motion of a projectile—it is evident that the deflecting force of refraction muft exceed the greateft force that we have any knowledge of, in a greater proportion than the weight of Mount Ætna exceeds that of a particle of fand. We would defire Mr de la Place to fufpend his hopes of eftablifhing univerfal fatalifm, till he can reconcile thefe phenomena with his fundamental principle, "*that all forces which are diffufed from a fingle point, neceffarily and effentially diminifh in the inverfe duplicate ratio of the diftances*." Till he can do this, he had better ftill allow, with Newton, that the felection of the duplicate ratio for the action of gravity (by which alone the folar fyftem can be rendered permanent and orderly) is a mark of wifdom and benevolence. We would advife him to reconcile his mind to this; and perhaps, like the modeft and admiring Newton, he may, in good time, find comfort in the thought.

It is alfo highly worthy of remark, that this refracting force, almoft immenfe, which is fo plainly exerted between the particles of bodies and light, when confidered as of the fame kind with thofe that produce chemical union, appears abundantly fufficient for explaining fome

Thevenot. some of the most wonderful phenomena of chemistry; such as the prodigious elasticity of steam, of gunpowder, and the still more astonishing explosion of fulminating gold and silver. Some of the phenomena of deflected light are produced by these optical forces acting at distances sufficiently great to admit of measurement; as in the Newtonian observations on the passage of light near the edges of opaque bodies. These deflections enable us to compare the deflecting forces with gravity. The *refracting* force, however, is vastly greater than even this, as may be seen by the greater deflection which is produced by it; and, being exerted along a space incomparably smaller, it must be greater still. Here, then, are forces fully adeqnate to the phenomena of fulmination. And we would again desire Mr de la Place to remark that, although these exploding forces are irresistible, their action seems to vanish entirely beyond the limits of mathematical contact. This is plain from the fact, that those explosions do not project the fragments to great distances. This is remarkably the case in all the most eminent of them. Common or nitric gunpowder is perhaps the only great exception. This particular circumstance will surely suggest to this eminent analyst the *inverse triplicate* ratio of the distance as more likely to explain the phenomena than his favourite law.

We trust that our readers will not be displeased with this short sketch of Dr Herschel's discovery, and the few reflections which it naturally suggested to our minds. We shall not be greatly surprised, although it should produce a sort of counter-revolution in chemical science, in consequence of new conceptions which it may give us of the union of bodies with light and heat. The phenomena of the vegetable and animal economy shew that they are susceptible of combination with other substances besides the basis of vital air. Whatever changes this may produce in the great revolution which has already taken place in chemical science, they will (in our opinion) be favourable to true philosophy; because Dr Herschel's discovery co-operates with other arguments of sound mathematical reasoning, to overturn that principle on which De la Place hopes to found his atheistical doctrine of fate and necessity. It contributes therefore to restore to the face of Nature that smiling feature of providential WISDOM which Newton had the honour of exhibiting to the view of rational men. The sun is the source of light and genial warmth to a vast system, which is held together, in almost eternal order and beauty, by a law of attraction selected by Infinite Wisdom, as the only one adequate to this magnificent purpose.

THEVENOT (Melchisedec), librarian to the king of France, and a celebrated writer of travels, was born at Paris in 1621, and had scarcely gone through his academical studies, when he discovered a strong passion for visiting foreign countries. At first he saw only part of Europe; but then he took great care to procure very particular informations and memoirs from those who had travelled over other parts of the globe, and out of those composed his "Voyages and Travels."—He laid down among other things, some rules, together with the invention of an instrument, for the better finding out of the longitude, and the declination of the needle; and some have thought that these are the best things in his works, since travels, related at second hand, can never be thought of any great authority or moment; not but Thevenot travelled enough to relate some things upon his own knowledge. Another passion in him, equally strong with that for travelling, was to collect scarce books in all sciences, especially in philosophy, mathematics, and history; and in this he may be said to have spent his whole life. When he had the care of the King's library, though it was one of the best furnished in Europe, he found 2000 volumes wanting in it which he had in his own. Besides printed books, he bought a great many manuscripts in French, English, Spanish, Italian, Latin, Greek, Hebrew, Syriac, Arabic, Turkish, and Persic. The marbles presented to him by Mr Nointel, at his return from his embassy to Constantinople, upon which there are bass-reliefs and inscriptions almost 2000 years old, may be reckoned among the curiosities of his library. He spent most of his time among his books, without aiming at any post of figure or profit: he had, however, two honourable employments; for he assisted at a conclave held after the death of Pope Innocent X. and was the French king's envoy at Genoa. He was attacked with what is called a slow fever in 1692, and died October the same year, at the age of 71. According to the account given, he managed himself very improperly in this illness; for he diminished his strength by abstinence, while he should have increased it with hearty food and generous wines, which were yet the more necessary on account of his great age.—Thevenot's Travels into the Levant, &c. were published in English in the year 1687, folio; they had been published in French at Paris 1663, folio. He wrote also "L'Art de Nager," the Art of Swimming, 12mo, 1696.

Thomas. THOMAS (Christian) was born at Leipsic 1655, and was well educated, first under his father, and afterwards in the Leipsic university. At first he acquiesced in the established doctrines of the schools; but upon reading Puffendorf's "Apology for rejecting the Scholastic Principles of Morals and Law," light suddenly burst upon his mind, and he determined to renounce all implicit deference to ancient dogmas. He read lectures upon the subject of Natural Law, first from the text of Grotius, and afterwards from that of Puffendorf, freely exercising his own judgment, and, where he saw reason, advancing new opinions. Whilst his father was living, paternal prudence and moderation restrained the natural vehemence and acrimony of the young man's temper, which was too apt to break out, even in his public lectures. But when he was left to himself, the boldness with which he advanced unpopular tenets, and the severity with which he dealt out his satirical censures, soon brought upon him the violent resentment of theologians and professors.

An "Introduction to Puffendorf," which Thomas published in the year 1687, wherein he deduced the obligation of morality from natural principles, occasioned great offence. The following year he became still more unpopular, by opening a monthly literary journal, which he intitled "Free Thoughts, or Monthly Dialogues on various Books, chiefly new;" in which he attacked many of his contemporaries with great severity. The raillery of this satirical work was too provoking to be endured: complaints were lodged before the ecclesiastical court of Dresden; the bookseller was called upon to give up the author; and it was only through the in-

terest

Thomas. tereſt of the Mareſchal that Thomas eſcaped puniſhment. The title of the work was now changed; but its ſpirit remained. A humours and ſatirical life of Ariſtotle, and ſeveral other ſarcaſtic papers, kept alive the flame of reſentment, till at length it again burſt forth, on a charge brought againſt him before the ſame court by the clergy of Leipſic, for contempt of religion; but he defended himſelf with ſuch ability, that none of his adverſaries choſe to reply, and the matter was dropped.

A ſatirical review, which he wrote, of a treatiſe "On the Divine Right of Kings," publiſhed by a Daniſh divine; "A Defence of the Sect of the Pictiſts," and other eccentric and ſatirical publications, at laſt inflamed the reſentment of the clergy againſt Thomas to ſuch a degree, that he was threatened with impriſonment. To eſcape the ſtorm which thickened about him, he entreated permiſſion from the Elector of Brandenburg, in whoſe court he had ſeveral friends, that he might read private lectures in the city of Hall. This indulgence being obtained. Thomas became a voluntary exile from Leipſic. After a ſhort interval, he was appointed public profeſſor of juriſprudence, firſt in Berlin, and afterwards at Hall. In theſe ſituations, he found himſelf at full liberty to indulge his ſatirical humour, and to engage in the controverſies of the times: and as long as he lived, he continued to make uſe of this liberty in a manner which ſubjected him to much odium. At the ſame time, he perſevered in his endeavours to correct and ſubdue the prejudices of mankind, and to improve the ſtate of philoſophy. He died at Hall in the year 1728.

Beſides the ſatirical journal already mentioned, Thomas wrote ſeveral treatiſes on logic, morals, and juriſprudence; in which he advanced many dogmas contrary to received opinions. In his writings on phyſics, he leaves the ground of experiment and rational inveſtigation, and appears among the myſtics. His later pieces are in many particulars inconſiſtent with the former.—His principal philoſophical works are, "An Introduction to Aulic Philoſophy, or Outlines of the Art of Thinking and Reaſoning;" "Introduction to Rational Philoſophy;" "A Logical Praxis;" "Introduction to Moral Philoſophy;" "A Cure for Irregular Paſſions, and the Doctrine of Self-Knowledge;" "The new Art of diſcovering the ſecret Thoughts of Men;" "Divine Juriſprudence;" "Foundations of the Law of Nature and Nations;" "Diſſertation on the Crime of Magic;" "Eſſay on the Nature and Eſſence of Spirit, or Principles of Natural and Moral Science;" "Hiſtory of Wiſdom and Folly."

From the ſpecimen given by Dr Enfield of his more peculiar tenets (for we have read none of his books), Thomas appears to have been a man of wonderful inconſiſtency in his opinions; teaching on one ſubject rational piety and true ſcience, and on another abſurdity and atheiſm. "No other rule (he ſays) is neceſſary in reaſoning, than that of following the natural order of inveſtigation; beginning with thoſe things which are beſt known, and proceeding, by eaſy ſteps, to thoſe which are more difficult." This is perfectly conſiſtent with the foundation of the Baconian logic; and is indeed the only foundation upon which a ſyſtem of ſcience can poſſibly be built. Yet could the man, who profeſſes to proceed from a principle ſo well eſtabliſhed, gravely advance, as concluſions of ſcience, the following abſurdities: "Perception is a paſſive affection, produced by ſome external object, either in the intellectual ſenſe, or the inclination of the will. God is not perceived by the intellectual ſenſe, but by the inclination of the will: for creatures affect the brain; but God, the heart. All creatures are in God: nothing is exterior to him. Creation is extenſion produced from nothing by the divine power. Creatures are of two kinds, paſſive and active; the former is matter, the latter ſpirit. Matter is dark and cold, and capable of being acted upon by ſpirit, which is light, warm, and active. Spirit may ſubſiſt without matter, but deſires a union with it. All bodies conſiſt of matter and ſpirit, and have therefore ſome kind of life. Spirit attracts ſpirit, and thus ſenſibly operates upon matter united to ſpirit. This attraction in man is called *love;* in other bodies *ſympathy.* A finite ſpirit may be conſidered as a limited ſphere, in which rays, luminous, warm, and active flow from a centre. Spirit is the region of the body to which it is united. The region of finite ſpirits is God. The human ſoul is a ray from the divine nature; whence it deſires union with God, who is love. Since the eſſence of ſpirit conſiſts in action, and of body in paſſion, ſpirit may exiſt without thought; of this kind are light, ether, and other active principles in nature." Fortunately, this jargon is as unintelligible as the categories of Kant, and the blaſphemies of Spinoza; for an account of which the reader is referred to *Critical* PHILOSOPHY in this *Suppl.* and to SPINOZA in the *Encycl.*

Thomas, || Thornton.

Biographical Dictionary. THORNTON (Bonnel), a modern poet, the intimate friend of Lloyd and Colman, and juſtly claſſed with them in point of talents, was born in Maiden-lane, London, in the year 1724. He was the ſon of an apothecary; and being educated at Weſtminſter ſchool, was elected to Chriſt-Church, Oxford, in the year 1743. He was thus eight years ſenior to Colman, who was elected off in 1751. The firſt publication in which he was concerned was, "The Student, or Oxford and Cambridge Miſcellany," which appeared in monthly numbers; and was collected in two volumes 8vo, in 1748. Smart was the chief conductor of the work; but Thornton, and other wits of both univerſities, aſſiſted in it. He took his degree of maſter of arts in 1750; and as his father wiſhed him to make phyſic his profeſſion, he took the degree of bachelor of that faculty in 1754. In the ſame year he undertook the periodical paper called *The Connoiſſeur*, in conjunction with Colman, which they continued weekly to the 30th of September 1756. In the concluding paper, the different ages and purſuits of the two authors are thus jocularly pointed out, in the deſcription of the double author, Mr Town. "Mr Town is a fair, black, middle ſized, very ſhort man. He wears his own hair and a periwig. He is about thirty years of age (literally thirty-two), and not more than four-and-twenty. He is a ſtudent of the law and a bachelor of phyſic. He was bred at the univerſity of Oxford, where, having taken no leſs than three degrees, he looks down on many learned profeſſors as his inferiors; yet having been there but little longer than to take the firſt degree of bachelor of arts, it has more than once happened that the cenſor-general of all England has been reprimanded by the cenſor of his college, for neglecting to furniſh the uſual eſſay, or, in the collegiate phraſe, the theme of of the week." Engaged in purfuits of this kind, Bonnel Thornton did not very clofely follow the profeffion to which his father deftined him, but lived rather a literary life, employing his pen on various fubjects. To the daily paper called the *Public Advertifer*, then in high reputation, he was a frequent contributor; and he once had it in contemplation to treat with Mr Ritch for the patent of Covent Garden theatre. In 1764, Mr Thornton married Mifs Sylvia Brathwaite, youngeft daughter of Colonel Brathwaite, who had been governor of a fort in Africa. In 1766, encouraged, as he fays himfelf, by the fuccefs of his friend Colman's Terence, he publifhed two volumes of a tranflation of Plautus in blank verfe; propofing to complete the whole if that fpecimen fhould be approved. Thefe volumes contained feven plays, of which the *Captive* was tranflated by Mr Warner, who afterwards completed all that Thornton had left unfinifhed; and the *Mercator* by Mr Colman. The remaining five are, the *Amphitryon*, *Miles Gloriofus*, *Trinummus*, *Aulularia*, *Rudens*. Some parts of the remaining plays which Thornton had tranflated are preferved by his continuator. There can be no doubt that this is the beft way of tranflating the old comedies, and that Thornton was well qualified for the tafk; but the work has never been in high favour with the public. Yet Warburton faid of it, that "he never read fo juft a tranflation, in fo pure and elegant a ftyle." Thornton publifhed in 1767, *The Battle of the Wigs*, as an additional canto to Garth's Difpenfary; the fubject of which was the difputes then fubfifting between the fellows and licentiates.

The life of Thornton was not deftined to attain any great extenfion: in the prime of his days, while he was furrounded by domeftic felicity, the comforts of fortune, and the refpect of fociety, ill health came upon him; and medical aid proving inefficient, he died, of the gout in his ftomach, May 9, 1768, at only 44 years of age. His wife, a daughter, and two fons, furvived him. Befides the productions already mentioned, he wrote the papers in the Adventurer marked A; "An Ode to St Cecilia's day, adapted to the ancient Britifh Mufic," a burlefque performance; "The Oxford Barber;" with many detached effays in the public papers. A few letters addreffed to his Sylvia before they were married, difplay great tendernefs, expreffed with franknefs and eafe. A fmall edition of his works might, with much propriety, be prefented to the public, before it fhall be too late to afcertain them all. His character may be taken from his epitaph, written in Latin by his friend Dr Warton, and placed on his monument in Weftminfter Abbey. It is to this effect: "His genius, cultivated moft happily by every kind of polite literature, was accompanied and recommended by manners open, fincere, and candid. In his writings and converfation he had a wonderful livelinefs, with a vein of pleafantry peculiarly his own. In ridiculing the failings of men, without bitternefs, and with much humour, he was fingularly happy; as a companion, he was delightful."

THETFORD, a townfhip in the fouth-eaft corner of Orange county, Vermont, on the weftern bank of Connecticut river, about 10 miles north of Dartmouth College, and contains 862 inhabitants.—*Morse.*

THOMAS's *Bay*, on the W. coaft of the ifland of Antigua. It affords fome fhelter from the S. and S. E. winds.—*ib.*

Thomas *Ifland, St*, or the *Danes Ifland*, is the largeft and moft northerly of the Virgin Iflands, in the Weft-Indies, and is about 9 miles long and 3 broad. It has a fandy foil and is badly watered, but enjoys a confiderable trade, efpecially in time of peace, in the contraband way; and privateers in time of war fell their prizes here. A large battery has been erected for its defence, mounted with twenty pieces of cannon, N. lat. 18 22, W. long. 64 51. It has a fafe and commodious harbour, and lies about 30 miles eaft of the ifland of Porto Rico.—*ib.*

Thomas *Ifland, St*, on the weft coaft of New-Mexico. N. lat. 20 10, weft long. 113 5.—*ib.*

Thomas, *St*, a town of Guiana in S. America, fituated on the banks of the Oroonoko. N. lat. 75, weft long. 62 36.—*ib.*

Thomas, *Port St*, a harbour in the bay of Honduras, on the Spanifh Main; from which goods are fhipped to Europe.—*ib.*

Thomas, *St*, the chief town of New-Andalufia, or Paria, in the northern divifion of Terra Firma.—*ib.*

Thomas, *St*, a parifh of Charlefton diftrict, in S. Carolina. It contains 3,836 inhabitants; of whom 397 are whites, and 3,405 flaves.—*ib.*

THOMASTOWN, a poft-town of the Diftrict of Maine, Lincoln county, on the weft fide of Penobfcot Bay, and about 4 leagues from Franklin Ifland, at the mouth of the river St George, which divides this town from Warren and Cufhing, to the weftward. A confiderable river in the fouth-eaft part of the townfhip is called Weffoweffgeeg. From the hill of Madambettocks may be feen iflands and lands to a great diftance; and near it there is thought to be plenty of iron ore; but no attempts have been made to afcertain its quality. The grand ftaples of Thomaftown are lime and lumber. Lime-ftone is very common, and fpots of land, or rather rock, of fix rods fquare, are frequently fold for 100 dollars. There are now about 35 kilns erected, each of which, on an average, will produce 200 fifty gallon cafks. Thefe kilns, if burned only three times a year, (though many are 5 or 6 times) will furnifh about 21,000 cafks; which neat, after all expenfes, about fix fhillings a cafk. Too much attention being paid to this bufinefs, prevents a due cultivation of the lands. There are now owned on the river 12 brigs, fchooners, and floops, equal to about 1,100 tons, employed in foreign and coafting voyages. On the river, and its feveral ftreams, are a number of tide and other grift and faw mills, which afford great profit to their owners. A fort with a number of cannon, and a regular garrifon of provincials, was formerly ftationed about five miles below the head of the tide. Few veftiges of the fort now remain; but in place of it an elegant building was erected in 1794, by the Hon. Henry Knox, Efq. The fettlement of Thomaftown began about 1720, in 1777 it was incorporated, in 1790 it contained 801 inhabitants; and it was computed to contain in 1796 above 1,200. There are here no public fchools conftantly kept, though there are feveral private ones throughout the year. There are two churches, the one for Baptifts, who are the moft numerous, and the other for Congregationalifts. Here is alfo a focial library. The compact

Thome, || Thunder.

pact part of the town is 7 miles foutherly of Camden, 7 eaft of Warren, 39 N. E. by E. of Wifcaffet, 215 N. E. of Bofton, and 564 N. E. of Philadelphia.—*ib.*

THOME, *St*, or *St Thomas*, a plain in the centre of the ifland of St Domingo, in the Weft Indies, on the fouth fide of the firft chain of the mountains of Cibao, near which Artibonite river takes its rife. It is contiguous to the north of that of St John of Maguana. The fort of St Thomas was erected here, near the head of the Artibonite, by Chriftopher Columbus to protect the mines againft the Indians. There is now no veftige of the fort remaining.—*ib.*

THOMPSON, a townfhip of Windham county, in the north eaft corner of Connecticut; having the town of Killingly on the fouth, the ftate of Rhode-Ifland eaft, and that of Maffachufetts on the north; from which laft it receives Quinabaug and Five-mile rivers. —*ib.*

THOPICANOS, a fmall river of the N. W. Territory, which runs fouthward to Wabafh river, into which it enters a few miles eaftward of Ouixtanon. —*ib.*

THORNTON, a townfhip of New-Hampfhire, in Grafton county, at the head of Merrimack river, which contains 385 inhabitants. It was incorporated in 1781. —*ib.*

THOULOUSE, *Port*, on the fouth coaft of the ifland of Cape Breton, near the entrance of the Strait of Fronfac or Canfo, lies between the gulf called Little St Peter and the iflands of St Peter. It was formerly called Port St Peter, and is 60 miles weft of Gabaron Bay. —*ib.*

THOUSAND *Ifles* are fituated in St Lawrence, or Iroquois river, a little north of Lake Ontario.—*ib.*

Thousand *Lakes*, a name given to a great number of fmall lakes near the Miffiffippi, a little to the N. E. of St Francis river, which is about 60 miles above St Anthony's Falls. The country about thefe lakes, though but little frequented, is the beft within many miles for hunting; as the hunter feldom fails returning loaded beyond his expectation. Here the river Miffiffippi is not above 90 yards wide.—*ib.*

THREE *Brothers*, 3 iflands within the river Effequibo on the eaft coaft of S. America.—*ib.*

Three *Iflands Bay*, or *Harbour*, on the eaft coaft of the Ifland of St Lucia, in the Weft-Indies.—*ib.*

Three *Points*, *Cape*, on the coaft of Guiana, in S. America. N. lat. 10 38, W. long. 61 57.—*ib.*

Three *Sifters*, three fmall ifles on the weft fhore of Chefapeak Bay, which lie between Weft river and Parker's Ifland.—*ib.*

THRUM *Cap*, in the S. Pacific Ocean, a fmall circular ifle, not more than a mile in circumference, feven leagues N. 62° W. from Lagoon Ifland. High water, at full and change, between 11 and 12 o'clock. S. lat. 18 35, W. long. 139 48.—*ib.*

THULE, *Southern*, an ifland in the S. Atlantic Ocean, the moft foutherly land ever difcovered; hence the name. S. lat. 59 34, W. long. 27 45.—*ib.*

THUNDER. There is not one of the appearances of nature which has fo much engaged the attention of mankind as thunder. The favage, the citizen, and the philofopher, have obferved it with dread, with anxiety, and with curiofity; and the philofopher of our times treats the others with a fmile of condefcenfion, while he here enjoys the fulleft triumph of his fuperiority:

Thunder.

Felix qui potuit rerum cognofcere caufas,
Atque metus omnes et inevitabile fulmen
Subjecit pedibus.

But though this grand phenomenon has long engaged the curious attention of philofophers, it is but very lately that they have been able to explain it; that is, to point out the more general law of nature of which it is a particular inftance. Inflammable vapours had long furnifhed them with a fort of explanation. The difcovery of gunpowder, and ftill more that of inflammable air, gave fome probability to the exiftence of extenfive ftrata of inflammable vapours in the upper regions of the atmofphere, which, being fet on fire at one end, might burn away in rapid fucceffion, like a train of gunpowder. But the fmalleft inveftigation would fhew fuch a diffimilarity in the phenomena, and in the general effects, that this explanation can have no value in the eyes of a true naturalift. Horrid explofion, and a blaft which would fweep every thing from the furface of the earth, muft be the effects of fuch inflammation. The very limited and capricious nature of the ravages made by thunder, render them altogether unlike explofions of elaftic fluids.

2 Thunder refembles the electrical fhock

No fooner were the wonderful effects of the charged electrical phial obferved, than naturalifts began to think of this as exhibiting fome refemblance to a thunderftroke (fee Electricity, *Encycl.* n° 12.); but it was not till toward the year 1750 that this refemblance was viewed in a proper light by the celebrated Franklin. In a differtation written that year, he delivers his opinion at large, and notices particularly the following circumftances of fimilarity.

In feveral remarkable particulars.

1. The colour and crooked form of lightning, perfectly fimilar to that of a vivid electrical fpark between diftant bodies, and unlike every other appearance of light. This angular, defultory, capricious form of an electrical fpark, and of forked lightning, is very fingular. No two fucceffive fparks have the fame form. Their fharp angles are unlike every appearance of motion through unrefifting air. Such motions are always curvilineal. The fpark is like the fimultaneous exiftence of the light in all its parts; and the fact is, that no perfon can pofitively fay in which direction it moves.

2. Lightning, like electricity, always ftrikes the moft advanced objects—hills, trees, fteeples.

3. Lightning affects to take the beft conductors of electricity. Bell wires are very frequently deftroyed by it. At Leven houfe in Fifefhire, in 1733, it ran along a gilded moulding from one end of the houfe to the other, exploding it all the way, as alfo the tinfoil on the backs of feveral mirrors, and the gilding of fcreens and leather hangings.

4. It burns, explodes, and deftroys thefe conductors precifely as electricity does. It diffolves metals; melts wires; it explodes and tears to pieces bodies which contain moifture. When a perfon is killed by lightning, his fhoes are commonly burft. When it falls on a wet furface, it fpreads along it. The Royal William, in Louifburgh harbour, in 1758, received a thunderftroke, which diffipated the maintop-gallant maft in duft, and came down on the wet decks in one fpark, which

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which ſpread over the whole deck as a ſpout of water would have done. This is quite according to electrical laws.

5. It has ſometimes ſtruck a perſon blind. Electricity has done the ſame to a chicken which it did not kill.

6. It affects the nervous ſyſtem in a way reſembling ſome of the known effects of electricity. The following is a moſt remarkable inſtance: —— Campbell, Eſq. of Succoth, in Dunbartonſhire, has been blind, for ſeveral years. The diſorder was a gutta ſerena. He was led one evening along the ſtreets of Glaſgow by his ſervant Alexander Dick, during a terrible thunder ſtorm. The lightning ſometimes fluttered along the ſtreets for a quarter of a minute without ceaſing. While this fluttering laſted, Mr Campbell ſaw the ſtreet diſtinctly, and the changes which had been made in that part by taking down one of the city gates. When the ſtorm was over, his entire blindneſs returned.—We have from a friend another inſtance, no leſs remarkable. One evening in autumn he was ſitting with a gentleman who had the ſame diſorder, and he obſerved ſeveral lambent flaſhes of lightning. Their faces were turned to the parlour window; and immediately after a flaſh, the gentleman ſaid to his wife "Go, my dear, make them ſhut the white gate; it is open, you ſee." The lady did ſo, and returned; and, after a little, ſaid, "But how did you know that the gate was open?" He exclaimed, "My God! I ſaw it open, and two men look in, and go away again," (which our friend alſo had obſerved). The gentleman on being cloſe queſtioned, could not recollect having had another glance, nor why it had not ſurpriſed him; but of the glimpſe itſelf he was certain, and deſcribed the appearance very exactly.

7. Lightning kills; and the appearances perfectly reſemble thoſe of a mortal ſtroke of electricity. The muſcles are all in a ſtate of perfect relaxation, even in thoſe ſituations where it is uſually otherwiſe.

8. Lightning is well known to deſtroy and to change the polarity of the mariner's needle.

3 Dr Franklin diſcovered that it was the ſame.

Dr Franklin was not contented with the bare obſervation of theſe important reſemblances. He availed himſelf of many curious diſcoveries which he had made of electrical laws. In particular, having obſerved that electricity was drawn off at a great diſtance, and without the leaſt violence of action, by a ſharp metallic point, he propoſed to philoſophers to erect a tall maſt or pole on the higheſt part of a building, and to furniſh the top of it with a fine metalline point, properly inſulated, with a wire leading to an inſulated apparatus for exhibiting the common electrical appearances. To the whole of this contrivance he gave the name of *thunder-rod*, which it ſtill retains. He had not a proper opportunity of doing this himſelf at the time of writing his diſſertation in a letter from Philadelphia to the Royal Society of London; but the contents were ſo ſcientific, and ſo intereſting, that in a few weeks time they were known over all Europe. His directions were followed in many places. In particular, the French academicians, encouraged by the preſence of their monarch, and the great ſatisfaction which he expreſſed at the repetition of Dr Franklin's moſt inſtructive experiments, which diſcovered and eſtabliſhed the theory of poſitive and negative electricity, as it is ſtill received, were eager to execute his orders, making his grand experiment, which promiſed ſo fairly to bring this tremendous operation of nature not only within the pale of ſcience, but within the management of human power.

But, in the mean time, Dr Franklin, impatient of delay, and perhaps incited by the honourable deſire of well-deſerved fame, put his own ſcheme in practice. His inventive mind ſuggeſted to him a moſt ingenious method of preſenting a point to a thunder cloud at a very great diſtance from the ground. This was by fixing his point on the head of a paper kite, which the wind ſhould raiſe to the clouds, while the wet ſtring that held it ſhould ſerve for a conductor of the electricity. We preſume that it was with a palpitating heart that Dr Franklin, unknown to the neighbours, and accompanied only by his ſon, went into the fields, and ſent up his meſſenger that was to bring him ſuch news from the heavens. He told a perſon, who repeated it in the hearing of the preſent writer, that when he ſaw the fibres of the cord raiſe themſelves up like hogs briſtles, he uttered a deep ſigh, and would have wiſhed that moment of joy to have been his laſt. He obtained but a few faint ſparks from his apparatus that day; but returned to his houſe in a ſtate of perfect happineſs, now feeling that his name was never to die. Thus did the ſoap bubble, and the paper kite, from being the playthings of children, become, in the hands of Newton, and of Franklin, the means of acquiring immortal honour, and of doing the moſt important ſervice to ſociety.

We may juſtly conſider this as one of the greateſt of philoſophical diſcoveries, and as doing the higheſt honour to the inventor; for it was not a ſuggeſtion from an accidental obſervation, but aroſe from a ſcientific compariſon of facts, and a ſagacious application of the doctrine of poſitive and negative electricity: a doctrine wholly Dr Franklin's, and the reſult of the moſt acute and diſcriminating obſervation. It was this alone that ſuggeſted the whole; and by explaining to his ſatisfaction the curious property of ſharp points, gave him the courage to handle the thunderbolt of Jove.

It is then a point fully aſcertained, that thunder and lightning are the electric ſnap and ſpark, as much ſuperior to our puny imitations as we can conceive from the immenſe extent of the inſtruments in the hands of Nature. If, ſays Dr Franklin, a conductor one foot thick and five feet long will produce ſuch ſnaps as agitate the whole human frame, what may we not expect from a ſurface of 10,000 acres of electrified clouds? How loud muſt be the exploſion? how terrible the effects?

4 Electrical ſtates of the atmoſphere.

This diſcovery immediately directed the attention of philoſophers to the ſtate of the atmoſphere with reſpect to electricity; and in this alſo Dr Franklin led the way. He immediately erected his thunder rods; and they have been imitated all over the world, with many alterations or improvements, according to the different views and ſkill of their authors. It is needleſs to inſiſt here on their conſtruction. They have been deſcribed in the article ELECTRICITY (*Encycl.*); and any perſon well acquainted with its theory, as laid down in the *Supplementary* article ELECTRICITY, will be at no loſs to accommodate his own conſtruction to his ſituation and purpoſes.

Dr Franklin took the lead, as we have already obſerved, Thunder. ferved, in this examination of the electrical ftate of the atmofphere. He feldom found it without giving figns of electricity, and this was generally negative. See *Phil. Tranf.* Vol. XLVIII. p. 358. and 785.

Mr Canton repeated thofe experiments, and found the fame refults; both, however, found that the electricity would frequently change from pofitive to negative, and from negative to pofitive, in very fhort fpaces of time, as different portions of clouds or air paffed the thunder-rod.

5 Cautions to be obferved in this examination by a thunder rod.

We muft here remark, that our acquaintance with the laws of electricity fufficiently informs us, that the electricity of our thunder-rod may frequently be of a different kind from that of the cloud which excites the appearances at our apparatus. We know that air, like glafs, is a non-conductor; and that when it is brought into any ftate of electricity, either by communication, or by mere induction, it will remain in that ftate for fome time, and that it always changes its electricity *per ftratum*. A pofitive cloud, in the higher regions of the atmofphere, will render the air immediately below it negative, and a ftratum below that pofitive. If the thunder rod be in this pofitive ftratum, it will exhibit pofitive electricity; but if the cloud be confiderably nearer, the rod, by being in the adjoining negative ftratum, may fhow a negative electricity which will exceed the pofitive electricity which the diftant pofitive cloud would have induced on its lower end by mere pofition, had the intervening air been away. This excefs of negative electricity muft depend on the degree in which the furrounding ftratum of air has been rendered negative. If this has been the almoft inftantaneous effect of the prefence of the pofitive cloud, it cannot be rendered fo negative as to produce negative electricity in the lower end of the thunder rod. But if the ftratum of air has for fome confiderable time accompanied the pofitive cloud, its negative electricity has been increafing, and fome would remain, even if the cloud were removed. We muft, at all times, confider the thunder rod as affected by *all* the electricity in its neighbourhood. The diftant pofitive cloud would at any rate render the lower end of the rod pofitive, without communication, by merely difplacing the electricity in the rod itfelf, juft as the north pole of a loadftone would make the remote end of a foft iron rod a north pole. In like manner, the negative ftratum of air immediately adjoining to the pofitive cloud would make the lower end of the rod negative, without communication. A pofitive ftratum of air below this would have the contrary effect. The appearances, then, at the end of the rod, muft be the refult of the prevalence of one of thefe above the others; and many intervening circumftances muft be underftood, before we can infer with certainty the ftate of a cloud from the appearances at the lower end of the apparatus. It would, therefore, be a moft inftructive addition to a thunder rod to have an electrofcope at both ends. If they fhew the fame kind of electricity, we may be affured that it is by communication, and is the fame with that of the furrounding ftratum of air: But if they fhew oppofite electricities (which is generally the cafe), then we learn that it is by pofition or induction. We recommend this to the careful attention of the philofopher.

In this way we perfectly explain an appearance which puzzled both of the above-mentioned obfervers. When a fingle low cloud approached the rod, the electrofcope would fhew pofitive electricity, but negative when the cloud was in the zenith, and pofitive again when it had paffed by. We alfo learn from this the caufe of Dr Franklin's difappointment in his expectations of very remarkable phenomena by means of his kite. He imagined that it would be vaftly fuperior to the apparatus which he had recommended to the philofophers of Europe. But the ftring of the kite, traverfing feveral ftrata in different ftates of electricity, ferved as a conductor between them, and he could only obtain the fuperplus; which might be nothing, even when the clouds were ftrongly electrified.

The moft copious and curious obfervations on the electrical ftate of the atmofphere are thofe by Profeffor Beccaria of Turin. He had connected the tops of feveral fteeples of the city by infulated wires. He did the fame thing at a monaftery on a high hill in the neighbourhood. Each of thefe collected the electricity of a feparate ftratum of confiderable extent. He frequently found thefe two ftrata in oppofite ftates of ftrong electricity.

6 Beccaria's general laws of atmofpheric electricity.

The following general obfervations are made out from a comparifon of a vaft variety of more particular ones made in different places:

1. The air is almoft always electrical, efpecially in the day time and dry weather; and the electricity is generally pofitive. It does not become negative, unlefs by winds from places where it rains, fnows, or is foggy.

2. The moifture of the air is the conftant conductor of its electricity in clear weather.

3. When dark or wet weather clears up, the electricity is always negative. If it has been very moift, and dries very faft, the electricity is very intenfe, and diminifhes when the air attains its greateft drynefs; and may continue long ftationary, by a fupply of air in a drying ftate from diftant places.

4. If, while the fky overcafts in the zenith, only a high cloud is formed, without any fecondary clouds under it, and if this cloud is not the extenfion of another which rains in fome remote place, the electricity (if any) is always pofitive.

5. If the clouds, while gathering, are fhaped like locks of wool, and are in a ftate of motion among each other; or if the general cloud is forming far aloft, and ftretches down like defcending fmoke, a frequent pofitive electricity prevails, more intenfe as the changes in the atmofphere are quicker; and its intenfity predicts the great quantity of fnow or rain which is to follow.

6. When an extenfive, thin, level cloud forms, and darkens the fky, we have ftrong pofitive electricity.

7. Low thick fogs, rifing into dry air, carry up fo much electricity as to produce fparks at the apparatus. If the fog continues round the apparatus without rifing, the electricity fails.

8. When, in clear weather, a cloud paffes over the apparatus, low and tardy in its progrefs, and far from any other, the pofitive electricity gradually diminifhes, and returns when the cloud has gone over.

9. When many white clouds gather over head, continually uniting with and parting from each other, and thus form a body of great extent, the pofitive electricity increafes.

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10. In the morning, when the hygrometer indicates drynefs equal to that of the preceding day, pofitive electricity obtains, even before funrife.

11. As the fun gets up, this electricity increafes; more remarkably if the drynefs increafes. It diminifhes in the evening.

12. The mid-day electricity, of days equally dry, is proportional to the heat.

13. Winds always leffen the electricity of a clear day, efpecially if damp; therefore they do not electrify the air by friction on folid bodies.

14. In cold feafons, with a clear fky and little wind, a confiderable electricity arifes after funfet, at dew falling.

The fame happens in temperate and warm weather.

If, in the fame circumftances, the general drynefs of the air is lefs, the electricity is alfo lefs.

15. The electricity of dew, like that of rain, depends on its quantity. This electricity of dew may be imitated by electrifying the air of a clofe room (not too dry), and filling a bottle with very cold water, and fetting it in the upper part of the room. As the damp condenfes on its fides, an electrometer will fhew very vivid electricity.

Such a collection of obfervations, to be fit for inference, requires very nice difcrimination. It is frequently difficult to difcover electricity in damp air, though it is then generally ftrongeft; becaufe the infulation of the apparatus is hurt by the dampnefs. To make the obfervation with accuracy, requires a portable apparatus, whofe infulation can be made good at all times. With fuch apparatus we fhall never mifs obferving electricity in fogs, or during fnow.

Curious phenomenon of a tickling fog.

There is a very curious phenomenon, which may be frequently obferved in Edinburgh, and no doubt in other towns fimilarly fituated. In a clear day of the month of May, an eafterly wind frequently brings a fog with it, which advances from the fea in a denfe body; and when it comes up the High-ftreet, it chills the body exceedingly, while it does not greatly affect the thermometer. Immediately before its gaining the ftreet, one feels like a tickling on the face, as if a cobweb had fallen on it, and naturally puts up his hand, and rubs the face. We have never found this to fail, and have often been amufed with feeing every perfon rubbing his face in his turn. The writer of this article has obferved the fame thing at St Peterfburgh, in a fummer's evening, when a low fog came on about ten o'clock.

The general appearances of a thunder ftorm are nearly as follow:

7 Phenomena of a thunder ftorm.

For the moft part the wind is gentle, or it is calm. A low denfe cloud begins in a place previoufly clear: this increafes faft in fize; but this is only upwards, and in an arched form, like great bags of cotton. The lower furface of the cloud is commonly level, as if it refted on a glafs plane.

Soon after appear numberlefs fmall ragged clouds, like flakes of cotton teazled out. Thefe are moving about in various uncertain directions, and continually changing their ragged fhape. This change, however, is generally by augmentation. Whatever occafions the precipitation of the diffolved water feems to gain ground. As thefe clouds move about, they approach each other, and then ftretch out their ragged arms towards each other. This is not by an augmentation, but by a real bending of thefe tatters towards the other cloud. They feldom come into contact; but after coming very near in fome parts, they as plainly recede, either in whole, or by bending their arms away from each other.

But during this confufed motion, the whole mafs of fmall clouds approaches the great one above it; and when near it, the clouds of the lower mafs frequently coalefce with each other before they finally coalefce with the upper cloud: But as frequently the upper cloud increafes without them. Its lower furface, from being level and fmooth, now becomes ragged, and its tatters ftretch down towards the others, and long arms are extended towards the ground. The heavens now darken apace, the whole mafs finks down; wind arifes, and frequently fhifts in fqualls; fmall clouds are now moving fwiftly in various directions; lightning now darts from cloud to cloud. A fpark is fometimes feen coexiftent through a vaft horizontal extent, of a crooked fhape, and of different brilliancy in its different parts. Lightning ftrikes between the clouds and the earth—frequently in two places at once. A continuation of thefe fnaps rarifies the cloud; and in time it diffipates. This is accompanied by heavy rain or hail; and then the upper part of the clouds is high and thin.

During this progrefs of the ftorm, the thunder rod is ftrongly electrified; chiefly when the principal cloud is over head. The ftate of the electricity frequently changes from pofitive to negative—almoft every flafh, however diftant, occafions a fudden ftart of the electrofcope, and then a change of the electricity. When the cloud is more uniform, the electricity is fo too.

8 Sources of atmofpheric electricity.

The queftion now is, In what manner does the air acquire this electricity? How come its different parts to be in different ftates, and to retain this difference for a length of time? and how is the electric equilibrium reftored with that rapidity, and to that extent, that we obferve in a thunder ftorm? For we know that air is a very imperfect conductor, and tranfmits electricity to fmall diftances only, and very flowly. We fhall mention feveral circumftances, which are known facts in electricity, and muft frequently concur, at leaft, with the other caufes of this grand phenomenon.

Air is rendered electrical in a great variety of ways.

1. All operations which excite electricity in other bodies have the fame effect on air. It is electrified by friction. When blown on any body, fuch as glafs, &c. that body exhibits electricity by a fenfible electrofcope. We therefore conclude that the air has acquired the oppofite electricity from this rubber. A glafs veffel, exhaufted of air, and broken in the dark, gives a loud crack, and a very fenfible flafh of light. An air-gun, difcharged (without a ball) in the dark, does the fame. Blowing on an electric with a pair of bellows never fails to excite it. In fhort, the facts to this purpofe are numberlefs.

2. Electricity is produced by a number of chemical operations, which are continually going on. The melting and freezing of electric bodies in contact with each other, fuch as chocolate in its moulds, wax-candles in their moulds, fealing-wax, &c. Nay, it is highly probable that any body, in paffing from its fluid to its folid form, or the contrary, is electrical. This is the cafe when a folution of Glauber's falt, or of nitre, in water, is made to cryftallize all at once by agitation.

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The ſolution of bodies in their menſtrua is, in like manner, productive of electricity in many caſes. Thus iron or chalk, while diſſolving in the ſulphuric acid, produce negative electricity in the mixture, and poſitive in the electric vapours which ariſe from them.

A moſt copious ſource of electricity is the converſion of water into elaſtic ſteam by violent heats. When this is done in a proper apparatus, the electricity of the liquid is negative, and the vapour is poſitive. But if this be accompanied by a decompoſition of the water, the liquid is ſometimes ſtrongly negative. Thus, when water evaporates ſuddenly from a red hot ſilver cup, the cup is ſtrongly negative; but if from clean red hot iron, ſo that the iron is calcined, and inflammable air produced, the iron is poſitive. If the decompoſition of the water is ſufficiently copious to do more than compenſate for the negative electricity produced by the mere expanſion of the water into ſteam, the electricity is poſitive; but not otherwiſe. Water expanded from a piece of red hot coal always gives negative electricity, and this frequently very ſtrong. Theſe experiments ſhould always be made in metalline veſſels. If made in glaſs veſſels, the glaſs takes a charge, which expends the produced electricity, and remains nearly neutral, ſo that the production of electricity is not obſerved. Theſe facts are to be found among many experiments of Mr Sauſſure. But there is here a very wide field of new inquiry, which cannot fail of being very inſtructive, and particularly in the preſent queſtion. We ſee ſome of the effects very diſtinctly in ſeveral phenomena of thunder and lightning. Thus, the great eruptions of Ætna and Veſuvius are always accompanied by forked lightnings, which are ſeen darting among the volumes of emitted ſmoke and ſteam. Here is a very copious converſion of water into elaſtic ſteam; and here alſo it is moſt reaſonable to expect a copious decompoſition of water, by the iron and coally matters, which are expoſed to the joint action of fire and water. Theſe two electricities will be oppoſite; or when not oppoſite, will not be equal: in either of which caſes, we have vaſt maſſes of ſteam in ſtates fit for flaſhing into each other.

A fact more to our purpoſe is, that if a ſilk or linen cloth, of a downy texture, be moiſtened or damped, and hung before a clear fire to dry, the fibres briſtle up, and on bringing the finger, or a metal knob, near them, they are plainly attracted by it. We found them negatively electric. This ſhews that the ſimple ſolution of water in air produces electricity. And this is the chief operation in Nature connected with the ſtate of the atmoſphere. It is thus that the watery vapours from all bodies, and particularly the copious exſudation of plants, diſappear in our atmoſphere. There can be no doubt but that the oppoſite electricity will be produced by the precipitation of this vapour; that is, by the formation of clouds in clear air. When damp, but clear air in one veſſel expands into an adjoining veſſel, from which the air has been exhauſted, a cloud appears in both, and a delicate electrometer is affected in both veſſels; but our apparatus was not fitted for aſcertaining the kind of electricity produced. Here then is another unexplored field of experiment. We got two veſſels made, having diaphragms of thin ſilk. Theſe were damped, and ſet into two tubs of water, of very different temperatures. Dry air was then blown through them, and came from their ſpouts ſaturated with water. The ſpouts were turned toward each other. Being of very different temperatures, the ſtreams produced a cloud upon mixing together, and a ſtrong negative electricity was produced. We even found that an electrometer, placed in a veſſel filled with condenſed air, was affected when this air was allowed to ruſh out by a large hole.

Laſtly, we know that the tourmaline, and many of the columnar cryſtals, are rendered electrical by merely heating and cooling. Nay, Mr Canton found that dry air became negative by heating, and poſitive by cooling, even when it was not permitted to expand or contract.

When water is precipitated, and forms a cloud, it is reaſonable to expect that it will have the electricity of the air from which it is precipitated. This may be various, but in general negative: For the heat by which the air was enabled to diſſolve the water made it negative; and much more the friction on the ſurface of the earth. But as heat cauſed it to diſſolve the water, cold will make it precipitate it; and we ſhould therefore expect that the air will be in the ſtate in which it was when it took up the water. But if it be cooled ſo faſt as to precipitate it in the form of rain, or ſnow, or hail, we may expect poſitive electricity. Accordingly, in ſummer, hail ſhowers always ſhew ſtrong poſitive electricity; ſo does ſnow when falling dry.

Here, then, are copious ſources of atmoſpheric electricity. The mere expanſion and condenſation of the air, and ſtill more the ſolution and precipitation of watery vapours in it, are perhaps ſufficient to account for all the inequality of electric ſtate that we obſerve in the atmoſphere.

9 Strata of the atmoſphere are in different ſtates of electricity, and are tranſparent.

The maſſes of air thus differently conſtituted are evidently diſpoſed in ſtrata. The clouds are ſeen to be ſo. Theſe clouds are not the ſtrata, but the boundaries of ſtrata; which, from the very nature of things, are in different ſtates with reſpect to the ſuſception or precipitation of water. When two ſuch ſtrata are thus adjoining, they will ſlowly act on each other's temperature, and by mixing will form a thin ſtratum of cloud along their mutual confines. If the one ſtratum has any motion relative to the other, and be in the ſmalleſt degree diſturbed, they will mix to a greater depth in each; and this mixture will not be perfectly uniform. The extreme mobility of air will greatly increaſe this jumble of the adjoining parts of the two ſtrata, and will give the cloud a greater thickneſs. If the jumble has been very great, ſo as to puſh one of them through the other, we ſhall have great towering clouds, perhaps pervading the whole thickneſs of the ſtratum of air. We take theſe clouds to be like great foggy bladders, ſuperficially opaque where they have come into contact with the ſurrounding ſtratum of air, but tranſparent within.

When the wind, or ſtratum in motion, does not puſh all the quieſcent air before it, it generally gets over it, and then flows along its upper ſide, and, by a partial mixing, produces a fleecy cloud, as already deſcribed. We may obſerve here, by the way, that the motion of thoſe fleecy clouds is by no means a juſt indication of the motion of the ſtratum; it is nearly the motion compoſed of the half of the motions of the two.

10 Theſe ſtrata have ſtrata of clouds interpoſed.

This is in all probability the ſtate of the atmoſphere, conſiſting of ſtrata of clear air many hundred yards thick, Thunder. thick, feparated from each other by thin fleeces of clouds, which have been produced by the mixture of the two adjoining ftrata. This is no fancy; for we actually fee the fky feparated by ftrata of clouds at a great diftance from each other. And we fee that thefe ftrata maintain their fituations, without farther admixture, for a long time, the bounding clouds continuing all the while to move in different directions. In the year 1759, during the fiege of Quebec, a hard gale blew one day from the weftward, which made it almoft impracticable to fend a number of provifion boats to our troops ftationed above the town. While the men were tugging hard at the oars againft the wind, and hardly advancing, though the tide of flood favoured them, the French threw fome bombs to deftroy the boats. One of thefe burft in the air, near the top of its flight, which was about a quarter of a mile high. The round ball of fmoke produced by the explofion remained in the fame fpot for above feven minutes, and difappeared by gradual diffufion. The lower air was moving to the eaftward at leaft 30 feet per fecond.

In 1783, when a great fleet rendezvoufed in Leith Roads, the fhips were detained by an eafterly wind, which had blown for fix weeks without intermiffion. The fky was generally clear; fometimes there was a thin fleece of clouds at a great height, moving much more flowly in the fame direction with the wind below. During the laft eight days, the upper current was from the weftward, as appeared by the motion of the upper clouds. High towering clouds came down the river, with a little rain; the ftrata were jumbled, and the whole atmofphere grew hazy and uniform: then came thunder, and heavy rain, and the wind below fhifted to the weftward.

Thus it is fufficiently evinced, that the atmofphere frequently confifts of fuch ftrata, well diftinguifhed from each other: their appearance and progrefs leave us no room to doubt but that they come from different quarters, and had been taken up or formed at different places, and in different circumftances, and therefore differing in refpect of their electrical ftates.

11 The electric equilibrium is reftored very flowly in general.

The confequence of their continuing long together would be a gradual but flow progrefs of their electricity to a ftate of equilibrium. The air is perhaps never in a perfectly dry ftate, and its moifture will caufe the electricity to diffufe itfelf gradually. It is not beyond the power of our mathematics to afcertain the progrefs of this approximation to the electric equilibrium. We fee fomething very like it in the curious experiments of Beccaria with mirror plates laid together, and charged by means of a coating on the outer plates. Thefe plates were found to confift of alternate ftrata of pofitive and negative electricity, which gradually penetrated through the plates, and coalefced till they were reduced to two ftrata; perhaps in time the electricity would have difappeared entirely by thefe two alfo coalefcing. In the fame manner there would be a flow transfufion of fenfible electricity through thefe ftrata without any fenfible appearances. If any collateral caufes fhould make a part more damp than the reft, there would be a more brifk transference through it, accompanied with faint flafhes of lambent lightning.

12 A rapid and extenfive reftoration is a thunder clap.

But thunder requires a rapid communication, and a reftoration of electric equilibrium in an inftant, and to a vaft extent. The means for this are at hand, furnifhed by Nature. The ftrata of charged air are furnifhed with a coating of cloud. The lower ftratum is coated on the underfide by the earth.

13 Manner in which this is effected by a coating of cloud.

When a jumble is made in any of the ftrata, a precipitation of vapour muft generally follow. Thus a conductor is brought between the electrical coatings. This will quickly enlarge, as we fee that in our little imitations the knobs of our conductors inftantaneoufly arrange any particles of duft which chance to lie in the way, in fuch a manner as to complete the line of conduct, and occafion a fpark to fly at a much greater diftance than it would have leaped if no duft had been interpofed. We have often procured a difcharge between two knobs which were too far afunder, by merely breathing the damp air between them. In this manner the interpofed cloud immediately attracts other clouds, grows ragged by the paffage of electricity through clear air, where it caufes a precipitation by altering the natural equilibrium of its electricity; for a certain quantity of electricity may be neceffary for air's holding a certain quantity of vapour. Accordingly we fee in a thunder ftorm that fmall clouds continually and fuddenly form in parts formerly clear. Whatever caufes thunder, does in fact promote this precipitation.

Thefe clouds have the electricity of the furrounding air, and muft communicate it to others in an oppofite ftate, and within reach. They muft approach them, and muft afterwards recede from them, or from any that are in the fame ftate of electricity with themfelves. Hence their ragged forms, and the fimilar form of the under furface of the great cloud; hence their continual and capricious fhifting from place to place: they are carriers, which give and take between the other clouds, and they may become ftepping ftones for the general difcharge.

If a fmall cloud form a communication with the ground, and the great cloud be pofitive or negative, we muft have a complete difcharge, and all the electrical phenomena, with great violence; for this coating of vapour is abundantly complete for the purpofe. It confifts of fmall veficles, which are fufficiently near each other for difcharging the whole air that is in their interftices. A phial coated with amalgam is by no means fully coated. If we hold it between the eye and the light, we fhall fee that it is only covered with a number of detached points of amalgam, which looks like a cobweb. Yet this glafs is almoft completely difcharged by a fingle fpark, the refiduum being hardly perceptible.

14 The difcharge is commonly between the clouds

The general fcene of thunder is the heavens; and it is by no means a frequent cafe that a difcharge is made into the earth. The air intervening between the earth and the loweft coating is commonly very much confufed in confequence of the hills and dales, which, by altering the currents of the winds, tofs up the inferior parts, and mix them with thofe above. This generally keeps the earth pretty much in the fame electrical ftate as the loweft ftratum of the clouds.

15 Which are horizontally diftant.

Nor are the great thunder ftorms in general inftances of the reftoration of equilibrium between two ftrata immediately incumbent on each other. They feem, for the moft part, to be ftrokes between two parcels of air which are horizontally diftant. This, however, we do not affirm with great confidence. Our chief reafon for thinking fo is, that in thefe great ftorms the fpark or fhaft of forked lightning is directed horizontally, and

fometimes

Thunder.

16 Particular account of forked lightning, and explanation of the long continued and rumbling noife of thunder.

fometimes feen at once through an extent of feveral miles.

The nature of this fpark has not, we think, been properly confidered. It is fimply compared to a long electrical fpark, which we conceive to be drawn through pure air, and is confidered as marking the actual transference of electricity from one end to the other. But this we doubt very much. We are certain of having obferved fhafts of lightning at one and the fame inftant ftretching horizontally, though with many capricious zigzags and lateral fputterings, at leaft five miles. We cannot conceive this to have been the ftriking diftance, becaufe the greateft vertical diftance of the ftrata is not the half of this. We rather think that it is a fimultaneous range of difcharges, each accompanied with light, differently bright according to the electrical capacity of the cloud into which it is made; and if there is a real transference of electric matter on this occafion (which we do not affirm), it is only of a fmall quantity from one cloud to the next adjoining. This we think confirmed by the found of thunder. It is not a fnap, incomparably louder than our loudeft fnap from coated glafs; but a long continued, rumbling, and *very unequable* noife. There is no doubt but that this fnap was almoft fimultaneous through the whole extent of the fpark; but its different parts are conveyed to our ear in time, and are therefore heard by us in fucceffion; and it is not an uniform roar, but a rumbling noife, unequally loud, according as the different parts of the fnap are indeed differently loud. We fhould hear a noife of the fame kind if we ftood at one end of a long line of foldiers, who difcharged their mufquets (differently loaded) in the fame inftant. When any part of the fpark is very near us, and is not very diffufe, the fnap begins with great fmartnefs, and continues for fome time, not unlike the violent tearing of a piece of ftrong filk; after which it becomes more and more mellow as it comes from a greater diftance. We do not, however, affirm, that the whole extenfive fpark and fnap are co-exiftent or fimultaneous. The cloud is, in all probability, but an indifferent conductor, and even a fenfible time may elapfe during the propagation of the fpark to a great diftance. Beccaria obferved this in a line of 250 feet of chain, lying loofely on the ground, and confifting of near 6000 links. He thought that it employed a full fecond; but when the chain was gently ftretched, the communication feemed inftantaneous.

17 Obfervations on the electric fpark.

We cannot help thinking that even the electrical fnap between two metal knobs is of the fame kind. Not a quantity of luminous matter which iffues from the one and goes to the other, but a light that is excited or produced in different material interjacent particles of air or other interpofed matter. The angular and fputtering form is quite incompatible with the motion of a fimple luminous point. Nay, our chemical knowledge here comes in aid, and obliges us to fpeculate about the manner in which this light is produced. Whence does it come? It may be produced by two knobs of ice. We know that water confifts of vital and inflammable air, which have already emitted the light which made an ingredient of their compofition. The fpark therefore does not come from the ice. Is it then from the air? If fo, perhaps water is produced, or rather fomething elfe, for there is not always inflammable air at hand to compofe water. Yet the transference of electricity has decompofed the air, or has robbed it of part of its light. The remainder may not be water; but it is no longer air. Is not this confirmed by the peculiar fmell which always accompanies electric fparks? and the peculiar tafte, not unlike the tafte felt on the tongue when it is touched by the zinc in the experiments on Galvinism? Even the fine pencil of light which flows from a point pofitively electrified, appears through a magnifying glafs to confift, not of luminous lines, but of lines of luminous points. And thefe points are of different brilliancy and different colour, both of which are inceffantly changing. And be it farther obferved, that thefe lines are curves, diverging from each other, and convex to the axis. This circumftance indicates a mutual repulfion, arifing, in all probability, from the expanfion of the air. And, laftly, no fpark nor light of any kind can be obtained in a fpace perfectly void of air.

All thefe circumftances concur in explaining the nature of the fhaft of forked lightning. It is a feries of appearances excited in the intervening medium, and which produce fome chemical change in it. Thunder, when it ftrikes a houfe, always leaves a peculiar fmell. Inflammable air has alfo a peculiar and very difagreeable fmell. The fmell produced by electricity greatly refembles the fmell produced by ftriking two pieces of quartz together.

18 Deluc's notion of thunder not probable.

Mr Deluc fuppofes that the electrical fpark, as it is exhibited in thunder, is always accompanied by the decompofition of air now fo familiarly known, and that this is the origin of the deluge of rain which commonly finifhes the ftorm. But this is not in the fmalleft degree probable. The decompofition extends furely no farther than where the light is feparated; and we fhould no more expect a deluge of rain, even if we had inflammable air ready at hand, than we expect drops of water in our electrical experiments. Something different from water follows this decompofition, total or partial, of the vital air; and the water which we do obferve to accompany thunder, is no more than what we fhould expect from the copious precipitation of water in a cloudy form. Mr Sauffure's obfervations affure us that the particles of a cloud are veficles. Indeed no perfon who has looked narrowly at a fog, or has obferved how large the particles are of the cloud which forms in a receiver when we fuddenly diminifh the denfity of the air, and who obferves how flowly thefe particles defcend, can doubt of their being hollow veficles. We cannot perhaps explain their formation; but there they are. We can hardly conceive them receiving the commotion which accompanied the fnap without collapfing by the agitation. Perhaps the very ceffation of their electricity may produce this effect. They will therefore no longer float in the air, but fall, and unite, and come to the ground in rain. We may expect this rain to be copious, for it is the produce of two ftrata of clouds. It greatly contributes to the putting an end to the ftorm, by paffing through the ftrata, and helping to reftore the equilibrium.

19 Why and how thunder may continue for fome time.

One may at firft expect that a fingle clap of thunder will reftore the equilibrium of any extent of clouds, and we require an explanation of their frequent repetition before this is accomplifhed. This is not difficult, and the fact is a confirmation of the above theory, which is confiderably different from the generally received notions

tions of the ſubject. We conſider the ſtratum of clear air as the charged electric; poſitive on one ſide, and negative on the other, and coated with conducting clouds. When the diſcharge is made, the ſtate of electricity is indeed changed through the whole ſtratum, but the equilibrium is by no means completed. The ſtratum is perhaps a quarter of a mile in thickneſs. The diſcharge does not immediately affect all this: but does it ſuperficially, leaving the reſt unbalanced. It is like the reſiduum which is left in a Leyden phial when the diſcharge has been made by means of a ſpark drawn at a diſtance. It is ſtill more like the reſiduum of the diſcharge of a Leyden phial that is coated only in patches on one ſide. Each of theſe patches diſcharges what is immediately under it and round it to a certain ſmall diſtance, but leaves a part beyond this ſtill charged. This redundant electricity gradually diffuſes itſelf into the ſpaces juſt now diſcharged; and, after ſome conſiderable time has elapſed, another diſcharge may be made. In like manner, the electricity remaining in the interior of the ſtratum diffuſes itſelf, comes within the action of the coating, and may be again diſcharged by a clap of thunder. We have a ſtill better parallel to this in Beccaria's experiments with two or more plates of glaſs laid together. After the firſt diſcharge, the internal ſurfaces will exhibit certain electricity. Lay the plates together, and, after ſome time, the electricity of the inner ſurfaces will be different, and another diſcharge may be obtained.

Magnetiſm affords the beſt illuſtration of this. If a magnet be brought near a piece of ſoft iron, lying below a paper on which iron filings are lightly ſtrewed, it will inſtantly induce a north pole on one end and a ſouth pole on the other; and this will be diſtinctly obſerved by the way in which theſe filings will arrange themſelves. But if, inſtead of ſoft iron we place a bar of hard tempered ſteel, the ſouth pole will be but a ſmall matter removed from the north pole; but by continuing the magnet long in the ſame place, the diſtribution of magnetiſm in the piece of hard ſteel will gradually advance along the bar, and after a long time the neutral point will be almoſt in the middle of the bar, and the ſouth pole will be at the farther end. See Magnetism, in this *Suppl.*

20 Moſt thunder ſtrokes are returning strokes

We ſaid that the clouds were the uſual ſcenes of the violent electric phenomena. We imagine that the greateſt part of the thunder ſtrokes which have been felt have been of the kind which Lord Mahon, now Lord Stanhope, calls the returning ſtroke. If two clouds A and B are incumbent over the plain *a* and *b*; and if A be poſitive and B negative, the earth will be maintained in a negative ſtate at *a*, and a poſitive ſtate at *b*. If the diſcharge be now made between the clouds A and B, the electricity muſt inſtantly ruſh up through a conductor at *a*, and down through one at *b*, and each place will have a ſtroke. The ſame thing will happen if the negative cloud B is above the poſitive cloud A, but not in ſo great a degree; for the negative electricity at *a* will now be much leſs than in the other caſe, becauſe it is induced only by the prevalence of the poſitive cloud A over the more remote negative cloud B.

A + — B

a — + *b*

This returning ſtroke explains, much better than we can by any direct ſtroke, the capricious effects of thunder. A perſon at Vienna received a terrible ſhock by having his hand on a thunder-rod during a violent exploſion which he ſaw above three miles diſtant. Sparks are obſerved at thunder-rods at every the moſt diſtant flaſh of lightning.

21 Beccaria's theory of thunder not juſt.

Beccaria has a different theory of thunder. He imagines that the different parts of the earth are in different ſtates of electricity, and that the clouds are the reſtoring conductors. But this does not accord with what we know of electricity. The earth is ſo good a conductor, that Dr Watſon could not obſerve any time loſt in communicating the electricity to the diſtance of more than four miles. It is very true, that the earth is almoſt always in a ſtate of very unequal, and even oppoſite, electricity in its different parts; but this ariſes from the variety of clouds ſtrongly electrified in the oppoſite way. This induces electricity, or diſturbs the natural uniform diffuſion of electricity, juſt as the bringing magnets or loadſtones into the neighbourhood of a piece of iron, without touching it, renders it magnetical in its different parts. While they continue in their places, the piece of iron will be magnetical, and differently ſo in its different parts.

Such are the thoughts which occur to us on this ſubject. But we by no means affirm that we have given a full account of the procedure of Nature; we have only pointed out ſeveral neceſſary conſequences of the known laws of electricity, and of its production in the atmoſphere by means of natural operations which are continually going on. Theſe *muſt* operate, and produce an electrical ſtate of the atmoſphere greatly reſembling what we obſerve: and we have ſhewn, from the acknowledged doctrines of electricity, how this want of equilibrium may be removed, and muſt be removed, by the ſame operations of Nature. The equilibrium muſt be reſtored by means of the conducting coating furniſhed by the clouds. But theſe may be the leaſt conſiderable of Nature's reſources; and the ſubject is ſtill an unexplored field, in the examination of which we may hope to make great progreſs, in conſequence of our daily increaſing knowledge of the chemical ſtate of the atmoſphere.

22 Dr Franklin's invention of a guard againſt thunder.

Knowledge is valuable chiefly as it is uſeful. No man ever ſaw the propriety of this apothegm more ſtrongly than Dr Franklin, or more aſſiduouſly adhered to it in the courſe of a long and ſtudious life. However greatly we may admire his ſagacity, penetration, and logical diſcrimination, in the diſcoveries he has made in the ſcience of electricity, and his diſcovery of the identity of electricity and thunder, we muſt acknowledge infinitely greater obligations to him for putting it in our power to ward off the fatal, and formerly inevitable ſtroke, of this awful agent in the hands of Nature.

Dr Franklin conſiders the earth as performing the office of a conductor in reſtoring the electric equilibrium of the atmoſphere, which has been diſturbed by the inceſſant action of the unwearied powers of Nature.

He obſerves that the uſual preference will be given to the beſt conductors. In this reſpect, a metal rod far ſurpaſſes the brick, ſtone, timber, and other materials which compoſe our buildings, eſpecially when they are dry, as is uſually the caſe in the thundery ſeaſon. He therefore adviſes us to place metalline conductors in the way of the atmoſpherical electricity, in thoſe places where it is moſt likely to ſtrike, and to continue them down

Thunder. down to the moift earth, at fome depth under the furface. Nay, as it has been found that thunder has not in every inftance ftruck the higheft parts of buildings, he advifes to raife the metalline conductors to fome confiderable height above the building, the more certainly to invite the electricity to take this courfe.

23 Directions for conftructing it.

To enfure fuccefs, he obferves that the electrical fhock diffipates water, and even metalline conductors when too fmall. He therefore advifes to make the conductor at leaft half an inch fquare, none of that fize having ever been deftroyed, though fmaller have, by the thunder: yet even thefe had conducted the thunder to the ground with perfect fafety to the building.

No part of a conductor muft terminate in the building; for the electricity accumulates exceedingly at the remote extremities of all long rods, and tends to fly off with great force, efpecially if another conductor is near. This aids the accumulation, by acquiring at its upper end an electricity oppofite to that of the lower end of the other: and this effect, produced by the influence of a pofitive cloud, makes the upper and negative end of the lower portion of a divided conductor draw more electricity to the lower end of the upper portion. This redundant electricity, ftrongly attracted by the negative lower portion, flies off with great violence through the air; or if furrounded with any matter capable of converfion into elaftic vapour by heat, burfts it with irrefiftible force. Thus the thunder, acting on the vane fpindle of St Bride's fteeple in London, fprung from its lower end to the upper end of an iron window bar, and burft the ftone in which it was fixed, by expanding the moifture into fteam. In like manner it burft the ftone at the lower end of this bar, to make its way to an iron cramp which connected the oppofite fides of the fteeple; from this it ftruck to another cramp; and fo from cramp to cramp, till it reached the gutter leads of the church, burfting and throwing off the ftonework in many places.

All interruptions muft therefore be carefully avoided, and the whole muft be made as much as poffible one continued metal rod.

Farther, Dr Franklin, obferving the fingular property which fharp points poffefs of drawing off the electricity in filence, advifes us to finifh our conductor with a fine point of gilt copper, which cannot be blunted by ruft.

24 Is the thunder rod an effectual and fafe contrivance?

But as thus raifing the conductor, and pointing it, are fo many invitations to the thunder to take this courfe; and as we cannot be certain that the quantity thus invited may not be more than what the rod can conduct with fafety—it has appeared to Dr Wilfon, and other able electricians, that it will be fafer to give abundance of conduct to what may unavoidably vifit us, without inviting what might otherwife have gone harmlefsly by.

This was attentively confidered by Dr Franklin, Dr Watfon, Mr Canton, Dr Wilfon, and others, met as a committee of the Royal Society, at the defire of the Board of Ordnance, to contrive a conductor for the powder magazine at Purfleet.

We think that the theory of induced electricity, founded on Dr Frankin's difcoveries, and confirmed by all the later inventions of the electrophorus, condenfer, &c. will decide this queftion in the moft fatisfactory manner.

When a cloud pofitively electrified comes over a building, it renders it negatively electrical in all its parts, if of conducting materials, and even the ground on which it ftands. This effect is more remarkably produced if the ftructure is of a tall and flender fhape, like a fteeple or a rod. Therefore the external electrical fluid is attracted by the building with greater force than if it had confifted of materials lefs conductive. A difcharge will therefore be made through it in preference to any neighbouring building, becaufe it is more eminently negative. For the fame reafon, if there are two buildings equal and fimilar, one of them being a good conductor, and the other being a lefs perfect one, the perfect conductor, becoming more powerfully negative, the cloud will become more ftrongly pofitive over this houfe than over the other, and the ftroke will be made through it.

Thunder. 25 Scientific account of the ftate of electricity induced on a building by a thunder cloud,

26 And on the thunder rod.

The fame thing muft obtain in a perfect conductor continued from the top to the foundation of a houfe, built of worfe conducting materials. The conductor becoming more eminently negative than any other part of the building, the electric fluid will be more ftrongly attracted by it, accumulated in its neighbourhood, and will all be difcharged through it, fo long as it is able to conduct.

If the building is of great extent, the proximity of one part of the building to the thunder cloud may produce an accumulation of electrical fluid in its neighbourhood, in preference to a more perfect, but remote, conductor. But when the diftances from the cloud are not very unequal, the accumulation will always be in the neighbourhood of the perfect conductor; and this will determine the difcharge that way. The accumulation in the neighbourhood of the rod will be fmall indeed, when the rod is fmall; but then it is denfe, and the whole of electric phenomena fhew that it is the denfity, and not the quantity, of accumulation which produces the violent tendency to fly off; it is this alone which makes it impoffible to confine electricity in a body which terminates in a fharp point.

For the fame reafon, bodies of the fame materials and fhape will increafe the accumulation in the adjoining part of the cloud in proportion as they are nearer to it, or more advanced beyond the reft of the building.

And bodies of flender fhape, and pointed, will produce this accumulation in their neighbourhood in a ftill more remarkable degree, and determine the courfe of the difcharge with ftill greater certainty.

But it is evident that a metallic rod, no higher than the reft of the building, may occafion an accumulation in the adjoining part of a near thunder cloud fufficient to produce a difcharge, when the building itfelf, confifting of imperfect conductors, would not have provoked the difcharge at all. It may therefore be doubted whether we have derived any advantage from the conductor.

27 Effect of all interruptions in the conductor.

To judge properly of this, we muft confider houfes as they really are, confifting of different materials, in very different fhapes and fituations; and particularly as having many large pieces of metal in their conftruction, in various pofitions with regard to the cloud, the ground, and to each other. Suppofe all the reft of the building to be of non-conducting materials. When a pofitive thunder cloud comes overhead, every piece of metal in the building becomes electrical, without having received any thing as yet from the cloud; that end of each

Thunder.

each which is neareſt the cloud becoming negative, and the remote end poſitive. But, moreover, the electricity of one increaſes the electricity of its neighbour. Then the moſt elevated becomes more ſtrongly attractive at its upper end than it would have been had the others been away; and therefore produces a greater accumulation in the nearer part of the thunder cloud than it would otherwiſe have done, and it will receive a ſpark. By this its lower end becomes more overcharged, and this makes the upper end of the next more undercharged, and the ſpark is communicated to it, and ſo on to the ground; which would not have happened without this ſucceſſion of conductors. Thus it is eaſy to conceive, that the accumulation in the cloud is juſt inſufficient to produce a diſcharge—While things are in this ſtate, juſt ready to ſnap, ſhould a man chance to paſs under a bell wire, or under a luſtre hanging by a chain, his body will immediately augment the poſitive electricity of the lower end of the conductor above him, and thus will augment the negative electricity of its upper end. This again will produce the ſame effect in the conductor above it: and thus each conductor becomes more overcharged at its lower end, and more undercharged at the upper end. Before this, every thing was juſt ready to ſnap. All will now ſtrike at once. The cloud will be diſcharged through the houſe, and the man will be the ſacrifice, the whole diſcharge being made through his body. This needs no demonſtration for any well-informed electrician. Thoſe who have only ſuch a knowledge of the theory as can be gathered from the writings of Prieſtley, Cavallo, and other popular authors, may convince themſelves of the truth of what is here delivered in the following manner.

In dry weather, and the moſt favourable circumſtances for good electrical experiments, let a very large globe, ſmoothly covered with metal, and well inſulated, be as highly electrified as poſſible, without expoſing it to a rapid diſſipation. To enſure this circumſtance (which is important) let it be electrified till it begins to ſputter, and note the ſtate of the electrometer. Diſcharge this electricity, and electrify it to about half of this intenſity. Provide three or four inſulated metal conductors, about three inches long and an inch diameter, terminated by hemiſpheres, and all well poliſhed.

Having electrified the globe, as above directed, bring one of the inſulated conductors ſlowly up to it, and note its diſtance when it receives a ſpark. In doing this, take care that there be no conducting body near the remote end of the inſulated conductor. It will be beſt to puſh it gradually forward by means of a long glaſs rod. Withdraw the conductor, diſcharge its electricity, reſtore the globe to its former electricity, indicated by an electrometer, and repeat this experiment till the greateſt ſtriking diſtance is exactly diſcovered. Now ſet another of the inſulated conductors about half an inch behind the firſt, and puſh them forward together, by a glaſs rod, till a ſpark is obtained. The ſtriking diſtance will be found greater than before. Then repeat this laſt experiment, with this difference, that the two conductors are puſhed forward by taking hold of the remote one. The ſtriking diſtance will be found much greater than before. Laſtly, puſh forward the two conductors, the remote one having a wire communicating with the ground, till they are a ſmall matter *without* the ſtriking diſtance; and, leaving them in this ſituation, take any little conducting body, ſuch as a braſs ball fixed on the end of a glaſs rod, and paſs it briſkly through between the globe and the neareſt conductor, or through between the two conductors, taking care that it touch neither of them in the paſſage. It will be ſeen that, however ſwift the paſſage is made, there will be a diſcharge through all the four bodies. The inference from this is obvious and demonſtrative.

A very remarkable inſtance of this fact was ſeen at the chapel in Tottenham Court Road, London. A man, going into the chapel by the eaſt door, was killed by the thunder, which came down from the little bell-houſe, along the bell-wire, and the rod of the clock pendulum, from the end of which it leaped to ſome iron work above the door, and from thence, from nail to nail, till it reached the man's head.

This interruption of conduct, which is almoſt unavoidable in the conſtruction of any building, is the cauſe of moſt of the accidents that are recorded; for when the ends of thoſe communicating conductors are incloſed in materials of leſs conducting power, the electricity, in making its way to the next in a very denſe ſtate, never fails to explode every thing which can be converted into elaſtic vapour by heat. There is always a ſufficient quantity of moiſture in the ſtone or brickwork for this purpoſe; and moſt vegetable ſubſtances contain moiſture or other expanſible matter. The ſtone, brick, or timber, is burſt, and thrown to a conſiderable diſtance; or if kept together by a weight of wall, the wall is ſhattered. It is worth remarking that although no force whatever ſeems able to prevent this exploſion, the quantity of matter exploded is extremely ſmall; for the ſtones are never thrown to a greater diſtance than they would have been by two or three grains of gunpowder properly confined.

All theſe accidents will be prevented by giving a ſufficient uninterrupted conduct; and it is proper to make uſe of ſuch a conductor, although it may invite many diſcharges which would not otherwiſe happen. So long as the conductor is ſufficient for the purpoſe, there ſeems to be no doubt of the propriety of this maxim. 28

A thunder rod will protect even when it is not able to diſcharge the whole thunder.

But the moſt ſerious objection remains. As we are certain that theſe conductors, whether raiſed above the building or not, will produce diſcharges through them which otherwiſe would not have happened, and as we are quite uncertain whether the quantity contained in a thunder cloud may not greatly exceed what the thunder rod can conduct without being diſſipated in ſmoke, it ſeems very dangerous thus to invite a ſtroke which our conductor may not be able to diſcharge. In particular, it is reaſonable to believe that the ſtrata of electrified clouds which come near the earth loſe much of their electricity by paſſing over the ſharp points of trees, &c. while thoſe which are much higher may retain their electricity undiminiſhed, and paſs on. May it not therefore happen, that our conductor will invite a fatal ſtroke, which would have gone harmleſsly by?

The doubt is natural, and it is important.

Let us ſuppoſe a very extenſive and highly electrified cloud, in a poſitive ſtate, to come within ſuch a diſtance from a building as *juſt not to ſtrike it*, if unprovided with a conductor, but which will moſt certainly ſtrike the ſame building furniſhed with a conductor; and let the electricity be ſo great that the conductor ſhall be diſſipated in ſmoke before even a

Thunder. ſmall part of it is diſcharged—What will be the fate of the building? We believe that it will be perfectly ſafe.

However rapid we may ſuppoſe that motion by which electricity is communicated, it is ſtill motion, and time elapſes during the propagation. The cloud is diſcharged, not in a very inſtant, but in a very ſhort time. Part of the cloud is therefore diſcharged, while it explodes the conductor, and the electricity of the remainder is now too weak (by our ſuppoſition) to ſtrike the building no longer furniſhed with a conductor. This muſt be the caſe, however large and powerful the cloud may be, and however ſmall the conductor.

But ſuppoſe that the cloud has come ſo near as to ſtrike the building unprovided with a conductor. Then as much will be diſcharged through the building as it can conduct; and if the quantity be too great, the building will be deſtroyed: but let a conductor (though inſufficient) be added. The diſcharge will be made through it as long as it laſts, and the remainder only will be diſcharged through the houſe, ſurely with much leſs danger than before.

The truth of theſe concluſions from theory is fully verified by fact. When the church of Newbury in New England was ſtruck by lightning in 1755, a bell wire, no bigger than a knitting needle, conducted the thunder with perfect ſafety to the building as far down the ſteeple as the wire reached, though the ſtroke was ſo great that the wire had been exploded, and no part of it remained, but only a mark along the wall occaſioned by its ſmoke. From the termination of the wire to the ground the ſteeple was exceedingly ſhattered, and ſtones of great weight were thrown out from the foundation (where they were probably moiſter) to the diſtance of 20 and 30 feet.

Another remarkable inſtance happened in the ſummer palace at St Peterſburg. A Heyduk and a ſoldier of a foot regiment were ſtanding centinels at the door of the jewel-chamber: the Heyduk, with his ſcimitar reſting on his arm, was careleſsly leaning on the ſoldier, who had his muſket ſhouldered. Both were ſtruck down with lightning; and the ſoldier was killed, his left leg ſcorched, and his ſhoes burſt. The Heyduk had received no damage, but felt himſelf tripped up, as if a great dog had run againſt him. A narrow ſlip of gold lace, which was ſewed along the ſeam of his jacket and pantaloon breeches, reaching to his ſhoes, had been exploded on the left ſide. This ſeems to have been his protection. In all probability, the ſtroke came to both along the muſket (or perhaps to the Heyduk along the ſcimitar). The Heyduk had a complete, though inſufficient, conductor, and was ſafe. The ſoldier had not, and was killed. The puſh felt by the former probably aroſe from the exploſion of the lace.

It ſeems therefore plain that metalline conductors are always a protection; that advancing them above the building, increaſes their protection; and that pointing them may ſometimes enable them to diminiſh a ſtroke, by diſcharging part of the electricity ſilently.

Dr Franklin having formed all his notions of thunder from his pre eſtabliſhed theory, and having ſeen the principal phenomena ſo conformable to it, was naturally led to expect this conformity in caſes which he could not eaſily examine preciſely by experiment. Accordingly, in his firſt diſſertation, he affirmed that a fine point always diſcharges a thunder cloud ſilently, and at a great diſtance. The analogous experiments in artificial electricity are ſo beautiful and ſo perſpicuous, that this confidence in the protecting power of fine points is not ſurpriſing: and this confidence was rendered almoſt complete by a moſt ſingular caſe which fell under his own obſervation. He was awakened one night by loud cracks in his ſtair caſe, as if ſome perſon had been laſhing the wainſcoating with a great horſe-whip. He thought it ſo, and got up in anger to chide the idle fool. On looking out at his chamber door, he ſaw that the diſturbance proceeded from electric exploſions at ſome interruptions of his conductor. He ſaw the electricity paſs, ſometimes in bright ſparks, producing thoſe loud thwacks, and ſometimes in a long continued ſtream of denſe white dazzling light as big as his finger, illuminating the ſtair-caſe like ſunſhine, and making a loud noiſe like a cutler's wheel. Had the cloud (ſays he) retained all this till it came within ſtriking diſtance, the conſequences would have been inconceivably dreadful. Yet not long after this he found that he had been in a miſtake; for the houſe of Mr Watt in Philadelphia, furniſhed with a finely pointed conductor, was ſtruck by a terrible clap of thunder, and the point of the conductor was melted down about two inches. This is perhaps the only inſtance on record of a finely-pointed *conductor* being ſtruck. The board room at the powder magazine at Purfleet was indeed ſtruck, though provided with a conductor; but the ſtroke was through another part of the building. St Peter's church, Cornhill, has been eight times ſtruck between 1772 and 1787; while St Michael's, in its neighbourhood, and much higher, has never had a ſtroke ſince 1772, when it was furniſhed with an excellent pointed conductor by Mr Nairne.

29 A pointed conductor may ſometimes be ſtruck.

Dr Franklin having ſeen the above exception to his rule, and reflected on it, acknowledges that there are caſes where a pointed conductor may be ſtruck, viz. when it ſerves as a ſtepping ſtone, to *complete* a canal of conveyance already near completed. A *ſmall* cloud may ſometimes ſerve as a ſtepping ſtone (like the man coming under a luſtre) for the electricity to come out of a great cloud, and diſcharge through the pointed conductor. Whenever it comes to the ſtriking diſtance from the conductor, it will explode at once; whereas the great cloud itſelf muſt have come nearer, and had its force gradually diminiſhed. It is remarkable that a point, employed in this way in artificial electricity, muſt be brought nearer to another body than a ball need be, before it can receive a ſtroke. The difference is about one-third of the whole. Nairne found, that a ball nine-tenths of an inche in diameter, exploded at the diſtance of nine inches, and a point at ſix inches diſtance.

We muſt alſo obſerve that a pointed conductor can have no advantage over a blunt one in the caſe of a returning ſtroke; which is perhaps the moſt common of any. This depends on another diſcharge, which is made perhaps at a great diſtance. This was moſt diſtinctly the caſe in the inſtance mentioned ſome time ago, of the perſon at Vienna who had a ſhock from a thunder rod by an exploſion far diſtant. This thunder rod was a very fine one, furniſhed with five gilt points.

Still, however, this property of ſharp points was greatly over-rated by Dr Franklin, and thoſe who took all their

Thunder. their notions of electricity from the simple discoveries of his sagacious mind. Unfortunately Dr Franklin had not cultivated mathematical knowledge; and, ever eager after discovery, and ardent in all his pursuits, his wonderful penetration carried him through, and seldom allowed him to rest long on false conclusions. He was certainly one of the greatest *philosophers:* and a little erudition would perhaps have brought him side by side with Newton. It was reserved, however, for Lord C. Cavendish and for Æpinus, to subject the investigations of Franklin to number and measure. By studying what they have written on the subject, or even the view which we have given of their theory in the article Electricity *(Suppl.)*, the reader will be fully convinced, that a point has little or no advantage over a ball, with respect to a thunder cloud which is brought to the thunder rod by a brisk wind; although when it comes slowly up during an almost perfect calm, it may discharge all that can be discharged without a snap. The constipation in a point is indeed very great, but the quantity constipated is moderate; and therefore its action, at any considerable distance, is but trifling. All this is fully verified by Dr Wilson's judicious experiments in the Pantheon. He had a prodigious quantity of electrified surface suspended there, and made a pointed apparatus come to its striking distance with a motion which he could regulate and measure. And he found that with the very moderate velocity of twelve feet in a second, he never failed of procuring a very smart stroke. The experiments made in the usual way by the partisans of sharp points (for it became a matter of indecent party) were numberless, and decidedly in their favour. The great and just authority of Dr Franklin, who was one of the committee, procured them still more consideration, or at least hindered people from seeing the force of Dr Wilson's reasoning. It is somewhat surprising, that Dr Wilson, a lover of mathematical learning, and a good judge, as appears from his publication of the papers of Mr Robins, did not himself see the full force of his own experiments. He had not surely studied either Æpinus or Cavendish. He indeed frequently says, that the state of the electricity in a thunder cloud, and in coated glass, is exceedingly different; and that the first extends its sensible influence much farther than the last, when both have the same quantity of electricity. But he seems not to have formed to himself any adequate notion of the difference. Had he done this, he would have seen that he has disposed his great electrified surface very improperly. It should have been collected much nearer his pointed apparatus, that this might, if possible, have been within the sphere of attraction of every part of his artificial cloud. He would then have found results, some of which would have been much more favourable to his own general opinion, while others would have exhibited the peculiarities of the sharp point in a more showy manner than any thing we have seen.

30 Dr Franklin over-rated the protection of pointed conductors.

31 Thunder cloud very unlike coated glass;

Reasoning from the true theory of coated glass, we shall learn that, when the glass is exceedingly thin, the accumulation of electricity, or the charge, will be exceedingly great; while the external appearance, or apparent energy, of the electricity may be hardly sensible, and will extend to a very small distance. Thus, a circular plate of coated glass, six inches in diameter and one-twentieth thick, when electrified so as to make an electrometer diverge 50 degrees, contains about 60 times as much electricity as a brass plate, of the same diameter, electrified to the same degree; and these two will have the same influence on an electrometer placed at a distance from them, and will give a spark nearly at the same distance. The spark from the coated glass will be bright, and will give a shock; while that from the brass plate will be trifling. The cause of the equality of influence is, that the positive electricity of the one side of the coated glass is almost balanced by the negative electricity of the other side, and the unbalanced part is about $\frac{1}{59}$th of the whole. If we now take a brass plate of $46\frac{1}{2}$ inches in diameter, and electrify it to the same degree with the coated glass, we shall find that it will require the same number of turns of the machine to bring it to this state, or to charge the coated glass. They contain the same quantity of electricity, and the spark of both will give the same shock. But this large plate will have a much wider influence: a person coming within ten feet of it will see his hair bend towards it, and feel like a cobweb on his face.

32 And the influence of sharp points is trifling.

It may be farther demonstrated that the power of a point to abstract the electricity to a given degree from the large plate, is vastly smaller than its power to abstract it to the same degree from the coated plate. This is different in the different degrees of the abstraction, and cannot be expressed by any one number.

All these considerations taken together, shew us that the pointed conductor has little advantage over the ball in the circumstance above mentioned. It has however, an advantage, and therefore should be employed; and in the case of a calm, or very gentle progress of the thunder cloud, the advantage may be very great.

33 An extensive and substantial metalline conductor is the chief security.

Thus we think the question decided; and the only remaining consideration is the quantity of metallic conduct that should be given. Prudence teaches us not to spare, especially in very lofty buildings. The conductor on the dome of St Paul's in London consists of four iron straps, each four inches broad and one half an inch thick. This conductor was once made red hot by a thunder stroke. No instance has been found of a rod one half an inch square being exploded. The accident at Mr Watt's house in Philadelphia is curious. The brass wire which terminated the rod had been ten inches long and one-fourth thick at the base, and two one-half inches were melted. It was unable, therefore, to conduct that stroke when its diameter was less than one-sixteenth of an inch.

We recommend lead or copper in preference to iron. Iron wastes by rust, and by exfoliating retains water, which may be dangerous by its expansion. A strap of lead, two inches broad and one-fourth thick, stapled down to the roof or wall with brass staples, secures us from all risks from neglect. An iron rod, or one fastened with iron cramps, requires frequent inspection, to see that nothing has failed or wasted by rust. The point or points should surely be copper. It would be very proper to connect all the leads of the ridges, gutters, and spouts, with the conductor, by straps of lead. This will greatly extend its protection.

A great extent of building is not sufficiently secured by one conductor. And a powder magazine should have some erected round it at a distance on masts.

Maxims

Maxims in a Thunder Storm.

Avoid being under trees—but be near them: do not avoid rain. When in a room, avoid the fire fide, which would bring you into the neighbourhood of the higheft part of the houfe, viz. the ftack of chimneys. The bell-wire, the grate, the fire irons—are bad neighbours. Nay, the foot of the chimney is not a good one, efpecially if it has ever caked together by burning (A). Go to the middle of the room, and fit down, if not near a luftre, or any thing hanging from the ceiling. Avoid mirrors, or gilded mouldings.

Thunder *Bay*, in Lake Huron, lies about half way between Saganna Bay and the N. W. corner of the lake. It is about 9 miles acrofs either way; and is thus called from the thunder frequently heard there. —*Morse.*

Thunder Clouds, in phyfiology, are thofe clouds which are in a ftate fit for producing lightning and thunder. See the preceding article.

THURMAN, a townfhip in Wafhington county, New York; taken from Queenfburg, and incorporated in 1792.—*Morse.*

THUS, in fea-language, a word ufed by the pilot in directing the helmfman or fteerfman to keep the fhip in her prefent fituation when failing with a fcant wind, fo that fhe may not approach too near the direction of the wind, which would fhiver her fails, nor fall to leeward, and run farther out of her courfe.

TIAGA *Point*, or *Cape*, on the weft coaft of New-Mexico, is a rough head land, 8 leagues from the valley of Colima.—*Morse.*

TIAOGU, an ancient Indian town, about 150 miles up the Sufquehannah river.—*ib.*

TIBER *Creek*, a fmall ftream which runs foutherly through the city of Wafhington, and empties into Potowmac river. Its fource is 236 feet above the level of the tide in the creek; the waters of which and thofe of Reedy-Branch may be conveyed to the Prefident's houfe, and to the capitol.—*ib.*

TIBERIAS (anc. geog.), the laft town of Galilee, fituated on the fouth fide of the lake Tiberias; built by Herod the Tetrarch, and called *Tiberias* in honour of the Emperor Tiberius; diftant 30 ftadia from Hippus, 60 from Gadara, and 120 from Scythopolis: whence it appears to have been at no great diftance from where the Jordan runs out of the lake. It is a number of times mentioned by St John the Evangelift. Pliny places it on the weft extremity of the lake, commending the falubrity of its hot waters. Jerome fays, the ancient name was *Chennereth*; which, if true, will account for the name of the lake.

TIBERON, *Cape*, a round black rock on the S. W. part of the fouthern peninfula of the ifland of St Domingo, and forms the N. W. limit of the bay of Tiberon.—*Morse.*

Tiberon, or *Tiburon*, a bay and village on the S. W. part of the ifland of St Domingo. The bay is formed by the cape of its name on the N. W. and Point Burgau on the S. E. a league and three-fourths apart. The ftream called a river, falls in at the head of the bay, on the weftern fide of the village; which ftands on the high-road, and, according to its courfe along the fea-fhore, 10 leagues fouth of Cape Dame Marie, 20 from Jeremie, and 32 by the winding of the road from Les Cayes. The cape is in lat. 18 20 30 N. and in long. 76 52 40 W. The exports from Cape Tiberon, from Jan. 1, 1789, to Dec. 31, of the fame year, were 1000lbs white fugar—377,800lbs brown fugar—600,002lbs coffee—13,672lbs cotton—1,088lbs indigo—and fmall articles to a confiderable amount. Total value of duties on exportation, 2,465 dollars 76 cents. —*ib.*

Tiberon, a fort, near the town or village above mentioned; taken by the French, the 21ft March, 1795. —*ib.*

TICKLE *Harbour*, on the eaft coaft of Newfoundland, fifteen leagues from Bonaventura Port.—*ib.*

Tickle *Me Quickly*, a name given by Britifh feamen to a fine, little, fandy bay of Terra Firma, on the Ifthmus of Darien, at the N. W. end of a reef of rocks, having good anchorage and fafe landing. The extremity of the rocks on one fide, and the Samballas Iflands (the range of which begins from hence) on the other fide, guard it from the fea, and fo form a very good harbour. It is much frequented by privateers.—*ib.*

TICONDEROGA, in the State of New-York, built by the French in the year 1756, on the north fide of a peninfula formed by the confluence of the waters iffuing from Lake George into Lake Champlain. It is now a heap of ruins, and forms an appendage to a farm. Its name fignifies *Noify*, in the Indian language, and was called by the French *Corillor*. Mount Independence, in Addifon county, Vermont, is about 2 miles S. E. of it, and feparated from it by the narrow ftrait which conveys the waters of Lake George and South river into Lake Champlain. It had all the advantages that art or nature could give it, being defended on 3 fides by water furrounded by rocks, and on half of the fourth by a fwamp, and where that fails, the French erected a breaft-work 9 feet high. This was the firft fortrefs attacked by the Americans during the revolutionary war. The troops under General Abercrombie were defeated here in the year 1758, but it was taken the year following by Gen. Amherft. It was furprifed by Cols. Allen and Arnold, May 10, 1775, and was retaken by Gen. Burgoyne in July, 1777.—*ib.*

Tierra *Auftral del Efpiritu Santo*, called by Bougainville,

(A) In the terrible thunder ftroke on Leven Houfe in Scotland, the two great ftreams of electricity had taken the courfe of the vents which had been moft in ufe, but not to get at the iron work, for it had branched off from the vents, at a great diftance from the bottom. The chief conductors through the building had been various gilded mouldings, gilded leather hangings, gilded fcreens, picture frames, and the foil of mirrors. In this progrefs the fteps have been fo many, and fo capricious, that no line of progrefs can be traced, according to any principle. The thunder feems to have electrified at once the whole of the leaden roof, and, befides the two main tracks along the vents, to have afterwards darted at every metal thing in its way. The loweft point of the track was a leaden water ciftern; which, however, received no damage; but a thick ftone wall was burft through to get at it.

ville, *The Archipelago of the Great Cyclades*, and by Capt. Cook, *The New Hebrides*, may be confidered as the eaftern extremity of the vaft Archipelago of *New Guinea*. Thefe iflands are fituated between the latitudes of 14 29 and 20 4 S. and between 169 41 and 170 21 E. long. from Greenwich, and confift of the following iflands, fome of which have received names from the different European navigators, and others retain the names which they bear among the natives; viz. Tierra Auftral del Efpiritu Santo, St Bartholomew, Mallicollo, Pic de l'Etoile, Aurora, Ifle of Lepers, Whitfuntide, Ambrym, Paoon, Shepherds Ifles, Sandwich, Erromango, Immer, Tanna, Erronan, Annatom, Apee, Three Hills, Montagu, Hinchinbrook, and Erromanga. Quiros, who firft difcovered thefe iflands, in 1606, defcribes them, as "richer and more fertile than Spain, and as populous as they are fertile; watered with fine rivers, and producing filver, pearls, nutmegs, mace, pepper, ginger, ebony of the firft quality, wood for the conftruction of veffels, and plants which might be fabricated into fail-cloth and cordages, one fort of which is not unlike the hemp of Europe." The inhabitants of thefe iflands, he defcribes, as of feveral different races of men; black, white, mulatto, tawny, and copper-coloured; a proof, he fuppofes, of their intercourfe with various people. They ufe no fire arms, are employed in no mines, nor have they any of thofe means of deftruction which the genius of Europe has invented. Induftry and policy feem to have made but little progrefs among them: they build neither towns nor fortreffes; acknowledge neither king nor laws, and are divided only into tribes, among which there does not always fubfift a perfect harmony. Their arms are the bow and arrows, the fpear and the dart, all made of wood. Their only covering is a garment round the waift, which reaches to the middle of the thigh. They are cleanly, of a lively and grateful difpofition, capable of friendfhip and inftruction. Their houfes are of wood, covered with palm leaves. They have places of worfhip and burial. They work in ftone, and polifh marble, of which there are many quarries. They make flutes, drums, wooden fpoons, and from the mother of pearl, form chiffels, fciffars, knives, hooks, faws, hatchets, and fmall round plates for necklaces. Their canoes are well built and neatly finifhed. Hogs, goats, cows, buffaloes, and various fowls and fifh, for food are found in abundance on and about thefe iflands. Added to all thefe and many other excellencies thefe iflands are reprefented as having a remarkably falubrious air, which is evinced by the healthy, robuft appearance of the inhabitants, who live to a great age, and yet have no other bed than the earth. Such is the defcription which Quiros gives of thefe iflands in and about which he fpent fome months, and which he reprefents to the king of Spain as "the moft delicious country in the world; the garden of Eden, the inexhauftible fource of glory, riches, and power to Spain." On the north fide of the largeft of thefe iflands, called *Efpiritu Santo*, is a bay, called *San Felipe* and *Sant-Yago*, which, fays Quiros, "penetrates 20 leagues into the country; the inner part is all fafe, and may be entered with fecurity, by night as well as by day. On every fide, in its vicinity, many villages may be diftinguifhed, and if we may judge by the fmoke which rifes by day, and the fires that are feen by night, there are many more in the interior parts." The harbour in this bay, was named by Quiros, *La Vera Cruz*, and is a part of this bay, and large enough to admit 1000 veffels. The anchorage is on an excellent bottom of black fand, in water of different depths, from 6 to 40 fathoms, between two fine rivers.—*ib.*

TIERRA del Fuego, feveral iflands at the fouthern extremity of America. They take their name from a volcano on the largeft of them. They are all very barren and mountainous; but from what Mr Forfter fays, in his Voyage to the South Sea, the climate does not appear to be fo rigorous and tempeftuous as it is reprefented in Anfon's Voyage. Upon the lower grounds and iflands, that were fheltered by the high mountains, Mr Forfter found feveral forts of trees and plants, and a variety of birds. Among the trees was Winter's bark-tree, and a fpecies of *arbutus*, loaded with red fruit of the fize of fmall cherries, which were very well tafted. In fome places there is alfo plenty of celery. Among the birds was a fpecies of duck, of the fize of a goofe, which ran along the fea with amazing velocity, beating the water with its wings and feet. It had a gray plumage, with a yellow bill and feet, and a few white quill-feathers. At the Falkland Iflands it is called a *loggerhead-duck*. Among the birds are alfo plenty of geefe and falcons. The rocks of fome of the iflands are covered with large mufcle-fhells, the fifh of which is well flavoured. The natives of this country are fhort in their perfons, not exceeding five feet fix inches at moft, their heads large, their faces broad, their cheek bones prominent, and their nofes flat. They have little brown eyes, without life; their hair is black and lank, hanging about their heads in diforder, and befmeared with train-oil. On the chin they have a few ftraggling fhort hairs inftead of a beard. The whole affemblage of their features forms the moft loathfome picture of mifery to which human nature can poffibly be reduced. Thofe which Mr Forfter faw had no other clothing than a fmall piece of feal fkin, which hung from their fhoulders to the middle of their back, being faftened round the neck with a ftring: the reft of their body was perfectly naked. Their natural colour feems to be an olive brown, with a kind of glofs, refembling that of copper; but many of them difguife themfelves with ftreaks of red paint, and fometimes, though feldom, with white. Their whole character is a ftrange compound of ftupidity, indifference, and inactivity. They have no other arms than bows and arrows; and their inftruments for fifhing are a kind of fifh-gigs. They live chiefly on feals flefh, and like the fat oily part moft. There is no appearance of any fubordination among them; and their mode of life approaches nearer to that of brutes than that of any other nation.

TIGNARES, the chief town of the captainfhip of Rio Grande in Brazil.—*Morse.*

TILLANDSIA, the large barren wild pine of the Weft Indies; a genus of the monogynia order, belonging to the hexandria clafs of plants. It is called *Caragatua* by Father Plumier, and is a parafitic plant, and ought perhaps, in ftrict propriety, to be denominated an *aquatic*: for although it is fufpended in the air among the branches of lofty trees, to whofe boughs it is faftened by its numerous roots; yet it is not indebted to thofe boughs, like the miffletoe and other parafitic plants, for nourifhment, but merely for fupport; provident Nature having, in a very extraordinary manner, fupplied this with other means to preferve its exiftence:

For

For the leaves, which much resemble those of the pine-apple, but are larger, surround this plant in a circular manner; each leaf being terminated near the stalk with a hollow bucket, which contains about half a pint of water. It is by these numerous small reservoirs of water that the roots, as well as every other part of this plant, are supplied with nourishment without the help of any earth. The flourishing condition of this plant, as well as the great growth of fig-trees, upon barren rocks, shews that water is of greater use to vegetation than earth.

One contrivance of Nature in this vegetable, says Dr Sloane, is truly admirable. The seed is crowned with many long downy threads, not only that it may be carried every where by the wind, but that by those threads, when driven through the boughs, it may be held fast, and stick to the arms and prominent parts of the barks of trees. So soon as it sprouts or germinates, although it be on the under part of a bough, its leaves and stalks rise perpendicular or erect: if they assumed any other direction, the cistern or reservoir just mentioned, made of the hollow leaves, could not hold water, which is necessary to the life and nourishment of the plant. In scarcity of water this reservoir is useful, not to the plant only, but to men, and even to birds and all sorts of insects, which come thither in troops, and seldom go away without refreshment.

To the same purpose, Dampier, in his voyage to Campeachy relates, "that the wild pine has leaves that will hold a pint and an half or quart of rain-water, which refreshes the leaves, and nourishes the roots. When we find these pines, we stick our knives into the leaves, just above the root; and the water gushing out we catch it in our hats, as I myself have frequently done, to my great relief."

TIMÆUS, a Greek historian, the son of Andronicus, who was eminent for his riches and excellent qualities, was born at Tauromenium in Sicily, and flourished in the time of Agathocles. He wrote several books, and among the rest an history of his own country; but they are all lost.

Timæus, a famous Pythagorean philosopher, was born at Locres in Italy, and lived before Plato. There is still extant a small treatise of his on Nature and the Soul of the World, written in the Doric dialect. This treatise, which is to be found in the works of Plato, furnished that great Philosopher with the subject of his treatise intitled *Timæus*.

TIMMISKAMAIN *Lake*, in Lower Canada, is about 30 miles long and 10 broad, having several small islands. Its waters empty into Utawas river, by a short and narrow channel, 30 miles N. of the N. part of Nepissing lake. The Indians named Timmiscamaings reside round this lake.—*Morse*.

TINICUM, two townships of Pennsylvania; the one in Buck's county, the other in that of Delaware.—*ib.*

TINKER'S *Island*, one of the Elizabeth Islands, on the coast of Massachusetts, off Buzzard's Bay, 8 miles from the main land of Barnstable county. It is the second in magnitude, and the middle one of the 3 largest. It is about 3 miles long from north to south, and about a mile and a half broad from east to west; and between this and Nashawn Island is a channel for sloops and small vessels, as there is also between it and Slocum's Island, about a mile farther to the westward.—*ib.*

TINMOUTH, a township of Nova-Scotia on the eastern coast. It was formerly called Pictou, and lies about 40 miles from Truro.—*ib.*

Tinmouth, a township of Vermont, Rutland county, and contains 935 inhabitants.—*ib.*

TINNING, the covering or lining of any thing with melted tin, or with tin reduced to a very fine leaf. Looking-glasses are foliated or *tinned* with thin plates of beaten tin, by a process described under the title Foliating, *Encycl.*

Kettles, sauce-pans, and other kitchen utensils, which are usually made of copper, are tinned by the following process: The surface to be tinned, if of new copper, should first be cleaned or scoured with salt and sulphuric acid (vitriolic acid) diluted with water. This, however, is not always done; some workmen contenting themselves with scouring it with sand perfectly dry, or with scales of iron. Powdered rosin is then strewed over it; and when the vessel or utensil is considerably heated, melted tin is poured into it, and rubbed with flax coiled hard over the surface to be coated. This tin may be either pure, such as that known by the name of *grain-tin*; or a composition consisting of two parts of tin and one of lead. For very obvious reasons, we should certainly prefer the pure tin; but the generality of workmen give the preference to the composition, because the surface coated with it appears more brilliant. The tin is not always put into the vessel in a liquid state; for some workmen strew it in small pieces over the surface to be coated, and then heat the vessel till the tin melt, when they rub it as formerly.

In tinning old vessels which have been tinned before, the process is somewhat different. In these cases, the surface is first scraped with an instrument proper for the purpose, or scoured with the scales of iron, which may be always found in a blacksmith's shop: it is then strewed over with sal ammoniac in powder, instead of rosin, or an infusion of sal ammoniac in stale urine is boiled in it till the urine be evaporated, and it is then tinned with pure tin; the composition of tin and lead being in this case never used. The tin, while liquid, is rubbed into the surface with a piece of sal ammoniac, instead of a bundle of flax. When iron vessels are to be tinned, they are first cleaned with muriatic acid, after which the process is the same as in the tinning of old copper.

In the year 1785, Mr John Poulain of Mortlake, Surry, obtained a patent for the discovery of a new composition for tinning vessels, especially such as are used for culinary purposes. This composition consists of grain-tin one pound, good malleable iron one ounce and a half, platinum one drachm, silver one penny-weight, gold three grains; the whole must be well fused together in a crucible, with one ounce of pounded borax, and two ounces of pounded glass, and then cast in small ingots. The composition, to be fit for use, must be heated and put in a metal mortar, also heated over a fire, and well pounded with a heated metal pestle; when it is well pounded, make an ingot of it, by putting it on the fire in a mould made of iron plate, in which mould the composition must be well stirred and let to cool; then it is fit for use. To apply the composition, first tin the utensil or vessel with grain-tin and sal ammoniac, as is usually done in the common way of tinning; clean well the tinned part of the metal utensil or vessel,

vessel, and then apply a coat of the composition with sal ammoniac, as is usually done in the common way of tinning; and when the composition is well spread, let it cool; then make it a little red-hot in all its parts, to neal it, and plunge the metal utensil or vessel, while yet hot, in cold water; then, with a sharp scraper, scrape and rub off the rough or grumous particles of the composition applied on the metal utensil or vessel, and scour it well with sand. The same operation must be repeated for every coat of the composition that is applied; two coats of the composition are quite sufficient for culinary utensils or vessels, and a thin coat of grain tin may be applied over the last coat of the composition, to smooth it. The author adds, that his composition may be employed for covering or plating the surfaces of all materials made of copper, brass, iron, and other metals or mixtures of metals, and that it should be applied with a charcoal fire in preference to any other fire. All this may be true, and it may be a very valuable coating to copper; but the scarcity, high price, and infusibility of platinum, must for ever prevent it from coming into very general use.—We think that even the *Enamelling of Vessels for the Kitchen* must be more common. See that article in this *Supplement*.

The following process is less expensive, whilst the coating given by it is exceedingly durable, adds strength to the copper vessel, and secures it much longer than the common tinning from the action of acids:

When the vessel has been prepared and cleaned in the usual manner, it must be roughened on the inside by being beat on a rough anvil, in order that the tinning may hold better, and be more intimately connected with the copper. The process of tinning must then be begun with perfectly pure grained tin, having an addition of sal ammoniac instead of the common colophonium or resin. Over this tinning, which must cover the copper in an even and uniform manner throughout, a second harder coat must be applied, as the first forms only a kind of medium for connecting the second with the copper. For this second tinning you employ pure grained tin mixed with zinc in the proportion of two to three, which must be applied also with sal ammoniac smooth and even, so that the lower stratum may be entirely covered with it. This coating, which, by the addition of the zinc, becomes pretty hard and solid, is then to be hammered with a smoothing hammer, after it has been properly rubbed and scoured with chalk and water; by which means it becomes more solid, and acquires a smooth compact surface.

Vessels and utensils may be tinned in this manner on both sides. In this case, after being exposed to a sufficient heat, they must be dipped in the fluid tin, by which means both sides will be tinned at the same time.

As this tinning is exceedingly durable, and has a beautiful colour, which it always retains, it may be employed for various kinds of metal instruments and vessels which it may be necessary to secure from rust.

TINPLATE, called in Scotland *White-iron*, is a thin plate of iron covered with tin, to which it is united by chemical affinity. See Chemistry, n° 122. *Suppl.*

TINSIGNAL, a rich silver mine in the province of Costa Rica.—*Morse.*

TINTA, a jurisdiction in the empire of Peru; wherein is the famous silver mine called Condonoma.—*ib.*

TINTAMARE, a river of Nova-Scotia, which is navigable 3 or 4 miles up for small vessels.—*ib.*

TINTO, a river of Terra Firma, 20 leagues to the east of Cape Honduras.—*ib.*

TIOGA, a township of Pennsylvania, in Luzerne county.—*ib.*

Tioga, a county of New York, bounded east by Otsego, west by Ontario, north by Onondago, and south by the State of Pennsylvania. It contains the towns of Newtown, Union, Chemung, Owego, Norwich, Jerico, and Chenengo, in which are 1,165 electors, according to the State census of 1796. The courts of common pleas and general sessions of the peace for the county are held on the first Tuesdays in May, October, and February, in every year, alternately at Chenengo, in the town of Union, and at Newtown Point, in the town of Chemung. Some curious bones have been dug up in this county. About 12 miles from Tioga Point, the bone or horn of an animal was found, 6 feet 9 inches long; 21 inches round, at the long end, and 15 inches at the small end. It is incurvated nearly to an arch of a large circle. By the present state of both the ends, much of it must have perished; probably 2 or 3 feet from each end.—*ib.*

Tioga *Point*, the point of land formed by the confluence of Tioga river with the east branch of Susquehannah river. It is about $5\frac{1}{2}$ miles southerly from the line which divides New-York State from Pennsylvania, and is about 150 miles N. by W. of Philadelphia, and 20 S. E. of Newtown. The town of Athens stands on this point of land.—*ib.*

Tioga *River*, a branch of the Susquehannah, which rises in the Alleghany Mountains in about lat. 42, and running eastwardly, empties into the Susquehannah at Tioga Point, in lat. 41 57. It is navigable for boats about 50 miles. There is said to be a practicable communication between the southern branch of the Tioga, and a branch of the Alleghany, the head waters of which are near each other. The Seneca Indians say they can walk 4 times in a day from the boatable waters of the Alleghany, to those of the Tioga, at the place now mentioned.—*ib.*

TIOOKEA, an Island in the South Pacific Ocean, one of those called George's Islands. S. lat. 14 27, W. long. 144 56.—*ib.*

TIPRA, the name of certain mountainous districts to the eastward of Bengal, inhabited by a people of very singular manners. As every thing which contributes a single fact to the history of human nature is interesting to the philosopher, the reader will be pleased with the following account of the religion, laws, and manners of these people, taken from the 2d volume of the *Asiatic Researches.*

Though they acknowledge one Creator of the universe, to whom they give the name of Pa'tiya'n, they believe that a deity exists in every tree, that the sun and moon are gods, and that whenever they worship those subordinate divinities Pátiyán is pleased. This is very similar to the religious creed of ancient Greece and Rome, differing only with respect to creation, which, in the proper sense of the word, the Greeks and Romans seem not to have admitted.

If any one of these mountaineers, called in the memoir Cucis, put another to death, the chief of the tribe, or other persons who bear no relation to the deceased, ceafed, have no concern in punifhing the murderer; but if the murdered perfon have a brother or other heir, he may take blood for blood; nor has any man whatever a right to prevent or oppofe fuch retaliation.

When a man is detected in the commiffion of theft or other atrocious offence, the chieftain caufes a recompenfe to be given to the complainant, and reconciles both parties; but the chief himfelf receives a cuftomary fine, and each party gives a feaft of pork or other meat to the people of his refpective tribe.

In ancient times, it was not a cuftom among them to cut off the heads of the women whom they found in the habitations of their enemies; but it happened once that a woman afked another, why fhe came fo late to her bufinefs of fowing grain? fhe anfwered, that her hufband was gone to battle, and that the neceffity of preparing food and other things for him had occafioned her delay. This anfwer was overheard by a man at enmity with her hufband; and he was filled with refentment againft her, confidering, that as fhe had prepared food for her hufband for the purpofe of fending him to battle againft his tribe, fo in general, if women were not to remain at home, their hufbands could not be fupplied with provifion, and confequently could not make war with advantage. From that time it became a conftant practice to cut off the heads of the enemy's women, efpecially if they happen to be pregnant, and therefore confined to their houfes: and this barbarity is carried fo far, that if a Cuci affail the houfe of an enemy, and kill a woman with child, fo that he may bring two heads, he acquires honour and celebrity in his tribe, as the deftroyer of two foes at once.

As to the marriages of this wild nation, when a rich man has made a contract of marriage, he gives four or five head of *gayáls* (the cattle of the mountains) to the father and mother of the bride, whom he carries to his own houfe: Her parents then kill the *gayáls*; and having prepared fermented liquors and boiled rice with other eatables, invite the father, mother, brethren, and kindred of the bridegroom to a nuptial entertainment. When a man of fmall property is inclined to marry, and a mutual agreement is made, a fimilar method is followed in a lower degree; and a man may marry any woman except his own mother. If a married couple live cordially together, and have a fon, the wife is fixed and irremoveable; but if they have no fon, and efpecially if they live together on bad terms, the hufband may divorce his wife, and marry another woman.

They have no idea of heaven or hell, the reward of good, or the punifhment of bad, actions; but they profefs a belief, that when a perfon dies, a certain fpirit comes and feizes his foul, which he carries away; and that whatever the fpirit promifes to give at the inftant when the body dies, will be found and enjoyed by the dead; but that if any one fhould take up the corfe and carry it off, he would not find the treafure.

The food of this people confifts of elephants, hogs, deer, and other animals; of which if they find the carcafes or limbs in the forefts, they dry them, and eat them occafionally.

When they have refolved on war, they fend fpies before hoftilities are begun, to learn the ftations and ftrength of the enemy, and the condition of the roads; after which they march in the night, and two or three hours before daylight make a fudden affault with fwords, lances, and arrows: if their enemies are compelled to abandon their ftation, the affailants inftantly put to death all the males and females, who are left behind, and ftrip the houfes of all their furniture; but fhould their adverfaries, having gained intelligence of the intended affault, be refolute enough to meet them in battle, and fhould they find themfelves overmatched, they fpeedily retreat and quietly return to their own habitations. If at any time they fee a ftar very near the moon, they fay, "to-night we fhall undoubtedly be attacked by fome enemy;" and they pafs that night under arms with extreme vigilance. They often lie in ambufh in a foreft near the path, where their foes are ufed to pafs and repafs, waiting for the enemy with different forts of weapons, and killing every man or woman who happens to pafs by: in this fituation, if a leech, or a worm, or a fnake, fhould bite one of them, he bears the pain in perfect filence; and whoever can bring home the head of an enemy, which he has cut off, is fure to be diftinguifhed and exalted in his nation. When two hoftile tribes appear to have equal force in battle, and neither has hopes of putting the other to flight, they make a fignal of pacific intentions, and, fending agents reciprocally, foon conclude a treaty; after which they kill feveral head of *gayáls*, and feaft on their flefh, calling on the fun and moon to bear witnefs of the pacification: but if one fide, unable to refift the enemy, be thrown into diforder, the vanquifhed tribe is confidered as tributary to the victors; who every year receive from them a certain number of *gayáls*, wooden difhes, weapons, and other acknowledgments of vaffalage. Before they go to battle, they put a quantity of roafted *álus* (efculent roots like potatoes), and pafte of rice-flour, into the hollow of bamboos, and add to them a provifion of dry rice with fome leathern bags full of liquor: then they affemble, and march with fuch celerity, that in one day they perform a journey ordinarily made by letter-carriers in three or four days, fince they have not the trouble and delay of dreffing victuals. When they reach the place to be attacked, they furround it in the night, and at early dawn enter it, putting to death both young and old, women and children, except fuch as they choofe to bring away captive: they put the heads, which they cut off, into leathern bags; and if the blood of their enemies be on their hands, they take care not to wafh it off. When after this flaughter they take their own food, they thruft a part of what they eat into the mouths of the heads which they have brought away, faying to each of them, "Eat, quench thy thirft, and fatisfy thy appetite; as thou haft been flain by my hand, fo may thy kinfmen be flain by my kinfmen!" During their journey, they have ufually two fuch meals; and every watch, or two watches, they fend intelligence of their proceedings to their families. When any one of them fends word that he has cut off the head of an enemy, the people of his family, whatever be their age or fex, exprefs great delight, making caps and ornaments of red and black ropes; then filling fome large veffels with fermented liquors, and decking themfelves with all the trinkets they poffefs, they go forth to meet the conqueror, blowing large fhells, and ftriking plates of metal, with other rude inftruments of mufic. When both parties are met, they fhow extravagant joy, men and women dancing and finging together; and if a married man has brought an enemy's

Tipra.

enemy's head, his wife wears a head drefs with gay ornaments, the hufband and wife alternately pour fermented liquor into each other's mouths, and fhe wafhes his bloody hands with the fame liquor which they are drinking. Thus they go revelling, with exceffive merriment, to their place of abode; and having piled up the heads of their enemies in the court yard of their chieftain's houfe, they fing and dance round the pile; after which they kill fome *gayáls* and hogs with their fpears; and having boiled the flefh, make a feaft on it, and drink the fermented liquor. The richer men of this race faften the heads of their foes on a bamboo, and fix it on the graves of their parents, by which act they acquire great reputation. He who brings back the head of a flaughtered enemy, receives prefents from the wealthy of cattle and fpirituous liquor; and if any captives are brought alive, it is the prerogative of thofe chieftains, who were not in the campaign, to ftrike off the heads of the captives. Their weapons are made by particular tribes; for fome of them are unable to fabricate inftruments of war.

In regard to their civil inftitutions; the whole management of their houfehold affairs belongs to the women; while the men are employed in clearing forefts, building huts, cultivating land, making war, or hunting game and wild beafts. Five days (they never reckon by months or years) after the birth of a male child, and three days after that of a female, they entertain their family and kinfmen with boiled rice and fermented liquor; and the parents of the child partake of the feaft. They begin the ceremony with fixing a pole in the court yard; and then killing a *gayál* or a hog with a lance, they confecrate it to their deity; after which all the party eat the flefh and drink liquor, clofing the day with a dance and with fongs. If any one among them be fo deformed, by nature or by accident, as to be unfit for the propagation of his fpecies, he gives up all thought of keeping houfe, and begs for his fubfiftence, like a religious mendicant, from door to door, continually dancing and finging. When fuch a perfon goes to the houfe of a rich and liberal man, the owner of the houfe ufually ftrings together a number of red and white ftones, and fixes one end of the ftring on a long cane, fo that the other end may hang down to the ground; then, paying a kind of fuperftitious homage to the pebbles, he gives alms to the beggar; after which he kills a *gayál* and a hog, and fome other quadrupeds, and invites his tribe to a feaft: the giver of fuch an entertainment acquires extraordinary fame in the nation, and all unite in applauding him with every token of honour and reverence.

When a *Cúcì* dies, all his kinfmen join in killing a hog and a *gayál;* and, having boiled the meat, pour fome liquor into the mouth of the deceafed, round whofe body they twift a piece of cloth by way of fhroud: all of them tafte the fame liquor as an offering to his foul; and this ceremony they repeat at intervals for feveral days. Then they lay the body on a ftage, and kindling a fire under it, pierce it with a fpit and dry it; when it is perfectly dried, they cover it with two or three folds of cloth, and, enclofing it in a little cafe within a cheft, bury it under ground. All the fruits and flowers that they gather within a year after the burial they fcatter on the grave of the deceafed: but fome bury their dead in a different manner; covering them firft with a fhroud, then with a mat of woven reeds, and hanging them on a high tree. Some, when the flefh is decayed, wafh the bones, and keep them dry in a bowl, which they open on every fudden emergence; and, fancying themfelves at a confultation with the bones, purfue whatever meafures they think proper; alleging that they act by the command of their departed parents and kinfmen. A widow is obliged to remain a whole year near the grave of her hufband; where her family bring her food: if fhe die within the year, they mourn for her; if fhe live, they carry her back to her houfe, where all her relations are entertained with the ufual feaft of the *Cúcis*.

Tirefias, || Tifcan.

If the deceafed leave three fons, the eldeft and the youngeft fhare all his property; but the middle fon takes nothing: if he have no fons, his eftate goes to his brothers; and if he have no brothers, it efcheats to the chief of the tribe.

TIRESIAS, a famous foothfayer of antiquity, was the fon of Everes and the nymph Chariclo. Pherecydes fays, that Minerva being accidentally feen by Tirefias, as fhe was bathing with Chariclo in the fountain of Hippocrene, the goddefs was enraged, and declared that he fhould fee nothing more: on which he inftantly loft his fight; but afterwards received from the goddefs fuperior endowments. Others fay, that Juno ftruck him ftone-blind for deciding a cafe between Jupiter and her, to her diffatisfaction; for which Jupiter gave him the faculty of divination: He was the moft celebrated prophet in the Grecian annals. Ulyffes is ordered by Circe to confult him in the fhades.

> There feek the Theban bard depriv'd of fight,
> Within irradiate with prophetic light.

But, befides the honour done to him by Homer, Sophocles makes him act a venerable and capital part in his tragedy of Oedipus. Callimachus afcribes to Minerva the gift of his fuperior endowments; the pre-eminence of his knowledge is likewife mentioned by Tully in his firft book of Divination. And not only Tirefias is celebrated by Diodorus Siculus, but his daughter Daphne, who, like her father, was gifted with a prophetic fpirit, and was appointed prieftefs at Delphos. She wrote many oracles in verfe, from whence Homer was reported to have taken feveral lines, which he interwove in his poems. As fhe was often feized with a divine fury, fhe acquired the title of *fibyl*, which fignifies "enthufiaft." She is the firft on whom it was beftowed: in aftertimes this denomination was given to feveral other females that were fuppofed to be infpired, and who uttered and wrote their predictions in verfe; which verfe being fung, their function may be juftly faid to unite the priefthood with prophecy, poetry, and mufic.

TISBURY, a fmall fifhing town on the fouth fide of the ifland of Martha's Vineyard, 9 miles from Chilmark, and 97 from Bofton. The townfhip was incorporated in 1671, and contains 1142 inhabitants. It is in Duke's county, Maffachufetts, and in 1796 the eafterly part was incorporated into a feparate townfhip. —*Morse.*

TISCAN, a village of Ouenca, and department of Alanfis, in Quito, in South-America, which was entirely deftroyed by an earthquake, but the inhabitants efcaped, and removed to a fafer fituation. The marks of this dreadful convulfion of nature are ftill vifible.—*ib.*

TISRI, or Tizri, in chronology, the firft Hebrew month of the civil year, and the 7th of the ecclefiaftical or facred year. It anfwered to part of our September and October.

TITHING-Men, are now a kind of petty conftables, elected by parifhes, and fworn in their offices in the court-leet, and fometimes by juftices of the peace, &c. There is frequently a tithing-man in the fame town with a conftable, who is, as it were, a deputy to execute the office in the conftable's abfence; but there are fome things which a conftable has power to do, that tithing-men and head-boroughs cannot intermeddle with. When there is no conftable of a parifh, his office and the authority of a tithing-man feems to be all one under another name.

TITHONUS, in fabulous hiftory, the fon of Laomedon king of Troy, and the brother of Priamus; was beloved by Aurora, who carried him to Delos, thence to Ethiopia, and at laft to heaven, where fhe prevailed on the Deftinies to beftow upon him the gift of immortality: but forgot to add that of youth, which could only render the prefent valuable. At length Tithonus grew fo old that he was obliged to be rocked to fleep like an infant; when Aurora, not being able to put an end to his mifery by death, transformed him into a grafshopper; which renews its youth by cafting his fkin, and in its chirping retains the loquacity of old age.

TITICACA, an ifland of S. America, in the South Pacific Ocean, near the coaft of Peru.—*Morse.*

Titicaca, or *Chucuito*, a lake of Charcas, in Peru; and is the largeft of all the known lakes in S. America. It is of an oval figure, with an inclination from N. W. to S. E. and about 80 leagues in circuit. The water is, in fome parts, 70 or 80 fathoms deep. Ten or twelve large, befides a greater number of fmaller ftreams fall into it. The water of this lake, though neither falt nor brackifh, is muddy, and has fomething fo naufeous in its tafte, as not to be drank. One of the moft fplendid temples in the empire was erected on an ifland in this lake, by the Yncas. The Indians, on feeing the violent rapacity of the Spaniards, are thought to have thrown the immenfe collection of riches in the temple, into this lake. But thefe valuable effects were thrown into another lake, in the valley of Orcos, 6 leagues S. of Cufco, in water 23 or 24 fathoms deep. Towards the S. part of Titicaca Lake, the banks approach one another, fo as to form a kind of bay, terminating in a river, called El Defaguadero, or the drain; and afterwards forms the Lake of Paria, which has no vifible outlet. Over the river El Defaguadero ftill remains the bridge of rufhes, invented by Capac-Yupanqui, the fifth Ynca, for tranfporting his army to the other fide, in order to conquer the provinces of Collafuyo. The Defaguadero is here between 80 and 100 yards in breadth, flowing with a very impetuous current, under a fmooth, and, as it were, fleeping furface. The Ynca, to overcome this difficulty, ordered 4 very large cables to be made of a kind of grafs, which covers the lofty heaths and mountains of that country, and by the Indians called Ichu: fo that thefe cables were the foundation of the whole ftructure. Two of thefe being laid acrofs the water, fafcines of dry juneira, and totora, two fpecies of rufhes, were faftened together, and laid acrofs the cables. On this again the two other cables were laid, and covered with fimilar fafcines fecurely faftened on, but of a fmaller fize than the firft, and arranged fo as to form a level furface. And by this means the Ynca procured a fafe paffage for his army. This bridge of rufhes, which is about five yards broad, and one yard and a half above the furface of the water, is carefully repaired, or rebuilt, every fix months by the neighbouring provinces, in purfuance of a law made by that Ynca; and fince often confirmed by the kings of Spain, on account of its vaft ufe, it being the channel of intercourfe between thofe provinces on each fide the Defaguadero.—*ib.*

TITLE for orders, in the church of England, is an affurance of being employed and maintained as an officiating clergyman in fome cathedral or parochial church, or other place of Divine worfhip. And, by the 33*d Canon*, "no one is to be ordained but in order to be a curate or incumbent, or to have fome minifter's place in fome church, or except he be fellow, conduct, or chaplain, in fome college in one of the univerfities, or be mafter of arts of five years ftanding, and live there at his own coft." By the fame canon, the bifhop who ordains a clerk without title, is bound to keep him till he prefer him to fome ecclefiaftical living.

TIVERTON, a townfhip of Rhode-Ifland, in Newport county, having the eaftern Paffage and part of Mount Hope Bay on the W. and N. W. the State of Maffachufetts on the N. and E. and Little-Compton townfhip on the fouth. It contains 2,453 inhabitants, including 25 flaves. It is about 13 miles N. N. E. of Newport.—*Morse.*

TIZON, a river in the N. W. part of S. America, 600 miles from New-Spain. In a journey made thus far, in 1606, the Spaniards found fome large edifices, and met with fome Indians who fpoke the Mexican language, and who told them, that a few days journey from that river, towards the N. was the kingdom of Tollan, and many other inhabited places whence the Mexicans migrated. It is, indeed, confirmed by Mr Stewart, in his late travels, that there are civilized Indians in the interior parts of America. Beyond the Miffouri, he met with powerful nations who were courteous and hofpitable, and appeared to be a polifhed and civilized people, having regularly built towns, and enjoying a ftate of fociety not far removed from the European; and indeed to be perfectly equal wanted only iron and fteel.—*ib.*

TLASCALA, or *Los Angelos*, a province of New-Spain.—*ib.*

TOA, one of the two rivers, Bajamond being the other, which empty into the harbour of Porto Rico, in the ifland of that name in the Weft-Indies.—*ib.*

TOAHOUTU, one of the two fmall iflands to the N. eaftward of the S. end of Otaha Ifland, one of the Society Iflands, in the South Pacific Ocean.—*ib.*

TOAMENSING, two townfhips of Pennfylvania; the one in Montgomery county, the other in that of Northampton.—*ib.*

TOBY's *Creek*, an eaftern branch of Alleghany river, in Pennfylvania: its fouthern head water is called Little Toby's Creek. It runs about 55 miles in a W. S. W. and W. courfe, and enters the Alleghany about 20 miles below Fort Franklin. It is deep enough for batteaux for a confiderable way up, thence by a fhort portage to the W. branch of Sufquehannah, by which a good communication is formed between Ohio, and the eaftern parts of Pennfylvania.—*ib.*

TOCAYMA, a city of Terra Firma, and in New Granada.—*ib.*

TOD of wool, is mentioned in the ftatute 12 Carol. II. c. 32. as a weight containing 2 ftone, or 28 pounds.

TOGOSAHATCHEE *Creek*, a water of Oakmulgee river, in Georgia.—*Morse.*

TOLLAND, a county of Connecticut, bounded N. by the State of Maffachufetts, S. by New-London county, E. by Windham, and W. by Hartford county. It is fubdivided into 9 townfhips, and contains 13,106 inhabitants, including 47 flaves. A great proportion of the county is hilly, but the foil is generally ftrong and good for grazing.—*ib.*

TOLLAND, the chief town of the above county, was incorporated in 1715, and is about 18 miles N. E. of Hartford. It has a Congregational church, courthoufe, gaol, and 20 or 30 houfes, compactly built, in the centre of the town.—*ib.*

TOLU, a town of Terra Firma, S. America, with a harbour on a bay of the N. Sea. The famous balfam of the fame name comes from this place; 114 miles S. W. of Carthagena. N. lat. 9 36, W. long. 75 22.—*ib.*

TOMACO, a large river of Popayan, and Terra Firma, S. America, about 9 miles N. E. of Galla Ifle. About a league and a half within the river is an Indian town of the fame name, and but fmall, the inhabitants of which commonly fupply fmall veffels with provifions, when they put in here for refrefhment.—*ib.*

TOMAHAWK *Ifland*, on the eaft coaft of Patagonia, is 24 miles N. E. of Seal's Bay.—*ib.*

TOMBA *River*, on the coaft of Peru, is between the port of Hilo and the river of Xuly or Chuly. There is anchorage againft this river in 20 fathoms, and clean ground. Lat. 17 50 S.—*ib.*

TOMBIGBEE *River*, is the dividing line between the Creeks and Chactaws. Above the junction of Alabama and Mobile rivers, the latter is called the Tombigbee river, from the fort of Tombigbee, fituated on the weft fide of it, about 96 miles above the town of Mobile. The fource of this river is reckoned to be 40 leagues higher up, in the country of the Chickafaws. The fort of Tombigbee was captured by the Britifh, but abandoned by them in 1767. The river is navigable for floops and fchooners about 35 leagues above the town of Mobile: 130 American families are fettled on this river, that have been Spanifh fubjects fince 1783.—*ib.*

TOMBUCTOO, a large city in North Africa, and capital of a kingdom of the fame name. It has for fome years paft been the great object of European refearch, being one of the principal marts for that extenfive commerce which the Moors carry on with the Negroes. The hopes of acquiring wealth in this purfuit, and zeal for propagating their religion, have filled this extenfive city with Moors and Mahomedan converts; the king himfelf, and all the chief officers of ftate are Moors; and they are faid to be more fevere and intolerant in their principles than any other of the Moorifh tribes in this part of Africa. Mr Park was informed, by a venerable old Negro, that when he firft vifited Tombuctoo, he took up his lodging at a fort of public inn, the landlord of which, when he conducted him into his hut, fpread a mat on the floor, and laid a rope upon it; faying, "if you are a Muffulman, you are my friend, fit down; but if you are a Kafir, you are my flave; and with this rope I will lead you to market." The reigning fovereign of Tombuctoo, when Mr Park was in Africa, was named *Abu Abrahima.* He was reported to poffefs immenfe riches, and his wives and concubines were faid to be clothed in filk, and the chief officers of ftate live in confiderable fplendour. The whole expenfe of his government is defrayed by a tax upon merchandize, which is collected at the gates of the city.

Of that city very little is known with accuracy, as it has never been vifited by any European. It is the largeft on the Niger, Houffa only excepted; and probably contains from 60,000 to 80,000 inhabitants. In fome of the Gazetteers, its houfes are faid to be built in the form of bells; but they are probably fuch buildings as thofe of Sego, which fee in this *Supplement.* Tombuctoo, according to Major Rennel, is in 16° 30′ N. Lat. and 1° 33′ E. Long. from Greenwich.

TOMINA, a jurifdiction in the archbifhopric of La Plata in Peru. It begins about 18 leagues S. E. from the city of Plata; on its eaftern confines dwell a nation of wild Indians, called Chiriguanos. It abounds with wine, fugar and cattle.—*Morse.*

TOMISCANING, a lake of N. America, which fends its waters fouth eaftward through Ottawas river, into Lake St Francis in St Lawrence river. The line which feparates Upper from Lower Canada, runs up to this lake by a line drawn due north, until it ftrikes the boundary line of Hudfon's Bay, or New-Britain.—*ib.*

TOMPSONTOWN, a village of Pennfylvania, in Mifflin county, containing about a dozen houfes. It is 22 miles from Lewiftown.—*ib.*

TOM's *Creek*, in New-Jerfey, which feparates the towns of Dover and Shrewfbury.—*ib.*

TOMSOOK, in the language of Bengal, a bond.

TONDELO, a river at the bottom of the Gulf of Campeachy, in the S. W. part of the Gulf of Mexico; 15 miles due weft of St Annes, and 24 eaft of Guafickwalp. It is navigable for barges and other veffels of from 50 to 60 tons.—*Morse.*

TONEWANTO, the name of a creek and Indian town, in the north-weftern part of New-York. The creek runs a weftward courfe and enters Niagara river oppofite Grand Ifland, 8 miles N. of Fort Erie. It runs about 40 miles, and is navigable 28 miles from its mouth. The town ftands on its S. fide, 18 miles from Niagara river. Alfo the Indian name of Fifhing Bay, on Lake Ontario.—*ib.*

TONGATABOO, one of the Friendly Iflands, in the S. Pacific Ocean, about 60 miles in circuit, but rather oblong, and wideft at the E. end. It has a rocky coaft, except to the N. fide, which is full of fhoals and iflands, and the fhore is low and fandy. It furnifhes the beft harbour or anchorage to be found in thefe iflands. The ifland is all laid out in plantations, between which are roads and lanes for travelling, drawn in a very judicious manner for opening an eafy communication from one part of the ifland to another. S. lat. 21 9, W. long. 174 46. Variation of the needle, in 1777, was 9 53 E.—*ib.*

TONTI, an ifland at the mouth of Lake D'Urfe, at the eastern extremity of Lake Ontario, is within the British territories; 11 miles N. E. of Point au Goelans, and 12 W. of Grand Island, having several isles between it and the latter.—*ib.*

TONTI, or *Tonty*, a river which empties through the N. shore of Lake Erie; 22 miles W. by N. of Riviere a la Barbue.—*ib.*

TONTORAL, *Cape*, on the coast of Chili, in S. America, 15 leagues to the N. of Guasca, and in lat. 27 30 S.—*ib.*

TOOBAUAI, one of the Society Islands, in the S. Pacific Ocean, not more than 5 or 6 miles across in any part. S. lat. 23 25, W. long. 149 23.—*ib.*

TOOSCHCONDOLCH, an Indian village on the N. W. coast of N. America, of considerable importance in the fur-trade; situated on a point of land between two deep sounds. N. lat. 53 2, W. long. 131 30.—*ib.*

TOOTH-ACHE, a well known excruciating pain (see *Encycl.*), for the alleviation, and even the cure of which, many specifics have been offered to the public. Of one of the most extraordinary of these, there is an account, in a small work published at Florence in 1794, by professor Gerbi, who gives the description of an insect, a kind of *curculio*, which, from its property of allaying the tooth-ache, has received the epithet of *antiodontalgicus*, and which is found on a species of thistle, *carduus spinosissimus*. The flowers of this thistle, when analysed, gave the acid of galls, the muriatic acid, oxalat of lime, extractive matter, and a very little resin. On the bottom of the calyx, which supports the flowers, there are often found excrescences like the gall-nut, which are at first spheroidal, afterwards cylindric, and at length assume the figure of two hemispheres: they consist of the like component parts with the flowers, but contain more resin, and far more oxalat of lime; as the gall apple of the oak, according to the experiments of M. Branchi, which are here mentioned, contains more of the acid of galls than the bark and other parts of the oak, in which he could discover no sulphuric acid. The insect, according to the author's observations, eats not only the parenchyma, but also the vessels and fibres of the leaves. The egg, before the worm makes its appearance, is nourished by the sap of the plant, and of the above excrescences, in which it resides, by means of the attractive power that the egg possesses for certain vegetable juices and substances. The excrescences arise by the accumulation of a solid substance, which is precipitated from the nourishing juices of the thistle, diminished by nourishing the egg and the worm. This insect, the eggs of which are deposited in these excrescences, is, together with the *curculio* of the centaury, a new species. It is of a longish figure; covered below with short yellow hair, and above with golden yellow velvety spots. Its corslet is variegated with specks; and the covering of its wings with specks and stripes. It has a short proboscis, and shews some likeness to the *curculio villosus* of Geoffroy. Its larva represents a sort of ichneumon. By chemical analysis it exhibits some traces of common salt; by distillation with a strong dry heat, some volatile lixivious salts; and it contains besides these, some gelatinous, and a little sebaceous and slimy extractive matter. If about a dozen or fifteen of these insects, when in the state of larva, or even when come to perfection, be bruised and rubbed

slowly between the fore-finger and the thumb, until they have lost their moisture, and if the painful tooth, where it is hollow, be touched with that finger, the pain ceases sometimes instantaneously. This power or property the finger will retain for a year, even though it be often washed and used. A piece of shammoy leather will serve equally well with the finger. Of 629 experiments, 401 were attended with complete success. In two of these cases, the hollow teeth arose from some fault in the juices: in the rest they were merely local. If the gums are inflamed, the remedy is of no avail.

To the truth of this tale the reader will give what credit he pleases; but it is surely very difficult to believe, that a living finger, continually perspiring, can retain for a year the moisture imbibed from this insect. But it seems there are other insects which have the property of curing the tooth-ache; such as the *carabus chrysocephalus* of Rossi; the *carabus ferrugineus* of Fabricius; the *coccinella septem punctata* (the lady bird); the *chrysomela populi*, and the *chrysomela sanguinolenta*. It would appear, therefore, that this property belongs to various kinds of the *coleoptera*.

The idea of these insects being endowed with the property of curing the tooth-ache is not confined to Italy; for Dr Hirsch, dentist to the court of Weimar, asserts (*Verkundiger*, September 24, 1798) that he employed them with the happiest effect, except in some cases where his patients were females. He says, that he took that small insect, found commonly among corn, *coccinella septem punctata*, and bruised it between his fingers. He then rubbed the fingers with which he had bruised it, till they became warm at the points, and touched with them the unsound parts of the gums, as well as the diseased tooth. Dr Hirsch adds, that he made the same experiment a few days after with equal success, though he had not bruised a new insect with his fingers. He seems to think that, to ensure the efficacy of the process, the insect should be alive; because when dead, its internal parts, in which he presumes the virtue chiefly resides, become dried up, leaving only the wings and an empty shell; and therefore proposes to physicians to turn their attention to the finding out of some method for preserving the virtue of the insect so that its efficacy may be in full vigour throughout the year.

Besides these beetles, charcoal has been recommended as an anodyne in the tooth-ache; but whether it operates merely by filling the hollow of the tooth, and thereby preventing the access of atmospheric air to the nerve, or by any of its singular and hitherto unknown qualities, seems not to have been well ascertained.

TOOTOOCH, a small low island in Nootka Sound, on the N. W. coast of North-America, on the eastern side of which is a considerable Indian village; the inhabitants of which wear a garment apparently composed of wool and hair, mostly white, well fabricated, and probably by themselves.—*Morse.*

TOPIA, a mountainous, barren part of New-Biscay province in Mexico, North-America; yet most of the neighbouring parts are pleasant, abounding with all manner of provisions.—*ib.*

TOPSFIELD, a township of Massachusetts, Essex county, containing 780 inhabitants. It is 8 miles westerly of Ipswich, and 39 N. by E. of Boston.—*ib.*

TOPSHAM, a township of Vermont, in Orange county, Topſham, || Torelli.

county, weſt of Newbury, adjoining. It is watered by ſome branches of Wait's river, and contains 162 inhabitants.—*ib.*

Topsham, a townſhip of the Diſtrict of Maine, in Lincoln county, 32 miles in circumference, and more than 25 miles is waſhed by water. It is bounded on the N. W. by Little river; N. by Bowdoin and Bowdoinham; E. by Cathance and Merry Meeting Bay; S. and S. W. by Amariſcoggin river, which ſeparates it from Brunſwick in Cumberland county. The inhabitants amount to 826 ſouls, and they live in ſuch eaſy circumſtances, that none have ever been ſo poor as to ſolicit help from the pariſh. It was incorporated in 1764. A few Engliſh attempted to ſettle here in the end of the laſt, or beginning of the preſent century. Theſe were cut off by the natives. Some families ventured to ſettle in this hazardous ſituation in 1730; from which period, until the peace of 1763, the inhabitants never felt wholly ſecure from the natives. It is 37 miles S. by W. of Hallowell, and 156 N. by E. of Boſton; and is nearly in lat. 44 N. and long. 70 W. —*ib.*

TOR, a town of Aſia, in Arabia Petræa, ſeated on the Red Sea, with a good harbour, defended by a caſtle. There is a handſome Greek convent, in whoſe garden are fountains of bitter water, which they pretend are thoſe rendered ſweet by Moſes, by throwing a piece of wood into them. Some think that this town is the ancient Elana. E. Long. 31. 25. N. Lat. 28. 0.

TORBAY, a town on the eaſtern coaſt of Nova-Scotia; 22 miles S. W. of Roaring Bull Iſland, and 100 N. E. of Halifax.—*Morse.*

TORBEK, a village on the ſouth ſide of the ſouth peninſula of the iſland of St Domingo; 3 leagues N. W. of Avache Iſland.—*ib.*

TORELLI (Joſeph), was born at Verona on the 4th of November 1721. His father Lucas Torelli, who was a merchant, dying while young Torelli was but an infant, he was left entirely to the care of his mother Antonia Albertini, a Venetian lady of an excellent character. After receiving the firſt rudiments of learning, he was placed under the Ballerini, who, obſerving the genius of the boy, prevailed upon his mother to ſend him to complete his education at Patavia. Here he ſpent four years entirely devoted to ſtudy, all his other paſſions being abſorbed by his thirſt for knowledge.

The unſullied innocence of his life, and the prudence and gravity of his conduct, ſoon attracting the attention of his maſters, they not only commended him with eagerneſs, but performed to him the part of parents, converſed with him familiarly about their reſpective ſciences, and read over to him privately the lectures which they had to deliver. This was the caſe particularly with Hercules Dondinus, under whom Torelli ſtudied juriſprudence. But he by no means confined himſelf to that ſcience alone. The knowledge which he acquired was ſo general, that upon whatever ſubject the converſation happened to turn, he delivered his ſentiments upon it in ſuch a manner that one would have thought he had beſtowed upon it his whole attention.

After receiving the degree of Doctor, he returned home to the enjoyment of a conſiderable fortune; which putting it into his power to chooſe his own mode of living, he determined to devote himſelf entirely to literary purſuits. He reſolved, however, not to cultivate one particular branch to the excluſion of every other, but to make himſelf maſter of one thing after another, as his humour inclined him; and he was particularly attentive to lay an accurate and ſolid foundation. Though he declined practiſing as a lawyer, he did not on that account, relinquiſh the ſtudy of law. The Hebrew, Greek, Latin, and Italian languages, occupied much of his time. His object was to underſtand accurately the two firſt, and to be able to write and ſpeak the two laſt with propriety and elegance. Beſides theſe languages, he learned French, Spaniſh, and Engliſh. On the laſt, in particular, he beſtowed uncommon pains; for he was peculiarly attached to the Britiſh nation, and to Britiſh writers, whom he peruſed with the greateſt attention; not merely to acquire the language, but to imbibe alſo that force and loftineſs of ſentiment for which they are ſo remarkable. Nay, he even began an Italian tranſlation of Paradiſe Loſt.

He likewiſe made himſelf acquainted with ethics, metaphyſics, and polemical divinity; to which laſt ſubject he was induced to pay attention by the cuſtom of his country. With ancient hiſtory he was very familiarly acquainted, calling in to his aſſiſtance, while engaged in that ſtudy, the aids of chronology, geography, and criticiſm. This laſt art, indeed, by means of which what is counterfeit may be diſtinguiſhed from what is genuine, what is interpolated from what is uncorrupted, and what is excellent from what is faulty, he carried about with him as his counſellor and his guide upon all occaſions.

The theory of *muſic* he ſtudied with attention, preferring thoſe powerful airs which make their way into the ſoul, and rouſe the paſſions at the pleaſure of the muſician. His knowledge of *pictures* was held in high eſtimation by the artiſts themſelves, who were accuſtomed to aſk his opinion concerning the fidelity of the deſign, the harmony of colours, the value of the picture, and the name of the painter. He himſelf had a collection, not remarkably ſplendid indeed, but exceedingly well choſen. *Architecture* he ſtudied with ſtill greater attention, becauſe he conſidered it as of more real utility. Nor did he neglect the purſuits of the *antiquarian*, but made himſelf familiarly acquainted with coins, gems, medals, engravings, antique veſſels, and monuments. Indeed ſcarce any monumental inſcriptions were engraved at Verona which he had not either compoſed or corrected. With the *antiquities* of his own country he was ſo intimately acquainted, that every perſon of eminence, who viſited Verona, took care to have him in their company when they examined the curioſities of the city.

But theſe purſuits he conſidered merely as amuſements; mathematics and the belles-lettres were his ſerious ſtudies. Theſe ſtudies are, in general, conſidered as incompatible; but Torelli was one of the few who could combine the gravity of the mathematician with the amenity of the muſes and graces, and who handle the compaſs and the plectrum with equal ſkill. Of his progreſs in mathematics, ſeveral of his treatiſes, and eſpecially his edition of Archimedes, publiſhed ſince his death by the univerſity of Oxford, are ſufficient proofs. Nor was his progreſs in the more pleaſing parts of literature leſs diſtinguiſhed. In both theſe ſtudies he was partial to the ancients, and was particularly hoſtile to the poetry and the literary innovations of the French.

Nothing

Torelli, Tormentin Cape, ‖ Torpedo.

Nothing could be purer or more elegant than his Latin ftyle, which he had acquired at the expenfe of much time and labour. His Latin tranflation of Archimedes is a fufficient proof of this, and is indeed really wonderful, if we confider that the Romans, being far inferior to the Greeks in mathematical knowledge, their language was of neceffity deftitute of many neceffary words and phrafes. He wrote the Italian language with the claffic elegance of the 14th and 15th centuries. Witnefs his different works in that language, both in profe and verfe. He tranflated the whole of Æfop's Fables into Latin, and Theocritus, the *Epithalamium* of Catullus, and the *comedy* of Plautus, called *Pfeudolus*, into Italian verfe. The two firft books of the Æneid were alfo tranflated by him with fuch exactnefs, and fo much in the ftile of the original, that they may well pafs for the work of Virgil himfelf.

His life, like his ftudies, was drawn after the model of the ancient fages. Frugal, temperate, modeft, he exhibited a ftriking contraft to the luxurious manners of his age. In religion he adhered ftrictly, though not fuperftitioufly, to the opinions of his anceftors. He was firm to his refolutions, but not foolifhly obftinate; and fo ftrict an obferver of equity, that his probity would have remained inviolate, even though there had been no law to bind him to juftice. He never married, that he might have leifure to devote himfelf, with lefs interruption, to his favourite ftudies. Every one readily found admiffion to him, and no man left him without being both pleafed and inftructed; fuch was the fweetnefs of his temper, and the readinefs with which he communicated information. He adhered with great conftancy to his friendfhips. This was particularly exemplified in the cafe of Clemens Sibiliatus, who has favoured the world with the life of Torelli. With him he kept up the clofeft connection from a fchool boy till the day of his death. He was peculiarly attached likewife to many men of diftinction, both in Italy and Britain. He died in Auguft 1781, in the 70th year of his age.

The following is a complete lift of his works, his edition of Archimedes excepted, which was not publifhed till after his death:

1. "Lucubratio Academica, fivi Somnium Jacobi Pindemontii, &c." Patavii, 1743.—2. "Animadverfiones in Hebraicum Exodi Librum et in Græcum lxx Interpretationem;" Veronæ, 1744.—3. "De principe Gulæ incommodo, ejufque remedio, Libri duo;" Coloniæ Agrippinæ, 1744.—4. "De Probabili Vitæ Morumque Regula;" Coloniæ, 1747.—5. "Li due primi Canti dell' Iliade (di Scipione Maffei) e lie due primi dell' Eneide di Giufeppe Torelli tradotti in verfi Italiani;" Verona, 1749.—6. "Gli fteffi due canti dell' Eneide riftampati foli lo fteffo anno per lo fteffo Ramanzini."—7. "Scala de Meriti a capo d'anno Trattato Geometrico;" Verona, 1751.—8. "De Nihilo Geometrico, lib. 2.;" Veronæ, 1758.—9. "Lettera intorno a due paffi del Purgatorio di Dante Alighiero;" *ib.* 1760.—10. "Della Denominazione del corrente anno vulgarmente detto 1760 in Bologna per Lelio della Volpe."—11. "Il pfeudolo. Comedia, &c. e fi aggiunge la traduzione d'alcuni Idilli di Teocritoe di Mofco;" Firenze, 1765.—12. "Inno a Maria Virgine nella Feftivita della fua Concezione;" Verona, 1766.—13. "Lettera a Miladi Vaing-Reit premeffa al libro che ha per titalo xii. lettere Inglefi, con altra lettera all'autore della fuddetta;" Verona, 1767.—14. "Elegia di Tommafo Gray, Poeta Inglefe, in un Cimetero Campeftre in verfi Italiani rimati;" Verona, 1767.—15. "Geometrica;" Veronæ, 1769.—16. "Demonftratio antiqui Theorematis de motuum commixtione;" Veronæ, 1774.—17. "Lettera fupra Dante contro il Signor di Voltaire;" Verona, 1781.—18. "Poemetto di Catullo fu le Nozze di Peleo e Tetite, ed un Epitalamio dello fteffo;" 1781.—19. "Œfopi Fabulæ."—20. "Teocrito tradotto, in verfi Tofcani."—21. "Elementi d'Euclide tradotti nell idioma Italiano."—22. "Elementorum Profpectivæ, libri duo."

TORMENTIN *Cape*, on the W. fide of the Straits of Northumberland, or Sound, between the ifland of St John's and the E. coaft of Nova-Scotia, is the N. point of the entrance to Bay Vert. It is due weft from Governor's Ifland, on the S. E. coaft of the ifland of St John's. In fome maps this point is called *Cape Storm*. —*Morse*.

TORONTO, a Britifh fettlement on the north-weftern bank of Lake Ontario, 53 miles N. by W. of Fort Niagara. N. lat. 44 1, W. long. 79 10.—*ib.*

TORPEDO, or Cramp fish, has been defcribed under the generic title Raja; and an attempt made to explain its electrical phenomena in the article Electricity, n° 258, &c. (Both thefe articles are in the *Encyclopædia*). From fome late difcoveries, however, of Volta and others, the fhock given by the torpedo appears much more analagous to the fhock of Galvanism than to that of common electricity; and even the electrical organs of the fifh feem to refemble the apparatus with which thofe difcoveries in galvanifm were made.

In the 63d volume of the Philofophical Tranfactions, Mr Hunter defcribes the electric organ of the torpedo as confifting of a number of columns varying in their length from an inch and a half to a quarter of an inch, with diameters about two-tenths of an inch. The number of columns in each organ of the torpedo which he prefented to the Royal Society was about 470; but in a very large torpedo which he diffected, the number of columns in one organ was 1182. Thefe columns were compofed of films parallel to the bafe of each; and the diftance between each partition of the columns was $\frac{1}{150}$th of an inch. From thefe facts, the reader will find the anomalies of torpedinal electricity (fuppofing it the fame with common electricity) accounted for in a very ingenious and philofophical manner by Mr Nicholfon, at p. 358 of the firft volume of his valuable journal. We pafs on, however, to point out the refemblance between it and the lately difcovered phenomena in galvanifm.

Take any number of plates of copper, or which is better, of filver, and an equal number of tin, or, which is much better, of zinc, and a like number of difcs, or pieces of card, or leather, or cloth (A), or any porous fubftance

(A) Woollen or linen cloth appear to be more durable, and more fpeedily foaked, than card.

Torpedo.

substance capable of retaining moisture. Let these last be soaked in pure water, or, which is better, salt and water or alkaline leys. The silver or copper may be pieces of money. Build up a pile of these pieces; namely, a piece of silver, a piece of zinc, and a piece of wet card: then another piece of silver, a piece of zinc, and a piece of wet card; and so forth, in the same order (or any other order, provided the pieces succeed each other in their turn), till the whole number intended to be made use of is builded up. The instrument is then completed.

In this state it will afford a perpetual current of the galvanic influence through any conductor communicating between its upper and lower plates; and if this conductor be an animal, it will receive an electrical shock as often as the touch is made, by which the circuit is completed. Thus if one hand be applied to the lower plate, and the other to the upper, the operator will receive a shock, and that as often as he pleases to lift his finger and put it down again.

This shock resembles the weak charge of a battery of immense surface; and its intensity is so low that it cannot make its way through the dry skin. It is therefore necessary that a large surface of each hand should be well wetted, and a piece of metal be grasped in each, in order to make the touch; or else that the two extremities of the pile should communicate with separate vessels of water, in which the hands may be plunged.

The commotion is stronger the more numerous the pieces. Twenty pieces will give a shock in the arms, if the above precautions be attended to. One hundred pieces may be felt to the shoulders. The current acts on the animal system while the circuit is complete, as well as during the instant of commotion, and the action is abominably painful at any place where the skin is broken.

That this influence, whatever it may be, has a striking resemblance to the repeated shocks given by the torpedo, is obvious; but what it really is in itself must be ascertained, if it can be ascertained at all, by future experiments. Mr Nicholson indeed, from whose Journal we have taken this account of Volta's apparatus and its effects, seems confident that these effects proceed from an electrical stream or current; but this mode of operation is quite foreign from all the laws of electricity known to us. The galvanic influence in this apparatus appears to move perpetually in a circle; to which we are acquainted with no fact in electricity that is at all similar. Galvanism, too, seems capable of accumulation, even while surrounded by conducting substances, which is quite inconsistent with all that we *distinctly* know of electricity and its laws.

That the energy of the apparatus, however, is the effect of an electric stream or current, our ingenious author thinks proved by the condenser with which Sig. Volta ascertained the kind of the electricity, and obtained its spark. He finds the action strongest, or most pungent, on wounds on the minus side of the apparatus, or where the wounds give out electricity; a fact also observable in the common electric spark.

The theory of the learned inventor seems to be, that it is a property of such bodies as differ in their power of conducting electricity, that when they are brought into contact they will occasion a stream of the electric matter. So that if zinc and silver be made to communicate immediately by contact, there will be a place of good conducting energy; and if they be made to communicate mediately by means of water, there will be a place of inferior conducting energy: and wherever this happens, there will be a stream or current produced in the general stock of electricity. This is not deduced as the consequence of other more simple facts; but is laid down as a general or simple principle grounded on the phenomena. If so, is it not a *petitio principii?* That such bodies as zinc and silver, when properly disposed, pruduce a stream or current, or something analogous to a stream or current, in the galvanic fluid, follows indeed indisputably from the phenomena; but it by no means follows from the same phenomena that galvanism is electricity; for electricity seems subject to different laws. See ELECTRICITY and THUNDER, both in this *Supplement*.

It must be acknowledged that the discovery of the galvanic shock and spark, and of the apparent existence of two opposite states of galvanism corresponding to positive and negative electricity, considerably increase the analogy; which in the article GALVANISM, *Suppl.* we have admitted to be very striking: but supposing no fallacy in any of Volta's experiments, we do not think that these discoveries amount to any thing like a demonstration of the conclusions which have been drawn from them. It is by no means certain that light is essentially connected with the electric fluid; for we know that it is not essentially connected with heat; (See *THERMOMETRICAL Spectrum*, in this *Suppl.*) The flash, for example, of lightning may be merely an extrication of light, in consequence of the action of electricity upon the atmosphere in its passage, or on the bodies upon which it impinges; and there are many instances of a similar extrication, as in the collision of two pieces of flint, where neither electricity nor galvanism were ever suspected to have any share in producing the phenomenon. Why may not the progress of the galvanic fluid have a similar effect in this instance with that of electricity, though the two fluids be essentially different between themselves? But we have more to say on this subject.

Messrs Nicholson and Carlisle constructed an apparatus similar to that of Volta, which gave them a shock as before described, and a very acute sensation wherever the skin was broken. Their first research was directed to ascertain that the shock they felt was really an electrical phenomenon. For this purpose the pile was placed upon Bennett's gold leaf electrometer, and a wire was then made to communicate from the top of the pile to the metallic stand or foot of the instrument; so that the circuit of the shock would have been through the leaves, if they had diverged; but no signs of electricity appeared. Recourse was then had to the revolving doubler; of which the reader will find an account in our Supplementary article ELECTRICITY, n° 203. The doubler had been previously cleared of electricity by twenty turns in connection with the earth. The negative divergence was produced in the electrometer. Repeated experiments of this kind shewed that the silver end was in the minus, and the zinc end in the plus state.

Here a pile of 17 half crowns, with a like number of pieces of zinc, and of pasteboard soaked in salt water, though it gave a severe shock, exhibited no symptoms of of electricity till affifted by the doubler. Will it be faid that this arofe from want of intenfity in the galvanic fhock? We can only reply, that a much lefs intenfe fhock of electricity would have produced a fenfible divergence in the inftrument without the doubler. What was the caufe of this difference? We have, however, no doubt but that electricity was concerned in this phenomenon; for we have fhewn elfewhere (fee THUNDER, *Suppl.)*, that either *electricity* is produced, or the equilibrium of the electrical fluid difturbed, by every chemical folution; and we fhall fee immediately that chemical folutions are perpetually going on in Volta's apparatus.

Very early in the courfe of this experiment, the contacts being made fure by placing a drop of water upon the upper plate, Mr Carlifle obferved a difengagement of gas round the touching wire. This gas, though very minute in quantity, evidently feemed to have the fmell afforded by hydrogen when the wire of communication was fteel. This, with fome other facts, led Mr Nicholfon to propofe to break the circuit by the fubftitution of a tube of water between two wires. They therefore inferted a brafs wire through each of two corks inferted in a glafs tube of half an inch internal diameter. The tube was filled with New River water, and the diftance between the points of the wires in the water was one inch and three quarters. This compound difcharger was applied fo that the external ends of its wire were in contact with the two extreme plates of a pile of 36 half crowns, with the correfponding pieces of zinc and pafteboard. A fine ftream of minute bubbles immediately began to flow from the point of the lower wire in the tube which communicated with the filver, and the oppofite point of the upper wire became tarnifhed, firft deep orange, and then black. On reverfing the tube, the gas came from the other point, which was now loweft; while the upper, in its turn, became tarnifhed and black. Reverfing the tube again, the phenomena again changed their order. In this ftate the whole was left for two hours and a half. The upper wire gradually emitted whitifh filmy clouds, which, towards the end of the procefs, became of a pea-green colour, and hung in perpendicular threads from the extreme half inch of the wire, the water being rendered femiopaque by what fell off, and in a great part lay, of a pale green, on the lower furface of the tube, which, in this difpofition of the apparatus, was inclined about forty degrees to the horizon. The lower wire of three quarters of an inch long, conftantly emitted gas, except when another circuit, or complete wire, was applied to the apparatus; during which time the emiffion of gas was fufpended. When this laft mentioned wire was removed, the gas re-appeared as before, not inftantly, but after the lapfe of four beats of a half fecond clock ftanding in the room. The product of gas, during the whole two hours and a half, was two-thirtieths of a cubic inch. It was then mixed with an equal quantity of common air, and exploded by the application of a lighted waxed thread.

Meffrs Nicholfon and Carlifle had been led, by their reafoning on the firft appearance of hydrogen, to expect a decompofition of the water; but it was with no little furprize that they found the hydrogen extricated at the contact with one wire, while the oxygen fixed itfelf, in combination with the other wire, at the diftance of almoft two inches. This new fact ftill remains to be explained, and feems, fays Mr Nicholfon, to point at fome general law of the agency of electricity in chemical operations. Does it not as naturally fuggeft a fufpicion that galvanifm is not electricity; efpecially as we are informed, by Mr Cruickfhank of Woolwich, that Meffrs Nicholfon and Carlifle difcovered, that "galvanifm decompofes water with much greater facility than electricity, and with phenomena fomewhat different?" What the particular differences are, he does not fay; but we learn from Mr Nicholfon himfelf, that from the general tenor of his experiments, it appears to be eftablifhed, that the decompofition of water by galvanifm is more effectual the lefs the diftance is between the wires, but that it ceafes altogether when the wires are in contact.

Mr Nicholfon concludes his memoir with mentioning concifely the effects of a pile of 100 half crowns, and a chemical incident, which appears to be the moft remarkable of thofe which he has yet obferved.

The pile was fet up with pieces of green woollen cloth foaked in falt water. It gave fevere fhocks, which were felt as high as the fhoulders. The tranfition was much lefs forcible through a number of perfons, but it was very perceptible through nine. The fpark was frequently vifible when the difcharge was made in the dark, and a gleam of light was alfo, in fome inftances, feen about the middle of the column at the inftant of the explofion. The affiftants were of opinion that they heard the fnap.

The extrication of the gafes was rapid and plentiful by means of this apparatus. When copper wires were ufed for the broken circuit, with muriatic acid diluted with 100 parts of water in the tube, no gas, nor the leaft circulation of the fluid was perceived, when the diftance of the wires was two inches. A fhort tube, with two copper wires very near each other in common water, was made part of the circuit, and fhewed by the ufual phenomena, that the ftream of electricity was rapidly paffing. The wires in the muriatic acid were then flided within the third of an inch of each other. For the fake of brevity he avoids enumerating the effects which took place during feveral hours, and fimply ftates, that the minus wire gave out fome hydrogen during an hour; while the plus wire was corroded, and exhibited no oxyd; but a depofition of copper was formed round the minus, or lower wire, which began at its lower end: that no gas whatever appeared in this tube during two hours, though the depofition was going on, and the fmall tube fhewed the continuance of the electric ftream; and that the depofition, at the end of four hours, formed a ramified metallic vegetation, nine or ten times the bulk of the wire it furrounded.

In this experiment, it appeared that the influence of electricity increafing the oxydability of the upper wire, and affording nafcent hydrogen from the lower, caufed the latter to act as the precipitant of a folution of one and the fame metal.

Mr Nicholfon, we fee, continues to call it electricity with the utmoft confidence, as if it could not poffibly be any thing elfe; and yet he fays that the galvanic fhock is much lefs forcible when paffed through a number of perfons than when paffed only through one. This, we believe, does not hold in the fhocks of common electricity; and the difference probably arifes from the cuticle

ticle obftructing the paffage of the one and not of the other. Volta himfelf fays, that *this* electricity, for he too is defirous to prove it electricity, does not diffufe itfelf through the air. It is fo univerfally known that very dry air is no conductor of electricity, that he muft mean, on this occafion, air not uncommonly dry; otherwife the non-diffufion of *this* electricity through air would not diftinguifh it, as he feems to admit it does, from common electricity. But what occafions this diftinction, if the two electricities be the fame?

Lieutenant-colonel Haldane, well known in the fcientific world, made experiments with Volta's pillar, both in a horizontal and in a vertical pofition. With a large pillar, placed vertically, he obtained very weak figns of electricity. He connected the apparatus with the conductor of an electrical machine, and found the effect rather impeded than affifted by the common electric ftream. He placed the plate of Bennet's electrometer in the circuit, without producing electric figns. He found that the galvanic apparatus, placed between the outfide and infide of a jar, prevented its charging, and that it is alfo capable of conducting the charge, though not rapidly: and, on the whole, from the very minute exhibition of the attractive and repellent powers, while the caufticity, the fhock, and the oxydation, are fo very powerful, he cannot be perfuaded that electricity is the principal agent, though fome might be generated, or difengaged, during the operation of the apparatus.

This is exactly our own opinion, which is ftrongly corroborated by the refults of fome very curious experiments made by Mr Cruickfhank of Woolwich. Thefe experiments our limits permit us not to detail. They were made with a view to afcertain the nature and relative proportions of the gafes obtained from water and other fluids by this influence; and the author thinks himfelf authorifed to conclude from them:

1. That hydrogen gas, mixed with a very fmall proportion of oxygen and ammonia, is fomehow difengaged at the wire connected with the filver extremity of the machine; and that this effect is equally produced, whatever the nature of the metallic wire may be, provided the fluid operated upon be pure water.

2. That where metallic folutions are employed inftead of water, the fame wire which feparates the hydrogen revives the metallic calx, and depofits it at the extremity of the wire in its pure metallic ftate; in this cafe no hydrogen gas is difengaged. The wire employed for this purpofe may be of any metal.

3. That of the earthy folutions, thofe of magnefia and argil only are decompofed by the filver wire; a circumftance which ftrongly favours the production of ammonia.

4. That when the wire connected with the zinc extremity of the pile confifts either of gold or platinum, a quantity of oxygen gas, mixed with a little azote and nitrous acid, is difengaged; and the quantity of gas thus obtained is a little better than $\frac{1}{3}$d of the hydrogen gas feparated by the filver wire at the fame time.

5. That when the wire connected with the zinc is filver, or any of the imperfect metals, a fmall portion of oxygenous gas is likewife given out; but the wire itfelf is either oxydated or diffolved, or partly oxydated and partly diffolved: indeed, the effect in this cafe produced upon the metal is very fimilar to that of the concentrated nitrous acid, where a great deal of the metal is oxydated, and but a fmall quantity held in folution.

6. That when the gafes obtained by gold or platinum wires are collected together and exploded over mercury, the whole nearly difappears and forms water, with probably a little nitrous acid; for there was always a thick white vapour perceived for fome time after the explofion. The refiduary gas, in this cafe, appeared to be azote.

In reflecting on thefe experiments, it would appear that in fome of them the water muft be decompofed: but how this can be effected is by no means fo eafily explained. For example, it feems extremely myfterious how the oxygen fhould pafs filently from the extremity of the filver wire to that of the zinc wire, and there make its appearance in the form of gas. It is to be obferved, likewife, that this effect takes place which ever way the wires are placed, and whatever bends may be interpofed between their extremities, provided the diftance be not too great. On confidering thefe facts more minutely, it appeared to Mr Cruickfhank that the eafieft and fimpleft mode of explanation would be, to fuppofe that the galvanic influence (whatever it may be) is capable of exifting in two ftates, that is, in an oxygenated and deoxygenated ftate; that when it paffes from metals to fluids containing oxygen, it feizes their oxygen, and becomes oxygenated; but when it paffes from the fluid to the metal again, it affumes its former ftate, and becomes deoxygenated. Now when water is the fluid interpofed, and the influence enters it from the filver fide deoxygenated (and we fuppofe that it always paffes from the deoxygenated to the oxygenated fide), it feizes the oxygen of the water, and difengages the hydrogen, which accordingly appears in the form of gas; but when the influence enters the zinc wire, it parts with the oxygen, with which it had formerly united; and this either efcapes in the form of gas, unites with the metal to form an oxyd, or, combined with a certain portion of water, &c. may, according to the German chemifts, form nitrous acid. When a metallic folution is the interpofed fluid, the effect produced may be explained in two ways; but the fimpleft is to fuppofe that the influence, in paffing from the filver wire, feizes the oxygen of the metallic calx, and afterwards depofits it on entering the zinc one. In this cafe no gas fhould appear at the filver wire; but when a perfect metal is employed, oxygen fhould be difengaged from the zinc wire: and this, as has been already mentioned, is exactly what takes place.

What our author confiders as the ftrongeft argument in favour of this hypothefis, and what we confider as an argument equally ftrong to prove that galvanifm differs effentially from electricity, is, that all fluids which do not contain oxygen, are incapable of tranfmitting the galvanic fluid, fuch as alcohol, æther, the fat, and effential oils, as he has proved by direct experiment; but on the contrary, that all thofe which do contain oxygen conduct it more or lefs readily, as all aqueous fluids, metallic folutions, and acids, more efpecially the concentrated fulphuric acid; which it decompofes. In this laft inftance, the oxygen produced can hardly be afcribed to the decompofition of water; for this acid, when properly concentrated, does not contain any fenfible quantity. By this theory alfo we can readily explain the oxydation of the zinc plates in the machine; where the fluid in paffing from the different pairs of plates appears to be alternately oxygenated and deoxygenated. Although I am not (fays Mr Cruickfhank) by any means entirely fatisfied with this hypothefis, yet as it is the only one by which I can explain the different phenomena, it was thought advifable to throw it out, merely with a view to induce others to reafon upon the fubject, and to incite them to make experiments, by which alone truth can be afcertained.

We approve heartily of his conduct. It is for the fame reafon, and not to maintain at all hazards any preconceived opinion of our own, that we have urged every objection that occurs to us againft the hypothefis of the identity of galvanifm and electricity. Thefe fluids or influences appear to us to differ effentially; but ftill we admit that future experiments and future reafonings *may remove* our objections, which, however, ought never to be loft fight of *till* they be removed. If ingenious men, adopting implicitly the hypothefis of Volta and Mr Nicholfon, fhall inftitute a fet of experiments to afcertain the laws of the galvanic influence, they will be very apt to make their experiments fupport their hypothefis, inftead of employing them as guides to the temple of truth. Mr Nicholfon fays, that in all the experiments made by him and Mr Carlifle, the action of the inftrument was freely tranfmitted through the ufual conductors of electricity (meaning, we fuppofe, metals and watery fluids), but that it was ftopped by glafs and other non-conductors. We have experienced the fame thing, and fo far we acknowledge a ftriking refemblance between galvanifm and electricity; but, on the other hand, we have never been able to make any accumulation of galvanifm by means of coated electrics, whilft Mr Cruickfhank found that the galvanic influence cannot be tranfmitted through alcohol, ether, or effential oils. In thefe inftances, the difference between galvanifm and electricity feems to be as ftriking as the refemblance is in the others. Indeed thefe differences between the one and the other are fo many and fo great, that M. Fabbroni attributes the phenomena of galvanifm not to electricity, but to a chemical operation; to the tranfition of oxygen into a combination, and to the formation of a new compound. He had obferved, in repeating the common experiment, that if he wiped his tongue as accurately as poffible, the fenfation of tafte excited by the two metals was fo diminifhed as to be hardly diftinguifhed. The faliva, or fome other moifture, muft therefore be of fome importance in this phenomenon. He afterwards inftituted a fet of very proper experiments; from which it appeared to him that an evident chemical action takes place in the operations of galvanifm, and that it is unneceffary to feek farther for the nature of the new ftimulus. Galvanifm (he fays) is manifeftly a combuftion or oxydation of the metals; and the ftimulating principle may be either the caloric which is difengaged, or the oxygen which paffes into new combinations; or the new metallic falt; but which of thefe he has not afcertained.

Without adopting or rejecting thefe conclufions, we recommend them to the attention of our chemical readers; for it is only by expert and fcientific chemifts that we expect the nature and properties of galvanifm to be afcertained. In the mean time it is proper to obferve, that the pile of Volta continues in order for about three days, and fcarcely three; and that on account of the corrofion of the fæces of the zinc, it is neceffary to renew them previous to each conftruction of the pile. This may be done by fcraping or grinding, or by cleaning them with diluted muriatic acid.

To avoid the trouble of conftantly repiling the pieces of filver and zinc, Mr Cruickfhank conftructed a kind of trough of baked wood, 26 inches in length, 1.7 inches deep, and 1.5 inches wide; in the fides of this trough grooves were made oppofite to each other about the tenth of an inch in depth, and fufficiently wide to admit one of the plates of zinc and filver when foldered together; three of thefe grooves were made in the fpace of one inch and three tenths, fo that the whole machine contained 60 pair of plates. A plate of zinc and filver, each 1 6 inches fquare, well cemented together, were introduced into each of thefe grooves or notches, and afterwards cemented into the trough by a compofition of rofin and wax, fo perfectly that no water could pafs from one cell to the other, nor between the plates of zinc and filver. This circumftance muft be ftrictly attended to, elfe the machine will be extremely imperfect. When all the plates were thus fecured in the trough, the interftices or cells formed by the different pairs of plates were filled with a folution of the muriat of ammonia, which here fupplied the place of the moiftened papers in the pile, but anfwered the purpofe much better. It is hardly neceffary to obferve, that in fixing the zinc and filver plates, they muft be placed regularly, as in the pile, *viz.* alternately zinc and filver, the filver plate being always on the fame fide. When a communication was made between the firft and laft cell, a ftrong fhock was felt in the arms, but fomewhat different from that given by the pile, being quicker, lefs tremulous, and bearing a greater refemblance to the common electrical fhock. He conftructed two of thefe machines, which contained in all 100 pair of plates; thefe when joined together gave a very ftrong fhock, and the fpark could be taken in the day time at pleafure; but what furprifed him not a little, was the very flender power which they poffeffed in decompofing water: in this refpect they were certainly inferior to a pile of 30 pair, although fuch a pile would not give a fhock of one third the ftrength.

This apparatus retained its power for many days, and would in all probability have retained it much longer, had not the fluid got between the dry furfaces of the metals. To remedy this defect, he foldered the zinc and filver plates together, and found that this method anfwers very well. The zinc plates may be cleaned at any time, by filling the different cells for a few minutes with the dilute muriatic acid. Although this apparatus may not entirely fuperfede the pile, efpecially if it fhould be found to decompofe water, &c. but flowly, yet in other refpects it will no doubt be found very convenient and portable.

If this article be thought long, and if we appear to have loft fight of our original fubject, the *Torpedo*, we have only to plead in excufe for our conduct, that whilft we could not avoid pointing out the refemblance between the fhock given by the torpedo and that by Volta's apparatus, we felt it a kind of duty to embrace the only opportunity that we fhall have of laying before our readers the additional information refpecting the phenomena of GALVANISM which we have receiv-

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ed since the publication of that article. These phenomena are yet new, and they are unquestionably important; indeed so very important, that to us it appears neither impossible, nor even improbable, that to the galvanic agency of metals and minerals may be attributed volcanoes and earthquakes.

TORRINGTON, or *Bedford's Bay*, on the southern coast of Nova-Scotia, and its entrance is at America Point, about 3 miles N. of the town of Halifax. It has from 10 to 13 fathoms at its mouth, but the bay is almost circular, and has from 14 to 50 fathoms water in it. A prodigious sea sets into it in winter.—*Morse.*

Torrington, a township of Connecticut, in Litchfield county, 8 miles N. of Litchfield.—*ib.*

TORTOISES, *the River of*, lies 10 miles above a lake 20 miles long, and 8 or 10 broad, which is formed by the Mississippi in Louisiana and Florida. It is a large fine river, which runs into the country a good way to the N. E. and is navigable 40 miles by the largest boats.—*ib.*

TORTUE, an island on the N. side of the island of St Domingo, towards the N. W. part, about 9 leagues long from E. to W. and 2 broad. The W. end is nearly 6 leagues from the head of the bay of Moustique. The freebooters and buccaniers drove the Spaniards from this island in 1632; in 1638, the Spaniards massacred all the French colony; and in 1639, the buccaniers retook Tortue. In 1676, the French took possession of it again.—*ib.*

TORTUGAS, *Dry*, shoals to the westward, a little southerly from Cape Florida, or the S. Point of Florida, in North-America. They are 134 leagues from the bar of Pensacola, and in lat. 24 32 N. and long. 83 40 W. They consist of 10 small islands or keys, and extend E. N. E. and W. S. W. 10 or 11 miles; most of them are covered with bushes, and may be seen at the distance of four leagues. The south-west key, one of the smallest, but the most material to be known, is in lat. 24 32 N. and long. 83 40 W. From the S. W. part of this key, a reef of coral rocks extends about a quarter of a mile; the water upon it is visibly discoloured.—*ib.*

Tortugas Harbour, *Turtle's Harbour*, or *Barracco de Tortugas*, on the coast of Brazil, in S. America, is 60 leagues at E. S. E. from the point or cape of Arbrasec, or Des Arbres Sec, and the shore is flat all the way from the gulf of Maranhao.—*ib.*

Tortugas, an island so named from the great number of turtle found near it, is near the N. W. part of the island of St Domingo.—*ib.*

Tortugas, or *Sal Tortuga*, is near the W. end of New-Andalusia and Terra Firma. It is uninhabited, although about 30 miles in circumference, and abounding with salt. N. lat. 11 36, W. long. 65. It is 14 leagues to the west of Margaritta Island, and 17 or 18 from Cape Blanco on the main. There are many islands of this name on the north coast of South-America.—*ib.*

Tortugas *Point*, on the coast of Chili, and in the South Pacific Ocean, is the south point of the port of Coquimbo, and 7 or 8 leagues from the Pajaros Islands. Tortugas road is round the point of the same name, where ships may ride in from 6 to 10 fathoms, over a bottom of black sand, near a rock called the Tortugas. The road is well sheltered, but will not contain above 20 or 30 ships safely. Ships not more than 200 tons burden may careen on the Tortugas rock.—*ib.*

TOSQUIATOSSY *Creek*, a north head water of Alleghany river, whose mouth is east of Squeaughta Creek, and 17 miles north-westerly of the *Ichua Town.*—*ib.*

TOTOWA, a place or village at the Great Falls in Passaik river, New-Jersey.—*ib.*

TOTTERY, a river which empties through the south-eastern bank of the Ohio, and is navigable with batteaux to the Occasioto Mountains. It is a long river, and has few branches, and interlocks with Red Creek, or Clinche's river, a branch of the Tennessee. It has below the mountains, especially for 15 miles from its mouth, very good land.—*ib.*

TOUCAN, or American Goose, is one of the modern constellations of the southern hemisphere, consisting of nine small stars.

TOULON, a township of New-York, in Ontario county. In 1796, 93 of the inhabitants were electors. —*Morse.*

TOWERHILL, a village in the township of South-Kingstown, Rhode-Island, where a post-office is kept. It is 10 miles west of Newport, and 282 from Philadelphia.—*ib.*

TOWNSHEND, a township of Windham county, Vermont, west of Westminster and Putney, containing 676 inhabitants.—*ib.*

Townshend, a township of Middlesex county, Massachusetts, containing 993 inhabitants. It was incorporated in 1732, and lies 45 miles northward of Boston.—*ib.*

Townshend, a harbour on the coast of the District of Maine, where is a bold harbour, having 9 fathoms water, sheltered from all winds. High water, at full and change, 45 minutes after 10 o'clock.—*ib.*

TRACADUCHE, now *Carleton*, a settlement on the northern side of Chaleur Bay, about 5 leagues from the great river Casquipibiac, in a south-west direction. It is a place of considerable trade in cod-fish, &c.—*ib.*

TRACTORS, Metallic. See Perkinism in this *Suppl.*

TRACTRIX, in geometry, a curve line, called also Catenaria; which see, *Encycl.* and Arch, *Suppl.*

TRADESCANT (John), an ingenious naturalist and antiquary, was, according to Anthony Wood, a Fleming or a Dutchman. We are informed by Parkinson, that he had travelled into most parts of Europe, and into Barbary; and from some emblems remaining upon his monument in Lambeth church-yard, it plainly appears that he had visited Greece, Egypt, and other eastern countries. In his travels, he is supposed to have collected, not only plants and seeds, but most of those curiosities of every sort which, after his death, were sold by his son to the famous Elias Ashmole, and deposited in his museum at Oxford. When he first settled in England cannot, at this distance of time, be ascertained. Perhaps it was at the latter end of the reign of Queen Elizabeth, or the beginning of that of King James I. His print, engraven by Hollar before the year 1656, which represents him as a person very far advanced in years, seems to countenance this opinion. He lived in a great a great houſe at South Lambeth, where his muſeum was frequently viſited by perſons of rank, who became benefactors thereto: among theſe were King Charles I. (to whom he was gardener), Henrietta Maria his Queen, Archbiſhop Laud, George Duke of Buckingham, Robert and William Cecil, Earls of Saliſbury, and many other perſons of diſtinction. John Tradeſcant may therefore be juſtly conſidered as the earlieſt collector (in England) of every thing that was curious in natural hiſtory, viz. minerals, birds, fiſhes, inſects, &c. He had alſo a good collection of coins and medals of all ſorts, beſides a great variety of uncommon rarities. A catalogue of theſe, publiſhed by his ſon, contains an enumeration of the many plants, ſhrubs, trees, &c. growing in his garden, which was pretty extenſive. Some of theſe plants are, if not totally extinct, at leaſt become very uncommon, even at this time: though this able man, by his great induſtry, made it manifeſt, in the very infancy of botany, that there is ſcarce any plant extant in the known world that will not, with proper care, thrive in England.

When his houſe at South Lambeth, then called *Tradeſcant's Ark*, came into Aſhmole's poſſeſſion, he added a noble room to it, and adorned the chimney with his arms, impaling thoſe of Sir William Dugdale, whoſe daughter was his third wife; where they remain to this day.

It were much to be wiſhed, that the lovers of botany had viſited this once famous garden before, or at leaſt in the beginning of the preſent century. But this ſeems to have been totally neglected till the year 1749, when Dr Watſon and the late Dr Mitchell favoured the Royal Society with the only account now extant of the remains of Tradeſcant's garden.

When the death of John Tradeſcant happened is not known; no mention being made thereof in the regiſter-book of Lambeth church.

TRAJECTORY, a term often uſed, generally for the path of any body, moving either in a void, or in a medium that reſiſts its motion; or even for any curve paſſing through a given number of points. Thus Newton, Princip. lib. 1. prop. 22. propoſes to deſcribe a trajectory that ſhall paſs through five given points.

TRAITOR's Island, one of the Archipelago called *Navigator's Iſlands*, in the South Sea (See that article, *Suppl.*). It is low and flat, with only a hill of ſome height in the middle; and is divided into two parts by a channel, of which the mouth is about 150 toiſes wide. It abounds with bannanas, yams, and the fineſt cocoa-nuts, which Perouſe ſays he ever ſaw. About twenty canoes approached the French ſhips without dread, traded with a good deal of honeſty, and never refuſed, like the natives of the archipelago of Navigators, to give their fruit before they were paid for it; nor, like them, did they give a preference to beads over nails and pieces of iron. They ſpoke, however, the ſame language, and had the ſame ferocious look; their dreſs, their manner of tatowing, and the form of their canoes, were the ſame; nor could we (ſays the author) doubt that they were one and the ſame people: they differed, indeed, in having univerſally two joints cut off from the little finger of the left hand; whereas, in the iſlands of Navigators, I only perceived two individuals who had ſuffered that operation. They were alſo of much lower ſtature, and far leſs gigantic make; a difference proceeding, no doubt, from the ſoil of theſe iſlands, which being leſs fertile, is conſequently leſs favourable to the expanſion of the human frame.

TRAMMELS, in mechanics, an inſtrument uſed by artificers for drawing ovals upon boards, &c. One part of it conſiſts of a croſs with two grooves at right angles; the other is a beam carrying two pins, which ſlide in thoſe grooves, and alſo the deſcribing pencil. All the engines for turning ovals are conſtructed on the ſame principles with the trammels: the only difference is, that in the trammels the board is at reſt, and the pencil moves upon it; in the turning engine, the tool, which ſupplies the place of the pencil, is at reſt, and the board moves againſt it. See a demonſtration of the chief properties of theſe inſtruments by Mr Ludlam, in the *Phil. Tranſ.* vol. lxx. p. 378, &c.

TRANQUILLITY, a place in Suſſex county, New-Jerſey, 8 miles ſoutherly of Newtown.—*Morse.*

TRANSFORMATION, in geometry, is the changing or reducing of a figure, or of a body, into another of the ſame area, or the ſame ſolidity, but of a different form. As, to transform or reduce a triangle to a ſquare, or a pyramid to a parallelopipedon.

Transformation of Equations, in algebra, is the changing equations into others of a different form, but of equal value. This operation is often neceſſary, to prepare equations for a more eaſy ſolution.

TRANSLATION, in literature, is a matter of ſo much importance, that no other apology can be made for the very imperfect manner in which it is treated in the *Encyclopædia*, than a candid declaration that it was impoſſible to enter at all upon the ſubject within the narrow limits to which we were then reſtricted by the proprietors of the work. The fundamental laws of tranſlation, which we gave from Dr Campbell of Aberdeen, we believe indeed to be unexceptionable; but the queſtion is, how are theſe laws to be obeyed?

In order that a tranſlator may be enabled to give a complete tranſcript of the ideas of the original work, it is almoſt needleſs to obſerve, that he muſt poſſeſs a perfect knowledge of both languages, *viz.* that of his author, and that into which he is to tranſlate; and that he muſt have a competent acquaintance with the ſubject of which his author treats. Theſe propoſitions we conſider as ſelf evident; but if any of our readers ſhall be of a different opinion, we refer them to an *Eſſay on the Principles of Tranſlation*, publiſhed 1797 by Cadell and Davies, London, where they will find our doctrine very clearly illuſtrated. It may be proper to add, that ſuch a knowledge of the Greek and Latin languages as merely enables a man to read them with eaſe and entertainment to himſelf, is by no means ſufficient to qualify him for tranſlating every Greek and Latin book, even though it treats of a ſubject with which he has a general acquaintance. The religious rites and ceremonies of the Greeks and Romans, as well as the radical words of their language, were derived from the Eaſt; and he who is an abſolute ſtranger to oriental literature, will be very liable to miſtake occaſionally the ſenſe of Greek and Roman authors who treat of religious ſubjects. We could illuſtrate the truth of this poſition by quotations from ſome of the moſt admired modern tranſlations of the Greek Scriptures, which we have no heſitation to ſay fall very ſhort of the authoriſed verſion in accuracy as well as in elegance. The divines employed by King

Tranflation.

James to tranflate the Old and New Teftaments were profoundly fkilled in the learning, as well as in the languages of the Eaft; whilft fome of thofe who have prefumed to improve their verfion feem not to have poffeffed a critical knowledge of the Greek tongue, to have known ftill lefs of the Hebrew, and to have been abfolute ftrangers to the dialect fpoken in Judea in the days of our Saviour, as well as to the manners, cuftoms, and peculiar opinions of the Jews fects. Neither metaphyfical acutenefs, nor the moft perfect knowledge of the principles of tranflation in general, will enable a man who is ignorant of thefe things to improve the authorifed verfion either of the Gofpels or the Epiftles; for fuch a man knows not accurately, and therefore cannot give a complete tranfcript of the ideas of the original work.

But fuppofing the tranflator completely qualified with refpect to knowledge, it becomes a queftion, whether he may, in any cafe, add to or retrench the ideas of his author? We are ftrongly inclined to think, that, in no cafe, it is allowable to take fuch liberties; but the ingenious and elegant effayift, whofe work on the principles of tranflation we muft always quote with refpect, is of a different opinion. "To give a general anfwer (fays he) to this queftion, I would fay, that this liberty may be ufed, but with the greateft caution. It muft be further obferved, that the fuperadded idea fhall have the moft neceffary connection with the original thought, and actually increafe its force. And, on the other hand, that whenever an idea is cut off by the tranflator it muft be only fuch as is an acceffory, and not a principle, in the claufe or fentence. It muft likewife be confeffedly redundant, fo that its retrenchment fhall not impair or weaken the original thought. Under thefe limitations, a tranflator may exercife his judgment, and affume to himfelf, in fo far, the character of an original writer."

Of the judicious ufe, as he thinks it, of this liberty, the author quotes many examples, of which we fhall felect three, as well calculated to illuftrate our own ideas of the fubject.

In the firft book of the Iliad, Achilles, having refolved, though indignantly, to give up Brifeis, defires Petroclus to deliver her to the heralds of Agamemnon:

> Ὡς φατο· Πατροκλος δε φιλω επεπειθεθ' ἑταιρω·
> Εκ δ' αγαγε κλισιης Βρισηιδα καλλιπαρηον,
> Δωκε δ' αγειν· τω δ' αυτις ιτην παρα νηας Αχαιων·
> Ἡ δ' ακεους' ἁμα τοισι γυνη κιεν· *Ilias*, A. 345.

> Patroclus now th' unwilling beauty brought;
> She in foft forrows, and in penfive thought,
> Paft filent, as the heralds held her hand,
> And oft look'd back, flow moving o'er the ftrand.
> Pope.

Our author thinks, and we heartily agree with him, that the amplification in the three laft lines of this verfion highly improves the effect of the picture; but we cannot confider this amplification as a new idea fuperadded. It was the object of Homer to inform his countrymen, that Brifeis went with the heralds *unwillingly*. This he does by the words ἡ δ' ακεουσ' ἁμα τοισι γυνη κιεν· and it is by no means improbable, that the rhythmical movement of the verfe may have prefented to the ancient Greeks the image of the lady, walking flowly and reluctantly along. This image, we are fure, is not produced by a literal tranflation of the Greek words into Englifh; and therefore it was Pope's duty, not to add to the ideas of the original, but, by amplification, to prefent to his own countrymen the picture which Homer, by the fuperiority of the Greek language and rythm, had prefented to his.

In the ninth book of the Iliad, where Phœnix reminds Achilles of the care he had taken of him while an infant, one circumftance, extremely mean, and even difgufting, is found in the original:

> ——— ὁτε δη σ' επ' εμοισιν εγω γουνασσι καθισσας
> Οψου τ' ασαιμι προταμων, και οινον επισχων·
> Πολλακι μοι κατεδευσας επι ςηθεσσι χιτωνα,
> Οινου αποβλυζων εν νηπιεη αλεγεινη.

The literal verfion of thefe lines is indeed very grofs: "When I placed you before my knees, I crammed you with meat, and gave you wine, which you often vomited upon my bofom, and ftained my clothes, in your troublefome infancy:" but we cannot agree with our author, that the Englifh reader is obliged to Pope for having altogether funk this naufeous image. What is, or ought to be, our object in reading Homer? If it be merely to delight our ear with fonorous lines, and pleafe our fancy with grand or fplendid images, the tranflator certainly did right in keeping out of view this difgufting picture of favage life; but when he did fo, he cannot be faid to have given a complete tranfcript of his author's ideas. To pleafe ourfelves, however, with fplendid images, is not our only object when ftudying the works of the ancient poets. Another, and in our opinion a more important object, is to acquire a lively notion of ancient manners; and if fo, Pope grofsly mifleads the mere Englifh reader, when, inftead of the beaftly image of Homer, he prefents him with the following fcene, which he may daily meet with in his own family, or in the families of his friends:

> Thy infant breaft a like affection fhow'd,
> Still in my arms, an ever pleafing load;
> Or at my knee, by Phœnix would'ft thou ftand,
> No food was grateful but from Phœnix hand:
> I pafs my watchings o'er thy helplefs years,
> The tender labours, the compliant cares.

This is a picture of the domeftic manners of Great Britain in the 18th century, and not of Greece in the heroic ages.

In the beginning of the eighth book of the Iliad, Homer puts into the mouth of Jove a very ftrange fpeech, ftuffed with braggart vaunting and ludicrous images. This, as our author obferves, is far beneath the dignity of the thunderer; but it is only beneath the dignity of the thunderer as our habits and modes of thinking compel *us* to conceive fuch a being. The thunderer of the Greeks was a notorious adulterer and fodomite, whofe moral character finks beneath that of the meaneft of our bravos; and as he had dethroned his father, and waged for fome time a doubtful war with certain *earthly* giants, it does not appear to us that the boafting fpeech which Homer puts into his mouth is at all unfuitable to his acknowledged attributes. But whether it be or not, was not the tranflator's concern. Homer, when he compofed it, certainly thought it not unworthy of the thunderer; and whatever Pope's opinion might be, he had

had no right to fubftitute his own notions of propriety for thofe of his author. The mythological tales of the poets, and more efpecially of Homer and Hefiod, conftituted, as every one knows, the religious creed of the vulgar Greeks (fee POLYTHEISM, n° 33. *Encycl.*); and this circumftance makes it doubly the duty of a tranflator to give, on fuch fubjects, a fair tranfcript of his author's ideas, that the mere Englifh reader, for whom he writes, may know what the ancients really thought of the objects of their idolatrous worfhip. This Pope has not done in the fpeech under confideration; and has therefore, in our opinion, deviated widely from the firft and moft important of the three general laws of tranflation. Johnfon has apologized, we think fufficiently, for many of Pope's embellifhments of his author; but he has not attempted to make an apology for fuch embellifhments as alter the fenfe. We cannot indeed conceive a pretence upon which it can ever be allowable in a tranflator to add to the ideas of his author, to retrench, or to vary them. If he be tranflating hiftory, and find his author advancing what he *believes* to be falfe, he may correct him in a note; but he has no right to make one man utter, as his own, the belief or the fentiments of another, when that belief, and thofe fentiments, are *not* his own. If he be tranflating a work of fcience, he may likewife correct the errors of his author in notes, as Dr Clerke corrected thofe of Rohault; but no man has a right to give to a Rohault the fcience of a Newton. The tranflator of a poem may certainly employ amplification to place in a ftriking light the images or the fentiments of the original work; but he muft not alter thofe images or fentiments fo as to make that appear grand or elegant in the verfion, which is mean or difgufting in the original. On every occafion on which he takes fuch liberties as thefe, he ceafes to be a tranflator, and becomes a faithlefs paraphraft.

The fecond general law of tranflation, though certainly lefs important, is perhaps more difficult to be obferved than the firft. We have ftated it in thefe words: (See TRANSLATION, *Encycl.*) "The ftyle and manner of the original fhould be preferved in the tranflation;" but it is obvious that this cannot be done by him who poffeffes not fufficient tafte and judgment to afcertain with precifion to what clafs the ftyle of the original belongs. "If a tranflator fail in this difcernment, and want this capacity, let him be ever fo thoroughly mafter of the fenfe of his author, he will prefent him through a diftorting medium, or exhibit him in a garb that is unfuitable to his character." It would obvioufly be very improper to tranflate the elegantly fimple language of Cæfar into rounded periods like thofe of *The Rambler*, or the Orations of Cicero into the language of Swift.

The chief characteriftic of the hiftorical ftyle of the facred Scriptures is its fimplicity; and that fimplicity is, for the moft part, well preferved in the authorifed verfion. It is, however, loft in many of the modern verfions. Caftalio's, for inftance, though intitled to the praife of elegant latinity, and though, in general, faithful to the fenfe of the original, yet exhibits numberlefs tranfgreffions of the law which is now under confideration. Its fentences are formed in long and intricate periods, in which many feparate members are artfully combined; and we obferve a conftant endeavour at claffical phrafeology and ornamented diction, inftead of the beautiful fimplicity of the original.

The verfion of the Scriptures by Arias Montanus is, in fome refpects, a contraft to that of Caftalio. By adopting the literal mode of tranflation, Arias undoubtedly intended to give as faithful a picture as he could, both of the fenfe and of the manner of the original. Not attending to the peculiar idioms of the Hebrew, Greek, and Latin tongues, which, in fome refpects, are very different from each other, he has, by giving to his Latin the combination and idioms of the two firft of thefe languages, fometimes made the facred writers talk abfurdly. In Latin, as every fchool-boy knows, two negatives make an affirmative, whilft in Greek they add force to the negation. Χωρις εμου ου δυνασθε ουδεν fignifies, "Without me ye can do nothing," or, "Ye cannot *poffibly* do any thing;" but Arias has tranflated the words *fine me non poteftis facere nihil, i. e.* "without me ye cannot do nothing," or, "ye *muft* do fomething," which is directly contrary to the meaning of our Lord. It is not therefore by tranflating literally or verbally that we can hope to preferve the ftyle and manner of the original.

To exprefs in florid or elevated language the ideas of an author who writes himfelf in a fimple ftyle, is not to give in the verfion a juft picture of the original; but to attempt, for the fake of verbal accuracy, to introduce into one language the peculiar idioms or conftruction of another, is ftill worfe, as in this mode of tranflation the fenfe, as well as the manner of the original, is loft. The rule obvioufly is to ufe, in the verfion, the words and phrafeology which we have reafon to believe that the author would himfelf have ufed, had he been mafter of the language into which we are tranflating his ideas. Thus if we are to tranflate into Englifh a piece of elegantly fimple Greek or Latin, we muft make ourfelves completely mafter of the author's meaning, and, neglecting the Greek or Latin *idioms*, exprefs that meaning in elegantly fimple Englifh. We need not add, that when the language of the original is florid or grand, if that ftyle be fuited to the fubject, the language of the tranflation fhould be florid or grand likewife; but care muft always be taken that perfpicuity be not facrificed to ambitious ornaments of any kind; for ornaments which obfcure the fenfe are worfe than ufelefs.

If thefe reflections be juft, it is obvious that a poem cannot be properly tranflated into profe. The mere fenfe may doubtlefs be thus transferred from one language into another, as has generally been done by Macpherfon in his hobbling verfion of the Iliad, and perhaps more completely by a late tranflator of Anacreon; but in fuch a verfion, the ftyle and manner of the original muft neceffarily be loft. Of this the following accurate profe tranflation of Anacreon's ninth ode (on a dove) is a ftriking inftance:

"O lovely Pigeon! whence, whence do you fly? Whence, fpeeding through the air, do you breathe, and diftil fo many perfumes? Who is your mafter? For it concerns me to know. 'Anacreon fent me to a youth, —to Bathyllus, at prefent the prince, and difpofing of all things. Venus fold me, receiving a little hymn in return. And I ferve Anacreon in fuch tranfactions as thefe: and now I carry his letters, fuch as you fee: and he affirms that he will immediately make me free.

But

But I will remain a fervant with him although he may difmifs me: For wherefore does it behove me to fly, both over mountains, and fields, and to perch on trees, devouring fome ruftic food? Now indeed I eat bread, fnatching it from the hands of Anacreon himfelf; and he gives to me the wine to drink which he drinks before me; and having drunk, I perhaps may dance, and cover my mafter with my wings; then going to reft, I fleep upon the lute itfelf. You have it all;—begone: you have made me more talkative, O mortal! than even a jay*."

* *The Odes of Anacreon, tranflated into Englifh profe, printed at York,* 1796.

How inferior is the general effect of this piece of profe to that of the well-known poetical verfions of Addifon and Johnfon? and yet the mere *ideas* of the original are perhaps more faithfully tranfcribed by this anonymous writer than by either of thofe elegant tranflators. The emotions indeed excited by the original are not here brought into view.

The third general law of tranflation is fo nearly allied to the fecond, that we have very few directions to give for the obfervation of it. He who, in his verfion, preferves the ftyle and manner of the original, as we have endeavoured to fhew that they *ought* to be preferved, will, of courfe, give to the tranflation the eafe of original compofition. The principal difficulty that he has to encounter in this part of his tafk, will occur in the tranflating of idiomatical and proverbial phrafes. Hardly any two languages are conftructed precifely in the fame way; and when the ftructure of the Englifh language is compared with that of the Greek and Latin, a remarkable difference between the ancient and modern tongues is found to pervade the whole. This muft occafion very confiderable difficulty; but it is a difficulty which will be removed by a due obfervance of the former law, which directs the tranflator to make his author fpeak Englifh in fuch a ftyle to Englifhmen as he fpoke his own tongue to his own countrymen, and of courfe to ufe the Englifh idiom with Englifh words. But what is to be done with thofe proverbial phrafes of which every language has a large collection, and which allude to local cuftoms and manners?

The ingenious author of the Effay fo often quoted, very properly obferves, in anfwer to this queftion, that the tranflation is perfect when the tranflator employs, in his own language, an idiomatic phrafe correfponding to that of the original. "It is not (fays he) poffible perhaps to produce a happier inftance of tranflation by correfponding idioms, than Sterne has given* in the tranflation of Slaukenbergius's tale. *Nihil me penitet hujus nafi*, quoth Pamphagus; that is, "My nofe has been the making of me." *Nec eft cur pœniteat;* that is, "How the deuce fhould fuch a nofe fail?" *Miles peregrini in faciem fufpexit!* "The centinel looked into the ftranger's face. Never faw fuch a nofe in his life!"

* *Triftram Shandy.*

"As there is nothing (continues our author) which fo much conduces both to the eafe and fpirit of compotion as a happy ufe of idiomatic phrafes, there is nothing which a tranflator, who has a moderate command of his own language, is fo apt to carry to an extreme." Of this he gives many ftriking examples from Echard's tranflation of Terence and Plautus, for which we muft refer the reader to the Effay itfelf. He obferves, likewife, that in the ufe of idiomatic phrafes, a tranflator frequently forgets both the country of his original author, and the age in which he wrote; and while he makes a Greek or Roman fpeak French or Englifh, he unwittingly puts into his mouth allufions to the manners of modern France or England. This, to ufe a phrafe borrowed from painting, may be termed an offence againft the *coftume*. The proverbial expreffion *βατραχω ὑδωρ*, in Theocritus, is of fimilar import with the Englifh proverb, *to carry coals to Newcaftle;* and the Scotch, *to drive falt to Dyfart;* but it would be a grofs impropriety to ufe either of thefe expreffions in the tranflation of an ancient claffic. Of fuch improprieties our author points out many inftances both in French and Englifh tranflations of the claffics; and he might have increafed the number by quotations from Blackwell's Memoirs of the Court of Auguftus, where, inftead of Roman fenators and their wives, we meet with modern gentlemen and ladies, with *fecretaries at war, paymafters, commiffary generals*, and *lord high admirals*. It is true the memoirs of the court of Auguftus is no tranflation; but with refpect to coftume, it is neceffarily fubject to the laws of tranflation.

Offences againft coftume are often committed by the ufe of improper words as well as of improper phrafes. To introduce into dignified and folemn compofition words affociated with mean and ludicrous fubjects, is equally a fault in an original author and in a tranflator; and it is obvioufly improper, in the tranflation of works of very high antiquity, to make ufe of words which have but lately been admitted into the language of the tranflator. Faults of this kind are very frequent in Dr Geddes's tranflation of the Bible, as when the *paffover* is called the *fkipover;* the tabernacle of the congregation, the *convention-tent;* and a burnt-offering, a *holocauft*. The firft of thefe expreffions prefents to the imagination an image profanely ludicrous; the fecond, brings into our view the French Convention, which, we fufpect, occupied no fmall portion of the Doctor's thoughts, when they fhould have been wholly employed on the facred text; and the word *holocauft*, which muft be unintelligible to the mere Englifh reader, is, in the mind of every man of letters, clofely affociated with the abominable rites performed at the facrifices of the ancient heathens. But it is needlefs to point out faults of this kind in a work which is open to more ferious objections, and which, we truft, fhall never be generally read. We are forry that truth compels us to fay, that the novel expreffions introduced by Dr Campbell into his verfion of the gofpels—fuch as *confluence* for multitude, and *reign* for kingdom—are, to fay the beft of them, no improvements of the authorifed verfion. We will not rank them with Dr Geddes's innovations, becaufe we will not clafs the great author of the *Differtation on Miracles* with a paradoxical Chriftian of no communion; but we do not think that Dr Campbell's laurels were frefhened on his brow by the tranflation of the Gofpels.

We fhall conclude this article with the following reflections, taken from the Effay which has been fo often quoted:

"If the order in which we have claffed the three general laws of tranflation be their juft and natural arrangement, which, we prefume, will hardly be denied, it follows, that, in every cafe where it is neceffary to make a facrifice of one of thefe laws to another, a due regard ought to be paid to their rank and comparative importance. When the genius of the original language differs much from that of the tranflation, it is often neceffary

ceffary to depart from the author's manner in order to convey a faithful picture of his fenfe; but it would be highly prepofterous to depart, in any cafe, from the fenfe, for the fake of imitating the manner. Equally improper would it be, to facrifice either the fenfe or manner of the original, if thefe can be preferved confiftently with purity of expreffion, to a fancied eafe or fuperior gracefulnefs of compofition; and it is certain that the fenfe may always be preferved, though to purity of expreffion the manner of the original muft fometimes be facrificed."

TRAP, a village in Talbot county, Maryland; about 6 miles S. E. of Oxford.—*Morse.*

Trap, *The*, a village of Pennfylvania, in Montgomery county, having about a dozen houfes, and a German Lutheran and Calvinift church united. It is 9 miles from Morriftown, 11 from Pottfgrove, and 26 from Philadelphia.—*ib.*

Trap, a village of Maryland, in Somerfet county, fituated at the head of Wicomico Creek, a branch of the river Wicomico, 7 miles fouth-weft of Salifbury, and 6 north of Princefs Ann.—*ib.*

TRAPEZOID, fometimes denotes a trapezium that has two of its fides parallel to each other; and fometimes an irregular folid figure, having four fides not parallel to each other.

TRAPTOWN, a village of Maryland, in Frederick county, fituated on Cotoctin Creek, between the South and Cotoctin Mountains, and 7 miles fouth-wefterly of Fredericktown.—*Morse.*

TRAVERSE, in gunnery, is the turning a piece of ordnance about, as upon a centre, to make it point in any particular direction.

Traverse, in fortification, denotes a trench with a little parapet, fometimes two, one on each fide, to ferve as a cover from the enemy that might come in flank.

Traverse, in a wet fofs, is a fort of gallery, made by throwing fauciffons, joifts, fafcines, ftones, earth, &c. into the fofs, oppofite the place where the miner is to be put, in order to fill up the ditch, and make a paffage over it.

Traverse alfo denotes a wall of earth, or ftone, raifed acrofs a work, to ftop the fhot from rolling along it.

Traverse alfo fometimes fignifies any retrenchment, or line fortified with fafcines, barrels, or bags of earth, or gabions.

Traverse *Bay, Great,* lies on the N. E. corner of Lake Michigan. It has a narrow entrance, and fets up into the land fouth-eaftward, and receives Traverfe river from the E.—*Morse.*

TRAVESTY, or burlefque tranflation, is a fpecies of writing which, as it partakes, in a great degree, of original compofition, is not to be meafured by the laws of ferious tranflation. It conveys neither a juft picture of the fentiments, nor a faithful reprefentation of the ftyle and manner of the original; but pleafes itfelf in exhibiting a ludicrous caricatura of both. It difplays an overcharged and grotefque refemblance, and excites our rifible emotions by the incongruous affociation of dignity and meannefs, wifdom and abfurdity. This affociation forms equally the bafis of travefty and of ludicrous parody, from which it is no otherwife diftinguifhed than by its affuming a different language from the original. In order that the mimickry may be underftood, it is neceffary that the writer choofe, for the exercife of his talents, a work that is well known, and of great reputation. Whether that reputation is deferved or unjuft, the work may be equally the fubject of burlefque imitation. If it has been the fubject of general, but undeferved praife, a parody or a travefty is then a fair fatire on the falfe tafte of the original author and his admirers, and we are pleafed to fee both become the objects of a juft caftigation. The *Rehearfal*, *Tom Thumb*, and *Crononhotonthologos*, which exhibit ludicrous parodies of paffages from the favourite dramatic writers of the times, convey a great deal of juft and ufeful criticifm. If the original is a work of real excellence, the travefty or parody detracts nothing from its merit, nor robs the author of the fmalleft portion of his juft praife. We laugh at the affociation of dignity and meannefs; but the former remains the exclufive property of the original, the latter belongs folely to the copy. We give due praife to the mimical powers of the imitator, and are delighted to fee how ingenioufly he can elicit fubjects of mirth and ridicule from what is grave, dignified, pathetic, or fublime.

But this fpecies of compofition pleafes only in a fhort fpecimen. We cannot bear a lengthened work in travefty. The incongruous affociation of dignity and meannefs excites rifibility chiefly from its being unexpected. Cotton's and Scarron's Virgil entertain but for a few pages: the compofition foon becomes tedious, and at length difgufting. We laugh at a fhort exhibition of buffoonery; but we cannot endure a man who, with good talents, is conftantly playing the fool.

TREACLE (fee *Encycl.*) or Melasses, is a fubftance very wholefome, but of a tafte difagreeably fweet. Methods have accordingly been propofed for purifying it, fo that it may, on many occafions, fupply the place of refined fugar, which has long been at a price which a great number of poor perfons cannot afford to pay for what muft now be confidered as a neceffary of life. The following is the procefs for purifying treacle, given by the M. Cadet (Devaux) in the *Feuille du Cultivateur*, founded upon experiments made by Mr Lowitz of Peterfburgh:

Take of treacle 24 lbs. of water 24 lbs. of charcoal, thoroughly burnt, 6 lbs. Bruife the charcoal grofsly, mix the three fubftances in a caldron, and let the mixture boil gently upon a clear wood fire. After it has boiled for half an hour, pour the liquor through a ftraining-bag, and then replace it upon the fire, that the fuperfluous water may be evaporated, and that the treacle may be brought to its original confiftence. There is little or no lofs by this operation, as 24 lbs. of treacle give nearly the fame quantity of fyrup.

This procefs has been repeated in the large way, and has fucceeded: the treacle is fenfibly ameliorated, fo that it may be ufed for many difhes; neverthelefs, thofe with milk, and the fine or aromatic *liqueurs*, are not near fo good as with fugar.

TREADHAVEN *Creek*, a fmall branch of Choptank river.—*Morse.*

TREASURY *Iflands*, form a part of Mr Shortland's *New-Georgia*, (Surville's Archipelago of the Arfacides) lying from 6 38 to 7 30 S. lat. and from 155 34 to 156 E. long. from Greenwich.—*ib.*

TREBISOND, a large, populous, and ftrong town of Turkey in Afia, in the province of Jenich, with a Greek archbifhop's fee, a harbour, and a caftle. It is feated

feated at the foot of a very fteep hill. The walls are fquare and high, with battlements; and are built with the ruins of ancient ftructures, on which are infcriptions not legible. The town is not populous; for there are more woods and gardens in it than houfes, and thefe but one ftory high. The caftle is feated on a flat rock, with ditches cut therein. The harbour is at the eaft end of the town, and the mole built by the Genoefe is almoft deftroyed. It ftands on the Black Sea, 104 miles north-weft of Erzerum, and 440 eaft of Conftantinople. E. Lon. 40° 25′ N. lat. 40° 45′.

TREE. Under this title (*Encycl.*) we gave an account of the method recommended by Meffrs Forfyth and Hitt for curing injuries and defects in trees. The actual cautery is employed in Cevennes, and in the department de l'Allier in France, for ftopping the progrefs of rottennefs in large trees. When they perceive that this very common and deftructive difeafe begins to make fome progrefs in the chefnut tree, by excavating its trunk, they collect heath, and other combuftible vegetables, and burn them in the very cavity, till the furface is completely converted into a coal. It feldom happens that the tree perifhes by the effect of this operation, and it is always found that this remedy fufpends the progrefs of the decay. It is practifed in the fame manner, and with fimilar fuccefs, on the white oak. When we compare the effects of the actual cautery on the animal fyftem, in fimilar difeafes, a new refemblance is feen between the difeafes which affect the organic beings of both kingdoms, as well as between the remedies by which they may be oppofed.—*Nicholfon's Journal.*

TRENCHE MONT *River*, a fmall river of the ifland of St John's, in the Gulf of St Lawrence. It empties into the fea 3 or 4 leagues to the weftward of the eaftern extremity of the ifland.—*Morse.*

TRECOTHIC, a townfhip in Grafton county, New-Hampfhire, incorporated in 1769.—*ib.*

TRENT, a fmall river of N. Carolina, which falls into Neus river, at Newbern. It is navigable for fea veffels, 12 miles above the town, and for boats 20.—*ib.*

TRENTON, is one of the largeft towns in New-Jerfey, and the metropolis of the ftate, fituated in Hunterdon county, on the E. fide of Delaware river, oppofite the falls, and nearly in the centre of the ftate from N. to S. The river is not navigable above thefe falls, except for boats which will carry from 500 to 700 bufhels of wheat. This town, with Lamberton, which joins it on the fouth, contains between 200 and 300 houfes, and about 2,000 inhabitants. Here the legiflature ftatedly meets, the fupreme court fits, and moft of the public offices are kept. The inhabitants have lately erected a handfome court-houfe, 100 feet by 30, with a femi-hexagon at each end, over which is a baluftrade. Here are alfo a church for Epifcopalians, one for Prefbyterians, one for Methodifts, and a Quaker meeting-houfe. In the neighbourhood of this pleafant town, are a great many gentlemen's feats, finely fituated on the banks of the Delaware, and ornamented with tafte and elegance. Here is a flourifhing academy. It is 12 miles S. W. of Princeton, 30 from Brunfwick, and 30 N. E. of Philadelphia. N. lat. 40 15, W. long. 74 15.—*ib.*

TRENTON, a fmall poft-town of the Diftrict of Maine, Hancock county, 12 miles W. by S. of Sullivan, 31 N. E. by E. of Penobfcot, 286 N. E. of Bofton, and 633 N. E. of Philadelphia. This town is near Defert Ifland; and in a part of it called *The Narrows* were about 40 families in 1796.—*ib.*

TRENTON, the chief town of Jones' county, N. Carolina, fituated on the S. fide of Trent river. It contains but few houfes, befides the court-houfe and gaol. It is 521 miles from Philadelphia.—*ib.*

TREPASSI *Bay*, or *Trefpaffes Bay*, and *Harbour*, on the fouth fide of Newfoundland Ifland, near the S. E. part, and about 21 miles to the N. weftward of Cape Race, the S. E. point of the ifland. The harbour is large, well fecured, and the ground good to anchor in. —*ib.*

TRIANGLE, Arithmetical, a kind of numeral triangle, or triangle of numbers, being a table of certain numbers difpofed in form of a triangle. It was fo called by Pafcal; but he was not the inventor of this table, as fome writers have imagined, its properties having been treated of by other authors fome centuries before him, as is fhewn in Dr Hutton's Mathematical Tracts, vol. i. p. 69. &c.

The form of the triangle is as follows:

1					
1	1				
1	2	1			
1	3	3	1		
1	4	6	4	1	
1	5	10	10	5	1
1	6	15	20	&c.	
1	7	21	&c.		
1	8	&c.			
1	9				

And it is conftructed by adding always the laft two numbers of the next two preceding columns together, to give the next fucceeding column of numbers.

The firft vertical column confifts of units; the fecond, a feries of the natural numbers 1, 2, 3, 4, 5, &c.; the third, a feries of triangular numbers 1, 3, 6, 10, &c.; the fourth, a feries of pyramidal numbers, &c. The oblique diagonal rows, defcending from left to right, are alfo the fame as the vertical columns. And the numbers taken on the horizontal lines are the co-efficients of the different powers of a binomial. Many other properties and ufes of thefe numbers have been delivered by various authors, as may be feen in the Introduction to Hutton's Mathematical Tables, pages 7, 8, 75, 76, 77, 89, fecond edition.

Triangle *Ifland*, a fmall ifland, one of the Bahamas. N. lat. 20 51, W. long. 69 53.—*Morse.*

Triangle *Shoals*, lie to the weftward of the peninfula of Yucatan, near the E. fhore of the Bay of Campeachy, nearly W. of Cape Condecedo. N. lat. 17 5, W. long. 111 59.—*ib.*

TRIANGULAR Compasses, are fuch as have three legs or feet, by which any triangle or three points, may be taken off at once. Thefe are very ufeful in the conftruction of maps, globes, &c.

Triangular Numbers, are a kind of polygonal numbers; being the fums of arithmetical progreffions, which have 1 for the common difference of their terms.

Thus, from thefe arithmeticals 1 2 3 4 5 6,
are formed the triangular numbers 1 3 6 10 15 21,
or the third column of the arithmetical triangle above-mentioned.

The fum of any number n of the terms of the triangular numbers, 1, 3, 6, 10, &c. is =

$$\frac{n^3}{6}+\frac{n^2}{2}+\frac{n}{3}, \text{ or } \frac{n}{1}\times\frac{n+1}{2}\times\frac{n+2}{3}$$

which is alfo equal to the number of fhot in a triangular pile of balls, the number of rows, or the number in each fide of the bafe, being *n*.

The fum of the reciprocals of the triangular feries, infinitely continued, is equal to 2; viz.

$$1+\frac{1}{3}+\frac{1}{6}+\frac{1}{10}+\frac{1}{15}, \&c. = 2.$$

For the rationale and management of thefe numbers, fee *Malcolm's Arith.* book 5. ch. 2.; and *Simpfon's Algeb.* fec. 15.

TRIESTE, a fmall, but ftrong and ancient feaport of Italy, in Iftria, on the gulph of Venice, with a bifhop's fee. It is beautifully fituated on the fide of a hill, about which the vineyards form a femicircle. The ftreets are narrow; but there is a large fquare, where they keep the annual fair. The harbour is fpacious, but not good; becaufe it is open to the W. and S. W. winds. The inhabitants have a good trade in falt, oil, almonds, iron, &c. brought from Laubach; and they make good wines. The cathedral, and the late Jefuits church, are the two beft buildings. It belongs to the Houfe of Auftria, and is eight miles north of Capo d'Iftria, and 80 north-eaft of Venice. E. Long. 14 4. N. Lat. 45. 56.

Trieste *Bay*, on the coaft of Terra Firma, is nearly due fouth from Bonair Ifland, one of the Little Antilles, to the eaft of Curaffou Ifland.—*Morse.*

Trieste *Ifland*, a fmall ifland at the bottom of the Gulf of Campeachy, weftward of Port-Royal Ifland, about 3 leagues from E. to W. The creek which feparates it from Port-Royal Ifland is fcarcely broad enough to admit a canoe. Good frefh water will be got by digging 5 or 6 feet deep in the falt fand; at a lefs depth it is brackifh and falt, and at a greater depth than 6 feet it is falt again.—*ib.*

TRINIDAD, a fmall ifland in the S. Atlantic Ocean, due E. off Spiritu Santo, in Brazil. S. lat. 20 30, W. long. 41 20. It is alfo called Trinity.—*ib.*

Trinadad, or *Trinidada Ifland*, near the coaft of Terra Firma, at the north part of S. America. It partly forms the Gulf of Paria, or Bocca del Drago, and is much larger than any other upon the coaft. It is 36 leagues in length, and 18 or 20 in breadth, but the climate is rather unhealthy, and little of it is cleared. The current fets fo ftrong along the coaft from E. to W. as to render moft of its bays and harbours ufelefs. It produces fugar, fine tobacco, indigo, ginger, a variety of fruit, fome cotton and Indian corn. It was taken by Sir Walter Raleigh, in 1595, and by the French in 1676, who plundered the ifland, and extorted money from the inhabitants. It was captured by the Britifh in February, 1797. It is fituated between 59 and 62 W. long. and in 10 N. lat. The N. E. point lies in lat. 10 28 N. and long. 59 37 W. The chief town is St Jofeph.—*ib.*

Trinidad, La, a town of Mexico, in the province of Guatimala, on the banks of the river Belen, 12 miles from the fea; but the road is almoft impaffable by land. It is 70 miles S. E. of Guatimala, and 24 eaft of La Conception. N. lat. 13, W. long. 91 40.—*ib.*

Trinidad, La, on the north coaft of the Ifthmus of Darien, lies eaftward of Bocca del Toro, and fome clufters of fmall iflands, and S. W. of Porto Bello and Fort Chagre. N. lat. 8 30, W. long. 81 30.—*ib.*

Trinidad, or *La Sonfonate Port*, a town on a bay of the Pacific Ocean, about 65 miles S. E. of Petapa, and 162 from the town of Guatimala. All the goods that are fent from Peru and Mexico to Acaxatla, about 12 miles from it, are brought to this port. It is 9 miles from the town to the harbour which is much frequented, and is a place of great trade; being the neareft landing to Guatimala for fhips that come from Peru, Panama, and Mexico.—*ib.*

Trinidad, La, one of the fea-ports on the fouth part of the ifland of Cuba, in the Weft-Indies; fituated N. W. from the weft end of the groupe of iflands called Jardin de la Reyna. N. lat. 21 40, W. long. 80 50.—*ib.*

Trinidad, La, an open town of Veragua, and audience of Mexico, in N. America.—*ib.*

Trinidad *Channel*, has the ifland of Tobago on the N. W. and that of Trinidad on the fouth.—*ib.*

Trinidad, or *Trinity*, a town of New-Granada, and Terra Firma, in S. America, about 23 miles N. E. of St Fe.—*ib.*

TRINITARIANS (Order of), was inftituted at Rome in the year 1198, under the pontificate of Innocent III. the founders whereof were John de Matha and Felix de Valois. His Holinefs gave them permiffion to eftablifh this order for the deliverance of captives, who groaned under the tyranny of the infidels: he gave them as a habit a white gown, ornamented with a red and blue crofs. After the death of the two founders, Pope Honorious III. continued the order; and their rule was approved by his fucceffor Clement IV. in 1367. At firft they were not permitted to eat flefh; and when they travelled, were to ride only upon affes. But their rule was corrected and mitigated by the bifhop of Paris, and the abbots of St Victor and St Genevieve, who allowed them to eat any kind of food, and to ufe horfes. This order poffeffed, at one time, about 250 convents in 13 different provinces: fix of which were in France; namely, France, Normandy, Picardy, Champaine, Languedoc, and Provence; three in Spain, viz. New Caftile, Old Caftile, and Arragon; one in Italy, and one in Portugal. There was formerly the province of England, where this order had 43 houfes; that of Scotland, where it had nine; and that of Ireland, where it had 52; befides a great number of monafteries in Saxony, Hungary, Bohemia, and other countries. The convent of Cerfroy in France was head of the order. It is impoffible for us to fay what is now the ftate of the order, which can have no vifible exiftence in France, and is probably fuppreffed even in Italy.

TRINITY *Bay*, on the eaft fide of Newfoundland Ifland, between lat. 47 53 30, and 48 37 N.—*Morse.*

Trinity *Port*, a large bay of Martinico Ifland, in the Weft-Indies, formed on the fouth-eaft by Point Caravelle.—*ib.*

Trinity *Ifle* lies near the coaft of Patagonia, in S. America, eaftward of York Iflands. S. lat. 50 37.—*ib.*

Trinity *Ifle*, the north-eafternmoft of the fmall iflands on the fouth-eaft coaft of the peninfula of Alafka, on the N. W. coaft of N. America, N. E. of Foggy Iflands.—*ib.*

TRIO, a cape on the coaft of Brazil, S. America.—*ib.*

TRIONES, in aftronomy, a fort of conftellation, or affemblage aſſemblage of ſeven ſtars in the Urſa Major, popularly called *Charles's Wain*.—From the *ſeptem triones* the north pole takes the denomination *ſeptentrio*.

TRIPOLI of Syria is, according to Mr Browne, by no means ſo populous a place as we were led to repreſent it in the *Encyclopædia*. It is indeed, he ſays, a city of ſome extent, ſituated about a mile and a half from the ſea; but inſtead of ſixty, he eſtimates its population at about ſixteen thouſand. The air is rendered unwholeſome by much ſtagnant water. The town is placed on a ſlight elevation, the length conſiderably exceeding the breadth. On the higheſt ground, to the ſouth, is the caſtle, formerly poſſeſſed by the earls of Tripoli; it is large and ſtrong. Hence is viſible a part of mount Libanus, the ſummit of which is covered with ſnow. The gardens in the vicinity are rich in mulberry and other fruit trees. The city is well built, and moſt of the ſtreets are paved.

Here is found a number of Mohammedan merchants, ſome of the richeſt and moſt reſpectable in the empire. Silk is the chief article of commerce.

The *miri*, or fixed public revenue paid by Tripoli to Conſtantinople, is only about L.1000 Sterling, 20 purſes, a-year. Syria at preſent contains only four Paſhaliks, Damaſcus, Aleppo, Acré, and Tripoli; the laſt of which is the ſmalleſt in territory and power. Our author obſerved no antiquities at Tripoli; but the country round it is noted for producing the beſt tobacco in Syria.

TRISECTION, the dividing a thing into three equal parts. The term is chiefly uſed in geometry, for the diviſion of an angle into three equal parts. The *triſection of an angle* geometrically, is one of thoſe great problems, whoſe ſolution has been ſo much ſought for by mathematicians for 2000 years paſt; being, in this reſpect, on a footing with the famous quadrature of the circle, and the duplicature of the cube.

TRISTAN d'Acunha, the largeſt of three iſlands which were viſited by Lord Macartney and his ſuit on the 31ſt of December 1792. The other two are diſtinguiſhed by the names of *Inacceſſible* and *Nightingale* iſlands. "Inacceſſible (as Sir Eraſmus Gower obſerved) ſeems to deſerve that name, being a high, bluff, as well as apparently barren plain, about nine miles in circumference, and has a very forbidding appearance. There is a high rock detached from it at the ſouth end. Its latitude is 37° 19′ ſouth; its longitude 11° 50′ weſt from Greenwich. This rude looking ſpot may be ſeen at 12 or 14 leagues diſtance. Nightingale iſland is irregular in its form, with a hollow in the middle, and is about ſeven or eight miles in circumference, with ſmall rocky iſles at its ſouthern extremity. It is deſcribed as having anchorage on the north-eaſt ſide. Its latitude is 37° 29′ ſouth; and longitude 11° 48′ weſt from Greenwich. It may be ſeen at ſeven or eight leagues diſtance. The largeſt of theſe three iſlands, which comparatively may be called the great iſle of *Triſtan d'Acunha*, is very high, and may be ſeen at 25 leagues diſtance. It ſeems not to exceed in circumference 15 miles. A part of the iſland towards the north riſes perpendicularly from the ſea to a height apparently of a thouſand feet or more. A level then commences, forming what among ſeamen is termed *table land*, and extending towards the centre of the iſland; from whence a conical mountain riſes, not unlike in appearance to the Peak of Teneriffe, as ſeen from the bay of Santa Cruz. Boats were ſent to ſound and to examine the ſhore for a convenient place to land and water. In conſequence of their report, the Lion (a ſhip of 64 guns) ſtood in, and came to anchor in the evening on the north ſide, in 30 fathoms water, one mile from the ſhore; the bottom black ſand with ſlime; a ſmall rock, off the weſt point, bearing ſouth-weſt by ſouth, juſt open with the weſtern extremity of the iſland; a caſcade, or fall of water, emptying itſelf upon the beach, ſouth by eaſt. All the ſhore, from the ſouthern point to the eaſtern extremity, appears to be clear of danger, and ſteep, except the weſt point, where there are breakers about two cables length, or near 500 yards from the ſhore. The ſhip, when anchored, was overſhadowed by the dark maſs of that portion of the iſland whoſe ſides ſeemed to riſe, like a moſs-grown wall, immediately from the ocean. On the right the elevation was leſs rapid, and between the riſing part and the ſea was left a flat, of ſome extent, covered with ſedge-graſs, interſperſed with ſmall ſhrubs, which, being perfectly green, looked from the ſhip like a pleaſant meadow, watered by a ſtream that fell, afterwards, from its banks upon the beach. The officers, who went aſhore, reported, that the caſks might be filled with freſh water by means of a long hoſe, without moving them from the boats. The landing place thereabouts was alſo deſcribed as being ſafe, and ſuperior to any other that had been examined. From the plain, the land roſe gradually towards the central mountain, in ridges covered with trees of a moderate ſize and height. The coaſt abounded with ſea lions and ſeals, penguins and albatroſſes. One of the latter was brought on board, his wings meaſuring ten feet from tip to tip; but others are ſaid to have been found much larger. The coaſt was covered with a broad ſea-weed, ſeveral fathoms long, and deſervedly by naturaliſts termed *gigantic fucus*. Some good fiſh was caught with the hook and line.

"The accident of a ſudden guſt, by which the anchor was in a few hours driven from its hold, and the ſhip forced out to ſea, prevented the iſland from being explored, as was intended. It is probable that had the Lion anchored in 20, inſtead of 30 fathoms water, the anchor would have held firmly. Some advantage was obtained, however, from coming to this place. The juſt poſition of thoſe iſlands, in reſpect to their longitude, was aſcertained, by the mean of ſeveral time-pieces, to be about two degrees to the eaſtward of the place where they are laid down in charts, taken from obſervations made at a period when the inſtruments for this purpoſe were leſs accurate than at preſent. The ſpot where the Lion anchored was determined, by good meridional obſervations, and by accurate time-pieces, to be 37° 6′ ſouth latitude, and 11° 43′ weſt longitude from Greenwich. The compaſs had ſeven degrees of variation weſtward from the pole. Fahrenheit's thermometer ſtood at 67 degrees. It was uſeful alſo to have aſcertained, that a ſafe anchorage, and plenty of good water, were to be found here. Theſe iſlands are certainly worthy of a more particular inquiry; for they are not 50 leagues from the general track of veſſels bound to China, and to the coaſt of Coromandel, by the outer paſſage. In war time, an excellent rendezvous might be ſettled there, for ſhips that wanted no other ſupply but that of water. When circumſtances require

require particular difpatch, it is practicable to come from England to Triftan d'Acunha without ftopping in the way, and afterwards to the end of the voyage to India or China."

Thefe iflands are feparated by a fpace of about fifteen hundred miles from any land to the weftward or northward of them. They are fituated in that part of the fouthern hemifphere, in the neighbourhood of which a continent, to balance the quantity of land in the northern hemifphere, was once expected to be found, but where it has been fince difcovered that there is none. Of what extent, however, the bafes of thefe iflands are under the furface of the fea, cannot be afcertained; or whether they may, or may not, be fufficient to make up for the defect of land appearing above water. Navigators report, that to the eaftward of them are other fmall iflands, differing not much in latitude, fuch as Gough and Alvarez iflands, and the Marfouines; as well as extenfive fhoals, lying due fouth of the moft foutherly point of Africa, and extending eafterly feveral degrees. That all thefe together form a chain, fome of fubaqueous, and fome of fuperaqueous mountains, but all connected by their roots, is perhaps a conjecture lefs improbable, than that they fhould feparately arife, like tall columns, from the vaft abyfs.

A fettlement in Triftan d'Acunha is known to have been twice in the contemplation of adventurers, but not as yet to have been carried into execution. One had the project of rendering it a mart for the change of the light manufactures of Hindoftan, fuited to hot climes, for the filver of the Spanifh fettlements in South America; in the route between which places it is conveniently fituated. The other plan meant is only as a fuitable fpot for drying and preparing the furs of fea lions and feals, and for extracting the fpermaceti of the white or long-nofed whale, and the whale-bone and oil of the black fpecies. Whales of every kind were feen fporting about Triftan d'Acunha, particularly near the fetting of the fun; and the fword fifh likewife made its appearance occafionally.—*Sir George Staunton's Account of the Embaffy to China.*

TRISTO, a bay on the north coaft of S. America, is W. S. W. of the river Turiano. It has good anchorage and is well fheltered from the fwell of the fea. —*Morse.*

TRITON, in zoology, a genus belonging to the order of vermes mollufca. The body is oblong; the tongue is fpiral; it has twelve tentacula, fix on each fide, the hindmoft ones having claws like a crab. There is but one fpecies, found in holes of rocks about the fhore.

TRIVIGILLO *Bay*, in the Gulf of Honduras, or fouth fhore of the Gulf of Mexico, is within the Ifland of Pines. Dulce river lies a little to the weft.—*Morse.*

TROCADIE, a fmall ifland on the N. coaft of the Ifland of St John's, lying off the mouth of Shimene Port, and in the Gulf of St Lawrence.—*ib.*

TROIS *Rivieres*, a bay at the eaft end of the abovementioned Ifland of St John's, and weft of Cape Breton Ifland. Three ftreams fall into it from different directions; hence its name. N. lat. 46 5, W. long. 62 15.—*ib.*

Trois *Rivieres*, or the *Three Rivers*, or *Treble River*, a town of Lower Canada, fettled by the French in 1610; and is fo called from the junction of three waters a little below the town where they fall into the river St Lawrence. The town ftands on the northern bank of the St-Lawrence, at that part of the river called Lake St Pierre. It is but thinly inhabited; is commodioufly fituated for the fur trade, and was formerly the feat of the French government, and the grand mart to which the natives reforted. It is pleafantly fituated in a fertile country, about 50 miles fouth-weft of Quebec. The inhabitants are moftly rich, and have elegant, well furnifhed houfes, and the country round wears a fine appearance. N. lat. 46 51, W. long. 75 15.—*ib.*

TROMPEAUR, *Cape, del Enganna*, or *Falfe Cape*, is the eafternmoft point, of the ifland of St Domingo. N. lat. 18 25, W. long. from Paris 71.—*ib.*

TROPIC *Keys*, are fmall iflands or rocks, on the north of Crab Ifland, and off the eaft coaft of Porto Rico Ifland. A number of tropic birds breed here, which are a fpecies never feen but between the tropics. —*ib.*

TROQUOES, a bay at the fouthern extremity of the eaftern part of Lake Huron, feparated from Matchudoch Bay on the N. E. by a broad promontory.—*ib.*

TROQUQUA, an ifland on the north coaft of S. America, in the mouth of a fmall bay near Cape Seco, a fhort way S. E. from the eaft point of the bay or river Taratura.—*ib.*

TROTTER (Mrs Catharine), was the daughter of Captain David Trotter, a Scotch gentleman. He was a commander in the royal navy in the reign of Charles II. and at his death left two daughters, the youngeft of whom, Catharine, our celebrated author, was born in London, Auguft 1679. She gave early marks of her genius; and learned to write, and alfo made herfelf miftrefs of the French language, by her own application and diligence, without any inftructor; but fhe had fome affiftance in the ftudy of the Latin grammar and logic, of which latter fhe drew up an abftract for her own ufe. The moft ferious and important fubjects, and efpecially religion, foon engaged her attention.—But notwithftanding her education, her intimacy with feveral families of diftinction of the Romifh perfuafion, expofed her, while very young, to impreffions in favour of that church; which not being removed by her conferences with fome eminent and learned members of the church of England, fhe embraced the Romifh communion, in which fhe continued till the year 1707. In 1695, fhe produced a tragedy called *Agnes de Caftro*, which was acted at the theatre-royal when fhe was only in her 17th year. The reputation of this performance, and the verfes which fhe addreffed to Mr Congreve upon his Mourning Bride, in 1697, were probably the foundation of her acquaintance with that celebrated writer. Her fecond tragedy, *Fatal Friendfhip*, was acted in 1698, at the new theatre in Lincoln's-Inn-Fields. This tragedy met with great applaufe, and is ftill thought the moft perfect of her dramatic performances. Her dramatic talents not being confined to tragedy, fhe brought upon the ftage, in 1701, a comedy called *Love at a lofs*, or *Moft votes carry it.* In the fame year fhe gave the public her third tragedy, entitled the *Unhappy Penitent*, acted at the theatre-royal in Drury-lane. But poetry and dramatic writing did not fo far engrofs the thoughts of our author but that fhe fometimes turned them to fubjects of a very different nature; and diftinguifhed herfelf in an extraordinary

manner

manner in defence of Mr Locke's writings; a female metaphyfician being a remarkable phenomenon in the republic of letters.

She returned to the exercife of her dramatic genius in 1703, and fixed upon the revolution of Sweden, under Guftavus Erickfon, for the fubject of a tragedy. This tragedy was acted, in 1706, at the Queen's theatre in the Hay-Market. In 1707, her doubts concerning the Romifh religion, which fhe had fo many years profeffed, having led her to a thorough examination of the grounds of it, by confulting the beft books on both fides of the queftion, and advifing with men of the beft judgment, the refult was a conviction of the falfenefs of the pretenfions of that church, and a return to that of England, to which fhe adhered during the remainder of her life. In 1708, fhe was married to the Rev. Mr Cockburn, then curate of St Dunftan's in Fleet-ftreet, but he afterwards obtained the living of Long-Horfeley, near Morpeth in Northumberland. He was a man of confiderable abilities; and, among feveral other things, wrote an account of the Mofaic Deluge, which was much approved by the learned.

Mrs Cockburn's remarks upon fome writers in the controverfy concerning the foundation of moral duty and moral obligation, were introduced to the world, in Auguft 1743, in the Literary Journal, intitled *The Hiftory of the Works of the Learned*. The ftrength, clearnefs, and vivacity fhewn in her remarks upon the moft abftract and perplexed queftions, immediately raifed the curiofity of all good judges about the concealed writer; and their admiration was greatly increafed when her fex and advanced age were known. Dr Rutherforth's Effay on the Nature and Obligations of Virtue, publifhed in May 1744, foon engaged her thoughts; and notwithftanding the afthmatic diforder which had feized her many years before, and now left her fmall intervals of eafe, fhe applied herfelf to the confutation of that elaborate difcourfe, and finifhed it with a fpirit, elegance, and perfpicuity equal, if not fuperior, to all her former writings.

The lofs of her hufband in 1748, in the 71ft year of his age, was a fevere fhock to her; and fhe did not long furvive him, dying on the 11th of May 1749, in her 71ft year, after having long fupported a painful diforder with a refignation to the Divine will, which had been the governing principle of her whole life, and her fupport under the various trials of it.

Her works are collected into two large volumes 8vo, by Dr Birch; who has prefixed to them an account of her life and writings.

TROU JACOB, on the fouth fide of the ifland of St Domingo. From this to Cape Beate, or Cape a Foux, the fhore is rocky.—*Morse*.

TROU, Le, a fettlement in the northern part of the French divifion of the ifland of St Domingo. It is $5\frac{1}{2}$ leagues E. of Ouanaminthe, and 2 S. E. of Limonade. N. lat. 19 35, W. long. from Paris 74 22.—*ib*.

TROY, a poft-town of New-York, Ranffelaer county, 6 miles north of Albany, 3 S. of Lanfingburg city, and 271 from Philadelphia. The townfhip of Troy is bounded E. by Peterfburg, and was taken from Renffellaerwyck townfhip, and incorporated in 1791. In 1796, 550 of the inhabitants were electors. Seven years ago, the fcite of the flourifhing village of Troy was covered with flocks and herds, and the fpot on which a fchool, containing 160 fcholars, is now erected, was then probably a fheepfold. The fchool is under the direction of three fchoolmafters, and is a very promifing feminary.—*ib*.

TRUMPET MARINE, or MARIGNY. This is a ftringed inftrument, invented in the 16th century by an Italian artift Marino or Marigni, and called a *trumpet*, becaufe it takes only the notes of the trumpet, with all its omiffions and imperfections, and can therefore execute only fuch melodies as are fitted for that inftrument. It is a very curious inftrument, though of fmall mufical powers, becaufe its mode of performance is totally unlike that of other ftringed inftruments; and it deferves our very particular attention, becaufe it lays open the mechanifm of mufical founds more than any thing we are acquainted with; and we fhall therefore make ufe of it in order to communicate to our readers a philofophical theory of mufic, which we have already treated in detail as a liberal or fcientific art.

Plate XLV.

The trumpet marine is commonly made in the form of a long triangular pyramid, ABCD, fig. A. on which a fingle ftring EFG is ftrained over a bridge F by means of the finger pin L. At the narrow end are feveral frets 1, 2, 3, 4, 5, &c. between E and K, which divide the length EF into aliquot parts. Thus E 1 is $\frac{1}{12}$ of EF, E 2 is $\frac{1}{11}$, and fo on. The bow is drawn lightly acrofs the cord at H, and the ftring is ftopped by preffing it with the finger immediately above the frets, but not fo hard as to make it touch the fret. When the open ftring is founded, it gives the fundamental note. If it be ftopped, in the way now defcribed, at $\frac{1}{3}$d of its length from E, it yields the 12th of the fundamental; if ftopped at $\frac{1}{4}$th, it gives the double octave; if at $\frac{1}{5}$th, it gives the 17th major, &c. In fhort, it always gives the note correfponding to the length of the part between the fret and the nut E. The founds refemble thofe of a pipe, and are indeed the fame with thofe known by the name *harmonics*, and now executed by every performer on inftruments of the viol or violin fpecies. But in order to increafe the noife, the bridge F is conftructed in a very particular manner. It does not reft on the found-board of the inftrument through its whole breadth, but only at the corner *a*, where it is firmly fixed. The other extremity is detached about $\frac{1}{100}$ of an inch from the found-board; and thus the bridge being made to tremble by the ftrong vibration of the thick cord, rattles on the found-board, or on a bit of ivory glued to it. The ufual way in which this motion is procured, is to have another ftring paffing under the middle of the bridge in fuch a manner that, by ftraining it tight, we raife the corner *b* from the found-board to the proper height. This contrivance increafes prodigioufly the noife of the inftrument, and gives it fomewhat of the fmart found of the trumpet, though very harfh and coarfe. But it merits the attention of every perfon who wifhes to know any thing of the philofophy of mufical founds, and we fhall therefore fay as much on the fubject as will conduce to this effect.

Galileo, as we have obferved in the article TEMPERAMENT, *Suppl.* was the firft who difcovered the real connection between mathematics and mufic, by demonftrating that the times of the vibrations of elaftic cords of the fame matter and fize, and ftretched by equal weights, are proportional to the lengths of the ftrings.

He

He inferred from this that the mufical pitch of the found produced by a ftretched cord depended folely on the frequency of the vibrations. Moreover, not being able to difcover any other circumftance in which thofe founds phyfically refembled each other, and reflecting that all founds are immediately produced by agitations of air acting on the ear, he concluded that each vibration of the cord produced a fonorous pulfe in the air, and therefore that the pitch of *any* found whatever depended on the frequency of the aerial pulfes. In this way alone the found of a ftring, of a bell, of an organ pipe, and the bellow of a bull, may have the fame pitch. He could not, however, demonftrate this in any cafe but the one above mentioned. But he was encouraged to hope that mathematicians would be able to demonftrate it in all cafes, by his having obferved that the fame proportions obtained in organ pipes as in ftrings ftretched by equal weights. But it required a great progrefs in mechanical philofophy, from the ftate in which Galileo found it, before men could fpeculate and reafon concerning the pulfes of air, and difcover any analogy between them and the vibrations of a ftring. This analogy, however, was difcovered, and its demonftration completed, as we fhall fee by and by. In the mean time, Galileo's demonftration of the vibrations of elaftic cords became the foundation of all mufical philofophy. It muft be thoroughly underftood before we can explain the performance of the trumpet marine.

The demonftration of Galileo is remarkable for that beautiful fimplicity and perfpicuity which diftinguifh all the writings of that great mechanician, and it is the elementary propofition in all mechanical treatifes of mufic. Few of them indeed contain any thing more; but it is extremely imperfect, and is juft only on the fuppofition that all the matter of the ftring is collected at its middle point, and that the reft of it has elafticity without *inertia*. This did not fuit the accurate knowledge of the laft century, after Huyghens and Newton had given the world a tafte of what might be done by profecuting the Galilean mechanics. When a mufical cord has its middle point drawn afide, and it is ftrained into the fhape of two ftrait lines, if it be let go, it will be obferved not to vibrate in this form. It may eafily be feen in the extremity of its excurfions, where it refts, before it return by its elafticity. The reafon is this (fee fig. B.) When the middle point C of the cord is drawn afide, and the cord has the form of two ftraight lines AC, CB, this point C, being pulled in the directions CA, CB, at once, is really accelerated in the direction CD, which bifects the angle ACB; and if it were then detached from the reft of the material cord, it would move in that direction. But any other point *f* between C and B has no accelerating force whatever acting on it. It is equally pulled in the directions *f* C and *f* B. The particle C therefore is obliged to drag along with it the inert matter of the reft of the cord; and when it has come to any intermediate fituation *c*, the cord cannot have the form of two ftraight lines A *c*, *c* B, with the particle *f* fituated in *'f*. This particle will be left fomewhat behind, as in φ, and the cord will have a curved form A *c* φ B; and in this form it will vibrate, going to the other fide, and affuming, not the rectilineal form ADB, but the curved form A ∂ B. That every particle of the curve A *e c 'f* B is now accelerated toward the axis AB is evident, becaufe every part is curved, and the whole is ftrained toward A and B, which tends to ftraighten every part of it. But in order that the whole may arrive at the axis in one moment, and conftitute a ftraight line AB, it is evidently neceffary that the accelerating force on every particle be as the diftance of the particle from that point of the axis at which it arrives. It is well known to the mathematician that the accelerating force by which any particle is urged towards a rectilineal pofition, with refpect to the adjoining particles, is proportional to the curvature. Our readers who are not familiar with fuch difcuffions, may fee the truth of this fundamental propofition by confidering the whole of A *c* B as only a particle or minute portion of a curve, magnified by a microfcope. The force which ftrains the curve may be reprefented by *c* A or AE. Now it is well known (and is the foundation of Galileo's demonftration) that the ftraining force is to the force with which *c* is accelerated in the direction *c* E as A *c* to *c* D, or as AE to *c* D, or as AE to twice *c* E. Now *c* E is the meafure of the curvature of A *c* B, being its deflection from a right line. Therefore when the ftraining force is the fame all over the curve, the accelerating force, by which any portion of it tends to become ftraight, is proportional to the curvature of that portion. And if *r* be the radius of a circle paffing through A, *c*, and B, and coinciding with this element of a curve, it is plain that $c\text{D} : c\text{A} = c\text{A} : r$, or that the radius of curvature is to the element *c* A as the extending force to the accelerating force; and $c\text{D} = \frac{c\text{A}^2}{r}$; and is inverfely as *r*, or directly as the curvature.

Hence we fee the nature of that curve which a mufical chord muft have, in order that all its parts may arrive at the axis at once. The curvature at *c* muft be to the curvature at *f* as E *c* to *g f*. But this may not be enough. It is farther neceffary that when *c* has got half way to E, the curvature in the different points of the new curve into which the cord has now arranged itfelf, be alfo, in every point, proportional to the diftance from the axis. Now this *will* be the cafe if the extreme curve has been fuch. For, taking the cord in any other fucceffive fhape, the diftance which each point has gone in the fame moment muft be proportional to the force which impelled it; therefore the remaining diftances of all the points from the axis will have the fame proportion as before. And the geometrical and evident confequence of this is, that the curvatures will alfo be in the fame proportion.

Therefore a cord that is once arranged in this form will always preferve it, and will vibrate like a cycloidal pendulum, performing its ofcillations in equal times, whether they be wide or narrow. Therefore fince this perfect ifochronifm of vibrations is all that is wanted for preferving the fame mufical pitch or tone, this cord will always have the fame note.

This propofition was the difcovery of Dr Brooke Taylor, one of the ornaments of our country*, and is publifhed in his celebrated work *Methodus Incrementorum*. The inveftigation, however, and the demonftration in that work, are fo obfcure and fo tedious that few had patience to perufe them. It was more elegantly treated afterwards by the Bernoullis and others. The curve got the name of the *Taylorean curve;* and is confidered by many eminent mathematicians as a trochoid, *viz.*

* See his life, *Encycl.*

Trumpet Marine.

viz. the curve defcribed by a point in the nave or fpoke of a wheel while the wheel rolls along a ftraight line. But this is a miftake, although it is allied to the trochoid in the fame manner that the figure of fines is allied to the cycloid. Its phyfical property intitles it to the name of the HARMONICAL CURVE. As this curve is not only the foundation of all our knowledge of the vibration of elaftic cords, but alfo furnifhes an equation which will lead the mathematician through the whole labyrinth of aereal undulations, and be of ufe on many other occafions; and as the firft mathematicians have, through inattention, or through enmity to Dr Taylor, affected to confider it as the trochoid already well known to themfelves—we fhall give a fhort account of its conftruction and chief properties, fimplified from the elegant defcription given by Dr Smith in his Harmonics.

Let SDTV, QERP (fig. C.), be circles defcribed round the centre C. Draw the diameters QCR, ECP, cutting each other at right angles. From any point G in the exterior circle draw the radius GC, cutting the interior circle in F, draw KHFI parallel to QCR, and make HI, HK, each equal to the arch EG. Let this be done for every point of the quadrantal arch EGR. The points I, K, are in the harmonic curve; that is, the curve AKDIB paffing through the points K and I, determined by this conftruction, has its curvature in every point K proportional to the diftance KN from the bafe AB.

To demonftrate this, draw FL perpendicular to the axis, and join EL. Take another point g in the outer circle indefinitely near to G. Draw $g\,c$, cutting the inner circle in f, and $f\,h$ and $f\,l$ perpendicular to DC, CT, and join El. Then fuppofe two lines Km', Km' perpendicular to the curve in K and k. They muft meet in m', the centre of the equicurve circle. Draw KNn' perpendicular to the bafe, and $m'\,n'$ parallel to it, and join $k\,n$. Laftly, draw XL x perpendicular to EL.

It is plain that k O, the difference of HK and $h\,k$, is equal to Gg, the difference of GE and g E, and that KO is equal to F r, and Ll to rf. Alfo, becaufe ELX is a right angle, $EX = \frac{EL^2}{EC}$.

We have $Fr : Ff = CL : CF, = CL : CD.$

$Ff : Gg = \quad CD : CE.$

Therefore $Fr : Gg$, or $KO : Ok = CL : CE.$

The triangles ECL and kOK are therefore fimilar, as are alfo kOK and K$n\,m$, and confequently ECL and K$n\,m$; and becaufe EC is parallel to Kn, EL is parallel to Km. For the fame reafon km is parallel to El, and the triangles E$l\,x$ and m K k are fimilar, and

$Lx : Kk = LE : Km,$

and $Lx : Kk = EC : Kn.$ But farther,

$Lx : Ll = CE : CL$

$Ll : Ff = KN : CD$, being $= FL : FC$

$Ff : Gg = CD : CE$, being $= Ff : kO$

$Gg : Kk = CE : CL$, being $= KO : Kk.$

Therefore $Lx : Kk = KN \times CE : EL^2, = KN : EX.$

Therefore $KN : EX = LE : Km$, and $Km = \frac{EX \cdot LE}{KN}$,

and $KN : EX = CE : Kn$, and $Kn = \frac{EX \cdot CE}{KN}$.

In the very narrow vibrations of mufical cords, CD is exceedingly fmall in comparifon with CE, fo that EX·EL, or EX CE, may, without fenfible error, be taken for CE², and then we obtain Km or Kn (which hardly differ) $= \frac{CE^2}{KN}$, and therefore the curvature is proportional to KN. The fmall deviation from this ratio would feem to fhew that this conftruction does not give the harmonic curve with accuracy. But it is not fo. For it will be found that although the curvature is not as KN, it is ftill proportional to the fpace which any particle K muft really defcribe in order to arrive at the axis. Thefe paths are lines whofe curvatures diminifh as they approach to DC.

We fee 1*ft*, that the bafe ACB of the curve is equal to the femicircular arch QER.

2*d*, Alfo that the tangent KZ in any point K is perpendicular to EL.

3*d*, We learn that the curvature at A and B is nothing, for in thefe two points KN is nothing.

4*th*, The radius of curvature at D is precifely $= \frac{CE^2}{CD}$.

Therefore as the ftring approaches the axis, and CD diminifhes, the curvature diminifhes in the fame proportion. The vibrations therefore are performed like thofe of a pendulum in a cycloid, and are ifochronous, whether wide or narrow, and therefore the mufical pitch is conftant.

This is not ftrictly true, becaufe in the wide vibrations the extenfion or extending force is fomewhat greater. Hence it is that a ftring when violently twanged founds a little fharper at the beginning. Dr Long made a harpfichord whofe ftrings were ftretched by weights, by which this imperfection was removed.

It is proper to exhibit the curvature at D in terms of the length AB, and of the greateft excurfion c D. Therefore let c be the circumference of a circle whofe diameter is 1. Let AB the length of the cord be = L, and let CD the $\frac{1}{2}$ breadth of the vibration be B.

We had a little ago $Dm = \frac{CE^2}{CD}$, but $c : 1 = AB : CE$, and $CE = \frac{AB}{c}$, and $CE^2 = \frac{AB^2}{c^2}$. Therefore $Dm = \frac{AB^2}{c^2 \times CD}, = \frac{L^2}{9{,}87CD}$ nearly.

We can now tell the number of vibrations made in a fecond by a ftring. This we obtain by comparing its motion, when impelled by the accelerating force which acts on it, with its motion when acted on by its weight only. Therefore let L be the length of a ftring, and W its weight, and let E be the ftraining weight, or extending force. Let f be the force which accelerates the particle D d of the cord, and w the weight of that particle, while W is the weight of the whole cord. Let z be the fpace which the particle D d would defcribe during the time of one vibration by the uniform action of the force f, and let S be the fpace which it would defcribe in the fame time by its weight w alone. Then (DYNAMICS, *Suppl.* n° 103. cor. 6.) the time in which f would impel the particle D d along $\frac{1}{2}$ DC, is to the time of one vibration as $1 : c$. And $\frac{1}{2}$ DC is to z as the fquare of the time of defcribing $\frac{1}{2}$ DC, is to the fquare of the time of defcribing z; that is, $1 : c^2 = \frac{1}{2} DC : 2z$, and $c^2 . DC = 2z$.

Now, by the property of the harmonic curve,

$AB : Dm = 2z : AB$

But

Trumpet Marine.

But $Dm : Dd = E : f$
And $Dd : AB = w : W$
Therefore $2z \cdot E \cdot w = AB f \cdot W$
And $f : w = 2z \times E : AB \times W$
But $w : f = 2S : 2z$
Therefore $2S \times E = AB \times W$
And $2E : W = AB : S$.

That is, a mufical cord, extended by a force E, performs one vibration DCV in the time that a heavy body defcribes a fpace S, which is to the length of the cord as its weight is to twice the extending force.

Now let g be the fpace through which a heavy body falls in one fecond, and let the time of a vibration (eftimated in parts of a fecond) be T. We have

$$AB : S = 2E : W$$
$$S : g = T^2 : 1^2$$
$$\text{Therefore } AB : g = 2E \cdot T^2 : W$$
$$\text{And } AB \times W = T^2 \times 2E \times g$$
$$\text{Therefore } T^2 = \frac{AB \times W}{2g.E}, \text{ and } T = \sqrt{\frac{AB \times W.}{2g.E}}$$

Let n be the number of vibrations made in a fecond.

$$n = \frac{1}{T}, = \sqrt{\frac{2g.E}{AB.W}} = \sqrt{\frac{2gE}{L.W}}.$$

If the length of the cord be meafured in feet, $2g$ is very nearly 32. If in inches, $2g$ is 386, more nearly. Therefore $n = \sqrt{\frac{32\,E}{L.W}}$ or $\sqrt{\frac{386\,E}{L.W}}$. This may eafily be compared with obfervation. Dr Smith hung a weight of 7 pounds, or 49,000 grains, on a brafs wire fufpended from a finger pin, and fhortened it till it was in perfect unifon with the double octave below the open ftring D of a violin. In this ftate the wire was 35,55 inches long, and it weighed 31 grains.

Now $\sqrt{\frac{384 \times 49000}{35{,}55 \times 31}} = 130{,}7 = n$. This wire, therefore, ought to make 130,7 vibrations in a fecond. Dr Smith proceeded to afcertain the number of aereal pulfes made by this found, availing himfelf of the theory of the beats of tempered confonances invented by himfelf. On his fine chamber organ he tuned upwards the perfect fifths DA, A *e*, *e b*, and then tuned downward the perfect 6th *e d*. Thus he obtained an octave to D, which was too fharp by a comma, and he found that it beat 65 times in 20 feconds. Therefore the number of vibrations was $\frac{65}{20}$ 81, or 263,25. Thefe were complete pulfes or motions from D to V and back again, and therefore contained $526\frac{1}{2}$ fuch vibrations as we have now been confidering. The double octave below fhould make $\frac{1}{4}$th of this, or 131,6, which is not a complete vibration more than the above theory requires: more accurate coincidence is needlefs.

This theory is therefore very completely eftablifhed, and it may be confidered as one of the fineft mechanical problems which has been folved in the 18th century. We mention it with the greater minutenefs, becaufe the merit of Dr Taylor is not fufficiently attended to. Mr Rameau, and the other great theorifts in mufic, make no mention of him; and fuch as have occafion to fpeak of the abfolute number of vibrations made by any mufical note, always quote Mr Sauveur of the French academy. This gentleman has written fome very excellent differtations on the theory of mufic, and Sir Ifaac Newton in his *Principia* often quotes his authority. He has given the actual determination of the number of vibrations of the note C, obtained in a manner fimilar to that practifed by Dr Smith on his chamber organ, and which agrees extremely well with that meafure. But Mr Sauveur has alfo given a mechanical inveftigation of the problem, which gives the fame number of vibrations that he obferved. We prefume that Rameau and others took the demonftration for good: and thus Mr Sauveur paffes on the continent for the difcoverer of this theorem. But it was not publifhed till 1716, though read in 1713; whereas Dr Taylor's demonftration was read to the Royal Society in May 1714. But this demonftration of Mr Sauveur is a mere paralogifm, where errors compenfate errors; and the affumption on which he proceeds is quite gratuitous, and has nothing to do with the fubject. Yet John Bernoulli, from enmity to Taylor and the Englifh mathematicians, takes not the leaft notice of this fophifticated demonftration, accommodated to the experiment, and fo devoid of any pretenfions to argument that this fevere critic could not but fee its falfity.

Sauveur was one of the firft who obferved diftinctly that remarkable fact which Mr Rameau made the foundation of his mufical theory, *viz.* that a full mufical note is accompanied by its octave, its twelfth, and its feventeenth major. It had been cafually obferved before, by Merfennus, by Perrault, and others; but Sauveur tells diftinctly how to make the obfervation, and affirms it to be true in all deep notes. Rameau afferts it to be univerfally and neceffarily true in all notes, and the foundation of all mufical pleafure.

It had been difcovered before this time, that not only a full note caufed its unifon to refound, but alfo that a 12th, being founded near any open ftring, the ftring *refounded* to this 12th. It does the fame to a 15th, a 17th major, a 22d, &c.

Dr Wallis added a very curious circumftance to this obfervation. Two of his pupils, Mr Noble and Mr Pigot, in 1673, amufing themfelves with thefe refonances, obferved, that if a fmall bit of paper be laid on the ftring of a violin which is made to refound to its unifon, the paper is thrown off: a proof that the ftring refounded by really vibrating, and that it is thrown into thefe vibrations by the pulfes of the air produced by the other ftring. In like manner the paper is thrown off when the ftring refounds to its octave. But the young gentlemen obferved, that when the paper was laid on the middle point of the ftring, it remained without agitation, although the ftring ftill refounded. They found the fame thing when they made the ftring refound to its 12th: papers laid on the two points of divifion lay ftill, but were thrown off when laid on any other place. In fhort, they found it a general rule, that papers laid on any points of divifion correfponding to the note which was refounded, were not agitated.

Dr Wallis (the greateft theorift in mufic of the 17th century) juftly concluded that thefe points of the refounding ftring were at reft, and that the intermediate parts were vibrating, and producing the notes correfponding to their lengths.

From this Mr Sauveur, with great propriety, deduced the theory of the performance of the trumpet marine, the vielle, the clavichord, and fome other inftruments.

When

Trumpet Marine.

When the ſtring of the trumpet marine is gently ſtopped at $\frac{1}{2}$, and the bow drawn lightly acroſs it at H (fig. A), the full vibration at the finger is ſtopped; but the ſtring is thrown into vibrations of ſome kind, which will either be deſtroyed or may go on. It is of importance to ſee what circumſtance will permit their continuance.

Suppoſe an elaſtic cord put into the ſituation ABCDE, (fig. D), ſuch that AB, BC, CD, DE, are all equal, and that BCD is a ſtraight line. Let the point C be made faſt, and the two points B and D be let go at once. It is evident that the two parts will immediately vibrate in two harmonical curves A*b*C and CDE, which will change to ABC and C*d*E, and ſo on alternately. It is alſo evident that if a line FCG be drawn touching the curve ABC, it will alſo touch the curve CDE; and the line which touches the curve A*b*C in C, will alſo touch the curve C*d*E. In every inſtant the two halves of the cord will be curves which have a common tangent in the point C. The undoubted conſequence of this is, that the point C will not be affected by theſe vibrations, and its fixure may be taken away. The cord will continue to vibrate, and will give the ſound of the octave to its fundamental note.

The condition, then, which muſt be implemented, in order that a ſtring may reſound to its octave, or take the ſound of its octave, is ſimply this, that its two parts may vibrate equally in oppoſite directions. This is evidently poſſible; and when the bow is drawn acroſs the ſtring of the trumpet marine at H, and irregular vibrations are produced in the whole ſtring, thoſe which happen to be in one direction on both ſides of the middle point, where it is gently ſtopped by the finger, will deſtroy each other, and the conſpiring ones will be inſtantly produced, and then every ſucceeding action of the bow will increaſe them.

The ſame thing muſt happen if a ſtring is gently ſtopped at one-third of its length; for there will be the ſame equilibrium of forces at the two points of diviſion, ſo that the fixures of theſe points may be removed, and the ſtring will vibrate in three parts, ſounding the 12th of the fundamental.

We may obſerve, by the way, that if the bow be drawn acroſs the ſtring at one of the points of diviſion, correſponding to the ſtopping at the other end of the ſtring, it will hardly give any diſtinct note. It rattles, and is intolerably harſh. The reaſon is plain: The bow takes ſome hold of the point C, and drags it along with it. The cord on each ſide of C is left behind, and therefore the two curves cannot have a common tangent at C. The vibrations into which it is thus jogged by the bow deſtroy each other.

We now ſee why the trumpet marine will not ſound every note. It will ſound none but ſuch as correſpond to a diviſion of the ſtring into a number of equal parts, and its note will be in uniſon with a ſtring equal to one of thoſe parts. Therefore it will *firſt* of all ſound the fundamental, by its whole length;

2. Its octave, correſponding to - $\frac{1}{2}$ its length
3. The 12th, - - - - $\frac{1}{3}$
4. The 15th, or double octave, - $\frac{1}{4}$
5. The 17th, - - - - $\frac{1}{5}$
6. The 19th, - - - - $\frac{1}{6}$
7. The 21ſt, which is not in the diatonic ſcale of our muſic, - $\frac{1}{7}$
8. The triple octave or 22d, $\frac{1}{8}$ its length
9. The 23d, or 2d in the ſcale of the triple octave, . - - $\frac{1}{9}$
10. The 24th or 3d in this ſcale, $\frac{1}{10}$
11. The 25th, a falſe 4th of this ſcale, $\frac{1}{11}$
12. The 26th, a perfect 5th of this ſcale, $\frac{1}{12}$
13. The 27th, a falſe 6th of ditto, $\frac{1}{13} = \frac{3}{39}$ or $\frac{3}{40}$
14. The 28th, a falſe 7th minor, - $\frac{1}{14}$
15. The 28th, a perfect 7th major, $\frac{1}{15}$
16. The quadruple octave, - $\frac{1}{16}$

Thus we ſee that this inſtrument will not execute all muſic, and indeed will not complete any octave, becauſe it will neither give a perfect 4th nor 6th. We ſhall preſently ſee that theſe are the very defects of the trumpet.

This ſingular ſtringed inſtrument has been deſcribed in this detail, chiefly with the view of preparing us for underſtanding the real trumpet. The Vielle, Savoyarde, or Hurdygurdy, performs in the ſame manner. While the wheel rubs one part of the ſtring like a bow, the keys gently preſs the ſtrings, in points of aliquot diviſion, and produce the harmonic notes.

It is to prevent ſuch notes that the part of harpſichord wires, lying between the bridge and the pins, are wrapped round with liſt. Theſe notes would frequently diſturb the muſic.

Laſtly on this head, the Æolian harp derives its vaſt variety of fine ſounds from this mode of vibration. Seldom do the cords perform their fundamental or ſimple vibrations. They are generally ſounding ſome of the harmonies of their fundamentals, and give us all this variety from ſtrings tuned in uniſon.

Muſical Trumpet.

Trumpet, Muſical, is a wind inſtrument which ſounds by preſſing the cloſed lips to the ſmall end, and forcing the wind through a very narrow aperture between the lips. This is one of the moſt ancient of muſical inſtruments, and has appeared in all nations in a vaſt variety of forms. The conch of the ſavage, the horn of the cowherd and of the poſtman, the bugle horn, the lituus and tuba of the Romans, the military trumpet, and the trombone, the *cor de chaſſe* or French horn—are all inſtruments winded in the ſame manner, producing their variety of tones by varying the manner and force of blowing. The ſerpent is another inſtrument of the ſame kind, but producing part of its notes by means of holes in the ſides.

Although the trumpet is the ſimpleſt of all muſical inſtruments, being nothing but a long tube, narrow at one end and wide at the other, it is the moſt difficult to be explained. To underſtand how ſonorous and regulated undulations can be excited in a tube without any previous vibration of reeds to form the waves at the entry, or of holes to vary the notes, requires a very nice attention to the mechaniſm of aereal undulations, and we are by no means certain that we have as yet hit on the true explanation. We are certain, however, that theſe aereal undulations do not differ from thoſe produced by the vibration of ſtrings; for they make ſtrings reſound in the ſame manner as vibrating cords do. Galileo, however, did not know this argument for his aſſertion that the muſical pitch of a pipe, like that of a cord, depended on the frequency alone of the aereal undulations; but he thought it highly probable, from his obſervations on the ſtructure of organs, that the notes of pipes were related to their lengths in the ſame manner as thoſe of wires, and he expreſsly makes this remark.

remark. Newton having difcovered that found moved at the rate of about 960 feet per fecond, obferved that, according to the experiments of Mr Sauveur, the length of an open pipe is half the length of an aereal pulfe. This he could eafily afcertain by dividing the fpace defcribed by found in a fecond by the number of pulfes.

Daniel Bernoulli, the celebrated promoter of the Newtonian mechanics, difcovered, or at leaft was the firft who attentively marked, fome other circumftances of refemblance between the undulations of the air in pipes and the vibrations of wires. As a wire can be made, not only to vibrate in its full length, founding its fundamental note, but can alfo be made to fubdivide itfelf, and vibrate like a portion of the whole, with points of reft between the vibrating portions, when it gives one of its harmonic notes; fo a pipe cannot only have fuch undulations of air going on within it as are competent to the production of its fundamental note, but alfo thofe which produce one of its harmonic notes. Every one knows that when we force a flute by blowing too ftrongly, it quits its proper note, and gives the octave above. Forcing ftill more, produces the 12th. Then we can produce the double octave or 15th, and the 17th major, &c. In fhort, by attending to feveral circumftances in the manner of blowing, all the notes may be produced from one very long pipe that we produce from the trumpet marine, and in precifely the fame order, and with the fame omiffions and imperfections. This alone is almoft equivalent to a proof that the mechanifm of the undulations of air in a pipe are analogous to that of the vibrations of an elaftic cord. Having with fo great fuccefs inveftigated the mechanifm of the partial vibrations of wires, and alfo another kind of vibrations which we fhall mention afterwards, incomparably more curious and more important in the philofophy of mufical founds, Mr Bernoulli undertook the inveftigation of thofe more myfterious motions of air which are produced in pipes; and in a very ingenious differtation, publifhed in the Memoirs of the Academy of Paris for 1762, &c. he gives a theory of them, which tallies in a wonderful manner with the chief phenomena which we obferve in the wind inftruments of the flute and trumpet kind. We are not, however, fo well fatisfied with the truth of his *affumptions* refpecting the ftate of the air, and the precife form of the undulations which he affigns to it; but we fee that, notwithftanding a probability of his being miftaken in thefe circumftances (it is with great deference that we prefume to fuppofe him miftaken), the chief propofitions are ftill true; and that the changes from note to note muft be produced in the order, though perhaps not in the precife manner, affigned by him.

It is by no means eafy to conceive, with clearnefs, the way in which mufical undulations are excited in the various kinds of trumpets. Many who have reputation as mechanicians, fuppofe that it is by means of vibrations of the lips, in the fame manner as in the hautboy, clarionette, and reed pipes of the organ, where the air, fay they, is put in motion by the trembling reed. But this explanation is wrong in all its parts; even in the reed-pipes of an organ, the air is *not* put in motion by the reeds. They are indeed the *occafions* of its mufical undulation, but they do not *immediately impel* it into thofe waves. This method (and indeed all methods but the vibrations of wires, bells, &c.) of producing found is little underftood, though it is highly worthy of notice, being the origin of animal voice, and becaufe a knowledge of it would enable the artifts to entertain us with founds hitherto unknown, and thus add confiderably to this gift of our Bountiful Father, who has fhewn in the ftructure of the larynx of the human fpecies, that he intended that we fhould enjoy the pleafures of mufic as a *laborum dulce lenimen*. He has there placed a micrometer apparatus, by which, *after* the other mufcles have done their part in bringing the glottis nearly to the tenfion which the intended note requires, we can eafily, and inftantly, adjuft it with the utmoft nicety.

We truft, therefore, that our readers will indulge us while we give a very curfory view of the manner in which the tremulous motion of the glottis, or of a reed in an organ pipe, produces the fonorous undulations with a conftant or uniform frequency, fo as to yield a mufical note.

If we blow through a fmall pipe or quill, we produce only a whizzing or hiffing noife. If, in blowing, we fhut the entry with our tongue, we hear fomething like a folid blow or tap, and it is accompanied with fome faint perception of a mufical pitch, juft as when we tap with the finger on one of the holes of a flute when all the reft are fhut. We are then fenfible of a difference of pitch according to the length of the pipe; a longer pipe or quill giving a graver found. Here, then, is like the beginning of a fonorous undulation. Let us confider the ftate of the air in the pipe: It was filled by a column of air, which was moving forward, and would have been fucceeded by other air in the fame ftate. This air was therefore nearly in its ftate of natural denfity. When the entry is fuddenly ftopped by the tongue, the included air already in motion, continues its motion. This it cannot do without growing rarer, and then it is no longer a balance for the preffure of the atmofphere. It is therefore retarded in its motion, totally ftopped (being in a rarefied ftate), and is then preffed back again. It comes back with an accelerated motion, and recovers its natural denfity, while the ftate of rarefaction goes forward through the open air like any other aereal pulfe. Its motions are fomewhat, but not altogether, like that of a fpiral wire, which has been in like manner moving uniformly along the pipe, and has been ftopped by fomething catching hold of its hindermoft extremity. This fpring, when thus catched behind, ftretches itfelf a little, then contracts *beyond* its natural ftate, and than expands again, quivering feveral times. It can be demonftrated that the column of air will make but one quiver. Suppofe this accomplifhed in the hundredth part of a fecond, and that at that inftant the tongue is removed for the hundredth part of a fecond, and again applied to the entry of the pipe. It is plain that this will produce fuch another pulfe, which will join to the former one, and force it out into the air, and the two pulfes together will be like two pulfes produced by the vibration of a cord. If, inftead of the tongue we fuppofe the flat plate of an organ-reed to be thus alternately applied to the hole and removed, at the exact moments that the renewals of air are wanted, it is plain that we fhall have *fonorous* undulations of *uniform* frequency, and therefore a mufical note. This is the way in which reeds produce their effect, not by *impelling* the air into alternate ftates

ftates of motion to and fro, and alternate ftrata of rarefied and condenfed air, but by giving them time to acquire this ftate by the combination of the air's elafticity with its progreffive motion.

The adjuftment of the fucceeding puff of air to the pulfe which precedes it, fo that they may make one fmooth and regular pulfe, is more exact than we have yet remarked; for the ftoppage of the hole not only *occafions* a rarefaction *before it*, but by checking the air which was juft going to enter, makes a condenfation *behind the door* (fo to fpeak); fo that, when the paffage is again opened, the two parcels of air are fitted for fupporting each other, and forming one pulfe.

Suppofe, in the next place, that the reed, inftead of completely fhutting the hole each time, only half fhuts it. The fame thing muft ftill happen, although not in fo remarkable a degree. When the paffage is contracted, the fupply is diminifhed, and the air now in the pipe muft rarefy, by advancing with its former velocity. It muft therefore retard; by retarding regain its former denfity; and the air not yet got into the pipe, muft condenfe, &c. And if the paffage be again opened or enlarged in the proper time, we fhall have a complete pulfe of condenfed and rarefied air; and this muft be accompanied by the beginning of a mufical note, which may be continued like the former.

This will be a fofter or more mellow note than the other; for the condenfed and rarefied air will not be fo fuddenly changed in their denfities. The difference will be like the difference of the notes produced by drawing a quill along the teeth of a comb, and that produced by the equally rapid vibrations of a wire. For let it be remarked here, that mufical notes are by no means confined, as theorifts commonly fuppofe, to the regular cycloidal agitations of air, fuch as are produced by the vibrations of an elaftic cord; but that any crack, fnap, or noife whatever, when repeated with fufficient frequency, becomes *ipfo facto* a mufical found, of which we can tell the pitch or note. What can be lefs mufical than the folitary cracks of fnaps made by a ftiff door when very flowly opened? Do this brifkly, and the creak changes to a chirp, of which we can tell the note. The founds will be harfh or fmooth, according as the fnaps of which they are compofed are abrupt or gradual.

This diftinction of founds is moft fatisfactorily confirmed by experiment. If the tongue of the organ reed is quite flat, and if, in its vibrations, it apply itfelf to the whole margin of the hole at once, fo as completely to fhut it (as is the cafe in the oldfafhioned regal ftop of the organ), the note is clear, fmart, and harfh or hard: but if the lips of the reed are curved, or the tongue roperly bent backward, fo that it applies itfelf to the edges of the hole *gradatim*, and never completely fhuts the paffage, the note may have any degree of mellow fweetnefs. This remark is worth the attention of the inftrument-makers or organ builders, and enables them to vary the VOICE of the organ at pleafure. We only mention it here as introductory to the explanation of the founds of the trumpet.

We truft that the reader now perceives how the air, proceeding along a pipe, may be put in the ftate of alternate ftrata of condenfed and rarefied air, the particles, in the mean time, proceeding along the pipe with a very moderate velocity; while the *ftate of undulation* is propagated at the rate of eleven or twelve hundred feet in a fecond; juft as we may fometimes fee a ftream of water gliding gently down a canal, while a wave runs along its furface with much greater rapidity.

It will greatly affift the imagination, if we compare thefe aëreal undulations with the undulations of water in an open canal. While the water is flowing fmoothly along, fuppofe a fluice to be thruft up from the bottom quite to the furface, or beyond it. This will immediately caufe a depreffion on the lower fide of the fluice, by the water's going along the canal, and a heaping up of the water on the other fide. By properly timing the motion of this fluice up and down, we can produce a feries of connected waves. If the fluice be not pufhed up to the furface but only one-half way, there will be the fame fucceffion of waves, but much fmoother, &c. &c.

It is in this ftate, though not by fuch means, that the air is contained in a founding trumpet. It is not brought into this ftate by any tremor of the lips. The trumpeter fometimes feels fuch a tremor; but whenever he feels it, he can no longer found his note. His lips are painfully tickled, and he muft change his manner of winding.

When blowing with great delicacy and care, the deepeft notes of a French horn, or trombone, we fometimes can feel the undulations of the air in the pipe diftinctly fluttering and beating againft the lips; and it is difficult to hinder the lips from being affected by it; but we feel plainly that it is not the lips which are fluttering, but the air before them. We feel a curious inftance of this when we attempt to whiftle in concert. If our accompanier intonates with a certain degree of incorrectnefs, we feel fomething at our own lips which makes it impoffible to utter the intended note. This happens very frequently to the perfon who is whiftling the upper note of a greater third. In like manner, the undulations in a pipe react on the reed, and check its vibrations. For if the dimenfions of a pipe are fuch that the undulations formed by the reed cannot be kept up in the pipe, or do not fuit the length of the pipe, the reed will either not play at all, or will vibrate only in ftarts. This is finely illuftrated by a beautiful and inftructive experiment. Take a fmall reed of the *vox humana* ftop of an organ, and fet it in a glafs foot, adapted to the windbox of the organ. Inftead of the common pipe above it, fix on it the fliding tube of a fmall telefcope. When all the joints are thruft down, touch the key, and look attentively to the play of the reed. While it is founding, draw out the joints, making the pipe continually longer. We fhall obferve the reed thrown into ftrange fits of quivering, and fometimes quite motionlefs, and then thrown into wide fonorous vibrations, according as the *maintainable* pulfe is commenfurate or not with the vibrations of the reed. This plainly fhews that the air is not impelled into its undulations by the reed, but that the reed accommodates itfelf to the undulations in the pipe.

We acknowledge that we cannot explain with diftinctnefs in what manner the air in a trumpet is firft put into mufical undulations. We fee that it is only in very long and flender tubes that this can be done. In fhort tubes, of confiderable diameter, like the cowherd's horn, we obtain only one or two very indiftinct notes, of which it is difficult to name the pitch; and this requires great force of blaft; whereas, to bring

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out the deep notes of the French horn, a very gentle and well regulated blaſt is neceſſary. The form of the lips, combined with the force of the blaſt, form all the notes. But this is in a way that cannot be taught by any deſcription. The performer learns it by habit, and *feels* that the inſtrument leaps into its note without him, when he gradually varies his blaſt, and continues ſounding the ſame note; although he, in the mean time, makes ſome ſmall change in his manner of blowing. This is owing to what Mr Bernoulli obſerved. The tube is ſuited only to ſuch pulſes, and can only maintain ſuch pulſes as correſpond to aliquot parts of its length; and when the embouchure is very nearly, but not accurately, ſuited to a particular note, that note *forms itſelf* in the tube, and, reacting on the lips, brings them into the form which can maintain it with eaſe. We have a proof of this when we attempt to ſound the note correſponding to one-ſeventh of the length. Not having a diſtinct notion of this note, which makes no part of our ſcale of melody, we cannot eaſily prepare for it in the way that habit teaches us to prepare for the others: whereas, from what we ſhall ſee preſently, the notes *one-ſixth* and *one-eighth* are both familiar to the mind, and eaſily produced. When, therefore, we attempt to produce the note *one-ſeventh*, we ſlide, againſt our will, into the *one-ſixth* or *one eighth*.

Nor can we completely illuſtrate the formation of muſical pulſes by waves in water. A canal is equally ſuſceptible of every height and length of progreſſive waves; whereas we ſee that a certain length of tube will maintain only certain determined pulſes of air.

We muſt therefore content ourſelves for the preſent with having learned, by means of the reed pipes, how the air may exiſt progreſſively in a tube, in an alternate ſtate of condenſation and rarefaction; and we ſhall now proceed to conſider how this ſtate of the air is related to the length of the tube. And here we can do no more than give an outline of Mr Bernoulli's beautiful theory of flutes and trumpets, but without a mathematical examination of the particular motions. We can, however, ſhew, with ſufficient evidence, how the different notes are produced from the ſame tube. It requires, however, a very ſteady attention from the reader to enable him to perceive how the different portions of this air act on each other. We truſt that this will now be given.

The conditions which muſt be implemented, in order to maintain a muſical pulſe, are two: 1. That the vibrations of the different plates of air be performed in equal times, otherwiſe they would all mix and confound each other. 2. That they move all together, all beginning and all ending at the ſame inſtant. It does not appear that any other ſtate of vibration can exiſt and be maintained.

The column of air in a tube may be conſidered as a material ſpring (having weight and inertia). This ſpring is compreſſed and coiled up by the preſſure of the atmoſphere. But in this coiled ſtate it can vibrate in its different parts, as a long ſpiral wire may do, though preſſed a little together at the ends. It is evident that the air within a pipe, ſhut at both ends, may be placed in ſuch a ſituation, *in a variety of ways*, that it will vibrate in every part, in the ſame manner as a chord of the ſame length and weight, ſtrained by a force equal to the preſſure of the atmoſphere. Thus, in the ſhut pipe AB (fig. 1.), ſuppoſe a harmonic curve ACB, or a wire of the ſame weight with the air, throwing itſelf into the form of this curve. The force which impels the point C to the axis is to that which impels the point *c* as CE to *ce*. Now, ſuppoſe the air in this pipe divided into parallel ſtrata or plates, croſſing the tube like diaphragms. In order that theſe may vibrate in the ſame manner (not acroſs the tube, but in the direction of its axis), all that is neceſſary for the moment is, that the exceſs of the preſſure of the ſtratum *dd* above that of the ſtratum *ff* may be to the exceſs of the preſſure of DD above that of FF as *ce* to CE. In this caſe, the ſtratum *ce* will be accelerated in the direction *ef*, and the ſtratum EE is accelerated in the ſame direction, and in the due proportion. Now this may be done in an infinite variety of ways for a ſingle moment. It depends, not on the abſolute denſity, but on the *variation* of denſity; becauſe the preſſure by which a particle of air is urged in any direction ariſes from the *difference* of the diſtances of the adjoining particles on each ſide of it. But in order to *continue* this vibration, or in order that it may obtain at once in the whole pipe, this variation of denſity muſt continue, and be according to ſome connected law. This circumſtance greatly limits the ways in which the vibration may be kept up. Mr Bernoulli finds that the iſochroniſm and ſynchroniſm can be maintained in the following manner, and in no other that he could think of:

Plate XLV.

Let AB (fig. 2.) be a cylindrical pipe, ſhut at A, and open at B. Then, in whatever manner the ſound is produced in the pipe, the undulations of the contained air muſt be performed as follows: Let *a a* be a plate of air. This plate will approach to, and recede from, the ſhut end A, vibrating between the ſituations *b b* and *c c*, the whole vibration being *b c*, and the plate will vibrate like a pendulum in a cycloid. The greater we ſuppoſe the excurſions *a b*, *a c*, the louder will the ſound be; but the duration of them all muſt be the ſame, to agree with the fact that the tone remains the ſame. The motion will be accelerated in approaching to *a a* from either ſide, and retarded in the receſs from it. Let us next conſider a plate $\alpha\alpha$, more remote from A. It muſt make ſimilar vibrations from the ſituation $\beta\beta$ to the ſituation $\gamma\gamma$. But theſe vibrations muſt be greater in proportion as the plate is farther from A. It cannot be conceived otherwiſe: For ſuppoſe the plate $\alpha\alpha$ to make the *ſame* excurſions with *aa*, and that the reſt do the ſame. Then they will all retain the ſame diſtances from each other; and thus there will be no force whatever acting on any particles to make them vibrate. But if every particle make excurſions proportional to its diſtance from A, the *variation* of denſity will, in any inſtant, be the ſame through the whole pipe, and each particle in the vibrating plate $\beta\beta$ will be accelerated or retarded in proportion to its diſtance from A; while the accelerations and retardations over all will, in any inſtant, be proportional to the diſtance of each particle from its place of reſt. All this will appear to the mathematician, who attentively conſiders any momentary ſituation of the particles. In this manner all the particles will ſupport each other in their vibrations.

It follows from this deſcription that the air in the tube is alternately rarefied and condenſed. But theſe changes are very different in different parts of the tube. They muſt be greateſt of all at A; becauſe, while all the

the plates approach to A, they concur in condenfing the air immediately adjoining to A; while the air in *a a* and *α α* is lefs condenfed by the action of the plates beyond it. The air at B is always of its natural denfity, being in equilibrio with the furrounding air. At B, therefore, there is a fmall parcel of air, of its natural denfity, which is alternately going in and out.

This account is confirmed by many facts. If the bottom of the pipe be fhut by a fine membrane, ftretched acrofs it like a drumhead, with a wire ftretched over it, either externally or internally, in the fame manner as the catgut is ftretched acrofs the bottom of a drum, it will be thrown into ftrong vibrations, making a very loud noife, by rattling againft the crofs wire. The fame thing happens if the membrane be pafted over a hole clofe to the bottom, leaving a fmall fpace round the edge of the hole without pafte, fo that the membrane may play out and in, and rattle on the margin of the hole. This alfo makes a prodigious noife. Now, if the membrane be pafted on a hole far from the bottom, the agitations will be much fainter; and when the hole is near the mouth of the pipe, there will be none.—When a pipe has its air agitated in this manner, it is giving the loweft note of which it is fufceptible.

Let us next confider a pipe open at both ends. Let CB (fig. 3.) be this pipe. It is plain that, if there be a partition A in the middle, we fhall have two pipes AB, AC, each of which may undulate in the manner now defcribed, if the undulations in each be in oppofite directions. It is evidently poffible, alfo, that thefe undulations may be the fame in point of ftrength in both, and that they may begin in the fame inftant. In this cafe, the air on each fide of the partition will be in the fame ftate, whether of condenfation or rarefaction, and the partition A itfelf will always be in equilibrio. It will perfectly refemble the point C of the mufical cord BFCGH (fig. 6.), which is in equilibrio between the vibrating forces of its two parts. In the pipe, the plates of air on each fide are either both approaching it, or both receding from it, and the partition is either equally fqueezed from both fides, or equally drawn outwards. Confequently this partition may be removed, and the parcels of air on each fide will, in any inftant, fupport each other. There feems no other way of conceiving thefe vibrations in open pipes which will admit of an explanation by mechanical laws. The vibrations of all the plates muft be obtained without any mutual hinderance, in order to produce the tone which we really hear; and therefore fuch vibrations are impreffed by Nature on each plate of air.

But if this explanation be juft, it is plain that this pipe CB muft give the fame note with the pipe AB (fig. 2.) of half the length, fhut at one end. But the found, being doubled, with perfect confonance, muft be clear, ftrong, and mellow. Now this is perfectly agreeable to obfervation; and this fact is an unequivocal confirmation of the juftnefs of the theory. If we take a flender pipe, about fix inches long and one half of an inch wide, fhut at one end, and found it by blowing acrofs its mouth, as we whiftle on the pipe of a key, or acrofs a hole that is clofe to the mouth, and formed with an edge like the found-hole of a German flute, we fhall get a very diftinct and clear tone from it. If we now take a pipe of double the length, open at both ends, and blow acrofs its mouth, we obtain the fame note, but more clear and ftrong. And the note produced by blowing acrofs the mouth is not changed by a hole made exactly in the middle, in refpect of its mufical pitch, although it is greatly hurt in point of clearnefs and ftrength. Alfo a membrane at this hole is ftrongly agitated. All this is in perfect conformity to this mechanifm.

Thus we have, in a great meafure, explained the effect of an open and a fhut pipe. The fhut pipe is always an octave, graver than an open pipe of the fame length; becaufe the open pipe is in unifon with the fhut pipe of half the length.

Let AC (fig. 4.) be a pipe fhut at both ends. We may confider it as compofed of two pipes AB, BC, ftopped at A and C, and open at B. Undulations may be performed in each half precifely as in the pipe AB of fig. 2.; and they will not, in the fmalleft degree obftruct each other, if we only fuppofe that the plates in each half are vibrating at once in the *fame* direction. The condenfation in AB will correfpond with the rarefaction in BC, and the middle parcel B will maintain its natural denfity, vibrating to, and again acrofs the middle; and two plates *a a*, *α α*, which are equally diftant from B, will make equal excurfions in the fame direction.

We may produce found in this pipe by making an opening at B. Its note will be found to be the fame with that of BC of fig. 2. or of AB of fig. 2.

In the next place, let a pipe, fhut at one end, be confidered as divided into any odd number of equal parts, and let them be taken in pairs, beginning at the ftopped end, fo that there may be an odd one left at the open end. It is plain that each of thefe pairs may be confidered as a pipe ftopped at both ends, as in fig. 4.

For the partitions will, of themfelves, be in equilibrio, and may be removed, and vibrations may be maintained in the whole, confiftent with the vibration of the odd part at the open end; and thefe vibrations will all fupport each other, and the plates of air which are at the point of divifion will remain at reft. Conceive the pipe AB of fig. 2. to be added to the pipe AC of fig. 4. the part A of the firft being joined to A of the other. Now, fuppofe the vibrations to be performed in both, in fuch a manner that the fimultaneous undulations on each fide of the junction may be in oppofite directions. It is plain that the partition will be in equilibrio, and may be removed; and the plate of air will perform the fame office, being alternately the middle plate of a condenfed and of a rarefied parcel of air. The two pipes CA, AB will together give the fame note that AB would have given alone, but louder.

In like manner may another pipe, equal to AC, be joined to the fhut end of this compound pipe, as in fig. 5. and the three will ftill give the fame note that AB would have done alone.

And in the fame manner may any number of pipes, each equal to AC, be added, and the whole will give ftill the fame note that AB would have given alone.

Hence it legitimately follows, that if the undulations can be once begun in this manner in a pipe, it may give either the found competent to it, as a fingle pipe AB (fig. 2.); or it may give the found competent to a pipe of $\frac{1}{3}$d, $\frac{1}{5}$th, $\frac{1}{7}$th, &c. of its length; the undulations in each part AB, BC, CD, maintaining themfelves in the

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the manner already defcribed. This feems the only way in which they can be preferved, both ifochronous and fynchronous.

It is known that the graveft tones of pipes are as the lengths of the pipes, or the frequency of the undulations are inverfely as their lengths. (This will be *demonftrated* prefently). Therefore thefe acceffory tones fhould be as the odd numbers 3, 5, 7, &c. and the whole tones, including the fundamental, fhould form the progreffion of the odd numbers 1, 3, 5, 7, &c.

This is abundantly confirmed by experiment. Take a German flute, and ftop all the finger holes. The flute, by gradually forcing the blaft, will give the fundamental, the 12th, the 17th, the 21ft, &c. (A).

Again, let AD (fig. 6.) reprefent the length of a pipe. Conftruct on AD an harmonic curve AEBFCGHD, in fuch a manner that HD may be $\frac{1}{2}$ AB, = $\frac{1}{2}$ BC, = $\frac{1}{2}$ CH. The fmall ordinates *m n* will exprefs the total excurfion of the plates of air at the points *m*, *n*, &c. and thofe ordinates which are above the axis will exprefs excurfions on one fide of the place of reft, and the ordinates below will mark the excurfions in the oppofite directions, in the fame manner as if this harmonic curve were really a vibrating cord. Thefe excurfions are nothing in the points A, B, C, H, and are greateft at the points E, F, G, D, where the little mafs of air retains its natural denfity, and travels to and again, condenfing the air at B, or rarefying it, according as the parcels E and F are approaching to or receding from each other. The points A, B, C, H, may be called Nodes, and the parts E, F, G, D, may be called Bights or Loops. This reprefents very well to the eye the motion of the plates of air. The denfity and velocity need not be minutely confidered at prefent. It is enough that we fee that when the denfity is increafing at A, by the approach of the parcel E, it is diminifhing at B by the recefs of E and F; and increafing at C, by the approach of F and G, and diminifhing at H, by the recefs of G. In the next vibration it will be diminifhing at A and C, and increafing at B and H. And thus the alternate nodes will be in the fame ftate, and the adjoining nodes in oppofite ftates.

The reader muft carefully diftinguifh this motion from the undulatory motion of a pulfe, inveftigated by Newton, and defcribed in the article Acoustics, *Encycl.* That undulation is going on at the fame time, and is *a refult* of what we are now confidering, and the caufe of our hearing this undulation. The undulation we are now confidering is the original agitation, or rather it is the sounding body, as much as a vibrating ftring or bell is; for it is not the trumpet that we hear, but the air trembling in the trumpet. The trumpet is performing the office, not of the ftring, but of the pin and bridge on which the ftring is ftrained. This is an important remark in the philofophy of mufical founds.

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There is yet another fet of notes producible from a pipe befides thofe which follow in the order of frequency 1, 3, 5, 7, &c.

Suppofe a pipe open at both ends, founding by blowing acrofs the end, and undulating, as already defcribed, with a node in the middle A (fig. 3.) If we ftill exprefs the fundamental note of the pipe AB of fig. 2. by 1, it is plain that the fundamental of an open pipe of the fame length will have the frequency of its undulations expreffed by 2; becaufe an open pipe of twice the length of AB (fig 2.) will be 1, the two pipes AB (fig. 2.), and CB (fig. 3.), being in unifon.

But this open pipe may be made to undulate in another manner; for we have feen that AB of fig. 2. joined to CA of fig. 4. may found altogether when the partition A is removed, ftill giving the note of AB (fig. 2.) Let fuch another as AB (fig. 2.) be added to the end C, and let the partition be removed. The whole may ftill undulate, and ftill produce the fame note; that is, a pipe open at both ends may found a note which is the fundamental of a pipe like AB (fig. 2.), but only one-fourth of its length. The pipe CB of fig. 3. may thus be fuppofed to be divided into four equal parts, CE, EA, AF, FB, of which the extreme parts EC and FB contain undulations fimilar to thofe in AB (fig. 2.); and the two middle parts contain undulations like thofe in CA (fig. 4.) The partitions at E and F may be removed, becaufe the undulations in EC and EA will fupport each other, if they are in oppofite directions; and thofe in FB and FA may fupport each other in the fame manner.

It muft here be remarked, that in this ftate of undulation the direction of the agitations at the two extremities is the fame; for in the middle piece EF the particles are moving one way, condenfing the air at E, while they rarefy it at F. Therefore, while the middle parcel is moving from E towards F, the air at B muft be moving towards F, and the air at C muft be moving from E. In fhort, the air at the two extremities muft, in every inftant, be moving in the oppofite direction to that of the air in the middle.

In like manner, if the pipe CB of fig. 3. be divided into fix parts, the two extreme parts may undulate like AB of fig. 2. and the four inner parts may undulate like two pipes, fuch as CA of fig. 4. and the whole will give the found which makes the fundamental of a pipe, of one-fixth of the length, or having the frequency 6.

We may remark here, that the fimultaneous motion of

(A) A little reflection will teach us that thefe tones will not be perfectly in the fcale. A certain proportion between the diameter and length of the pipe produces a certain tone. Making the pipe wider or fmaller flattens or fharpens this tone a little, and alfo greatly changes its clearnefs. Organ builders, who have tried every proportion, have adopted what they found beft. This requires the diameter to be about $\frac{1}{11}$th or $\frac{1}{12}$th of the length. Therefore, when we caufe the fame pipe to found different notes, we neglect this proportion; and the notes are falfe, and even very coarfe, when we produce one correfponding to a very fmall portion of the pipe. For a fimilar reafon, Mr Lambert found that, in order to make his pitch-pipe found the octave to any of its notes, it was not fufficient to fhorten its capacity one-half by pufhing down the pifton; he found that the part remaining muft be lefs than the part taken off by a fixed quantity $1\frac{5}{12}$ inches. Or, the length which gave any note being x, the length for its octave muft be $\frac{x - 1\frac{5}{12}}{2}$.

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of the air at the extremities is in oppofite directions, whereas in the laft cafe it was in the fame direction. This is eafily feen; for as the partition which is between the two middle pieces muft always be in equilibrio, the air muft be coming in or going out at the extremities together. This circumftance muft give fome fenfible difference of character to the founds 4 and 6. In the one, the agitations at each end of the tube are in the fame direction, and in the other they are in the oppofite. Both produce pulfes of found which are conveyed to the ear. Thus we fee that the air in a pipe open at both ends may undulate in two ways. It may undulate with a node in the middle, giving the note of AB (fig. 2.), or of its 3d, 5th, 7th, &c. paft; and it may undulate with a loop or bight in the middle, founding like $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{6}$, &c. of AB, fig. 2.

In like manner may this pipe produce founds whofe frequency are expreffed by 8, 10, &c. and proceed as the even numbers.

This ftate of agitation may be reprefented in the fame way that we reprefented the founds 1, 3, 5, &c. by conftructing on AM (fig. 7,) an harmonic curve, with any number of nodes and loops. Divide the parts AF, FD, DE, EM, equally in C, O, P, B. CB will correfpond to the pipe, and the ordinates to the curve GFHDLEN will exprefs the excurfions of the plates of air.

If the pipe gives its fundamental note, its length muft be reprefented by CO, and the undulations in it will refemble the vibrations of part CO of a cord, whofe length AD is equal to 2CO, and which has a node in F.

If the pipe is founding its octave, it will be reprefented by CP, and its undulations will refemble the vibrations of a cord CP, whofe length AE is $\frac{2}{3}$ of CP, having nodes at F and D, &c. &c.

We can now fee the poffibility of fuch undulations exifting in a pipe as will be permanent, and produce all the variety of notes by a mere change in the manner of blowing, and why thefe notes are in the order of the natural numbers, precifely as we obferve to happen in winding the trumpet or French horn. We have, *1ft*, the fundamental expreffed by 1; then the octave 2: then the 12th, 3; the double octave 4; then the third major of that octave 5, or 17th of the fundamental; then the octave of the 12th, or the 5th of this double octave = 6. We then jump to the triple octave 8, without producing the intermediate found correfponding to $\frac{1}{7}$th of the pipe. With much attention we can hit it; and it is a fact that a perfon void of mufical ear ftumbles on it as eafily as on any other. But the mufician, finding this found begin with hum, and his ear being grated with it, perhaps thinks that he is miftaking his embouchure, and he flides into the octave. After the triple octave, we eafily hit the founds correfponding to $\frac{1}{9}$ and $\frac{1}{10}$, which are the 2d and 3d of this octave. The next note $\frac{1}{11}$ is fharper than a juft 4th. We eafily produce the note 12, which is a juft 5th; 13 is a falfe 6th; 14 is a found of no ufe in our mufic, but eafily hit; 15 and 16 give the exact 7th and 8th of this octave.

Thus, as we afcend, we introduce more notes into every octave, till at laft we can nearly complete a very high octave; but in order to do this with fuccefs, and tolerable readinefs, we muft take an inftrument of a very low pitch, that we may be able nearly to fill up the fteps of the octave in which our melody lies. Few players can make the French horn or trombone found its real fundamental, and the octave is generally miftaken for it. The proof of this is, that moft players can give the 5th of the loweft note that they are able to produce; whereas the 5th of the real fundamental cannot be uttered. Therefore that loweft note is not the fundamental, but the octave to the fundamental.

Few performers can found even this fecond octave on a fhort inftrument, fuch as the ordinary military trumpet; and what they imagine to be the fundamental found of this inftrument is the double octave above it. This appears very ftrange; and it may be afked, how we know what is really the fundamental note of a trumpet? The anfwer to this is to be obtained only by demonftrating, on mechanical principles, what is the frequency of undulation correfponding to a given length of pipe. This is a propofition equally fundamental with its correfponding one in the theory of mufical cords; but we have referved it till now, becaufe many readers would ftop fhort at fuch an inveftigation, who are able to underftand completely what we have now delivered concerning the mufic of the trumpet.

Suppofe therefore a pipe fhut at both ends, and that the whole weight of the contained air is concentrated in its middle point, the reft retaining its elafticity without inertia: or (which is a more accurate conception), let the middle point be conceived as extending its elafticity to the two extremities of the pipe, being repelled from each by a force inverfely as the diftance. Let the length of this pipe be L. This may alfo exprefs the weight of the middle plate of air, which will always be proportional to the length of the pipe, becaufe all is fuppofed to be concentrated there. Let E be the elafticity of the air. This muft be meafured by the preffure of the atmofphere, or by the weight of the column of mercury in the barometer. Perhaps the rationale of this will be better conceived by fome readers by confidering E as the height of a homogeneous atmofphere. Then it is plain that E is to L as the weight of this atmofpheric column to the weight of the column of the fame air which fills the pipe whofe length is L. Then it is alfo plain that E is to L as the external preffure; and confequently, as the elafticity which fupports that preffure is to the weight or inertia of the matter to be moved. Let this middle plate or diaphragm be withdrawn from its place of reft to the very fmall diftance a. The elafticity or repulfion will be augmented on one fide and diminifhed on the other; and the difference between them is the only force which impels the diaphragm toward the middle point, and caufes it to vibrate, or produces the undulation. It is plain that the repulfion on one fide is $\frac{\frac{1}{2}L}{\frac{1}{2}L-a} \times E$, or $\frac{L}{L-2a}E$ $\left(\text{for } \frac{1}{2}L-a : \frac{1}{2}L = E : \frac{\frac{1}{2}LE}{\frac{1}{2}L-a}\right)$, and the repulfion on the other fide is $\frac{\frac{1}{2}L}{\frac{1}{2}L+a} \times E$, or $\frac{L}{L+2a}E$. The difference of thefe repulfions is $E \times L \times \frac{4a}{L^2-4^2}$. But as we fuppofe a exceedingly fmall in comparifon with L,

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L, this difference, or the accelerating force, may fafely be expreffed by $E\,\frac{4a}{L}$, or $4a\,\frac{E}{L}$.

Hence we deduce, in the firft place, that the undulations will be ifochronous, whether wide or narrow; becaufe the accelerating force is always proportional to the diftance a from the middle point.

Now, let a pendulum, whofe quantity of matter is L, and length a, be fuppofed to vibrate in a cycloid by the force $\frac{4a}{L}E$, or $\frac{4E}{L}a$. It muft perform its vibrations in the fame time with the plate of air; becaufe the moving force, the matter to be moved, and the fpace along which they are to be fimilarly impelled, are the fame in both cafes. Let another pendulum, having the fame quantity of matter L, vibrate by its weight L alone. In order that thefe two pendulums may vibrate in equal times, their lengths muft be as the accelerating forces. Therefore we muft have $\frac{4E}{L}a : L = a : \frac{aL^2}{4Ea}, = \frac{L^2}{4E}$, which is therefore the length of the fynchronous pendulum.

Now, a cord without weight and inertia, but loaded with the weight L at its middle point, and ftrained by a weight E, and drawn from the axis to the diftance a, is precifely fimilar in its motion to the diaphragm we are now confidering, and muft make its ofcillations in the fame time.

This is applicable to any number of plates of air, by fubftituting in the cord a loaded point for each of the plates; for when the cafe is thus changed, both in the pipe and the cord, the fpace to be paffed over by the plate of air bears the fame proportion to a, which is paffed over by the whole air concentrated in the middle point, which the fpace to be paffed over by the correfponding loaded point of the cord bears to that paffed over by the whole matter of the cord concentrated in the middle point; and the fame equality of ratios obtains in the accelerating forces of the plate of air and the correfponding loaded point of the cord. Suppofe, then, a pipe divided into 2, 3, 4, &c. equal parts, by 1, 2, 3, diaphragms, each of which contains the air of the intervening portions of the pipe, the whole weight L being equally divided among them. If there be but one diaphragm, its weight muft be L; if two, the weight of each muft be $\frac{1}{2}$ L; if three, the weight of each muft be $\frac{1}{3}$ L; and fo on for any number.

By confidering this attentively, we may infer, without farther inveftigation, what will be the undulations of all the different plates of air in a pipe ftopped at both ends. We have only to compare it with a cord fimilarly divided and loaded. Increafe the number of loaded points, and diminifh the load on each, continually—it is evident that this terminates in the cafe of a fimple cord, with its matter uniformly diffufed; and a fimple pipe, with its air alfo uniformly diffufed over its whole length.

Therefore, if we take an elaftic cord, and ftretch it by fuch a weight that the extending weight may bear the fame proportion to the accelerating force acting on the whole matter concentrated in its middle point, which the elafticity of the air bears to its accelerating force acting on the whole matter concentrated at the mouth of an open pipe, founding its fundamental note, the cord and the air will vibrate in the fame time. Moreover, fince the proportion between the vibrations of a cord fo conftituted, and thofe of a cord having its matter uniformly diffufed, is the fame with the proportion between the undulations in a pipe fo conftituted, and thofe of a pipe in which the air is uniformly diffufed—it is plain that the vibrations of the cord and of the pipe in their natural ftate will alfo be performed in equal times.

We look on this as the eafieft way of obtaining a diftinct perception of the authority on which we reft our knowledge of the abfolute number of undulations of the air in a pipe of given length. It may be obtained directly; and Daniel Bernoulli, Euler, and others, have given very elegant folutions of this problem, without having recourfe to the analogy of the vibrations of cords and undulations of a column of air. But it requires more mathematical knowledge than many readers are poffeffed of who are fully able to follow out this analogical inveftigation.

Let us therefore compare this theory with experiment. What we call an open pipe of an organ is the fame which we, in this theory, have confidered as a pipe open at both ends; for the opening at the foot, which the organ builders call the VOICE of the pipe, is equivalent to a complete opening. The aperture, and the fharp edge which divides the wind, may be continued all round, and the wind admitted by a circular flit, as is reprefented in fig. 10. We have tried this, and it gives the moft brilliant and clear tones we ever heard, far exceeding the tones of the organ. An open organ pipe, therefore, when founding its fundamental note, undulates with one node in its middle, and its undulations are analogous, in refpect of their mechanifm, with the vibrations of a wire of the fame length, and the fame weight, with the column of air in the pipe, and ftretched by a weight equal to that of a column of the fame air, reaching to the top of a homogeneous atmofphere, or equal to the weight of a column of mercury as high as that in the barometer.

Dr Smith (fee *Harmonics*, 2d edit. p. 193.) found that a brafs wire whofe length was 35,55 inches, and weight 31 troy grains, and ftretched by 7 pounds avoirdupois or 49000 grains, was in perfect unifon with an open organ pipe whofe length was 86,4 inches.

Now 86,4 inches of this wire weighs 75,34 grains. When the barometer ftands at 30 inches, and the thermometer at 55° (the temperature at the time of the experiment), the height of a homogeneous atmofphere is 332640 inches. This has the fame proportion to the length of the pipe which the preffure of the atmofphere has to the weight of the column of air contained in the pipe.

Now 86,4 : 332640 = 75,34 : 290060. This wire, therefore, fhould be ftretched (if the theory be juft) by 290060 grains, in order to be unifon with the other wire, and we fhould have $35{,}55^2 : 86{,}4^2 = 49000 : 290060$
But, in truth, - $35{,}55^2 : 86{,}4^2 = 49000 : 289430$
The difference is - - - - - 630
The error fcarcely exceeds $\frac{1}{500}$, and does not amount to an error of one vibration in a fecond.

We muft therefore account this theory as accurate, feeing that it agrees with experiment with all defirable exactnefs.

We

We may alfo deduce from it a very compendious rule for determining the abfolute number of aereal pulfes made by an open pipe of any given length. When confidering the vibrations of cords, we found that the number of vibrations made in a fecond is $\sqrt{\frac{386\,E}{LW}}$, where E is the extending weight, W the weight of the cord, and L its length. Let H be the height of a homogeneous atmofphere. We have its weight $= \frac{HW}{L}, = E$. Therefore fubftituting $\frac{HW}{L}$ for E in the above formula, we have the number of aereal pulfes made per fecond $= \sqrt{\frac{386\,H}{L^2}}$, or $= \frac{\sqrt{386\,H}}{L}$. Now $\sqrt{386}$ H, computed in inches, is 11331. Therefore, if we alfo meafure the length of the pipe L in inches, the pulfes in a fecond are $= \frac{11331}{L}$. Thus, in the cafe before us, $\frac{11331}{86,4} = 131,12$, or this pipe produces 131 pulfes in a fecond. Dr Smith found by experiment that it produced 130,9, differing only about $\frac{1}{5}$th of a pulfe.

We fee that the pitch of a pipe depends on the height of the homogeneous atmofphere. This may vary by a change of temperature. When the air is warmer it expands, and the weight of the induced column is leffened, while it ftill carries the fame preffure. Therefore the pitch muft rife. Dr Smith found his organ a full quarter tone higher in fummer than in winter. The effect of this is often felt in concerts of wind inftruments with ftringed inftruments. The heat which fharpens the tone of the firft flattens the laft. The harpfichord foon gets out of tune with the horns and flutes.

Sir Ifaac Newton, comparing the velocity of found with the number of pulfes made by a pipe of given length, obferved that the length of a pulfe was twice the length of the open pipe which produced it. Divide the fpace paffed over in a fecond by the number of pulfes, and we obtain the length of each pulfe. Now it was found that a pipe of 21,9 inches produced 262 pulfes. The velocity of found (as computed by the theory on which our inveftigation of the undulations in pipes proceeds) is 960 feet. Now $\frac{960 \times 12}{262} = 44$ inches very nearly, the half of which is 22, which hardly differs from 21,9. The difference of this theoretical velocity of found, and its real velocity 1142 feet per fecond, remains ftill to be accounted for. We may juft obferve here, that when a pipe is meafured, and its length called 21,9 we do really allow it too little. The voice hole is equivalent to a portion, not inconfiderable of its length, as appears very clearly from the experiments of Mr Lambert on a variable pitch pipe, and on the German flute, recorded in the Berlin Memoirs for 1775. He found it equivalent to $\frac{1}{6}$th; and this is fufficient for reconciling thefe meafures of a pulfe with the real velocity of found.

The determination which we have given of the undulations of air in an organ pipe is indirect, and is but a fketch of the beautiful theory of Daniel Bernoulli, in which he ftates with accuracy the precife undulation of each plate of air, both in refpect of pofition, denfity, velocity, and direction of its motion. It is a pleafure to obferve how the different equations coincide with thofe which exprefs the vibrations of an elaftic cord. But this would have taken up much room, and would not have been fuited to the information of many curious readers, who can eafily follow the train of reafoning which we have employed.

Mr Bernoulli applies the fame theory to the explanation of the undulations in flutes, or inftruments whofe founds are modified by holes in the fides of the pipe. But this is foreign to our purpofe of explaining the mufic of the trumpet. We fhall only obferve, that a hole made in that part of a pipe where a node fhould form itfelf, in order to render practicable the undulations competent to a particular note, prevents its formation, and in its place we only get fuch undulations (and their correfponding founds) as have a loop in that place. The intelligent reader will perceive that this fingle circumftance will explain almoft every phenomenon of flutes with holes; and alfo the effects of holes in inftruments with a reed voice, fuch as the hautboy or clarionette.

We now fee that the found or mufical pitch of a pipe is inverfely as its length, in the fame manner as in ftrings. And we learn, by comparing them, that the found of a trumpet has the fame pitch with an open organ pipe of the fame length. A French horn, 16 feet long, has the found C *fa ut*, which is alfo the found of an open flute-pipe of that length.

The Trombone, great trumpet, or Sackbut, is an old inftrument defcribed by Merfennus, and other authors of the laft century. It has a part which flides (air-tight) within the other. By this contrivance the pitch can be altered by the performer as he plays. This is a great improvement when in good hands; becaufe we can thus correct all the falfe notes of the trumpet, which are very offenfive, when they occur in an emphatical or holding note of a piece of mufic. We can even employ this contrivance for filling up the blanks in the lower octaves.

We muft not take leave of this fubject without taking notice of another difcovery of Mr Bernoulli's, which is exceedingly curious, and of the greateft importance in the philofophy of mufic.

Artifts had long ago obferved that the deep notes of mufical inftruments are fometimes accompanied by their harmonic founds. This is moft clearly perceived in bells, fome of which give thefe harmonics, particularly the 12th, almoft as ftrong as the fundamental. Muficians, by attending more carefully to the thing, feem now to think that this accompaniment is univerfal. If one of the fineft founding ftrings of the bafes of a harpfichord be ftruck, we can hear the 12th very plainly as the found is dying away, and the 17th major is the laft found that dies away on the ear. This will be rendered much more fenfible, if we divide the wire into five parts, and at the points of divifion tie round it a thread with a faft knot, and cut the ends off very fhort. This makes the ftring falfe indeed by the unequal loading; but, by rendering thofe parts fomewhat lefs moveable by this additional matter, the portions of the wire between thefe points are thus jogged, as it were, into fecondary vibrations, which have a more fenfible proportion to the fundamental vibration. This is ftill more

 fenfible

fenfible in the found of the ftrings of a violincello when fo loaded; but we muft be careful not to load them too much, becaufe this would fo much retard the fundamental vibration, without retarding the fecondary vibrations, that both cannot be maintained together. (*N. B.* This experiment always produces a beat in the found).—Liftening to a fine founding flute pipe of the organ, we can alfo very often perceive the fame thing. Mr Rameau, and moft other theorifts in mufic, now affert that this is the effence of a mufical found, and *neceffarily* exifts in all of them, diftinguifhing them from harfh noifes. Rameau has made this the foundation of his fyftem of mufic, afferting that the pleafure of harmony refults from the fuccefsful imitation of this harmony of Nature, (fee Music, *Encycl.*). But a little logic fhould convince thefe theorifts that they muft be miftaken. If a note is mufical becaufe it has thefe accompaniments, and by this compofition alone is a mufical note, what are thefe harmonics? Are they mufical notes? This is granted. Therefore they have the fame compofition; and a mufical note muft confift at once of every poffible found; yet we know that this would be a jarring noife. A little mathematics, too, or mechanics, would have convinced them. A fimple vibration is furely a moft poffible thing, and therefore a fimple found. No, fay the theorifts; for though the vibration of the cord may be fimple, it produces fuch undulations in the air as excite in us the perception of the harmonics. But this is a mere affertion, and leaves the queftion undecided. Is not a fimple undulation of the air as poffible as the fimple vibration of a cord?

It is, however, a very curious thing, that almoft all mufical founds really have this accompaniment of the octave, 12th, double octave, and 17th major; for thefe are the harmonics that we hear.

The jealoufy of Leibnitz and of John Bernoulli, and their unfriendly thoughts refpecting all the Britifh mathematicians, made John Bernoulli do every thing in his power to leffen the value of Dr Taylor's inveftigation of the vibration of a mufical cord. Taylor gave him a good opportunity. Perhaps a little vain of his inveftigation of this abftrufe matter, he thought too much of it. He affirmed that the harmonic curve was the effential form of a ftring giving a mufical note. This was denied without knowing at firft whether it was true or falfe. But as the analytic mathematics improved, it was at length found that there are an infinity of forms into which an elaftic cord can be thrown, which are confiftent both with ifochronous vibrations, whether wide or narrow, and alfo with the condition of the whole cord becoming a ftraight line at once. Euler, D'Alembert, and De la Grange, have profecuted this matter with great ingenuity, and it is one of the fineft problems of the prefent day.

Daniel Bernoulli, of a very different caft of mind from his illuftrious friends, admired both Newton and Taylor; and fo far from wifhing to eclipfe Dr Taylor by the additions he had made to his theory, tried whether he could not extend Taylor's doctrine as far as the author had faid. When he took a review of what he had done while explaining the partial vibrations of mufical cords, he thought it very poffible that while a cord is vibrating in three portions, with two nodes or points of reft, and founding the 12th to its fundamental, it might at the fame time be alfo vibrating as a fimple cord, and founding its fundamental note. It was poffible, he thought, that the three portions might be vibrating between the four points with a triple frequency, while the two middle nodes were vibrating acrofs the ftraight line between the two pins; and thus the vibrating cord might be a moveable axis, to which the rapid vibrations of the three parts might always be referred. This was very fpecious, and when a little more attentively confidered, became more probable; for if the cord $ApBqCrD$ (fig. 8.) be vibrating as a 12th to its fundamental AD, the points B and C are in equilibrio. If therefore thefe two points be laid hold of by hooks, and be drawn afide to β and γ, while the ftring is yet vibrating, this fhould not hinder the vibrations. If the hooks be annihilated in an inftant, the whole fhould vibrate between A and D; and this fhould be in a way very different from the fimple vibration. The queftion now is, will the cord *continue* to vibrate with the loops $\beta s \gamma$, $\beta q \gamma$, &c. in the 900th part of a fecond (for inftance), while the whole ftring vibrates from $A \beta \gamma D$ to $A \beta' \gamma' D$ in the 300th part of a fecond? or will it at once acquire the form of the fimple harmonic curve? The cafe in which it is moft likely to take the latter mode of vibration is when the points β and γ are let go at the inftant that each portion of the ftring is in the middle of its vibration, and therefore forms the line $A \beta \gamma D$. But a moment's confideration will fhew us that it cannot do this; for at that inftant the point v, for inftance, which had come from q, is moving outwards with a moft rapid motion, and therefore will continue to go outward, while β and γ are approaching the axis. The point w, on the contrary, is at this moment approaching the axis with a motion equally rapid. They cannot therefore all come to the axis at once, and the vibration muft differ greatly from a fimple one. On the other hand, let it be fuppofed that both fpecies of vibrations can be preferved, and that, at the moment of letting go the points β and γ, the cord has the form $Am\beta q\gamma nD$. Then, when β and γ have come to B and C, having made $\frac{1}{2}$ a vibration, the point m will be in the axis, having made a vibration downward, and a half vibration upwards, q, in like manner, is in the axis, having made a whole vibration upwards, and half a vibration downwards. n is like m. Thus the whole comes to the axis at once; and in fuch a manner, that if the points B and C were inftantly ftopped, the three portions would continue their partial vibrations without any new effort. The refult of this compound vibration muft be a compound pulfe of air, which will excite in us the perception of the fundamental found and of its 12th. The confequence will be the fame if the points β and γ are ftopped any where fhort of the axis; and therefore (faid Bernoulli) the ftring will really vibrate fo if not ftopped at all.

But this was refufed by Euler, who obferved that in the points β and γ of contrary flexure, having no curvature, there can be no accelerating force. This caufed Bernoulli to attempt a direct inveftigation, examining minutely the curvatures and accelerating forces in the different points.

He had the pleafure of finding that the accelerating forces arifing from the curvature in every point, were precifely fuch as would produce the accelerations neceffary in thofe points for performing the motion that was

was required. And he exhibited the equations expreffive of the ftate of the cord in all thefe points. And, on the faith of thefe equations, he reftored the Taylorean curve to the rank which its inventor had given it; and he afferted that in every mufical vibration the cord was difpofed in a harmonical curve either fimple or compound. He farther fhewed that the equations which Euler and D'Alembert had given for the mufical cord (at leaft in the cafes which they had publifhed) were included in his equations, and that their equations only exhibited its momentary ftates, while his own equations fhewed the phyfical connection of them all; which is, that the whole cord forms a harmonic curve between the two fixed pins, while its different portions form fubordinate harmonic curves on the firft as an axis. Euler and D'Alembert, although they acknowledge this in the particular cafes which they had taken as examples, on account of their fimplicity, ftill infift that no fubordinate harmonic vibrations can correfpond to all the ftates of an elaftic cord which their equations exhibit as ifochronous and permanent. Mr Bernoulli's death put an end to the controverfy, and the queftion (confidered as a general theory) is perhaps ftill undecided. It may very probably be true, that as a fimple vibration may be permanent which never has the form of the fimple harmonic defcribed by Dr Taylor, fo a vibration may exift compounded of fuch vibrations, and therefore not expreffible by any equation deduced from the Taylorean curve.

But, in the mean time, Mr Bernoulli has made the moft beautiful difcovery in mechanics which has appeared in the courfe of the laft century, and has explained the moft curious phenomenon of continued founds, *viz.* the *almoft univerfal* accompaniment of the harmonic notes of any fundamental found. For this *fufceptibility* of compounded variation is not confined to a 12th, but is equally demonftrable of every other harmonic. Nay, it is evident that the fame fimple vibration of a cord may furnifh a moveable axis to more than one harmonic. For as the fimple vibration can have a fubordinate harmonic vibration fuperinduced upon it, fo may this compounded vibration have another fuperinduced on it, and fo on to any degree of compofition. And farther, as Mr Bernoulli has fhewn the complete analogy between the accelerations of the different points of an elaftic cord and of the correfponding plates of a column of air, it legitimately follows that all the confequences which we can eafily deduce, refpecting the vibrations of an elaftic cord, may be affirmed refpecting the undulations of a column of air in a pipe. Therefore this accompaniment of the harmonics muft not be confined to the mufic of ftrings and bells, but equally obtains in the mufic of wind inftruments. And thus the doctrine becomes univerfal.

Mr Bernoulli did not think it enough to fhew that thefe compound vibrations are poffible. He endeavours to fhew that this accompaniment muft be frequent. He illuftrates this very prettily, by fuppofing that a toothed wheel is turned round, and rubs with its teeth on an elaftic cord. If the fucceffive dropping of the teeth keep exactly pace with fuch vibrations as the cord can take and maintain by its elafticity, thefe will certainly be formed on it. If the intervals do not *exactly* correfpond, a little reflection will fhew that the agitation which the cord acquires will approximate to thofe which it can maintain: and if when they are exactly fo in any place of it, and the wheel be in that inftant removed, this vibration will remain and diffufe itfelf through the reft of the cord; fo that the very laft dying quiver (fo to fpeak) will be harmonic. Every *harmonic* agitation tends, by the very nature of the thing, to continue, while thofe that are incompatible really *do* deftroy each other; and the very laft muft be the remainder or fuperplus of fuch as could continue, over thofe which deftroyed each other. Accordingly, the harmonic notes of wires are always moft diftinctly heard as the found is dying away.

There is no occafion now to fay any thing about the fallacy of Rameau's *Generation Harmonique* as a theory of mufical pleafure. Our harmonies pleafe us, not becaufe a found is accompanied by its harmonics, but becaufe harmonics pleafe. His principle is therefore a tautology, and gives no inftruction whatever. His theory is a very *forced* accommodation of this principle to the practice of muficians, and tafte of the Public. He is exceedingly puzzled in the cafe of the *fousdominante*, or 4th of the fcale, and the 6th where there is no refonance. He fays that thefe notes, "fremiffent, quoiqu' elles ne refonnent pas." But this mifleads us. They do not refound; becaufe a 4th and a 6th cannot be produced at all by dividing the chord. They tremble; becaufe the falfe 4th and falfe 6th are very near the true ones, and the true 4th and 6th would both tremble and refound, if they were made falfe. A ftring will both tremble and refound, if very nearly true, as any one obferves the 12th and 17th on a harpfichord tremble and refound very ftrongly, though they are tempered notes. The whole theory is overturned at once by tuning the 4th falfe, fo as to correfpond to an aliquot divifion of the cord. It will then refound; and if this had happened to be agreeable, it would have been catched at as the foufdominant.

The phyfical caufe of the pleafure of harmonic founds is yet to feek, as much as our choice of thofe notes for melody which give us the beft harmony (fee Temperament, *Suppl.*). We have no hefitation in faying that, with refpect to our choice, the two are quite independent. Thoufands enjoy the higheft pleafure from melody who never heard a harmonious found. All the untaught fingers, and all fimple nations, are examples. They not only fix on certain intervals as the fteps of their tunes, but are difgufted when other fteps are taken. Nor do we hefitate, for the very fame reafons, to fay that the rules of accompaniment are dependent on the cantus or air, and by no means on the fundamental bafs of Rameau. The dependence affumed by him, as the rule of accompaniment, would, if properly adhered to, according to his own notions of the comparative values of the harmonics, lead to the moft fantaftic airs imaginable, always jumping by large intervals, and altogether incompatible with graceful mufic. The rules of modulation which he has fqueezed out of his principle, are nothing but forced, very forced, accommodations of a very vague principle to the current practice of his contemporaries. They do not fuit the primitive melodies of many nations, and they have caufed thefe national mufics to degenerate. This is acknowledged by all who are not perverted by the prevailing habits. We have heard, and could write down, fome moft enchanting lullabies of fimple peafant women,

men, poffeffed of mufical fenfibility, but far removed, in the cool fequeftered vale of life, from all opportunities of ftealing from our great compofers. Some of thefe lullabies never fail to charm, even the moft erudite mufician, when fung by a fine flexible voice: but it would puzzle Mr Rameau to accompany them *fecundum artem*.

We conclude this fubject by defcribing a moft beautiful and inftructive experiment.

Mr Watt, the celebrated engineer, was amufing himfelf (about the year 1765) with organ building, and invented a monochord of continued found, by which he could tune an organ with mathematical precifion, according to any propofed fyftem of temperament. It confifted of a covered ftring of a violincello, founding by the friction of an ivory wheel. The inftrument did not anfwer Mr Watt's purpofe, by reafon of the dead harfhnefs of its tone, and a flutter in the ftring by the unequal action of the wheel. But Mr Watt was amufed by obferving the ftring frequently taking, of its own accord, points of divifion, which remained fixed, while the reft was in a ftate of ftrong vibration. The inftrument came into the poffeffion of the writer of this article. He foon faw that it gave him an opportunity of making all the experiments which Bernoulli could only relate. When the ftring was kept in a ftate of fimple vibration, by a very uniform and gentle motion of the wheel, if its middle point was then gently touched with a quill, this point immediately ftopped, but the ftring continued to vibrate in two parts, founding the octave: And this it continued to do, however ftrong the vibrations were rendered afterwards by increafing the preffure and velocity of the wheel. The fame thing happened if the ftring was gently touched at one-third. It inftantly divided itfelf into three parts, with two nodes, and founded the 12th. In the fame manner the double octave, the 17th, and all other harmonics, were produced and maintained.

But the pretteft experiment was to put fomething foft, fuch as a lock of cotton, in the way of the wide vibrations of the cord, at one-third and two-thirds of its length, fo as to difturb them when they became very wide. When this was done, the ftring inftantly put on the appearance of fig. 8. performing at once the full vibration competent to its whole length, and the three fubordinate vibrations, correfponding to one-third of its length, and founding the fundamental and the 12th with equal ftrength. In this manner all the different accompaniments were produced at pleafure, and could be continued, even with ftrong founds. And it was amufing to obferve, when the wheel was ftrongly preffed to the ftring, and the motion violent, the nodes would form themfelves on various parts of the ftring, running from one part to another. This was always accompanied with all the jarring founds which correfponded to them.

When the ftring was making very gentle, fimple vibrations, and the wheel hardly touching it, if a violincello was made to found the 12th very ftrongly in its neighbourhood, the ftring inftantly divided itfelf, and vibrated in unifon, frequently retaining its fimple vibration and fundamental tone. We recommend this experiment to every perfon who wifhes to make himfelf well acquainted with the mechanifm of mufical founds. He will fee, in a moft fenfible and convincing manner, how a fingle ftring of the Æolian harp gives us all the changes of harmony, fliding from one found to another, according as it is affected in its different parts by an irregular breeze of wind. The writer of this article has attempted to regulate thefe fweet harmonic notes, and to introduce them into the organ. His fuccefs has been very encouraging, and the founds far exceed in pathetic fweetnefs any that have yet been produced by that noble inftrument. But he has not yet brought them fully under command, nor made them ftrong enough for any thing but the fofteft chamber mufic. Other neceffary occupations prevent him from giving the attention to this fubject that it deferves. He recommends it therefore to the mufical inftrument makers as richly deferving their notice. His general method was this: A wooden pipe is made, whofe fection is a double fquare. A partition in the middle divides it into two pipes, along fide of each other. One of them communicates with the foot and wind cheft, and is fhut at the upper end. The other is open at the upper, and fhut at the lower end. In the partition there is a flit almoft the whole length, and the fides of this flit are brought to a very fmooth chamfered or feather edge. A fine catgut is ftrained in this flit, fo as almoft to touch the fides. It is evident that when the wind enters one pipe by the foot, it paffes through the flit into the other, and efcapes at the top, which is open. In its paffage it forces the catgut into motion, and produces a mufical note, having all the fweetnefs of the Æolian harp. The ftrength of found may be increafed by increafing the body of air which is made to undulate. This was done by ufing, inftead of catgut, very narrow filk tape or ribband varnifhed: but the unavoidable raggednefs of the edges made the founds coarfe and wheefing. Flat filver wire was not fufficiently elaftic; flat wire, ufed for watch balance fprings, was better, but ftill very weak founded. Other methods were tried, which promifed better. A thin round plate of metal, properly fupported by a fpring, was fet in a round hole, made in another plate not fo thin, fo as juft not to touch the fides. The air forced through this hole made the fpring plate tremble, dancing in and out, and produced a very bold and mellow found.—This, and fimilar experiments, are richly worth attention, and promife great additions to our inftrumental mufic.

TRURO, a town of Nova-Scotia, fituated in Halifax county, at the head of the Bafin of Minas, oppofite to, and 3 miles foutherly of, Onflow; 40 miles N. by W. of Halifax, and 40 from Pictou. It was fettled by the North-Irifh, fome Scotch, and the defcendants of North-Irifh. Through this town runs the river called by the Indians Shubbenacadie, navigable for boats to within 9 miles of Port Sackville.—*Morse.*

Truro, a townfhip of Maffachufetts, fituated in Barnftable county, lies between lat. 41 57, and 42 4 N. and between long. 70 4 and 70 13 W. It is on the eafternmoft part of the peninfula of Cape Cod, 57 miles S. E. of Bofton, in a ftraight line, but as the road runs it is 112, and 40 from the court-houfe of Barnftable. It is the *Pamet* of the Indians, and after its fettlement in 1700 was fome time called *Dangerfield;* it was incorporated under its prefent name in 1709, and contains 1,193 inhabitants. Only one family of Indians remained a few years fince, and lived on *Pamet Point*. In the valley called *Great Hollow*, a creek fets up from the bay, at the mouth of which is a tide harbour. The other landing-places are of fmall note.

Pamet

Pamet Harbour is about 100 yards wide at the mouth, but is wider within; and if repaired would be of public utility. It lies above 3 leagues S. E. of Cape Cod harbour. The hill on which the meeting-houfe ftands branches from the high land of Cape-Cod, well known to feamen. The mountain of clay in Truro, in the midft of fandy hills, feems to have been placed there by the God of Nature, to ferve as a foundation for a light-houfe, which if erected might fave the lives of thoufands, and millions of property. The foil of Truro is, in moft places, fandy, like Provincetown; and the inhabitants derive their principal fubfiftence from the fea, which here abounds with vaft variety of fifh. Great part of their corn and vegetables are procured from Bofton and the neighbouring towns. Two inhabitants of Truro, Captains David Smith and Gamaliel Collings, were the firft who adventured to Falkland Iflands in purfuit of whales. This voyage, which was crowned with fuccefs, was undertaken in 1774, by the advice of Admiral Montague of the Britifh navy. The whalemen of Truro now vifit the coaft of Guinea and Brazil. Many of the mafters of fhips employed from Bofton and other ports, are natives of Truro. The elderly men and fmall boys remain at home to cultivate the ground; the reft are at fea two-thirds of the year. The women are generally employed in fpinning, weaving, knitting, &c.—*ib.*

TRUXILLO, a bay, harbour, and town, at the bottom of St Giles's Bay, on the coaft of Honduras, in the gulf of that name. The bay is about 6 miles broad, being deep and fecure, and defended by a caftle; but it has little trade. The town ftands about a league from the North Sea, between two rivers, the mouths of which, with fome iflands before them, form the harbour. The country is exceedingly fruitful in corn and grapes, and notwithftanding the heat of the climate, very populous. The city is defended by a thick wall towards the fea, and is inacceffible but by a narrow, fteep afcent. The caftle joins to the wall, and ftands on a hill. Behind the city are high mountains. It lies 300 miles N. E. of Amapalla. N. lat. 15 20, W. long. 85 56.—*ib.*

Truxillo, the firft diocefe in the audience of Lima, in Peru.—*ib.*

Truxillo, a bay or harbour, and one of the principal cities of the province of the fame name in Peru, is 11 leagues from Chocope, and 80 N. W. of Lima; and according to Ulloa, the city lies in lat. 8 6 3 S. and long. 77 30 W. It ftands in the valley of Chimo, on a fmall river, about half a league from the fea; is furrounded with a brick wall, and from its circuit may be claffed among cities of the third order. Two leagues to the northward is the port of Guanchaco, the channel of its trade. The houfes make an elegant appearance, being generally of brick, with ftately balconies and fuperb porticos.—*ib.*

Truxillo, or *Noftra Seniora de la Paz*, a town of New-Granada (Venezuela) and Terra Firma, in S. America, 125 miles fouth of Maracaibo Lake; on the fouthernmoft bank of which lake is a village, called Truxillo, dependent on this city. The city is in lat. 9 21 N. and long. 69 15 W.—*ib.*

TRYON *Mountains*, in N. Carolina, lie N. W. of the town of Salifbury, on the borders of the State of Tenneffee.—*ib.*

TSCHIRNHAUS, (Ehrenfred Walther Von), a name well known in the republic of letters, and one of the ornaments of the 17th century, was born April 10, 1651, at Kiflingfwald near Gorlitz in Upper Lufatia. His father was Erneft Chriftopher Von Tfchirnhaus, Baron Kiflingfwald and Stolzberg, and Obernfchonfeld, privy counfellor, and in various offices of rank under the Electors George I, and II. of Saxony, the firft of whom honoured him with the diftinction of the gold chain and portrait, as a mark of his fenfe of his merits and fervices. The mother of the young Von Tfchirnhaus was Maria Stirling, daughter of *Baron Stirling et Achil*, Stirling of Achil, or Achyle, in Scotland, an old and refpectable family, as appears by an epitaph which the Duke Chriftian, brother of the Elector George II. infcribed on the tomb of Johan Albert Stirling of Achil, in the cathedral of Marckfpurg. This gentleman had been prefident of the fenate of the electorate, privy counfellor, director of the impofts, and mafter of horfe to the Prince, and had, by his faithful and ufeful fervices, acquired his higheft efteem.

E. W. Von Tfchirnhaus was born, as has been obferved, at Kiflingfwald, the ufual refidence of the family, and poffeffed by it during more than 300 years. The family came originally from Bohemia, and appears to have been confiderable, feeing that, from the earlieft accounts of it in Lufatia, the Barons of Kiflingfwald are generally found in the moft refpectable civil offices.

The figure which Baron Von Tfchirnhaus, the fubject of this relation, has made in the fcientific and political world, makes it fuperfluous to fay that his early years were well employed. Quick apprehenfion, a clear perception of the fubject of his thoughts, and the moft ardent and infatiable thirft for knowledge, diftinguifhed him during his academical education. When 17 years of age, he was fent to Leyden. In 1672 all ftudy was interrupted in Holland by the din of war; and Mr Van Tfchirnhaus left the univerfity for the camp. His knowledge in mathematics, mechanics, and all phyfical fcience, found ample room in the military fervice for fhewing the importance of thofe fciences; and Tfchirnhaus fo diftinguifhed himfelf by his fervice in this way, that Baron Nieuland, a general officer of great merit, and at the fame time an accomplifhed fcholar, took delight in pufhing him into every fervice where he could fhew himfelf and his talents.

After two years fervice, he returned to his father's; but finding little to intereft him in the life of a mere country gentleman, and ftill burning with the fame thirft of knowledge, he prevailed on his father to allow him to travel. His younger brother George Albrecht Von Tfchirnhaus, Baron Obernfchonfeld, which he inherited from his grandfather Stirling, loved him with the warmeft affection, and fupplied him liberally with what was required for his appearance every where in a manner becoming his rank, and for fully gratifying his curiofity. He ufed often to fay, "Sorry was I to lofe the company of my dear brother, and I fometimes wifhed to accompany him; but not having his thirft for knowledge, I knew that his love for me would debar him of much happinefs, which I fhould thus have obftructed." *Felices animæ!* He went to Holland, from thence into England, France, Italy, Sicily, Malta, Greece.—Returning through the Tyrol, he met his brother at Vienna, where both were in great favour at the court of

Leopold,

Leopold. Wherever he went, he made himfelf acquainted with the moft eminent in all departments of fcience, living with them all in the mutual exchange of difcoveries and of kind offices. In Holland he was intimate with Huyghens and Hudde; in England with Newton, Wallis, Halley, and Oldenburgh; in France, among a people who more fpeedily contract acquaintance, there was not a man of note with whom he did not cultivate an active acquaintance—and, fortunately, Leibnitz then lived at Paris: in Italy, he was particularly careffed by Michaeli, foon after Cardinal; and was in the clofeft correfpondence with Kircher. His enjoyments, however, were derived folely from the communications of the moft eminent; his curiofity was directed to every thing, and wherever he faw an ingenious artifan, he was eager to learn from him fomething ufeful. In 1682, when at Paris for the third time, he communicated to his friends his celebrated theory of the cauftic curves, which marked him out as a valuable acquifition, and he was elected a member of the Royal Academy of Sciences, which was then reformed by the great minifter Colbert, and the moft illuftrious in all nations were picked out for its ornaments. There he found himfelf feated with Leibnitz, Huyghens, John Bernoulli, &c.

After twelve years employed in vifiting Europe, he returned home: but after a fhort ftay, went to Flanders, and prepared to publifh his work, intitled *Medicina Mentis;* of which the fubject may almoft be gueffed, from the way in which he had exercifed his own mind. Having the moft exalted notions of the intellectual and moral nature of man, he thought that the continual fupply of information was as neceffary as the continual fupply of food. And his great principle was TO ENLIGHTEN. This work was committed to the care of fome friends, and did not appear till 1687, at Amfterdam. A fecond edition appeared at Leipfic in 1695.

Finding now that his moderate fortune was infufficient for the great public projects he had in view, he fought for affiftance, and endeavoured to make friends by frequenting the court of the Elector at Drefden. He foon became a favourite of his Princes, George the II. and III. and was appointed to active offices of great refponfibility. By the orders and encouragement of the Elector, then king of Poland, he introduced into his native country the firft manufacture of glafs; and his project foon throve to fuch a degree, that not only Saxony was fupplied, but they even began to export the finer kinds of white glafs for windows; in which manufacture Saxony ftill excels. It was in the courfe of experiments for improving this manufacture that Tfchirnhaus made the celebrated great burning glaffes which ftill bear his name. He made two of thefe lenfes, and gave one to the Emperor, and the other to the Academy of Paris. He was eager to improve the art of forming and polifhing optical glaffes; and in the profecution of the theory on which their performance depends, he made fome beautiful difcoveries in the department of pure geometry. It is well known that all the fciences are allied, and of a family, and that eminence in one is feldom attainable without the affiftance of others. His prefent purfuits led him to the ftudy of chemiftry, which he profecuted with the fame ardour which he exhibited in every thing he undertook. But all the while, mathematics, and efpecially geometry, was his favourite ftudy; and he was anxious to make the fame advances in the general paths of mathematical inveftigation which he thought he had made in the general laws of material nature. He apprehended that only bye paths were yet known, and that many things were yet inacceffible; becaufe we had not yet found out the great roads from which thofe branches were derived. He was of Des Cartes's opinion, that the true road in mathematics muft be an eafy one, except in cafes which were, in their own nature, complicated. Very early, therefore, he began writing on mathematical fubjects, always continuing his general views of the fcience, and his endeavours to fyftematife the ftudy; but, at the fame time, beftowing a very particular attention on any branch which chanced to intereft him; each of thefe his epifodical ftudies in mathematics deferves the name of a department of the fcience. This is the cafe with his theory of cauftic curves, with his method of tangents, and his attempt to free Leibnitz's calculus from all confideration of infinitefimal quantities. Mr Tfchirnhaus feldom gave himfelf any trouble with a particular problem. In all his mathematical performances, there is an evident connection with fomething which he confidered as the great whole of the fcience; and the manner of treating the different queftions is plainly accommodated to a fyftem in his thoughts. This he intended as the third part of the Medicina Mentis; and, having nearly completed the fecond, he had propofed thefe as the occupation of the enfuing winter (1708-9). But his death, which may be called premature, has deprived the world of thefe, and other beneficent and ufeful labours.

Mr Von Tfchirnhaus was of the moft mild and gentle difpofition, as was well known to all who enjoyed his acquaintance. This difpofition was fo eminent in him, that fcarcely any perfon ever faw him angry, or even much ruffled in his temper. He forgave injuries frankly and heartily, and often ftood the friend (unknown) of thofe who had wronged him. By fuch conduct, he changed fome enmities into the moft fteady and affectionate friendfhips. As an inquirer and an inventor, he had contentions with other claimants, and fome difputes about the legitimacy of his methods; as, for example, with Nicholas Fatio Duiller, who attacked Tfchirnhaus's method of tangents; and Preftet and Rolle, who found fault with his expreffion of equations of the third degree. But thefe were all friendly debates, and never carried him beyond the limits of gentlemanly behaviour. He began to difpute with Ozanam about a quadratrix; but on being merely told that he was miftaken, by P. Souciet, he immediately acknowledged his error, and corrected it.

Many original and important mathematical performances of Mr Von Tfchirnhaus are to be feen in the Leipfic Acts, in the Memoirs of the Academy of Sciences at Paris, and other literary journals. His happy generalifation of Dr Barrow's theorem for the focus of a flender pencil of rays after reflection or refraction, and the theory of cauftic curves, in which this terminates, both conftitutes one of the moft elegant branches of optical fcience, and affords a rich harveft of very curious and unexpected geometrical truths. The manner in which he notices the rough way in which his firft and fole miftake in this theory was pointed out, is perhaps incomparable as an example of gentlemanlike reprehenfion,

PLATE XLV.

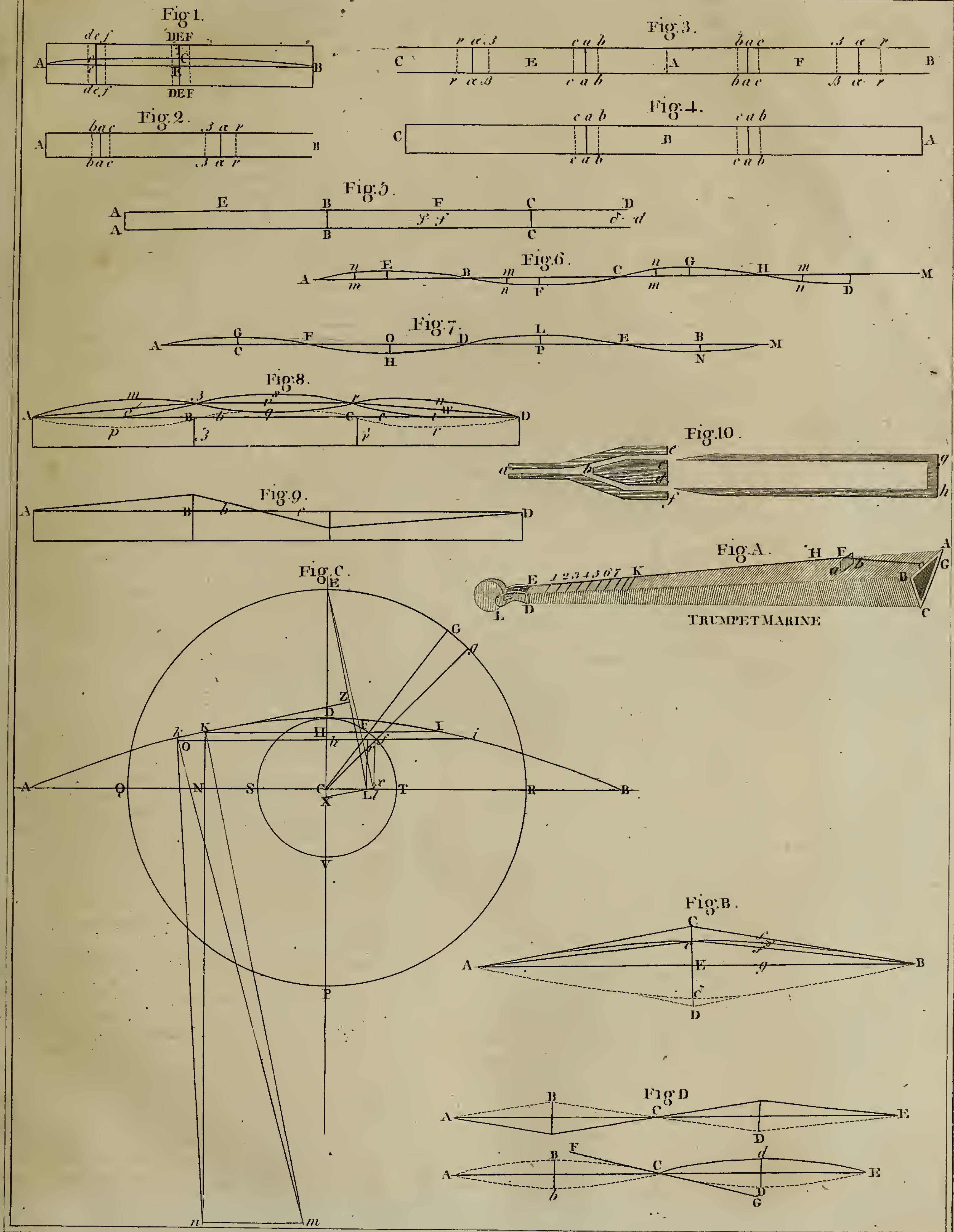
Fig.1.
Fig.2.
Fig.3.
Fig.4.
Fig.5.
Fig.6.
Fig.7.
Fig.8.
Fig.9.
Fig.10.
Fig.A.
TRUMPET MARINE
Fig.C.
Fig.B.
Fig D

Tschirnhaus.

reprehenfion, and is a leffon for literati of all defcriptions, highly valuable on account of the foft way in which it falls, while it is convincing as a mathematical theorem.

Tfchirnhaus was the difcoverer of the fubftance of which the celebrated Saxon porcelain is made, and of the manner of working it up; by which he eftablifhed a manufacture highly profitable to his country, and has given us the fineft pottery in the world. He never wearied in fpreading ufeful knowledge; and the fhops of our artifans of almoft all kinds were fupplied with books of inftructions and patterns, many of them written by Mr Von Tfchirnhaus, or under his infpection. Ufeful books of all kinds were tranflated out of foreign languages at his expenfe. Men of genius in the arts were enabled, through the encouragement of himfelf and his friends, and often by his pecuniary affiftance, to bring their talents before the public eye. In fhort, he feemed at all times to prefer the public good to his own; and never felt fo much pleafure as when he could promote fcience or the ufeful arts. He was as it were ftimulated to this by an innate propenfity. And as he was more defirous of *being* than of *appearing* the accomplifhed man, he was in no concern what notice others took of his fervices to the public. He even reprefents the defire of fame as hoftile to the improvement either of fcience or morality, in his *Medicina Mentis*; a work which is acknowledged by all who knew him to be a picture of his own amiable mind. He lightly efteemed riches; and knew not what ufe they were of, except for providing the neceffaries of life, and the means of acquiring knowledge. In perfect conformity to this maxim, he modeftly, and with elegant refpect, refufed the ample prefents made him by his affectionate fovereign; and when he was added to his cabinet council, he received the diploma, but begged and obtained to be free from the title. And when he prefented his great burning glafs to the Emperor, and got from him the dignity and infignia of Baron of the Empire, he pleaded for leave to decline it, requefting to keep the chain and portrait, which he always wore under his veft. He expended a very great portion of the ample revenue left him by his father in the fervice of his country, by promoting the ufeful arts and fciences.

Mr Von Tfchirnhaus venerated truth above all things; faying, that thofe who thought any thing comparable with it were not the fons of God, but ftep children, and that the love of truth is the ruling affection in every man of a worthy heart. In a letter to an intimate friend, he faid that, by the age of five-and-twenty, he had completely fubdued the love of glory, of riches, and of worldly pleafures; and that at no time he had found it difficult to reprefs vanity, becaufe he was every day confcious of having acted worfe than he was certain that he might and fhould have done. He felt himfelf humbled in the fight of the All-perfect Judge.

Nor was all this the vain boaft of a man averfe to bufinefs, and poffeffed of an ample fortune, which permitted him, without inconvenience, to pleafe his fancy in ftudy, and in helping others with what to himfelf was fuperfluous. Such a character, though rare, may exift, without being the object of much refpect. No: Mr Tfchirnhaus was really a philofopher of the true ftoic fect, in refpect of fortitude of mind, while a good Chriftian in modefty and diffidence. In the laft five years of his life he bore up under troubles, and embarraffments, and misfortunes in his family, which would have tried the mind of Cato himfelf. But in the midft of thefe ftorms he was unfhaken, and preferved his ferenity of mind. He was even fenfible of this being a rare gift of Providence, and ufed frequently to exprefs his thankfulnefs for a treafure fo precious. He felt deeply his relation to the Author of Nature, and rejoiced in thinking himfelf fubject to the providence of God. He faid that he was fully perfuaded that he would meet with perfect juftice, and would therefore ftrive to perform his own part to the utmoft of his power, that his future condition might be the more happy, and that he might in the mean time enjoy more fatisfaction on reflecting on his own conduct. His lot, he faid, was peculiarly fortunate: having fuch thirft for novelty, he would have been unhappy without an affluent fortune; and his own enjoyments encouraged neither vice nor idlenefs in himfelf or in the minifters to his pleafures.

This amiable perfon was of a conftitution not puny, but not robuft, and he had hurt it by too conftant ftudy. He feared no difeafe; thinking that he had a cure or an alleviation for all but one, namely, the ftone and gravel. He had a dread of this, and laboured to find a preventative or a remedy. He thought that he had alfo done a great deal here; and defcribes in his *Medicina Corporis* a preparation of whey, which he faid he ufed with great advantage to his health. But his precautions were in vain: He was attacked with the gravel, which, after three months fuffering, brought on a fuppreffion of urine. The phyficians faw that his end approached; and finding him difregard their prefcriptions, they quitted him. He treated himfelf (it is faid judicioufly) for fome time, and with fome appearance of fuccefs; but at laft he faw death not far off. He dictated a letter to his Sovereign, thanking him for all his favours and kindnefs, and recommended his children to his protection. He never fretted nor complained; but frequently, with gliftening eyes, expreffed his warmeft thanks to Providence for the wonderful track of good fortune and of happinefs that he had enjoyed; and faid that he alfo felt fome fatisfaction in the confcioufnefs that fome of this was owing to his own prudent conduct. He poffeffed his entire faculties to the laft moment, and when he felt his fpirit juft about to depart, his laft words were, "*Jö triumphé—Victoria!*" No longer able to fpeak, he made figns for what he wanted; and a little after, fhutting his eyes, as if to fleep, he gently, and without a groan, yielded up his fpirit, about four o'clock in the morning of the 11th of October 1708, aged 56.

His funeral was performed in a manner becoming his rank, and the body conveyed to the family vault. The Elector (King of Poland) defrayed the expenfe; for he would not allow his family to have any thing to do with the funeral of a man of fo public a character, and fo univerfally beloved.

The account of fuch a life as that of Baron Von Tfchirnhaus would, at all times, make a pleafant and ufeful impreffion. In thefe our times, in the beginning of the 19th century, after fociety has availed itfelf of all the acquifitions in fcience and art, furnifhed by that ardent age of the world which this gentleman contributed to adorn; in an age when we boaft of illumination unparalleled in hiftory, and of improvements almoft amounting

ing to perfection; and in particular, of an emancipation from the prejudices which had obſcured our view of the chief good, and ſtifled public ſpirit—now, when we are ſo full of knowledge that it is running over on all hands, in volumes of inſtruction, how to make the world one happy family; in theſe bright days of philanthropiſm, can the public records of Europe exhibit a ſuperior character to that of Mr Von Tſchirnhaus, either in reſpect of wiſdom or of diſpoſition? Was he not a philanthropiſt, a ſincere lover of mankind? Was he not wiſe, in employing his great acquired knowledge as the means of direct and active beneficence, by limiting his exertions to the extent of thoſe circles where his own efforts would be effective? He did not write books, teaching others how to do good: he taught it by example; being determined that his own wiſhes to ſee men happier ſhould not fail by the want of ſuch wiſhes in others, even after he ſhould inſtruct them. He never allowed his inſatiable curioſity for freſh diſcoveries to interfere with the immediate turning to the good of his own country the knowledge he had already acquired. He probably never thought of improving the ſituation of the Chineſe or the Mexicans, finding that it required all his ample fortune, and all the intereſt and influence he could acquire, to do the good he wiſhed in Saxony. We doubt not but that he was equally attentive to the ſtill narrower circle of duties formed by his own family. We ſee that he was a dearly beloved brother; which could hardly be without his alſo being a loving brother and a dutiful ſon. The nature of the diſtreſſes which he experienced in his family, and the manner in which he behaved under them, ſhew him to have been an eminent Chriſtian moraliſt. With a modeſty that is unmatched by any one of the thouſands who have poured out inſtructions upon us during the laſt ten years, and a gracefulneſs which characteriſes the gentleman, his *Medicina Mentis* is offered to public notice, merely as an experimental proof that a certain way of thinking and acting is productive of internal quiet of mind; of great mental enjoyment, both moral and intellectual; and of peace, and the good will of thoſe around us: and that it did, in fact, produce a dutiful and comfortable reſignation to the unavoidable trials of human life. He pretends not to be greatly ſuperior in wiſdom to his neighbours, but merely tells how things ſucceeded with himſelf. He did not ſcruple, however, to publiſh to the world diſcoveries in ſcience, in which he had got the ſtart of others during that buſy period of ſcientific occupation: and theſe diſcoveries in mathematics were highly prized by the firſt men of the age; nor will the name of Tſchirnhaus, or his cauſtic curves, ever be forgotten.

We felt ourſelves obliged to the friend who took notice of the omiſſion of this gentleman's name, ſo eminent in the mathematical world, in the courſe of our alphabet; but when we looked into the memoirs of the Academy of Paris for 1709 for ſome account of him, what we there ſaw appeared ſuch a continual panegyric, that we could not take it as a fair picture of any real character. Looking about for more impartial information, we found in the *Acta Eruditorum*, Leipſ. 1709, the account of which the foregoing is an abſtract, except a particular or two which we have copied from an account in the Literary Journal of Breſlaw, by Count Herberſtein, whom we can ſcarcely ſuſpect of undue partiality, becauſe he had ſome diſputes with Mr Von Tſchirnhaus on mathematical ſubjects. May we not ſay, "the memory of this man is ſweet!"

TSHAMIE, the Indian name of a tree in the Northern Circars of Hindoſtan. It grows, ſays Dr Roxburgh, to be a pretty large tree, is a native of moſt parts of the coaſt, chiefly of low lands at a conſiderable diſtance from the ſea, and may be only a variety of *proſopis ſpicigera*, for the thorns are in this ſometimes wanting; flowers during the cold and beginning of the hot ſeaſons. *Trunk* tolerably erect, bark deeply cracked, dirty aſh colour. *Branches* irregular, very numerous, forming a pretty large ſhady head. *Prickles* ſcattered over the ſmall branches; in ſome trees wanting. *Leaves* alternate, generally bipinnate, from two to three inches long; pinnæ from one to four, when in pairs oppoſite, and have a gland between their inſertions. *Leaflets* oppoſite, from ſeven to ten pair, obliquely lanced, ſmooth, entire, about half an inch long, and one-ſixth broad. *Stipules* none. *Spikes* ſeveral axillary, filiform, nearly erect. *Bracts* minute, one-flowered, falling. *Flowers* numerous, ſmall, yellow, ſingle, approximated. *Calyx* below, five-toothed. *Filaments* united at the baſe. *Anthers* incumbent, a white gland on the apex of each, which falls off ſoon after the flower expands. *Style* crooked. *Stigma* ſimple. *Legume* long, pendulous, not inflated. *Seeds* many, lodged in a brown meally ſubſtance.

The pod of this tree is the only part uſed. It is about an inch in circumference, and from ſix to twelve long; when ripe, brown, ſmooth, and contains, beſides the ſeeds, a large quantity of brown meally ſubſtance, which the natives eat; its taſte is ſweetiſh and agreeable; it may therefore be compared to the Spaniſh *algaroba*, or locuſt tree. (*Ceratonia ſiliqua*, Linn.)

In compliance with Dr Kœnig's opinion, Dr Roxburgh calls this tree a *proſopis*; but as he thinks the antheral glands give it a claim to the genus *adenanthera*, we have retained the Indian name till its botanical claſſification ſhall be aſcertained by thoſe who have greater authority in the ſcience than we lay claim to.

TUAPE, the chief town of the diviſion of Senora, in New Mexico.—*Morſe*.

TUBAI, a ſmall iſland, one of the Society Iſlands, in the S. Pacific Ocean, is about 4 or 5 leagues to the N. by W. or N. N. W. from Bolabola. S. lat. 16 12, W. long. 151 44.—*ib.*

TUCAPEE, on the coaſt of Chili, and the W. ſide of S. America, is on the S. Atlantic Ocean, 10 leagues N. N. E. from Rio Imperial, and 10 to the iſland of Santa Maria, or St Mary.—*ib.*

TUCKABATCHEES, a town of the Creek nation of Indians.—*ib.*

TUCKAHOE *Creek*, in Maryland, Talbot county, a branch of Choptank river.—*ib.*

TUCKER (Abraham), Eſq; a curious and original thinker, was a gentleman of affluent fortune, and author of "The Light of Nature purſued," 9 vols 8vo; of which the five firſt volumes were publiſhed by himſelf in 1768, under the aſſumed name of "Edward Search, Eſq;" and the four laſt after his death, in 1777, as "The poſthumous Work of Abraham Tucker, Eſq; publiſhed from his manuſcript as intended for the preſs by the author." Mr Tucker lived at Betchworth-caſtle, near Dorking, in Surry; an eſtate which he purchaſed

Tucker.

purchafed in the early part of his life. He married the daughter of Edward Barker, Efq; by whom he had two daughters; one of whom married Sir Henry St John, and died in his lifetime; the other furvived, and now lives at Betchworth-caftle. He loft his eyefight a few years before his death, which happened in 1775. To defcribe him as a neighbour, landlord, father, and magiftrate, it would be neceffary to mention the moft amiable qualities in each. It is unneceffary to add that he was very fincerely regretted by all who had the pleafure of his acquaintance, and who ftood connected with him in any of thofe relations.

Tucker (Jofiah, D. D.) well known as a political and commercial writer, was born at Langhorn, in Caermarthenfhire, in the year 1712. His father was a farmer, and having a fmall eftate left him at or near Aberyftwith, in Cardiganfhire, he removed thither; and perceiving that his fon had a turn for learning, he fent him to Ruthin fchool, in Denbighfhire, where he made fo refpectable a progrefs in the claffics, that he obtained an exhibition at Jefus College, Oxford. It is generally underftood that feveral of his journeys to and from Oxford were performed on foot, with a ftick on his fhoulder, and bundle at the end of it. Thus it might be faid by him, as by Simonides, "*Omnia mea mecum porto.*"

At the age of 23 he entered into holy orders, and ferved a curacy for fome time in Gloucefterfhire. About 1737 he became curate of St Stephen's church in Briftol, and was appointed minor-canon in the cathedral of that city. Here he attracted the notice of Dr Jofeph Butler, then Bifhop of Briftol, and afterwards of Durham, who appointed Mr Tucker his domeftic chaplain. By the intereft of this prelate Mr Tucker obtained a probendal ftall in the cathedral of Briftol; and on the death of Mr Catcott, well known by his treatife on the Deluge, and a volume of excellent fermons, he became rector of St Stephen. The inhabitants of that parifh confift chiefly of merchants and tradefmen; a circumftance which greatly aided his natural inclination for commercial and political ftudies.

When the famous bill was brought into the Houfe of Commons for the naturalization of the Jews, Mr Tucker, confidering the meafure rather as a merchant or politician than as a Chriftian divine, wrote in defence of it with a degree of zeal which, to fay no more, was at leaft indecent in a man of his profeffion. As fuch it was viewed by his brethren of the clergy, and by his parifhioners; for, while the former attacked him in pamphlets, newfpapers, and magazines, the latter burnt his effigy dreffed in canonicals, together with the letters which he had written in defence of the naturalization.

In the year 1753 he publifhed an able pamphlet on the "Turkey Trade;" in which he demonftrates the evils that refult to trade in general from chartered companies. At this period Lord Clare (afterwards Earl Nugent) was returned to Parliament for Briftol; which honour he obtained chiefly through the ftrenuous exertions of Mr Tucker, whofe influence in his large and wealthy parifh was almoft decifive on fuch an occafion. In return for this favour the earl procured for him the deanery of Gloucefter, in 1758, at which time he took his degree of doctor in divinity. So great was his reputation for commercial knowledge, that Dr Thomas Hayter, afterwards Bifhop of London, who was then tutor to his prefent majefty, applied to Dr Tucker to draw up a differtation on this fubject for the perufal of his royal pupil. It was accordingly done, and gave great fatisfaction. This work, under the title of "The Elements of Commerce," was printed in quarto, but never publifhed.

Dr Warburton, who became Bifhop of Gloucefter in the year 1760, thinking very differently from Dr Tucker of the proper ftudies of a clergyman, as well as of the project for naturalizing the Jews, faid once to a perfon who was praifing the Elements of Commerce, that "his Dean's trade was religion, and religion his trade." This farcafm, though not perhaps groundlefs, was certainly too fevere; for fome of the Dean's publications evince him to have devoted part of his time at leaft to the ftudy of theology, and to have been a man of genuine benevolence.

In the year 1771, when a ftrong attempt was made to procure an abolition of fubfcription to the 39 articles, Dr Tucker came forward as an able and moderate advocate of the church of England. About this time he publifhed "Directions for travellers;" in which he lays down excellent rules, by which gentlemen who vifit foreign countries may not only improve their own minds, but turn their obfervations to the benefit of their native country.

The Dean was an attentive obferver of the American conteft. He examined the affair with a very different eye from that of a party-man, or an interefted merchant; and he difcovered, as he conceived, that both fides would be better off by an abfolute feparation. Mr Burke's language in the Houfe of Commons, in confequence of his publifhing this opinion, was harfh, if not illiberal. In his famous fpeech on the American taxation bill, April the 13th, 1774, he called the Dean of Gloucefter the advocate of the court faction, though it is well known that the court difapproved of the propofal as much as the oppofition. This attack roufed the Dean to refentment; and he publifhed a letter to Mr Burke; in which he not only vindicates the purity of his own principles, but retorts upon his adverfary in very forcible and farcaftic terms. He afterwards fupported Lord Nugent's intereft in Briftol againft that of Mr Burke, and was certainly very inftrumental in making the latter lofe his election.

When the terrors of an invafion were very prevalent in 1779, Dr Tucker circulated, in a variety of periodical publications, fome of the moft fenfible obfervations that were ever made on the fubject, in order to quiet the fears of the people. In 1781 he publifhed, what he had printed long before, "A Treatife on Civil Government," in which his principal defign is to counteract the doctrines of Locke and his followers. The book made a confiderable noife, and was very fharply attacked by feveral writers on the democratic fide of the queftion, particularly by Dr Towers and Dr Dunbar of Aberdeen. This laft gentleman acted a part which, if not difhonourable, was at leaft uncommon. The Dean had thrown off thirty copies of his work long before he publifhed it; and thefe he fent to different men of eminence, that he might avail himfelf of their animadverfions before he fhould fubmit it to the public at large. Principal Campbell of Aberdeen received one copy for this purpofe; and Dr Dunbar having

ing by him been favoured with a perufal of it, inftead of fending his objections privately to the author, publifhed fevere remarks on it in a work which he had then in the prefs. Thus was the anfwer to the Dean of Gloucefter's Treatife on Government publifhed before that treatife itfelf; but Dr Dunbar was no match for Dr Tucker.

In the year 1782 our author clofed his political career with a pamphlet intitled "*Cui Bono?*" in which he balances the profit and lofs of each of the belligerent powers and recapitulates all his former pofitions on the fubject of war and colonial poffeffions. His publications fince that period confifted of fome tracts on the commercial regulations of Ireland, on the exportation of woollens, and on the iron trade. In 1777 he publifhed feventeen practical fermons, in one volume octavo. In the year 1778, one of his parifhioners, Mifs Pelloquin, a maiden lady of large fortune and moft exemplary piety, bequeathed to the Dean her dwelling-houfe in Queen-Square, Briftol, with a very handfome legacy, as a teftimony of her great efteem for his worth and talents. In the year 1781 the Dean married a lady of the name of Crowe, who refided at Gloucefter.

It fhould be recorded to his praife, that though enjoying but very moderate preferment (for to a man of no paternal eftate, or other ecclefiaftical dignity, the Deanery of Gloucefter is no very advantageous fituation), he was notwithftanding a liberal benefactor to feveral public inftitutions, and a diftinguifhed patron of merit. The celebrated John Henderfon of Pembroke-College, Oxford, was fent to the univerfity, and fupported there, at the Dean's expenfe, when he had no means whatever of gratifying his ardent defire for ftudy. We fhall mention another inftance of generofity in this place, which reflects the greateft honour upon the Dean. About the year 1790 he thought of refigning his rectory in Briftol, and, without communicating his defign to any other perfon, he applied to the Chancellor, in whofe gift it is, for leave to quit it in favour of his curate, a moft deferving man, with a large family. His Lordfhip was willing enough that he fhould give up the living, but he refufed him the liberty of nominating his fucceffor. On this the Dean refolved to hold the living himfelf till he could find a fit opportunity to fucceed in his object. After weighing the matter more deliberately, he communicated his wifh to his parifhioners, and advifed them to draw up a petition to the Chancellor in favour of the curate. This was accordingly done, and figned by all of them, without any exception, either on the part of the diffenters or others. The Chancellor being touched with this teftimony of love between a clergyman and his people, yielded at laft to the application; in confequence of which the Dean cheerfully refigned the living to a fucceffor well qualified to tread in his fteps. Since that time he refided chiefly at Gloucefter, viewing his approaching diffolution with the placid mind of a Chriftian, confcious of having done his duty both to God and man. He died in November 1799. The following we believe to be a tolerably correct lift of his works.

Theological and Controverfial.—1. A Sermon, preached before the Governors of the Infirmary of Briftol, 1745. 2. Letters in behalf of the Naturalization of the Jews. 3. Apology for the Church of England, 1772. 4. Six Sermons, 12mo, 1773. 5. Letter to Dr Kippis on his Vindication of the Proteftant Diffenting Minifters. 6. Two Sermons and Four Tracts. 7. View of the Difficulties of the Trinitarian, Arian, and Socinian Syftems, and Seventeen Sermons, 1777.

Political and Commercial.—8. A pamphlet on the Turkey Trade. 9. A brief View of the Advantages and Difadvantages which attend a Trade with France. 10. Reflections on the Expediency of Naturalizing foreign Proteftants, and a Letter to a Friend on the fame Subject. 11. The Pleas and Arguments of the Mother Country and the Colonies ftated. 12. A Letter to Mr Burke. 13. Quere, Whether a Connection with, or Separation from, America, would be for national Advantage? 14. Anfwers to Objections againft the Separation from America. 15. A Treatife on Civil Government. 16. *Cui Bono?* 17. Four Letters on national Subjects. 18. Sequel to Sir William Jones on Government. 19. On the Difpute between Great Britain and Ireland. 20. Several Papers under the Signature of Caffandra, &c. on the Difficulties attendant on an Invafion. 21. A Treatife on Commerce (Mr Coxe, in his Life of Sir Robert Walpole, fays that this was printed, but never publifhed).

Mifcellaneous.—22. Directions for Travellers. 23. Cautions againft the Ufe of Spirituous Liquors. 24. A Tract againft the Diverfions of Cock-fighting, &c.

TUCKERTON, the port of entry for the diftrict of Little Egg-Harbour, in the State of New-Jerfey. —*Morse.*

TUCUYO, a town of New-Granada, and Terra Firma, in N. America. It ftands in a valley of the fame name, every where furrounded by mountains. The air is very healthy, and the foil fruitful, and a river divides the place. It is 200 miles S. of Maracaibo city. N. lat. 7 10, W. long. 68 36.—*ib.*

TUFTONBOROUGH, a town of New-Hampfhire, in Strafford county, fituated on the N. E. fide of Lake Winipifeogee, adjoining Wolfborough, containing 109 inhabitants.—*ib.*

TUGELO *River*, in Georgia, is the main branch of Savannah river. The other great branch is Keowee, which joining with the other, 15 miles N. W. of the northern boundary of Wilke's county, form the Savannah. Some branches of the Tugelo rife in the State of Tenneffee. A refpectable traveller relates that in ten minutes, having walked his horfe moderately, he tafted of Tugelo, Apalachicola, and Hiwaffee rivers. —*ib.*

TUICHTENOONA *Creek*, in the State of New-York, is 16 miles above Schenectady. E. of the creek is a curious Indian infcription.—*ib.*

TULIPOMANIA, the very proper name given to a kind of gambling traffic in *tulip-roots*, which prevailed in Holland and the Netherlands during fome part of the 17th century. It was carried on to the greateft extent in Amfterdam, Haerlem, Utrecht, Alkmaar, Leyden, Rotterdam, Hoorn, Enkhuyfen, and Meedenbliek; and rofe to the greateft height in the years 1634, 1635, 1636, and 1637. Munting, who, in 1696, wrote a book of 1000 pages folio on the fubject, has given a few of the moft extravagant prices, of which we fhall prefent the reader with the following. For a root of that fpecies called the *Viceroy*, the after-mentioned articles, valued as below, were agreed to be delivered.

Tulipomania.

		Florins.
2	lafts of wheat	448
4	ditto rye	558
4	fat oxen	480
8	fat fwine	240
12	fat fheep	120
2	hogfheads of wine	70
4	tons beer	32
2	ditto butter	192
1000	pounds of cheefe	120
	a complete bed	100
	a fuit of clothes	80
	a filver beaker	60
	Sum	2500

Thefe tulips afterwards were fold according to the weight of the roots. Four hundred perits* of Admiral Liefken coft 4400 florins; 446 ditto of Admiral Von der Eyk, 1620 florins; 106 perits Schilder coft 1615 florins; 200 ditto Semper Auguftus, 5500 florins; 410 ditto Viceroy, 3000 florins, &c. The fpecies Semper Auguftus has been often fold for 2000 florins; and it once happened that there were only two roots of it to be had, the one at Amfterdam and the other at Haerlem. For a root of this fpecies, one agreed to give 4600 florins, together with a new carriage, two grey horfes, and a complete harnefs. Another agreed to give twelve acres of land for a root: for thofe who had not ready money, promifed their moveable and immoveable goods, houfe and lands, cattle and clothes. A man, whofe name Munting once knew, but could not recollect, won by this trade more than 60,000 florins in the courfe of four months. It was followed not only by mercantile people, but alfo by the firft noblemen, citizens of every defcription, mechanics, feamen, farmers, turf-diggers, chimney-fweeps, footmen, maid-fervants, and old clothes-women, &c. At firft, every one won and no one loft. Some of the pooreft people gained in a few months houfes, coaches, and horfes, and figured away like the firft characters in the land. In every town fome tavern was felected which ferved as a change, where high and low traded in flowers, and confirmed their bargains with the moft fumptuous entertainments. They formed laws for themfelves, and had their notaries and clerks.

* A *perit* is a fmall weight lefs than a grain.

To get poffeffion of fine flowers was by no means the real object of this trade, though many have faid that it was, and though we have known fome individuals in Scotland, who, led away by what they thought the fafhion, have given ten guineas for a tulip root. During the time of the tulipomania, a fpeculator often offered and paid large fums for a root which he never received, and never wifhed to receive. Another fold roots which he never poffeffed or delivered. Oft did a nobleman purchafe of a chimney-fweep tulips to the amount of 2000 florins, and fold them at the fame time to a farmer; and neither the nobleman, chimney-fweep, or farmer, had roots in their poffeffion, or wifhed to poffefs them. Before the tulip feafon was over, more roots were fold and purchafed, befpoke, and promifed to be delivered, than in all probability were to be found in the gardens of Holland; and when Semper Auguftus was not to be had, which happened twice, no fpecies perhaps was oftener purchafed and fold. In the fpace of three years, as Munting tells us, more than ten millions were expended in this trade in only one town of Holland.

To underftand this gambling traffic, it may be neceffary to make the following fuppofition. A nobleman befpoke of a merchant a tulip root, to be delivered in fix months, at the price of 1000 florins. During thefe fix months the price of that fpecies of tulip muft have rifen or fallen, or remained as it was. We fhall fuppofe that, at the expiration of that time, the price was 1500 florins; in that cafe, the nobleman did not wifh to have the tulip, and the merchant paid him 500 florins, which the latter loft and the former won. If the price was fallen when the fix months were expired, fo that a root could be purchafed for 800 florins, the nobleman then paid to the merchant 200 florins, which he received as fo much gain; but if the price continued the fame, that is, 1000 florins, neither party gained or loft. In all thefe circumftances, however, no one ever thought of delivering the roots or of receiving them. Henry Munting, in 1636, fold to a merchant at Alkmaar, a tulip root for 7000 florins, to be delivered in fix months; but as the price during that time had fallen, the merchant paid, according to agreement, only 10 *per cent.* "So that my father (fays the fon) received 700 florins for nothing; but he would much rather have delivered the root itfelf for 7000." The term of thefe contracts was often much fhorter, and on that account the trade became brifker. In proportion as more gained by this traffic, more engaged in it; and thofe who had money to pay to one, had foon money to receive of another; as at faro, one lofes upon one card, and at the fame time wins on another. The tulip dealers often difcounted fums alfo, and transferred their debts to one another; fo that large fums were paid without cafh, without bills, and without goods, as by the Virements at Lyons. The whole of this trade was a game at hazard, as the Miffiffippi trade was afterwards, and as ftock-jobbing is at prefent. The only difference between the tulip trade and ftock-jobbing is, that at the end of the contract the price in the latter is determined by the Stock Exchange; whereas in the former it was determined by that at which moft bargains were made. High and low priced kinds of tulips were procured, in order that both the rich and the poor might gamble with them; and the roots were weighed by perits, that an imagined whole might be divided, and that people might not only have whole, but half and quarter lots. Whoever is furprifed that fuch a traffic fhould become general, needs only to reflect upon what is done where lotteries are eftablifhed, by which trades are often neglected, and even abandoned, becaufe a fpeedier mode of getting fortunes is pointed out to the lower claffes.

At length, however, this trade fell all of a fudden. Among fuch a number of contracts many were broken; many had engaged to pay more than they were able; the whole ftock of the adventurers was confumed by the extravagance of the winners; new adventurers no more engaged in it; and many becoming fenfible of the odious traffic in which they had been concerned, returned to their former occupations. By thefe means, as the value of tulips ftill fell, and never rofe, the fellers wifhed to deliver the roots *in natura* to the purchafers at the prices agreed on; but as the latter had no defire for

for tulips at even fuch a low rate, they refufed to take them or to pay for them. To end this difpute, the tulip-dealers of Alkmaar fent, in the year 1637, deputies to Amfterdam; and a refolution was paffed on the 24th of February, that all contracts made prior to the laft of November 1636 fhould be null and void; and that, in thofe made after that date, purchafers fhould be free on paying ten *per cent.* to the vender.

The more difgufted people became with this trade, the more did complaints increafe to the magiftrates of the different towns; but as the courts there would take no cognizance of it, the complainants applied to the States of Holland and Weft Friefland. Thefe referred the bufinefs to the determination of the provincial council at the Hague; which, on the 27th of April 1637, declared that it would not deliver its opinion on this traffic until it had received more information on the fubject; that in the mean time every vender fhould offer his tulips to the purchafer; and, in cafe he refufed to receive them, the vender fhould either keep them, or fell them to another, and have recourfe on the purchafer for any lofs he might fuftain. It was ordered alfo, that all contracts fhould remain in force till farther enquiry was made. But as no one could forefee what judgment would be given refpecting the validity of each contract, the buyers were more obftinate in refufing payment than before; and venders, thinking it much fafer to accommodate matters amicably, were at length fatisfied with a fmall profit inftead of exorbitant gain: and thus ended this extraordinary traffick, or rather gambling. *Beckmann's Hiftory of Inventions*, vol. i.

TULLY, one of the military townfhips of Onondago county, New-York, having Sempronius on the weft, and Fabius on the eaft. It is within the jurifdiction of Pompey, and lies 29 miles S. E. of the ferry on Cayuga Lake.—*Morse.*

TULPEHOCKEN, a branch of the Schuylkill, which empties into that river at Reading. Alfo, the name of a town of Pennfylvania, in Lancafter county, 6 miles weft of Middletown, and 65 north-weft of Philadelphia. Tulpehocken creek or river, and Quitapahilla, lead within 4 miles of each other. The water communication between Schuylkill and Sufquehannah muft be formed over a tract of country of about 40 miles in extent, from river to river, in a ftraight line; but about 60 miles as the navigation muft go. This tract is cut by the above 2 creeks. The bottom of the canal, through which the navigation muft pafs, will not here rife more than 30 feet above the level of the head waters of the above 2 creeks; nor fo much as 200 feet above the level of the waters of Sufquehannah or Schuylkill.—*ib.*

TUMAR, in Bengal, rent-roll or affeffment.

TUMBEZ, a town in the road to Lima and Peru, in South-America, 7 leagues from Salto, a place for landing of goods configned to this place, and in lat. 3 12 16 S. Near this town is a river of the fame name, which empties into the bay of Guayaquil. It has near 70 cane houfes.—*Morse.*

TUMBLING *Dam*, on Delaware river, is about 22 miles above Trenton.—*ib.*

TUMBREL, is a kind of carriage with two wheels, ufed either in hufbandry for dung, or in artillery to carry the tools of the pioneers, &c. and fometimes likewife the money of an army.

TUNBRIDGE, a townfhip of Vermont, Orange county, 12 miles weft of Thetford. It contains 487 inhabitants.—*Morse.*

TUNGSTEN (See CHEMISTRY, n° 178, &c. in this *Suppl.*) when well fufed, is, according to Guyton *alias* Morveau, of no higher fpecific gravity than 8.3406. This is very different from the fpecific gravity which has hitherto been affigned to it. The fame eminent chemift concludes, from its extreme brittlenefs and difficulty of fufion, that it affords little promife of utility in the arts, except in metallic alloys, or by virtue of the property which its oxyd poffeffes, of affording fixed colours, or giving fixity to the colours of vegetables.

TUNIA, a city of New-Granada, in Terra Firma. —*Morse.*

TUNJA, a town of New-Granada and Terra Firma, in South-America. Near it are mines of gold and emeralds. The air is temperate, and the foil fruitful. It is about 30 miles fouth-weft of Truxillo. N. lat. 4 51, W. long. 72 10.—*ib.*

TUNKHANNOCK, a townfhip and creek in Luzerne county, Pennfylvania. The creek is a water of Sufquehannah.—*ib.*

TUPINAMBAS, the name of a famous nation who inhabited Brazil on its firft difcovery by the Portuguefe. They left their chief abode about Rio de Janeiro, and wandered up to the parts near the Amazon, where the Tapayos are now the defcendants of that brave people. Their migration and hiftory are fully defcribed by Father Dacunha.—*ib.*

TURA *Bamba*, a fpacious plain of Peru, in South-America, at the extremity of which ftands the city of Quito. To this plain there is a road from Guayaquil. —*ib.*

TURBET, a townfhip of Pennfylvania, on Sufquehannah river.—*ib.*

TURIANO, a river on the north coaft of South-America, 3 leagues to the eaft of the iflands Barbarata. Near it is a falt pond which furnifhes all the coaft with falt, and there is harbour and road for fhips to ride in. —*ib.*

TURKEY, a fmall town of New-Jerfey, Effex county, 14 miles north-wefterly of Elizabeth-Town, and 179 north-eaft of Philadelphia.—*ib.*

TURKEY *Foot*, in Youghiogany river, is the point of junction of the great S. Branch, Little Croffings from the fouth-eaft, and N. Branch from the northward. It is 35 miles from the mouth of the river, 22 miles S. S. W. of Berlin, in Pennfylvania, and 36 north-eaft of Morgantown. N. lat. 39 44.—*ib.*

TURKEY *Point*, a promontory on the north fide of Lake Erie, lies oppofite to Prefque Ifle, on the fouth fide, about 50 miles acrofs.—*ib.*

TURKEY *Point*, at the head of Chefapeak Bay, is a point of land formed by the waters of the bay on the north-weft, and thofe of Elk river on the fouth eaft. It is about 15½ miles fouth-weft of Elkton, and 44 north-eaft of Annapolis. Here the Britifh army landed, in Auguft, 1777, before they advanced to Philadelphia.—*ib.*

TURKISH *Iflands*, a group of little iflands, called alfo *Ananas*, fince they are the iflands of *Don Diego Luengo*, thus called by him who difcovered them. They are more than 30 leagues north of Point Ifabelique, on the north coaft of the ifland of St Domingo.—*ib.*

TURKS *Iſlands*, ſeveral ſmall iſlands in the Weſt-Indies, about 35 leagues north-eaſt of the iſland of St Domingo, and about 60 to the ſouth-eaſt of Crooked Iſland. The Bermudians frequently come hither and make a great quantity of ſalt, and the ſhips which ſail from St Domingo commonly paſs within ſight of them. N. lat. 21 18, W. long. 71 5.—*ib.*

TURNER, a townſhip of the Diſtrict of Maine, Cumberland county, on the weſt bank of Androſcoggin river, which divides it from Green in Lincoln county. It was incorporated in 1786, contains 349 inhabitants. and lies 172 miles north of Boſton, and 31 ſouth-weſt of Hallowell.—*ib.*

TURNSOL, a dye-ſtuff manufactured in Holland, the preparation of which was long kept a profound ſecret. In order to miſlead foreigners, the Dutch pretended that turnſol was made from rags dyed with the juice of the ſun-flower (*Helianthus*), from which it obtained its name. Since the late revolution, however, in Holland, the true method employed by the Dutch for preparing this colour has been diſcovered, and the proceſs is as follows:—That kind of lichen called orchil (*Lichen-Rocella*. See that article in this *Suppl.*), or, when that cannot be procured, the large oak-moſs, after being dried and cleaned, is reduced to powder, and by means of a kind of oil-preſs the powder is forced through a braſs ſieve, the holes of which are ſmall. The ſifted powder is then thrown into a trough, and mixed with an alkali called *vetas*, which is nothing elſe than the aſhes of wine lees, in the proportion of half a pound of aſhes to one pound of powder. This mixture is moiſtened with a little human urine, for that of other animals contains leſs ammonia, by which a fermentation is produced; and the moiſtneſs is ſtill kept up by the addition of more urine. As ſoon as the mixture aſſumes a red colour, it is poured into another trough; is again moiſtened with urine, and then ſtirred round in order that the fermentation may be renewed. In the courſe of a few days it acquires a bluiſh colour, and is then carefully mixed with a third part of very pure pulveriſed potaſh; after which the mixture is put into wooden pails, three feet in height, and about half a foot broad. When the third fermentation takes place, and the paſte has acquired a conſiderably dark blue colour, it is mixed with chalk or pulveriſed marble, and ſtirred well round that the whole may be completely united. This laſt ſubſtance gives the colour no higher quality, and is intended merely to add to the weight. The blue, prepared in this manner, is poured into oblong ſquare iron moulds; and the cakes, when formed, are placed upon fir boards on an airy floor in order to dry, after which they are packed up for ſale.

TURPENTINE, a well known ſubſtance extracted from the pine. Under the article Pinus (*Encycl.*), we have given an account of one proceſs by which this extract is made; but the following, which is taken from the 31ſt volume of the *Journal de Phyſique*, is very different, and probably better. The pine from which turpentine is extracted, is never fit for this operation till it be thirty years of age. The extraction is begun in February and continued to the end of October. Inciſions are made with an hatchet, beginning at the foot of the tree on one ſide, and riſing ſucceſſively: they are repeated once or twice a week, the ſize about one finger's breadth acroſs, and three or four inches long. During the four years in which it is continued, the inciſions have riſen to about eight or nine feet. Then the inciſions are begun on the other ſide; and during this time the old ones fill up, and may be again opened after ſome years, ſo that a tree on a good ſoil, and well managed, may yield turpentine for a century. At the bottom of the tree, under the inciſion, a hole is dug in the ground to receive the reſin which flows from the tree. This reſin is called *terebinthine brut*, is of a milky colour, and is that which flows during the three ſummer months; it requires further purification.

The winter crop is called *barras galipot*, or white reſin: it ſticks to the bark of the tree, when the heat has not been ſtrong enough to let it flow into the trough in the ground. It is ſcraped off with iron knives.

Two methods are practiſed for purifying theſe reſins. That which is followed at Bayonne is to have a copper cauldron which will hold 300 lb. of materials fixed over a fire, and the flame circulating at the bottom of the copper. The turpentine is put in, melted with a gentle heat, and, when liquid, it is ſtrained through a ſtraw-baſket made for the purpoſe, and ſtretched over a barrel, which receives the ſtrained turpentine. This purification gives it a golden colour, and may be performed at all times of the year.

The ſecond manner, which is practiſed only in the mountain of De Buch, near Bordeaux, conſiſts in having a large tub, ſeven or eight feet ſquare, and pierced with ſmall holes at the bottom, ſet upon another tub to catch the liquor. This is expoſed to the hotteſt ſun for the whole day, filled two-thirds with turpentine, which as it melts falls through the holes, and leaves the impurities behind. This pure turpentine is leſs golden-coloured, and is much more eſteemed than the other. This proceſs can only be done in the ſummer.

To make *oil* of turpentine, an alembic, with a worm like what is uſed by the diſtillers, is employed here. It generally contains 250 lb. of turpentine, which is boiled gently, and kept at the boiling point till no more oil paſſes, when the fire is damped. This generally gives 60 lb. of oil, and the operation laſts one day.

The boiling turpentine, when it will give no more oil, is tapped off from the ſtill and flows into a tub, and from thence into a mould of ſand, which it fills, and is ſuffered to cool for at leaſt two days without diſturbing it. This reſidue is known under the name of *colophony*. It is of a brown colour, and very dry. It may be made clearer and nearer in colour to that of the reſin, by adding hot water to it before it is tapped off the ſtill, and ſtill boiling and ſtirring the water well with it, which is done with a beſom of wet ſtraw; and it is then ſold for roſin, but is little eſteemed, as it contains no eſſential oil.

TURTLE, *Iſland*, in the South Pacific Ocean, is nearly a league long, and not half ſo broad. It is ſurrounded by a reef of coral rocks, that have no ſoundings without them. S. lat. 19 49, W. long. 177 57.—*Morſe.*

Turtle *Creek*, in Pennſylvania, a ſmall ſtream which empties through the E. bank of Monongahela river, about 12 miles from the mouth of that river, at Pittſburg. At the head of this creek, General Braddock engaged a party of Indians, the 9th of July, 1755, on his way to Fort du Queſne, now Pittſburg, where he was repulſed, himſelf killed, his army put to flight, and the remains of the army brought off the field by the

addreſs

addrefs and courage of Colonel, afterwards General Wafhington.—*ib.*

Turtle *River*, in Georgia, empties into St Simon's Sound, and its bar has a fufficiency of water for the largeft veffel that fwims. At its mouth is the town of Brunfwick, which has a noble and capacious harbour. The town is regularly laid out, but not yet built. The lands on the banks of this river are faid to be excellent. —*ib.*

TURY, a river on the coaft of Brazil, in S. America, 40 leagues E. S. E. of the river Cayta. The ifland of St John lies juft off the river's mouth, and makes a very good harbour on the infide of it. But the paffage both in and out, is difficult, and no pilots are to be had.—*ib.*

TUSCARORA *Creek*, a fmall ftream of Pennfylvania, which empties through the S. W. bank of Juniatta river, 12 miles fouth-eaftward of Lewiftown.—*ib.*

Tuscarora *Villages*, lie a mile from each other, 4 miles from Queenftown, in Upper Canada, containing together about 40 decayed houfes. Veftiges of ancient fortifications are vifible in this neighbourhood. The Indian houfes are about 12 feet fquare; many of them are wholly covered with bark, others have the walls of logs, in the fame manner as the firft fettlers among white people built their huts, having chimnies in which they keep comfortable fires. Many of them, however, retain the ancient cuftom of having the fire in the centre of the houfe. The lands in the vicinity are of a good quality.—*ib.*

TUSCARORAS, a tribe of Indians in the ftate of New-York. They migrated from North Carolina, about the year 1712, and were adopted by the Oneidas, with whom they have fince lived, on the fuppofition that they were originally the fame tribe, from an affinity which there is in their language. They now confift of about 400 fouls, their village is between Kahnanwolohale and New-Stockbridge, on Tufcarora or Oneida Creek. They receive an annuity of about 400 dollars from the United States.—*ib.*

TUSCULANUM, a villa belonging to Cicero, near Tufculum, where he wrote his *Quæftiones Tufculanæ*, fo named from the place; thus become famous as well for the productions of genius as of nature. Formerly the villa of Sylla: now called *Grotta Ferrata.*—Another *Tufculanum* (infcription), a town of the Tranfpadana, fituated on the weft fide of the Lacus Benatus. Now faid to be called *Tofcolano*, in the territory of Brefcia, fubject to Venice. Here many monuments of antiquity are dug up.

TUSCULUM (anc. geog.) a town of Latium, to the north of Alba, fituated on an eminence, and therefore called *Supernum* (Horace, Strabo). In fight of Rome, at about the diftance of 100 ftadia, or 12 miles. Adorned with plantations and princely edifices: The fpot remarkable for the goodnefs of the foil, and its plenty of water. Built by Telegonus, who flew his father Ulyffes (Ovid, Horace); called the grandfon of Ulyffes in Silius Italicus. A municipium (Cicero); the birth-place of the elder Cato (Nepos, Cicero). Now *Frefcati*, in the Campania of Rome.

TUSKARAWI, the ancient name of a head water of Mufkingum river. It is alfo called Tufcarawas. —*Morse.*

TUTAPAN, a large town on the W. coaft of New-Mexico, in the N. Pacific Ocean. From the river Sacatulca, the high and rugged land extends N. W. 25 leagues.—*ib.*

TUTENAG, according to Sir George Staunton, is, properly fpeaking, zinc extracted from a rich ore, or calamine. The ore is powdered and mixed with charcoal-duft, and placed in earthen jars over a flow fire, by means of which the metal rifes in the form of vapour, in a common diftilling apparatus, and afterwards is condenfed in water. The calamine from which tutenag is thus extracted, contains very little iron, and no lead or arfenic, fo common in the calamine of Europe (See Calamine, *Encycl.*) Hence it is that tutenag is more beautiful than our zinc, and that the white copper of the Chinefe takes fo fine a polifh. See *White Copper*, in this *Supplement.*

TWELVE ISLES, or *Twelve Apoftles*, ifles on the S. fide of Lake Superior, and on the S. fide of the mouth of Weft Bay.—*Morse.*

TWENTY MILE *Creek*, an eaftern branch of Tombigbee river, in Georgia, which runs firft a S. by E. courfe, then turns to the S. W. Its mouth lies in about lat. 33 33 N. and long. 88 W.—*ib.*

Twenty Five Mile *Pond*, a fettlement in Lincoln county, Diftrict of Maine.—*ib.*

TWIGHTWEES, a tribe of Indians, in the N. W. Territory, inhabiting near Miami river and Fort. Warriors 200.—*ib.*

TYBEE *Ifland*, on the coaft of Georgia, lies at the mouth of Savannah river, to the fouthward of the bar. It is very pleafant, with a beautiful creek to the W. of it, where a fhip of any burden may lie fafe at anchor. A light-houfe ftands on the ifland, 80 feet high, and in lat. 32 N. and long. 81 10 W. The light-houfe is 7 miles E. S. E. ½ E. from Savannah, and 6 S. W. ¼ W. from Port Royal.—*ib.*

TYBOINE, a townfhip of Pennfylvania, in Cumberland county.—*ib.*

TYERS (Thomas), an author both in poetry and profe, the friend of Johnfon, and well known to moft of the eminent characters of the prefent time, was a ftudent of the Temple in 1753. His father intended him for the law, but the young man it feems penned a fonnet when he fhould engrofs. He was an accomplifhed, but not a profound man; and had tafte and elegance of mind, flightly tinged with gleams of genius. He wrote fome paftorals and political tracts, which probably will not furvive the partiality of his particular friends.

TYGART's *Valley*, in Pennfylvania, lies on Monongahela river.—*Morse.*

TYGER, a fmall river of S. Carolina, rifes in the Alleghany Mountains, and, taking a S. E. courfe nearly parallel to Enoree river, empties into Broad river, five miles above the Enoree.—*ib.*

TYNGSBOROUGH, a townfhip of Maffachufetts, Middlefex county, on Merrimack river, 31 miles north of Bofton.—*ib.*

TYPOGRAPHY, as the word imports, is the art of printing by types; but it is likewife ufed to fignify the multiplying of copies by any mechanical contrivance. Of the art of printing by types, and the many improvements from time to time either made or attempted in it, a pretty full account will be found in the *Encyclopædia*, under the titles Letter, Logography, and Printing; and in this *Supplement* under the word Printing.

Typography.

Printing. Of typography, in the other and larger fenfe, fome account may likewife be found in the *Encyclopædia* under the title *Method of Copying Writings*; but to almoft all thefe articles there is ample room for fome additions here.

The *ftereotype* printing of *Didot* and *Herhan*, being confidered in France as a great improvement, muft not be paffed over wholly without notice. The term *ftereotype* is derived from the Greek words στερεος and τυπος, becaufe in this method the types are fixed and immoveable in the form, fo that none of them can be pulled or difplaced by the preffman. We need hardly obferve, to thofe who are at all acquainted with the hiftory of printing, that the project of foldering a whole form together, or of cafting a folid form from an impreffion made by a general fyftem of types, or page ready compofed, is not new. It was realifed 70 years ago by William Ged, a goldfmith in Edinburgh; for an account of whofe method we refer the reader to his life in the *Encyclopædia*. Didot now follows nearly the fame procefs as Ged. He does not indeed caft his types to a mafs, but after the form is compofed and carefully corrected, he cements or folders the types together fo firmly that none of them is liable to be loofened by the action of the prefs or the adhefion of the balls. How far this method of printing is of value with regard to books which are altered and improved in every fubfequent edition, may, perhaps, be queftioned; but on a loofe confideration of the fubject, it feems as if it would, in every cafe, be advantageous to a bookfeller to print a few copies of a work, and keep the types ftanding to print others as they may be wanted;—we fay it would be advantageous, if it were not for the immenfe value in types, which would, by that means, be locked up. To form fome judgment of this, it may be ftated, that the works of Virgil, printed by Didot, in 18mo, form a beautiful volume of 418 pages, of 35 lines each. The character ranges line for line with that called burgeois, N° 2. in Caflon's book of fpecimens, the face of the letter being rather fmaller; and we are told* that the price of the plates of this work is twelve hundred franks, or 50l. fterling. From this fact fome judgment may be formed of the commercial queftion. We have cafually looked at different books printed by Didot, but can fay nothing of their correctnefs: the page is very pretty.

* *La Decade Philofophique.*

For multiplying copies of any writing, or of a book of ordinary fize, Rochon, of the French National Inftitute, and now director of the Marine Obfervatory at the port of Breft, invented, about the year 1781, a machine for engraving, with great celerity and correctnefs, the pages of the book or manufcript on fo many plates of copper. It was fubmitted to the examination of a committee of the Royal Academy of Sciences, whofe report of its utility was given in the following words:

"This machine appears to us to unite feveral advantages. 1*ft*, Engraved editions of books may be executed, by this means, fuperior to thofe which can be made by the hand of the engraver, however fkilful; and thefe engraved originals will be made with much more fpeed, and much lefs expenfe. 2*d*, As this machine is portable, and of no confiderable bulk, it may become very ufeful in armies, fleets, and public offices, for the impreffion of orders, inftructions, &c. 3*d*, It poffeffes the advantage which, in a variety of circumftances, is highly valuable, of being capable of being ufed by any man of intelligence and fkill, without requiring the affiftance of any profeffional workman. And, *laftly*, It affords the facility of waiting for the entire compofition and engravings of a work before any of the copies are pulled off; the expenfe of plates, even for a work of confiderable magnitude, being an object of little charge; and this liberty it affords to authors, may prove highly beneficial in works of which the chief merit confifts in the order, method, and connection of ideas."

Rochon's machine confifts of two brafs wheels*, placed on the fame axis above each other, and feparated by a number of pillars, each two inches in length. Thefe two wheels, with the interval which feparates them, are equivalent to a fingle wheel about three inches thick. In order therefore to fimplify the defcription, they are confidered as a fingle wheel which moves freely on its axis.

* See Plate XLVI.

This wheel is perforated near its circumference with a number of fquare holes, which are the fheaths or fockets through which a like number of fteel punches, of the fame fhape, are inferted, and are capable of moving up and down. They are very well fitted; and from this circumftance, as well as the thicknefs of the double wheel, they have no fhake, or fide motion, independent of the motion of the wheel itfelf. Every punch is urged upwards by a feparate fpring, in fuch a manner, that the wheel armed with its characters, or fteel types (the lower faces of the punches being cut into the figures of the feveral letters), may turn freely on its axis; and if it be moved, the feveral punches will pafs in fucceffion beneath an upright fcrew, for preffure. The fcrew is fixed in a very firm and folid frame, attached to the fupports of the machine; and by this arrangement a copperplate, difpofed on the table, or bed of the apparatus, will receive the impreffion of all the punches in fucceffion, as they may be brought beneath the vertical preffing fcrew, and fubjected to its action.

But as the prefs is fixed, it would neceffarily follow that each fucceffive impreffion would, in part, deftroy or mutilate the previous impreffions, unlefs the plate itfelf were moveable. It therefore becomes neceffary that the plate fhould be moveable in two directions: the firft, to determine the interval between the letters and words, and form the lines; and the other motion, which is more fimple, becaufe its quantity may remain the fame through the whole of a book, ferves to give the interval between line and line, and to form the pages.

It will eafily be conceived that it would be a tedious operation to feek, upon the circumference of the wheel, each feveral character, as it might be required to come beneath the prefs, becaufe it is neceffary to repeat this operation as many times as there are characters in a work. The author has confiderably diminifhed the time and trouble of this operation, by fixing upon the aixs of the great wheel, which carries the punches, another fmall wheel, about four inches in diameter, the teeth of which act upon a rack, which carries a rule moving between two fliders. This rule, or ftraight line, will therefore reprefent the developement, or unfolding of the circumference of the wheel which caufes it to move, and will fhew the pofition at the great wheel, which carries the punches. For thefe two wheels being concentric, the developement of the ſmall toothed wheel, of about two inches radius, will exhibit, in a ſmall ſpace (for example that of a foot), an accurate regiſter of the relative poſitions of the punches with regard to the preſſing-ſcrew. To obtain this effect, nothing more is neceſſary than to place a fixed index oppoſite to the moveable rule, which laſt is divided in the following manner:

The punch on which the firſt letter of the alphabet is engraved, muſt be brought under the centre of the preſſing-ſcrew; and a line of diviſion then drawn upon the moveable rule, to which the letter itſelf muſt be added to diſtinguiſh it. The index, already mentioned, being placed oppoſite, and upon this firſt diviſion, will ſerve to place immediately beneath the preſſing-ſcrew the punch or rather the character, correſponding with the diviſion upon the rule, without its being afterwards neceſſary to inſpect the place either of the punch or the ſcrew, with regard to each other. Conſequently, as ſoon as the diviſions which correſpond with all the punches inſerted in the wheel are engraved upon the ſtraight rule, the fixed index will immediately determine the poſition into which that wheel muſt be brought, in order to place the punches under the preſſing-ſcrew in the order which the work may require.

This regiſter, for this name diſtinguiſhes the rule and its index, has no other function in the machine than to guide the hand of the operator, and to ſhew when the punch is very near its proper poſition beneath the preſſing-ſcrew. When this is the caſe, the required poſition is accurately obtained by means of a detent or catch.

The detent which he uſes for this operation is a lever with two tails, one of which is urged toward the circumference of the wheel by a ſpring. To this extremity of the lever is fixed a piece of hardened ſteel, of the figure of a wedge, which, by means of a ſpring, is preſſed towards the axis of the great wheel, but may be relieved, or drawn back, by preſſure on the oppoſite tail of the lever, ſo as to permit the great wheel to revolve at liberty.

In the next place, it muſt be explained how this detent takes hold of the wheel, ſo as to retain it preciſely in the ſituation neceſſary to cauſe any one of the punches, at pleaſure, to give its impreſſion to the plate. For this purpoſe there are a number of notches cut in the circumference of the wheel, for the purpoſe of receiving the detent. Theſe notches may be about half an inch deep, wider towards the circumference than elſewhere, and it will be of advantage that this outer width ſhould be as great as the circumference of the wheel can conveniently allow. By this contrivance, the wedge will not fail to preſent itſelf oppoſite to one of the notches into which it will fall, and draw the wheel exactly to its due ſituation, even though the index of the regiſter ſhould not be brought preciſely to the line of diviſion appropriated to any particular letter. For if this laſt degree of preciſion were required in working the machine, it would be very prejudicial to the requiſite ſpeed which, above all things, is required in its uſe. When the wedge is therefore left at liberty, it not only enters immediately into its place, and moves the wheel till its two ſides apply fairly to the interior ſurfaces of the notch, but retains the wheel in this ſtate with the neceſſary degree of ſtability.

The method of giving the proper figure to theſe notches is very eaſy. For this purpoſe it is neceſſary, in the firſt place, to impreſs all the characters contained in the wheel on a plate of copper or pewter. The ſupport on which the plate is fixed muſt be moved in a right line, after each ſtroke of the punch, through ſuch a ſpace that the characters may be arranged one after the other without touching. Now, as the perfect linear arrangement (ſuppoſing every other part to be true) muſt depend on the notches, it might ſeem ſufficient to cut theſe according to the method uſed for the wheels of clock-work: but as it is very difficult to avoid ſome obliquity on the face of the punch, and perhaps in the hole through which it paſſes, it is in almoſt every caſe neceſſary to retouch the notch itſelf. The requiſite degree of preciſion may be eaſily obtained, when, upon examining with attention the print of the characters engraved upon the plate, the inequalities ſhall have been aſcertained by a very fine line paſſing exactly under the baſe of two ſimilar letters, aſſumed as objects of compariſon: for the irregularity of linear poſition may, by this means, be determined with great exactneſs, and remedied to the moſt extreme nicety. In this operation, the workman muſt file away part of that ſurface of the notch which is oppoſite to the direction of the motion the character requires. Great care muſt be taken to file only a ſmall portion at a time, in order that the inſtant may be ſeized at which the wedge, by entering into the notch, brings the character to its due ſituation.

Theſe details, reſpecting the right-lined arrangement on the characters, muſt not divert our attention from the very great celerity with which any letter is brought to its place under the preſs by means of the regiſter and detent. This celerity is an object of ſo much importance in the engraving of a great work, that every means ought to be purſued which may tend to increaſe it. For this reaſon it is that inſtead of following the alphabetic order in the arrangement of punches on the ſurface of the wheel, we ought to prefer that in which the ſum of the different motions to be given to the wheel, for engraving an entire work, ſhall be the leaſt poſſible. This tedious enquiry may well be diſpenſed with, by obſerving the order in which printers diſpoſe their caſes of characters, that the letters of the moſt frequent recurrence may be moſt immediately under the hand of the workman.

If all the characters afforded an equal reſiſtance to impreſſion in a plate of metal, a conſtant force would never fail to drive the punches to the ſame depth. But the faces of the letters are very unequal, and conſequently it will be neceſſary to uſe a variable force. Moſt workmen uſe the hammer, and not a ſcrew, as in this machine for ſtamping. If the hammer had been uſed in this machine, it is evident, that if we ſuppoſed it to have fallen from the ſame height upon every one of the punches, the force of the ſtroke could be rendered variable according to the nature of the characters, by placing a capital, or head, upon each, of an height properly adjuſted to receive the hammer after paſſing through a greater or leſs ſpace. But the heads of our punches are variable at pleaſure, becauſe they are ſcrewed on; and thus it is that, by experimentally adjuſting the heads of all the punches, a ſet of impreſſions are obtained of equal depths from every one of them. When, for

for example, the letter *i* is placed under the hammer, the upper part of its head is at a ſmall diſtance from the head of the hammer, in order that its fall, which begins always at the ſame place, may ſtrike this letter weakly; but when the letter M is brought under the hammer, the upper part of its head being much leſs elevated than that of the letter *i*, will receive a much ſtronger blow. The impreſſions of the letters M and *i* will therefore always be equally deep, if the heads of the punches be once properly fixed by experiment.

Inſtead of the ſtroke of a hammer, however, our author makes uſe of the preſſure of a ſcrew, of which the threads are ſo inclined that it runs through its female ſocket, and would fall out merely by its own weight. This conſtruction affords the double advantage of preſerving the impreſſions from the effects of the circular motion, and of affording a fall in the ſcrew of nearly nine lines for each revolution. The head of this ſcrew is ſolidly fixed in the centre of a braſs wheel, of which the poſition is horizontal. The diameter of this wheel muſt be ſufficiently large, that its motion may not be perceptibly affected by the irregularities of friction in the ſcrew. This conſiderable diameter is alſo requiſite, becauſe the preſſure of the ſcrew depends, not only upon the force which is applied, but the diſtance of the place of application from the centre of movement.

It is eſſential that this wheel ſhould have very little ſhake; for which reaſon it is adviſable that the axis of the ſcrew ſhould be prolonged above the wheel itſelf, that it may ſlide in a ſocket firmly fixed to the frame of the machine. In this ſituation, the wheel, which is fixed on the prolongation of the ſcrew, will have its plane conſtantly preſerved in a ſituation parallel to itſelf, without any libration, notwithſtanding the riſe and fall of near nine lines, or three quarters of an inch, which it undergoes for each revolution on its axis.

It has been ſtated, as a requiſite condition, that the ſcrew ſhould conſtantly fall from the ſame fixed point, or elevation, upon the heads of every one of the punches. To accompliſh this eſſential purpoſe, a lever is firmly fixed to the ſupport of the ſcrew; which lever reſembles the beam of a balance, having one of its extremities armed with a claw, and the other ſerving to give it motion through a ſmall vertical ſpace. The claw falls into a notch in the upper ſurface of the wheel attached to the ſcrew, as ſoon as that wheel has riſen to the deſired elevation; and that lever itſelf is ſo far limited in its motion, that it cannot take hold of the wheel, excepting when it has reached that height. The wheel, therefore, remains confined and immoveable, by means of this detent, and cannot deſcend until it is delivered by preſſure upon the oppoſite tail of the lever. In this machine, the wheel which has the preſſing ſcrew for its axis does not perform an entire revolution. It was with a view that there might never be any fall capable of ſhaking and diſturbing the machine that the author determined to uſe only two-thirds of a revolution to ſtrike thoſe punches, which afford the ſtrongeſt reſiſtance. The ſcrew conſequently falls only through ſix lines upon thoſe heads which are leaſt elevated, and about two lines upon thoſe which ſtand higheſt. Whence the difference between the extreme heights does not exceed four lines.

It is obvious that ſo ſmall a difference is not ſufficient to ſtrike all the characters from M to the letter *i*, when the wheel which governs the ſcrew is put in motion by a conſtant weight, of which the impulſe, like that of a hammer, is increaſed only by the acceleration of its fall. It is evident that this requiſite variation of force might be had by changing the weight; but it is equally clear, that the numberleſs and inceſſant changes which the engraving of an entire work would demand, would be incompatible with that degree of ſpeed which forms one of the firſt requiſites. He was therefore obliged to render the force of the weight, which turns the ſcrew, variable, by cauſing it to act upon levers of greater or leſs lengths, according to the different quantities of impulſe required by the ſeveral punches. For this purpoſe he adopted the following conſtruction: He connected by a ſteel chain to the wheel, which moves the ſcrew, another wheel, having its axis horizontal, ſo that the two wheels reſpectively command each other. They are of eqnal diameter, and the chain is no longer than to make an entire turn round each wheel. This ſecond wheel, or leading pully, is intended to afford the requiſite variations of force, which it does by means of a ſnail fixed upon its axis. The ſnail is acted upon by a cord paſſing over its ſpiral circumference, or groove, and bearing a weight which is only to be changed when a new ſet of punches for characters of a different ſize are put into the great wheel. The ſpiral is ſo formed, that when the weight deſcends only through a ſmall ſpace, the part of the cord, which is unwound, acts at a very ſhort diſtance from the centre of the pulley; but when the fall is greater, the part of the ſnail upon which it acts is ſo far enlarged as to afford a much longer lever, and, conſequently, to give a proportionally greater effect to the ſtroke. This conſtruction, therefore, by giving the advantage of a longer lever to a greater fall of the ſcrew, affords all the power which the nature of the work, and the different ſpaces of the letters demand.

The ſupport on which the plate is fixed muſt, as has before been remarked, move ſo as to form ſtrait lines. This motion, which ſerves to ſpace the different characters with preciſion, is obtained by means of a ſcrew, the axis of which remains fixed, and carries a female ſcrew or nut. The nut itſelf is attached to the ſupport of the metallic plate, which receives the letters, and carries it in the right lined direction without any deviation; becauſe it is confined in a groove formed between two pieces of metal. The ſcrew is moved by a lever, which can turn it in one direction only, becauſe it acts by a click upon a ratchet-wheel, which is fixed to the head of the ſcrew. The action of this lever always begins from a fixed ſtop; but the ſpace through which it moves is variable, according to the reſpective breadths of the letters. This new conſideration induced M. Rochon to fix upon the rule or plate of the regiſter, a number of pins, correſponding with the different diviſions which anſwer to each punch: theſe pins determine the diſtance to which the lever can move. It therefore becomes a condition, that its poſition in the machine ſhould be oppoſite to the fixed index which determines the character at any time beneath the preſſing-ſcrew. The lever and its pin are therefore the ſole agents employed to ſpace the characters. If the plate were not moved by the lever, the impreſſions would fall upon each other; and thus, for example, the letter *i* would be totally obliterated by the impreſſion of the letter *l*.

Whenever, therefore, it is required to diſpoſe the letters *i* and *l* befide each other, the plate muft be moved after ftriking the letter *i* through a fpace equal to the quantity of the defired operation. Suppofe this to be one-fourth of a line, and that the lever fhould run through an arc of ten degrees to move the plate through this quantity; as foon as the pin of the letter *l* fhall be adjufted to the neceffary length to enable the lever to defcribe an arc of ten degrees, the operation of fpacing the two letters *i* and *l* will be reduced to that of placing the laft letter beneath the fixed index, and moving the plate till the lever fhall be ftopped by the pin belonging to the letter *l*. All the other letters will be equally fpaced, if the difpofition of the punches in the wheel be fuch, that the laft ftroke of any letter fhall confound itfelf with any letter of a fingle ftroke, fuppofing them to be impreffed one after the other, without moving the lever between ftroke and ftroke. This arrangement deferves to be very ferioufly attended to, becaufe the procefs could not be performed without it.

Many well-informed perfons are of opinion, that the perfect equality which this machine for engraving affords in the formation of letters and figns the moft difficult to be imitated, may afford a means of remedying the dangers of forgery. It is certain that the performance exhibits a fimple and ftriking character of precifion, which is fuch, that the leaft experienced eyes might flatter themfelves, in certain cafes, to diftinguifh counterfeits from originals. Lavoifier, whom the friends of fcience and the arts will not ceafe to regret, made fome experiments of this kind for the *caiffe de'fcompte*, which were attended with perfect fuccefs. Artifts appointed for that purpofe endeavoured in vain to imitate a vignette, formed by the fucceffive and equal motion of a character of ornament.

TYRINGHAM, a townfhip of Maffachufetts, Berkfhire county. It contains 1397 inhabitants, lies 14 miles from the fhire town, and 140 weft of Bofton.—*Morse.*

TYRONE, two townfhips of Pennfylvania; the one in York county, the other in that of Cumberland.—*ib.*

TYRREL, a maritime county of Edenton diftrict, N. Carolina; bounded N. by Roanoke river and Albemarle Sound, and fouth by Beaufort. It is generally a low, flat, and fwampy country, and contains 4744 inhabitants, including 1176 flaves.—*ib.*

TYRTÆUS, an Athenian general and mufician, is celebrated by all antiquity for the compofition of military fongs and airs, as well as the performance of them. He was called to the affiftance of the Lacedæmonians in the fecond war with the Meffenians, about 685 B. C.; and a memorable victory which they obtained over that people is attributed by the ancient fcholiafts upon Horace to the animating found of a new military flute or clarion, invented and played upon by Tyrtæus. Plutarch tells us that they gave him the freedom of their city; and that his military airs were conftantly fung and played in the Spartan army to the laft hour of the republic. And Lycurgus the orator, in his oration againft Leocrates, fays, "The Spartans made a law, that whenever they were in arms, and going out upon any military expedition, they fhould all be firft fummoned to the king's tent to hear the fongs of Tyrtæus;" thinking it the beft means of fending them forth in a difpofition to die with pleafure for their country. Fragments of his poetry, in elegiac verfe, are preferved in Stobæus, Lycurgus Orat. in Fulvius Urfinus, at the end of Poems by illuftrious women: and in the Oxford edition of *Eleg. & Lyric. Frag. & Scholia.* printed 1759. Εα Σωζομενα, &c.

TYTLER (William, Efq;), fo well known in the literary world as one of the ableft, and certainly the moft gentlemanly, of the defenders of the fame of Mary Queen of Scots, was born at Edinburgh, October 12, 1711. He was the fon of Mr Alexander Tytler, writer (or attorney) in Edinburgh, by Jane, daughter of Mr William Leflie, merchant in Aberdeen, and granddaughter of Sir Patrick Leflie of Idan, provoft of that city. He received his education at the grammar fchool (or, as it is there called, the High School) and the univerfity of his native city, and diftinguifhed himfelf by an early proficiency in thofe claffical ftudies, which, to the lateft period of his life, were the occupation of his leifure hours, and a principal fource of his mental enjoyments.

In the year 1731, he attended the academical lectures of Mr Alexander Bayne, Profeffor of municipal law in the univerfity of Edinburgh, a gentleman diftinguifhed alike for his profeffional knowledge, his literary accomplifhments, and the elegance of his tafte. The Profeffor found in his pupil a congenial fpirit; and their connection, notwithftanding the difparity of their years, was foon ripened into all the intimacy of the ftricteft friendfhip. So ftrong indeed became at length that tie of affection, that the worthy Profeffor, in his latter years, not only made him the companion of his ftudies, but when at length the victim of a lingering difeafe, chofe him as the comforter of thofe many painful and melancholy hours which preceded his death.

At the age of 31, Mr Tytler was admitted into the Society of Writers to his Majefty's Signet, and continued the practice of that profeffion with very good fuccefs, and with equal refpect from his clients and the public, till his death, which happened on the 12th of September 1792. He married, in September 1745, Anne Craig, daughter of Mr James Craig of Dalnair, writer to the fignet, by whom he has left two fons, Alexander Frafer Tytler, his Majefty's Judge advocate for Scotland, and Profeffor of civil hiftory in the univerfity of Edinburgh; and Patrick Tytler, Lieutenant-colonel of a regiment of fencible infantry, and Fort-major of the caftle of Stirling; together with one daughter, Mifs Chriftina Tytler. His wife died about nine years before him; and, previoufly to that period, he had loft a fon and a daughter, both grown to maturity.

The moft remarkable feature of Mr Tytler's character was an ardour and activity of mind, prompted always by a ftrong fenfe of rectitude and honour. He felt with equal warmth the love of virtue and the hatred of vice; he was not apt to difguife either feeling, nor to compromife, as fome men more complying with the world might have done, with the fafhion of the time, or the difpofition of thofe around him. He feldom waved an argument on any topic of hiftory, of politics, or literature; he never retreated from one on any fubject that touched thofe more important points on which he had formed a decided opinion. Decided opinions he always formed on fubjects of importance; for on fuch fubjects he formed no opinions rafhly; and what he firmly believed he avowed with confidence, and fometimes with warmth.

Nor was it in opinion or argument only that this warmth and ardour of mind were confpicuous. They prompted him equally in action and conduct. His affection to his family, his attachment to his friends and companions, his compaffion for the unfortunate, were alike warm and active. He was in fentiment alfo what Johnfon (who felt it ftrongly in himfelf, and mentions it as the encomium of one of his friends) calls a *good hater;* but his hatred or refentment went no further than opinion or words, his better affections only rofe into action. In his opinions, or in his expreffion of them, there was fometimes a vehemence, an appearance of acrimony, which his friends might regret, and which ftrangers might cenfure; but he had no afperity in his mind to influence his actual conduct in life. He indulged oppofition, not enmity; and the world was juft to him in return. He had opponents; but two of his biographers, who knew him well, as well as the people with whom he moft affociated, declare their belief that he had not a fingle enemy. His contefts were on opinions, not on things; his difputes were hiftorical and literary. In converfation, he carried on thefe with uncommon intereft and vivacity; and the fame kind of impulfe which prompted his converfation (as is juftly obferved by an author, who publifhed fome notices of his life and character in the periodical work intitled *The Bee*) induced him to become an author. He wrote not from vanity or vain-glory, which Rouffeau holds to be the only inducement to writing; he wrote to open his mind upon paper; to fpeak to the public thofe opinions which he had often fpoken in private; opinions on the truth of which he had firmly made up his own conviction, and was fometimes furprifed when he could not convince others: it was fair to try, if, by a fuller expofition of his arguments, he could convince the world.

With this view, he publifhed, in 1759, his "Inquiry, hiftorical and critical, into the Evidence againft *Mary Queen of Scots*, and an Examination of the Hiftories of Dr Robertfon and Mr Hume with refpect to that Evidence;" in which he warmly efpoufed the caufe of that unfortunate Princefs, attacked with feverity the conduct of her enemies, and expofed the fallacy, in many parts the fabrication, of thofe proofs on which the charges againft her had been founded.

This was a caufe worthy of an advocate who loved truth better than popular applaufe; and Mr Tytler evinced himfelf to be fuch an advocate. The problem of Mary's guilt or innocence, if confidered merely as a detached hiftorical fact, would appear an object which, at this diftance of time, feems hardly to merit that laborious and earneft inveftigation to which it has given rife; though, even in this point of view, the mind is naturally ftimulated to fearch out the truth of a dark myfterious event, difgraceful to human nature; and our feelings of juftice and moral rectitude are interefted to fix the guilt upon its true authors. But when we confider that this queftion involves a difcuffion of the politics of both England and Scotland during one of the moft interefting periods of their hiftory, and touches the characters, not only of the two fovereigns, but of their minifters and ftatefmen, it muft then be regarded in the light of a moft important hiftorical inquiry, without which our knowledge of the hiftory of our own country muft be obfcure, confufed, and unfatisfactory. In addition to thefe motives of inquiry, this queftion has exercifed fome of the ableft heads both of earlier and of latter times; and it is no mean pleafure to engage in a conteft of genius and of talents, and to try our ftrength in the decifion of a controverfy which has been maintained on both fides with confummate ability.

As we have elfewhere (fee Mary, *Encycl.*) given an abftract of the arguments on both fides of this difputed queftion, it would be altogether improper to repeat them here; but juftice to the fubject of this memoir requires us to fay, that by his manner of difcuffing it he acquired high reputation in the republic of letters. Before the appearance of the Inquiry, fays an ingenious writer, it was the fafhion for literary difputants to attack each other like mifcreants and banditti. The *perfon* was never feparated from the *caufe;* and whatever attached the *one*, was confidered as equally affecting the *other;* fo that fcurrility and abufe bloated the pages even of a Bentley and a Ruddiman. The Hiftorical Inquiry was free from every thing of that fort: and though the higheft name produced not a mitigation of the force of any argument, the meaneft never fuffered the fmalleft abufe. He confidered it as being greatly beneath the dignity of a man contending for truth, to overftretch even an argument in the fmalleft degree, far more to pervert a fact to anfwer his purpofe on any occafion. In the courfe of his argument, he had too often occafion to fhew that this had been done by others; but he difdained to imitate them. His reafoning was forcible and elegant; impartially fevere, but always polite, and becoming the gentleman and the fcholar.

When this book appeared, it was univerfally read in Britain, and very well tranflated into French, under the title of "Recherches Hiftoriques et Critiques fur les Principales Preuves del'Accúfation intentée contre Marie Reine d'Ecoffe." The intereft it excited among literary men may be judged of from the character of thofe by whom it was reviewed on its publication, in the periodical works of the time. Dr Douglas, now bifhop of Salifbury, Dr Samuel Johnfon, Dr John Campbell, and Dr Smollet—all wrote reviews of Mr Tytler's book, containing very particular accounts of its merits, and elaborate analyfes of the chain of its arguments. As an argument on evidence, no fuffrage could perhaps be more decifive of its merit than that of one of the greateft lawyers, and indeed one of the ableft men that ever fat on the woolfack of England, the late Lord Chancellor Hardwicke, who declared Mr Tytler's Inquiry to be the beft concatenation of circumftantiate proofs brought to bear upon one point that he had ever perufed. What effect that body of evidence, or the arguments deduced from it, ought to have upon the minds of thofe to whom the fubject may become matter of inveftigation, we do not prefume to determine. The opinion of the late Dr Henry, author of the Hiftory of Great Britain on a New Plan, may perhaps be thought neither partial nor confident. He fays, in a letter to Mr Tytler, publifhed in the firft volume of Tranfactions of the Antiquarian Society of Scotland, That he would be a bold man who fhould now publifh an hiftory of Queen Mary in the fame ftrain with the two hiftorians (Mr Hume and Dr Robertfon), whofe opinions on the fubject the Inquiry had examined and controverted.

The moft exceptionable part of Mary's conduct, which, though it may admit of an apology, cannot be vindicated, is her marriage to Bothwell; and for that marriage

marriage Mr Tytler made an apology, founded on facts, which he would be a daring or very bigotted man who would attempt to controvert. See the article already referred to.

Besides the *Historical Inquiry*, and the *Dissertation on the Marriage of Queen Mary with the Earl of Bothwell*, our author published several other works on historical and literary subjects; of which the first was, the *Poetical remains of James I. King of Scotland*, consisting of *the King's Queir*, in six cantos, and *Christ's Kirk on the Green;* to which is prefixed a dissertation on the Life and Writings of King James, in one volume 8vo, printed at Edinburgh in 1783. This dissertation forms a valuable morsel of the literary history of Europe; for James ranked still higher in the literary world as a *poet*, than in the political world as a *prince* (A). Great justice is done to his memory in both respects in this dissertation: and the two morsels of poetry here rescued from oblivion will be esteemed by men of taste as long as the language in which they are written can be understood.

2. "A Dissertation on Scottish Music," first subjoined to Arnot's history of Edinburgh. The simple melodies of Scotland have been long the delight of the natives, many of which, to them, convey an idea of pathos that can be equalled by none other; and are much admired by every stranger of musical talents who has visited this country. They have a powerful effect, indeed, when properly introduced, as a relief, into a musical composition of complicated harmony. These are of two kinds, pathetic and humorous. Those who wish to receive information concerning this curious subject, will derive much satisfaction from the perusal of this dissertation. There is yet another kind of music peculiar to the Highlands of Scotland, of a more wild, irregular, and animating strain, which is but slightly treated here, and requires to be still more fully elucidated.

3. "Observations on the Vision, a poem," first published in Ramsay's Evergreen, now also printed in the Transactions of the Society of Antiquaries of Scotland. This may be considered as a part of the literary history of Scotland.

4. "On the Fashionable Amusements in Edinburgh during the last century," *ibid.* It is unnecessary to dwell on the light that such dissertations as these, when judiciously executed, throw upon the history of civil society and the progress of manners. Mr Tytler was likewise the author of N° 16. of the Lounger, a weekly paper, published at Edinburgh in the year 1786. His subject is the Defects of Modern Female Education in teaching the Duties of a Wife; and he treats that subject like a master.

On all Mr Tytler's compositions the character of the *man* is strongly impressed, which never, as in some other instances, is in the smallest degree contradicted by, or at variance with, the character of the *author*. He wrote what he felt, on subjects which he felt, on subjects relating to his native country, to the arts which he loved, to the times which he revered. His heart, indeed, was in every thing which he wrote, or said, or did. He had, as his family and friends could warmly attest, all the kindness of benevolence: he had its anger too; for benevolence is often the parent of anger. There was nothing neutral or indifferent about Mr Tytler. In philosophy and in history, he could not bear the coldness, or what some might call the temperance of scepticism; and what he firmly believed, it was his disposition keenly to urge.

His mind was strongly impressed by sentiments of religion. His piety was fervent and habitual. He believed in the doctrine of a particular Providence, superintending all the actions of individuals as well as the great operations of Nature: he had a constant impression of the power, the wisdom, and the benevolence of the Supreme Being; and he embraced, with thorough conviction, the truths of Christianity.

His reading was various and extensive. There was scarcely a subject of literature or taste, and few even of science, that had not at times engaged his attention. In history he was deeply versed; and what he had read his strong retentive memory enabled him easily to recal. Ancient as well as modern story was familiar to him; and, in particular, the British history, which he had read with the most minute and critical attention. Of this, besides what he has given to the public, a great number of notes, which he left in MS. touching many controverted points in English and Scottish history, afford the most ample proof.

In music as a science he was uncommonly skilled. It was his favourite amusement; and with that natural partiality which all entertain for their favourite objects, he was apt to assign to it a degree of moral importance which some might deem a little whimsical. He has often been heard to say, that he never knew a good taste in music associated with a malevolent heart: And being asked, What prescription he would recommend for attaining an old age as healthful and happy as his own? "My prescription (said he) is simple—short but cheerful meals, music, and a good conscience."

In domestic life, Mr Tytler's character was particularly amiable and praise-worthy. He was one of the kindest husbands and most affectionate fathers. At the beginning of this account, we mentioned his having lost, at an advanced period of life, an excellent wife, and a son and a daughter both grown to maturity, who merited and possessed his warmest affections. The temper of mind with which he bore these losses, he has himself expressed in a MS. note, written not long before his death; with which, as it conveys a sentiment equally important in the consideration of this life, and in the contemplation of that which is to come, we shall conclude the present memoir: "The lenient hand of time (says he, after mentioning the death of his wife and children), the lenient hand of time, the affectionate care of my remaining children, and the duty which calls on my exertions for them, have by degrees restored me to myself. The memory of those dear objects gone before me, and the soothing hope that we shall soon meet again, is now the source of extreme pleasure to me. In my retired walks in the country I am never alone; those dear shades are my constant companions! Thus what I looked upon as a bitter calamity, is now become to me the chief pleasure in life."

U, V.

(A) There is a beautiful historical picture of this prince playing on the harp, with his queen and a circle of his courtiers listening to the music, by Graham, in London; one of the most eminent artists of the age.

U, V.

VACCAS, *Cayo*, one of the Tortugas, or Florida Keys, to the eaftward of Bahia Honda; the diftance between them is 4 leagues, and the coaft in its direction turns to the northward. On the S. fide of Cayo Vaccas, about 8 miles from the W. end, there are wells of frefh water. A thick range of ifles go by this name. Bahia Honda is in lat. 24 35 N.—*Morse.*

VACCA, called alfo the *Cow's*, or *Neat's Tongue*, a low point on the W. coaft of Chili, in S. America, which bounds the bay of Tonguey to the weftward. —*ib.*

VACHE, or *Cows Ifland*, lies on the fouth coaft of the fouthern peninfula of the ifland of St Domingo, and is about 4½ leagues long, and in the broadeft part a league and a half from N. to S. The fouth point is 3 leagues E. of Point Abacou; and in lat. 18 4 N. and long. from Paris 76 2 W. It has a very good foil, with 2 or 3 tolerable ports, and lies very conveniently for trade with the Spanifh colonies on the continent, and with Cayenne. The feamen call this Afh Ifland, a corruption from Vafh, as it is pronounced.—*ib.*

VACH ET LE TORREAU, or *Cow and Bull Rocks*, on the fouth coaft of Newfoundland ifland, are about a mile S.E. of Cape St Mary, which is the point between the deep bay of Placentia on the W. and St Mary's Bay on the eaft. They are fair above water, but there are others near them which lurk under water.—*ib.*

VACUUM Boyleanum, is the approach to a real vacuum, to which we can arrive by means of the air-pump.

Torricellian Vacuum, is the moft complete vacuum which we can make by means of the torricellian tube. See Barometer, and Pneumatics, *Encycl.*

VADE-mecum, the title given to fuch books as men of particular profeffions, having frequent occafion to confult, may eafily carry about with them. Thus a fmall volume, publifhed in the beginning of the 18th century, giving an account of the ancient and prefent church of England, and of the duties, rights, privileges, and hardfhips of the clergy, is known by the title of *the Clergyman's Vade-mecum.*

VAE'S *Ifland, Anthony*, a fmall ifland on the E. coaft of Brazil, in S. America. It lies to the fouthward of the fandy Receif, and oppofite to it, which is joined to the continent by a bridge.—*Morse.*

VAKEEL, a minifter, agent, or ambaffador.

VALADOLID or *Valladolid*, called by the Indians *Comayagua*, is the chief city of the province of Honduras, in New Spain. It is the feat of the Governor, and is a bifhop's fee fuffragant of Mexico, fince the year 1558. It is feated on a plain, 30 miles W. of the Gulf of Honduras, 170 S. W. of Truxillo, and 65 S. E. of Merida. N. lat. 14 10, W. long. 51 21.—*Morse.*

VALENCIA, a town in the province of Caracas, on Terra Firma, South-America, about 80 miles N. of Baraquicimeto, and 250 W. of Cumana. N. lat. 10, W. long. 67.—*ib.*

VALGUS, *Bow* or *Bandy Legged.* Some children are bow-legged from their birth; others become fo from fetting them on their feet too early. The tibia of fome is crooked; the knees of others are diftorted; from a fault in the ankle, the feet of fome are turned inwards, thefe are called *vari;* and in others they turn outwards, thefe are called *valgi.* The beft method of preventing thefe diforders in weakly children, is to exercife them duly, but not violently; by dancing or toffing them about in one's arms, and not fetting them much on their feet, at leaft not without properly fupporting them: if the diforder attends at the birth, or increafes after it is begun, apply emollients, then apply boots of ftrong leather, wood, &c. as required to difpofe the crooked legs gradually to a proper form: or other inftruments may be ufed inftead of boots, which, when not too coftly, are ufually to be preferred. Slighter inftances of the diforders yield to careful nurfing without inftruments.

VALLEY *Forge*, a place on Schuylkill river, 15 miles from Philadelphia. Here General Wafhington remained with his army, in huts, during the winter of 1777, after the Britifh had taken poffeffion of that city. —*Morse.*

VALPARAISO, a large and populous town of Chili, in South-America, having a harbour forming the port of St Jago, in lat. 33 2 36, S. and long. 77 29, W. It is 390 miles E. of the ifland of Juan Fernandes. It carries on a confiderable trade with the port of Callao.—*ib.*

VANCOUVER'S *Fort*, in Kentucky, ftands at the junction of the two branches of Big Sandy river, 20 miles N. of Harmar's ftation.—*ib.*

VANDA', the Indian name of a plant of the genus Epidendrum; which fee, *Encycl.* The *vandá* is thus defcribed by Sir William Jones.

"Cal. *Spathes* minute, ftraggling. Cor. *Petals* five, diverging, oval-oblong, obtufe, wavy; the two loweft larger; the three higheft equal, bent towards the nectary. *Nectary* central, rigid: *Mouth* gaping, oblique: *Upper lip* fhorter, three-parted, with a polifhed honey-cup; *under lip* concave in the middle, keeled above, with two fmaller cavities below, two proceffes at the *bafe*, incurved, hollow, oval pointed, converging, honey-bearing. Stam. *Filaments* very fhort. *Anthers* round, flattifh, margined, covered with a lid, eafily deciduous from the *upper lip* of the nectary. Pist. *Germ.* beneath long, ribbed, contorted with curves of oppofite flexure. *Style* very fhort, adhering to the *upper lip*. *Stigma* fimple. Per. *Capfule* oblong-conic, wreathed, fix-keeled, each with two fmaller keels, three-celled, crowned with the dry corol. Seeds innumerable, like fine duft affixed to the *receptacle* with extremely fine hairs, which become thick wool. *Scapes* incurved, folitary, from the cavity of the leaf, at moft feven-flowered; pedicles alternate. *Petals* milk-white externally, tranfparent; brown within, yellow-fpotted. *Upper lip* of the nectary fnow-white; *under lip* rich purple, or light crimfon, ftriated at the bafe, with a bright yellow gland, as it feems, on each procefs. The flowers gratefully fragrant, and exquifitely beautiful, looking as if compofed of fhells, or made of enamel; crifp elaftic, vifcid internally. *Leaves* fheathing, oppofite, equally curved, rather flefhy, fword-form, retufe in two ways at the fummit, with one acute point. *Roots* fibrous, fmooth, flexible; fhooting even from the top of the leaves."

This lovely plant attaches itfelf chiefly to the higheft *Amras* and *Bilvas* (the *Mangifera* and *Cratæva* of Lin.); but it is an air-plant, and lives (fays the Prefident) in a pot *without earth or water:* its leaves are excavated upwards, to catch and retain dew.

VANDALIA, a duchy of Farther Pomerania, fubject to the king of Pruffia. Stolpen is the capital.

VANDALIA, a country in Germany, in the circle of Lower Saxony and duchy of Mecklenburg. It lies between the bifhopric and duchy of Schwerin, the lordfhips of Stocrock and Stargard, Pomerania, and the marquifate of Brandenburg; and is 75 miles in length and 7 in breadth. It contains feveral fmall lakes, and the principal town is Guftrow.

VANDERMONDE, member of the National Inftitute of Sciences and Arts, was born at Paris in the year 1735. He devoted his youth to felf-inftruction; and even at the age of thirty was far enough from fufpecting that he was deftined to inftruct others in his turn. Chance brought him near to the celebrated Fontaine. That fexagenary geometrician eafily divined the progrefs which Vandermonde would one day make in the mathematics; in him he anticipated, as it were, a fucceffor to himfelf; he patronifed and careffed him, let him into the fecret of his refearches, calculations, inventions, of that lively enjoyment which profound fpeculation gives to an elevated attentive mind; and which, blended with the fweets of tranquillity, the charms of retreat, and the confcioufnefs of fuccefs, becomes often a fort of paffion, as felicitous as durable. All that time Fontaine, whofe attention was again directed to the refearches which he had added to thofe of Jean Bernoulli, relative to the then famous queftion *of the toutocrones*, had the glory to be vanquifhed only by D'Alembert and La Grange. Vandermonde, a witnefs to this combat, neceffarily illuftrious, animated by the honour which he faw annexed to that glorious defeat, enchanted with the fight of Fontaine, as happy, in fpite of his age, from his love of geometry, as a youth of twenty could be with a fentiment lefs tranquil, thought he fhould infure his happinefs for ever, by yielding to a paffion which the ice of age could not extinguifh; in a word, he devoted himfelf to geometry.

His labours, however, were for fome time fecret; and perhaps the public would never have enjoyed the benefit of any of his works, if another geometrician (whofe name, fays Lacepede, cannot be pronounced, in this place, without a mixture of intereft and regret) had not infpired him with a confcioufnefs of his own ftrength, and courage to difplay it. Fontaine had already devoted him to geometry; Dufejour exhorted him to penetrate even into its fanctuary. In brief, he prefented himfelf to the Academy of Sciences, into which he was admitted in 1771; and in that very year juftified the fuffrages of his affociates, by a paper which he publifhed relative to the refolution of equations.

From the 16th century the method of refolving equations of the four firft degrees has been known, and fince that time the general theory of equations has received great improvements. In fpite, however, of the recent labours of many great geometricians, the folutions of equations of the fifth degree had in vain been attempted. Vandermonde wifhed to confolidate his labours with thofe of other illuftrious analyfts; and he propofed a new theory of equations, in which he feems to have made it particularly his bufinefs to fimplify the methods of calculation, and to contract the length of the *formulæ*, which he confidered as one of the greateft difficulties of the fubject.

This work was quickly followed by another on the problems called by geometricians *problems of fituation*. It feems to have been the deftiny of Vandermonde, as well as of Fontaine, who firft initiated him into the myfteries of mathematical fcience, to labour frequently upon fubjects already handled by the greateft mafter. In his firft memoir he had ftarted, fo to fpeak, in competition with La Grange and Euler; in his fecond, with Euler and Leibnitz. This laft was of opinion that the analyfis made ufe of in his time, by the geometricians, was not applicable to all queftions in the phyfical fciences; and that a new geometry fhould be invented, to calculate the relations of pofitions of different bodies, in fpace: this he called *geometry of fituation**. Excepting, however, one application, made by Leibnitz himfelf, to the game of *folitaire*, and which, under the appearance of an object of curiofity, fcarcely worthy the fublimity and ufefulnefs of geometry, is an example for folving the moft elevated and important queftions, Euler was almoft the only one who had practifed this geometry of fituation. He had reforted to it for the folution of a problem called the *cavalier*, which alfo appeared very familiar at firft fight, and was alfo pregnant with ufeful and important applications. This problem, with the vulgar, confifted merely in running through all the cafes of the chefs-board with the *knight* of the game of chefs; to the profound geometrician, however, it was a precedent for tracing the route which every body muft follow, whofe courfe is fubmitted to a known law, by conforming to certain required conditions, through all the points difpofed over a fpace in a prefcribed order. Vandermonde was chiefly anxious to find in this fpecies of analyfis a fimple notation, likely to facilitate the making of calculations; and he gave an example of this, in a fhort and eafy folution of the fame problem of the cavalier, which Euler had rendered famous.

* See Position, Suppl.

His tafte for the high conceptions of the fpeculative fciences, as blended with that which the *amor patriæ* naturally infpires for objects immediately ufeful to fociety, had led him to turn his thoughts towards perfecting the arts converfant in weaving, by indicating a manner of noting the points through which are to pafs the threads intended to form the lines which terminate the furface of different regular bodies: accordingly a great part of the above memoir is taken up with this fubject.

In the year following (1772) he printed a third memoir; in which he traced out a new path for geometers, difcovering, by learned analytical refearches, *irrational* quantities of a new fpecies, fhewing the fequels of which thefe *irrationals* are the terms or the fum, and pointing out a direct and general method of making in them all the poffible reductions.

In the fame year appeared his work on the Elimination of unknown Quantities in Algebra. This elimination is the art of bringing back thofe equations which include many unknown quantities, to equations which only

Vandermonde, || Varenius.

only contain one. The perfection of refearches in this art would confift in obtaining a general and particular *formula* of elimination in a form the moft concife and convenient, in which the number of equations and their degrees fhould be defigned by indeterminate letters. Vandermonde, while he confidered the geometers as very diftant from this point, had fome glimpfe of a poffibility of reaching it, and propofed fome new methods of approaching nearer it.

In 1778, he prefented in one of the public fittings of the Academy, a new fyftem of harmony, which he detailed more fully in another public fitting of 1780. In this fyftem, Vandermonde reduces the modes of proceeding adopted until his time, to two principal rules, which thus become eftablifhed on effects admitted by all muficians. Thefe two general rules, one on the fucceffion of according founds, the other on the arrangement of the parts, depend themfelves on a law more elevated, which, according to Vandermonde, ought to rule the whole fcience of harmony.

By the publication of this work, he fatisfactorily attained the end he had propofed to himfelf, and obtained the fuffrages of three great men, reprefentatives, fo to fpeak, of the three great fchools of Germany, France, and Italy; Gluck, Philidor, and Piccini.

With thefe labours, intermingled with frequent refearches on the mechanic arts, as well as on objects of political economy, the attention of Vandermonde was taken up; when, July 14, 1789, the voice of liberty refounded over the whole furface of France, and fuddenly all the thoughts, as well as all the affections, of Vandermonde, were engaged on the fide of what he called liberty.

He became fo furious a democrate, fo outrageous an enemy to every thing eftablifhed, that he concurred in the abolition of the Royal Academy, of which he had been fo ambitious of becoming a member, and affociated himfelf clofely with Robefpierre, Marat, and the reft of that atrocious gang of villains, who covered France with ruins, with fcaffolds, and with blood. This part of Vandermonde's hiftory is fuppreffed by his eulogift Lacepede, becaufe, forfooth, difcuffions on *political opinions* ought not, in his opinion, to be admitted into the fanctuary of the fciences.

In that fanctuary he did not long remain. Soon after his atrocities, he was attacked by a diforder in his lungs, which almoft taking away his breath, manifefted itfelf by alarming fymptoms, and conducted him by rapid fteps to the tomb. He died in the end of the year 1795; a ftriking inftance of the wayward violence of the human mind, which even the love of fcience could not keep at a diftance from tumult and uproar.

VAN DYKES, *Joft* and *Little*, two of the fmaller Virgin Iflands, fituated to the N. W. of Tortola. N. lat. 18 25, W. long. 63 15.—*Morfe.*

VANNSTOWN, in the country of the Cherokees, lies on a branch of Alabama river.—*ib.*

VARENIUS (Bernard), a learned Dutch geographer and phyfician of the 17th century, who was author of the beft mathematical treatife on geography intitled *Geographia Univerfalis, in qua affectiones generalis Telluris explicantur.* This excellent work has been tranflated into all languages, and was honoured by an edition, with improvements, by Sir Ifaac Newton, for the ufe of his academical ftudents at Cambridge.

Variable, || Variolæ Vaccinæ.

VARIABLE, in geometry and analytics, is a term applied by mathematicians to fuch quantities as are confidered in a variable or changeable ftate, either increafing or decreafing. Thus the abfciffes and ordinates of an ellipfis, or other curve line, are variable quantities; becaufe thefe vary or change their magnitude together, the one at the fame time with the other. But fome quantities may be variable by themfelves alone, or while thofe connected with them are conftant: as the abfciffes of a parallelogram, whofe ordinates may be confidered as all equal, and therefore conftant; alfo the diameter of a circle, and the parameter of a conic fection, are *conftant*, while their abfciffes are *variable*. See FLUXIONS, *Encycl.*

VARIATION OF CURVATURE, in geometry, is ufed for that inequality or change which takes place in the curvature of all curves except the circle, by which their curvature is more or lefs in different parts of them; and this variation conftitutes the quality of the curvature of any line. 1

VARIOLÆ VACCINÆ, or *Cow pox*, is the name commonly, though, as fome people think, improperly, given to a very fingular difeafe, which, for two or three years paft, has occupied a great fhare of the attention of medical men. It has been many years prevalent in fome of the great dairy counties in England, particularly Gloucefterfhire; and it has been long underftood by the farmers and others in thefe counties, that it for ever exempts all perfons who have been infected with it from the contagion of fmall-pox. *Variolæ Vaccinæ long known in Gloucefterfhire,*

It is very furprifing that, though they knew this fact, and although no perfon had ever been known to die of the cow-pox, they never thought of having recourfe to a voluntary infection of this kind, in order to free themfelves and their families from the poffibility of being infected with the variolous poifon, which fo often proves mortal. In one cafe, indeed, communicated to Dr Pearfon by Mr Downe of Bridport, the experiment was long ago tried by a farmer upon his own perfon, and with complete fuccefs: But this only makes it the more wonderful that his example fhould not have been followed. 2

In the town of Kiel, however, in the duchy of Holftein, where the difeafe is faid to be well known, as frequently affecting cows, we are told that children are fometimes inoculated with cow-pox *(Die Finnen)*, with a view to preferve their beauty; but that the people in the country do not like this inoculation, becaufe they pretend that it leaves behind it feveral diforders. 3 *And in the duchy of Holftein.*

With thefe exceptions Dr Jenner was the firft perfon who introduced the vaccine inoculation; and to him the public are alfo indebted for the firft careful and accurate inveftigation of this interefting fubject. The following is his account of the origin and hiftory of the difeafe, and of its characteriftic fymptoms. 4 *Vaccine inoculation introduced by Dr Jenner.*

" There is a difeafe to which the horfe, from his ftate of domeftication, is frequently fubject. The farriers have termed it *the greafe*. It is an inflammation and fwelling in the heel, from which iffues matter poffeffing properties of a very peculiar kind, which feems capable of generating a difeafe in the human body (after it has undergone the modification which I fhall prefently fpeak of), which bears fo ftrong a refemblance to the fmall-pox, that I think it highly probable that it may be the fource of that difeafe. *Origin of the difeafe, according to him.*

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"In this dairy county (Gloucefterfhire), a great number of cows are kept, and the office of milking is performed indifcriminately by men and maid fervants. One of the former having been appointed to apply dreffings to the heels of a horfe affected with *the greafe*, and not paying due attention to cleanlinefs, incautioufly bears his part in milking the cows with fome particles of the infectious matter adhering to his fingers. When this is the cafe, it commonly happens that a difeafe is communicated to the cows, and from the cows to the dairy maids, which fpreads through the farm until moft of the cattle and domeftics feel its unpleafant confequences. This difeafe has obtained the name of the cow-pox. It appears on the nipples of the cows in the form of irregular puftules. At their firft appearance they are commonly of a palifh blue, or rather of a colour fomewhat approaching to livid, and are furrounded by an eryfipelatous inflammation. Thefe puftules, unlefs a timely remedy be applied, frequently degenerate into phagedenic ulcers, which prove extremely troublefome. The animals become indifpofed, and the fecretion of milk is much leffened. Inflamed fpots now begin to appear on different parts of the hands of the domeftics employed in milking, and fometimes on the wrifts, which quickly run on to fuppuration, firft affuming the appearance of the fmall vefications produced by a burn. Moft commonly they appear about the joints of the fingers, and at their extremities; but whatever parts are affected, if the fituation will admit, thefe fuperficial fuppurations put on a circular form, with their edges more elevated than their centre, and of a colour diftantly approaching to blue. Abforption takes place, and tumors appear in each axilla. The fyftem becomes affected, the pulfe is quickened, and fhiverings, with general laffitude, and pains about the loins and limbs, with vomiting, come on. The head is painful, and the patient is now and then even affected with delirium. Thefe fymptoms varying in their degrees of violence, generally continue from one day to three or four, leaving ulcerated fores about the hands, which, from the fenfibility of the parts, are very troublefome, and commonly heal flowly, frequently becoming phagedenic, like thofe from whence they fprung. The lips, noftrils, eyelids, and other parts of the body, are fometimes affected with fores; but thefe evidently arife from their being needlefsly rubbed or fcratched with the patient's infected fingers. No eruptions of the fkin have followed the decline of the feverifh fymptoms in any inftance that has come under my infpection, one only excepted; and in this cafe a very few appeared on the arms: they were very minute, of a vivid red colour, and foon died away without advancing to maturation: fo that I cannot determine whether they had any connection with the preceding fymptoms.

5 Its appearances on the cow and the perfon who milks her.

"Thus the difeafe makes its progrefs from the horfe to the nipple of the cow, and from the cow to the human fubject.

6 Its fingularity,

"Morbid matter of various kinds, when abforbed into the fyftem, may produce effects in fome degree fimilar; but what renders the cow-pox virus fo extremely fingular is, that the perfon who has been thus affected is for ever after fecure from the infection of the fmall-pox; neither expofure to the variolous effluvia, nor the infertion of the matter into the fkin, producing this diftemper.

"It is neceffary to obferve, that puftulous fores frequently appear fpontaneoufly on the nipples of cows; and inftances have occurred, though very rarely, of the hands of the fervants employed in milking being affected with fores in confequence, and even of their feeling an indifpofition from abforption. Thefe puftules are of a much milder nature than thofe which arife from that contagion which conftitutes the true cow-pox. They are always free from the bluifh or livid tint fo confpicuous in that difeafe. No eryfipelas attends them, nor do they fhew any phagedenic difpofition, as in the other cafe, but quickly terminate in a fcab, without creating any apparent diforder in the cow. This complaint appears at various feafons in the year, but moft commonly in the fpring, when the cows are firft taken from their winter food and fed with grafs. It is very apt to appear alfo when they are fuckling their young. But this difeafe is not to be confidered as fimilar in any refpect to that of which I am treating, as it is incapable of producing any fpecific effects on the human conftitution. However, it is of the greateft confequence to point it out here, left the want of difcrimination fhould occafion an idea of fecurity from the infection of the fmall-pox, which might prove delufive."

7 Though it is fometimes confounded with another difeafe.

Dr Jenner adds, that the active quality of the virus from the horfe's heels is greatly increafed after it has acted on the nipples of the cow, as it rarely happens that the horfe affects his dreffer with fores, and as rarely that a milkmaid efcapes the infection when fhe milks infected cows. It is moft active at the commencement of the difeafe, even before it has acquired a pus like appearance. Indeed the Doctor is rather induced to think that the matter lofes this property entirely as foon as it is fecreted in the form of pus, and that it is the thin darkifh looking fluid only, oozing from the newly formed cracks in the heels, fimilar to what fometimes exudes from eryfipelatous blifters, which gives the difeafe. He is led to this opinion, from having often inferted pus taken from old fores in the heels of horfes, into fcratches made with a lancet, on the found nipples of cows, which has produced no other effect than fimple inflammation.

He is uncertain if the nipples of the cow are at all times fufceptible of being acted upon by the virus from the horfe, but rather fufpects that they muft be in a ftate of predifpofition, in order to enfure the effect. But he thinks it is clear that when the cow-pox virus is once generated, the cows, when milked with a hand really infected, cannot refift the contagion, in whatever ftate their nipples may chance to be. He is alfo doubtful whether the matter, either from the cow or the horfe, will affect the found fkin of the human body; but thinks it probable that it will not, except on thofe parts where the cuticle is very thin, as on the lips.

At what period the cow-pox was firft noticed in Gloucefterfhire is not upon record. The oldeft farmers were not unacquainted with it in their earlieft days when it appeared upon their farms, without any deviation from the phenomena which it now exhibits. Its connection with the fmall-pox feems to have been unknown to them. Probably the general introduction of inoculation firft occafioned the difcovery. Dr Jenner conjectures that its rife in that neighbourhood may not have been of very remote date, as the practice of milking cows might formerly have been in the hands of women

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women only; and confequently the cows might not in former times have been expofed to the contagious matter brought by the men fervants from the heels of horfes. He adds, that a knowledge of the fource of the infection is new in the minds of moft of the farmers, but has at length produced good confequences; and that it feems probable, from the precautions they are now difpofed to adopt, that the appearance of the cow-pox in that quarter may either be entirely extinguifhed or become extremely rare.

"With refpect to the opinion adduced (Dr Jenner obferves), that the fource of the infection is a peculiar morbid matter arifing in the horfe; although I have not (fays he) been able to prove it from actual experiments conducted immediately under my own eye, yet the evidence I have adduced appears to eftablifh it.

"They who are not in the habit of conducting experiments, may not be aware of the coincidence of circumftances, neceffary for their being managed fo as to prove perfectly decifive; nor how often men engaged in profeffional purfuits are liable to interruptions, which difappoint them almoft at the inftant of their being accomplifhed; however, I feel no room for hefitation refpecting the common origin of the difeafe, being well convinced that it never appears among the cows, except it can be traced to a cow introduced among the general herd which has been previoufly infected, or to an infected fervant, unlefs they have been milked by fome one who, at the fame time, has the care of a horfe affected with difeafed heels."

The following cafe, which we alfo quote from Dr Jenner, would feem to fhew that not only the heels of the horfe, but other parts of the body of that animal, are capable of generating the virus which produces the cow-pox.

"An extenfive inflammation of the eryfipelatous kind appeared, without any apparent caufe, upon the upper part of the thigh of a fucking colt, the property of Mr Millet, a farmer at Rockhampton, a village near Berkeley. The inflammation continued feveral weeks, and at length terminated in the formation of three or four fmall abfceffes. The inflamed parts were fomented, and dreffings were applied by fome of the fame perfons who were employed in milking the cows. The number of cows milked was twenty-four, and the whole of them had the cow-pox. The milkers, confifting of the farmer's wife, a man, and a maid-fervant, were infected by the cows. The man-fervant had previoufly gone through the fmall-pox, and felt but little of the cow-pox. The fervant-maid had fome years before been infected with the cow-pox, and fhe alfo felt it now in a flight degree: but the farmer's wife, who never had gone through either of thefe difeafes, felt its effects very feverely. That the difeafe produced upon the cows by the colt, and from them conveyed to thofe who milked them, was the *true* and not the *fpurious* cow-pox, there can be fcarcely any room for fufpicion; yet it would have been more completely fatisfactory had the effects of variolous matter been afcertained on the farmer's wife; but there was a peculiarity in her fituation which prevented my making the experiment."

8 Dr Jenner's opinion of the origin of the difeafe controverted.

Subfequent authors have not been all difpofed to adopt Dr Jenner's opinion that this difeafe derives its origin from the greafe in horfes. We have feen the Doctor himfelf allow that he has not been able to prove it decifively by actual experiments; and to eftablifh a fact fo contrary to all analogy, perhaps no weaker evidence ought to be admitted. The only other beftial diforder with which we are acquainted, which is capable of being communicated by contagion to the human fpecies, is hydrophobia: but here the diforder is the fame in man as in the animal from which he derives it; and the analogy holds good in the propagation of the vaccine difeafe from the cow to her milker. But that the difcharge from a local difeafe in the heel of a horfe fhould be capable of producing a general diforder in the conftitution of a cow, with fymptoms totally different, and that this new difeafe once produced fhould be capable of maintaining an uniform character in the cow and in man, feems a much greater departure from the ordinary proceeding of Nature. We are very far from faying that this is impoffible; for little indeed do we know of what Nature can or cannot do. All we mean to fay is, that a fact fo very extraordinary ought not to be haftily admitted.

In Holftein, we are told that the farmers do not know of any relation exifting between the greafe and the cow-pox, at leaft a perfon who refided three years in that country never heard of any. This, however, is certainly no proof. The fame communication which contains this remark (a letter from Dr De Carro of Vienna to Dr G. Pearfon) adds, "that in great farms men do not milk cows, but that in the fmaller ones that happens very often; that a difeafe of horfes, called *mauke* (true German name for *greafe*), is known by all thofe who take care of them; that old horfes particularly, attacked with the mauke, are always put in cow's ftables, and there are attended by women; and that it is particularly in harveft that men in fmall farms milk cows." It muft be allowed, then, that in this fituation, fuppofing Doctor Jenner's opinion well founded, the cow-pox was naturally to be looked for, and here accordingly we find it. The queftion is certainly of no real utility, and therefore it has very properly been lefs attended to than other points refpecting this diforder which lead to important practical conclufions.

Of all the queftions which have arifen relative to the cow-pox, there is none fo interefting, and luckily there is none which has received fo full a difcuffion, or fo fatisfactory an anfwer, as the one we are now about to confider. Are thofe perfons who have once had the cow-pox effectually and for ever fecured againft the variolous contagion?

9 A previous attack of this difeafe renders the body unfufceptible of fmall-pox.

Dr Jenner, in his firft publication, was decidedly of opinion that a previous attack of this diforder rendered the human body for ever unfufceptible of the variolous virus; and befides the univerfal popular belief in the countries where cow-pox is known, he brought forward a number of cafes in fupport of his affertion. By fome of thefe it appeared that perfons who had been affected with the cow-pox above twenty or thirty years before, continued fecure againft infection, either by the effluvia from patients under fmall-pox, or by inoculation. But along with this opinion he entertained other two, which, to many people, appeared fo furprifing as to take away all credit from the former. The firft was, that a previous attack of fmall-pox did not prevent a fubfequent attack of cow-pox; and the fecond was perhaps ftill more wonderful, that the cow-pox virus, although it rendered the conftitution unfufcepti-

10 Difficulties explained.

 ble

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ble of the ſmall-pox, ſhould nevertheleſs leave it unchanged with reſpect to its own action, for that the ſame perſon is ſuſceptible of repeated attacks of the cow-pox.

Theſe opinions have been ſubmitted to the teſt of very extenſive experience by a variety of intelligent practitioners; and we think there can now be little doubt that the two laſt are erroneous, while the truth of the firſt has been eſtabliſhed by an immenſe body of incontrovertible evidence.

The opinions that a perſon who has had the ſmall-pox may afterwards have the cow-pox, and that the ſame perſon may have the cow-pox more than once, probably aroſe from the diſtinction between the local effects of the vaccine virus, and the general diſorder of the conſtitution not having been ſufficiently attended to. It is generally admitted, that in the inoculated ſmall-pox the local affection may go ſo far as that a puſtule ſhall ariſe on the part, containing matter capable of communicating the true ſmall-pox to others, and yet, if no general affection of the conſtitution takes place, the patient is not ſecure from the diſorder. In like manner, there are caſes upon record which prove that a perſon may, after having had the ſmall-pox, have a local affection produced by inoculation, in which true variolous matter ſhall be formed capable of communicating both the local and conſtitutional ſymptoms of ſmall-pox to others; and nurſes, when much expoſed to variolous contagion, often have an eruption reſembling ſmall-pox upon ſuch parts of their ſkin as have been expoſed to the action of the virus, though they have formerly undergone the diſeaſe. Yet there is probably no perſon at this day who will go ſo far as to aſſert that the ſame perſon can have the ſpecific variolous fever more than once.

The caſe ſeems to be preciſely the ſame with reſpect to cow-pox. Doctor Pearſon and others have inoculated a number of perſons after they have had the ſmall-pox with the vaccine virus, and have produced only the local affection; and by the ſame teſt it is aſcertained that the ſame perſon cannot more than once have the conſtitutional ſymptoms of the cow-pox. Dr Woodville indeed tells us that he has ſeen one caſe of genuine cow-pox puſtule and ſpecific fever in a conſtitution which had previouſly ſuffered the ſmall-pox. There can be no higher authority on this ſubject than that of Dr Woodville; and if he had actually ſeen his patient in the ſmall-pox as well as the cow-pox, we ſhould have admitted this ſingle caſe as completely deciſive of the queſtion. But the only evidence of this perſon having had the ſmall-pox, is the aſſertion of the patient that he had it *when a child*. This we can by no means ſuſtain as concluſive in oppoſition to the Doctor's own experience, as well as the experience of Dr Pearſon.

That the milkers are ſubject to repeated attacks of the local ſymptoms of cow-pox, whether they have had the ſmall-pox or not, is certain. In the caſe of the farmer's ſervants at Rockhampton, which we have quoted above from Dr Jenner, one of whom had previouſly undergone the ſmall-pox, and the other the cow-pox, and both of whom were afterwards infected by the cow-pox *in a ſlight degree*, it ſeems reaſonable to conclude that the local ſymptoms only were preſent in the laſt attack. We may at the ſame time obſerve, that in a caſe of this kind, where a very painful ulcer is produced in a very ſenſible part, this may probably be attended by an increaſed frequency of pulſe; yet if this has not the ſpecific marks of the cow-pox fever, we ſhould not ſay that ſuch a perſon has the diſorder conſtitutionally.

11 Succeſs of vaccine inoculation.

With reſpect to the principal propoſition, that the ſpecific fever of cow-pox renders the conſtitution unſuſceptible of the variolous fever, we think no doubt now remains. Above 1000 perſons who have undergone the vaccine inoculation have been afterwards inoculated with variolous matter, which has produced no other than local effects. Beſides theſe, there have been a vaſt number inoculated by private practitioners in different parts of the kindom, the reſult of which has not been reported. But we may ſafely ſuppoſe, that if any one of them had afforded a concluſion oppoſite to the one now generally admitted, it would have been communicated to the public.

We muſt not, however, conceal one ſeemingly well authenticated caſe which has lately occurred, and which, ſo far as it goes, certainly militates againſt this concluſion, and which, we doubt not, will be eagerly caught at by the opponents of the new practice. We quote it from the Medical and Chirurgical Review for September 1800.

12 A ſeemingly well authenticated exception,

"Mr Malim, ſurgeon of Carey Street, London, inoculated a child, two years and an half old, with vaccine matter procured from Dr Jenner. On the third day there were ſufficient marks of the action of the virus, and from this time to the end of the diſeaſe the local affection proceeded regularly and without interruption. On the eighth day the child complained of headache and ſickneſs; had a quick pulſe, white tongue, and increaſed heat, with an enlargement and tenderneſs in the axilla. Theſe ſymptoms ſubſided in the courſe of the next day, and the child remained well till the twelfth, when it had a very ſevere attack of fever, ſucceeded, the following day by an eruption; the appearance, progreſs, and termination of which, left no doubt in the minds of ſeveral eminent practitioners of its being the ſmall-pox. That it was really ſo, has been ſince clearly proved by inoculation. There was a child ill of ſmall-pox in the houſe at the time the above inoculation for cow-pox was performed."

The Reviewers juſtly remark, that the hiſtory is defective, in not deſcribing more minutely the appearances of the inoculated parts at the different ſtages, as well as in not mentioning the length of time that the matter had been taken previous to being uſed. Both theſe points are the more important, as a ſuſpicion naturally ariſes, that the local affection which ſucceeded the vaccine inoculation was not the genuine cow-pox puſtule, but one of the ſpurious kind, which had not the power of deſtroying variolous ſuſceptibility. The matter having been furniſhed by Dr Jenner, no doubt, renders this ſuppoſition the leſs probable; but if it was either long or improperly kept after it came out of his hands, it may have undergone a material change, by putrefaction or otherwiſe. Dr Jenner mentions an inſtance of a practitioner, who had been accuſtomed to preſerve variolous matter in a warm pocket; a ſituation favourable for producing putrefaction in it. This matter when inſerted, was found to produce inflammation, ſwellings of the axillary glands, fever, and ſometimes eruptions; but not of the true variolous kind, as patients thus inoculated

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lated were found ftill fufceptible of the fmall-pox contagion. It is furely a poffible fuppofition, though merely a conjecture, that the vaccine matter in Mr Malim's cafe had undergone fome fuch change.

The cafe however, is in feveral refpects an interefting one. As it has been fuppofed that variolous contagion, communicated in the form of exhalation, does not affect the conftitution in lefs than fourteen or fifteen days, and as the vaccine matter, communicated by inoculation, produces its fpecific effects fome days earlier, it has been fuggefted, that wherever a perfon has been accidentally expofed to variolous effluvia, we fhould endeavour to anticipate the fmall-pox by immediately inoculating with the vaccine virus. But if there be nothing fallacious in the above cafe, it appears that this meafure would not ftop the progrefs of the fmall-pox, but that our patient would incur the additional danger of having two difeafes inftead of one.

13 Probably accounted for.

At all events, it muft be allowed that this child had been infected by the fmall-pox before the vaccine matter had begun to produce its fpecific effects, and probably even before the inoculation. Thus the fmall-pox may be confidered as having begun before the cow-pox; and though we fhould be forced to allow that, matters being thus fituated, the latter diforder could not prevent the farther progrefs of the former, it by no means follows, that when the cow-pox has fairly run its courfe, the conftitution is ftill fufceptible of fmall-pox. The two difeafes muft have exifted in this patient at the fame time, though the one was in a latent ftate during the active ftage of the other.

This folitary cafe, then is by no means conclufive, and certainly is not fufficient to outweigh the immenfe mafs of concurring evidence which is oppofe to it.

14 Advantages of the new practice.

We proceed now to another highly important branch of our fubject—the comparifon of the advantages and difadvantages of the two difeafes, with a view to the practice of inoculation.

Notwithftanding the immenfe number of cafes in which the inoculation of the cow-pox has been tried, we are not yet fully qualified to appreciate the value of the new practice; becaufe the difeafe has varied very much in feverity, and even in its moft remarkable fymptoms, and that without any caufe which has yet been difcovered.

Dr Jenner's account of the difeafe gave us reafon to think that the local affection in cow-pox was more fevere than in the inoculated fmall-pox: That the fever in this difeafe was never attended with dangerous fymptoms: that thofe fymptoms which affect the patient with feverity are entirely fecondary, excited by the irritating proceffes of inflammation and ulceration: that the difeafe was not attended with any eruption refembling fmall-pox: and that the fore produced by the inoculation was apt to degenerate into a very diftreffing phagedenic ulcer, which required to be treated with applications of a cauftic nature, of which he found the unguentum hydrargyri nitrati the moft ufeful.

Soon after Dr Jenner's publication, the attention of medical men was forcibly drawn to the fubject; and feveral eminent practitioners in London, particularly Dr George Pearfon, and Dr Woodville phyfician to the fmall-pox and inoculation hofpitals, immediately began to practife the vaccine inoculation. The latter gentleman foon publifhed an accurate and candid account of the effect of this virus upon 200 patients, with a table of the refults of above 500 cafes in which the inoculation was performed.

15 Anomalies in the progrefs of the difeafe.

It is very remarkable, that in none of thefe cafes did the inoculated part ulcerate in the manner defcribed by Dr Jenner, nor did the inflammation ever occafion any inconvenience, excepting in one inftance, in which it was foon fubdued by the aqua lythargiri acetati. The general affection of the conftitution, on the other hand, though in a great majority of cafes it was very flight, yet, in fome inftances, was fevere. An eruption, exactly refembling fmall-pox, was, contrary to expectation, a very common occurrence, and in fome the puftules were not fewer than 1000; and although in thefe cafes the difeafe was ftill unattended with fecondary fever, yet the febrile fymptoms which took place from the commencement were confiderable, and even alarming, as fometimes alfo happens with the inoculated fmall-pox.

Dr Woodville fometimes inoculated with matter from the primary fore in the arm, and fometimes with matter taken from the puftular eruption; and it appears from the table that a much larger proportion of thofe who were inoculated in the latter way had puftules, than of thofe who were inoculated either with matter immediately from the cow, or from the primary fore in the human body. There were 447 patients in all inoculated, either from the cow or from the primary fore; and of thefe 241 had puftules, and 206 had none. Sixty-two perfons, on the other hand, were inoculated with matter from the puftules of ten different patients; and of thefe no fewer than 57 had puftules, and only 5 efcaped without. Nor can it be faid that this difproportion arofe from thefe 10 patients having the difeafe in a more virulent form than ordinary, for matter was alfo taken from the primary fore in 4 of the 10, with which 48 were inoculated; of whom 27 had puftules, and 21 had none: whereas, of 9 perfons who were inoculated with matter from the puftules of thefe fame 4, only 2 efcaped without puftules. This obfervation correfponds alfo with Dr Pearfon's experience.

Although thefe eruptions have been met with by other practitioners, yet they certainly appear very rarely in private practice. Dr Woodville, for this reafon, confiders them, in a more recent publication as the effect of fome adventitious caufe, independent of the cow-pox: And this he fuppofes to be the variolated atmofphere of the hofpital, which thofe patients were neceffarily obliged to infpire during the progrefs of the cow-pox infection. This opinion, however, does not feem to agree well with his former remark, which, as we have faid, is confirmed, by Dr Pearfon, that eruptions rarely took place, if care was taken to avoid matter for inoculation from fuch as had puftules; a fact that cannot be explained on fuch a fuppofition. Neither is this idea reconcileable with what he alfo tells us, that the proportion of cafes in the hofpital attended with puftules has been of late only three or four in a hundred.

This change in the appearances of the difeafe in the hands of different practitioners, and even of the fame practitioner at different times, is one of the moft unaccountable circumftances refpecting this fingular diforder.

Variolæ Vaccinæ.

der. There is some curious information on this subject, contained in a letter from Mr Stromeyer of Hanover to Mr Hannehmaun.

"This year (says he) we have inoculated 40 persons, as well with the vaccine matter received of Dr Pearson as with that from Dr Jenner; all of whom underwent the disease properly.

"Betwixt the London and Gloucester vaccine matter, it appears to me there subsists an essential difference. The London matter produces frequently an eruption of small pimples; but they disappear within a day or two at farthest. Dr Pearson calls these eruptions *pustules*.—The Gloucester matter has never produced this effect here; but *frequently occasioned ulcerations of the inoculated part, of a tedious and long duration; which the latter never did:* on account of which I now only make use of Dr Pearson's vaccine matter. The nettle-fever-like eruptions I have observed several times, but never that sort of eruption, repeatedly noticed in London, which so much resembles the small-pox."

If these observations of Mr Stromeyer should be confirmed by the experience of others, they would go far to explain the difference which the London practitioners have found in this disease from the account given of it by Dr Jenner, notwithstanding the absence of the eruption resembling small-pox at Hanover. We believe an interchange of vaccine matter has once or twice taken place between London and Gloucestershire. Is it since that period that the eruption has been less frequent at London? Dr Pearson is inclined to suppose, that the comparative severity of the disease at London, during the first winter, arose rather from the difference in the human constitution at the different seasons of the year, than from any change in the state of the vaccine matter.

16 Mortality from the old practice over-rated by the advocates for the new.

In comparing the degree of danger from the inoculation of cow-pox with that arising from the inoculated small-pox, we are convinced that Dr Pearson greatly over-rates the mortality in the latter disorder. He supposes it to be no less than one in 200. Dr Moseley, on the other hand, who is a violent opponent of the vaccine inoculation, asserts, that he has inoculated several thousands with variolous matter, in Europe and the West Indies, without ever losing a patient and that several other persons, whom he knows, have done the same, with the same success. We are afraid, however, that the experience of other inoculators does not afford so favourable a result. We believe that in this country the mortality is often occasioned by improper treatment; and from comparing the accounts which we have received from practitioners of extensive experience, and undoubted veracity, we believe that, where the treatment is proper from the beginning, the symptoms very rarely arise to an alarming height, and that the mortality is not so great as one in 600. And this estimate nearly corresponds with Dr Woodville's very great experience. It must be allowed, that patients in an hospital are subject to some disadvantages, which may be avoided in private practice; yet, out of the last 5000 cases of variolous inoculation at the inoculation hospital, prior to the publication of the Doctor's reports, the mortality did not exceed one in 600.

Notwithstanding this statement, however, we are happy to say, that the danger in the vaccine disease is still much less. Dr Pearson tells us, that in little more than six months after the new inoculation was introduced into London, which includes the period at which the cow-pox assumed the most unfavourable appearance, 2000 persons at least underwent the operation; of these, one only, an infant at the breast, under the care of Dr Woodville, died. In this solitary fatal case, the local tumor was but very inconsiderable; and the eruptive symptoms took place on the seventh day, when the child was attacked with fits of the spasmodic kind, which recurred at short intervals, with increased violence, and carried it off on the eleventh day after the cow-pox matter had been infected into its arm, and after an eruption of about 80 pustules had appeared.

17 Great success of the new inoculation.

Since that time a much greater number, amounting certainly to several thousands have been inoculated with cow-pox in different parts of Great Britain and on the continent. Among these, not one fatal instance, that we have heard of, has occurred.

But even if the danger to the individual from the small-pox and from the cow-pox were equal, there is an important advantage to the public attending the latter, which we think would alone be sufficient to intitle it to a preference—It is not capable of being propagated by the effluvia arising from the bodies of persons infected with it. There are many situations in which a prudent surgeon will be restrained from inoculating with small-pox, lest the contagion should spread to other people, who may be either prevented by prejudice from submitting to the operation, or in whom it would be obviously improper, from the circumstances of age, teething, or the presence of some other disease. Here the cow-pox virus may be substituted with great propriety. It is chiefly from this quality that the cow-pox bids fair to extirpate the small-pox entirely.

This valuable property of the vaccine disorder is not, however, to be admitted without some limitation. When it produces numerous pustules on the body, Dr Woodville tells us, that the exhalations they send forth are capable of affecting others in the same manner as the small-pox. Two instances of casual infection in this way have fallen under his observation. In one, the disease was severe, and the eruption confluent; in the other, the disease was mild, and the pustules few. It has been remarked, that the inoculated cow-pox is little if at all, different from the disease when casually caught. But, strictly speaking, the above are the only two cases in which the disease has been communicated otherwise than by inoculation.

18 Whether the cow-pox and small-pox ought to be considered as different diseases.

The writers upon this subject are divided in opinion, whether the cow-pox and small-pox ought to be considered as different diseases, or whether they are merely varieties of the same disease.

They certainly, notwithstanding the strong analogy which subsists between them, differ from each other in several striking particulars. The cow-pox comes to man from the cow, and is capable of being carried back from him to that animal. Similar attempts with variolous matter have failed: in this respect, then, these two morbid poisons are altogether different.

The local tumor produced by the inoculation of the cow-pox is commonly of a different appearance from that which is the consequence of inoculation with variolous matter: for if the inoculation of the cow-pox be performed by a simple puncture, the consequent tumor, in the proportion of three times out of four, according

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cording to Dr Woodville, affumes a form completely circular, and it continues circumfcribed, with its edges elevated and well defined, and its furface flat, through every ftage of the difeafe; while that which is produced from the variolous matter, either preferves a peculiar form, or fpreads along the fkin, and becomes angulated, or irregular, or disfigured by numerous veficulæ. Another diftinction ftill more decifive and general, is to be drawn from the contents of the cow-pox tumor; for the fluid here formed very rarely becomes puriform; and the fcab which fucceeds is of a harder texture, exhibits a fmoother furface, and differs in its colour from that which is formed by the concretion of pus. The appearances, however, are fometimes fo changed, that they can in no refpect be diftinguifhed from thofe which arife from the inoculation of fmall-pox. We may alfo mention that the tendency of the fore in the inoculated part to degenerate into a phagedenic ulcer does not occur in fmall-pox.

On the other hand, the points in which thefe two difeafes refemble each other are very remarkable: When introduced into the body by inoculation, they affect the conftitution in nearly the fame length of time, and feem to be governed by nearly the fame laws. They mutually deftroy the fufceptibility of the body for the action of each other.

Dr Pearfon, who thinks the difeafes ought to be confidered as diftinct fpecies, neverthelefs draws the following conclufions, as eftablifhed by experience.

"That in certain conftitutions, or under the circumftances of certain co-operating agents, *the vaccine poifon produces a difeafe refembling the fmall-pox;* and of courfe the puftule in the inoculated part is *very different from that of the vaccine pox ordinarily occurring*, and the eruptions *refemble very much, if not exactly, fome varieties of the fmall-pox:* That in fome inftances thefe eruptions have occurred, although the inoculated part exhibited the genuine vaccine puftule: That the matter of fuch eruptive cafes, whether taken from the inoculated part, or from other parts, produces univerfally (A), or at leaft generally, fimilar eruptive cafes; and has not (he believes) been feen to go back, by paffing through different conftitutions, to the ftate in which it produces what is called the *genuine vaccine difeafe:* That eruptions, of a different appearance from variolous ones, fometimes occur in the true cow-pox."

19 They are probably only varieties of the fame difeafe.

From thefe facts we are ftrongly inclined to think that the vaccine difeafe and the fmall-pox ought merely to be confidered as varieties of the fame difeafe; and we have little doubt that they both derive their origin from the fame fource.

If Dr Jenner's opinion, that the vaccine difeafe is derived from *the greafe*, were fully eftablifhed, we fhould be difpofed to offer a conjecture, that the *fmall-pox*, in coming from the horfe to man, may have paffed through fome animal different from the cow, and may thus have undergone a modification fimilar to, but not exactly, the fame with what takes place in the paffage of the virus through the conftitution of the cow.

But without having recourfe to this conjecture, which is perfectly gratuitous, we are of opinion that the variations which have taken place in the cow-pox within the laft three years are fufficient to warrant a belief, that the fmall-pox may have originally been exactly the fame difeafe, even in the human conftitution, as the cow-pox is now; but that in a fucceffion of ages, and from the operation of caufes wholly unknown to us, it may have been changed to what we now fee it.

We fhall now conclude this article with a few practical remarks, which we hope may be of ufe to practitioners who mean to begin the vaccine inoculation.

20 Practical remarks.

It is of the utmoft confequence that the matter employed fhould be the genuine vaccine virus. Dr Jenner points out the following particulars as fources of a fpurious cow-pox: 1. That arifing from puftules on the nipples or udder of the cow, which puftules contain no fpecific virus. 2. From matter, although originally poffeffing the fpecific virus, which has fuffered a decompofition, either from putrefaction, or any other caufe lefs obvious to the fenfes. 3. From matter taken from an ulcer in an advanced ftage, though the ulcer arofe from a true cow-pox. 4. From matter produced on the human fkin from the contact of fome peculiar morbid matter generated by a horfe.

Many have remarked that inoculation with the vaccine matter is more apt to fail in communicating the infection than with variolous matter, efpecially if it be fuffered to dry upon the lancet before it is ufed. This does not feem to depend upon the virus of the former being more volatile, but upon its becoming more hard and indiffoluble upon exficcation. Care fhould therefore be taken to moiften it a confiderable time before it is ufed.

We have already noticed the danger that may arife from miftaking the local effects of the vaccine difeafe for its effects upon the conftitution. To guard practitioners againft this error, Dr Woodville makes the following remarks: "When a confiderable tumor and an extenfive rednefs take place at the inoculated part, within two or three days after the infectious matter has been applied, the failure of inoculation may be confidered as certain as where neither rednefs nor tumor is the confequence. This rapid and premature advancement of the inflammation will always be fufficient to prevent the inoculator from miftaking fuch cafes for thofe of efficient inoculation. But there are other circumftances under which I have found the inoculation to be equally ineffectual, and which, as being more likely to deceive the inoculator, require his utmoft circumfpection and difcrimination. I here allude to cafes in which it happens that though the local affection does not exhibit much more inflammation than is ufual, yet neither veficle nor puftule fupervenes; and in which, about the fixth or feventh day, it rapidly advances into an irregular fuppuration, producing a feftering or cruftaceous fore. Care, however, fhould be taken to diftinguifh this cafe from that in which the inoculated part affumes a puftular form, though it continues for one or two days only, when the fame appearances follow as thofe above defcribed; for I have experienced the latter inoculation to be as effectual as where the tumor has proceeded in the moft regular manner."

"The

(A) We have feen that Dr Woodville's table contains a few exceptions to this rule, though it ftrongly confirms the general truth of the propofition.

"The efflorefcence at the inoculated part, which feldom intervenes before the eighth, or later than the eleventh day, is to be regarded as an indication that the whole fyftem is affected; and if the patient has not felt any indifpofition on or before its approach, he may be affured that there will not be any afterwards. When efflorefcence does not commence till the eleventh day, it is almoft always attended with more indifpofition than when it occurs on the eighth or ninth day. The efflorefcence is more frequent in young infants than in children advanced to three or four years of age; and the former have the efflorefcence, and the difeafe more favourably than the latter, infomuch that by far the greater part of them have no perceptible illnefs, and require no medicines. On the other hand, in adults, the cow-pox frequently produces headache, pain of the limbs, and other febrile fymptoms, for two or three days, which are greatly relieved by a brifk purgative."

Since the above was written, vaccination has been extended all over Europe and into many parts of Afia. It has been practifed on a very large fcale in the Weft India iflands, with the moft complete fuccefs. In the United States it has been extenfively adopted with the happieft effects. Doctor J. R. Coxe of Philadelphia and Doctor Waterhoufe of Cambridge, Maffachufetts, have particularly diftinguifhed themfelves by their zeal and activity in extending the knowledge and practice of vaccination, and the medical gentlemen generally throughout the union, have laudably co-operated with them to extend the benefit of this moft important difcovery in all the ftates. Many thoufands have been inoculated and have had the difeafe in the regular form, and from the numerous trials which have been fairly made, there is no room to doubt of its being a complete prefervative againft the fmall-pox, and from the rapidity with which this beneficial practice is extending there is every reafon to expect that it will foon be univerfally eftablifhed.

We would, upon the whole, recommend the vaccine inoculation to our medical readers as being an effectual preventative againft the fmall pox, and fafer to the individual, while it is more advantageous to the public at large, in being lefs capable of propagation by contagion.

UCAH, *Port,* on the N. W. coaft of North-America, is fituated on Wafhington's Ifland, fouth of Port Geyer, and north of Port Sturgis. At its mouth are Needham's Ifles. The middle of the entrance of this bay is in lat. 52 25 N.—*Morse.*

UCAYALA *River*, a fouth branch of Amazon river.—*ib.*

UCHE, an Indian town fituated on the Chata Uche river. It is fituated, according to Bartram, on a vaft plain, and is the largeft, moft compact, and beft fituated Indian town he ever faw. The habitations are large and neatly built; the walls of the houfes are conftructed of a wooden frame, then lathed and plaiftered infide and out with a reddifh well tempered clay or mortar, which gives them the appearance of red brick walls; and the roofs are neatly covered with cyprefs bark, or fhingles. The town appears populous and thriving, full of youth and young children; and is fuppofed to contain about 1500 inhabitants. They are able to mufter 500 gunmen or warriors. Their national language is radically different from the Creek or Mufcogulge tongue, and is called the Savanna or Savanuca tongue. It is faid to be the fame or a dialect of the Shawanefe. Although in confederacy with the Creeks, they do not mix with them; and are of importance enough to excite the jealoufy of the whole Mufcogulge confederacy, and are ufually at variance, yet are wife enough to unite againft a common enemy to fupport the intereft of the general Creek confederacy.—*ib.*

VASE *River, Au,* empties into the Miffiffippi from the N. E. 3 miles below the Great Rock, about 55 N. W. by N. of the mouth of the Ohio, and about the fame diftance N. W. of Fort Maffac. It is navigable into the N. W. Territory about 60 miles, through a rich country, abounding in extenfive natural meadows, and numberlefs herds of buffaloe, deer, &c. It is about 8 miles above Cape St Antonio.—*ib.*

VASSALBOROUGH, a poft-town of the diftrict of Maine, in Lincoln county, on Kennebec river, half way between Hallowell and Winflow, 204 miles N. by E. of Bofton, and 551 from Philadelphia. It was incorporated in 1771, and contains 1,240 inhabitants. —*ib.*

VAUCLIN *Bay,* on the eaft coaft of the ifland of Martinico. Vauclin Point forms the fouth fide of Louis Bay, on the eaft coaft of the fame ifland.—*ib.*

VAVAOO, one of the Friendly Iflands in the South Pacific Ocean. It is about two days fail from Hapaee. —*ib.*

VEALTOWN, a village of New-Jerfey, near Bafkenridge, about 7 miles fouth-wefterly of Morriftown. —*ib.*

VEAU, *Anfe a,* a village on the north fide of the fouth peninfula of the ifland of St Domingo, 5 leagues weft by north of Miragoane, $4\frac{1}{2}$ eaftward of Petit Trou, and 19 north-eaft of Les Cayes.—*ib.*

VECTOR, or Radius Vector, in aftronomy, is a line fuppofed to be drawn from any planet, moving round a centre, or the focus of an ellipfe, to that centre or focus. It is fo called, becaufe it is that line by which the planet feems to be carried round its centre; and with which it defcribes areas proportional to the times.

VEGA, or *Conception of la Vega Real,* a town in the north-eaft part of the ifland of St Domingo, on the road from St Domingo city to Daxabon. It is fituated near the head of Yuna river, which empties into the bay of Samana; 12 leagues north-weft by weft of Cotuy, and about 38 eafterly of Daxavon, or Daxabon. It ftands on a beautiful plain among the mountains, on the very fpot where *Guarionex,* cacique of the kingdom of Magua, had refided. In 1494, or 1495, the fettlement of this town was begun by Columbus. Eight years after, it had become a city of importance, and fome times during the year, there were 240,000 crowns in gold, minted at this place. It was almoft deftroyed by an earthquake in 1564.—*Morse.*

VEGETABLES. } See *Vegetable Substances* in
VEGETATION. } this *Suppl.*

VEJAS, or *Morro de Vejas,* on the coaft of Peru, is about half a league from the ifland of Lobos.—*Morse.*

VELA, a cape on the coaft of Terra Firma, S. America, in about lat. 12 N. and long. 72 W. and about 18 leagues N. by E. of the town of La Hacha.—*ib.*

VELAS,

Velas, ‖ Ventilation.

VELAS, or *Velaſco*, a port on the weſt coaſt of New-Mexico, is 7 leagues north-weſt by north of the Morro Hermoſa, and 8 from St Catharine's Point.—*ib.*

VELICALA, a town on and near the head of the peninſula of California, near the coaſt of the N. Pacific Ocean, and northerly from Anclote Point. N. lat. about 20 35, W. long. 115 50.—*ib.*

VENEZUELO, a province of Terra Firma, bounded eaſt by Caracas, ſouth by New-Grenada, weſt by Rio de la Hacha, and on the north by the North Sea. It abounds with game and wild beaſts, producing plenty of corn twice a year, with fruits, ſugar, and tobacco, and the beſt cocoa plantations in America. It ſpreads round a gulf of the ſame name that reaches near 30 leagues within land; and the middle of this country is occupied by a lake 20 leagues long, and 30 broad, with a circumference of 80, and navigable for veſſels of 30 tons. It communicates with the gulf by a ſtrait, on which is built the city of Maracaibo, which gives name to both lake and ſtrait, which is defended by ſeveral forts which were attacked in the laſt century by Sir Henry Morgan, and the whole coaſt laid under contribution, and Maracaibo ranſomed. The province is about 100 leagues in length, and as much in breadth. It had its name from its ſmall lagoons, which make it appear like Venice at the entrance of the lake. The Spaniards maſſacred above a million of the natives in 1528. In 1550, the country was again depopulated; when a great number of black ſlaves were brought from Africa, and was one of the principal epochs of the introduction of negroes into the Weſt Indies. Soon after, a revolt of the negroes was the cauſe of another maſſacre, and Venezuelo became again a deſert. At preſent it is ſaid to contain about 100,000 inhabitants, who live tolerably happy, and raiſe great numbers of European ſheep. They cultivate tobacco and ſugar, which are famous over all America. They manufacture alſo ſome cotton ſtuffs. It has many populous towns, and its waters have gold ſands. Its capital, of the ſame name, or Cora, ſtands near the ſea-coaſt, about 50 miles ſouth-eaſt of Cape St Roman, N. lat. 10 30, W. long. 70 15.—*ib.*

VENEZUELO, a ſpacious gulf of the ſame province, communicating by a narrow ſtrait with Maracaibo Lake.—*ib.*

VENTA *de Cruz*, a town on the iſthmus of Darien, and Terra Firma. Here the Spaniſh merchandiſe from Panama to Porto Bello is embarked on the river Chagre, 40 miles ſouth of the latter, and 20 north of the former. N. lat. 9 26, weſt long. 81 36.—*ib.*

VENTILATION OF SHIPS is a matter of ſo great importance, that we would rather hazard the ſtating of an idle project for this purpoſe, than omit any thing which may be uſeful. We hazard nothing, however, in ſtating the following plan by Mr Abernethy, who candidly acknowledges that it is built upon the principles which we, together with the learned editor of Chambers's Cyclopædia, have borrowed from Dr Hailes. This plan conſiſts merely in cauſing two tubes to deſcend from above the deck to the bottom of a veſſel, or as low as ventilation is required; and which ſhould communicate by ſmaller pipes (open at their extremities) with thoſe places deſigned to be ventilated. There ſhould be a contrivance for ſtopping theſe communicating pipes, ſo that ventilation may be occaſionally prevented from taking place, or confined to any particular part of the veſſel.

Ventilation.

One of the principal air tubes ſhould deſcend as near to the ſtern of the veſſel as convenient, and the other as near to the ſtem.

Through that tube which is in the head, the foul air is to be extracted; and through that which is in the ſtern, the freſh air is to deſcend to the different decks and other apartments of the veſſel.

The extraction of the air is eaſily effected in the following manner: Let a tranſverſe tube be fitted to that which deſcends in the head of the veſſel: it may be ſunk within the level of the deck, ſo as to cauſe no inequality of ſurface. Let it be continued till it comes beneath the fire-place, then aſcend in a perpendicular direction through the fire, and open a little above it; or it may be made to communicate with the chimney. It would be more convenient if the fire was near the place where the tube riſes through the deck; but the experiment muſt equally ſucceed, if the tube be made to deſcend again till it is beneath the common fire-place. The effect that will reſult from this contrivance is obvious; when the tube which paſſes through the fire is heated, the air will aſcend with a force proportionable to its levity, and the aſcending column can only be ſupplied from below, conſequently it muſt come from all thoſe parts of the ſhip with which the main tube communicates.

When the ports are open, the quantity of air thus exhauſted from the ſhip will be ſupplied from all quarters; but if they were all ſhut, and the hatchways and other openings completely cloſed, the renewal of freſh air is made certain by means of the tube which deſcends in the ſtern. The main air tube, where it riſes above the deck in the ſtern, ſhould have an horizontal one fitted to it, which might be made to traverſe, ſo that it could be turned to windward; it might alſo expand at its extremity like the mouth of a trumpet; and thus perfectly freſh air muſt enter, and the force of the gale would tend to impel it into the veſſel.

When that part of the tube which paſſes through the fire is red hot, the draught which would be thus occaſioned might perhaps be too great, and the open pipes which communicate with the decks might emit and imbibe the freſh air in ſo direct a ſtream, that it might be injurious to thoſe perſons within the current.

Mr Abernethy therefore thinks it would be better if thoſe ſmaller pipes which lead from the main tubes were made to run along the decks and communicate with them by numerous orifices. Two pipes opening into the main exhauſting tube might be extended along the tops of the deck, in the angle formed between the ſides and the ceiling: and thus the air would be extracted equally from all parts, and in a manner not likely to occaſion injurious currents. Some diviſion of the ſtream of air which enters from the ſtern might alſo be made, if it were thought neceſſary.

Thus a very complete, and in no way injurious, ventilation may be obtained: the air in the veſſel would be perfectly changed when the fire was ſtrong, without expenſe or trouble; and a gradual and ſalubrious alteration of it might at all times be made, by a very little additional quantity of fuel. The air tubes ſhould conſiſt of ſeparate joints, ſo that occaſionally they might be taken to pieces; and to prevent their being injured or

Ventilation. or put out of order by rough usage, the copper pipes should be made of considerable strength, placed against the sides of the vessel, and even incased in wood.

In the Letters and Papers of the Bath Society, &c. we have the following description of a ventilator for preserving corn on ship board, by Thomas South, Esq :

Plate XLVII. Fig. 1. is a cylindrical air-vessel, or forcing pump, of lead, tin, or other cheap metal; its internal diameter being ten inches, and its length three feet; having a crutch-handled piston to work with, and an iron nosle, *viz.* a hollow inverted cone, two feet long, to condense the air, and increase its power in its passage downwards. This cylinder should be rivetted or screwed, by means of an iron collar or straps, to the deck it passes through, both above and below, as at *a a*; and should be farther secured by some holdfast near *b*, to keep it steady in working.

Fig. 2. is a bottom of wood, four inches and a half thick, with a projecting rim at its base, for the metal cylinder to rest on when cemented and screwed to the wood. The centre of this bottom is excavated, for the reception of the crown of the nosle. In the same figure the nosle is represented with its crown like a bowl dish, to condense the air gradually, without resistance, in its advance to the more contracted base of the inverted cone, *i. e.* the top of the entrance of the nosle. About two-thirds down this nosle may be fixed a male screw, as *c c*, for the purpose hereafter mentioned.

N. B. The forcing-pump should be cased in wood, to protect it from outward bruises, which would prevent the working of the piston, and ruin its effects. The leather round the embolus should be greased when used.

Fig. 3. is a crutch-handle, fastened to the embolus A by its iron legs B, B. A is a cylinder of wood, cased with leather, so as to fit well, but glide smoothly, in the metal cylinder; having an opening as large as its strength will permit, for the free access of atmospheric air. C is a valve well leathered on its top, and yielding downwards to the pressure of the air when the piston is raised up. D is a cross bar of iron, to confine the valve, so that it may close instantly on the return of the piston downwards.

Fig. 4. is a tin pipe or tube, of less than four inches diameter, and of such length, as when fixed to the base of the cylinder, fig. 1. shall admit the nosle *d*, fig. 2. to within half an inch of the valve E, at the bottom of the wooden cylinder F, in fig. 4; which valve E will then yield to the pressure of air condensed in its passage through the nosle, and deliver it into the pipes below. This valve must be well leathered on its upper surface, and fastened with an hinge of leather to the cylinder it is meant to close: affixed to its bottom is the spindle G, passing through a spiral spring H, which, being compressed on the descent of the valve, will, by its elasticity, cause it to rise again, close the aperture above, and retain the air delivered beneath it. On connecting this cylinder with the upper end of the nosle, at *e e*, fig. 2. we must carefully prevent any lapse of air that way, by a bandage of oakum smeared with wax, on which to screw the cylinder, like the joints of a flute, air-tight. I is a bar of iron, having a rising in its centre, wide enough for the spindle to play through, but at the same time sufficiently contracted to prevent the passage of the spiral spring.

Fig. 5. is an assemblage of tin pipes, of any lengths, shaped suitably and conveniently to their situation in the ship, to the form of which, when shut into one another, they must be adapted; observing only, that the neck be straight for a length sufficient to admit the lower end of the cylinder, fig. 4. as high as the letter F, or higher.

Fig. 6. To the middle pipe, which runs along the bottom, should be fixed a perpendicular one, fully perforated, to convey the air more readily into the centre of the heap; and this may have a conical top, as represented in the Plate, perforated with a smaller punch to prevent the air from escaping too hastily. In large cargoes, two or three of these perpendiculars may be necessary; and each should be well secured by an iron bar *g*, screwed down to prevent their being injured by the shifting of the cargo in stormy weather or a rolling sea. The top of the conical cap of these pipes may reach two-thirds up the cargo.

Fig. 7. is a valve of the same construction as that represented in fig. 4. but inclosed in a tube of brass, having a female screw at *f f*, adapted to the male screw *c c*, on the nosle fig. 2. and may then be inserted into the head of the pipe fig. 5. This will add to the expense; but in a large apparatus is to be preferred, as a more certain security from lapse of air, than the junction of the tube fig. 4. to the neck *e e* in fig. 2.

N. B. *e e* is a neck of wood, making a part of the bottom fig. 2. whereon to secure the tube fig. 4. when applied to the nosle. The joints of the pipes, when put together for use, should be made air-tight, by means of bees wax or some stronger cement, till they reach the bottom of the vessel, when there is no farther need of this precaution. The horizontal pipes should run by the side of the kelson the whole length of the hold. The tin plates of which K is made, should be punched in holes, like the rose of a watering-pot, in two or three lines only at most, and then formed into a tube, with the rough side outwards. L may have four or five lines of the like perforations. M, and the rest, should gradually increase in their number as they advance towards the middle of the hold, and continue fully perforated to the last pipe which should be closed at its end to prevent the ingress of the corn. It is the centre of the cargo which most requires ventilating, yet air should pervade the whole. Like the trade winds, it will direct its course to the part most heated, and, having effected its salutary purpose there, will disperse itself to refresh the mass.

Where the hatches are close-caulked, to prevent the influx of water, vent-holes may be bored in convenient parts of the deck, to be bunged up, and opened occasionally, from whence the state of the corn may be known by the effluvia which ascend when the ventilator is working.

The power of the ventilator is determined by the square of its diameter multiplied into the length of the stroke, and that again by the number of strokes in any given time.

The air-vessel or forcing-pump, with the rest of the apparatus here described, is adapted to a vessel of 120 tons burden; but by lengthening the air-vessel, extending its diameter to 14 inches, and adding 10 inches more to the length of the stroke, a power may be obtained of ventilating a cargo of 400 tons within the hour.

If

If this machine be properly wrought for one hour every day, or even every two days, beginning the operations immediately when the corn is put on board, the cargo may be preserved from taint or injury of every kind during the longeſt voyage.

VENTO *Sierra*, on the north coaſt of S. America, are mountains ſo named, behind the land called Punta de Delrio, oppoſite to Tortugas Iſland.—*Morse.*

VENUS, *Point*, in Otaheite Iſland, in the ſouth Pacific Ocean, is the eaſt point of Matavai or Port Royal Bay, and north point of the iſland. S. lat. 17 29, W. long. 149 36.—*ib.*

VERA *Cruz, La*, the grand port of Mexico, or New Spain, having a ſafe harbour protected by a fort, ſituated on a rock of an iſland nearly adjoining, called St John de Ulloa, in the Gulf of Mexico. It is, perhaps, one of the moſt conſiderable places for trade in the world, being the natural centre of the American treaſure, and the magazine for all the merchandize ſent from New Spain, or that is tranſported thither from Europe. It receives a prodigious quantity of Eaſt India produce by way of Acapulco, from the Philippine Iſlands. Moſt of its houſes are built of wood, and the number of Spaniſh inhabitants is about 3,000, mulattoes and mungrels, who call themſelves white. It is rather unhealthy, from the rank bogs around it. N. lat. 19 12, weſt long. 97 30. It is in the eaſt extremity of the province of Tlaſcala, or Los Angelos. At the Old Town, 15 or 16 miles further weſt, Cortez landed on Good Friday, 1518, when, being determined to conquer or die, he ſunk the ſhips that tranſported his handful of men hither. La Vera Cruz is 215 miles ſouth-eaſt of the city of Mexico.—*ib.*

VERAGUA, by Ulloa made a province of Terra Firma, in S. America, but others have it as a province of Guatimala and New Spain, in North-America; joining on the W. to Coſta Rica; on the E. to Panama; with the North Sea on the north; and the South Sea on the ſouth. The coaſt was firſt diſcovered by Chriſtopher Columbus in 1503, to whom it was granted with the title of Duke, and his poſterity ſtill enjoy it. The province is very mountainous, woody and barren; but has inexhauſtible mines of ſilver, and ſome gold, the duſt of the latter being found among the ſands of the rivers. Santiago de Veraguas, or Santa Fe, the capital, is but a poor place; and in this province is the river Veragua, on which that town ſtands.—*ib.*

VERAGUA, the river above mentioned, empties into the ſea 18 leagues to the ſouth-eaſt of the river or lake of Nicaragua, in lat. 10 5 N. Here is a very good port; but the iſland at its mouth is foul. The beſt anchorage is on the weſt and ſouth ſides next the main, where ſhips may ride under ſhore in from 8 to 9 fathoms, and ſafe from the north and eaſterly winds, that are moſt violent on this coaſt. Several iſlands lie off from the coaſt, both ſingly and in cluſters, from this to Cape Gracias a Dios; and to the eaſtward from hence is Chagre river.—*ib.*

VERA *Paz*, a province of the audience of Guatimala, and New Spain, in N. America. It has the bay of Honduras and Chiapa on the north, Guatimala on the ſouth, Honduras on the eaſt, and Soconuſca, with part of Chiapa, on the weſt. It is 48 leagues long, and 28 broad. The lands are mountainous, yielding little corn, but abounding in cedar, &c. The principal commodities are drugs, cocoa, cotton, wool, honey, &c. Its capital of the ſame name, or *Coban*, ſtands on the weſt ſide of a river which runs into Golfo Dulce, 184 miles eaſt of Guatimala. N. lat. 15 10, W. long. 93 15 —*ib.*

VERDE, or *Green Iſland*, on the N. coaſt of S. America, is at the mouth of the river St Martha.—*ib.*

VERDE *Key*, one of the Bahama Iſlands. N. lat. 22 12, W. long. 75 15.—*ib.*

VERDE, PORTO, or *Vedra*, is on the N. Atlantic Ocean, about 4½ leagues S. E. by E. of Rio Roxo. The iſland of Blydones is at the entrance of this port, round which ſhips may ſail on any ſide, there being 7 fathoms on the N. where it is ſhoaleſt, and 20 fathoms on the S. ſide, where is the beſt entrance into the river. This is a port of good trade, and ſometimes large ſhips put in here. The iſlands of Bayonne are 5 leagues to the S. of the iſland in the mouth of the port.—*ib.*

VERDEN, a duchy of Germany, in the circle of Lower Saxony. It is bounded on the eaſt and ſouth by that of Lunenberg; on the weſt, by the Weſer and the duchy of Bremen; and on the north, by the duchies of Bremen and Lunenburg; extending both in length and breadth about 28 miles. It conſiſts chiefly of heaths and high dry lands; but there are good marſhes on the rivers Weſer and Aller. In 1712, the Danes wreſted this duchy from Sweden, and, in 1715, ceded it to the king of Great Britain, as elector of Hanover; which ceſſion, in 1718, was confirmed by the Swedes. The inhabitants are Lutherans.

VERDERONNE, or *La Bourlarderie*, an iſland on the E. coaſt of Cape Breton Iſland. It is 7 or 8 leagues long; and at each end is a channel, through which the waters of the Labrador Lakes, in the inner part of Cape Breton Iſland, diſcharge into the ocean on the eaſt.—*Morse.*

VERDIGRIS, or ACETITE OF COPPER. See that article, *Encycl.* where an account is given of the proceſs by which verdigris was long manufactured. A different, and more economical proceſs, however, has for ſome years been practiſed in Montpellier, which is worthy of notice, becauſe it may be adopted in this country by ſubſtituting the huſks of gooſeberries or currants for thoſe of grapes.

In the manufacture of verdigris, the materials are copper and the huſks of grapes after the laſt preſſing. The copper is formed into round plates, half a line in thickneſs, and from twenty to twenty-five inches in diameter. Each plate, at Montpellier, is divided into twenty-five laminæ, forming almoſt all oblong ſquares of from four to ſix inches in length, three in breadth, and weighing about four ounces. They are beat ſeparately with a hammer on an anvil to ſmooth their ſurfaces, and to give the copper the neceſſary conſiſtence. Without this precaution it would exfoliate, and it would be more difficult to ſcrape the ſurface in order to detach the oxydated cruſt. Beſides this, ſcales of pure metal would be taken off, which would haſten the conſumption of the copper.

The huſks, which ſhould not be too much preſſed are firſt made to ferment by being put into cloſe vats, and the fermentation is generally completed in three or four days. The time, however, muſt vary according to the

 temperature

temperature in which they are kept, and other circumftances. Whilft the hufks are fermenting, a preliminary preparation is given to the copper plates. This confifts in diffolving verdigris in water in an earthen veffel, and rubbing over each plate with a piece of coarfe linen dipped in this folution. The plates are then immediately placed clofe to each other, and left in that manner to dry. Sometimes the plates are only laid on the top of the fermented hufks, or placed under thofe which have been already ufed for caufing the copper to oxydate. It has been obferved, that when this operation has not been employed, the plates grow black at the firft operation, inftead of becoming green. It is not, however, neceffary to thofe which have been once ufed, and are to be ufed again.

When the plates are thus prepared, and the hufks have been brought to ferment, the workmen try whether the latter are proper for the procefs, by placing under them a plate of copper, and leaving it buried there for twenty-four hours. If the plate, after this period, is found covered with a fmooth green cruft, in fuch a manner that none of the metal appears, they are then thought fit for being difpofed in layers with the copper. On the other hand, if drops of water are obferved on the furface of the plates, the plates are faid to *fweat*, and it is concluded that the heat of the hufks has not fufficiently fubfided. They confequently defer making another trial till the next day. When they are affured that the hufks are in a proper ftate, they form them into layers in the following manner:

The plates are all put into a box, which, inftead of having a bottom, is divided in the middle by a wooden grate. The plates difpofed on this grate are fo ftrongly heated by a chaffing-difh placed under them, that the woman employed in this labour is fometimes obliged to take them up with a cloth, in order that fhe may not burn her hands. As foon as they have acquired that heat, they are put into jars in layers with the hufks. Each jar is then clofed with a covering of ftraw, and left to oxydate. Thirty or forty pounds of copper, more or lefs according to the thicknefs of the plates, are put into each jar. At the end of ten, twelve, fifteen, or twenty days, the jar is opened; and if the hufks are white, it is time to take out the plates. The cryftals are then feen detached, and of a filky appearance on their furface. The hufks are thrown back, and the plates are put in what is called *relai*. For that purpofe they are immediately depofited in a corner of the cellar on fticks ranged on the floor. They are placed in an upright pofition, one leaning againft the other; and at the end of two or three days they are moiftened, by taking them up in handfuls and immerfing them in water in earthen pans. They are depofited quite wet in their former pofition, and left there for feven or eight days; after which they are once or twice immerfed again. This immerfion and drying are renewed fix or eight times every feven or eight days. As the plates were formerly put into wine, thefe immerfions were called *one wine*, *two wines*, *three wines*, according to the number of times. By this procefs the plates fwell up, the green is nourifhed, and a coat of verdigris is formed on all their furfaces, which may be eafily detached by fcraping them with a knife.

This verdigris, which is called *frefh* verdigris, *moift* verdigris, is fold by the manufacturers to people who dry it for foreign exportation. In this firft ftate it is only a pafte, which is carefully pounded in large wooden troughs, and then put into bags of white leather, a foot in height and ten inches in diameter. Thefe bags are expofed to the air or the fun, and are left in that ftate till the verdigris has acquired the proper degree of drynefs. By this operation it decreafes about 50 *per cent*. more or lefs according to its primitive ftate. It is faid to ftand proof by the knife, when the point of that inftrument pufhed againft a cake of verdigris through the fkin cannot penetrate it. White lead may be made by a fimilar procefs.

Cryftallized VERDIGRIS is manufactured at Montpellier in the following manner: A vinegar, prepared by the diftillation of four wine, is put into a kettle, and boiled on the common verdigris. After faturation the folution is left to clarify, and then poured into another kettle of copper, where it is evaporated till a pellicle forms on the furface. Sticks are then immerfed into it, and by means of fome packthread are tied to fome wooden bars that reft on the edge of the kettle. Thefe fticks are about a foot long, and are fplit crofs-wife nearly two inches at the end, fo that they open into four branches, kept at about the diftance of an inch from each other by fmall bags. The cryftals adhere to thefe fticks and cover them entirely, forming themfelves into groups or clufters, of a dark blue colour, and a rhomboidal fhape. Each clufter weighs from five to fix pounds. Three pounds of moift verdigris are required for one pound of the cryftals; the undiffolved refiduum is thrown away.

VERDUN, an ancient, ftrong, and confiderable town of France, in the department of Meufe, and late province of Lorrain, with a bifhop's fee, and a ftrong citadel. Its fortifications were conftructed by the Chevalier de Ville and Marfhal de Vauban. The latter was a native of this place. In 1755, great part of the cathedral was deftroyed by lightning. Verdun was taken by the Pruffians in 1792, but retaken by the French foon after. The inhabitants are noted for the fine fweetmeats they make. It is feated on the river Maefe, which runs through the middle, 42 miles fouthweft of Luxemburg, and 150 eaft of Paris. E. Lon. 5° 28′ N. lat. 43° 9′.

VERE, a parifh of the ifland of Jamaica, having Manury Bay in it; a very fecure road for fhipping.—*Morse*.

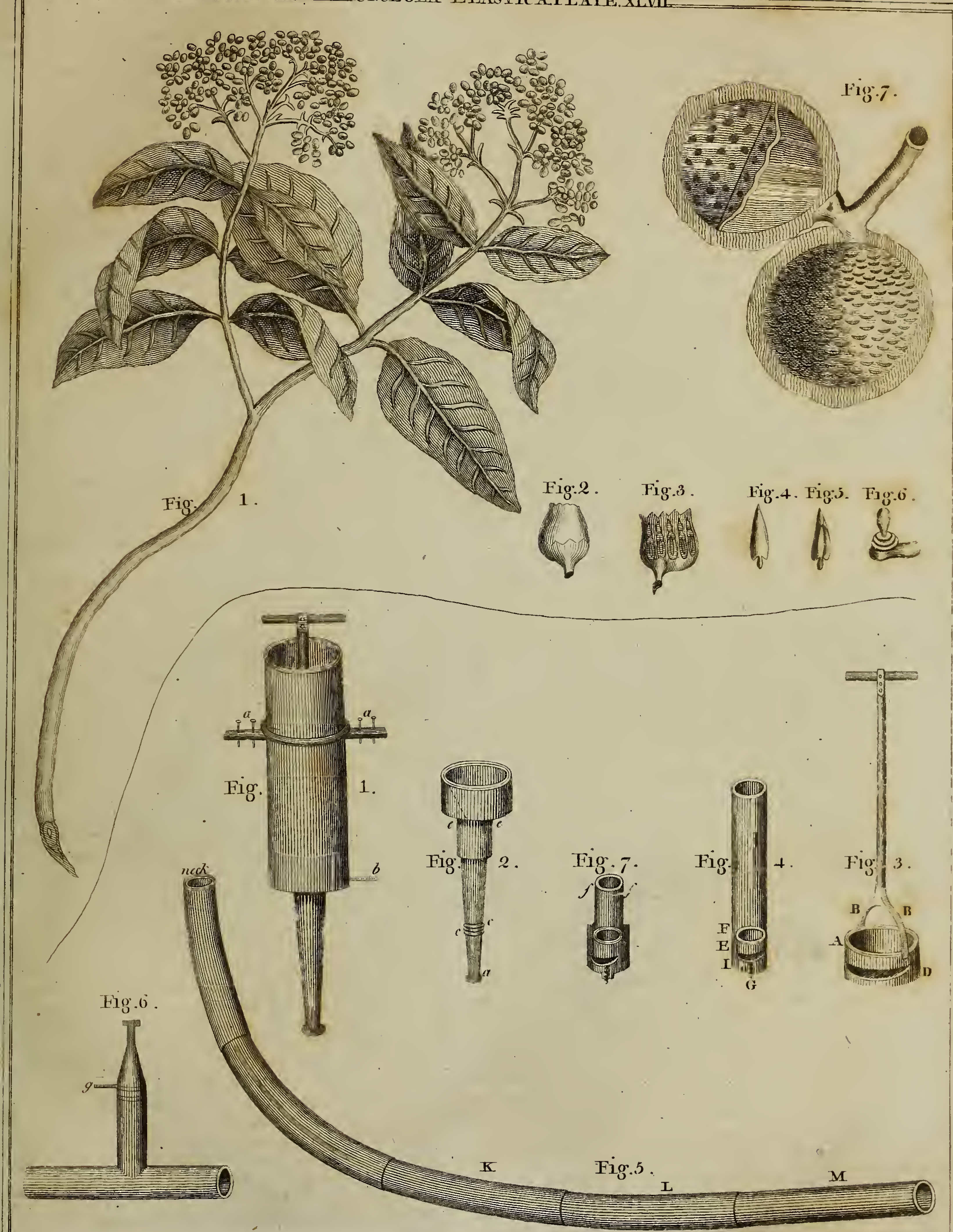
VERGENNES, a poft-town, and one of the moft growing and commercial towns of Vermont, in Addifon county, on Otter Creek, about 6 Miles from its mouth in Lake Champlain. It is regularly laid out, and contains a Congregational church, and about 60 houfes. In its neighbourhood are feveral mills. It is 115 miles north of Bennington, 22 S. of Burlington, and 407 N. E. by N. of Philadelphia. The townfhip contained 201 inhabitants in 1790.—*ib.*

VERINA, a fmall village, and Spanifh plantation of New-Andalufia, and Terra Firma, S. America. Its tobacco is reputed the beft in the world. It lies 60 miles eaft of Cumana.—*ib.*

VERMEJA, or *Vermillion Bay*, on the north fhore of the Gulph of Mexico, or coaft of Louifiana. It is to the N. W. of Afcenfion Bay, in about lat. 30 N. and long. 92 W.—*ib.*

VERMEJO, or *Bermejo*, an ifland and port on the coaft

URCEOLA ELASTICA. PLATE. XLVII.



Lawson sc

coaſt of Peru, 2 degrees N. and a little weſt of Lima. It is 4 leagues from Mongon on the north, and 6 from Guarmey Port on the ſouth.—*ib.*

VERMIFUGE, a medicine which expels worms from the inteſtines. Of theſe medicines numbers are daily advertiſed in the newſpapers as infallible, though the ingredients of which they are compoſed are carefully kept ſecret. We think it our duty therefore to aſſure our readers, that the medicines vended by quacks are generally the very ſame that would be preſcribed by a regular phyſician for the diſeaſe in which they are pretended to be ſpecifics, with this only difference, that the unſeen and unprincipled quack generally preſcribes them in more powerful doſes than the regular phyſician deems ſafe for his patient. Thus Ching's famous worm medicine, which has been ſo ſtrenuouſly recommended, is nothing more than mercury given in the very ſame form in which it is given by every phyſician; but Ching gives it in doſes, which, though they have not injured the children of a biſhop and a judge, we have *known* to *ſalivate* other children to the great hazard of their lives. It is indeed wonderful that parents ſhould truſt the health and the lives of their children to men whom they never ſaw, and whom they know to be not oppreſſed with an over delicate ſenſe of honour, in preference to a man of ſcience who has a character to ſupport, and who is probably their friend, and almoſt always their acquaintance.

Of the different vermifuges, however, it muſt be confeſſed that the greater number are liable occaſionally to fail. One of the moſt powerful which we have mentioned in the article MEDICINE, *Encycl.* is compoſed of the ſpiculæ of the *cowhage* or *cow-itch*; and ſince that article was publiſhed, it has come more into uſe, chiefly through the recommendation of Mr Chamberlaine ſurgeon. He ſays that a tea ſpoonful of the electuary (See MEDICINE, *Encycl.* p. 342.) may be ſafely given to a young child, and one or even two table ſpoonfuls to adults. The medicine is to be taken in the morning faſting; and the doſe to be repeated for two or three mornings, after which a gentle purge completes the cure. This medicine, however, Mr Chamberlaine prohibits in every caſe where there is a tendency to inflammation in any part of the inteſtinal canal, or where the mucus has been carried off or greatly diminiſhed by dyſentery or any other cauſe.

Dr Haemmerlin of Ulm has lately recommended as a very powerful and ſafe vermifuge the coraline of Corſica, and ſays that it has been ſo uſed in that iſland with complete ſucceſs from time immemorial. It is a fucus adhering to the rocks waſhed by the ſea, and ſometimes to the ſtones and ſhells thrown upon the ſhore. It is found in little tufts. It is generally of a yellow colour, with a reddiſh tincture. When dried, as it appears when offered for ſale, it contains a ſtrong ſmell of the ſea. It conſiſts of little cartilaginous ſtalks, with full threads, gradually cylindrical and tubulated. Its taſte is ſalt and unpleaſant. In the ſyſtem of plants of Linnæus, it belongs to the claſs *cryptogamia*. Its moſt common names are, ſea rock moſs; the Grecian herb; lemithochorton; and the coraline of Corſica. It is the *conferva helminthortos* of Schwendimann, and the *fucus helminthocorton* of Latourette. There is reaſon to think that all thoſe ſpecies of fucus whoſe texture is ſoft and ſpungy, might be applied to the ſame medicinal uſes. There is a ſort of red coraline found in Sweden which, according to ſome writers, is a greater deſtroyer of worms than any other known ſubſtance; being not too ſtrong for the ſtomach either of infants or of adults. Schwendimann aſſerts that the *conferva dichotoma* of Linnæus, which is found in the ditches in England, bears a ſtrong analogy to the coraline of Corſica. Might not this conferva be tried as a vermifuge? The Corſican coraline is in great eſtimation in the pharmacopœias of the Continent, eſpecially in that of Geneva, in which is given a recipe for preparing a ſyrup of it.

VERMILLIAS *Barryeras*, on the coaſt of Brazil, between the Iſland of St John's and Sypomba Iſland, which are 7 leagues aſunder. Here is a large bay with good anchorage.—*Morſe.*

VERMILLION, *Point*, called alſo Long Point, is the peninſula between Bay Puan and Lake Michigan. —*ib.*

VERMILLION *River*, in the N. W. Territory, runs north-weſtward into Illinois river, nearly oppoſite the S. W. end of Little Rocks, and 267 miles from the Miſſiſſippi. It is 30 yards wide, but ſo rocky as not to be navigable.—*ib.*

VERMILLION *Indians* reſide 220 miles up the Miami of the Lake.—*ib.*

VERMONT, one of the United States of North America, lies between 42° 44′ and 45° N. lat. and 1° 43′ and 3° 36′ E. lon. from Philadelphia. It is in length 158 miles, and breadth 70 (A) containing between 900 and 1000 ſquare miles. It is bounded north, by Lower Canada; eaſt, by Connecticut River, which divides it from New Hampſhire; ſouth, by Maſſachuſetts; weſt, by New York.

Vermont is naturally divided by the Green Mountain, which runs from ſouth to north, and divides the ſtate nearly in the middle. It is at preſent divided into the following counties, which lie in a circuit as you proceed from Bennington county, north, on the weſt ſide of the Green Mountains to the Canada line, then eaſt to Connecticut river; then ſouth, along the river to the Maſſachuſetts line, viz. Bennington, Rutland, Addiſon, Chittendon, Franklin, Orleans, Eſſex, Caledonia, Orange, Windſor and Windham.

The towns are incorporated and organized much in the ſame manner as the towns in Maſſachuſetts and Connecticut. In each of the towns granted by the governor of New Hampſhire, while this territory was under the juriſdiction of that province, in number 114, there is a reſerve of one right of land, in fee, uſually containing 330 acres, for the firſt ſettled miniſter in ſuch town; one right, as a glebe, for the church of England; one right to the ſociety in Great Britain for the propagation of the goſpel in foreign parts; and one right for the ſupport of a ſchool in the town. In the remaining towns granted by the State of Vermont, there is one right for the uſe of an univerſity; one for the uſe of ſchools, in each town; one for the uſe of county

(A) The northern line, ſeparating Vermont from Canada, is 90 miles long. The ſouthern line, dividing Vermont from Maſſachuſetts, is 40 miles in length. In the middle 55 miles.

county grammar ſchools, and one for the ſupport of the goſpel.

Lake Champlaine, more than half of which lies within the ſtate of Vermont, from Whitehall, formerly Skeenſborough, at the ſouthern extremity, including South Bay, to latitude 45°, is one hundred miles in length. It is about 14 miles in breadth in the wideſt place(B). Lake Memphremagog lies partly in the ſtate of Vermont, and partly in Lower Canada, the line croſſing it about 7 miles from the ſouthern extremity. This lake communicates with the St Lawrence, by the river St Francis. There are numerous ſmall lakes and ponds of leſs note, ſome of the principal of which are, Willoughby's lake, in Weſtmore, and Bell-water lake in Barton; the former furniſhes fiſh reſembling baſs, ſome weighing 23 pounds. They make a delicious feaſt for the new ſettlers. People travel 20 miles to this lake to procure a winter's ſtock of this fiſh. Leiceſter Pond or Lake, in the town of Saliſbury, is remarkable for the depth and tranſparency of its waters, and for a large ſpecies of trout which it produces, ſome of which have been found to weigh above nineteen pounds. Lake Bombazon, in Caſtleton, gives riſe to a branch of Poultney river, on which iron works have been erected in Fair Haven; and a large pond in the town of Wells. Lake Pleaſant in Greenſborough, abounds in trout of one or two pounds weight, many barrels of which are caught in a ſeaſon.

Few countries are better watered than the ſtate of Vermont. Numerous perennial fountains riſe on almoſt every farm. In this ſtate is the height of land, between Connecticut, Hudſon and St Lawrence. Streams deſcend from the mountains in various directions, and form numerous ſmall rivers, which fertilize the lands through which they paſs and furniſh abundant conveniences for mills and founderies. The river Connecticut forms the eaſtern boundary of Vermont. From its preſent importance to the commerce of this ſtate, and the opening of an Inland navigation from Hartford in Connecticut, to Barnet in Vermont, more than 100 miles from the ſouth line of this ſtate, which has lately been effected, it merits to be noticed in this place. This river has its ſource in the high lands which divide the waters falling ſouthward into the Atlantic, from thoſe which fall into the St Lawrence, about 50, others ſay 25, miles north of latitude 45°. From its northernmoſt part, to latitude 45° it is the boundary between the United States and the Britiſh dominions in America. The eaſtern, or principal branch of Connecticut river riſes in New Hampſhire, and runs north, then making a ſemi-circle, turns to the ſouth, and runs nearly ſouth about 40 miles below lat. 45°; then about 40 more it runs S. W. till it comes to Haverhill; then it runs ſouth to Northfield; below Northfield is a very large bend to the weſtward, and ſoon after to the eaſt again. Thence it proceeds, with ſome meanders, about Northampton and Hadley, nearly ſouth to Hartford, and thence ſoutheaſterly to Saybrook, where it empties itſelf into the ſound. Its length, from its ſource to the ſea, including all its turnings, is nearly four hundred miles, and it croſſes four parallels of latitude. Loaded boats aſcend from Hartford in Connecticut, to the mouth of Wells river, and even as far as Barnet near the foot of the falls, about two hundred and twenty miles from the ſea. In this courſe the navigation is interrupted by the Falls at Hadley, (which in one place deſcend *thirty feet*, and with amazing grandeur, though not in a continued ſheet. The deſcent is greater than in any one place at Bellows Falls) Miller's Falls, at and near Northfield; Bellows Falls, between Rockingham in Vermont, and Walpole in New Hampſhire; Queechy Falls, a little below the mouth of the river of that name, and White River Falls, four and an half miles below Dartmouth College. Companies have been formed by the ſeveral ſtates of Maſſachuſetts, New Hampſhire and Vermont, for the purpoſe of removing theſe obſtructions; and their object is now nearly accompliſhed. All the falls in this river, except Queechy and White River Falls, are locked.

The falls of Queechy are but a ſlight obſtruction. The falls or rapids of White River, have three diſtinct bars, which make a portage of three miles. In ſome parts, the water falls 20 feet.

At the mouth of Queechy, commonly called Water Queechy river, there is one of the moſt beautiful caſcades in New England. The river, here about 258 feet wide, pours over a ledge of rocks 40 feet high, in an almoſt perpendicular manner, juſt broken enough to throw the water in every fantaſtical and delightful form.

Many ſmaller rivers fall into Connecticut river, Memphremagog, Lake Champlaine, and the Hudſon.

The ſouth branch of Nullegan riſes in Random, and interlocks with the head of the Clyde. By theſe rivers the Indians formerly came in canoes from Lake Memphremagog to Connecticut river; the carrying place from one river to the other is about a mile. It croſſes the line between Random and Calderſburgh.

The rivers and lakes abound with various kinds of fiſh. Shad are taken in Connecticut river, as high as Bellows Falls, over which they never paſs. Salmon in plenty have heretofore been caught in the ſpring, the whole length of Connecticut river, and in moſt of its tributary ſtreams; but few, however, of late years. A ſmall ſpecies of ſalmon is taken in Lake Champlaine, the Winouſki, or Onion river, La Moille and Miſſiſcoui, but in none of the ſouthern rivers. Perch, pike, pickerel, maſkinungas, a very large ſpecies of pickerel, pout, mullet, and a fiſh called lake baſs, are found in great plenty. All the ſtreams abound with ſalmon-trout.

There are handſome bridges built over the Connecticut at Bellows Falls, Windſor and Hanover.

Beſides the numerous ſprings of freſh water, there are ſome chalybeate ſprings. There is a ſpring in Orwel, near

(B) The ſtate of New York has, by an act of the legiſlature, eſtabliſhed a company for the purpoſe of opening an inland navigation, by the Hudſon, from Lanſingburgh to fort Edward, and from fort Edward to Wood Creek and Lake Champlaine. The work is now in forwardneſs, and, when completed, will open to Vermont a water communication with Lanſingburgh, Albany and New York: The whole of this inland navigation will be three hundred and ſeventy miles, from latitude 45° to New York.

Vermont. near Mount Independence, and another in Bridport, which produce the Epfom falts.

There is alfo a curious mineral fpring on fome low land over againft the great Ox Bow, difcovered about the year 1770.

Vermont is divided, from north to fouth, by a high chain of mountains. This chain has, from the evergreens with which it is covered in many places, obtained the name of *Green Mountain*, from which the name of *Vermont* is derived to the ftate. The fouthern extremity is called Weft Rock, a precipice about three miles from New Haven, in Connecticut; thence the mountain ranges northward, rifing in height, as it advances through Connecticut, Maffachufetts and Vermont. The hills in Fairfield county are a principal branch, on the coaft of the Green Mountains. Towards Lake Memphremagog it fpreads into a high plain country, exceedingly fertile, and paffes into the province of Quebec. After having formed the rapids of St Francis, it collects into a high range of mountains, which terminate near the St Lawrence. From Maffachufetts line, more than 80 miles to the north, the weftern verge of the Green Mountain is from twenty to thirty miles on a ftraight line from Connecticut river. Almoft the whole of this country is formed with mountains ranging parallel with the courfe of Connecticut river. The weft range, which continues unbroken, with few exceptions, nearly through the ftate, is, in general, much the higheft. On the eaft they decreafe gradually to the meadows, and fometimes to the edge of the river. Thefe laft are interfected by the rivers which run into the Connecticut, in a direction nearly from the northweft to the foutheaft. The vallies, or rather glens, which feparate thefe ranges, are generally narrow, and moftly covered with hemlock, fir and fpruce.

About 100 miles from Maffachufetts line, between the waters of White river and Winoufki, or Onion river, there paffes off to the northeaft, a range of high lands, frequently rifing into very elevated mountains. This runs parallel with Connecticut river; the height being from ten to fifteen miles diftant, as far as the north line of the ftate. The weftern range continues northward, fometimes falling below the clouds, fometimes rifing above them. Between thefe two ranges, extending from twenty to thirty miles in breadth, is a beautiful champaign country, fecond in fertility, perhaps, to none in Vermont.

The moft remarkable mountains in the ftate, are Mount Anthony, between Bennington and Pownal, Stratton Mountain, Danby Mountain, Kellington Peaks, Kingfton Mountain, Camel's Rump, Mansfield Mountain, a very high mountain between Kelly Vale and Belvidere, Upper Great Monadnock, quite in the N. E. corner of the ftate, and Afcutney, between Windfor and Weatherfield. On the weft of the Green Mountain, there is one, and in fome places, two or three ranges of fmaller mountains, though frequently interrupted. Thefe extend as far as the north line of the county of Rutland: From that, to the latitude of forty-five degrees, one hundred miles in length, and from twenty to thirty miles in breadth, between Lake Champlaine and the Green Mountain, is a fine tract of land, abounding with only moderate hills. Through this whole extent, few tracts can be found unfit for cultivation.

It is remarkable that the hills and mountains are generally covered on the eaft fides with what is called hard wood, fuch as birch, beach, maple, afh, elm, and butternut; the weft fide is generally covered with evergreens. Vermont.

The climate, foil, productions, and animals differ little from thofe in New England.

The trade from this ftate is principally to Hartford, Bofton and New York. Some little trade is carried on with the province of Quebec. The remittances to Quebec are moftly made in lumber, fuch as boards, plank, fquare timber and ftaves, by Lake Champlaine and the St Lawrence. The articles of export to Hartford, Bofton, Portland and New York, are horfes, beef, pork, butter, cheefe, wheat, wheat flour, iron, nails, pot and pearl afhes. Of the two laft articles, one thoufand tons were made in the ftate in the year 1791.

The number of people in Vermont, according to the cenfus taken in 1790, was 85,589. The inhabitants of Vermont confift principally of emigrants from Maffachufetts and Connecticut, and their defcendants. There have been fome from Rhode Ifland, New Hampfhire, New York, and New Jerfey. Two towns in Caledonia county are moftly peopled from Scotland, and are Prefbyterians, partly of the Seceffion, and partly of the covenanted Church. The manners of the people are the fame as thofe of the ftates from whence they emigrated. The body of the inhabitants are congregationalifts. The other denominations are baptifts, epifcopalians, quakers, and a few methodifts. The ftate is rapidly peopling. In 1788, the townfhip of Danville, in the county of Orange, was a wildernefs without a fingle family. In 1792 they had two confiderable companies of militia; befide a company of light infantry, dreffed in uniform.

The inhabitants of this ftate are an affemblage of people from various places, of different fentiments, manners and habits. They have not lived together long enough to affimilate and form a general character. Affemble together, in imagination, a number of individuals of different nations; confider them as living together amicably, and affifting each other through the toils and difficulties of life, and yet rigoroufly oppofed in particular religious and political tenets; jealous of their rulers, and tenacious of their liberties, (difpofitions which originate naturally from the dread of experienced oppreffion, and the habit of living under a free government)—and you have a pretty juft idea of the character of the people of Vermont. Indolence is never a characteriftical feature of the fettlers of a new country. Emigrants in general are active and induftrious. The oppofite characters have neither fpirit nor inclination to quit their native fpot. The inference is, that Vermont is peopled with an active, induftrious, hardy, frugal race; as is really the cafe. And as it is a maxim that the inhabitants of all new countries grow virtuous before they degenerate, it will moft probably be fo in Vermont.

The inhabitants of the feveral towns feem generally difpofed, as foon as they are able, to fettle a minifter of the gofpel among them. Miffionaries, from Connecticut and Maffachufetts, to the new and fcattered fettlements, have been generally well received and treated with grateful refpect and kindnefs.

In 1796 there were, on the militia rolls, 19,500 men. Thefe were formed into 4 divifions, confifting of 8 brigades.

gades and 22 regiments. The increafe fince may be eftimated according to the increafe of inhabitants. The bravery of the *Green Mountain Boys* is proverbial.

In a new country, like Vermont, few have leifure to attend the arts and fciences beyond the prefent occafions of life. The higher branches of learning are therefore very little taught in this ftate. Numbers, however, are educated in the feminaries of the neighbouring ftates. In October, 1791, the legiflature of the ftate paffed an act for eftablifhing a univerfity at Burlington, on Lake Champlaine, in a delightful fituation, on the fouth fide of the Winoufki, or Onion river, and appointed 10 truftees. The fum of fix thoufand pounds was fecured by donation, part of which was to be applied to the erecting of buildings, and part fettled as a fund for the fupport of the inftitution. There have been referved in the feveral grants made by this ftate about thirty-three thoufand acres of land, for the ufe of the univerfity. This in a few years, will become a very valuable fund. There is in every town, granted by the ftate, confifting of about one hundred, a right of land, containing about three hundred and thirty acres, on an average, referved for the ufe of county grammar fchools; and in every town through the ftate, there is a right for the fupport of town fchools. In no country is common fchooling more attended to. A family of children, who could not read, write, and underftand common arithmetic, would be looked upon as little better than favages. The provifion, in this refpect, is certainly worthy of imitation. The inhabitants of each town are empowered by law to divide it into as many diftricts as fhall be found convenient; to appoint one or more perfons in each diftrict, who, with the felectmen of the town, form a board of truftees for the fchools of that town; and are empowered to leafe all lands and loan monies that belong to the town, for the ufe of fchools, and to profecute or defend any fuit or matter relating to their truft. The inhabitants of each diftrict have likewife a power to appoint a committee of one or more perfons, to raife by tax, on the rateable eftates of the inhabitants of the diftrict, one half of the fum which they may find neceffary for building a fchool-houfe and fupporting a fchool. The remainder of the money is to be raifed by fubfcription, or, if voted by two-thirds of the inhabitants, by a tax in like manner. By thefe means, every clafs of citizens may have accefs to the common fchools.

In five counties, grammar fchools have been eftablifhed, viz.

Towns.	Counties.	Years.
At Norwich,	Windfor,	1785.
Caftleton,	Rutland,	1787.
Peacham,	Caledonia,	1795.
Middlebury,	Addifon,	1797.
St Alban's,	Franklin,	——

The Middlebury academy in 1800, was, by act of Affembly, erected into a college with the ufual charter privileges, and is now flourifhing under the government and inftruction of a prefident and fubordinate officers. The college edifice is the largeft in the ftate.

The academy at Peacham is very flourifhing, and has ample funds in lands appropriated by charter, as has been mentioned. The annual rent of thefe lands, it is expected will, when the lands fhall be leafed, yield an annual income of eight or nine hundred dollars. A handfome donation of a farm, worth 1200 dollars, has lately been made by Mr James Orr, deceafed, of Barnet, originally from Scotland. A large and convenient building has been erected for the accommodation of the ftudents.

A Medical Society was inftituted in this State in 1784, and another in 1794.

The inhabitants of Vermont, by their reprefentatives in convention, at Windfor, on the 25th of December, 1777, declared that the territory called Vermont, was, and of right ought to be, a free and independent ftate; and for the purpofe of maintaining regular government in the fame, they made a folemn declaration of their rights, and ratified a conftitution, which is well known.

The fouth part of the territory of Vermont was formerly claimed by Maffachufetts. As early as the year 1718, that government had granted forty-nine thoufand acres, comprehending part of the prefent towns of Brattleborough, Fulton and Putney, as an equivalent to the colony of Connecticut, for fome lands which had been granted by Maffachufetts within the limits of the Connecticut charter. In the year 1725, the government of Maffachufetts erected a fort in the town of Brattleborough. Around this fort were begun the firft fettlements within the prefent limits of Vermont. On a final fettlement of a difpute between Maffachufetts and New-Hampfhire, the prefent jurifdictional line between Vermont and Maffachufetts, was run and eftablifhed, in the year 1741. From that time until the year 1764, this territory was confidered as lying within the jurifdiction of New Hampfhire. During this period, numerous grants were made; and, after the year 1760, fome confiderable fettlements were begun under the authority of that province. In the year 1764, by order of the king of Britain, this territory was annexed to the province of New York. The government of that province pretended to claim the right of foil, as well as jurifdiction, and held the grants formerly made under New Hampfhire, to be void. This occafioned a long feries of altercation between the fettlers and claimants under New Hampfhire and the government of New York, and which, at the commencement of the late revolution, terminated in the eftablifhment of a feparate jurifdiction in the prefent ftate of Vermont. A particular detail of this controverfy would be unentertaining. It is fufficient to obferve, that on the 17th day of October, 1790, the difpute was finally compromifed, by commiffioners appointed by the ftates of New York and Vermont; and the claims of New York, both to jurifdiction and property, extinguifhed, in confideration of the fum of thirty thoufand dollars to be paid by the ftate of Vermont to that of New York; and on the 4th of March, 1791, Vermont was admitted a member of the federal union. In the late war, between Britain and the United States, the inhabitants of this territory took a very early and active part. Immediately on the news of the battle of Lexington, a company of Volunteers, under the late general Ethan Allen, attacked and took the Britifh garrifon of Crown Point and Ticonderoga. A regiment was commiffioned by Congrefs and continued in fervice under the command of the late colonel Warner. Other troops were raifed and conftantly kept in fervice by the convention of New Hampfhire grants, and afterwards by the ftate of Vermont. The fpirit of thefe

thefe troops, and the militia of the grants, in the battle of Hubberton and Bennington, in the year 1777, and the affiftance which they afforded in the capture of Burgoyne, are well known to the public. General Burgoyne in a letter to the Britifh miniftry, written at Saratoga, makes the following obfervation: "The inhabitants of the New Hampfhire grants, a territory unpeopled and almoft unknown in the laft war, now pour forth by thoufands, and hang like dark clouds on my left."—*Morse.*

VERNON, a place in Suffex county, New-Jerfey, eaft of the fource of Wall Kill, and about 21 miles N. E. of Newtown.—*ib.*

VERRETTES, a fettlement in the French part of the Ifland of St Domingo, on the S. W. bank of Artibonite river; 4 miles S. by E. of the fettlement of Petit Riviere.—*ib.*

VERSAILLES, the chief town of Woodford county, Kentucky; fituated on a fmall ftream which falls into Kentucky river. It contains a court-houfe, ftone gaol, and about 30 houfes, and lies 13 miles W. by S. of Lexington.—*ib.*

VERSHIRE, a townfhip of Vermont, Orange county, adjoining Fairlee, and containing 439 inhabitants. —*ib.*

VERT *Bay*, or *Green Bay*, in the Straits of Northumberland, in N. America, opens to the N. E. oppofite St John's ifland. The head of the bay approximates within 12 miles of the north-eafternmoft branch of the Bay of Fundy. It is about 10 leagues to the N. W. of Tatamagauche Harbour, and ferves in part to feparate the Britifh provinces of Nova-Scotia and New-Brunfwick. —*ib.*

VESPA (See *Encycl.*). A new fpecies of this genus of infects has been lately defcribed by *Cuvier*, in a note read before the Philomathic Society of Paris. It has fome refemblance to the *vefpa nidulans* of Fabricius, which, as is generally known, is a native of certain parts of America. The nefts of the vefpa nidulans are conftructed of a very fine web, of a very folid and pretty white pafte. Their form is that of a bell clofed upon all fides, excepting a narrow hole at the bottom; and they are fufpended from the branches of trees.

The *vefpa* defcribed by Cuvier, which is a native of Cayenne in America, has in general more volume than the preceding fpecies, and its pafte is grey, coarfer, lefs homogeneous, and lefs folid. The bottom of its neft alfo, in lieu of being fhaped funnel-like, is flat, and the orifice appears at one of the fides of the bottom part, and not in the middle. In the country where it is found, this fpecies of wafp is called the *tatou fly* (*mouche tatou*). It differs greatly in form from that which Fabricius has defcribed; it is all entirely of a fhining black; the firft articulation, or joint of its abdomen, is narrow, and in form of a pear; the fecond, larger than the others, is in form of a bell: the wings are brown. The following is the character affigned to it by Cuvier:

Vefpatatua, Nigra, Nitida, Alis fufcis, abdomine pedicellato.

VESPERTILIO (fee *Encycl.*) has been fubjected to fome cruel, but curious experiments, by the Abbé Spallanzani and M. de Jurine. The former of thefe philofophers having let loofe feveral bats in a chamber perfectly dark, found that they flew about in it without any impediment, neither rufhing againft any thing in the apartment, nor touching the walls with their wings. This furprifed him; but imagining that they were conducted by fome glimpfe of light which he did not perceive, he blindfolded them with a fmall and very clofe hood. They then ceafed to fly; but he obferved, at the fame time, that this did not proceed from any deprivation of light, but rather from the conftraint thence occafioned, efpecially when a hood of a very light texture was attended with the fame effect.

He then conceived the idea of pafting up the eyes of the bats with a few drops of fize or gum; but they ftill flew about in the fame manner as if their eyes had been open. As this, however, was not fufficient, he pafted up the eyes of thefe animals with round bits of leather; and this even did not impede them in their flight.

That he might at length be certain of his object, he blinded them entirely, either by burning the cornea with a red hot wire, or by pulling out the pupil with a pair of fmall pincers, and fcooping out the eye entirely. Not contented even with this precaution, he covered the wounds with pieces of leather, that the light might have no influence whatever on the remains of the organs which had been deftroyed. The animals feemed to fuffer very much by this cruel operation; but when they were compelled to ufe their wings, either by day or by night, and even in an apartment totally dark, they flew perfectly well, and with great caution, towards the walls, in order to fufpend themfelves when they wifhed to reft. They avoided every impediment, great or fmall, and flew from one apartment to another, backwards and forwards, through the door by which they were connected, without touching the frame with their wings. In a word, they fhewed themfelves as bold and lively in their flight as any other animals of the fame fpecies which enjoy the ufe of their eye-fight.

Thefe experiments were repeated by M. Jurine, and with the fame refults. Spallanzani had fuppofed that the bat poffeffed fome organ or fenfe which is wanting in the human fpecies, and which fupplies to thefe animals the place of vifion; and Jurine determined to afcertain the truth or falfehood of this hypothefis by anatomical refearches. During the courfe of thefe, he found the organ of hearing very great in proportion to that of other animals, and a confiderable nervous apparatus affigned to that part. The upper jaw alfo is furnifhed with very large nerves, which are expanded in a tiffue on the muzzle.

M. Jurine then extended his experiments to the organ of hearing and that of fmell. Having put a fmall hood on a long eared bat, it immediately pulled it off, and flew. He ftopped up its ears with cotton; but it freed itfelf in the like manner from that inconvenience. He then put into its ears a maftic of turpentine and wax. During the operation the animal fhewed a great deal of impatience, and flew afterwards very imperfectly.

A long-eared bat, the ears of which had been bound up, flew very badly: but this did not arife from any pain occafioned by the ligature; for when its ears were fewed up, it flew exceedingly well. In all probability the animal would have preferred having its ears bound up to having them fewed. Sometimes it flew towards the cieling, extending its muzzle before it fettled.

M. Jurine poured liquid pomatum into the ears of a bat which enjoyed the ufe of its fight. It appeared to be much affected by this operation; but when the fubſtance was removed it took flight. Its ears were again filled, and its eyes were taken out; but it flew then only in an irregular manner, without any certain or fixed direction.

The ears of a horſe-ſhoe bat, which had the uſe of its ſight, were filled with tinder mixed with water. It was uneaſy under the operation, and appeared afterwards reſtleſs and ſtunned; but it conducted itſelf tolerably well. On being blinded, it ruſhed with its head againſt the ceiling, and made the air reſound with ſtrokes which it gave itſelf on the muzzle. This experiment was repeated on other bats with the like effects.

The tympanum of a large horſe-ſhoe bat was pierced with a pin (*trois quart*). The animal appeared to ſuffer much from the operation, and fell down in a perpendicular direction when thrown into the air. It died next morning. The ſame effect was produced on piercing the tympanum of a long-eared bat with a needle.

The author then made very accurate reſearches on the difference between the organiſation of the brain of theſe two kinds of bats; and, after a careful diſſection, found that the eye of the long-eared bat is much larger than that of the horſe-ſhoe bat, but that the optic nerve is proportioned to it. The outer part of the ear of the former is much larger than that of the latter, but the interior part is ſmaller.

The horſe-ſhoe bat is indemnified for this difference by a greater extenſion of the organ of ſmell, as evidently appears when the external elevations and irregularities of its muzzle are examined. When it is about to take flight, it agitates its noſe much more than the long-eared bat.

From theſe experiments, the author concludes: *Firſt*, That the eyes of the bat are not indiſpenſably neceſſary to it for finding its way; *ſecondly*, That the organ of hearing appears to ſupply that of ſight in the diſcovery of bodies, and to furniſh theſe animals with different ſenſations to direct their flight, and enable them to avoid thoſe obſtacles which may preſent themſelves.

VESSEL *Bay*, on the eaſt ſhore of Lake Champlain, ſets up to the N. E. in the townſhip of Charlotte, in Vermont.—*Morse.*

VIBRATION Figures, are certain figures formed by ſand or very dry ſaw-duſt, on a vibrating ſurface, which is connected with the ſenſation of ſound in our organs of hearing. If the ſurface, on which the figures are to be formed, be ſtrewed over with bodies eaſily put in motion, theſe, during the vibration, remain on the parts at reſt, and are thrown from the parts in motion. The form of the parts at reſt, which will be ſhewn by the ſand that remains unmoved, and which, in general, is ſymmetric, is called a *vibration figure*. To produce ſuch a figure, nothing is neceſſary but to know the method of bringing that part of the ſurface which you wiſh not to vibrate into a ſtate of reſt, and of putting in motion that which you wiſh to vibrate. On this depends the whole expertneſs of producing vibration figures.

Thus take a ſquare piece of glaſs, pretty thin, and very ſmooth, ſuch as that uſed for windows, about four or five inches over, or even more. Smooth it at the edges on a grinding-ſtone; ſtrew a little ſaw-duſt over its ſurface, and lay hold of it gently with the thumb and fore-finger of the left hand. Holding it thus by the middle, with the right hand rub a violin bow ſoftly againſt one of its edges, drawing the bow either up or down in a direction almoſt perpendicular to the ſurface of the glaſs, and you will ſee a tremulous movement, and the whole duſt leap about. If the bow be exactly in the middle of one of the ſides, the duſt will arrange itſelf almoſt in the direction of the two diagonals, dividing the ſquare into four iſoſceles triangles. If the bow be applied at a quarter only of the diſtance of the one corner from the other, the duſt will arrange itſelf in ſuch a manner as to be found in the two diameters of the ſquare, dividing it into four equal ſquares. At other times, when the bow deviates a little, the duſt forms a figure like a double C, when the two letters are joined back to back. If the ſquare be held by the two extremities of the diameter oppoſite to that againſt which the bow is applied, the duſt will form a kind of oval, one of the axes of which will be the ſame diameter. If the glaſs be of a circular figure, and be held by the middle, the duſt will arrange itſelf in ſuch a manner as to form the ſix radii of a regular hexagon. Theſe diſcoveries were made by Dr Chladni, about the time that he invented the muſical inſtrument, to which he gave the name of euphon (ſee that article, *Suppl.*); and as he found the vibration figures to vary in form with the various tones produced by the vibrating ſubſtances, a proſecution of his experiments may probably contribute to throw new light on the philoſophy of muſical ſounds. We ſhall therefore give, from the 3d volume of *Neues Journal der Phyſik*, by Profeſſor Gren, a few directions for making ſuch experiments.

Any ſort of glaſs may be employed, provided its ſurface be ſmooth; and when the plate has acquired the proper vibration, it ſhould be kept in that ſtate for ſome ſeconds, by continuing to rub it with the bow. The figures will thus be accurately formed.

Such plates ſhould be procured as are pretty equal in thickneſs. It may be ſaid, in general, that a plate the thinner it is will be ſo much the fitter for theſe experiments, though in this reſpect there is a certain minimum. In ſmall plates, ſuch as thoſe that are circular, and not above ſix inches in diameter, the obſervation is general; but in larger plates too great thinneſs is prejudicial. Beſides, it will be found that very thin glaſs is commonly very uneven, and muſt therefore be unfit for the experiments.

In practiſing the experiments, it will be proper to have plates of different ſizes; and the ſand employed ſhould not be too fine. In other words, it muſt be of ſuch a nature that when you incline the glaſs-plate it may readily roll off; becauſe, in that caſe, it will be eaſily thrown from the vibrating parts. It will be of advantage that it be mixed with fine duſt, which ſhews peculiar phenomena during the experiments, as it collects itſelf at one place of the vibrating part.

The plate muſt be equally beſtrewed with ſand, and not too thick, as the lines will then be exceedingly fine, and the figures will acquire a better defined appearance.

VICIOSAS *Iſlas*, iſles of the Bay of Honda, on the coaſt of Honduras, or the Spaniſh Main.—*Morse.*

VICTORIA, an iſland on the coaſt of Brazil, eaſtward of St Sebaſtian's Iſland.—*ib.*

VICTORY, *Cape*, is the extreme N. W. point of the ſtraits of Magellan, at the opening to the S. Pacific Ocean. S. lat. 52 15, W. long. 76 40.—*ib.*

VICTORY, a townſhip of Vermont, ſituated in Eſſex county, and bounded eaſt by Guildhall, on Connecticut river.—*ib.*

VIENNA, a port of entry and poſt-town of the eaſtern ſhore of Maryland, Dorcheſter county, on the weſt ſide of Nanticoke river, about 15 miles from its mouth. It contains about 30 houſes, but carries on a briſk trade with the neighbouring ſea-ports, in lumber, corn, wheat, &c. Its foreign exports in 1794, amounted to 1,667 dollars. It is 15 miles N. W. of Saliſbury, 32 S. S. E. of Eaſton, and 150 S. S. W. of Philadelphia.—*ib.*

VIENNA, the capital of Greene county, Kentucky; ſituated on the north ſide of Green river, about 158 miles W. S. W. of Lexington.—*ib.*

Hutton's Mathematical Dictionary.

VIETA (Francis), a very celebrated French mathematician, was born in 1540 at Fontenai, or Fontenai-le-Comté, in Lower Poitou, a province of France He was Maſter of requeſts at Paris, where he died in 1603, being the 63d year of his age. Among other branches of learning in which he excelled, he was one of the moſt reſpectable mathematicians of the 16th century, or indeed of any age. His writings abound with marks of great originality, and the fineſt genius as well as intenſe application. His application was ſuch, that he has ſometimes remained in his ſtudy for three days together without eating or ſleeping. His inventions and improvements in all parts of the mathematics were very conſiderable. He was in a manner the inventor and introducer of Specious Algebra, in which letters are uſed inſtead of numbers, as well as of many beautiful theorems in that ſcience. He made alſo conſiderable improvements in geometry and trigonometry. His angular ſections are a very ingenious and maſterly performance: by theſe he was enabled to reſolve the problem of Adrian Romanus, propoſed to all mathematicians, amounting to an equation of the 45th degree. Romanus was ſo ſtruck with his ſagacity, that he immediately quitted his reſidence of Wirtzbourg in Franconia, and came to France to viſit him, and ſolicit his friendſhip. His Apollonius Gallus, being a reſtoration of Apollonius's tract on Tangencies, and many other geometrical pieces to be found in his works, ſhew the fineſt taſte and genius for true geometrical ſpeculations.—He gave ſome maſterly tracts on Trigonometry both plane and ſpherical, which may be found in the collection of his works, publiſhed at Leyden in 1646, by Schooten, beſides another large and ſeparate volume in folio, publiſhed in the author's life-time, at Paris, in 1579, containing extenſive trigonometrical tables, with the conſtruction and uſe of the ſame, which are particularly deſcribed in the introduction to Dr Hutton's Logarithms, p. 4. &c. To this complete treatiſe on trigonometry, plane and ſpherical, are ſubjoined ſeveral miſcellaneous problems and obſervations; ſuch as, the quadrature of the circle, the duplication of the cube, &c. Computations are here given of the ratio of the diameter of a circle to the circumference, and of the length of the ſine of 1 minute, both to a great many places of figures; by which he found that the ſine of 1 minute is

between 2908881959
and 2908882056;

alſo the diameter of a circle being 1000, &c. that the perimeter of the inſcribed and circumſcribed polygon of 393216 ſides will be as follows, viz. the

perim. of the inſcribed polygon - 31415926535
perim. of the circumſcribed polygon 31415926537

and that therefore the circumference of the circle lies between thoſe two numbers.

Vieta having obſerved that there were many faults in the Gregorian Kalendar, as it then exiſted, compoſed a new form of it, to which he added perpetual canons, and an explication of it, with remarks, and objections againſt Clavius, whom he accuſed of having deformed the true Lelian reformation, by not rightly underſtanding it.

Beſides theſe, it ſeems a work, greatly eſteemed, and the loſs of which cannot be ſufficiently deplored, was his *Harmonicon Cœleſte*, which being communicated to father Merſenne, was, by ſome perfidious acquaintance of that honeſt minded perſon, ſurreptitiouſly taken from him and irrecoverably loſt, or ſuppreſſed, to the great detriment of the learned world. There were alſo, it is ſaid, other works of an aſtronomical kind, that have been buried in the ruins of time.

Vieta was alſo a profound decipherer, an accompliſhment that proved very uſeful to his country. As the different parts of the Spaniſh monarchy lay very diſtant from one another, when they had occaſion to communicate any ſecret deſigns, they wrote them in ciphers and unknown characters during the diſorders of the league. The cipher was compoſed of more than 500 different characters which yielded their hidden contents to the penetrating genius of Vieta alone. His ſkill ſo diſconcerted the Spaniſh councils for two years, that they publiſhed it at Rome, and other parts of Europe, that the French king had only diſcovered their ciphers by means of magic.

VILLA *de Moſc*, a town in the province of Tabaſco, 4 leagues from the town of Eſtape, on Tabaſco river.—*Morse.*

VILLA *Hermoſo*, a town of Mexico or New-Spain, near the mouth of a river which falls into the Bay of Campeachy, and Gulf of Mexico.—*ib.*

VILLA *Nova*, in Brazil, about 120 miles weſt of Porto Seguro, and as far S. E. by S. of Carloſa.—*ib.*

VILLA *Rica*, or *Almeria*, a town of Tlaſcala or New-Spain, in N. America. It ſtands on the coaſt on a ſmall river, having an indifferent port, but in a better air than Vera Cruz, 20 leagues north of the latter. A clandeſtine trade is carried on here between ſome of the Spaniſh merchants on the ſhore, and French of St Domingo and Martinique.—*ib.*

VILLIA, *La*, a town and river of Veragua and Guatimala audience, in New-Spain. It is about 7 leagues from Nata, bordering on Panama. The river is very large, and at low water breaks at the mouth as on a flat ſhore; ſo that large ſhips anchor within cannon ſhot, but barks of about 40 tons may go up about a league and a half. The harbour is a quarter of a league above the town. About a league to the windward, is a large rock, generally covered with vaſt numbers of wild fowl.—*ib.*

VINALHAVEN, a townſhip on the coaſt of the Diſtrict of Maine, in Hancock county, containing 578 inhabitants. It is ſouth-eaſt of Deer Iſland, and 250 miles from Boſton.—*ib.*

VINCENTS,

VINCENTS, *Fort*, in the N. W. Territory, ftands on the eaft fide of Wabafh river, 150 miles from its mouth. It was erected in the year 1787, in order to repel the incurfions of the Wabafh Indians, and to fecure the weftern lands from intruding fettlers. It has four fmall brafs cannon, and is garrifoned by a Major and 2 companies. The town of Vincents contained, in 1792, about 1,500 fouls, principally of French extraction. It is 300 miles S. W. of Fort Recovery. N. lat. 39 15, W. long. 90 7. They raife Indian corn, and wheat; and tobacco of an extraordinary good quality; fuperior, it is faid, to that produced in Virginia. They have a fine breed of horfes, brought originally by the Indians from the Spanifh fettlements, on the weftern fide of the Miffiffippi. Here are large herds of fwine, and black cattle, and the fettlers deal with the Indians for furs and deer-fkins. Hemp of a good quality grows fpontaneoufly in the low lands of the Wabafh; as do grapes, of which the inhabitants make a fufficient quantity, for their own confumption, of well tafted red wine. Hops, large and good, are found in many places, and the lands are particularly adapted to the culture of rice. All European fruits thrive well both here, and in the country bordering on the river Ohio.—*ib.*

VINCENT, *St*, one of the 14 captainfhips of Brazil, in S. America, and the moft foutherly one. The capital is an inconfiderable place, with only about 60 houfes, and the harbour will not receive large veffels. It has 5 or 6 fugar-mills, and lies 76 leagues fouth-weft of Rio Janeiro. S. lat. 23 40, W. long. 45 10.—*ib.*

Vincent, *St*, a town on the coaft of Brazil; fituated on Amiaz Ifland, in the Bay of All Saints or Sanctos; in which ifland is the city of Dos Sanctos, the ifland lying on the weft fide of the entrance into the ifland. S. lat. 24 15, W. long. 46 30.—*ib.*

Vincent, *de la Pazes*, *St*, or *Onda*, a town of Popayan and Terra Firma, in S. America; about 25 miles eaftward of San Sebaftian, with a port where canoes from Carthagena and St Martha unload their merchandize. —*ib.*

Vincent, a townfhip of Pennfylvania, fituated in Chefter county.—*ib.*

Vincent, *Port St*, on the coaft of Chili, in the S. Pacific Ocean, is 6 miles N. N. E. of the mouth of the river Biobio, having a fafe harbour and fecure againft all winds but the weft, which blows right in. Talcaguama Port is 6 miles to the northward of it.—*ib.*

VINCENTO, a channel which goes in on the weft fide of the channel of Amiaz Ifland, in the Bay of All Saints, on the coaft of Brazil.—*ib.*

VINER'S *Ifland*, in Hudfon's Bay, lies N. E. of the mouth of Albany river.—*ib.*

VINEYARD, *New*, a plantation in Lincoln county, Diftrict of Maine, on the two north-eafternmoft branches of Sandy river, about 59 miles N. by W. of Brunfwick, and 37 N. W. of Hallowell.—*ib.*

Vineyard *Sound*, on the fouth-eaftern coaft of Maffachufetts, is the ftrait or paffage between the Elizabeth Iflands and Martha's Vineyard. The S. W. channel of which, about 7 miles broad, has Gay Head on the S. E. and the Sow and Pigs on the N. W.—*ib.*

VINTAIN, a town fituated about two miles up a creek on the fouthern fide of the river Gambia. It is much reforted to by Europeans, on account of the great quantities of bees-wax which are brought hither for fale. The wax is collected in the woods by the Feloops, a wild and unfociable race of people. Their country, which is of confiderable extent, abounds in rice; and the natives fupply the traders, both on the Gambia and Caffamanfa rivers, with that article, and alfo with goats and poultry, on very reafonable terms. The honey which they collect is chiefly ufed by themfeves in making a ftrong intoxicating liquor, much the fame as the mead which is produced from honey in Great Britain.

In their traffic with Europeans, the Feloops generally employ a factor, or agent, of the Mandingo nation, who fpeaks a little Englifh, and is acquainted with the trade of the river. This broker makes the bargain; and, with the connivance of the European, receives a certain part only of the payment; which he gives to his employer as the whole; the remainder (which is very truly called the *cheating money*) he receives when the Feloop is gone, and appropriates to himfelf as a reward for his trouble. Vintain, according to Mr Park, from whofe valuable travels this account of the Feloops is taken, is fituated in 13° 9′ North Lat. and 15° 56′ Long. Weft from Greenwich.

VIPER *Key*, one of the Tortugas, on the coaft of Florida; 5 miles N. eaftward of Duck Key, and 3½ E. of Old Matacombe.—*Morse.*

VIRGIL, a military townfhip of Onondago county, New-York, having Dryden on the W. Cincinnatus E. Homer N. and on the S. 230,000 acres of land on Sufquehannah river, ceded to the State of Maffachufetts. It is under the jurifdiction of Homer, which was incorporated in 1794.—*ib.*

VIRGIN GORDA, one of the principal of the Virgin Ifles, in the Weft-Indies. It lies 4 leagues to the E. of Tortula, and of a very irregular fhape. Its greateft length from E. to W. is about 18 miles; is worfe watered than Tortula, and has fewer inhabitants. A mountain which rifes in the centre, is affirmed to contain a filver mine. N. lat. 18 18, W. long. 64.—*ib.*

VIRGIN *Iflands*, a group of fmall iflands in the Weft-Indies, to the eaftward of the ifland of Porto Rico, belonging to different European powers. They extend for the fpace of 24 leagues, from E. to W. and about 16 leagues from N. to S. and nearly approach the eaft coaft of Porto Rico. They are every way dangerous to navigators, though there is a bafon in the midft of them of 6 or 7 leagues in length, and 3 or 4 in breadth, in which fhips may anchor and be fheltered and land-locked from all winds; which is named the Bay of Sir Francis Drake, from his having paffed through them to St Domingo. Thofe which are occupied and inhabited appear under their refpective names; but others are deftitute both of names and inhabitants. The Britifh and Danes poffefs moft of them; but the Spaniards claim thofe near Porto Rico. The ifland of *Virgin Gorda*, on which depend Anegada, Nicker, Prickley Pear, Mofquito Iflands, Camanoes, Dog-Iflands, the Fallen City, the Round Rock, Ginger, Cooper's, Salt, Peter's and Dead Cheft, belong to the *Britifh*; as alfo *Tortola*, on which depend Joft Van Dykes, Little Van Dykes, Guana, Beef, and Thatch Iflands. To the *Danes* belong *St Thomas's Ifland*, on which Brafs, Little Saba, Buck Ifland, Great and Little St James, and Bird Ifland are dependant; with *St John's*, to which depend Lavango, Cam, and Witch Iflands; and they have alfo Santa Ifland, or St Croix.

The

The *Spaniards* claim Serpent's Ifland, (called by the Britifh Green Ifland) the Tropic Keys, Great and Little Paffage Ifland, and particularly Crab Ifland. The Booby birds are fo tame on Bird Ifland, that a man, it is faid, in a fhort time, may catch fufficient in his hand to fupply a fleet. Thefe iflands lie about lat. 18 20 N. and the courfe through them, with due attention, is perfectly fafe at weft by N. and weft-north-weft as far as the weft end of the fourth ifland. Leave this on the ftarboard fide, and the ifland called Foul Cliff, on the larboard, between which there is 16 fathoms, and a free channel to the weftward, before there is any alteration of the courfe; for though there be but fix or feven fathoms in fome places, it is no where fhoaler, and in fome places there is from 16 to 20 fathoms. The ifland of Anguilla, on the north fide of St Martin's Ifland, is E. S. E. from them.—*ib.*

VIRGINITY, the teft or criterion of a virgin; or that which intitles her to the denomination. See Hymen, *Encycl.*

VIRGIN MARY *Cape*, the N. E. point of the entrance of the ftraits of Magellan, in the S. Atlantic Ocean, is a fteep white cliff. S. lat. 52 32, W. long. 67 54. The variation of the compafs, in 1780, was 24 30, E.—*Morse.*

VIRGIN *Rocks*, off the S. E. part of the coaft of Newfoundland Ifland, 20 leagues S. E. of Cape Race. N. lat. 46, according to others, lat. 46 30, and thefe laft fay 17 or 18 leagues S. E. by E. of Cape Ballard. —*ib.*

VISION. In the article Optics, n° 154. (*Encycl.*), it is faid, that as we have a power of contracting or relaxing the *ligamenta ciliaria*, and thereby altering the form of the cryftalline humour of the eye, we hence fee objects diftinctly at different diftances. It appears, however, from fome experiments made by Mr Everard Home and Mr Ramfden, in the year 1794, that this power of contracting and relaxing the ligamenta ciliaria is not alone fufficient to account for the phenomenon. Converfing with Mr Home on the different ufes of the chryftalline humour, Mr Ramfden faid, that as that humour "confifts of a fubftance of different denfities, the central parts being the moft compact, and from thence diminifhing in denfity gradually in every direction, approaching the vitreous humour on one fide, and the aqueous humour on the other, its refractive power becomes nearly the fame with that of the two contiguous fubftances. That fome philofophers have ftated the ufe of the chryftalline humour to be, for accommodating the eye to fee objects at different diftances; but the firmnefs of the central part, and the very fmall difference between its refractive power near the circumference and that of the vitreous or the aqueous humour, feemed to render it unfit for that purpofe; its principal ufe rather appearing to be for correcting the aberration arifing from the fpherical figure of the cornea, where the principal part of the refraction takes place, producing the fame effect that, in an achromatic object-glafs, we obtain in a lefs perfect manner by proportioning the radii of curvature of the different lenfes. In the eye the correction feems perfect, which in the object-glafs can only be an approximation; the contrary aberrations of the lenfes not having the fame ratio: fo that, if this aberration be perfectly corrected, at any given diftance from the centre, in every other it muft be in fome degree imperfect.

"Purfuing the fame comparifon: In the achromatic object-glafs we may conceive how much an object muft appear fainter from the great quantity of light loft by reflection at the furfaces of the different lenfes, there being as many primary reflections as there are furfaces; and it would be fortunate if this reflected light was totally loft. Part of it is again reflected towards the eye by the interior furfaces of the lenfes; which, by diluting the image formed in the focus of the object glafs, makes that image appear far lefs bright than it would otherwife have done, producing that milky appearance fo often complained of in viewing lucid objects through this fort of telefcope.

"In the eye, the fame properties that obviate this defect, ferve alfo to correct the errors from the fpherical figure, by a regular diminution of denfity, from the centre of the cryftalline outward. Every appearance fhews the cryftalline to confift of laminæ of different denfities; and if we examine the junction of different media, having a very fmall difference of refraction, we fhall find that we may have a fenfible refraction without reflection. Now, if the difference between the contiguous media in the eye, or the laminæ in the cryftalline, be very fmall, we fhall have refraction without having reflection: and this appears to be the ftate of the eye; for although we have two furfaces of the aqueous, two of the cryftalline, and two of the vitreous humour, yet we have only one reflected image; and that being from the anterior furface of the cornea, there can be no furface to reflect it back, and dilute an image on the retina.

"This hypothefis may be put to the teft whenever accident fhall furnifh us with a fubject having the cryftalline extracted from one eye, the other remaining perfect in its natural ftate; at the fame time we may afcertain whether or no the cryftalline is that part of the organ which ferves for viewing objects at different diftances diftinctly. Seeing no reflection at the furface of the cryftalline, might lead fome perfons to infer that its refractive power is very inconfiderable; but many circumftances fhew the contrary; yet what it really is may be readily afcertained by having the focal length and diftance of a lens from the operated eye, that enables it to fee objects the moft diftinctly; alfo the focal length of a lens, and its diftance from the perfect eye, that enables it to fee objects at the fame diftance as the imperfect eye: thefe data will be fufficient whereby to calculate the refractive power of the cryftalline with confiderable precifion.

"Again, having the fpherical aberration of the different humours of the eye, and having afcertained the refractive power of the cryftalline, we have data from whence to determine the proportional increafe of its denfity as it approaches the central part, on a fuppofition that this property corrects the aberration.

"An opportunity prefented itfelf for bringing the obfervations of Mr Ramfden, refpecting the ufe of the cryftalline lens, to the proof. A young man came into St George's Hofpital with a cataract in the right eye. The cryftalline lens was readily extracted, and the union of the wound in the cornea took place unattended by inflammation; fo that the eye fuffered the fmalleft

fmalleft degree of injury that can attend fo fevere an operation. The man himfelf was in health, 21 years of age, intelligent, and his left eye perfect: the other had been an uncommonly fhort time in a difeafed ftate, and 27 days after the operation appeared to be free from every other defect but the lofs of the cryftalline lens.

" A number of experiments were made on the imperfect eye, affifted by a lens, and compared with the perfect eye. The aim of thefe trials, which were judicioufly varied, was to afcertain whether the eye which had been deprived of the cryftalline lens was capable of adjufting itfelf to diftinct vifion at different diftances. Among other refults, the perfect eye, with a glafs of $6\frac{1}{2}$ inches focus, had diftinct vifion at 3 inches; the near limit was $1\frac{7}{8}$ inch, the diftant limit lefs than 7 inches. The imperfect eye, with a glafs $2\frac{2}{10}$ inches focus, with an aperture $\frac{3}{10}$ths of an inch, had diftinct vifion at $2\frac{1}{8}$ inches, the near limit $1\frac{7}{8}$ inch, and the diftant limit 7 inches. The accuracy with which the eye was brought to the fame point, on repeating the experiment, proved it to be uncommonly correct; and as he did not himfelf fee the fcale ufed for admeafurement, there could be no fource of fallacy. From the refult of this experiment, it appears that the range of adjuftment of the imperfect eye, when the two eyes were made to fee at nearly the fame focal diftance, exceeded that of the perfect eye. Mr Ramfden fuggefted a reafon why the point of diftinct vifion of the imperfect eye might appear to the man himfelf nearer than it was in reality; namely, that from the imperfection of this organ he might find it eafier to read the letters when they fubtended a greater angle than at his real point of diftinct vifion. The experiments, however, appear to fhew that the internal power of the eye, by which it is adjufted to fee at different diftances, does not refide in the cryftalline lens, at leaft not altogether; and that if any agency in this refpect can be proved to refide in the cryftalline, the other powers, whatever they may be, are capable of exertion beyond their ufual limits, fo as to perform its office in this refpect.

" From thefe confiderations, and in confequence of other reflections tending to fhew that an elongation of the optical axis is not probably the means of adjuftment, thefe philofophers directed their enquiries to afcertain how far the curvature of the cornea might be fubject to change. They found by trial that this part of the organ poffeffes a degree of elafticity which is very confiderable, both for its perfection and its range; and by anatomical diffection it was found that the four ftraight mufcles of the eye do in effect terminate in the cornea at their tendinous extremities; that the whole external lamina of the cornea could by gentle force be feparated, by means of thefe mufcles, from the eye; fo that the tendons feem loft in the cornea, and this laft has the appearance of a central tendon. It was alfo feen that the central part of the cornea is the thickeft and the moft elaftic.

" Thefe were confiderable advances towards eftablifhing the hypothefis of adjuftment by the external curve of the eye. It remained to be fhewn, by experiments on the living fubject, that this curve does really vary in the due direction, when the mind perceives the diftinct vifible fenfation of objects at different diftances. For this purpofe Mr Ramfden provided an apparatus, confifting of a thick board fteadily fixed, in which was a fquare hole large enough to admit a perfon's face; the forehead and chin refting againft the upper and lower bars, and the cheek againft either of the fides; fo that when the face was protruded, the head was fteadily fixed by refting on three fides; and in this pofition the left eye projected beyond the outer furface of the board. A microfcope, properly mounted, fo as with eafe to be fet in every requifite pofition, was applied to view the cornea with a magnifying power of thirty times. In this fituation, the perfon whofe eye was the object of experiment was defired to look at the corner of a chimney, at the diftance of 235 yards, through a fmall hole in a brafs plate, fixed for that purpofe, and afterwards to look at the edge of the hole itfelf, which was only fix inches diftant. After fome management and caution, which the delicate nature of thefe experiments requires, the motion of the cornea, which was immediately perceptible, became very diftinct and certain. The circular fection of its furface remained in a line with the wire in the field of the microfcope, when the eye was adjufted to the diftant object, but projected confiderably beyond it when adapted to the near one. When the diftant object was only 90 feet from the obferver, and the near object fix inches, the difference in the prominence of the cornea was eftimated at 1-800th of an inch. Thefe experiments were repeated and varied at different times and on different fubjects. The obferver at the microfcope found no difficulty in determining, from the appearance of the cornea, whether the eye was fixed on the remote or the near object.

" From thefe different experiments Mr Home confiders the following facts to have been afcertained:

" 1. That the eye has a power of adjufting itfelf to different diftances when deprived of the cryftalline lens; and therefore the fibrous and laminated ftructure of that lens is not intended to alter its form, but to prevent reflections in the paffage of the rays through the furfaces of media of different denfities, and to correct fpherical aberration.

" 2. That the cornea is made up of laminæ; that it is elaftic, and when ftretched is capable of being elongated 1-11th part of its diameter, contracting to its former length immediately upon being left to itfelf.

" 3. That the tendons of the four ftraight mufcles of the eye are continued on to the edge of the cornea, and terminate, or are inferted, in its external laminæ: their action will therefore extend to the edge of the cornea.

" 4. That in changing the focus of the eye from feeing with parallel rays to a near diftance, there is a vifible alteration produced in the figure of the cornea, rendering it more convex; and when the eye is again adapted to parallel rays, the alteration by which the cornea is brought back to its former ftate is equally vifible."

Mr Home made many other experiments with a view to throw light upon this curious fubject; and the refult of the whole appears to be, that the adjuftment of the eye is produced by three different changes in that organ; an increafe of curvature in the cornea, an elongation of the axis of vifion, and a motion of the cryftalline lens. Thefe changes, in a great meafure, depend upon the contraction of the four ftraight mufcles of the eye.

eye. Mr Ramſden, from computations grounded on the principles of optics and general ſtate of the facts, eſtimates that the increaſe of curvature of the cornea may be capable of producing one-third of the effect, and that the change of place of the lens, and elongation of the axis of viſion, ſufficiently account for the other two-thirds of the quantity of adjuſtment neceſſary to make up the whole.

The following obſervations on Viſion by Doctor David Hoſack of New-York, were read before the Royal Society, May 1, 1794, and the author has politely permitted their inſertion in this work.

"By what power is the eye enabled to view objects diſtinctly at different diſtances? As the pupil is enlarged or diminiſhed according to the greater or leſs quantity of light, and in a certain degree to the diſtance of the object, it would readily occur that theſe different changes of the pupil would account for the phænomena in queſtion. Accordingly anatomiſts and philoſophers, who have written upon this ſubject, have generally had recourſe to this explanation.

"Amuſing myſelf with theſe changes of the pupil, as a matter of curioſity, by preſenting to the eye different objects at different diſtances, I ſoon perceived that its contraction and dilatation were irregular and more limited than had been ſuppoſed; *i. e.* that approaching the object nearer the eye, within a certain diſtance, the pupil not only ceaſed to contract, but became again dilated; and that beyond a few yards diſtance, it alſo ceaſed to dilate: theſe circumſtances immediately occurred as objections to the above explanation; for were it from the contraction and dilatation of the iris alone that we ſee objects at different diſtances, I naturally concluded it ſhould operate regularly to produce its effects; but if to view an object at a few yards diſtance it be enlarged to the utmoſt extent, ſurely it muſt of itſelf be inſufficient to view one at the diſtance of ſeveral miles; for example, the heavenly bodies.

"Another difficulty here preſents itſelf: in viewing the ſun, inſtead of dilating, according to the diſtance, it contracts, obeying rather the quantity or intenſity of the light, than the diſtance of the object. Knowing no other obvious power in the eye itſelf of adapting it to the different diſtances of objects, it occurred to me to inquire, whether the combined action of the external muſcles could not have this effect. I firſt propoſed this query to an optician of eminence in London, and who has written expreſsly on this ſubject. I repeated the ſame queſtion to a celebrated teacher of anatomy. Encouraged by their replies, I have ſince attended more particularly to the ſubject, and hope my inquiries have not been altogether unſucceſsful. As introductory to a more diſtinct view of what I have to advance, it appears neceſſary to premiſe the following obſervations, relative to thoſe general laws of viſion which are more particularly connected with this part of the ſubject, and to which we ſhall have occaſion of frequent reference.

"1ſt. Let ABC, (plate 3 appendix fig. 1.) be an object placed before the double convex lens DE, at any diſtance greater than the radius of the ſphere whereof the lens is a ſegment; the rays which iſſue from the different points of the object, and fall upon the lens, will be ſo bent by the refractive power of the glaſs as to be made to convene at as many other points behind the lens, and at the place of their concourſe they will form an image or picture of the object. The diſtance of the image behind the glaſs varies in proportion to the diſtance of the object before the glaſs; the image approaching as the object recedes, and receding as that approaches. For if we ſuppoſe, (fig. 2.), A and B two radiating points, from which the rays AC, AD, and BC, BD, fall upon the lens CD, it is manifeſt that the rays from the neareſt point A diverge more than thoſe from the more diſtant point B, the angle at A being greater than that of B (A); conſequently the rays from A, whoſe direction is AE and AF when they paſs through the glaſs, muſt convene at ſome point (as G) more diſtant from the lens than the point H, where the leſs diverging rays BK and BL from the point B are made to convene; which may alſo be proved by experiment with the common convex glaſs (B).

"It will be neceſſary to have this propoſition in view, as we ſhall afterwards have occaſion to uſe it in ſhewing, that by varying the diſtance between the retina and the anterior part of the eye we are enabled to ſee objects at different diſtances.

"2d. If an object, as AB, (fig. 3.) be placed at a proper diſtance before the eye (E), the rays which fall from the ſeveral points of the object falling upon the cornea paſs through the pupil, and will be brought together by the refractive power of the different parts of the eye on as many correſponding points of the retina, and there paint the image of the object, in the ſame manner as the images of objects placed before a convex lens are painted upon the ſpectrum, placed at a proper diſtance behind it; thus the rays which flow from the point A are united on the retina at C, and thoſe which proceed from B are collected at D, and the rays from all the intermediate points are convened at as many intermediate points of the retina; on this union of the rays at the retina depends diſtinct viſion. But ſuppoſing the eye of a given form, ſhould the point of union lie beyond the retina, as muſt be the caſe with thoſe from the leſs diſtant object, agreeable to the preceding propoſition; or ſhould they be united before they arrive at the retina, as from the more diſtant object, it is evident that the picture at the retina muſt be extremely confuſed. Now as the rays which fall upon the eye from radiating points at different diſtances have different degrees of divergence, and the divergence of the rays increaſing as the diſtance of the radiating point leſſens, and, *vice verſa*, leſſening as that increaſes; again, as thoſe rays which have greater degrees of divergence, viz. from the nearer objects, require a ſtronger refractive power to bring them together at a given diſtance than what is neceſſary to make thoſe meet which diverge leſs, it is manifeſt, that to ſee objects diſtinctly at different diſtances, either the refractive power of the eye muſt be increaſed or diminiſhed, or the diſtance between the iris and retina be varied, correſponding with the different diſtances of the objects; both

(A) *Euclid*, Book I. Prop. 21.
(B) See *Kepler* Diopt. Poſtul. *Smith's Optics*, *Graveſande*, &c.

both of which probably take place, as will hereafter appear (c).

" Having then eftablifhed thefe as our premifes, we fhall next examine the different principles which have been employed for explaining vifion at different diftances.

" Moft writers upon this fubject refer this power of the eye to the contraction and dilatation of the iris. Within certain limits this would, upon firft examination, as already obferved, appear to be the cafe, fince the pupil enlarges as the object is further removed from the eye, and again contracts as it is brought near. The extent of this principle I have already pointed out; but I fufpect we alfo err in attributing to the difference of diftance what are only effects of different quantities of light, a circumftance in which it is the more eafy to commit error as they are generally proportionate one to the other; *i. e.* as the object is near we require a lefs degree of light, and to exclude what is fuperfluous the iris contracts; but as it is more diftant, a greater quantity of light becomes neceffary, and the iris dilates: thus far we fee the ufe of the enlargement or diminution of the pupil, as the object is more or lefs diftant. But diftinct vifion does not confift in the quantity of light alone, though too much or too little would obfcure the image.

" It is alfo neceffary that the rays which flow from the object fhould fall upon the retina in a certain direction, to form a diftinct picture; but furely the greater or lefs quantity of light, the greater or lefs number of rays, which it is only the property of the iris to diminifh or increafe, cannot alter the direction.

" But there is ftill another argument to prove, that the contraction or enlargement of the pupil is not of itfelf fufficient to produce diftinct vifion at different diftances, viz. that the myopes, whofe pupil contracts and dilates as in other eyes, are ftill unable to adapt the eye to different diftances; and the means by which this is remedied certainly does not confift in a larger or fmaller aperture for the rays to pafs through, but a power of altering their direction, which the change in the fhape of the eye had rendered too convergent. The fame fact is alfo obfervable in thofe who fquint; the pupil in both eyes equally contracts and dilates, but ftill the vifion of one eye is lefs perfect than the other. Another principle upon which it has been attempted to explain this power of the eye, is a fuppofed change in the convexity of the cryftalline lens; the ancients had fome obfcure notion of it, but it has been lately purfued by Mr Thomas Young, in a paper publifhed in the Philofophical Tranfactions of London for 1793. He has endeavoured to demonftrate the exiftence of mufcles in the cryftalline lens, and by their action to account for diftinct vifion at different diftances. This opinion deferves here the more particular examination, having met the attention of the Royal Society, and thereby likely to influence the general opinion upon this fubject.

" That we may not miftake the meaning of the author, I beg leave to premife his defcription of the ftructure of the lens. ' The cryftalline lens of the ox,' he obferves, ' is an orbicular convex tranfparent body, compofed of a confiderable number of fimilar coats, of which the exterior clofely adhere to the interior; each of thefe coats confifts of fix mufcles, intermixed with a gelatinous fubftance, and attached to fix membranous tendons. Three of thefe tendons are anterior, three pofterior; their length is about two-thirds of the femidiameter of their coat; their arrangement is that of three equal and equidiftant rays meeting in the axis of the cryftalline; one of the anterior is directed towards the outer angle of the eye, and one of the pofterior towards the inner angle; fo that the pofterior are placed oppofite to the middle of the interftices of the anterior, and planes paffing through each of the fix, and through the axis, would mark on either furface fix regular equidiftant rays. The mufcular fibres arife from both fides of each tendon, they diverge till they reach the greateft circumference of the coat, and having paffed it, they again converge till they are attached refpectively to the fides of the neareft tendons of the oppofite furface. The exterior or pofterior portion of the fix, viewed together, exhibits the appearance of three penniformiradiated mufcles.'

" In the firft place, to fay nothing of the tranfparency of mufcles, as an argument againft their exiftence, we muft unavoidably fuppofe, as they have *membranous tendons*, which Mr Young informs us he diftinctly obferved, that thefe tendons cannot poffefs the fame degree of tranfparency and denfity with the bellies of thefe mufcles; that is, they muft poffefs fome degree of opacity, or certainly he could not have pointed out their membranous ftructure, nor even the tendon itfelf, as diftinct from the body of the mufcle; and if they have not the fame denfity, from their fituation, and being of a penniform fhape, muft there not be fome irregularity from the difference in the refraction of thofe rays which pafs through the bellies of thofe mufcles, and thofe again which pafs through their membranous tendons? This ftructure then, of confequence, cannot be well adapted for a body whofe regular fhape and tranfparency are of fo much confequence.

" Again, Mr Young defcribes fix mufcles in each layer; but Leeuwenhoek, whofe authority he admits as accurate, relative to the mufcularity of the lens, is certainly more to be attended to in his obfervation of bodies lefs minute, viz. as to the layers themfelves, in which thefe mufcles are found, and which of courfe are larger, and more eafily obferved; but, with his accuracy of obfervation, he has computed, that there are near 2000 laminæ; and according to Mr Young, fuppofing each layer to contain fix mufcles, we have neceffarily, in all, 12,000 mufcles; the action of which certainly exceeds human comprehenfion. I hope this will not be deemed trifling minutenefs, as it is a neceffary and regular confequence, if we admit their exiftence as defcribed.

" But

(c) " Facile enim intelligitur, quo longius radii adveniunt, eo magis effe parallelos; eo minus ergo differre ab axi, et eo minoribus viribus corneæ et lentis cryftallinæ in focum cogi. Ut enim corpus magis diftat, ita fub minori angulo radii adveniunt. Contra fi corpus confpicuum valde vicinum fuerit, radiorum ab eo advenientium angulus eft major, et adeo magis divergentes in oculum incidunt, et viribus egent refringentibus majoribus omnibus denfioribus."—*Haller, Elem. Phyf.* lib. xvi.

"But fecondly, as to the exiftence of thefe mufcles, I cannot avoid expreffing a doubt. With the utmoft accuracy I was capable of, and with the affiftance of the *beft* glaffes, to my difappointment, I cannot bear witnefs to the fame circumftances related by Mr Young, but found the lens perfectly tranfparent; at the fame time, left it might be attributed to the want of habit in looking through glaffes, I beg leave to obferve, that I have been accuftomed to the ufe of them in the examination of the more minute objects of natural hiftory. After failing with the glaffes in the natural vifcid ftate of the lens, I had recourfe to another expedient; I expofed different lenfes before the fire to a moderate degree of heat, by which they became opaque and dry; in this ftate it is eafy to feparate the layers defcribed by Mr Young; but although not fo numerous as noticed by the accurate Leeuwenhoek, ftill they were too numerous to fuppofe each to have contained fix mufcles; for I could have fhewn diftinctly at leaft fifty layers, without the affiftance of a glafs, as was readily granted by thofe to whom I exhibited them.

"But a circumftance which would feem to prove that thefe layers poffefs no diftinct mufcles is, that in this opaque ftate they are not vifible, but confift rather of an almoft infinite number of concentric fibres (if the term be at all appropriate) not divided into particular bundles, but fimilar to as many of the fineft hairs of equal thicknefs, arranged in fimilar order: fee fig. 4, 5, and 6, where the arrangement of the layers and fibres has been painted from the real lens of an ox, and that without the affiftance of a glafs. To obferve this fact, any perfon may try the experiment at pleafure, and witnefs the fame with the naked eye, even feparating many layers and their fibres with the point of a penknife.

"This regular ftructure of layers, and thofe confifting of concentric fibres, is unqueftionably better adapted for the tranfmiffion of the rays of light, than the irregular ftructure of mufcles. It may, perhaps, be urged, that the heat to which I expofed the lens may have changed its ftructure: in anfwer to that I obferve, it was moderate in degree, and regularly applied; of confequence we may prefume, as it appeared uniformly opaque, that every part was alike acted upon; but by boiling the lens, where the heat is, without doubt, regularly applied, we obferve the fame ftructure.

"Thirdly, that it is not from any changes of the lens, and that this is not the moft effential organ in viewing objects at different diftances, we may alfo infer from this undeniable fact, that we can, in a great degree, do without it; as after couching or extraction, by which operations all its parts muft be deftroyed, capfule, ciliary proceffes, mufcles, &c.

"Mr Young afferts, from the authority of Dr Porterfield, that patients, after the operation of couching, have not the power of accommodating the eye to the different diftances of objects; at prefent, I believe the contrary fact is almoft univerfally afferted (D).

"Befides, if the other powers of the eye are infufficient to compenfate for the lofs of this denfe medium, the lens, a glafs of the fame fhape anfwers the purpofe, and which certainly does not act by changing its figure. I grant their vifion is not fo perfect; but we have other circumftances upon which this can be more eafily explained; which will be particularly noticed under the next head. It may not be improper alfo to obferve, that the fpecific gravity of the cryftalline compared with that of the vitreous humour, and of confequence, its denfity and power of refraction, is not fo great as has been generally believed. Dr Bryant Robinfon, by the hydroftatic balance, found it to be nearly as 11 to 10. I have alfo examined them with the inftrument of Mr Schmeiffer, lately prefented to the Royal Society, and found the fame refult; of confequence the cryftalline lens is not fo effentially neceffary for vifion as has been reprefented; efpecially as it is alfo probable, that upon removing it, the place which it occupied is again filled by the vitreous humour, whofe power of refraction is nearly equal. At the fame time we cannot fuppofe the lens an unneceffary organ in the eye, for nature produces nothing in vain; but that it is not of that indifpenfable importance, writers upon optics have taught us to believe.

"Fourthly, Mr Young tells us, he has not yet had an opportunity of examining the human cryftalline; and grants, that from the fpherical form of it in the fifh, fuch a change as he attributes to the lens in quadrupeds cannot take place in that clafs of animals. The lenfes which I have examined in the manner abovementioned were the human, thofe of the ox, the fheep, the rabbit, and the fifh, and in all the fame lamellated ftructure is obfervable; even in the fpherical lens of the fifh thefe lamellæ are equally diftinct, but without the fmalleft appearance of a mufcle.

"From thefe circumftances I cannot avoid the conclufion, that they do not exift; at the fame time I am perfuaded that Mr Young met with appearances which he fuppofed were mufcles; but I am fatisfied he will readily acknowledge, that the examination of the cryftalline lens in its vifcid glutinous ftate, is not only attended with much difficulty, but that the fmalleft change of circumftances might lead to error; which I apprehend may, probably, have been the cafe in that inftance.

"Upon examining it after boiling, or expofing it to a gradual degree of heat before the fire, when it may be handled with freedom, he will readily obferve (without a glafs) the numerous lamellæ, and the arrangement of their fibres, which I have defcribed.

"Another opinion has been fanctioned by many refpectable writers, of the effects of the ciliary proceffes in changing the fhape and fituation of the lens; fome fuppofed

(D) "Et lente ob cataractam extracta vel depofita oculum tamen ad varias diftantias videre, ut in nobili viro video abfque ullo experimento quo eam facultatem recuperaverit. Etfi enim tunc ob diminutas vires quæ radios uniunt, æger lente vitrea opus habet, eadem tamen lens in omni diftantia fufficit."—*Haller, El. Phyf.*

"La lentille criftalline n'eft cependant point de première neceffité pour la vifion. Aujourd'hui, dans l'opération de la cataracte on l'enlève entièrement, et la vifion n'en fouffre point."—*De la Metherie Vues Phyfiologiques.* See alfo *De la Hire, Hamberger Phyfiolog.*

fuppofed it to poffefs the power of changing the figure of the cryftalline, rendering it more or lefs convex (E); others, that it removed it nearer to the cornea (F); and others, that it removed it nearer the retina (G).

" The advocates for thefe different opinions all agree in attributing thefe effects to a fuppofed mufcularity of the ciliary proceffes.

" Of the ftructure of thefe proceffes Haller obferves, ' In omni certe animalium genere proceffus ciliares abfque ulla mufculofa funt fabrica, mere vafculofi vafculis ferpentinis percurfi molli facti membrana.' Which ftructure, I believe, at prefent is univerfally admitted. But even fuppofing them mufcular, fuch is their delicacy of ftructure, their attachment, and direction, that we cannot poffibly conceive them adequate to the effects afcribed to them. Befide, what we obferved of the mufcles of the lens itfelf, alfo applies to the proceffes, viz. that they may be deftroyed, as in couching or extraction, and yet the eye be capable of adapting itfelf to the different diftances of objects. For a more full refutation of thefe opinions, fee Haller's large work.

The Situation, Structure, and Action of the external Mufcles (H).

" Upon carefully removing the eyelids, with their mufcles, we are prefented with the mufcles of the eye itfelf, which are fix in number; four called recti, or ftraight; and two oblique; fo named from their direction, (fee Pl. 3. Appen. fig. 4.) AAAA, the tendons of the recti mufcles, where they are inferted into the fclerotic coat, at the anterior part of the eye. B, the fuperior oblique, or trochlearis, as fometimes called, from its paffing through the loop or pulley connected to the lower angle of the orbiter notch in the os frontis; it paffes under the fuperior rectus mufcle, and backwards to the pofterior part of the eye, where it is inferted by a broad flat tendon into the fclerotic coat. C, the inferior oblique, arifing tendinous from the edge of the orbiter procefs of the fuperior maxillary bone, paffes ftrong and flefhy over the inferior rectus, and backwards under the abductor to the pofterior part of the eye, where it is alfo inferted by a broad flat tendon into the fclerotic coat. DDD, the fat in which the eye is lodged. In fig. 5. we have removed the bones forming the external fide of the orbit, with a portion of the fat, by which we have a diftinct view of the abductor. ABC, three of the recti mufcles, arifing from the back part of the orbit, paffing ftrong, broad, and flefhy over the ball of the eye, and inferted by flat, broad tendons into the fclerotic coat, at its anterior part. D, the tendon of the fuperior oblique mufcle. E, the inferior oblique, fig. 6. A, the abductor of the eye. B, the flefhy belly of the fuperior oblique, arifing ftrong, tendinous, and flefhy from the back part of the orbit. C, the optic nerve. D and E, the recti mufcles.

" The ufe afcribed to thefe different mufcles, is that of changing the direction of the eye, to turn it upwards, downwards, laterally, or in any of the intermediate directions, accommodated either to the different fituation of objects, or to exprefs the different paffions of the mind, for which they are peculiarly adapted. But is it inconfiftent with the general laws of nature, or even with the animal œconomy, that from their combination they fhould have a different action, and thus an additional ufe? To illuftrate this we need only witnefs the action of almoft any fet of mufcles in the body; for example, in lifting a weight, the combined action of the mufcles of the arm, fhoulder, and cheft, is different from the individual action of either fet, or of any individual mufcle; or an inftance nearer our purpofe may be adduced, viz. the actions of the mufcles of the cheft and belly, making a compreffion upon the vifcera, as in the difcharge of urine, fæces, &c. But to queftion this fact would be to queftion the influence of the will in any one of the almoft infinite variety of motions in the human body.

" I prefume, therefore, it will be admitted that we have the fame power over thefe mufcles of the eye as of others, and I believe we are no lefs fenfible of their combined action; for example, after viewing an object at the diftance of half a mile, if we direct our attention to an object but ten feet diftance, every perfon muft be fenfible of fome exertion; and if our attention be continued but for a fhort time, a degree of uneafinefs and even pain in the ball of the eye is experienced; if again we view an object within the focal diftance, *i. e.* within fix or feven inches, fuch is the intenfity of the pain that the exertion can be continued but a very fhort time, and we again relieve it by looking at the more diftant objects; this, I believe, muft be the experience of every perfon, whofe eyes are in the natural and healthy ftate, and accordingly has been obferved by almoft every writer upon optics.

" But the power of this combination, even from analogy, appears too obvious to need further illuftration. I fhall therefore next endeavour to point out their precife action.

" Suppofing the eye in its horizontal natural pofition; I fee an object diftinctly at the diftance of fix feet, the picture of the object falls exactly upon the retina; I now direct my attention to an object at the diftance of fix inches, as nearly as poffible in the fame line; although the rays from the firft object ftill fall upon my eye, while viewing the fecond, it does not form a diftinct picture on the retina, although at the fame diftance as before, which fhews that the eye has undergone fome change; for while I was viewing the firft object I did not fee the fecond diftinctly, although in the fame line: and now, *vice verfa*, I fee the fecond diftinctly, and not the firft; the rays from the firft, therefore, as they ftill fall upon the eye, muft either meet before or behind the retina; but we have fhewn that the rays from the more diftant object convene fooner than thofe from the lefs

(E) *Des Cartes*, *Scheinerus*, *Bidious*, *Mollinettus*, *Sanctorius*, *Jurin*.

(F) *Kepler*, *Zinn*, *Porterfield*.

(G) *La Chariere*, *Perrault*, *Hartfoeker*, *Briffeau*, and *Derham*.

(H) For the accuracy of the reprefentation I have annexed (in Pl. 3. Appen.) I can vouch, having been at much pains in the diffection; from which I had the painting taken by a moft accurate hand, Mr S. Edwards, a gentleman well known for his abilities in the plates of that admirable work, the Flora Londinenfis.

lefs diftant object, therefore the picture of the object at fix feet falls before, while the other forms a diftinct image upon the retina; but as my eye is ftill in the fame place as at firft, the retina has by fome means or other been removed to a greater diftance from the fore part of the eye to receive the picture of the nearer object, agreeable to the principle page 455. From which it is evident, that to fee the lefs diftant object either the retina fhould be removed to a greater diftance, or the refracting power of the media fhould be increafed: but I hope we have fhewn that the lens, which is the greateft refracting medium, has no power of changing itfelf. Let us next inquire, if the external mufcles, the only remaining power the eye poffeffes, are capable of producing thofe changes. With refpect to the anterior part of the eye, we have feen the fituation of thofe mufcles; the recti ftrong, broad, and flat, arifing from the back part of the orbit, paffing over the ball as over a pulley, and inferted by broad flat tendons at the anterior part of the eye; the oblique inferted toward the pofterior part, alfo by broad flat tendons; when they act jointly, the eye being in its horizontal pofition, it is obvious, as every mufcle in action contracts itfelf, the four recti by their combination muft neceffarily make a comparifon upon the different parts of the eye, and thus elongate its axis, while the oblique mufcles ferve to keep the eye in its proper direction and fituation. For my own part, I have no more difficulty in conceiving of this combination of thofe mufcles than I have at prefent of the different flexors of my fingers in holding my pen. But other correfponding effects are alfo produced by this action; not only the diftance between the anterior and pofterior parts of the eye is increafed, but of confequence the convexity of the cornea, from its great elafticity, is alfo increafed, and that in proportion to the degree of preffure, by which the rays of light paffing through it are thence neceffarily more converged. But another effect, and one not inconfiderable, is, that by this elongation of the eye, the media, viz. the aqueous, cryftalline, and vitreous humours through which the rays pafs, are alfo lengthened, of confequence their powers of refraction are proportionably increafed; all which correfpond with the general principle. It may however be faid, that as the four recti mufcles are larger and ftronger than the two oblique, the action of the former would overcome that of the latter, and thus draw back the whole globe of the eye; but does not the fat at the pofterior part of the orbit alfo afford a refiftance to the too great action of the recti mufcles, efpecially as it is of a firm confiftence, and the eye refts immediately upon it? Admitting then that this is the operation of the external mufcles when in a ftate of contraction, it is alfo to be obferved, we have the fame power of relaxing them, in proportion to the greater diftance of the object, until we arrive at the utmoft extent of indolent vifion.

"But, as a further teftimony of what has been advanced, I had recourfe to the following experiment, which will fhew that the eye is eafily compreffible, and that the effects produced correfpond with the principles I have endeavoured to illuftrate.

"With the common *fpeculum oculi* I made a very moderate degree of preffure upon my eye, while directing my attention to an object at the diftance of about twenty yards; I faw it diftinctly, as alfo the different intermediate objects; but endeavouring to look beyond it, every thing appeared confufed. I then increafed the preffure confiderably, in confequence of which I was enabled to fee objects diftinctly at a much nearer than the natural focal diftance; for example, I held before my eye, at the diftance of about two inches, a printed book; in the natural ftate of the eye I could neither diftinguifh the lines nor letters; but upon making preffure with the fpeculum I was enabled to diftinguifh both lines and letters of the book with eafe.

"Such then I conceive to be the action and effects of the external mufcles, and which I apprehend will alfo apply in explaining many other phænomena of vifion; fome of thofe it will not be improper at prefent briefly to notice.

"Firft, may not the action of thofe mufcles have more or lefs effect in producing the changes of vifion which take place in the different periods of life? At the fame time the original conformation of the eye, the diminution of its humours, and, probably, of the quantity of fat upon which the eye is lodged, are alfo to be taken into the account. But the external mufcles becoming irregular and debilitated by old age, in common with every other mufcle of the body, are not only incapable of compenfating for thefe loffes, but cannot even perform their wonted action, and thus neceffarily have confiderable influence in impairing vifion. Again, does not the habit of long fight fo remarkable in failors and fportfmen, who are much accuftomed to view objects at a great diftance, and that of fhort fight, as of watchmakers, feal-cutters, &c. admit of an eafy folution upon this principle? as we know of no part of the body fo fufceptible of an habitual action as the mufcular fibre.

"Secondly. How are we to account for the weaker action of one eye in the cafe of fquinting? That this is the fact has been well afcertained; Dr Reid(1) upon this fubject obferves, that he has examined above twenty perfons that fquinted, and found in all of them a defect in the fight of one eye. Porterfield and Jurin have made the fame obfervation.

"The diftorted pofition of the eye has, I believe, been generally attributed to the external mufcles; but no fatisfactory reafon has ever been given why the eye, directed towards an object, does not fee it diftinctly at the fame diftance as with the other. The ftate of the iris here cannot explain it, as it contracts and dilates in common with the other; nor can we fuppofe any mufcles the lens might poffefs could have any effect, as they are not at all connected with the nature of this difeafe.

"But the action of the external mufcles, I apprehend, will afford us a fatisfactory explanation. When the eye is turned from its natural direction, for example, towards the inner canthus, it is obvious that the *adductor* mufcle is fhortened, and its antagonift, the *abductor*, lengthened; confequently, as the abductor has not the fame power of contracting itfelf with the adductor, when the eye is directed towards an object, their power of action being different and irregular, the compreffion

(1) See his Inquiry into the Human Mind, page 322.

compreffion made upon the eye and its humours muft alfo be equally irregular, and therefore infufficient to produce the regular changes in the refraction and fhape of the eye we have fhewn to be neceffary in adapting it to the different diftances of objects. The effects produced by making a partial preffure upon the eye with the finger, or *fpeculum oculi*, before noticed, would alfo appear to favour this explanation.

" Thirdly. May it not in part be owing to the lofs of this combined action of the external mufcles, and the difficulty of recovering it, that the operation of couching is fometimes unfuccefsful, efpecially when the cataract has been of long ftanding? This cannot be attributed to the iris, for it perhaps, dilates and contracts as before: nor to the mufcles of the lens, for they are removed; nor to the ftate of the nerve, for it is ftill fenfible to light; and yet the patient cannot fee objects diftinctly; and it is not an uncommon circumftance, even when the operation fucceeds, that the fight is flowly and gradually recovered. Inftances have occurred, Mr Bell (K) obferves, of the fight becoming gradually better for feveral months after the operation.

" When we have been long out of the habit of combining our mufcles in almoft any one action of life, as walking, dancing, or playing upon a mufical inftrument, we in a great meafure lofe the combination, and find a difficulty in recovering it, in proportion to the length of time we had been deprived of it; but the individual action of each mufcle remains as before. Thus, probably, with the mufcles of the eye. A variety of facts of a fimilar nature muft prefent themfelves to every perfon converfant in the fcience of optics, which may admit of a fimilar explanation.

" I have thus endeavoured, firft, to point out the limited action of the iris, and of confequence the infufficiency of this action for explaining vifion. Secondly, to prove that the lens poffeffes no power of changing its form to the different diftances of objects. Thirdly, that to fee objects at different diftances, correfponding changes of diftance fhould be produced between the retina and the anterior part of the eye, as alfo in the refracting powers of the media through which the rays of light are to pafs. And, fourthly, that the combined action of the external mufcles is not only capable of producing thefe effects, but that from their fituation and ftructure they are alfo peculiarly adapted to produce them.

" It is not then confiftent with every principle in the œconomy of nature and of philofophy, feeing the imperfections of the principles which have hitherto been employed in explaining the phænomena in queftion, to adopt the one before us, until (agreeable to one of the eftablifhed rules in philofophizing) other phænomena occur, by which it may be rendered either more general, or liable to objections?

" I have now finifhed what was propofed. I have declined entering into an extenfive view of the ftructure of the eye, or any of the general principles of optics, as thofe fubjects have been more ably treated in the works already cited, and thus would certainly have deftroyed every claim to attention, which thefe few pages in their prefent form may poffibly poffefs; and if I fhould be fo fortunate as to fucceed in eftablifhing the principle I have propofed, for explaining the phænomena dependent upon this more important organ of our body (if any part poffeffes a pre-eminence in nature), I alfo hope it may, in abler hands, admit of fome practical application, in alleviating the difeafes to which its delicate organization fo particularly expofes it (L)."

VITALITY, the power of fubfifting in life, which the fafhionable philofophers of the French and German fchools attribute to *chemiftry*. For a confutation of their abfurd and impious jargon on this fubject, we refer our readers, with fome degree of confidence, to the articles PHYSIOLOGY (*Encycl.*), and *Animal* SUBSTANCES (*Suppl.*)

VITTORIA, *St Juan de*, a city of Peru.—*Morse.*

VIVERRA (fee *Encycl.*) A new fpecies of this genus of animals was difcovered by Vaillant during his laft travels in Africa; at leaft he ranks under the generic name *Viverra*, the animal of which he gives the following defcription. Its body was of the fize of that of a kitten fix months old: it had a very large nofe, the upper jaw exceeding the lower near two-thirds of an inch in length, and forming a fort of moveable fnout refembling that of the *coati* of Guiana. The fore feet were armed with four large claws, very fharp and curved; the hind ones have each five, but they are fhort and blunt. All the fur on the upper part of the body is marked with crofs bands of a deep brown colour, on a ground of light brown with which many white hairs are intermixed. The lower part of the body and infides of the legs are of a reddifh white. The tail, which is very flefhy, and more than two-thirds longer than the body, is black at the tip, and the reft brown, intermixed with white hairs.

This animal employs its fore paws to dig very deep holes in the earth, in which it remains concealed during the day, not going out till fun-fet in queft of food.

The Hottentots who accompanied our traveller called it *muys-hond* (a moufe dog); a general name among the inhabitants of the Cape for all the fmaller carnivorous quadrupeds.

VIVES (Ludovicus), the contemporary and friend of Erafmus, was a native of Valentia in Spain. Though well trained in all the fubtleties of the fcholaftic philofophy at Paris, he had the good fenfe to difcover its futility, and diligently applied himfelf to more ufeful ftudies. At Louvain he undertook the office of a preceptor, and exerted himfelf with great ability and fuccefs in correcting barbarifm, chaftifing the corrupters of learning,

(K) See his Syftem of Surgery.

(L) Since the above pages have been written, I have found, upon confulting fome of the earlieft writers, that the effects of the external mufcles did not altogether efcape their attention; at the fame time they had no diftinct idea of their action: I muft therefore difclaim the originality of the thought, although I had never met with it before the circumftances already noticed, of the infufficiency of the iris, had fuggefted it. If, however, I have fucceeded in pointing out the precife action of thofe mufcles, and its application to the general principles of vifion, in which, I believe, I have never been anticipated, it will be the height of my wifhes.

learning, and reviving a taste for true science and elegant letters. Erasmus, with whom he lived upon the footing of intimate friendship, speaking of Vives when he was only 26 years of age, says, that there was no part of philosophy in which he did not excel; and that he had made such proficiency in learning, and in the arts of speaking and writing, that he scarcely knew his equal. He wrote a commentary upon Augustine's treatise *De Civitate Dei*, which discovers an extensive acquaintance with ancient philosophy. Henry VIII. of England, to whom he dedicated this work, was so pleased with it, that he invited the author to his court, and made him preceptor to his daughter Mary. Though he discharged his office with great fidelity, yet in consequence of his opposition to the king's divorce, he fell under his displeasure; and it was not without difficulty that he escaped to Bruges, where he devoted the remainder of his days to study. He died in the year 1537, or, according to Thuanus, in 1541. With Erasmus and Buddæus he formed a triumvirate of literature which did honour to the age. He wrote *De Prima Philosophia*, "On the First Philosophy;" *De Explanatione Essentiarum*, "On the Explanation of Essences;" *De Censura Veri*, "On the Test of Truth;" *De Initiis, Sectis, et Laudibus Philosophiæ*, "On the Origin, Sects, and Praises of Philosophy;" and *De Corruptis Artibus et Tradendis Disciplinis;* "On the Corruption of Science, and on Education." These writings, of which the two last are the most valuable, discover great strength of judgment, an extensive knowledge of philosophy, much enlargement of conception, uncommon sagacity in detecting the errors of ancient and modern philosophers, particularly of Aristotle and his followers, and, in fine, a mind capable of attempting things beyond the standard of the age in which he lived. To all this he added great perspicuity and elegance of style, not unworthy of the friend of Erasmus.

ULIETEA, one of the Society Islands in the S. Pacific Ocean, is about 7 or 8 leagues from the island of Huaheine, at S. W. by W. There are 9 uninhabited islands west of it. The south end lies in lat. 16 55 S. and long. 151 20 W.—*Morse*.

ULSTER, a mountainous and hilly county of New-York, containing all that part of the State bounded easterly by the middle of Hudson's river, southerly by the county of Orange, westerly by the state of Pennsylvania, and the west branch of Delaware river, and northerly by the county of Albany. In 1790, it contained 29.397 inhabitants, including 2,906 slaves. In 1796, there were 4,429 of the inhabitants qualified to be electors. It is divided into 16 townships. Chief town, Kingston. A part of this county and that of Otsego, were erected into a separate county, January, 1797.—*ib.*

ULTRAMARINE is a very fine blue powder, almost of the colour of the corn flower or blue-bottle, which has this uncommon property, that, when exposed to the air or a moderate heat, it neither fades nor becomes tarnished. On this account it is used in painting; but it was employed formerly for that purpose much more than at present, as smalt, a far cheaper article, was not then known. (See Cobalt, in this *Suppl.*) Ultramarine is made of the blue parts of the lapis lazuli, by separating them as much as possible from the other coloured particles with which they are mixed, and reducing them to a fine powder. The real lapis lazuli is found in the mountains of that part of Tartary called Bucharia, which extends eastward from the Caspian sea, and particularly at Kalab and Budukschu. It is sent thence to the East Indies, and from the East Indies to Europe. Good ultramarine must be of a beautiful dark colour, and free from sand as well as every other mixture. It must unite readily with oil; it must not become tarnished on a red-hot tile or plate of iron, and it ought to dissolve in strong acids, almost like the zeolite, without causing an effervescence. In the year 1763, an ounce of it at Paris cost four pounds sterling, and an ounce of *cendre d'outremer* which is the refuse, two pounds. The basis of this colour was long suspected to be copper, but the experiments of Margraff shewed that it was iron, in some unknown state of combination. New light has been thrown on this subject by Morveau, who has discovered that selenite loaded with iron, when decomposed by carbonaceous matter, yields a blue sulphuret of iron of equal permanency with the true ultramarine.

At present, smalt of a good colour is often purchased at a dear rate and substituted for ultramarine; and it is found that the colour of this preparation of cobalt is more durable in the fire than even that of the lapis lazuli. For the analysis of lapis lazuli, see Mineralogy, n° 69. *Suppl.*

ULYSSES, one of the military townships in Onondago county, New-York, situated at the southern end of Cayuga Lake, having Hector on the west, and Dryden on the east, which last township is included within the jurisdiction of Ulysses, which was incorporated in 1794. In 1796, 38 of the inhabitants were electors.—*Morse.*

UMBAGOG, a large lake of New-Hampshire, next in size to Lake Winipiseogee. It lies in Grafton county, and a small part of it in the District of Maine.—*ib.*

UNADILLA, a river of the state of New-York, called also *Tianaderha*, runs southward, and joining the Main Branch, forms Chenengo river.—*ib.*

Unadilla, a township of New-York, Otsego county, on the northern side of the main branch of Chenengo river. It is about 110 miles south-west of Albany; and, in 1796, 502 of its inhabitants were electors. In the same year, the townships of Suffrage, Otsego, and Butternuts, were taken from this township, and incorporated.—*ib.*

UNAMI, a tribe of the Delaware Indians, considered to be the head of that nation.—*ib.*

UNDERHILL, a township of Vermont, Chittenden county, 12 miles east of Colchester, and contains 65 inhabitants.—*ib.*

UNION, a county of South-Carolina, Pinckney district, containing 7,693 inhabitants, of whom 6,430 are whites, and 1,215 slaves. It sends two representatives and one senator to the state legislature. Chief town, Pinckneyville.—*ib.*

Union, a rocky township in Tolland county, Connecticut, west of Woodstock, and about 12 miles N. E. of Tolland.—*ib.*

Union, a township of the District of Maine, Lincoln county, containing 200 inhabitants. It was incorporated in 1786, and lies 290 miles from Boston.—*ib.*

Union, a post-town of the state of New-York, Tioga county, on the N. side of Susquehannah river, and west of the mouth of the Chenengo, 122 miles S. E. by E. of of Williamſburg, on Geneſſee river, 24 E. N. E. of Athens, or Tioga Point, 92 S. W. of Cooperſtown, and 340 N. by W. of Philadelphia. In 1796, there were in the townſhip, 284 of the inhabitants qualified electors. —*ib.*

UNION *River*, or *Plantation No.* 6, in the Diſtrict of Maine, is ſituated in Hancock county, 25 miles N. E. of Penobſcot.—*ib.*

UNION *River*, in the county of Hancock, Diſtrict of Maine, empties into Blue Hill Bay, on the E. ſide of Penobſcot Bay. Long-Iſland, in this bay, is in lat. 44 25, and long. 67 45.—*ib.*

UNION-TOWN, a poſt-town of Pennſylvania, Fayette county, on Redſtone Creek. It contains a church, a ſtone gaol, and a brick court-houſe, and about 80 dwelling-houſes. Near it are two valuable merchant mills. It is the ſeat of the county courts, and is 14 miles S. by E. of Brownſville, where Redſtone Creek enters the Monongahela, 58 miles S. of Pittſburg, 24 N. E. of Morgantown, in Virginia, and 327 W. of Philadelphia.—*ib.*

UNITAS, a village of N. Carolina, ſituated at the head of Gargal's Creek.—*ib.*

UNITED STATES OF AMERICA, ſituated between 31° and 46° north latitude, 8° E. and 24° W. lon. from Philadelphia, 64° and 96° W. lon. from London, is in length 1250 miles, and in breadth 1040. It is bounded north and eaſt, by Britiſh America, or the Provinces of Upper and Lower Canada, and New Brunſwick; ſouth-eaſt, by the Atlantic Ocean; ſouth by Eaſt and Weſt Florida; weſt, by the river Miſſiſſippi.

The American Republic, conſiſts of three grand diviſions, denominated the *Northern*, or more properly *Eaſtern*, *Middle* and *Southern* States. The *firſt* diviſion, (the Northern or Eaſtern States) comprehends Vermont, New Hampſhire, Diſtrict of Maine, (belonging to Maſſachuſetts) Maſſachuſetts, Rhode Iſland, and Connecticut. Theſe are called the New England States, and comprehend that part of America, which, ſince the year 1614, has been known by the name of New England. The *ſecond* diviſion (the Middle States) comprehends New York, New Jerſey, Pennſylvania, Delaware, and Territory N. W. of Ohio. The *third* diviſion (the Southern States) comprehends Maryland, Virginia, Kentucky, North Carolina, Tenneſſee, South Carolina, Georgia, and Miſſiſſippi Territory.

In the treaty of peace, concluded in 1783, the limits of the American United States are more particularly defined in the words following: "And that all diſputes which might ariſe in future on the ſubject of the boundaries of the ſaid United States may be prevented, it is hereby agreed and declared, that the following are and ſhall be their boundaries, viz. From the north-weſt angle of Nova Scotia, viz. that angle which is formed by a line drawn due north from the ſource of St Croix River to the Highlands, along the ſaid Highlands, which divide thoſe rivers that empty themſelves into the river St Lawrence from thoſe which fall into the Atlantic Ocean, to the north-weſternmoſt head of Connecticut river; thence down along the middle of that river to the forty-fifth degree of north latitude; from thence by a line due weſt on ſaid latitude, until it ſtrikes the river Iroquois or Cataraquie; thence along the middle of the ſaid river into Lake Ontario; through the middle of ſaid lake, until it ſtrikes the communication by water between that lake and Lake Erie; thence along the middle of ſaid communication into Lake Erie, through the middle of ſaid lake, until it arrives at the water communication between that lake and Lake Huron; thence through the middle of ſaid lake to the water communication between that lake and Lake Superior; thence through Lake Superior, northward of the Iſles Royal and Phillipeaux, to the Long Lake; thence through the middle of ſaid Long Lake, and the water communication between it and the Lake of the Woods, to the ſaid Lake of the Woods; thence through the ſaid lake to the moſt northweſtern point thereof, and from thence, on a due weſt courſe, to the River Miſſiſſippi; thence by a line to be drawn along the middle of ſaid River Miſſiſſippi, until it ſhall interſect the northernmoſt part of the thirty-firſt degree of north latitude.

"South, by a line to be drawn due eaſt from the determination of the line laſt mentioned, in the latitude of thirty-one degrees north of the equator, to the middle of the River Apalachicola, or Catahouche; thence along the middle thereof to its junction with the Flint River; thence ſtraight to the head of St Mary's River; and thence down along the middle of St Mary's River to the Atlantic Ocean.

"Eaſt, by a line to be drawn along the middle of the River St Croix, from its mouth, in the Bay of Fundy, to its ſource, and from its ſource directly north, to the aforeſaid Highlands, which divide the rivers that fall into the Atlantic Ocean from thoſe which fall into the River St Lawrence; comprehending all iſlands within twenty leagues of any part of the ſhores of the United States, and lying between lines to be drawn due eaſt from the points where the aforeſaid boundaries between Nova Scotia on the one part, and Eaſt Florida on the other, ſhall reſpectively touch the Bay of Fundy and the Atlantic Ocean, excepting ſuch iſlands as now are, or heretofore have been, within the limits of the ſaid province of Nova Scotia."

The territory of the United States, according to Mr Hutchins, contains, by computation, a million of ſquare miles, in which are 640,000,000 acres.

miles, in which are	640,000,000 acres.
Deduct for water	51,000,000
Acres of land in the United States	589,000,000

That part of the United States, comprehended between the weſt boundary line of Pennſylvania, on the eaſt; the boundary line between Great Britain and the United States, extending from the northweſt corner of Pennſylvania, to the northweſt extremity of the Lake of the Woods, on the north; the river Miſſiſſippi, to the mouth of the Ohio, on the weſt; and the river Ohio on the ſouth, to the aforementioned bounds of Pennſylvania, contains, by computation, about 411,000 ſquare miles, in which are 263,040,000 acres

ſquare miles, in which are	263,040,000 acres
Deduct for water	43,040,000
To be diſpoſed of by order of Congreſs, when purchaſed of the Indians	220,000,000

The whole of this immenſe extent of unappropriated weſtern territory, containing as above ſtated, 220,000,000 of acres, and ſeveral large tracts ſouth of the

the Ohio, (A) have been, by the ceffion of fome of the original thirteen ftates, and by the treaty of peace, transferred to the federal government, and are pledged as a fund for finking the debt of the United States. Of this territory the Indians now poffefs a very large proportion. Mr Jefferfon, in his report to Congrefs, November 8, 1791, defcribes the boundary line between us and the Indians, as follows: "Beginning at the mouth of the Cayahoga (which falls into the fouthernmoft part of the Lake Erie) and running up the river to the portage, between that and the Tufcarora (or N. E.) branch of the Mufkingum; then down the faid branch to the forks, at the croffing place above Fort Lawrence; then weftwardly, towards the portage of the Great Miami, to the main branch of that river; then down the Miami, to the fork of that river, next below the old fort which was taken by the French, in 1752; thence due weft to the river De la Panfe (a branch of the Wabafh) and down that river to the Wabafh. So far the line is precifely determined, and cleared of the claims of the Indians. The tract comprehending the whole country within the above defcribed line, the Wabafh, the Ohio, and the weftern limits of Pennfylvania, contains about 55,000 fquare miles. How far on the weftern fide of the Wabafh, the fouthern boundary of the Indians has been defined, we know not. It is only underftood in general, that their title to the lower country, between that river and the Illinois, was formerly extinguifhed by the French, while in their poffeffion."

Eftimate of the number of acres of water, north and weftward of the river Ohio, within the territory of the United States.

		Acres.
In Lake Superior,		21,952,780
Lake of the Woods,		1,133,800
Lake Rain, &c.		165,200
Red Lake,		551,000
Lake Michigan		10,368,000
Bay Puan,		1,216,000
Lake Huron,		5,009,920
Lake St Clair,		89,500
Lake Erie, weftern part,		2,252,800
Sundry fmall lakes and rivers,		301,000
In Lake Erie, weftward of the line extended from the north-weft corner of Pennfylvania, due north to the boundary between the Britifh territory and the United States,	410,000	
In Lake Ontario,	2,390,000	
Lake Champlaine,	500,000	
Chefapeak Bay,	1,700,000	
Albemarle Bay,	330,000	
Delaware Bay,	630,000	
All the rivers within the thirteen States, including the Ohio,	2,000,000	
		7,990,000
Total,		51,000,000

It may in truth be faid, that no part of the world is fo well watered with fprings, rivulets, rivers, and lakes, as the territory of the United States. By means of thefe various ftreams and collections of water, the whole country is checkered into iflands and peninfulas. The United States, and indeed all parts of North America, feem to have been formed by nature for the moft intimate union. The facilities of navigation render the communication between the ports of Georgia and New-Hampfhire far more expeditious and practicable, than between thofe of Provence and Picardy in France; Cornwall and Caithnefs, in Great-Britain; or Gallicia and Catalonia, in Spain. The canals opening between Sufquehannah and Delaware, between Pafquetank and Elizabeth Rivers, in Virginia, and between the Schuylkill and Sufquehannah, will open a communication from the Carolinas to the weftern counties of Pennfylvania and New-York. The improvement of the Patowmak, will give a paffage from the fouthern States to the weftern parts of Virginia, Maryland, Pennfylvania, and even to the lakes. From Detroit, to Alexandria, on the Potowmak, fix hundred and feven miles, are but two carrying places, which together do not exceed the diftance of forty miles. The canals of Delaware and Chefapeak will open the communication from South Carolina to New Jerfey, Delaware, the moft populous parts of Pennfylvania, and the midland counties of New York. Were thefe, and the canal between Afhley and Cooper Rivers, in South Carolina—the canals in the northern parts of the ftate of New-York, and thofe of Maffachufetts and New-Hampfhire, all opened, and many of them are in great forwardnefs, North America would thereby be converted into a clufter of large and fertile iflands, communicating with each other with eafe and little expenfe, and in many inftances without the uncertainty or danger of the feas.

There is nothing in other parts of the globe which refembles the prodigious chain of lakes in this part of the world. They may properly be termed inland feas of frefh water; and even thofe of the fecond or third clafs in magnitude, are of larger circuit than the greateft lake in the eaftern continent, the Cafpian Sea excepted. Some of the moft northern lakes belonging to the United States, have never been furveyed, or even vifited till lately by white people; of courfe we have no defcription of them which can be relied on as accurate. Others have been partially furveyed, and their relative fituation determined. The beft account of them which we have been able to procure is as follows:

The Lake of the Woods, the moft northern in the United States, is fo called from the large quantities of wood growing on its banks; fuch as oaks, pines, firs, fpruce, &c. This lake lies nearly eaft of the fouth end of Lake Winnepeck, and is fuppofed to be the fource or conductor of one branch of the river Bourbon, if there be fuch a river. Its length from eaft to weft is faid to be about feventy miles, and in fome places it is forty miles wide. The Killiftino Indians encamp on its borders to fifh and hunt. This lake is the communication between the Lakes Winnepeek and Bourbon, and Lake Superior.

Rainy

(A) Ceded by North Carolina, South Carolina, and Georgia, with certain refervations for the Indians and other purpofes.

United States.

Rainy, or Long Lake, lies eaſt of the Lake of the Woods, and is ſaid to be nearly an hundred miles long, and in no part more than twenty miles wide.

Eaſtward of this lake, lie ſeveral ſmall ones, which extend in a ſtring to the great carrying place, and thence into Lake Superior. Between theſe little lakes are ſeveral carrying places, which render the trade to the north-weſt difficult, and exceedingly tedious, as it takes two years to make one voyage from Michillimakkinac to theſe parts.

Lake Superior, formerly termed the Upper Lake, from its northern ſituation, is ſo called from its magnitude, it being the largeſt on the continent. It may juſtly be termed the Caſpian of America, and is ſuppoſed to be the largeſt body of freſh water on the globe. According to the French charts, it is 1500 miles in circumference (B). A great part of the coaſt is bounded by rocks and uneven ground. The water is pure and tranſparent, and appears generally, throughout the lake, to lie upon a bed of huge rocks. It has been remarked, in regard to the waters of this lake, (with how much truth we cannot ſay) that although their ſurface, during the heat of ſummer, is impregnated with no ſmall degree of warmth, yet, on letting down a cup to the depth of about a fathom, the water drawn from thence is cool and refreſhing.

The ſituation of this lake, from the moſt accurate obſervations which have come to our knowledge, lies between lat. 46° and 48° 30′ N. and lon. 84° and 91° 30′ W. from London.

There are many iſlands in this lake, two of them have each land enough, if proper for cultivation, to form a conſiderable province; eſpecially Iſle Royal, near the N. W. coaſt of the lake, which is not leſs than an hundred miles long, and in many places forty broad. The natives ſuppoſe theſe iſlands are the reſidence of the Great Spirit.

Two large rivers empty themſelves into this lake, on the north and north-eaſt ſide; one is called the Nipegon, which leads to a tribe of the Chipeways, who inhabit a lake of the ſame name, and the other is the Michipicooton river, the ſource of which is towards James's Bay, from whence there is ſaid to be but a ſhort portage to another river which empties itſelf into that bay.

Not far from the Nipegon is a ſmall river, that juſt before it enters the lake, has a perpendicular fall from the top of a mountain of ſix hundred feet. [*Carver*.] It is very narrow, and appears at a diſtance like a white garter ſuſpended in the air. There are upwards of thirty other rivers, which empty into this lake, ſome of which are of a conſiderable ſize. On the ſouth ſide of it is a remarkable point or cape of about ſixty miles in length, called point Chegomegan. About an hundred miles weſt of this cape, a conſiderable river falls into the lake, the head of which is compoſed of a great aſſemblage of ſmall ſtreams. This river is remarkable for the abundance of virgin copper that is found on and near its banks. Many ſmall iſlands, particularly on the eaſtern ſhores, abound with copper ore lying in beds, with the appearance of copperas. This metal might be eaſily made a very advantageous article of commerce. This lake abounds with fiſh, particularly trout and ſturgeon; the former weigh from twelve to fifty pounds, and are caught almoſt any ſeaſon of the year in great plenty. Storms affect this lake as much as they do the Atlantic Ocean; the waves run as high, and the navigation is equally dangerous. It diſcharges its waters from the ſouth-eaſt corner, through the Straits of St Marie, which are about forty miles long. Near the upper end of theſe ſtraits is a rapid, which, though it is impoſſible for canoes to aſcend, yet, when conducted by careful pilots, may be deſcended without danger.

Though Lake Superior is ſupplied by near forty rivers, many of which are large, yet it does not appear that one tenth part of the waters which are conveyed into it by theſe rivers is diſcharged by the abovementioned ſtraits. Such a ſuperabundance of water can be diſpoſed of only by evaporation (C). The entrance into this lake from the ſtraits of St Marie, affords one of the moſt pleaſing proſpects in the world. On the left may be ſeen many beautiful little iſlands that extend a conſiderable way before you; and on the right, an agreeable ſucceſſion of ſmall points of land, that project a little way into the water, and contribute, with the iſlands, to render this delightful baſon calm, and ſecure from thoſe tempeſtuous winds, by which the adjoining lake is frequently troubled.

Lake Huron, into which you enter through the Straits of St Marie, is next in Magnitude to Lake Superior. It

(B) Carver ſuppoſes it exceeds 1600 miles.

(C) That ſuch a ſuperabundance of water ſhould be diſpoſed of by evaporation is no ſingular circumſtance. "There are ſome ſeas," ſays an ingenious correſpondent who has not obliged me with his name, "in which there is a pretty juſt balance between the waters received from rivers, brooks, &c. and the waſte by evaporation. Of this the Caſpian Sea in Aſia affords an inſtance; which though it receives ſeveral large rivers, has no outlet. There are others, (to ſpeak in borrowed language) whoſe expenſe exceeds their income; and theſe would ſoon become bankrupt, were it not for the ſupplies which they conſtantly receive from larger collections of water, with which they are connected; ſuch are the Black and Mediterranean ſeas; into the former of which there is a conſtant current from the Mediterranean through the Boſphorus of Thrace; and into the latter, from the Atlantic, through the Straits of Gibraltar. Others again derive more from their tributary ſtreams than they loſe by evaporation. Theſe give riſe to large rivers. Of this kind are the Dambea, in Africa, the Winnipiſeogee, in New Hampſhire, Lake Superior and other waters in North America; and the quantity they diſcharge is only the difference between the influx and the evaporation. It is obſervable that on the ſhores the evaporation is much greater than at a diſtance from them on the ocean. The remarkable cluſter of lakes in the middle of North America, of which Lake Superior is one, was doubtleſs deſigned by a wiſe Providence, to furniſh the interior parts of the country with that ſupply of vapours, without which, like the interior parts of Africa, they muſt have been a mere deſert. It may be thought equally ſurpriſing that there ſhould be any water at all diſcharged from them, as that the quantity ſhould bear ſo ſmall a proportion to what they receive." [*Anonymous* MS.]

United States.

It lies between lat. 43° 30′ and 46° 30′ N. and between long. 80° and 84° 30′ W. from London. Its circumference is about one thoufand miles. On the north fide of this lake is an ifland called Manatou, fignifying a place of fpirits, and is confidered as facred by the Indians. On the fouth-weft part of this lake is Saganaum Bay, about eighty miles in length, and about eighteen or twenty miles broad. On its banks are great quantities of fand cherries. Thunder Bay, fo called from the thunder that is frequently heard here, lies about half way between Saganaum Bay and the north-weft corner of the lake. It is about nine miles acrofs either way. The fifh are the fame as in Lake Superior. At the north-weft corner this lake communicates with Lake Michigan, by the Straits of Michillimakkinac.

The Chippeway Indians live fcattered around this lake; particularly near Saganaum Bay. Their country, however, is to the eaftward of this lake.

Michigan Lake lies between latitude 42° 10′ and 46° 30′ north; and between 11° and 13° weft long. from Philadelphia. Its computed length is 280 miles, from north to fouth; its breadth from 60 to 70 miles. It is navigable for fhipping of any burthen; and at the northeaftern part communicates with Lake Huron, by a ftrait fix miles broad, on the fouth fide of which ftands fort Michillimakkinac, which is the name of the ftrait. In this lake are feveral kinds of fifh, particularly trout of an excellent quality, weighing from 20 to 60 pounds, and fome have been taken in the Straits of Michillimakkinac of 90 pounds. Weftward of this lake are large meadows, faid to extend to the Miffiffippi. It receives a number of rivers from the weft and eaft, among which is the river St Jofeph, very rapid and full of iflands. It fprings from a number of fmall lakes, a little to the north-weft of the Miami village, and runs north-weft into the fouth-eaft part of the lake. On the north fide of this river is fort St Jofeph, from which there is a road bearing north of eaft, to Detroit. The Powtewatimie Indians, who have about 200 fighting men, inhabit this river oppofite fort St Jofeph.

Between Lake Michigan on the weft, and Lakes Huron, St Clair, and the weft end of Erie on the eaft, is a fine tract of country, peninfulated, more than 250 miles in length, and from 150 to 200 in breadth. The banks of the lakes, for a few miles inland, are fandy and barren, producing a few pines, fhrub oaks and cedars. Back of this from either lake, the timber is heavy and good, and the foil luxuriant.

Lake St Clair lies about half way between Lake Huron and Lake Erie, and is about 90 miles in circumference. It receives the waters of the three great Lakes, Superior, Michigan and Huron, and difcharges them through the river or ftrait called Detroit, (or the Strait) into Lake Erie. This lake is of an oval form, and navigable for large veffels. The fort of Detroit is fituated on the weftern bank of the river of the fame name, about nine miles below Lake St Clair. The fettlements are extended on both fides of the ftrait or river for many miles towards Lake Erie, and fome few above the fort.

Lake Erie is fituated between forty-one and forty-three degrees of north latitude, and between 3° 40′ and 8° weft longitude. It is nearly three hundred miles long, from eaft to weft, and about forty in its broadeft part. A point of land projects from the north fide into this lake, feveral miles, towards the fouth-eaft called Long Point. The iflands and banks towards the weft end of the lake are fo infefted with rattle-fnakes, as to render it dangerous to land on them. The lake is covered near the banks of the iflands with large pond lily, the leaves of which lie on the furface of the water fo thick, as to cover it entirely for many acres together; on thefe in the fummer feafon lie myriads of water-fnakes bafking in the fun. Of the venomous ferpents which infeft this lake, the hiffing fnake is the moft remarkable. It is about eighteen inches long, fmall and fpeckled. When you approach it, it flattens itfelf in a moment, and its fpots, which are of various colours, become vifibly brighter through rage; at the fame time it blows from its mouth, with great force, a fubtile wind, faid to be of a naufeous fmell; and if drawn in with the breath of the unwary traveller, will infallibly bring on a decline, that in a few months muft prove mortal. No remedy has yet been found to counteract its baneful influence. This lake is of a more dangerous navigation than any of the others, on account of the craggy rocks which project into the water, in a perpendicular direction, many miles together from the northern fhore, affording no fhelter from ftorms.

Prefque Ifle is on the fouth-eaft fhore of this lake, about lat. 42° 10′. From this to Fort Le Beuf, on French Creek, is a portage of 15½ miles. About 20 miles north-eaft of this is another portage of 9¼ miles, between Chataughque Creek, emptying into Lake Erie, and Chataughque Lake, a water of Allegany river.

Fort Erie ftands on the northern fhore of Lake Erie, and the weft bank of Niagara river, in Upper Canada. This lake, at its north-eaft end, communicates with Lake Ontario, by the river Niagara, which runs from fouth to north, about 30 miles, including its windings, embracing in its courfe, Grand Ifland, and receiving Tonewanto Creek, from the eaft. About the middle of this river, are the celebrated Falls of Niagara, which are reckoned one of the greateft natural curiofities in the world. The waters which fupply the river Niagara rife near two thoufand miles to the north-weft, and paffing through the lakes Superior, Michigan, Huron, and Erie, receiving in their courfe conftant accumulations, at length, with aftonifhing grandeur, rufh down a ftupendous precipice of 137 feet perpendicular; and in a ftrong rapid, that extends to the diftance of eight or nine miles below, fall nearly as much more; the river then lofes itfelf in Lake Ontario. The water falls 57 feet in the diftance of one mile, before it falls perpendicularly (D). A fpectator ftanding on the bank of the river oppofite thefe falls, would not imagine them to be more than 40 or 50 feet perpendicular height. The noife of thefe falls, in a clear day and fair wind, may be heard between forty and fifty miles. When the water ftrikes the bottom,

(D) It is believed by the inhabitants in the neighbourhood of thefe falls, that formerly they were fix miles lower down than they now are, and that the change has been produced by the conftant operation of the water. But on a careful examination of the banks of the river, there appears to be no good foundation for this opinion. [*Gen. Lincoln.*]

tom, its ſpray riſes to a great height in the air, occaſioning a thick cloud of vapours, in which, when the ſun ſhines, may be ſeen, morning and evening, a beautiful rainbow. Fort Niagara, built by the French about the year 1725, is ſituated on the eaſt ſide of Niagara river, at its entrance into Lake Ontario, about 43° 20′ N. lat.

Lake Ontario is ſituated between forty-three and forty-five degrees north lat. and between one and five degrees W. long. Its form is nearly oval. Its greateſt length is from ſouth-weſt to north-eaſt, and its circumference about ſix hundred miles. It abounds with fiſh of an excellent flavour, among which are the Oſwego baſs, weighing three or four pounds. Its banks in many places are ſteep, and the ſouthern ſhore is covered principally with beech trees, and the lands appear good. It receives the waters of the Cheneſſee river from the ſouth, and of Onondago, at Fort Oſwego, from the ſouth-eaſt, by which it communicates, through Lake Oneida, and Wood Creek, with Mohawk river. On the north-eaſt, this lake diſcharges itſelf through the river Cataraqui, (which at Montreal, takes the name of St Lawrence) into the Atlantic Ocean. "It is aſſerted that theſe lakes fill once in ſeven years, and that 1794 was the year when they would be full; but as we are unacquainted with any laws of nature, by which this periodical effect ſhould be produced, we may with propriety doubt the fact." [*Gen. Lincoln.*]

About 8 miles from the weſt end of Lake Ontario, is a curious cavern, which the Meſſiſaugas Indians call *Manito' ah wigwam*, or *houſe of the Devil*. The mountains which border on the lake, at this place, break off abruptly, and form a precipice of 200 feet perpendicular deſcent; at the bottom of which the cavern begins. The firſt opening is large enough for three men conveniently to walk abreaſt. It continues of this bigneſs for 70 yards in a horizontal direction. Then it falls almoſt perpendicularly 50 yards, which may be deſcended by irregular ſteps from one to four feet diſtant from each other. It then continues 40 yards horizontally, at the end of which is another perpendicular deſcent, down which there are no ſteps. The cold here is intenſe. In ſpring and autumn, there are, once in about a week, exploſions from this cavern, which ſhake the ground for 16 miles round.

Lake Champlaine is next in ſize to Lake Ontario, and lies nearly eaſt from it, forming a part of the dividing line between the State of New York and the State of Vermont. It took its name from a French Governor, whoſe name was Champlaine, who was drowned in it. It was before called Corlaer's Lake. It is about 100 miles in length from north to ſouth, and in its broadeſt parts 12 or 14. It is well ſtored with fiſh, and the land on its borders and on the banks of its rivers is good. Crown Point and Ticonderoga are ſituated on the bank of this lake, near the ſouthern part of it.

Lake George lies to the ſouthward of Champlaine, and is a moſt clear, beautiful collection of water, 36 miles long, and from 1 to 7 miles wide. It emboſoms more than 200 iſlands, ſome ſay 365; very few of which are any thing more than barren rock, covered with heath, and a few cedar, ſpruce and hemlock trees and ſhrubs, and abundance of rattle-ſnakes. On each ſide it is ſkirted by prodigious mountains, from which large quantities of red cedar are every year carried to New York for ſhip timber. The lake is full of fiſhes, and ſome of the beſt kind; among which are the black or Oſwego baſs and large ſpeckled trouts. The water of this lake is about 100 feet above the level of Lake Champlaine. The portage between the two lakes is one mile and a half; but with a ſmall expenſe might be reduced to 60 yards; and with a ſufficient number of locks might be made navigable through for batteaux. This lake, in the French charts, is called Lake St Sacrament; and it is ſaid that the Roman Catholicks, in former times, were at the pains to procure this water for ſacramental uſes in all their churches in Canada: hence probably it derived its name.

The Miſſiſſippi receives the waters of the Ohio and Illinois, and their numerous branches from the eaſt; and of the Miſſouri and other rivers from the weſt. Theſe mighty ſtreams united are borne down with increaſing majeſty through vaſt foreſts and meadows, and diſcharged into the Gulf of Mexico. The great length and uncommon depth of this river, ſays Mr Hutchins, and the exceſſive muddineſs and ſalubrious quality of its waters, after its junction with the Miſſouri, are very ſingular (E). The direction of the channel is ſo crooked, that from New Orleans to the mouth of the Ohio, a diſtance which does not exceed four hundred and ſixty miles in a ſtrait line, is about eight hundred and fifty-ſix by water. It may be ſhortened at leaſt two hundred and fifty miles, by cutting acroſs eight or ten necks of land, ſome of which are not thirty yards wide. Charlevoix relates that in the year 1722, at Point Coupee, or Cut Point, the river made a great turn, and ſome Canadians, by deepening the channel of a ſmall brook, diverted the waters of the river into it. The impetuoſity of the ſtream was ſo violent, and the ſoil of ſo rich and looſe a quality, that in a ſhort time the point was entirely cut through, and travellers ſaved fourteen leagues of their voyage. The old bed has no water in it, the times of the periodical overflowing only excepted. The new channel has been ſince ſounded with a line of thirty fathoms without finding bottom. Several other points, of great extent, have, in like manner, been ſince cut off, and the river diverted into new channels.

In the ſpring floods the Miſſiſſippi is very high, and the current ſo ſtrong that it is with difficulty it can be aſcended; but this diſadvantage is remedied in ſome meaſure by eddies or counter-currents, which are generally found in the bends cloſe to the banks of the river, and aſſiſt the aſcending boats. The current at this ſeaſon deſcends at the rate of about five miles an hour. In autumn, when the waters are low, it does not run faſter than two miles, but it is rapid in ſuch parts of the river as have cluſters of iſlands, ſhoals and ſand-banks. The circumference

(E) In a half pint tumbler of this water has been found a ſediment of one inch of impalpable marle-like ſubſtance. It is notwithſtanding, extremely wholeſome and well taſted, and very cool in the hotteſt ſeaſons of the year; the rowers, who are there employed, drink of it when they are in the freeſt perſpiration, and never receive any bad effects from it. The inhabitants of New Orleans uſe no other water than that of the river, which, by being kept in jars, becomes perfectly clear.

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cumference of many of thefe fhoals being feveral miles, the voyage is longer, and in fome parts more dangerous than in the fpring. The merchandife neceffary for the commerce of the upper fettlements on or near the Miffiffippi, is conveyed in the fpring and autumn in batteaux, rowed by eighteen or twenty men, and carrying about forty tons. From New Orleans to the Illinois, the voyage is commonly performed in eight or ten weeks. A prodigious number of iflands, fome of which are of great extent, interfperfe that mighty river. Its waters, after overflowing its banks below the river Ibberville on the eaft, and the river Rouge on the weft, never return within them again, there being many outlets or ftreams, by which they are conducted into the Bay of Mexico, more efpecially on the weft fide of the Miffiffippi, dividing the country into numerous iflands. Thefe fingularities diftinguifh it from every other known river in the world. Below the Ibberville, the land begins to be very low on both fides of the river, acrofs the country, and gradually declines as it approaches nearer to the fea. The ifland of New Orleans, and the lands oppofite, are to all appearance of no long date; for in digging ever fo little below the furface, you find water and great quantities of trees. The many beaches and breakers as well as inlets, which have arifen out of the channel fince 1650, at the feveral mouths of the river, are convincing proofs that this peninfula was wholly formed in the fame manner. And it is certain that when La Salle failed down the Miffiffippi to the fea, the opening of that river was very different from what it is at prefent.

The nearer you approach to the fea, this truth becomes more ftriking. The bars that crofs moft of thefe fmall channels, opened by the current, have been multiplied by means of the trees carried down with the ftreams; one of which, ftopped by its roots or branches in a fhallow part, is fufficient to obftruct the paffage of thoufands more, and to fix them at the fame place. Aftonifhing collections of trees are daily feen in paffing between the Balize and the Miffouri. No human force is fufficient to remove them, and the mud carried down by the river ferves to bind and cement them together. They are gradually covered, and every inundation not only extends their length and breadth, but adds another layer to their height. In lefs than ten years time, canes, fhrubs and aquatic timber grow on them, and form points and iflands, which forcibly fhift the bed of the river.

Nothing can be afferted with certainty, refpecting the length of this river. Its fource is not known, but fuppofed to be upwards of three thoufand miles from the fea as the river runs. We only know, that from St Anthony's Falls in lat. 45° it glides with a pleafant clear current, and receives many large and very extenfive tributary ftreams, before its junction with the Miffouri, without greatly increafing the breadth of the Miffiffippi, though they do its depth and rapidity. The muddy waters of the Miffouri difcolour the lower part of the river, till it empties into the Bay of Mexico. The Miffouri is a longer, broader, and deeper river than the Miffiffippi, and affords a more extenfive navigation; it is in fact the principal river, contributing more to the common ftream than does the Miffiffippi. It has been afcended by French traders about twelve or thirteen hundred miles, and from the depth of water, and breadth of the river at that diftance, it appeared to be navigable many miles further.

From the Miffouri river, to nearly oppofite the Ohio, the weftern bank of the Miffiffippi is (fome few places excepted) higher than the eaftern. From Mine-au-fer to the Ibberville, the eaftern bank is higher than the weftern, on which there is not a fingle difcernible rifing or eminence, the diftance of feven hundred and fifty miles. From the Ibberville to the fea, there are no eminences on either fide, though the eaftern bank appears rather the higheft of the two, as far as the Englifh turn. Thence the banks gradually diminifh in height to the mouths of the river, where they are but a few feet higher than the common furface of the water.

The flime which the annual floods of the river Miffiffippi leave on the furface of the adjacent fhores, may be compared with that of the Nile, which depofits a fimilar manure, and for many centuries paft has infured the fertility of Egypt. When its banks fhall have been cultivated, as the excellency of its foil and temperature of the climate deferves, its population will equal that of any other part of the world. The trade, wealth and power of America, may, at fome future period, depend, and perhaps centre upon the Miffiffippi. This alfo refembles the Nile in the number of its mouths, all iffuing into a fea that may be compared to the Mediterranean, which is bounded on the north and fouth by the two continents of Europe and Africa, as the Mexican Bay is by North and South America. The fmaller mouths of this river might be eafily ftopped up, by means of thofe floating trees with which the river, during the floods, is always covered. The whole force of the channel being united, the only opening then left would probably grow deep, and the bar be removed.

Whoever for a moment will caft his eye over a map of the town of New Orleans, and the immenfe country around it, and view its advantageous fituation, muft be convinced that it or fome place near it, muft in procefs of time become one of the greateft marts in the world.

The Falls of St Anthony, in about lat. 45°, received their name from Father Lewis Hennipin, a French miffionary, who travelled into thefe parts about the year 1680, and was the firft European ever feen by the natives. The whole river, which is more than 250 yards wide, falls perpendicularly about thirty feet, and forms a moft pleafing cataract. The rapids below, in the fpace of three hundred yards render the defcent confiderably greater; fo that when viewed at a diftance, they appear to be much higher than they really are. In the middle of the falls is a fmall ifland, about forty feet broad, and fomewhat longer, on which grow a few cragged hemlock and fpruce trees; and about half way between this ifland and the eaftern fhore is a rock, lying at the very edge of the fall, in an oblique pofition, five or fix feet broad, and thirty or forty long. Thefe falls are peculiarly fituated, as they are approachable without the leaft obftruction from any intervening hill or precipice, which cannot be faid of any other confiderable falls perhaps in the world. The country around is exceedingly beautiful. It is not an uninterrupted plain, where the eye finds no relief, but compofed of many gentle afcents, which, in the fpring and fummer, are covered with verdure, and interfperfed with little groves, that give a pleafing variety to the profpect.

A little diſtance below the falls, is a ſmall iſland of about an acre and an half, on which grow a great number of oak trees, almoſt all the branches of which, able to bear the weight, are, in the proper ſeaſon of the year, loaded with eagles neſts. Their inſtinctive wiſdom has taught them to chooſe this place, as it is ſecure on account of the rapids above, from the attacks of either man or beaſt.

From the beſt accounts that can be obtained from the Indians, we learn that four of the largeſt rivers on the continent of North America, among which are the St Lawrence, the Miſſiſſippi, and the Oregon, or the River of the Weſt, have their ſources in the ſame neighbourhood. The waters of three of them are ſaid to be within 30 miles of each other. If the above information is correct, it ſhews that theſe parts are the higheſt lands in North America: And it is an inſtance not to be parallelled in the other three quarters of the globe, that four rivers of ſuch magnitude ſhould take their riſe together, and each, after running ſeparate courſes, diſcharge their waters into different oceans, at the diſtance of more than two thouſand miles from their ſources. For in their paſſage from this ſpot to the bay of St Lawrence, eaſt; to the bay of Mexico, ſouth; and to the bay at the Straits of Annian, weſt, where the river Oregon is ſuppoſed to empty, each of them traverſes upwards of two thouſand miles.

The Ohio is a moſt beautiful river. Its current gentle, waters clear, and boſom ſmooth and unbroken by rocks and rapids, a ſingle inſtance only excepted. It is one quarter of a mile wide at Fort Pitt; five hundred yards at the mouth of the Great Kanhaway: 1200 yards at Louiſville; and the rapids, half a mile, in ſome few places below Louiſville: but its general breadth does not exceed 600 yards. In ſome places its width is not 400, and in one place particularly, far below the rapids, it is leſs than 300. Its breadth in no one place exceeds 1200 yards, and at its junction with the Miſſiſſippi, neither river is more than 900 yards wide.

Its length, as meaſured according to its meanders by Captain Hutchins, is 1188 miles.

In common winter and ſpring floods, it affords 30 or 40 feet water to Louiſville, 25 or 30 feet to La Tarte's Rapids, forty miles above the mouth of the Great Kanhaway, and a ſufficiency at all times for light batteaux and canoes to Fort Pitt. The Rapids are in latitude 38° 8′. The inundations of this river begin about the laſt of March, and ſubſide in July, although they frequently happen in other months; ſo that boats which carry 300 barrels of flour, from the Monongahela, or Yohogany, above Pittſburg, have ſeldom long to wait for water only. During theſe floods a firſt rate man-of-war may be carried from Louiſville to New Orleans, if the ſudden turns of the river and the ſtrength of its current will admit a ſafe ſteerage; and it is the opinion of Col. Morgan, who has had all the means of information, that a veſſel properly built for the ſea, to draw 12 feet water, when loaded, and carrying from 12 to 1600 barrels of flour, may be more eaſily, cheaply and ſafely navigated from Pittſburgh to the ſea, than thoſe now in uſe; and that this matter only requires one man of capacity and enterprize to aſcertain it. He obſerves that a veſſel intended to be rigged as a brigantine, ſnow, or ſhip, ſhould be double decked, take her maſts on deck, and be rowed to the Ibberville, below which are no iſlands, or to New Orleans, with 20 men, ſo as to afford reliefs of 10 and 10 in the night. Such a veſſel without the uſe of oars, he ſays would float to New Orleans, from Pittſburgh, in 20 times 24 hours. If this be ſo, what agreeable proſpects are preſented to our brethren and fellow citizens in the weſtern country.

The rapids at Louiſville deſcend about 10 feet in a length of a mile and a half. The bed of the river there is a ſolid rock, and is divided by an iſland into two branches, the ſouthern of which is about two hundred yards wide, but impaſſable in dry ſeaſons. The bed of the northern branch is worn into channels by the conſtant courſe of the water and attrition of the pebble-ſtones carried on with that, ſo as to be paſſable for batteaux through the greater part of the year. Yet it is thought that the ſouthern arm may be moſt eaſily opened for conſtant navigation. The riſe of the waters in theſe rapids does not exceed 20 or 25 feet. We have a fort, ſituated at the head of the falls. The ground on the ſouth ſide riſes very gradually.

At Fort Pitt the river Ohio looſes its name, branching into the Monongahela and Allegany.

The Monongahela is four hundred yards wide at its mouth. From thence is twelve or fifteen miles to the mouth of Yohogany, where it is 300 yards wide. Thence to Redſtone by water is 50 miles; by land 30. Then to the mouth of Cheat River, by water 40 miles; by land 28; the width continuing at 300 yards, and the navigation good for boats. Thence the width is about 200 yards to the weſtern fork, fifty miles higher, and the navigation is frequently interrupted by rapids; which, however, with a ſwell of two or three feet, become very paſſable for boats. It then admits light boats, except in dry ſeaſons, 65 miles further, to the head of Tygart's valley, preſenting only ſome ſmall rapids and falls of one or two feet perpendicular, and leſſening in its width to twenty yards. The weſtern fork is navigable in the winter ten or fifteen miles towards the northern of the Little Kanhaway, and will admit a good waggon road to it. The Yohogany is the principal branch of this river. It paſſes through the Laurel Mountain, about thirty miles from its mouth; is ſo far, from 300 to 150 yards wide, and the navigation much obſtructed in dry weather by rapids and ſhoals. In its paſſage through the mountain it makes very great falls, admitting no navigation for ten miles, to the Turkey Foot. Thence to the Great Croſſing, about twenty miles it is again navigable, except in dry ſeaſons, and at this place is two hundred yards wide. The ſources of this river are divided from thoſe of the Potomak by the Allegany Mountain. From the falls, where it interſects the Laurel Mountain, to Fort Cumberland, the head of the navigation on the Potomak, is 40 miles of very mountainous road. Will's Creek, at the mouth of which was Fort Cumberland, is 30 or 40 yards wide, but affords no navigation as yet. Cheat River, another conſiderable branch of the Monongahela, is 200 yards wide at its mouth, and 100 yards at the Dunkard's ſettlement, fifty miles higher. It is navigable for boats, except in dry ſeaſons. The boundary between Virginia and Pennſylvania croſſes it about three or four miles above its mouth.

The Allegany river affords navigation at all ſeaſons for light batteaux to Venango, at the mouth of French Creek,

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Creek, where it is two hundred. yards wide; and it is practifed even to Le Bœuf, from whence there is a portage of fifteen miles and a half to Prefque-Ifle on Lake Erie.

The country watered by the Miffiffippi and its eaftern branches, conftitutes five-eighths of the United States; two of which five-eighths are occupied by the Ohio and its waters; the refiduary ftreams, which run into the Gulf of Mexico, the Atlantic, and the St Lawrence, water the remaining three eighths.

Before we quit the fubject of the weftern waters, we will take a view of their principal connexions with the Atlantic. Thefe are four; the Hudfon's river, the Patomak, St Lawrence, and Miffiffippi. Down the laft will pafs all the heavy commodities. But the navigation through the Gulf of Mexico is fo dangerous, and that up the Miffiffippi fo difficult and tedious, that it is thought probable that European merchandize will not be conveyed through that channel. It is moft likely that flour, timber, and other heavy articles will be floated on rafts, which will themfelves be an article for fale, as well as their loading, the navigators returning by land, as at prefent. There will therefore be a competition between the Hudfon, the Patomak, and the St Lawrence rivers, for the refidue of the commerce of all the country weftward of Lake Erie, on the waters of the lakes of the Ohio, and upper parts of Miffiffippi. To go to New York, that part of the trade which comes from the lakes or their waters, muft firft be brought into Lake Erie. Between Lake Superior and its waters, and Huron, are the Rapids of St Marie, which will permit boats to pafs, but not larger veffels. Lakes Huron and Michigan afford communication with Lake Erie by veffels of eight feet draught. That part of the trade which comes from the waters of the Miffiffippi, muft pafs from them through fome portage into the waters of the lakes. The portage from the Illinois river into a water of Michigan, is of one mile only. From the Wabafh, Miama, Mufkingum, or Allegany, are portages into the waters of Lake Erie, of from one to fifteen miles. When the commodities are brought into, and have paffed through Lake Erie, there is between that and Ontario, an interruption by the Falls of Niagara, where the portage is of eight miles; and between Ontario and the Hudfon's river are portages of the falls of Onondago, a little above Ofwego, of a quarter of a mile; from Wood Creek to the Mohawks river two miles; at the little falls of the Mohawks river half a mile; and from Schenectady to Albany fixteen miles. Befides the increafe of expenfe occafioned by frequent change of carriage, there is an increafed rifk of pillage produced by committing merchandize to a greater number of hands fucceffively. The Patomak offers itfelf under the following circumftances: For the trade of the lakes and their waters weftward of Lake Erie, when it fhall have entered that lake, muft coaft along its fouthern fhore, on account of the number and excellence or its harbours; the northern, though fhorteft, having few harbours, and thefe unfafe. Having reached Cayahoga, to proceed on to New York, it will have eight hundred and twenty-five miles and five portages; whereas it is but four hundred and twenty-five miles to Alexandria, its emporium on the Patomak, if it turns into the Cayahoga, and paffes through that, Big Beaver, Ohio, Yohogany, (or Monongalia and Cheat) and Patomak, and there are but two portages; the firft of which between Cayahoga and Beaver, may be removed by uniting the fources of thefe waters, which are lakes in the neighbourhood of each other, and in a champaign country; the other, from the waters of Ohio to Patomak, will be from fifteen to forty miles, according to the trouble which fhall be taken to approach the two navigations. For the trade of the Ohio, or that which fhall come into it from its own waters or the Miffiffippi, it is nearer through the Patomak to Alexandria than to New York, by five hundred and eighty miles, and it is interrupted by one portage only. There is another circumftance of difference too. The lakes themfelves never freeze, but the communications between them freeze, and the Hudfon's river is itfelf fhut up by the ice three months in the year; whereas the channel to the Chefapeak leads directly into a warmer climate. The fouthern parts of it very rarely freeze at all, and whenever the northern do, it is fo near the fources of the rivers, that the frequent floods, to which they are there liable, break up the ice immediately, fo that veffels may pafs through the whole winter, fubject only to accidental and fhort delays. Add to all this, that in cafe of a war with our neighbours of Canada, or the Indians, the route to New York becomes a frontier through almoft its whole length, and all commerce through it ceafes from that moment. But the channel to New York is already known to practice; whereas, the upper waters of the Ohio and the Patomak, and the great falls of the latter, are yet to be cleared of their obftructions.

The route by St Lawrence is well known to be attended with many advantages, and with fome difadvantages. But there is a fifth route, which the enlightened and enterprizing Pennfylvanians contemplate, which, if effected, will be the eafieft, cheapeft and fureft paffage from the lakes, and Ohio river, by means of the Sufquehannah, and a canal from thence to Philadelphia. The latter part of this plan, viz. the canal between Sufquehannah and the Schuylkill rivers, is now actually in execution. Should they accomplifh their whole fcheme, and they appear confident of fuccefs, Philadelphia, in all probability, will become, in fome future period, one of the largeft cities that has ever yet exifted.

Particular defcriptions of the other rivers in the United States, are given in the geographical accounts of thofe ftates, through which they refpectively flow. One general obfervation refpecting the rivers will, however, be naturally introduced here; and that is, that the entrance into almoft all the rives, inlets and bays, from New-Hampfhire to Georgia, are from fouth-eaft to north-weft.

The coaft of North America is indented with numerous. bays, fome of which are equal in fize to any in the known world. Beginning at the northeafterly part of the continent, and proceeding fouthwefterly, you find among the *largeft* of thefe bays, (for we do not pretend to a complete enumeration of them) firft the Bay or Gulf of St Lawrence, which receives the waters of the river of the fame name. Next are Chedebucto, and Chebucto Bays, in Nova-Scotia, the latter diftinguifhed by the lofs of a French fleet in a former war between France and Great Britain. The Bay of Fundy, between Nova-Scotia and New-Brunfwick, is remarkable for its tides, which rife to the height of fifty or fixty feet,

feet, and flow fo rapidly as to overtake animals which feed upon the fhore. Paffamaquoddy, Penobfcot, Broad and Cafco Bays, lie along the coaft of the Diftrict of Maine. Maffachufetts Bay fpreads eaftward of Bofton, and is comprehended between Cape Ann on the north, and Cape Cod on the fouth. The points of Bofton harbour are Nahant and Alderton points. Paffing by Narraganfet and other bays in the ftate of Rhode Ifland, you enter Long Ifland Sound, between Montauk Point and the main. This *Sound,* as it is called, is a kind of inland fea, from three to twenty-five miles broad, and about one hundred and forty miles long, extending the whole length of the ifland, and dividing it from Connecticut. It communicates with the ocean at both ends of Long Ifland, and affords a very fafe and convenient inland navigation.

The celebrated ftrait, called *Hell Gate,* is near the weft end of this Sound, about eight miles eaftward of New-York city, and is remarkable for its whirlpools, which make a tremendous roaring at certain times of tide. Thefe whirlpools are occafioned by the narrownefs and crookednefs of the pafs, and a bed of rocks which extend quite acrofs it; and not by the meeting of the tides from eaft to weft, as has been conjectured, becaufe they meet at Frogs Point, feveral miles above. A fkilful pilot may, with fafety, conduct a fhip of any burden through this ftrait with the tide, or, at ftill water, with a fair wind (F).

Delaware Bay is fixty miles long, from the Cape to the entrance of the river Delaware at Bombay Hook, and fo wide in fome parts, as that a fhip in the middle of it cannot be feen from the land. It opens into the Atlantic north-weft and fouth-eaft, between Cape Henlopen on the right, and Cape May on the left. Thefe Capes are eighteen or twenty miles apart.

The Chefapeak is a very fpacious bay, 150 (fome fay 170) miles in length from north to fouth, and from 7 to 18 miles broad. It is generally as much as 9 fathoms deep, and affords many commodious harbours, and a fafe and eafy navigation. Its entrance, which is 12 miles wide, is nearly E. N. E. and S. S. W. between Cape Charles, lat. 37° 12′, and Cape Henry, lat. 37° in Virginia. It feparates the eaftern parts of Virginia and Maryland, leaving a fmall part of the former, and a large portion of the latter of thefe ftates on its eaftern fhore. It receives the waters of the Sufquehannah, Patomak, Rappahannok, York and James Rivers, which are all large and navigable.

The tract of country belonging to the United States, is happily variegated with plains and mountains, hills and vallies. Some parts are rocky, particularly New England, the north parts of New York and New Jerfey, and a broad fpace, including the feveral ridges of the long range of mountains which run fouth-weftward through Pennfylvania, Virginia, North Carolina, and part of Georgia, dividing the waters which flow into the Atlantic, from thofe which fall into the Miffiffippi. In the parts eaft of the Allegany mountains, in the fouthern ftates, the country for feveral hundred miles in length, and fixty or feventy, and fometimes more, in breadth, is level and entirely free from ftone. It has been a queftion, agitated by the curious, whether the extenfive tract of low, flat country, which fronts the feveral ftates fouth of New York, and extends back to the hills, has remained in its prefent form and fituation ever fince the flood; or, whether it has been made by the particles of earth which have been wafhed down from the adjacent mountains, and by the accumulation of foil from the decay of vegetable fubftances; or, by earth wafhed out of the Bay of Mexico by the Gulf Stream, and lodged on the coaft; or, by the recefs of the ocean, occafioned by a change in fome other parts of the earth; or, from other caufes unknown to us. Several phenomena deferve confideration in forming an opinion on this queftion.

1. It is a fact well known to every perfon of obfervation who has lived in, or travelled through the fouthern ftates, that marine fhells and other fubftances which are peculiar to the fea fhore, are almoft invariably found by digging eighteen or twenty feet below the furface of the earth. A gentleman of veracity told the author, that in finking a well many miles from the fea, he found, at the depth of twenty feet, every appearance of a falt marfh, that is, marfh grafs, marfh mud, and brackifh water. In all this flat country, until you come to the hilly land, wherever you dig a well, you find the water, at a certain depth, frefh and tolerably good; but if you exceed that depth two or three feet, you come to a faltifh or brackifh water that is fcarcely drinkable; and the earth dug up, refembles, in appearance and fmell, that which is dug up on the edges of the falt marfhes.

2. On and near the margin of the rivers are frequently found fand hills, which appear to have been drifted into ridges by the force of water. At the bottom of fome of the banks in the rivers, fifteen or twenty feet below the furface of the earth, are wafhed out from the folid ground, logs, branches and leaves of trees; and the whole bank, from bottom to top, appears ftreaked with layers of logs, leaves and fand. Thefe appearances are feen far up the rivers, from eighty to an hundred miles from the fea, where, when the rivers are low, the banks are from fifteen to twenty feet high. As you proceed down the rivers towards the fea, the banks decreafe in height, but ftill are formed of layers of fand, leaves and logs, fome of which are entirely found, and appear to have been fuddenly covered to a confiderable depth.

3. It has been obferved that the rivers in the fouthern ftates, frequently vary their channels; that the fwamps and low grounds are conftantly filling up; and that the land, in many places, annually infringes upon the ocean. It is an authenticated fact, that no longer ago than 1771, at Cape Lookout, on the coaft of North Carolina, in about latitude 34° 50′, there was an excellent harbour, capacious enough to receive an hundred fail of fhipping at a time, in a good depth of water. It is now entirely filled up, and is folid ground. Inftances of this kind are frequent along the coaft.

It is obfervable, likewife, that there is a gradual defcent

(F) There is a tradition that Long Ifland and the adjacent Continent were, in former days, feparated only by a fmall river, and that the aboriginal inhabitants of this place could ftep from rock to rock, and crofs this "arm of the fea," as it may now be called, at *Hell Gate.* *Dr Mitchill.*

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descent of about eight hundred feet, by measurement, from the foot of the mountains to the sea board. This descent continues, as is demonstrated by soundings, far into the sea.

4. It is worthy of observation, that the soil on the banks of the rivers is proportionably coarse or fine according to its distance from the mountains. When you first leave the mountains, and for a considerable distance, it is observable, that the soil is coarse, with a large mixture of sand and shining heavy particles. As you proceed toward the sea, the soil is less coarse, and so on, in proportion as you advance, the soil is finer and finer, until, finally, is deposited a soil so fine, that it consolidates into perfect clay; but a clay of a peculiar quality, for a great part of it has intermixed with it reddish streaks and veins, like a species of *ochre*, brought probably from the *red lands* which lie up towards the mountains. This clay, when dug up and exposed to the weather, will dissolve into a fine mould, without the least mixture of sand or any gritty substance whatever. Now we know that running waters, when turbid, will deposit, first, the coarsest and heaviest particles, mediately, those of the several intermediate degrees of fineness, and ultimately, those which are the most light and subtle; and such in fact is the general quality of the soil on the banks of the southern rivers.

5. It is a well known fact, that on the banks of Savannah river, about ninety miles from the sea, in a direct line, and one hundred and fifty or two hundred, as the river runs, there is a very remarkable collection of oyster-shells of an uncommon size. They run in a north-east and south-west direction, nearly parallel to the sea coast, in three distinct ridges, which together occupy a space of seven miles in breadth. The ridges commence at Savannah river, and have been traced as far south as the northern branches of the Alatamaha river. They are found in such quantities, as that the Indigo planters carry them away in large boat loads for the purpose of making lime water, to be used in the manufacture of indigo. There are thousands and thousands of tons still remaining (G). The question is, how came they here? It cannot be supposed that they were carried by land. Neither is it probable that they were conveyed in canoes or boats to such a distance from the place where oysters are now found. The uncivilized natives, agreeably to their roving manner of living, would rather have removed to the sea shore, than have been at such immense labour in procuring oysters. Besides, the difficulties of conveying them would have been insurmountable. They would not only have had a strong current in the river against them, an obstacle which would not have been easily overcome by the Indians, who have ever had a great aversion to labour; but could they have surmounted this difficulty, oysters conveyed such a distance, either by land or water, in so warm a climate, would have spoiled on the passage, and have become useless. The circumstance of these shells being found in such quantities, at so great a distance from the sea, can be rationally accounted for in no other way, than by supposing that the sea shore was formerly near this bed of shells, and that the ocean has since, by the operation of certain causes not yet fully investigated, receded. These phenomena, as they cannot be otherwise accounted for, prove as far as it can be proved, that a great part of the flat country which spreads easterly of the Allegany mountains, had, in some past period, a superincumbent sea or water; but it is beyond the abilities of man to account for the change in a satisfactory manner.

The tract of country east of Hudson's river, comprehending part of the State of New York, the four New England States, and Vermont, is rough, hilly, and in some parts mountainous. In all parts of the world, and particularly on this western continent, it is observable, that as you depart from the ocean or from a river, the land gradually rises: and the height of land, in common, is about equally distant from the water on either side. The *Andes*, in South America, form the height of land between the Atlantic and Pacific Oceans. The Highlands between the district of Maine and the Province of Lower Canada, divide the rivers which fall into the St Lawrence, north, and into the Atlantic, south. The Green Mountains, in Vermont, divide the waters which flow easterly into Connecticut river from those which fall westerly into Lake Champlaine, Lake George, and Hudson's river.

Between the Atlantic, the Mississippi, and the Lakes, runs a long range of mountains, made up of a number of ridges. These mountains extend north-easterly and south-westerly, nearly parallel to the sea coast, about nine hundred miles in length, and from sixty to one hundred and fifty, and two hundred miles in breadth. Mr Evans observes, with respect to that part of these mountains which he travelled over, viz. in the back parts of Pennsylvania, that scarcely one acre in ten is capable of culture. This, however, is not the case in all parts of this range. Numerous tracts of fine arable and

(G) " On the Georgia side of the river, about 15 miles below Silver Bluff, the high road crosses a ridge of high swelling hills of uncommon elevation, and perhaps 70 feet higher than the surface of the river. These hills are from three feet below the common vegetative surface, to the depth of 20 or 30 feet, composed entirely of fossil oyster-shells, internally of the colour and consistency of clear white marble: They are of an incredible magnitude, generally 15 or 20 inches in length; from 6 to 8 wide, and from 2 to 4 in thickness, and their hollows sufficient to receive an ordinary man's foot. They appear all to have been opened before the period of petrifaction; a transmutation they seem evidently to have suffered. They are undoubtedly very ancient, or perhaps antediluvian. The adjacent inhabitants burn them to lime, for building, for which purpose they serve very well; and would undoubtedly afford an excellent manure, when their lands require it, these hills now being remarkably fertile. The heaps of shells lie upon a *stratum* of yellowish sand mould, of several feet in depth, upon a foundation of soft white rocks, that has the outward appearance of free stone, but on strict examination is really a testaceous concrete, or composition of sand and pulverised sea shells. In short, this testaceous rock approaches near in quality and appearance to the Bahama or Bermudian white rock." [*Bartram's Travels, p.* 318.]

and grazing land intervene between the ridges. The different ridges which compofe this immenfe range of mountains have different names in different ftates.

As you advance from the Atlantic, the firft ridge in Pennfylvania, Virginia, and North Carolina, is the Blue Ridge, or South Mountain, which is from one hundred and thirty to two hundred miles from the fea. Between this and the North Mountain fpreads a large fertile vale; next lies the Allegany ridge; next beyond this is the Long Ridge, called the Laurel Mountains, in a fpur of which, about latitude 36°, is a fpring of water, fifty feet deep, very cold, and it is faid, as blue as indigo. From thefe feveral ridges, proceed innumerable namelefs branches or fpurs. The Kittatinny Mountains run through the northern parts of New Jerfey and Pennfylvania. All thefe ridges, except the Allegany, are feparated by rivers, which appear to have forced their paffages through folid rocks.

The principal ridge is the Allegany, which has been defcriptively called the *back bone* of the United States. The general name for thefe mountains, taken collectively, feems not yet to have been determined. Mr Evans calls them the *Endlefs Mountains*: others have called them the *Appalachian* mountains, from a tribe of Indians, who live on a river which proceeds from this mountain, called the Appalachicola. But the moft common name is the *Allegany Mountains*, fo called, either from the principal ridge of the range, or from their running nearly parallel to the Allegany or Ohio River; which, from its head waters till it empties into the Miffiffippi, is known and called by the name of *Allegany River*, by the Seneca and other tribes of the Six Nations, who once inhabited it. Thefe mountains are not confufedly fcattered and broken, rifing here and there into high peaks, overtopping each other, but ftretch along in uniform ridges, fcarcely half a mile high. They fpread as you proceed fouth, and fome of them terminate in high perpendicular bluffs. Others gradually fubfide into a level country, giving rife to the rivers which run foutherly into the Gulf of Mexico.

They afford many curious phenomena, from which naturalifts have deduced many theories of the earth; fome of them have been very whimfical. Mr Evans fuppofes that the moft obvious of the theories which have been formed of the earth is, that it was originally made out of the ruins of another. "Bones and fhells which efcaped the fate of fofter animal fubftances, we find mixed with the old materials, and elegantly preferved in the loofe ftones and rocky bafes of the higheft of thefe hills." With deference, however, to Mr Evans's opinion, thefe appearances have been much more rationally accounted for by fuppofing the reality of the flood, of which Mofes has given us an account. Mr Evans thinks this too great a miracle to obtain belief. But whether is it a greater miracle for the Creator to alter a globe of earth by a deluge, when made, or to create one new from the ruins of another? The former certainly is not lefs credible than the latter. "Thefe mountains," fays our author, "exifted in their prefent elevated height before the deluge, but not fo bare of foil as now." How Mr Evans came to be fo circumftantially acquainted with thefe pretended facts, is difficult to determine, unlefs we fuppofe him to have been an Antediluvian, and to have furveyed them accurately before the convulfions of the deluge; and until we can be fully affured of this, we muft be excufed in not affenting to his opinion, and in adhering to the old philofophy of Mofes and his advocates. We have every reafon to believe that the primitive ftate of the earth was totally metamorphofed by the firft convulfion of nature, at the time of the deluge; that *the fountains of the great deep were indeed broken up*, and that the various *ftrata* of the earth were diffevered, and thrown into every poffible degree of confufion and diforder. Hence thofe vaft piles of mountains which lift their craggy cliffs to the clouds, were probably thrown together from the floating ruins of the earth: And this conjecture is remarkably confirmed by the vaft number of foffils and other marine *exuviæ* which are found imbedded on the tops of the mountains, in the interior parts of continents remote from the fea, in all parts of the world hitherto explored. The various circumftances attending thefe marine bodies, leave us to conclude, that they were actually generated, lived, and died in the very beds wherein they were found, and therefore thefe beds muft have originally been at the bottom of the ocean, though now in many inftances elevated feveral miles above its furface. Hence it has been fuppofed that mountains and continents were not primary productions of nature, but of a very diftant period of time from the creation of the world; a time long enough for the *ftrata* to have acquired their greateft degree of cohefion and hardnefs; and for the teftaceous matter of marine fhells to become changed to a ftony fubftance; for in the fiffures of the lime-ftone and other ftrata, fragments of the fame fhell have been frequently found adhering to each fide of the cleft, in the very ftate in which they were originally broken; fo that if the feveral parts were brought together, they would apparently tally with each other exactly. A very confiderable time therefore muft have elapfed between the chaotic ftate of the earth and the deluge, which agrees with the account of Mofes, who makes it a little upwards of fixteen hundred years. Thefe obfervations are intended to fhow, in one inftance out of many others, the agreement between revelation and reafon, between the account which Mofes gives us of the creation and deluge, and the prefent appearances of nature.

In the United States are to be found every fpecies of foil that the earth affords. In one part of them or another, they produce all the various kinds of fruits, grain, pulfe and hortuline plants and roots, which are found in Europe, and have been thence tranfplanted to America. Befides thefe, a great variety of native, vegetable productions.

The natural hiftory of the American States, is yet in its infancy. The productions of the fouthern ftates and of Canada, have not been well defcribed by any one author, in a work profeffedly for that purpofe; but are moftly intermixed with the productions of other parts of the world, in the large works of European Botanifts. This renders it difficult to felect them, and to give an accurate connected account of them. To remedy this inconvenience, and to refcue this country from the reproach of not having any authentic and fcientific account of its Natural Hiftory, Rev. Dr Cutler, who has already examined nearly all the vegetables of New England, has for fome time contemplated the publication of a botanical work of confiderable magnitude, confined principally to the productions of the New England

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States. Dr Barton, of Philadelphia, has been collecting materials for a work of a fimilar nature, to comprehend the middle and fouthern ftates; when finifhed, both together, will form a complete Natural Hiftory of the American States.

The birds of America, fays Catefby, generally exceed thofe of Europe in the beauty of their plumage, but are much inferior to them in the melody of their notes.

The middle ftates, including Virginia, appear to be the climates, in North America, where the greateft number and variety of birds of paffage celebrate their nuptials and rear their offspring, with which they annually return to more fouthern regions. Moft of our birds are birds of paffage from the fouthward. The eagle, the pheafant, grous and partridge of Pennfylvania, feveral fpecies of woodpeckers, the crow, blue jay, robin, marfh wren, feveral fpecies of fparrows or fnow birds, and the fwallow, are perhaps nearly all the land birds that continue the year round to the northward of Virginia.

Very few tribes of birds build or rear their young in the fouth or maritime parts of Virginia, in Carolina, Georgia and Florida; yet all thofe numerous tribes, particularly of the foft billed kind, which breed in Pennfylvania, pafs, in the fpring feafon, through thefe regions in a few weeks time, making but very fhort ftages by the way; and again, but few of them winter there on their return fouthwardly.

It is not known how far to the fouth they continue their route, during their abfence from the northern and middle ftates.

Among amphibious reptiles are the mud tortoife or turtle (Teftudo denticulata.) Speckled land tortoife (Teftudo carolina.) Great foft fhelled tortoife of Florida (Teftudo nafo cylindracea elongato, truncato. Bartram.) When full grown it weighs from 30 to 40 pounds, (fome fay 70 pounds) extremely fat and delicious food. Great land tortoife, called gopher; its upper fhell is about 18 inches long, and from 10 to 12 broad.—Found fouth of Savannah river.

Two fpecies of frefh water tortoifes inhabit the tide water rivers in the fouthern States; one is large, weighing from 10 to 12 pounds, the back fhell nearly of an oval form; the other fpecies fmall; but both are efteemed delicious food. The tortoifes of the northern ftates are of feveral fpecies, but have not been fcientifically defignated.

Of the frog kind there are many fpecies and in great numbers. Alfo of lizards, from the alligator to the fmall blue lizard.

Snakes are numerous, and of a great variety of kinds, fome of which, as the rattle fnake, are venomous and others not. They are not fo numerous nor fo venomous in the northern as in the fouthern ftates. In the latter, however, the inhabitants are furnifhed with a much greater variety of plants and herbs, which afford immediate relief to perfons bitten by thefe venomous creatures. It is an obfervation worthy of perpetual and grateful remembrance, that wherever venomous animals are found, the God of nature has kindly provided fufficient antidotes againft their poifon.

Of fifhes a vaft variety are found in the feas and rivers of the United States, from the whale down to the fmalleft fpecies.

A vaft variety of infects are found in the United States, of which fome catalogues have been publifhed by Dr Belknap and others.

According to the cenfus, taken by order of Congrefs, in 1790, the number of inhabitants in the United States of America, was three millions, nine hundred thirty thoufand, nearly. In this number none of the inhabitants of the Territory N. W. of the river Ohio, and but a part of the inhabitants of Tenneffee were included. Thefe added would undoubtedly have increafed the number to 3,950,000, at the period the cenfus was taken. According to the cenfus taken in 1800, the total number of inhabitants in the United States was five millions three hundred and five thoufand fix hundred and fixty fix, including eight hundred and ninety three thoufand fix hundred and five flaves.

The American Republic is compofed of almoft all nations, languages, characters and religions which Europe can furnifh; the greater part however, are defcended from Britain and Ireland.

The Americans, collected together from various countries, of different habits, formed under different governments, and of different languages, cuftoms, manners and religion, have not yet affimilated to that degree as to form a *national* character. We are yet an infant empire, rifing faft to maturity, with profpects of a vigorous and powerful manhood.

Until the revolution of 1783, Europeans were ftrangely ignorant of America and its inhabitants. They concluded that the new world *muft* be inferior to the old. The count de Buffon fuppofed that the animals in this country were uniformly lefs than in Europe, and thence concluded, that, "on this fide of the Atlantic there is a tendency in nature to diminifh the fize of her productions." The Abbe Raynal, in a former edition of his works, fuppofed this tendency or influence had its effect on the race of whites tranfplanted from Europe, and thence had the prefumption to affert that "America had not yet produced one good poet, one able mathematician, one man of genius in a fingle art or fcience." Had the Abbe been juftly informed, we prefume he would not have hazarded an affertion fo falfe, ungenerous and injurious to the genius and character of Americans. The fact is, the United States of America have produced their full proportion of genius in the fcience of war, in phyfics, aftronomy and mathematics; in mechanic arts, in government, in fifcal fcience, in divinity, in hiftory, in oratory, in poetry, in painting, in mufic, and the plaftic art. So many have diftinguifhed themfelves in fome of thefe branches of fcience, and fuch numbers are now living, that it would be an impracticable and invidious tafk to attempt an enumeration of them.

The two late important revolutions in America, which have been fcarcely exceeded in any former period of the world, viz. that of the declaration and eftablifhment of independence, and that of the adoption of a new and excellent form of government without blood fhed, have called to hiftoric fame many great and diftinguifhed characters who might otherwife have flept in oblivion.

One of the moft unamiable traits in the character of Americans, has been produced by the unjuftifiable practice of enflaving the negroes. The influence of flavery upon the morals, manners, induftry and liberties of a peoa people, is extremely pernicious. But under the federal government, from the meafures already adopted, we have reafon to indulge the pleafing hope, that all flaves in the United States, will in time be emancipated, in a manner moft confiftent with their own happinefs and the true intereft of their proprietors.

In the middle and northern ftates there are comparatively but few flaves; and of courfe there is lefs difficulty in giving them their freedom. In Maffachufetts alone, and we mention it to their diftinguifhed honour, there are NONE. Societies for the manumiffion of flaves have been inftituted in Philadelphia, New York, Providence and New Haven, and laws have been enacted in the New England ftates, to accomplifh the fame purpofe. And it is with pleafure we can affert, from the beft information, that the condition of the negroes in the fouthern ftates is much ameliorated of late, and that no further importation is likely ever to take place. The Friends, (commonly called Quakers) have evinced the propriety of their name, by their goodnefs in originating, and their vigorous exertions in executing the truly humane and benevolent defign of freeing the negroes. It is earneftly hoped, however, that no meafures will be adopted or purfued, which may hazard effects fo fhocking as have recently taken place in the Weft India Iflands, or which may produce a convulfion as unfavourable to the blacks as to their owners. The evil of flavery, if left pretty much to its own courfe, will beft cure itfelf. At any rate, benevolence dictates that its abolition fhould be gradual.

The Englifh language is univerfally fpoken in the United States, and in it bufinefs is tranfacted, and the records are kept. It is fpoken with great purity, and pronounced with propriety in New England, by perfons of education; and, excepting fome corruptions in pronunciation, by all ranks of people. In the middle and fouthern ftates, where they have had a great influx of foreigners, the language, in many inftances, is corrupted, efpecially in pronunciation. Attempts are making to introduce a uniformity of pronunciation throughout the ftates, which for political as well as other reafons, it is hoped will meet the approbation and encouragement of all literary and influential characters (H).

Intermingled with the Americans, are the Dutch, French, Germans, Swedes and Jews; all thefe retain, in a greater or lefs degree, their native language, in which they perform their public worfhip, converfe and tranfact their bufinefs with each other.

The time, however, is anticipated, at leaft earneftly wifhed for, when all improper diftinctions fhall be abolifhed; and when the language, manners, cuftoms, political and religious fentiments of the mixed mafs of people who inhabit the United States, fhall have become fo affimilated, as that all nominal and party diftinctions fhall be loft in the general and honourable name of AMERICANS.

Until the fourth of July, 1776, the prefent United States were Britifh colonies. On that memorable day, the Reprefentatives of the United States of America, in Congrefs affembled, made a folemn declaration, in which they affigned their reafons for withdrawing their allegiance from the King of Great Britain. Appealing to the Supreme Judge of the world for the rectitude of their intentions, they did, in the name and by the authority of the good people of the colonies, folemnly publifh and declare, That thefe United Colonies were, and of right ought to be FREE and INDEPENDENT States; that they were abfolved from all allegiance to the Britifh crown, and that all political connexion between them and Great Britain was, and ought to be, totally diffolved; and that as Free and Independent States, they had full power to levy war, conclude peace, contract alliances, eftablifh commerce, and do all other acts and things which Independent States may of right do. For the fupport of this declaration, with a firm reliance on the protection of divine Providence, the delegates then in Congrefs, fifty-five in number, mutually pledged to each other their lives, their fortunes, and their facred honour.

At the fame time they publifhed Articles of Confederation and Perpetual Union between the ftates, in which they took the ftyle of "THE UNITED STATES OF AMERICA," and agreed, that each ftate fhould retain its fovereignty, freedom, and independence, and every power, jurifdiction and right not exprefsly delegated to Congrefs by the confederation. By thefe articles, the Thirteen United States feverally entered into a firm league of friendfhip with each other for their common defence, the fecurity of their liberties, and their mutual and general welfare, and bound themfelves to affift each other, againft all force offered to, or attacks that might be made upon all, or any of them, on account of religion, fovereignty, commerce or any other pretence whatever. But for the more convenient management of the general interefts of the United States, it was determined, that Delegates fhould be annually appointed, in fuch manner as the Legiflature of each ftate fhould direct, to meet in Congrefs the firft Monday in November of every year, with a power referved to each ftate to recal its delegates, or any of them, at any time within the year, and to fend others in their ftead for the remainder of the year. No ftate was to be reprefented in Congrefs by lefs than two, or more than feven members; and no perfon could be a delegate for more than three years, in any term of fix years, nor was any perfon, being a delegate, capable of holding any office under the United States, for which he, or any other for his benefit, fhould receive

(H) "The northern and fouthern ftates differ widely in their cuftoms, climate, produce, and in the general face of the country. The middle ftates preferve a medium in all thefe refpects; they are neither fo level and hot as the ftates fouth, nor fo hilly and cold as thofe north and eaft. The inhabitants of the north are hardy, induftrious, frugal, and in general well informed; thofe of the fouth, owing to the warmth of their climate, are more effeminate, indolent and luxurious. The fifheries and commerce are the finews of the north; tobacco, rice, wheat and indigo of the fouth. The northern ftates are commodioufly fituated for trade and manufactures; the fouthern to furnifh provifions and raw materials; and the probability is, that the fouthern ftates will one day be fupplied with northern manufactures, inftead of European, and make their remittances in provifions and raw materials." *MS. Journal of E. Watfon Efq.*

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receive any falary, fees or emolument of any kind. In determining queftions in Congrefs, each ftate was to have one vote. Every ftate was bound to abide by the determinations of Congrefs in all queftions which were fubmitted to them by the confederation. The articles of confederation were to be invariably obferved by every ftate, and the Union to be perpetual; nor was any alteration at any time hereafter to be made in any of the articles, unlefs fuch alterations be agreed to in Congrefs, and be afterwards confirmed by the legiflatures of every ftate. The articles of confederation were ratified by Congrefs, July 9th, 1778.

Thefe articles of confederation, being found inadequate to the purpofes of a federal government, for obvious reafons, delegates were chofen in each of the United States, to meet and fix upon the neceffary amendments. They accordingly met in convention at Philadelphia, in the fummer of 1787, and agreed to propofe the following Constitution for the confideration of their conftituents, and which we here infert at length for the general information of the people, whom it concerns to be well acquainted with the nature of their own government.

We, the People of the United States, in order to form a more perfect union, eftablifh juftice, infure domeftic tranquillity, provide for the common defence, promote the general welfare, and fecure the bleffings of liberty to ourfelves and our pofterity, do ordain and eftablifh this Conftitution for the United States of America.

Art. 1. Sect. 1. All legiflative powers herein granted fhall be vefted in a Congrefs of the United States, which fhall confift of a Senate and Houfe of Reprefentatives.

Sect. 2. The Houfe of Reprefentatives fhall be compofed of members chofen every fecond year by the people of the feveral ftates, and the electors in each ftate fhall have the qualifications requifite for electors of the moft numerous branch of the ftate legiflature.

No perfon fhall be a Reprefentative who fhall not have attained the age of twenty-five years, and been feven years a citizen of the United States, and who fhall not, when elected, be an inhabitant of that ftate in which he fhall be chofen.

Reprefentatives and direct taxes fhall be apportioned among the feveral ftates which may be included within this union, according to their refpective numbers, which fhall be determined by adding to the whole number of free perfons, including thofe bound to fervice for a term of years, and excluding Indians not taxed, three-fifths of all other perfons. The actual enumeration fhall be made within three years after the firft meeting of the Congrefs of the United States, and within every fubfequent term of ten years, in fuch manner as they fhall by law direct. The number of reprefentatives fhall not exceed one for every thirty thoufand, but each ftate fhall have at leaft one reprefentative; and until fuch enumeration fhall be made, the ftate of New Hampfhire fhall be entitled to choofe three, Maffachufetts eight, Rhode Ifland and Providence Plantations one, Connecticut five, New York fix, New Jerfey four, Pennfylvania eight, Delaware one, Maryland fix, Virginia ten, North Carolina five, South Carolina five, and Georgia three.

When vacancies happen in the reprefentation from any ftate, the executive authority thereof fhall iffue writs of election to fill fuch vacancies.

The Houfe of Reprefentatives fhall choofe their Speaker and other officers; and fhall have the fole power of impeachment.

Sect. 3. The Senate of the United States fhall be compofed of two fenators from each ftate, chofen by the legiflature thereof, for fix years; and each fenator fhall have one vote.

Immediately after they fhall be affembled, in confequence of the firft election, they fhall be divided as equally as may be into three claffes. The feats of the fenators of the firft clafs fhall be vacated at the expiration of the fecond year, of the fecond clafs at the expiration of the fourth year, and of the third clafs at the expiration of the fixth year, fo that one third may be chofen every fecond year; and if vacancies happen by refignation, or otherwife, during the recefs of the legiflature of any ftate, the executive thereof may make temporary appointments until the next meeting of the legiflature, which fhall then fill fuch vacancies.

No perfon fhall be a fenator who fhall not have attained to the age of thirty years, and been nine years a citizen of the United States, and who fhall not, when elected, be an inhabitant of that ftate for which he fhall be chofen.

The Vice Prefident of the United States fhall be Prefident of the Senate, but fhall have no vote, unlefs they be equally divided.

The Senate fhall choofe their other officers, and alfo a Prefident pro tempore in the abfence of the Vice Prefident, or when he fhall exercife the office of Prefident of the United States.

The Senate fhall have the fole power to try all impeachments. When fitting for that purpofe, they fhall be on oath or affirmation. When the Prefident of the United States is tried, the Chief Juftice fhall prefide; and no perfon fhall be convicted without the concurrence of two-thirds of the members prefent.

Judgment in cafe of impeachment fhall not extend further than to removal from office, and difqualification to hold and enjoy any office of honour, truft or profit under the United States; but the party convicted fhall neverthelefs be liable and fubject to indictment, trial, judgment and punifhment, according to law.

Sect. 4. The times, places and manner of holding elections for fenators and reprefentatives, fhall be prefcribed in each ftate by the legiflature thereof; but the Congrefs may at any time by law make or alter fuch regulations, except as to the places of choofing Senators.

The Congrefs fhall affemble at leaft once in every year, and fuch meeting fhall be on the firft Monday in December, unlefs they fhall by law appoint a different day.

Sect. 5. Each houfe fhall be the judge of the elections, returns and qualifications of its own members, and a majority of each fhall conftitute a quorum to do bufinefs; but a fmaller number may adjourn from day to day, and may be authorifed to compel the attendance of abfent members, in fuch manner, and under fuch penalties as each houfe may provide.

Each houfe may determine the rules of its proceed-

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ings, punifh its members for diforderly behaviour, and, with the concurrence of two-thirds, expel a member.

Each houfe fhall keep a journal of its proceedings, and from time to time publifh the fame, excepting fuch parts as may in their judgment require fecrecy; and the yeas and nays of the members of either houfe on any queftion, fhall, at the defire of one-fifth of thofe prefent, be entered on the journal.

Neither houfe, during the feffion of Congrefs, fhall, without the confent of the other, adjourn for more than three days, nor to any other place than that in which the two houfes fhall be fitting.

Sect. 6. The Senators and Reprefentatives fhall receive a compenfation for their fervices to be afcertained by law, and paid out of the treafury of the United States. They fhall in all cafes except treafon, felony and breach of the peace, be privileged from arreft during their attendance at the feffion of their refpective houfes, and in going to and returning from the fame; and for any fpeech or debate in either houfe, they fhall not be queftioned in any other place.

No Senator or Reprefentative fhall, during the time for which he was elected, be appointed to any civil office under the authority of the United States, which fhall have been created, or the emoluments whereof fhall have been increafed during fuch time; and no perfon holding any office under the United States, fhall be a member of either houfe during his continuance in office.

Sect. 7. All bills for raifing revenue fhall originate in the Houfe of Reprefentatives; but the Senate may propofe or concur with amendments as on other bills.

Every bill which fhall have paffed the Houfe of Reprefentatives and the Senate fhall, before it becomes a law, be prefented to the Prefident of the United States; if he approve, he fhall fign it, but if not, he fhall return it, with his objections, to that houfe in which it fhall have originated, who fhall enter the objections at large on their journal, and proceed to re-confider it. If, after fuch re-confideration, two-thirds of that houfe fhall agree to pafs the bill, it fhall be fent, together with the objections to the other houfe, by which it fhall likewife be re-confidered, and if approved by two-thirds of that houfe it fhall become a law. But in all fuch cafes the votes of both houfes fhall be determined by yeas and nays, and the names of the perfons voting for and againft the bill fhall be entered on the journal of each houfe refpectively. If any bill fhall not be returned by the Prefident within ten days, (Sundays excepted) after it fhall have been prefented to him, the fame fhall be a law, in like manner as if he had figned it, unlefs the Congrefs, by their adjournment, prevent its return, in which cafe it fhall not be a law.

Every order, refolution, or vote, to which the concurrence of the Senate and Houfe of Reprefentatives may be neceffary (except on a queftion of adjournment) fhall be prefented to the Prefident of the United States; and before the fame fhall take effect, fhall be approved by him, or, being difapproved by him, fhall be re-paffed by two-thirds of the Senate and Houfe of Reprefentatives, according to the rules and limitations prefcribed in the cafe of a bill.

Sect. 8. The Congrefs fhall have power

To lay and collect taxes, duties, impofts and excifes; to pay the debts and provide for the common defence and general welfare of the United States; but all duties, impofts and excifes fhall be uniform throughout the United States;

To borrow money on the credit of the United States:

To regulate commerce with foreign nations, and among the feveral ftates, and with the Indian tribes;

To eftablifh an uniform rule of naturalization, and uniform laws on the fubject of bankruptcies throughout the United States;

To coin money, regulate the value thereof, and of foreign coin, and fix the ftandard of weights and meafures;

To provide for the punifhment of counterfeiting the fecurities and current coin of the United States;

To eftablifh poft offices and poft roads;

To promote the progrefs of fcience and ufeful arts, by fecuring for limited times, to authors and inventors, the exclufive right to their refpective writings and difcoveries;

To conftitute tribunals inferior to the fupreme court;

To define and punifh piracies and felonies commited on the high feas, and offences againft the law of nations;

To declare war, grant letters of marque and reprifal, and make rules concerning captures on land and water;

To raife and fupport armies, but no appropriation of money to that ufe fhall be for a longer term than two years;

To provide and maintain a navy;

To make rules for the government and regulation of the land and naval forces;

To provide for calling forth the militia to execute the laws of the union, fupprefs infurrections, and repel invafions;

To provide for organizing, arming, and difciplining the militia, and for governing fuch part of them as may be employed in the fervice of the United States, referving to the ftates refpectively the appointment of the officers, and the authority of training the militia according to the difcipline prefcribed by Congrefs;

To exercife exclufive legiflation in all cafes whatfoever over fuch diftrict (not exceeding ten miles fquare) as may by ceffion of particular ftates, and the acceptance of Congrefs, become the feat of the government of the United States, and to exercife like authority over all places purchafed by the confent of the legiflature of the ftate in which the fame fhall be, for the erection of forts, magazines, arfenals, dockyards, and other needful buildings:—And

To make all laws which fhall be neceffary and proper for carrying into execution the foregoing powers, and all other powers vefted by this conftitution in the government of the United States, or in any department or officer thereof.

Sect. 9. The migration or importation of fuch perfons as any of the ftates now exifting fhall think proper to admit, fhall not be prohibited by the Congrefs prior to the year one thoufand eight hundred and eight, but a tax or duty may be impofed on fuch importation, not exceeding ten dollars for each perfon.

The privilege of the writ of habeas corpus fhall not be fufpended, unlefs when in cafes of rebellion or invafion the public fafety may require it.

No bill of attainder or ex poft facto law fhall be paffed.

No

No capitation, or other direct tax, ſhall be laid, unleſs in proportion to the cenſus or enumeration herein before directed to be taken.

No tax or duty ſhall be laid on articles exported from any ſtate.—

No preference ſhall be given by any regulation of commerce or revenue to the ports of one ſtate over thoſe of another; nor ſhall veſſels bound to or from one ſtate, be obliged to enter, clear, or pay duties in another.

No money ſhall be drawn from the treaſury, but in conſequence of appropriations made by law; and a regular ſtatement and account of the receipts and expenditures of all public money ſhall be publiſhed from time to time.

No title of nobility ſhall be granted by the United States; and no perſon holding any office of profit or truſt under them, ſhall, without the conſent of Congreſs, accept of any preſent, emolument, office or title of any kind whatever, from any king, prince or foreign ſtate.

Sect. 10. No ſtate ſhall enter into any treaty, alliance or confederation; grant letters of marque and repriſal; coin money; emit bills of credit; make any thing but gold and ſilver coin a tender in payment of debts; paſs any bill of attainder, ex poſt facto law, or law impairing the obligation of contracts, or grant any title of nobility.

No ſtate ſhall, without the conſent of Congreſs, lay any impoſt or duties on imports or exports, except what may be abſolutely neceſſary for executing its inſpection laws; and the net produce of all duties and impoſts, laid by any ſtate on imports or exports, ſhall be for the uſe of the treaſury of the United States; and all ſuch laws ſhall be ſubject to the reviſion and control of the Congreſs. No ſtate ſhall, without the conſent of Congreſs, lay any duty of tonnage, keep troops, or ſhips of war, in time of peace, enter into any agreement or compact with another ſtate, or with a foreign power, or engage in war, unleſs actually invaded, or in ſuch imminent danger as will not admit of delay.

Art. 2. Sect. 1. The executive power ſhall be veſted in a Preſident of the United States of America. He ſhall hold his office during the term of four years, and, together with the Vice Preſident, choſen for the ſame term, be elected as follows:

Each ſtate ſhall appoint, in ſuch manner as the legiſlature thereof may direct, a number of electors, equal to the whole number of Senators and Repreſentatives to which the ſtate may be entitled in the Congreſs; but no Senator or Repreſentative, or perſon holding an office of truſt or profit under the United States, ſhall be appointed an elector.

The electors ſhall meet in their reſpective ſtates, and vote by ballot for two perſons, of whom one at leaſt ſhall not be an inhabitant of the ſame ſtate with themſelves. And they ſhall make a liſt of all the perſons voted for, and of the number of votes for each; which liſt they ſhall ſign and certify, and tranſmit, ſealed, to the ſeat of the government of the United States, directed to the Preſident of the Senate. The Preſident of the Senate ſhall, in the preſence of the Senate and Houſe of Repreſentatives, open all the certificates, and the votes ſhall then be counted. The perſon having the greateſt number of votes ſhall be the Preſident, if ſuch number be a majority of the whole number of electors appointed; and if there be more than one who have ſuch majority, and have an equal number of votes, then the Houſe of Repreſentatives ſhall immediately chooſe by ballot one of them for Preſident; and if no perſon have a majority, then from the five higheſt on the liſt, the ſaid Houſe ſhall in like manner chooſe the Preſident. But in chooſing the Preſident, the votes ſhall be taken by ſtates, the repreſentation from each ſtate having one vote; a quorum for this purpoſe ſhall conſiſt of a member or members from two-thirds of the ſtates, and a majority of all the ſtates ſhall be neceſſary to a choice. In every caſe, after the choice of the Preſident, the perſon having the greateſt number of votes of the electors ſhall be the Vice Preſident. But if there ſhould remain two or more who have equal votes, the Senate ſhall chooſe from them by ballot the Vice Preſident.

The Congreſs may determine the time of chooſing the electors, and the day on which they ſhall give their votes; which day ſhall be the ſame throughout the United States.

No perſon, except a natural born citizen, or a citizen of the United States at the time of the adoption of this conſtitution, ſhall be eligible to the office of Preſident; neither ſhall any perſon be eligible to that office who ſhall not have attained to the age of thirty-five years, and been fourteen years a reſident within the United States.

In caſe of the removal of the Preſident from office, or of his death, reſignation, or inability to diſcharge the powers and duties of the ſaid office, the ſame ſhall devolve on the Vice Preſident, and the Congreſs may by law provide for the caſe of removal, death, reſignation or inability, both of the Preſident and Vice Preſident, declaring what officer ſhall then act as Preſident, and ſuch officer ſhall act accordingly, until the diſability be removed, or a Preſident ſhall be elected.

The Preſident ſhall, at ſtated times, receive for his ſervices a compenſation, which ſhall neither be increaſed or diminiſhed during the period for which he ſhall have been elected, and he ſhall not receive within that period any other emolument from the United States, or any of them.

Before he enter on the execution of his office, he ſhall take the following oath or affirmation.

"I do ſolemnly ſwear (or affirm) that I will faithfully execute the office of Preſident of the United States, and will, to the beſt of my ability, preſerve, protect, and defend the conſtitution of the United States."

Sect. 2. The Preſident ſhall be commander in chief of the army and navy of the United States and of the militia of the ſeveral ſtates, when called into the actual ſervice of the United States; he may require the opinion, in writing, of the principal officer in each of the executive departments, upon any ſubject relating to the duties of their reſpective offices, and he ſhall have power to grant reprieves and pardons for offences againſt the United States, except in caſes of impeachment.

He ſhall have power, by and with the advice and conſent of the Senate, to make treaties, provided two-thirds of the ſenators preſent concur; and he ſhall nominate, and by and with the advice and conſent of the Senate, ſhall appoint ambaſſadors, other public miniſters and conſuls, judges of the ſupreme court, and all other officers of the United States, whoſe appointments are not herein otherwiſe provided for, and which ſhall be eſtabliſhed lifhed by law. But the Congrefs may by law veft the appointment of fuch inferior officers as they think proper in the Prefident alone, in the courts of law, or in the heads of departments.

The Prefident fhall have power to fill up all vacancies that may happen during the recefs of the Senate, by granting commiffions which fhall expire at the end of their next feffion.

Sect. 3. He fhall from time to time give to the Congrefs information of the ftate of the Union, and recommend to their confideration fuch meafures as he fhall judge neceffary and expedient; he may, on extraordinary occafions, convene both houfes, or either of them, and in cafe of difagreement between them, with refpect to the time of adjournment, he may adjourn them to fuch time as he fhall think proper; he fhall receive ambaffadors and other public minifters; he fhall take care that the laws be faithfully executed, and fhall commiffion all the officers of the United States.

Sect. 4. The Prefident, Vice Prefident, and all civil officers of the United States, fhall be removed from office on impeachment for, and conviction of, treafon, bribery, or other high crimes and mifdemeanors.

Art. 3. Sect. 1. The Judicial power of the United States fhall be vefted in one fupreme court, and in fuch inferior courts as the Congrefs may from time to time ordain and eftablifh. The Judges, both of the fupreme and inferior courts, fhall hold their offices during good behaviour, and fhall, at ftated times, receive for their fervices a compenfation, which fhall not be diminifhed during their continuance in office.

Sect. 2. The judicial power fhall extend to all cafes, in law and equity, arifing under this conftitution, the laws of the United States, and treaties made, or which fhall be made, under their authority; to all cafes affecting ambaffadors, other public minifters and confuls; to all cafes of admiralty and maritime jurifdiction; to controverfies to which the United States fhall be a party; to controverfies between two or more ftates, between a ftate and citizens of another ftate, between citizens of different ftates, between citizens of the fame ftate claiming lands under grants of different ftates, and between a ftate, or the citizens thereof, and foreign ftates, citizens or fubjects.

In all cafes affecting ambaffadors, other public minifters and confuls, and thofe in which a ftate fhall be a party, the fupreme court fhall have original jurifdiction. In all the other cafes before mentioned, the fupreme court fhall have appellate jurifdiction, both as to law and fact, with fuch exceptions, and under fuch regulations as the Congrefs fhall make.

The trial of all crimes, except in cafes of impeachment, fhall be by jury; and fuch trials fhall be held in the ftate where the faid crime fhall have been committed; but when not committed within any ftate, the trial fhall be at fuch place or places as the Congrefs may by law have directed.

Sect. 3. Treafon againft the United States fhall confift only in levying war againft them, or in adhering to their enemies, giving them aid and comfort. No perfon fhall be convicted of treafon unlefs on the teftimony of two witneffes to the fame overt act, or on confeffion in open court.

The Congrefs fhall have power to declare the punifhment of treafon, but no attainder of treafon fhall work corruption of blood, or forfeiture, except during the life of the perfon attainted.

Art. 4. Sect. 1. Full faith and credit fhall be given in each ftate to the public acts, records, and judicial proceedings of every other ftate. And the Congrefs may by general laws prefcribe the manner in which fuch acts, records and proceedings fhall be proved, and the effect thereof.

Sect. 2. The citizens of each ftate fhall be entitled to all privileges and immunities of citizens in the feveral ftates.

A perfon charged in any ftate with treafon, felony, or other crime, who fhall flee from juftice, and be found in another ftate, fhall, on demand of the executive authority of the ftate from which he fled, be delivered up, to be removed to the ftate having jurifdiction of the crime.

No perfon held to fervice or labour in one ftate, under the laws thereof, efcaping into another, fhall in confequence of any law or regulation therein, be difcharged from fuch fervice or labour, but fhall be delivered up on claim of the party to whom fuch fervice or labour may be due.

Sect. 3. New States may be admitted by the Congrefs into this union, but no new ftate fhall be formed or erected within the jurifdiction of any other ftate; nor any ftate be formed by the junction of two or more ftates, or parts of ftates, without the confent of the legiflatures of the ftates concerned as well as of the Congrefs.

The Congrefs fhall have power to difpofe of and make all needful rules and regulations refpecting the territory or other property belonging to the United States; and nothing in this conftitution fhall be fo conftrued as to prejudice any claims of the United States, or of any particular ftate.

Sect. 4. The United States fhall guarantee to every ftate in this union a republican form of government, and fhall protect each of them againft invafion; and on application of the legiflature, or of the executive (when the legiflature cannot be convened) againft domeftic violence.

Art. 5. The Congrefs, whenever two-thirds of both Houfes fhall deem it neceffary, fhall propofe amendments to this conftitution, or, on the application of the legiflatures of two-thirds of the feveral ftates, fhall call a convention for propofing amendments, which in either cafe, fhall be valid to all intents and purpofes, as part of this conftitution, when ratified by the legiflatures of three-fourths of the feveral ftates, or by Conventions in three-fourths thereof, as the one or the other mode of ratification may be propofed by the Congrefs: Provided, that no amendment which may be made prior to the year one thoufand eight hundred and eight fhall in any manner affect the firft and fourth claufes in the ninth fection of the firft article; and that no ftate, without its confent, fhall be deprived of its equal fuffrage in the Senate.

Art. 6. All debts contracted and engagements entered into, before the adoption of this conftitution, fhall be as valid againft the United States under this conftitution, as under the confederation.

This conftitution, and the laws of the United States which fhall be made in purfuance thereof; and all treaties made, or which fhall be made, under the authority

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of the United States, ſhall be the ſupreme law of the land; and the judges in every ſtate ſhall be bound thereby, any thing in the conſtitution or laws of any ſtate to the contrary notwithſtanding.

The Senators and Repreſentatives before mentioned, and the members of the ſeveral State Legiſlatures, and all Executive and Judicial officers, both of the United States and of the ſeveral ſtates, ſhall be bound by oath or affirmation, to ſupport this conſtitution; but no religious teſt ſhall ever be required as a qualification to any office or public truſt under the United States.

Art. 7. The ratification of the conventions of nine ſtates, ſhall be ſufficient for the eſtabliſhment of this conſtitution between the ſtates ſo ratifying the ſame.

DONE in Convention, by the unanimous conſent of the ſtates preſent, the ſeventeenth day of September, in the year of our Lord one thouſand ſeven hundred and eighty-ſeven, and of the Independence of the United States of America, the Twelfth. In Witneſs whereof, we have hereunto ſubſcribed our names.

GEORGE WASHINGTON, PRESIDENT.

Signed alſo by all the Delegates which were preſent from twelve ſtates.

Atteſt. WILLIAM JACKSON, SECRETARY.

The foregoing Conſtitution has ſince been adopted by all the ſtates in the Union, as is hereafter more particularly mentioned.

The Conventions of a number of the ſtates having at the time of their adopting the Conſtitution expreſſed a deſire, in order to prevent miſconſtruction or abuſe of its powers, that further declaratory and reſtrictive clauſes ſhould be added: And as extending the ground of public confidence in the government will beſt enſure the beneficent ends of its inſtitution,

Reſolved by the Senate and Houſe of Repreſentatives of the United States of America in Congreſs aſſembled, two-thirds of both houſes concurring, That the following articles be propoſed to the legiſlatures of the ſeveral ſtates, as amendments to the Conſtitution of the United States, all or any of which articles, when ratified by three-fourths of the ſaid legiſlatures, to be valid to all intents and purpoſes, as part of the ſaid conſtitution, viz.

Articles in addition to, and amendment of, the Conſtitution of the United States of America, propoſed by Congreſs, and ratified by the Legiſlatures of the ſeveral ſtates, purſuant to the fifth Article of the original conſtitution.

Art. 1. After the firſt enumeration required by the firſt article of the Conſtitution, there ſhall be one Repreſentative for every thirty thouſand, until the number ſhall amount to one hundred, after which the proportion ſhall be ſo regulated by Congreſs, that there ſhall be not leſs than one hundred Repreſentatives, nor leſs then one Repreſentative for every forty thouſand perſons, until the number of Repreſentatives ſhall amount to two hundred, after which the proportion ſhall be ſo regulated by Congreſs, that there ſhall not be leſs than two hundred Repreſentatives, nor more than one Repreſentative for every fifty thouſand perſons.

Art. 2. No law varying the compenſation for the ſervices of the Senators and Repreſentatives ſhall take effect, until an election of Repreſentatives ſhall have intervened.

Art. 3. Congreſs ſhall make no law reſpecting an eſtabliſhment of religion, or prohibiting the free exerciſe thereof; or abridging the freedom of ſpeech, or of the preſs; or the right of the people peaceably to aſſemble, and to petition the government for a redreſs of grievances.

Art. 4. A well regulated militia being neceſſary to the ſecurity of a free ſtate, the right of the people to keep and bear arms, ſhall not be infringed.

Art. 5. No ſoldier ſhall in time of peace be quartered in any houſe without the conſent of the owner, nor in time of war, but in a manner to be preſcribed by law.

Art. 6. The right of the people to be ſecure in their perſons, houſes, papers and effects againſt unreaſonable ſearches and ſeizures, ſhall not be violated; and no warrants ſhall iſſue, but upon probable cauſe, ſupported by oath or affirmation, and particularly deſcribing the place to be ſearched, and the perſons or things to be ſeized.

Art. 7. No perſon ſhall be held to anſwer for a capital, or otherwiſe infamous crime, unleſs on a preſentment or indictment of a grand jury, except in caſes ariſing in the land or naval forces, or in the militia when in actual ſervice in time of war or public danger: nor ſhall any perſon be ſubject for the ſame offence to be twice put in jeopardy of life or limb; nor ſhall be compelled in any criminal caſe to be a witneſs againſt himſelf, nor be deprived of life, liberty or property, without due proceſs of law; nor ſhall private property be taken for public uſe without juſt compenſation.

Art. 8. In all criminal proſecutions the accuſed ſhall enjoy the right to a ſpeedy and public trial, by an impartial jury of the ſtate and diſtrict wherein the crime ſhall have been committed, which diſtrict ſhall have been previouſly aſcertained by law, and to be informed of the nature and cauſe of the accuſation; to be confronted with the witneſſes againſt him; to have compulſory proceſs for obtaining witneſſes in his favour, and to have the aſſiſtance of counſel for his defence.

Art. 9. In ſuits at common law, where the value in controverſy ſhall exceed twenty dollars, the right of trial by jury ſhall be preſerved, and no fact, tried by a jury, ſhall be otherwiſe re-examined in any court of the United States, than according to the rules of the common law.

Art. 10. Exceſſive bail ſhall not be required, nor exceſſive fines impoſed, nor cruel and unuſual puniſhments inflicted.

Art. 11. The enumeration in the Conſtitution, of certain rights, ſhall not be conſtrued to deny or diſparage others retained by the people.

Art. 12. The powers not delegated to the United States by the Conſtitution, nor prohibited by it to the States, are reſerved to the States reſpectively, or to the people.

How many of the foregoing articles have become parts of the Conſtitution, by conſent of three fourths of the States, is not known to the writer. The following ſtates in 1796, had ratified all of them, viz. Maryland, North Carolina, South Carolina, New York, Virginia and Vermont. New Hampſhire, New Jerſey and Pennſylvania had rejected the ſecond article, and Delaware the firſt. Other amendments have ſince been propoſed.

The *Society of the Cincinnati* was inſtituted immediately on the cloſe of the war in 1783. At their firſt general meeting in Philadelphia, in May, 1784, they altered and amended the original inſtitution, and reduced

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duced it to its present form. They denominated themselves, "*The Society of the Cincinnati*," from the high veneration they possessed for the character of that illustrious Roman, *Lucius Quintus Cincinnatus*.

The persons who constitute this society, are all the commissioned and brevet officers of the army and navy of the United States, who served three years, and who left the service with reputation; all officers who were in actual service at the conclusion of the war; all the principal staff officers of the continental army; and the officers who have been deranged by the several resolutions of Congress, upon the different reforms of the army.

The motives which originally induced the officers of the American army to form themselves into a society of friends, are summed up in a masterly manner, in their circular letter. "Having," say they, "lived in the strictest habits of amity through the various stages of a war, unparalleled in many of its circumstances; having seen the objects for which we have contended, happily attained; in the moment of triumph and separation, when we were about to act the last pleasing, melancholy scene in our military drama; pleasing, because we were to leave our country possessed of independence and peace; melancholy, because we were to part, perhaps never to meet again; while every breast was penetrated with feelings which can be more easily conceived than described; while every little act of tenderness recurred fresh to the recollection, it was impossible not to wish our friendships should be continued, it was extremely natural to desire they might be perpetuated by our posterity to the remotest ages. With these impressions, and with such sentiments, we candidly confess we signed the institution. We knew our motives were irreproachable."

They rest their institution upon the two great pillars of FRIENDSHIP and CHARITY. Their benevolent intentions are, to diffuse comfort and support to any of their unfortunate companions who have seen better days, and have merited a milder fate; to wipe the tear from the eye of the widow, who must have been consigned, with her helpless infants, to indigence and wretchedness, but for this charitable institution; to succour the fatherless; to rescue the female orphan from destruction; and to enable the son to emulate the virtues of the father. "Let us, then," they conclude, "prosecute with ardor what we have instituted in sincerity; let Heaven and our own consciences approve our conduct; let our actions be our best comment on our words; and let us leave a lesson to posterity, That the glory of Soldiers cannot be completed, without acting well the part of Citizens."

The Society have an order, viz. a Bald Eagle of gold, bearing on its breast the emblems described as follows:

The principal figure is CINCINNATUS; three senators presenting him with a sword and other military ensigns: On a field in the back ground, his wife standing at the door of their cottage; near it a plough and other instruments of husbandry. Round the whole, *omnia reliquit servare rempublicam*. On the reverse, the sun rising, a city with open gates, and vessels entering the port; fame crowning *Cincinnatus* with a wreath, inscribed, *virtutis premium*. Below, hands joining, supporting a heart; with the motto, *esto perpetua*. Round the whole, *Societas Cincinnatorum, instituta*, A. D. 1783.

The three important objects of attention in the United States, are agriculture, commerce and manufactures. The richness of the soil, which amply rewards the industrious husbandman; the temperature of the climate, which admits of steady labour; the cheapness of land, which tempts the foreigner from his native home; and the extensive tracts of unsettled lands, leads us to fix on agriculture as the present great leading interest of this country. This furnishes outward cargoes not only for all our own ships, but for those also which foreign nations send to our ports; or in other words it pays all our importations; it supplies a great part of the clothing of the inhabitants, and food for them and their cattle. What is consumed at home, including the materials for manufacturing, has been estimated at four or five times the value of what is exported.

The number of people employed in agriculture, is at least three parts in four of the inhabitants of the United States. It follows of course that they form the body of the militia, who are the bulwark of the nation. The value of the property occupied by agriculture, is many times greater than the property employed in every other way. The settlement of waste lands, the subdivision of farms, and the numerous improvements in husbandry, annually increase the preeminence of the agricultural interest. The resources we derive from it, are at all times certain and indispensably necessary. Besides, the rural life promotes health, by its active nature; and morality, by keeping people from the luxuries and vices of the populous towns. In short, agriculture is the spring of our commerce, and the parent of our manufactures. It is friendly, nay it is necessary, to the existence of a republican form of government.

The vast extent of sea coast, which spreads before these confederated states; (1) the number of excellent harbours and sea-port towns; the numerous creeks and immense bays, which indent the coast; and the rivers, lakes and canals, which peninsulate the whole country; added to its agricultural advantages and improvements, give this part of the world superior advantages for trade. Our commerce, including our exports, imports, shipping, manufactures and fisheries, may properly be considered

(1) When the extent of America is considered, boldly fronting the old world, blessed with every climate, capable of every production, abounding with the best harbours and rivers on the globe, and already overspread with five millions of souls, mostly descendants of Englishmen, inheriting all their ancient enthusiasm for liberty, and enterprizing almost to a fault; what may be expected from such a people in such a country? The partial hand of nature has laid off America upon a much larger scale than any other part of the world. Hills in America are mountains in Europe, brooks are rivers, and ponds are swelled into lakes. In short, the map of the world cannot exhibit a country uniting so many natural advantages, so pleasingly diversified, and that offers such abundant and easy resources to agriculture, commerce and manufactures.

"In contemplating *future America*, the mind is lost in the din of cities, in harbours and rivers clouded with sails, and in the immensity of her population." [*MS. Journal of Elkanah Watson, Esq.*]

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conſidered as forming one intereſt. This has been conſidered as the great object, and the moſt important intereſt of the New England States.

The late war, which brought about our ſeparation from Great Britain, threw our commercial affairs into great confuſion. The powers of the old confederation were unequal to the complete execution of any meaſures, calculated effectually to recover them from their deranged ſituation. Through want of power in the old Congreſs to collect a revenue for the diſcharge of our foreign and domeſtic debt, our credit was deſtroyed, and trade of conſequence greatly embarraſſed. Each ſtate, in her deſultory regulations of trade, regarded her own intereſt, while that of the union was neglected. And ſo different were the intereſts of the ſeveral ſtates, that their laws reſpecting trade often claſhed with each other, and were productive of unhappy conſequences. The large commercial ſtates had it in their power to oppreſs their neighbours; and in ſome inſtances this power was directly or indirectly exerciſed. Theſe impolitic and unjuſtifiable regulations, formed on the impreſſion of the moment, and proceeding from no uniform or permanent principles, excited unhappy jealouſies between the claſhing ſtates, and occaſioned frequent ſtagnations in their trade, and in ſome inſtances, a ſecrecy in their commercial policy. But the wiſe meaſures which have been adopted by Congreſs, under the preſent government, have extricated us from theſe embarraſſments, and put a new and pleaſing face upon our affairs. Inveſted with the adequate powers, Congreſs have formed a ſyſtem of commercial regulations, which has placed our commerce on a reſpectable, uniform and intelligible footing, adapted to promote the general intereſts of the union, with the ſmalleſt injury to the individual ſtates.

The value of the exports of theſe ſtates before the revolution is not preciſely aſcertained; but the whole exportation of North America, including the remaining Britiſh Colonies, and Newfoundland, (whoſe fiſhery alone was eſtimated at more than 2,200,000 dollars in 1775) Bermuda, and the Bahamas, were computed to have been in 1771 15,280,000 dollars. In theſe were compriſed the ſhipments between thoſe iſlands and the main, and from province to province, as every veſſel which departed from one American port to another, was obliged to clear out her cargo as if deſtined for a foreign country.

The amount of exports of the United States in the year 1799 was 33,142,187 dollars in domeſtic produce, and 45,523,335 dollars in foreign produce, total 78,665,522 dollars. In time of peace however, ſo great an amount cannot be expected.

In reſpect to the commercial intercourſe between the United States and foreign nations, as regulated by exiſting treaties, or by the laws of the land, the ſubject is too extenſive, complex and important to be embraced to advantage within a compaſs proportioned to the nature of this work.

It is aſſerted that the value of the manufactures of the United State is more than double the value of their exports in native commodities, and alſo much greater than the groſs value of all their imports, including the value of goods exported again. The American manufacturers confine their attention chiefly to articles of neceſſity, comfort and utility. Since the eſtabliſhment of the preſent federal government the manufactures have increaſed with great rapidity; and particularly thoſe of the houſehold kind, which are carried on more or leſs in the families of almoſt all the farmers and planters in the ſeveral ſtates.

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Standing armies are deemed inconſiſtent with a republican government; we of courſe have none. Our military ſtrength lies in a well diſciplined militia. According to the cenſus of 1790, there were in the United States, 814,000 men of 16 years old and upwards, whites. Suppoſe that the ſuperanuated, the officers of government, and the other claſſes of people who are excuſed from military duty, amounted to 114,000, there remained at that period a militia of 700,000 men. The increaſe of this number has been in proportion to the increaſe of the whole number of inhabitants ſince the year 1790. Of the militia a great proportion are well-diſciplined, vetran troops. No nation or kingdom in Europe, can bring into the field an army of equal numbers, more formidable than can be raiſed in the United States.

The Revenue of the United States is raiſed from duties on the tonnage of veſſels entered in the United States, and on imported goods, wares and merchandize, and from an exciſe on various articles of conſumption. The amount of the duties ariſing on the tonnage of veſſels, for the year commencing October 1ſt, 1790, and ending September 30th, 1791, amounted to 145,347 dollars. The duties ariſing on goods, wares and merchandize, for the ſame year amounted to 3,006,722 dollars. The amount of the revenue from the exciſe was then eſtimated in round numbers at 400,000 dollars.

	Dols.	Cts.
Amount of the *Permanent* Revenue of the United States, 1795, ariſing from duties on imports and tonnage, on diſtilled ſpirits, poſtage of letters, patent fees, and intereſt of bank ſtock,	4,692,673	83
Temporary Revenue for the ſame period,	1,859,626	91
Total,	6,552,300	74
The Expenditures for the ſame year, for intereſt of foreign and public debt, civil and naval departments, &c.	5,481,843	84
Exceſs of Revenue beyond Expenditure,	1,070,456	90

At the cloſe of the year 1794, the debt of the United States amounted to 64,825,538 dollars and 70 cents, excluſive of the public ſtock purchaſed by means of the ſinking fund, and ſome other debts hereafter mentioned, which, if added, would have increaſed it to about 74,000,000 dollars.

The act, making proviſion for the debt of the United States, has appropriated the proceeds of the weſtern lands as a fund for the diſcharge of the public debt. And the act, making proviſion for the reduction of the public debt, has appropriated all the ſurplus of the duties on imports and tonnage, to the end of the year 1790, to the purpoſe of purchaſing the debt at the market price; and has authoriſed the Preſident to borrow the further ſum of two millions of dollars for the ſame object. Theſe meaſures ſerve to indicate the intention of the

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the legiſlature, as early and as faſt as poſſible, to provide for the extinguiſhment of the exiſting debt.

"The foreign and domeſtic debts of the United States of America," ſays Mr. Coxe, (K) "as they appeared upon their public books on the firſt day of the current year, 1794, amounted to a little more than ſeventy-four millions of dollars. From this ſum, ſeven or eight millions are to be deducted, being different kinds of ſtock purchaſed in by means of the ſinking fund, or due upon the books or upon certificates from the United States to ſeveral of the members of the union: that is to themſelves. Of the entire balance, about fourteen millions will not bear intereſt until the year 1800. Much of the debt bears an intereſt at one half of the eſtabliſhed rate of this country. Some of it bears an intereſt of two-thirds, ſome of three-fourths, and ſome of four-fifths of the medium of the legal intereſt of the ſtates. It therefore reſults that forty-eight millions of dollars in ſpecie, about £.11,000,000 ſterling, would purchaſe or diſcharge all the debts of the United States, which they owe to individuals, or to bodies politic other than themſelves."

The preſent eligible ſituation of the United States, compared with that of Europe at large, as it reſpects taxes or contributions for the payment of all public charges, appears from the following ſtatement, furniſhed (1792) by a gentleman of acknowledged abilities. In the United States, the average proportion of his earnings which each citizen pays for the ſupport of the civil, military and naval eſtabliſhments, and for the diſcharge of the intereſt of the public debts of his country, is about *one dollar and a quarter;* equal to *two day's* labour, nearly; that is, 5 millions of dollars to 4 millions of people. In Great Britain, France, Holland, Spain, Portugal, Germany, &c. the taxes for theſe objects, on an average, amount to about *ſix dollars and a quarter*, to each perſon. Hence it appears that in the United States we enjoy the bleſſings of free government and mild laws; of perſonal liberty, and protection of property, for one-fifth part of the ſum for each individual, which is paid in Europe for the purchaſe of public benefits of a ſimilar nature, and too generally without attaining their objects: For leſs than *one-fifth*, indeed, as in European countries, in general, 10 days labour, on an average, do not amount to $6\frac{1}{4}$ dollars. In this eſtimate proper allowances are made for public debts. The Indian war in the United States, at preſent, requires nearly half a million of dollars, annually, extra; but this, being temporary only, is not taken into the eſtimate.

From the beſt data that can be collected, the taxes in the United States, for county, town and pariſh purpoſes; for the ſupport of ſchools, the poor, roads, &c. appear to be conſiderably leſs than in thoſe countries; and perhaps the objects of them, except in roads, is attained in a more perfect degree. Great preciſion is not to be expected in theſe calculations; but we have ſufficient documents to prove that we are not far from the truth. The proportion in the United States is well aſcertained; and with equal accuracy in France by Mr Neckar; and in England, Holland, Spain and other kingdoms in Europe, by him, Zimmerman, and other writers on the ſubject.

For the objects of the late war and civil government in the United States, nearly 12 millions of dollars were annually raiſed, for nine years ſucceſſively, apportioned on the number of inhabitants at that period, which amounted to a little ſhort of *four dollars* to each perſon. This was raiſed principally by direct taxes. Perhaps a contribution of *ſix dollars* a perſon would not have been ſo ſeverely felt, had a part of it been raiſed by impoſt and exciſe. Theſe ſums, raiſed for the war, by the free exertions of the people, obviate all ſuch objections as aſſert that the United States are poor; at the ſame time they evince that their ſituation is eligible and proſperous, by ſhewing how large a proportion of their earnings the people in general can apply to their private purpoſes.

A national mint was eſtabliſhed in 1791. It has ſince been provided by law that the purity and intrinſic value of the ſilver coin ſhall be equal to that of Spain; and of the gold coins, to thoſe of the ſtricteſt European nations. The government of the United States derives no profit from the coinage.

The Bank of the United States was incorporated by act of Congreſs, February 25th, 1791, by the name and ſtyle of *The Preſident, Directors and Company of the Bank of the United States.* The amount of the capital ſtock is 10 million dollars, one-fourth of which is in gold and ſilver; the other three-fourths, in that part of the public debt of the United States, which, at the time of payment, bears an accruing intereſt of 6 per cent. per annum. Two millions of this capital ſtock of 10 millions, was ſubſcribed by the Preſident, in behalf of the United States. The ſtockholders are to continue a corporate body, by the act, until the 4th day of March, 1811; and are capable, in law, of holding property to an amount not exceeding, in the whole, 15 million dollars, including the aforeſaid 10 million dollars, capital ſtock. The corporation may not at any time owe, whether by bond, bill or note, or other contract, more than 10 million dollars, over and above the monies then actually depoſited in the bank for ſafe keeping, unleſs the contracting of any greater debt ſhall have been previouſly authoriſed by a law of the United States. The corporation is not at liberty to receive more than 6 per cent. per annum for or upon its loans or diſcounts; nor to purchaſe any public debt whatever, or to deal or trade, directly or indirectly, in any thing except bills of exchange, gold or ſilver bullion, or in the ſale of goods really and truly pledged, for money lent, and not redeemed in due time, or of goods which ſhall be the produce of its bonds; they may ſell any part of the public debt of which its ſtock ſhall be compoſed. Loans not exceeding 100,000 dollars, may be made to the United States, and to particular ſtates, of a ſum not exceeding 50,000 dollars.

Offices for the purpoſes of diſcount and depoſit only, may be eſtabliſhed within the United States, upon the ſame terms, and in the ſame manner, as ſhall be practiſed at the bank. Five of theſe offices, called *Branch Banks*, have been already eſtabliſhed, viz. at Boſton, New-York, Baltimore, Charleſton, and Waſhington. The

(K) View of the United States, p. 496.

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The faith of the United States is pledged that no other bank ſhall be eſtabliſhed by any future law of the United States, during the continuance of the above corporation. The great benefits of this Bank, as it reſpects public credit and commerce, have already been experienced.

The conſtitution of the United States provides againſt the making of any law reſpecting an eſtabliſhment of religion, or prohibiting the free exerciſe of it. And in the conſtitutions of the reſpective ſtates, religious liberty is a fundamental principle. In this important article, our government is diſtinguiſhed from that of any of the nations in Europe. Religion here is placed on its proper baſis; without the feeble and unwarranted aid of the civil power, it is left, to be ſupported by its own evidence, by the lives of its profeſſors, and the Almighty care of its Divine Author. Its public teachers are maintained by an equal tax on property, by pew rents, monies at intereſt, marriage and burial fees, ſmall glebes, land rents, and voluntary contributions.

All being left at liberty to chooſe their own religion, the people, as might eaſily be ſuppoſed, have varied in their choice. The bulk of the people would denominate themſelves Chriſtians; a ſmall portion of them are Jews; ſome plead the ſufficiency of natural religion, and reject revelation as unneceſſary and fabulous; and many have yet their religion to chooſe. Chriſtians profeſs their religion under various forms, and with different ideas of its doctrines, ordinances and precepts. The following denominations of Chriſtians are more or leſs numerous in the United States, viz. Congregationaliſts, Preſbyterians, Dutch Reformed Church, Epiſcopalians, Baptiſts, Quakers or Friends, Methodiſts, Roman Catholics, German Lutherans, German Calviniſts or Preſbyterians, Moravians, Tunkers, Mennoniſts, Univerſaliſts and Shakers. For a particular account of theſe ſeveral ſects of Chriſtians, the reader is referred to Miſs H. Adams's "View of Religions."

Of theſe ſects of Chriſtians, Congregationaliſts are the moſt numerous. In New England alone, beſides thoſe which are ſcattered through the middle and ſouthern ſtates, there are about 1200 congregations of this denomination.

Next to Congregationaliſts, Preſbyterians are the moſt numerous denomination of Chriſtians in the United States. They have a conſtitution, by which they regulate all their eccleſiaſtical proceedings, and a confeſſion of faith, which all church officers and church members are required to ſubſcribe. Hence they have preſerved a ſingular uniformity in their religious ſentiments, and have conducted their eccleſiaſtical affairs with a great degree of order and harmony.

The body of the preſbyterians inhabit the middle and ſouthern ſtates, and are united under the ſame conſtitution. By this conſtitution, the Preſbyterians, who are governed by it, in 1796 were divided into four ſynods and eighteen preſbyteries; viz. 1. Synod of New York, 5 preſbyteries; 94 congregations; 61 ſettled miniſters.—2. Synod of Philadelphia, 6 preſbyteries; 92 congregations; 60 ſettled miniſters, beſides the miniſters and congregations belonging to Baltimore preſbytery.—3. Synod of Virginia, 4 preſbyteries; 70 congregations; 49 ſettled miniſters, excluſive of the congregations and miniſters of Tranſylvania preſbytery.—4. Synod of the Carolinas, 3 preſbyteries; 82 congregations; 42 ſettled miniſters; the miniſters and congregations in Abbington preſbytery not included. If we ſuppoſe the number of congregations in the preſbyteries which made no returns to their Synods to be 100, and the number of ſettled miniſters in the ſame to be 40, the whole number of preſbyterian congregations in this connexion, will be 438, which are ſupplied by 223 ſettled miniſters, and between 70 and 80 candidates, beſides a number of ordained miniſters who have no particular charges. Each of the four Synods meet annually; beſides which they have a joint meeting by their commiſſioners, once a year, in General Aſſembly at Philadelphia.

The Preſbyterian churches are governed by congregational, preſbyterial and ſynodical aſſemblies. Theſe aſſemblies poſſeſs no civil juriſdiction. Their power is wholly moral or ſpiritual, and that only miniſterial and declarative. They poſſeſs the right of requiring obedience to the laws of Chriſt, and of excluding the diſobedient from the privileges of the church; and the powers requiſite for obtaining evidence and inflicting cenſure; but the higheſt puniſhment to which their authority extends, is to exclude the contumacious and impenitent from the congregation of believers.

The Dutch Reformed churches in the United States, who maintain the doctrine of the ſynod of Dort, held in 1618, are between 70 and 80 in number, conſtituting ſix claſſes, which form one ſynod, ſtyled "The Dutch Reformed Synod of New York and New Jerſey." The claſſes conſiſt of miniſters and ruling elders; each claſſis delegates two miniſters and an elder to repreſent them in ſynod.

The number of Proteſtant Epiſcopal churches in the United States is not aſcertained; in New England there are between forty and fifty; but in the ſouthern ſtates they are much more numerous. Biſhops of Connecticut, New York, Pennſylvania, Virginia, Maſſachuſetts, Vermont, Maryland and South Carolina have been elected by the conventions of their reſpective ſtates, and have been duly conſecrated.

The Baptiſts, with ſome exceptions, are upon the Calviniſtic plan as to doctrines, and independents as to church government and diſcipline.

Of this denomination there were in 1793—45 Aſſociates, 1032 Churches, 1291 Miniſters, and 73471 Members.

Friends, commonly called Quakers. (L) This denomination of Chriſtians aroſe about the year 1648, and were firſt collected into religious ſocieties by their highly

 reſpected

(L) They received their appellation from this circumſtance—In the year 1650, George Fox, being brought before two juſtices in Derbyſhire, one of them, ſcoffing at him, for having bidden him and thoſe about him, to *tremble* at the word of the Lord, gave to him and his followers, the name of *Quakers*; a name by which they have ſince been uſually denominated; but they themſelves adopted the appellation of *Friends*.

refpected elder, George Fox. They came to America as early as 1656. The firft fettlers of Pennfylvania were all of this denomination; and the number of Friends meetings in the United States at prefent, is between 300 and 400, 250 of which are fouth of the ftate of New York.

The Methodift denomination of Chriftians arofe in England in 1739; and made their firft appearance in America, about the year 1772. Their general ftyle is, "The United Societies of the Methodift Epifcopal Church."

The late celebrated Mr John Wefley, is confidered as the father of the clafs of Methodifts, called *Arminian Methodifts*. The famous Mr Whitefield, was the leader of the *Calviniftic Methodifts*, who are numerous in England, and a few are in different parts of the United States.

In 1797, the number of *Wefleian* Methodifts in the United States, was 46,445 whites, 12,218 blacks; of thefe 2482 were in New England, 8 only of which were blacks.

The whole number of Roman Catholics in the United States was eftimated, in 1796, at about 50,000; one half of which were in the ftate of Maryland. They have a Bifhop, who refides in Maryland, and many of their congregations are large and refpectable.

The German inhabitants in thefe ftates, who principally belong to Pennfylvania and New York, are divided into a variety of fects; the principal of which are Lutherans, Calvinifts or Prefbyterians, Moravians, Tunkers, and Mennonifts. Of thefe, the German Lutherans are the moft numerous. Of this denomination, and the German Prefbyterians or Calvinifts, who are next to them in numbers, there are upwards of 60 minifters, in Pennfylvania—and the former have 12, and the latter 6 churches in the ftate of New York. Many of their churches are large and fplendid, and in fome inftances furnifhed with organs. Thefe two denominations live together in the greateft harmony, often preaching in each others churches, and fometimes uniting in the erection of a church, in which they alternately worfhip.

The Moravians are a refpectable body of Chriftians in thefe ftates. Of this denomination, there were, in 1788, about 1300 fouls in Pennfylvania; viz. at Bethlehem, between 5 and 600, which number has fince increafed—at Nazareth, 450; at Litiz, upwards of 300. Their other fettlements in the United States, are at Hope, in New Jerfey, about 100 fouls; at Wachovia, on Yadkin river, North Carolina, containing 6 churches. Befides thefe regular fettlements, formed by fuch only as are members of the Brethren's Church, and live together in good order and harmony, there are in different parts of Pennfylvania, Maryland and New Jerfey, and in the cities and towns of Newport, (Rhode Ifland), New York, Philadelphia, Lancafter, Yorktown, &c. congregations of the brethren, who have their own church and minifter, and hold the fame principles, doctrinal tenets, and church rites and ceremonies as the former, though their local fituation does not admit of fuch particular regulations as are peculiar to the regular fettlements.

They call themfelves, "The *United Brethren of the Proteftant Epifcopal Church*." They are called Moravians, becaufe the firft fettlers in the Englifh dominions were chiefly migrants from Moravia. Thefe were the remnant and genuine defcendants of the church of the ancient United Brethren, eftablifhed in Bohemia and Moravia, as early as the year 1456. About the middle of the 16th century, they left their native country to avoid perfecution, and to enjoy liberty of confcience, and the true exercife of the religion of their forefathers. They were received in Saxony, and other Proteftant dominions, and were encouraged to fettle among them, and were joined by many ferious people of other denominations. They adhere to the Auguftan Confeffion of Faith, which was drawn up by the Proteftant divines at the time of the reformation in Germany, in the year 1530, and prefented at the diet of the empire at Augfburg; and which, at that time, contained the doctrinal fyftem of all the eftablifhed Proteftant churches. They retain the difcipline of their ancient church, and make ufe of Epifcopal ordination, which has been handed down to them in a direct line of fucceffion for more than three hundred years (M).

They profefs to live in ftrict obedience to the ordinances of Chrift, fuch as the obfervation of the Sabbath, Infant Baptifm, and the Lord's Supper; and in addition to thefe, they practife the foot wafhing, the kifs of love, and the ufe of the lot.

They were introduced into America by Count Zinzendorf, and fettled at Bethlehem, which is their principal fettlement in America, as early as 1741. Regularity, induftry, ingenuity and economy, are characteriftics of thefe people.

The Tunkers, fo called in derifion from the word *tunken, to put a morfel in fauce*, firft appeared in America, in the fall of the year 1719, when about twenty families landed in Philadelphia, and difperfed themfelves in various parts of Pennfylvania. They are what are called General Baptifts, and hold to general redemption and general falvation.

Their principal fettlement was at Ephrata, fometimes called Tunkers-town, in Lancafter county, fixty miles weftward of Philadelphia. Befides this congregation there were, in 1770, fourteen others in various other parts of Pennfylvania, and fome in Maryland. The whole, exclufive of thofe in Maryland, amounted to upwards of 2000 fouls.

The Mennonifts derive their name from Menno Simon, a native of Witmars, in Germany, a man of learning, born in the year 1505, in the time of the reformation by Luther and Calvin. He was a famous Roman Catholic preacher, till about the year 1531, when he became

(M) See David Crantz's Hiftory of "The Ancient and Modern United Brethren's Church, tranflated from the German, by the Rev Benjamin La Trobe." London, 1780. Thofe who wifh to obtain a thorough and impartial knowledge of their religious fentiments and cuftoms, may fee them excellently fummed up in a plain but nervous ftyle, in "An Expofition of Chriftian Doctrine, as taught in the Proteftant Church of the United Brethren," written in German, by A. G. Spangenberg; and tranflated and publifhed in Englifh in 1794.

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came a Baptift. Some of his followers came into Pennfylvania from New York and fettled at Germantown, as early as 1692. This is at prefent their principal congregation, and the mother of the reft. Their whole number, in 1770, in Pennfylvania, was upwards of 4000, divided into thirteen churches, and forty-two congregations, under the care of fifteen ordained minifters, and fifty-three licenfed preachers.

The denomination ftyled Univerfalifts, has of late years confiderably increafed in the United States, they have a number of churches in different places; though the tenets of the different focieties vary confiderably, they all agree in the belief of General Salvation.

There is a fmall fect of Chriftians called Shakers, which have exifted in America fince 1774, when a few of them came from England to New York, and there being joined by a few others, they fettled at Nifqueunia, above Albany, which is their principal fettlement: A few others are fcattered in different parts of the country but are now diminifhing.

The Jews are not numerous in the United States. They have fynagogues at Savanna, Charlefton, (S. C.) Philadelphia, New York, and Newport. Befides thofe who refide at thefe places, there are a few others fcattered in different towns in the United States.

The Jews in Charlefton, among other peculiarities in burying their dead, have thefe: After the funeral dirge is fung, and juft before the corpfe is depofited in the grave, the coffin is opened, and a fmall bag of earth, taken from the grave, is carefully put under the head of the deceafed; then fome powder, faid to be earth brought from Jerufalem, and carefully kept for this purpofe, is taken and put upon the eyes of the corpfe, in token of their remembrance of the Holy Land, and of their expectations of returning thither in God's appointed time. Whether this cuftom is univerfal among the Jews, is not known.

They generally expect a glorious return to the Holy Land, when they fhall be exalted above all the nations of the earth. And they flatter themfelves that the period of their return will fpeedily arrive, though they do not venture to fix the precife time.

The whole number of perfons who profefs the Jewifh religion, in all parts of the world, is fuppofed to be about three millions; who as their phrafe is, are witneffes of the unity of *God* in all the nations in the world.

After the revolution (of which an account has been given in Encyclopædia volume 1ft) the United States began to experience the defects of their general government. While an enemy was in the country, fear, which had firft impelled the colonies to affociate in mutual defence, continued to operate as a band of political union. It gave to the refolutions and recommendations of Congrefs the force of laws, and generally commanded a ready acquiefcence on the part of the ftate legiflatures. Articles of confederation and perpetual union had been framed in Congrefs, and fubmitted to the confideration of the ftates, in the year 1778. Some of the ftates immediately acceded to them; but others, which had not unappropriated lands, hefitated to fubfcribe a compact which would give an advantage to the ftates which poffeffed large tracts of unlocated lands, and were thus capable of a great fuperiority in wealth and population. All objections, however, had been overcome, and by the acceffion of Maryland, in March, 1781, the articles of confederation were ratified, as the frame of government for the United States.

These articles, however, were framed during the rage of war, when a principle of common fafety fupplied the place of a coercive power in government; by men who could have had no experience in the art of governing an extenfive country, and under circumftances the moft critical and embarraffing. To have offered to the people, at that time, a fyftem of government armed with the powers neceffary to regulate and control the contending interefts of thirteen States, and the poffeffions of millions of people, might have raifed a jealoufy between the ftates or in the minds of the people at large, that would have weakened the operations of war, and perhaps have rendered a union impracticable. Hence the numerous defects of the confederation.

On the conclufion of peace, thefe defects began to be felt. Each ftate affumed the right of difputing the propriety of the refolutions of Congrefs, and the intereft of an individual ftate was placed in oppofition to the common intereft of the union. In addition to this fource of divifion, a jealoufy of the powers of Congrefs began to be excited in the minds of the people.

The jealoufy of the privileges of freemen had been roufed by the oppreffive act of the Britifh parliament; and no fooner had the danger from this quarter ceafed, than the fears of the people changed their object, and were turned againft their own rulers.

In this fituation, there were not wanting men of induftry and talents, who have been enemies to the revolution, and who embraced the opportunity to multiply the apprehenfions of people and increafe the popular difcontents. A remarkable inftance of this happened in Connecticut. As foon as the tumults of war had fubfided, an attempt was made to convince the people, that the act of Congrefs paffed in 1778, granting to the officers of the army half pay for life, was highly unjuft and tyrannical; and that it was but the firft ftep towards the eftablifhment of penfions and an uncontrollable defpotifm. The act of Congrefs, paffed in 1783, commuting half pay for life, for five years full pay, was defigned to appeafe the apprehenfions of the people, and to convince them that this gratuity was intended merely to indemnify the officers for their loffes by the depreciation of the paper currency, and not to eftablifh a precedent for the granting of penfions. This act however did not fatisfy the people, who fuppofed that the officers had been generally indemnified for the lofs of their pay, by the grants made them from time to time by the legiflatures of the feveral ftates. Befides, the act, while it gave five years full pay to the officers, allowed but one year's pay to the privates; a diftinction which had great influence in exciting and continuing the popular ferment, and one that turned a large fhare of the public rage againft themfelves.

The moment an alarm was raifed refpecting this act of Congrefs, the enemies of our independence became active in blowing up the flame, by fpreading reports unfavourable to the general government, and tending to create public diffentions. Newfpapers, in fome parts of the country, were filled with inflammatory publications; while falfe reports and groundlefs infinuations were induftrioufly circulated to the prejudice of Congrefs and the officers of the late army. Among a people feelingly alive to every thing that could affect the rights for which

which they had been contending, theſe reports could not fail of having a powerful effect; the clamour ſoon became general; the officers of the army, it was believed, had attempted to raiſe their fortunes on the diſtreſſes of their fellow-citizens, and Congreſs become the tyrants of their country.

Connecticut was the ſeat of this uneaſineſs; although other ſtates were much agitated on the occaſion. But the inhabitants of that ſtate, accuſtomed to order and a due ſubordination to the laws, did not proceed to outrages; they took their uſual mode of collecting the ſenſe of the ſtate—aſſembled in town meetings—appointed committees to meet in convention, and conſult what meaſures ſhould be adopted to procure a redreſs of their grievances. In this convention, which was held at Middletown, ſome nugatory reſolves were paſſed, expreſſing the diſapprobation of the half-pay act, and the ſubſequent commutation of the grant for five years whole pay. The ſame ſpirit alſo diſcovered itſelf in the aſſembly at their October ſeſſion, 1783. A remonſtrance againſt the acts in favour of the officers, was framed in the houſe of repreſentatives, and notwithſtanding the upper houſe refuſed to concur in the meaſure, it was ſent to Congreſs, as already mentioned.

During this ſituation of affairs, the public odium againſt the officers was augmented by another circumſtance. The officers, juſt before the diſbanding of the army, had formed a ſociety, called by the name of the *Cincinnati*, after the Roman Dictator, Cincinnatus.

Whatever were the real views of the framers of this inſtitution, its deſign was generally underſtood to be harmleſs and honourable. The oſtenſible views of the ſociety could not however ſcreen it from popular jealouſy. A ſpirited pamphlet appeared in South Carolina, the avowed production of Mr Burke, one of the Judges of the ſupreme court in that ſtate, in which the author attempted to prove that the principles on which the ſociety was formed, would, in proceſs of time, originate and eſtabliſh an order of nobility in this country, which would be repugnant to the genius of our republican governments, and dangerous to liberty. This pamphlet appeared in Connecticut, during the commotions raiſed by the half-pay and commutation acts and contributed not a little to ſpread the flame of oppoſition.

Notwithſtanding the diſcontents of the people were general, and ready to burſt forth into ſedition, yet men of information, viz. the officers of government, the clergy, and perſons of liberal education, were moſtly oppoſed to the unconſtitutional ſteps taken by the committees and convention at Middletown. They ſupported the propriety of the meaſures of Congreſs, both by converſation and writing, proved that ſuch grants to the army were neceſſary to keep the troops together, and that the expenſe would not be enormous nor oppreſſive. During the cloſe of the year 1783, every poſſible exertion was made to enlighten the people, and ſuch was the effect of the arguments uſed by the minority, that in the beginning of the following year the oppoſition ſubſided, the committees were diſmiſſed, and tranquillity reſtored to the ſtate. In May, the legiſlature were able to carry ſeveral meaſures which had before been extremely unpopular. An act was paſſed granting the impoſt of five per cent. to Congreſs; another giving great encouragement to commerce; and ſeveral towns were incorporated with extenſive privileges, for the purpoſe of regulating the exports of the ſtate, and facilitating the collection of debts.

The oppoſition to the congreſſional acts in favour of the officers, and to the order of the Cincinnati, did not riſe to the ſame pitch in the other ſtates as in Connecticut; yet it produced much diſturbance in Maſſachuſetts, and ſome others. Jealouſy of power had been univerſally ſpread among the people of the United States. The deſtruction of the old forms of governments, and the licentiouſneſs of war, had, in a great meaſure, broken their habits of obedience; their paſſions had been inflamed by the cry of deſpotiſm; and like centinels, who have been ſuddenly ſurpriſed by the approach of an enemy, the ruſtling of a leaf was ſufficient to give them an alarm. This ſpirit of jealouſy operated with other cauſes to relax the energy of federal operations.

During the war, vaſt ſums of paper currency had been emitted by Congreſs, and large quantities of ſpecie had been introduced, towards the cloſe of the war, by the French army, and the Spaniſh trade. This plenty of money enabled the ſtates to comply with the firſt requiſitions of Congreſs; ſo that during two or three years, the federal treaſury was, in ſome meaſure, ſupplied. But when the danger of war had ceaſed, and the vaſt importations of foreign goods had leſſened the quantity of circulating ſpecie, the ſtates began to be very remiſs in furniſhing their proportion of monies. The annihilation of the credit of the paper bills had totally ſtopped their circulation, and the ſpecie was leaving the country in cargoes, for remittances to Great Britain; ſtill the luxurious habits of the people, contracted during the war, called for new ſupplies of goods; and private gratifications ſeconded the narrow policy of ſtate intereſt in defeating the operations of the general government.

Thus the revenues of Congreſs were annually diminiſhing; ſome of the ſtates wholly neglecting to make proviſion for paying the intereſt of the national debt; others making but a partial proviſion, until the ſcanty ſupplies received from a few of the richeſt ſtates, would hardly ſatisfy the demands of the civil liſt.

This weakneſs of the federal government, in conjunction with the flood of certificates or public ſecurities, which Congreſs could neither fund nor pay, occaſioned them to depreciate to a very inconſiderable value. The officers and ſoldiers of the late army, and thoſe who furniſhed ſupplies for public exigencies, were obliged to receive for wages theſe certificates, or promiſſory notes, which paſſed at a fifth, an eighth or tenth of their nominal value; being thus deprived at once of the greateſt part of the reward due for their ſervices. Some indeed profited by ſpeculations in theſe evidences of the public debt; but ſuch as were under a neceſſity of parting with them, were robbed of that ſupport which they had a right to expect and demand from their countrymen.

Pennſylvania indeed made proviſion for paying the intereſt of her debts, both ſtate and federal; aſſuming her ſuppoſed proportion of the continental debt, and giving the creditors her own ſtate notes in exchange for thoſe of the United States. The reſources of that ſtate are immenſe, but ſhe was not able to make punctual payments, even in a depreciated paper currency.

Maſſachuſetts, in her zeal to comply fully with the requiſitions of Congreſs, and ſatisfy the demands of her own

own creditors, laid a heavy tax upon the people. This was the immediate caufe of the rebellion in that ftate, in 1786. But a heavy debt lying on the ftate, added to burdens of the fame nature, upon almoft every corporation within it; a decline, or rather an extinction of public credit; a relaxation and corruption of manners, and a free ufe of foreign luxuries; a decay of trade and manufactures, with a prevailing fcarcity of money; and, above all, individuals involved in debt to each other;—thefe were the real, though more remote caufes of the infurrection. It was the tax which the people were required to pay, that caufed them to feel the evils which we have enumerated: This called forth all their other grievances; and the firft act of violence committed, was the burning or deftroying of the tax-bill. This fedition threw the ftate into a convulfion which lafted about a year; courts of juftice were violently obftructed; the collection of debts was fufpended; and a body of armed troops under the command of general Lincoln, was employed, during the winter of 1786, to difperfe the infurgents. Yet fo numerous were the latter in the counties of Worcefter, Hampfhire and Berkfhire, and fo obftinately combined to oppofe the execution of law by force, that the governor and council of the ftate thought proper not to entruft general Lincoln with military powers, except to act on the defenfive, and to repel force with force, in cafe the infurgents fhould attack him. The leaders of the rebels, however, were not men of talents; they were defperate, but without fortitude; and while they were fupported with a fuperior force, they appeared to be impreffed with that confcioufnefs of guilt, which awes the moft daring wretch, and makes him fhrink from his purpofe. This appears by the conduct of a large party of the rebels before the magazine at Springfield; where general Shepard, with a fmall guard was ftationed to protect the continental ftores. The infurgents appeared upon the plain, with a vaft fuperiority of numbers, but a few fhot from the artillery made the multitude retreat in diforder, with the lofs of four men. This fpirited conduct of general Shepard, with the induftry, perfeverance and prudent firmnefs of general Lincoln, difperfed the rebels—drove the leaders from the ftate, and reftored tranquillity. An act of indemnity was paffed in the legiflature for all the infurgents, except a few of the leaders, on condition they fhould become peaceable fubjects, and take the oath of allegiance. The leaders afterwards petitioned for pardon, which, from motives of policy, was granted by the legiflature (N).

But the lofs of public credit, popular difturbances and infurrections, were not the only evils which were generated by the peculiar circumftances of the times. The emiffions of bills of credit and tender laws, were added to the black catalogue of political diforders.

The expedient of fupplying the deficiencies of fpecie, by emiffions of paper bills, was adopted very early in the colonies. The expedient was obvious, and produced good effects. In a new country, where population is rapid, and the value of lands increafing, the farmer finds an advantage in paying legal intereft for money; for if he can pay the intereft by his profits, the increafing value of his lands will in a few years difcharge the principal.

In no colony was this advantage more fenfibly experienced than in Pennfylvania. The emigrations to that province were numerous; the natural population rapid; and thefe circumftances combined, advanced the value of real property to an aftonifhing degree. As the firft fettlers there, as well as in other provinces, were poor, the purchafe of a few foreign articles drained them of fpecie. Indeed for many years the balance of trade muft have neceffarily been greatly againft the colonies.

But bills of credit, emitted by the ftate and loaned to the induftrious inhabitants, fupplied the want of fpecie, and enabled the farmer to purchafe ftock. Thefe bills were generally a legal tender in all colonial or private contracts, and the fums iffued did not generally exceed the quantity requifite for a medium of trade; they retained their full nominal value in the purchafe of commodities. But as they were not received by the Britifh merchants, in payment of their goods, there was a great demand for fpecie and bills, which occafioned the latter at various times to appreciate. Thus was introduced a difference between the Englifh fterling money and the currencies of the colonies, which remains to this day (O).

The advantages the colonies had derived from bills of credit, under the Britifh government, fuggefted to Congrefs, in 1775, the idea of iffuing bills for the purpofe of carrying on the war. And this was perhaps their only expedient. Money could not be raifed by taxation; it could not be borrowed. The firft emiffions had no other effect upon the medium of commerce, than to drive the fpecie from circulation. But when the paper fubftituted for fpecie, had, by repeated emiffions, augmented the fum in circulation much beyond the ufual fum of fpecie, the bills began to lofe their value. The depreciation continued in proportion to the fums emitted, until feventy, and even one hundred and fifty nominal paper dollars, were hardly an equivalent for one Spanifh milled dollar. Still, from the year 1775 to 1781, this depreciating paper currency was almoft the only medium of trade. It fupplied the place of fpecie, and enabled Congrefs to fupport a numerous army; until the fum in circulation amounted to two hundred millions of dollars. But about the year 1780, fpecie began to be plentiful, being introduced by the French army, a private trade with the Spanifh iflands, and an illicit intercourfe with the Britifh garrifon at New York. This circumftance accelerated the depreciation of paper bills, until their value had funk almoft to nothing. In 1781, the merchants and brokers in the fouthern ftates, apprehenfive of the approaching fate of the

(N) See a well written impartial Hiftory of this rebellion, by the late George Richards Minot, Efq.

(O) A Dollar in fterling money, is 4/6. But the price of a dollar rofe in New England currency to 6*f.* in New York to 8*f.* in New Jerfey, Pennfylvania and Maryland to 7/6. in Virginia to 6*f.* in North Carolina to 8*f.* in South Carolina and Georgia to 4/8. This difference, originating between paper and fpecie, or bills, continued afterwards to exift in the nominal eftimation of gold and filver.

the currency, pushed immense quantities of it suddenly into New England, made vast purchases of goods in Boston; and instantly the bills vanished from circulation.

The whole history of this continental paper is a history of public and private frauds. Old specie debts were often paid in a depreciated currency; and even new contracts for a few weeks or days were often discharged with a small part of the value received. From this plenty and fluctuating state of the medium, sprung hosts of speculators and itinerant traders, who left their honest occupations for the prospect of immense gains, in a fraudulent business, that depended on no fixed principles, and the profits of which could be reduced to no certain calculations.

To increase these evils, a project was formed to fix the price of articles, and restrain persons from giving or receiving more for any commodity than the price stated by authority. These regulating acts were reprobated by every man acquainted with commerce and finance; as they were intended to prevent an effect without removing the cause. To attempt to fix the value of money, while streams of bills were incessantly flowing from the treasury of the United States, was as ridiculous as an attempt to restrain the rising of water in rivers amidst showers of rain.

Notwithstanding all opposition, some states framed and attempted to enforce these regulating acts. The effect was, a momentary apparent stand in the price of articles; innumerable acts of collusion and evasion among the dishonest; numberless injuries done to the honest; and finally a total disregard of all such regulations, and the consequent contempt of laws and the authority of the magistrate.

During these fluctuations of business, occasioned by the variable value of money, people lost sight, in some measure, of the steady principles which had before governed their intercourse with each other. Speculation followed and relaxed the rigour of commercial obligations.

Industry likewise had suffered by the flood of money which had deluged the states. The prices of produce had risen in proportion to the quantity of money in circulation, and the demand for the commodities of the country. This made the acquisition of money easy, and indolence and luxury, with their train of desolating consequences, spread themselves among all descriptions of people.

But as soon as hostilities between Great Britain and America were suspended, the scene was changed. The bills emitted by Congress had for some time before ceased to circulate: and the specie of the country was soon drained off to pay for foreign goods, the importations of which exceeded all calculation. Within two years from the close of the war, *a scarcity of money* was the general cry. The merchants found it impossible to collect their debts, and make punctual remittances to their creditors in Great Britain; and the consumers were driven to the necessity of retrenching their superfluities in living, and of returning to their ancient habits of industry and economy.

This change was however progressive and slow. In many of the states which suffered by the numerous debts they had contracted, and by the distresses of war, the people called aloud for emissions of paper bills to supply the deficiency of a medium. The depreciation of the continental bills was a recent example of the ill effects of such an expedient, and the impossibility of supporting the credit of paper, was urged by the opposers of the measure as a substantial argument against adopting it. But nothing would silence the popular clamour; and many men, of the first talents and eminence, united their voices with that of the populace. Paper money had formerly maintained its credit, and been of singular utility; and past experience, notwithstanding a change of circumstances, was an argument in its favour that bore down all opposition.

Pennsylvania, although one of the richest states in the union, was the first to emit bills of credit, as a substitute for specie. But the revolution had removed the necessity of it, at the same time, that it had destroyed the means by which its former credit had been supported. Lands, at the close of the war, were not rising in value; bills on London could not so readily be purchased, as while the province was dependent on Great Britain; the state was split into parties, one of which attempted to defeat the measures most popular with the other; and the depreciation of continental bills, with the injuries which it had done to individuals, inspired a general distrust of all public promises.

Notwithstanding a part of the money was loaned on good landed security, and the faith of that wealthy state pledged for the redemption of the whole at its nominal value, yet the advantages of specie as a medium of commerce, especially as an article of remittance to London, soon made a difference of ten per cent. between the bills of credit and specie. This difference may be considered rather as an appreciation of gold and silver, than a depreciation of paper; but its effects, in a commercial state, must be highly prejudicial. It opens the door to frauds of all kinds, and frauds are usually practised on the honest and unsuspecting, especially upon all classes of labourers.

North Carolina, South Carolina, and Georgia, had recourse to the same wretched expedient to supply themselves with money; not reflecting that industry, frugality, and good commercial laws are the only means of turning the balance of trade in favour of a country, and that this balance is the only permanent source of solid wealth and ready money. But the bills they emitted shared a worse fate than those of Pennsylvania; they expelled almost all the circulating cash from the States; they lost a great part of their nominal value, they impoverished the merchants, and embarrassed the planters.

The state of Virginia tolerated a base practice among the inhabitants of cutting dollars and smaller pieces of silver, in order to prevent it from leaving the state. This pernicious practice prevailed also in Georgia. (P)

Maryland escaped the calamity of a paper currency. The house of delegates brought forward a bill for the emission of bills of credit to a large amount; but the senate

(P) A dollar was usually cut in five pieces, and each passed by toll for a quarter; so the man who cut it gained a quarter, or rather a fifth.

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fenate firmly and fuccefsfully refifted the pernicious fcheme. The oppofition between the two houfes was violent and tumultuous; it threatened the ftate with anarchy; but the queftion was carried to the people, and the good fenfe of the fenate finally prevailed.

New Jerfey, fituated between two of the largeft commercial towns in America, was confequently drained of fpecie. This ftate alfo emitted a large fum in bills of credit, which ferved to pay the intereft of the public debt; but the currency depreciated, as in other ftates.

Rhode Ifland exhibited a melancholy proof of that licentioufnefs and anarchy which always follows a relaxation of the moral principles. In a rage for fupplying the ftate with money, and filling every man's pocket without obliging him to earn it by his diligence, the legiflature paffed an act for making one hundred thoufand pounds in bills; a fum much more than fufficient for a medium of trade in that ftate, even without any fpecie. The merchants in Newport and Providence, oppofed the act with firmnefs; and their oppofition added frefh vigour to the refolution of the affembly, and induced them to enforce the fcheme by a legal tender of a moft extraordinary nature. They paffed an act, ordaining that if any creditor fhould refufe to take their bills, for any debt whatever, the debtor might lodge the fum due, with a juftice of the peace, who fhould give notice of it in the public papers; and if the creditor did not appear and receive the money within fix months from the firft notice, his debt fhould be forfeited. This act aftonifhed all honeft men; and even the promoters of paper money-making in other ftates, and other principles, reprobated this act of Rhode Ifland, as wicked and oppreffive. But the ftate was governed by faction. During the cry for paper money, a number of boifterous, ignorant men, were elected into the legiflature, from the fmaller towns in the ftate. Finding themfelves united with a majority in opinion, they formed and executed any plan their inclination fuggefted; they oppofed every meafure that was agreeable to the mercantile intereft; they not only made bad laws to fuit their own wicked purpofes, but appointed their own corrupt creatures to fill the judicial and executive departments. Their money depreciated fufficiently to anfwer all their vile purpofes in the difcharge of debts; bufinefs almoft totally ceafed; all confidence was loft; the ftate was thrown into confufion at home, and was execrated abroad.

Maffachufetts Bay had the good fortune, amidft her political calamities, to prevent an emiffion of bills of credit. New Hampfhire made no paper; but in the diftreffes which followed her lofs of bufinefs after the war, the legiflature made horfes, lumber and moft articles of produce, a legal tender in the fulfilment of contracts. It is doubtlefs unjuft to oblige a creditor to receive any thing for his debt, which he had not in contemplation at the time of the contract. But as the commodities which were to be a tender by law, in New Hampfhire, were of an intrinfic value, bearing fome proportion to the amount of the debt, the injuftice of the law was lefs flagrant, than that which enforced the tender of paper in Rhode Ifland. Indeed a fimilar law prevailed for fome time in Maffachufetts; and in Connecticut it is optional with the creditor either to imprifon the debtor, or take land on execution, at a price to be fixed by three indifferent freeholders; provided no other means of payment fhall appear to fatisfy the demand. It muft not however be omitted, that while the moft flourifhing commercial ftates introduced a paper medium, to the great injury of honeft men, a bill for an emiffion of paper in Connecticut, where there is very little fpecie, could never command more than one-eighth of the votes of the legiflature. The movers of the bill have hardly efcaped ridicule: fo generally is the meafure reprobated, as a fource of frauds and public mifchief.

The legiflature of New York, a ftate that had the leaft neceffity and apology for making paper money, as her commercial advantages always furnifh her with fpecie fufficient for a medium, iffued a large fum in bills of credit, which fupported their value better than the currency of any other ftate. Still the paper raifed the value of fpecie, which is always in demand for exportation, and this difference of exchange between paper and fpecie, ever expofes commerce to moft of the inconveniencies refulting from a depreciated medium.

Such is the hiftory of paper money thus far; a miferable fubftitute for real coin, in a country where the reins of government are too weak to compel the fulfilment of public engagements, and where all confidence in public faith is totally deftroyed.

While the ftates were thus endeavouring to repair the lofs of fpecie, by empty promifes, and to fupport their bufinefs by fhadows, rather than by reality, the Britifh miniftry formed fome commercial regulations that deprived them of the profits of their trade to the Weft Indies and Great Britain. Heavy duties were laid upon fuch articles as were remitted to the London merchants for their goods, and fuch were the duties upon American bottoms, that the ftates were almoft wholly deprived of the carrying trade. A prohibition was laid upon the produce of the United States, fhipped to the Englifh Weft India Iflands in American built veffels, and in thofe manned by American feamen. Thefe reftrictions fell heavy upon the eaftern ftates, which depended much upon fhip-building for the fupport of their trade; and they materially injured the bufinefs of the other ftates.

Without a union that was able to form and execute a general fyftem of commercial regulations, fome of the ftates attempted to impofe reftraints upon the Britifh trade that fhould indemnify the merchant for the loffes he had fuffered, or induce the Britifh miniftry to enter into a commercial treaty and relax the rigor of their navigation laws.

Thefe meafures, however, produced nothing but mifchief. The ftates did not act in concert, and the reftraints laid on the trade of one ftate, operated to throw the bufinefs into the hands of its neighbour. Maffachufetts, in her zeal to counteract the effect of the Englifh navigation laws, laid enormous duties upon Britifh goods imported into that ftate; but the other ftates did not adopt a fimilar meafure; and the lofs of bufinefs foon obliged that ftate to repeal or fufpend the law. Thus when Pennfylvania laid heavy duties on Britifh goods, Delaware and New Jerfey made a number of free ports to encourage the landing of goods within the limits of thofe ftates; and the duties in Pennfylvania ferved no purpofe, but to create fmuggling.

Thus divided, the ftates began to feel their weaknefs. Moft of the legiflatures had neglected to comply with the requifitions of Congrefs for furnifhing the federal treafury;

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treafury; the refolves of Congrefs were difregarded; the propofition for a general impoft to be laid and collected by Congrefs was negatived firft by Rhode Ifland, and afterwards by New York. The Britifh troops continued, under pretence of a breach of treaty on the part of America, to hold poffeffion of the forts on the frontiers of the ftates. Many of the ftates individually were infefted with popular commotions or iniquitous tender laws, while they were oppreffed with public debts; the certificates or public notes had loft moft of their value, and circulated merely as the objects of fpeculation; Congrefs loft their refpectability, and the United States their credit and importance.

In the midft of thefe calamities, a propofition was made in 1785, in the houfe of delegates in Virginia, to appoint commiffioners, to meet fuch as might be appointed in the other ftates, who fhould form a fyftem of commercial regulations for the United States, and recommend it to the feveral legiflatures for adoption. Commiffioners were accordingly appointed, and a requeft was made to the legiflature of the other ftates to accede to the propofition. Accordingly feveral of the ftates appointed commiffioners, who met at Annapolis in the fummer of 1786, to confult what meafures fhould be taken to unite the ftates in fome general and efficient commercial fyftem. But as the ftates were not all reprefented, and the powers of the commiffioners were, in their opinion, too limited to propofe a fyftem of regulations adequate to the purpofes of government, they agreed to recommend a general convention to be held at Philadelphia the next year, with powers to frame a general plan of government for the United States. This meafure appeared to the commiffioners abfolutely neceffary. The old confederation was effentially defective. It was deftitute of almoft every principle neceffary to give effect to legiflation.

It was defective in the article of legiflating over ftates, inftead of individuals. All hiftory teftifies that recommendations will not operate as laws, and compulfion cannot be exercifed over ftates, without violence, war and anarchy. The confederation was alfo deftitute of a fanction to its laws. When refolutions were paffed in Congrefs, there was no power to compel obedience by fine, by fufpenfion of privileges, or other means. It was alfo deftitute of a guarantee for the ftate governments. Had one ftate been invaded by its neighbour, the union was not conftitutionally bound to affift in repelling the invafion, and fupporting the conftitution of the invaded ftate. The confederation was further deficient in the principle of apportioning the quotas of money to be furnifhed by each ftate; in a want of power to form commercial laws, and to raife troops for the defence and fecurity of the union; in the equal fuffrage of the ftates, which placed Rhode Ifland on a footing in Congrefs with Virginia; and to crown all the defects, we may add the want of a judiciary power, to define the laws of the union, and to reconcile the contradictory decifions of a number of independent judicatories.

Thefe and many inferior defects were obvious to the commiffioners, and therefore they urged a general convention, with powers to form and offer to the confideration of the ftates, a fyftem of general government that fhould be lefs exceptionable. Accordingly in May, 1787, delegates from all the ftates, except Rhode Ifland, affembled at Philadelphia, and chofe General Wafhington for their prefident. After four months deliberation, in which the clafhing interefts of the feveral ftates appeared in all their force, the convention agreed to recommend the plan of federal government which we have already recited.

As foon as the plan of the federal conftitution was fubmitted to the legiflatures of the feveral ftates, they proceeded to take meafures for collecting the fenfe of the people upon the propriety of adopting it. In the fmall ftate of Delaware, a convention was called in November, which, after a few days deliberation, ratified the conftitution without a diffenting voice.

In the convention of Pennfylvania, held the fame month, there was a fpirited oppofition to the new form of government. The debates were long and interefting. Great abilities and firmnefs were difplayed on both fides; but on the 13th of December, the conftitution was received by two-thirds of the members. The minority were diffatisfied, and with an obftinacy that ill became the reprefentatives of a free people, publifhed their reafons of diffent, which were calculated to inflame a party already violent, and which, in fact, produced fome difturbances in the weftern part of the ftate.

In New Jerfey, the convention which met in December, were unanimous in adopting the conftitution; as was likewife that of Georgia.

In Connecticut there was fome oppofition; but the conftitntion was, on the 9th of January, 1788, ratified by three-fourths of the votes in convention, and the minority peaceably acquiefced in the decifion.

In Maffachufetts, the oppofition was large and refpectable. The convention, confifting of more than three hundred delegates, were affembled in January, and continued their debates with great candor and liberality, about five weeks. At length the queftion was carried for the conftitution by a fmall majority; and the minority, with that manly condefcenfion which becomes great minds, fubmitted to the meafure, and united to fupport the government.

In New Hampfhire, the federal caufe was for fome time doubtful. The greateft number of the delegates in convention, were at firft on the fide of the oppofition; and fome, who might have had their objections removed by the difcuffion of the fubject, were inftructed to reject the conftitution. Although the inftructions of conftituents cannot, on the true principles of reprefentation, be binding upon a deputy, in any legiflative affembly, becaufe his conftituents are but a *part* of the ftate, and have not heard the arguments and objections of the *whole*, whereas his act is to affect the *whole* ftate, and therefore is to be directed by the fenfe or wifdom of the whole, collected in the legiflative affembly; yet the delegates in the New Hampfhire convention conceived very erroneoufly, that the fenfe of the freemen in the towns, thofe little diftricts, where no act of legiflation can be performed, impofed a reftraint upon their own wills. An adjournment was therefore moved and carried. This gave the people opportunity to gain a further knowledge of the merits of the conftitution, and at the fecond meeting of the convention, it was ratified by a refpectable majority.

In Maryland, feveral men of abilities appeared in the oppofition, and were unremitted in their endeavours to perfuade the people that the propofed plan of govern-

ment

ment was artfully calculated to deprive them of their deareft rights; yet in convention it appeared that five-fixths of the voices were in favour of it.

In South Carolina, the oppofition was refpectable; but two-thirds of the convention appeared to advocate and vote for the conftitution.

In Virginia, many of the principal characters oppofed the ratification of the conftitution with great abilities and induftry. But after a full difcuffion of the fubject, a fmall majority, of a numerous convention, appeared for its adoption.

In New York, two-thirds of the delegates in convention were, at their firft meeting, determined to reject the conftitution. Here therefore the debates were the moft interefting, and the event extremely doubtful. The argument was managed with uncommon addrefs and abilities on both fides of the queftion. But during the feffion, the ninth and tenth ftates had acceded to the propofed plan, fo that by the conftitution, Congrefs were empowered to iffue an ordinance for organizing the new government. This event placed the oppofition on new ground; and the expediency of uniting with the other ftates, the generous motives of conciliating all differences, and the danger of a rejection, influenced a refpectable number, who were originally oppofed to the conftitution, to join the federal intereft. The conftitution was accordingly ratified by a fmall majority; but the ratification was accompanied here, as in Virginia, with a bill of rights, declaratory of the fenfe of the convention, as to certain great principles, and with a catalogue of amendments, which were to be recommended to the confideration of the new Congrefs, and the feveral ftate legiflatures.

North Carolina met in convention in July, to deliberate on the new conftitution. After a fhort feffion, they rejected it by a majority of one hundred and feventy-fix againft feventy-fix. In November 1789, however, this ftate again met in convention, and ratified the conftitution by a large majority.

Rhode Ifland was doomed to be the fport of a blind and fingular policy. The legiflature, in confiftency with the meafures which had been before purfued, did not call a convention, to collect the fenfe of the ftate upon the propofed conftitution; but in an unconftitutional and abfurd manner, fubmitted the plan of government to the confideration of the people. Accordingly it was brought before town-meetings, and in moft of them rejected. In fome of the large towns, particularly in Newport and Providence, the people collected and refolved, with great propriety, that they could not take up the fubject; and that the propofition for embracing or rejecting the federal conftitution, could come before no tribunal but that of the *ftate* in convention or legiflature. On the 24th of May, 1790, a convention of this ftate met at Newport, and on the 29th, adopted the conftitution by a majority of *two* only.

Vermont, in convention at Bennington, January 10th, 1791, ratified the conftitution of the United States, by a great majority (R).

From the moment the proceedings of the general convention at Philadelphia tranfpired, the public mind was exceedingly agitated, and fufpended between hope and fear, until nine ftates had ratified their plan of a federal government. Indeed the anxiety continued until Virginia and New York had acceded to the fyftem. But this did not prevent the demonftrations of their joy, on the acceffion of each ftate.

On the ratification in Maffachufetts, the citizens of Bofton, in the elevation of their joy, formed a proceffion in honour of the happy event, which was novel, fplendid and magnificent. This example was afterwards followed, and in fome inftances improved upon, in Baltimore, Charlefton, Philadelphia, New Haven, Portfmouth and New York, fucceffively. Nothing could equal the beauty and grandeur of thefe exhibitions. A fhip was mounted upon wheels, and drawn through the ftreets; mechanics erected ftages, and exhibited fpecimens of labour in their feveral occupations, as they moved along the road; flags with emblems, defcriptive of all the arts and of the federal union, were invented and difplayed in honour of the government; multitudes of all ranks in life affembled to view the fplendid fcenes; while fobriety, joy and harmony marked the brilliant exhibitions, by which the Americans celebrated the eftablifhment of their empire.

On the 3d of March, 1789, the delegates from the eleven ftates which at that time had ratified the conftitution, affembled at New York, where a convenient and elegant building had been prepared for their accommodation. On opening and counting the votes for Prefident,

(R) The following exhibits at one view, the order, time, &c. in which the feveral ftates ratified the federal conftitution.

					Majority.
Delaware,	December	3,	1787,	unanimoufly,	
Pennfylvania,	December	13,		46 to 23	23
New Jerfey,	December	19,		unanimoufly,	
Georgia,	January	2,	1788,	unanimoufly,	
Connecticut,	January	9,		128 to 40	88
Maffachufetts,	February	6,		187 to 168	19
Maryland,	April	28,		63 to 12	51
South Carolina,	May	23,		149 to 73	76
New Hampfhire,	June	21,		57 to 46	11
Virginia,	June	25,		89 to 79	10
New York,	July	26,		30 to 25	5
North Carolina,	November	27,	1789,	193 to 75	118
Rhode Ifland,	May	29,	1790,		2
Vermont,	January	10,	1791,	by a great majority	
Kentucky,					

dent, it was found that GEORGE WASHINGTON was *unanimoufly* elected to that dignified office, and that JOHN ADAMS was chofen Vice Prefident. The annunciation of the choice of the firft and fecond magiftrates of the United States, occafioned a general diffufion of joy among the friends to the union, and fully evinced that thefe eminent characters were the choice of the people.

On the 30th of April, 1789, George Wafhington was inaugurated Prefident of the United States of America, in the city of New York. The ceremony was performed in the open gallery of Federal Hall, in the view of many thoufand fpectators. The oath was adminiftered by Chancellor Livingfton. Several circumftances concurred to render the fcene unufually folemn—The prefence of the beloved Father and Deliverer of his country—the impreffions of gratitude for his paft fervices—the vaft concourfe of fpectators—the devout fervency with which he repeated the oath, and the reverential manner in which he bowed to kifs the facred volume—thefe circumftances, together with that of his being chofen to the moft dignified office in America, and perhaps in the world, by the unanimous voice of more than three millions of enlightened *freemen*, all confpired to place this among the moft auguft and interefting fcenes which have ever been exhibited on this globe. For feveral years after the eftablifhment of the new conftitution, the United States were happily diftinguifhed by affording a few materials for hiftory.

The deliberations of the legiflature of the union were marked with wifdom, and the meafures they adopted productive of great national profperity. The wife appointments to office, which in general were made—the eftablifhment of a revenue and judiciary fyftem, and of a national bank—the affumption of the debts of the individual ftates, and the encouragement given to manufactures, commerce, literature, and to ufeful inventions, opened the faireft profpects of the peace, union and increafing refpectability of the American States. Thefe profpects have been realized.

The account of the United States which is here prefented to our readers, is extracted from that valuable work, the American Univerfal Geography, by the Rev. Dr Morfe.—To give a regular hiftory, or even a fketch, of the progrefs of things under the adminiftration of the Federal government—of the wifdom and firmnefs exhibited by the Prefident and Congrefs, in their meafures in times the moft critical and trying—of the intrigues and collifions of contending parties—of the dangers, domeftic and foreign which we have fo happily efcaped—and of the exifting ftate of our political affairs, does not fall in with the plan of this work.

UNITY, a fettlement in Lincoln county, Diftrict of Maine, between the Weft Ponds, 7 or 8 miles weft of Sidney, oppofite to Vaffalborough, and 15 miles northweft of Hallowell. It lies on Sandy river, about 16 miles from its mouth.—*Morse.*

UNITY, a townfhip of New-Hampfhire, fituated in Chefhire county, a few miles north-eaft of Charlefton. It was incorporated in 1764, and contains 538 inhabitants.—*ib.*

UNITY *Town*, in Montgomery county, Maryland, lies 2 or 3 miles from Patuxent river, 11 from Montgomery court-houfe, and 24 N. of the city of Wafhington.—*ib.*

VOLCANIC *Ifland*, between Swallow Ifland and *Santa Cruz*, about 8 leagues north of the latter, in the Pacific Ocean, in which Mendana, in 1595, faw a volcano, which flamed continually. S. lat. 10 30.—*ib.*

VOLUNTOWN, a townfhip on the E. line of Connecticut, Windham county, E. of Plainfield, 19 miles N. E. of Norwich, and 26 S. W. of Providence. It was fettled in 1696, having been granted to volunteers in the Narraganfet war; hence its name. It was incorporated in 1719. It is 20 miles long, and between 3 and 4 broad, and has a large fwamp abounding with white pine, fufficient to fupply the neighbouring towns with materials for building.—*ib.*

VORTICES of Des Cartes are now juftly exploded; but being the fiction of a very fuperior mind, they are ftill an object of curiofity, as being the foundation of a great philofophical romance. According to the author of that romance, the whole of infinite fpace was full of matter; for with him matter and extenfion were the fame, and confequently there could be no void. This immenfity of matter he fuppofed to be divided into an infinite number of very fmall cubes; all of which, being whirled about upon their own centres, neceffarily gave occafion to the production of two different elements. The firft confifted of thofe angular parts which, having been neceffarily rubbed off, and grinded yet fmaller by their mutual friction, conftituted the moft fubtle and moveable part of matter. The fecond confifted of thofe little globules that were formed by the rubbing off of the firft. The interftices betwixt thefe globules of the fecond element were filled up by the particles of the firft. But in the infinite collifions, which muft occur in an infinite fpace filled with matter, and all in motion, it muft neceffarily happen that many of the globules of the fecond element fhould be broken and grinded down into the firft. The quantity of the firft element having thus been increafed beyond what was fufficient to fill up the interftices of the fecond, it muft, in many places, have been heaped up together, without any mixture of the fecond along with it. Such, according to Des Cartes, was the original divifion of matter. Upon this infinitude of matter thus divided, a certain quantity of motion was originally impreffed by the Creator of all things, and the laws of motion were fo adjufted as always to preferve the fame quantity in it, without increafe, and without diminution. Whatever motion was loft by one part of matter, was communicated to fome other; and whatever was acquired by one part of matter, was derived from fome other: and thus, through an eternal revolution from reft to motion, and from motion to reft, in every part of the univerfe, the quantity of motion in the whole was always the fame.

But as there was no void, no one part of matter could be moved without thrufting fome other out of its place, nor that without thrufting fome other, and fo on. To avoid, therefore, an infinite progrefs, he fuppofed that the matter which any body pufhed before it rolled immediately backwards to fupply the place of that matter which flowed in behind it; as we may obferve in the fwimming of a fifh, that the water which it pufhes before it immediately rolls backwards to fupply the place of what flows in behind it, and thus forms a fmall circle or vortex round the body of the fifh. It was in the fame manner that the motion originally impreffed by the Creator upon the infinitude of matter neceffarily produced in it an infinity of greater and fmaller vortices,

tices, or circular ſtreams: and the law of motion being ſo adjuſted as always to preſerve the ſame quantity of motion in the univerſe, thoſe vortices either continued for ever, or by their diſſolution gave birth to others of the ſame kind. There was thus at all times an infinite number of greater and ſmaller vortices, or circular ſtreams, revolving in the univerſe.

But whatever moves in a circle is conſtantly endeavouring to fly off from the centre of its revolution. For the natural motion of all bodies is in a ſtraight line. All the particles of matter therefore, in each of thoſe greater vortices, were continually preſſing from the centre to the circumference, with more or leſs force, according to the different degrees of their bulk and ſolidity. The larger and more ſolid globules of the ſecond element forced themſelves upwards to the circumference, while the ſmaller, more yielding, and more active particles of the firſt, which could flow even through the interſtices of the ſecond, were forced downwards to the centre. They were forced downwards to the centre notwithſtanding their natural tendency was upwards to the circumference; for the ſame reaſon that a piece of wood, when plunged in water, is forced upwards to the ſurface, notwithſtanding its natural tendency is downwards to the bottom; becauſe its tendency downwards is leſs ſtrong than that of the particles of water, which, therefore, if one may ſay ſo, preſs in before it, and thus force it upwards. But there being a greater quantity of the firſt element than what was neceſſary to fill up the interſtices of the ſecond, it was neceſſarily accumulated in the centre of each of theſe great circular ſtreams, and formed there the fiery and active ſubſtance of the ſun. For, according to that philoſopher, the ſolar ſyſtems were infinite in number, each fixed ſtar being the centre of one; and he is among the firſt of the moderns who thus took away the boundaries of the univerſe: even Copernicus and Kepler, themſelves, have confined it within what they ſuppoſed the vault of the firmament.

The centre of each vortex being thus occupied by the moſt active and moveable parts of matter, there was neceſſarily among them a more violent agitation than in any other part of the vortex, and this violent agitation of the centre cheriſhed and ſupported the movement of the whole. But among the particles of the firſt element, which fill up the interſtices of the ſecond, there are many, which, from the preſſure of the globules on all ſides of them, neceſſarily receive an angular form, and thus conſtitute a third element of particles leſs fit for motion than thoſe of the other two. As the particles, however, of this third element were formed in the interſtices of the ſecond, they are neceſſarily ſmaller than thoſe of the ſecond, and are therefore, along with thoſe of the firſt, urged down towards the centre, where, when a number of them happen to take hold of one another, they form ſuch ſpots upon the ſurface of the accumulated particles of the firſt element, as are often diſcovered by teleſcopes upon the face of that ſun which enlightens and animates our particnlar ſyſtem. Thoſe ſpots are often broken and diſpelled by the violent agitation of the particles of the firſt element, as has hitherto happily been the caſe with thoſe which have ſucceſſively been formed upon the face of our ſun. Sometimes, however, they encruſt the whole ſurface of that fire which is accumulated in the centre; and the communication betwixt the moſt active and the moſt inert parts of the vortex being thus interrupted, the rapidity of its motion immediately begins to languiſh, and can no longer defend it from being ſwallowed up and carried away by the ſuperior violence of ſome other like circular ſtream; and, in this manner, what was once a ſun becomes a planet. Thus the time was, according to the ſyſtem, when the Moon was a body of the ſame kind with the ſun, the fiery centre of a circular ſtream of ether, which flowed continually round her; but her face having been cruſted over by a congeries of angular particles, the motion of this circular ſtream began to languiſh, and could no longer defend itſelf from being abſorbed by the more violent vortex of the earth, which was then, too, a ſun, and which chanced to be placed in its neighbourhood. The moon therefore became a planet, and revolved round the earth. In proceſs of time, the ſame fortune, which had thus befallen the moon, befel alſo the earth; its face was encruſted by a groſs and inactive ſubſtance; the motion of its vortex began to languiſh, and it was abſorbed by the greater vortex of the ſun: but though the vortex of the earth had thus become languid, it ſtill had force enough to occaſion both the diurnal revolution of the earth, and the monthly motion of the moon. For a ſmall circular ſtream may eaſily be conceived as flowing round the body of the earth, at the ſame time that it is carried along by that great ocean of ether which is continually revolving round the ſun; in the ſame manner, as in a great whirlpool of water, one may often ſee ſeveral ſmall whirlpools, which revolve round centres of their own, and at the ſame time are carried round the centre of the great one. Such was the cauſe of the original formation and conſequent motions of the planetary ſyſtem. When a ſolid body is turned round its centre, thoſe parts of it which are neareſt, and thoſe which are remoteſt from the centre, complete their revolutions in one and the ſame time. But it is otherwiſe with the revolutions of a fluid: the parts of it which are neareſt the centre complete their revolutions in a ſhorter time than thoſe which are remoter. The planets, therefore, all floating in that immenſe tide of ether which is continually ſetting in from weſt to eaſt round the body of the ſun, complete their revolutions in a longer or a ſhorter time, according to their nearneſs or diſtance from him.

This bold ſyſtem was eminently fitted to captivate the imagination; and though fraught with contradictions and impoſſibilities, attempts have been made to revive it, even in this country, under different names. All thoſe ſyſtems which repreſent the motions of the heavenly bodies as being the effect of the phyſical agency of ethers, of air, of fire, and of light, of which the univerſe is conceived to be full, labour under the ſame difficulties with the Carteſian hypotheſis; and very few of them, if any, are ſo neatly put together. It is ſurely ſufficient, however, to demoliſh this goodly fabric, barely to aſk how an abſolute infinity of matter can be divided into cubes, or any thing elſe? how there can poſſibly be interſtices in a perfect plenum? or how in ſuch a plenum any portion of matter can be thruſt from its place?

UPATCHAWANAN, or *Temiſcamain*, a Canadian ſettlement in N. America, in lat. 47 17 30 north.—*Morſe.*

UPPER ALLOWAYS *Creek*, in Salem county, New-Jerſey.—*ib.*

UPPER BALD EAGLE, a townſhip of Pennſylvania, in Mifflin county.—*ib.*

UPPER DISTRICT, a diviſion of Georgia, which contains the counties of Montgomery, Waſhington, Hancock, Greene, Franklin, Oglethorpe, Elbert, Wilkes, Warren, Columbia, and Richmond.—*ib.*

UPPER DUBLIN, a townſhip of Pennſylvania, in Montgomery county.—*ib.*

UPPER FREEHOLD, a townſhip of New-Jerſey, Monmouth county, adjoining to Burlington and Middleſex counties on the north and ſouth-weſt, and Freehold on the eaſt. It contains 3,442 inhabitants.—*ib.*

UPPER GREAT MONADNOCK, in the townſhip of Lemington, in the north-eaſt corner of Vermont, on Connecticut river.—*ib.*

UPPER HANOVER, a townſhip of Pennſylvania, Montgomery county.—*ib.*

UPPER MARLBOROUGH, a poſt-town of Maryland, 16 miles ſouth-eaſt of Bladenſburg, 15 north-eaſt of Piſcataway, and 162 ſouth-weſt of Philadelphia.—*ib.*

UPPER MILFORD, a townſhip of Pennſylvania, Northampton county.—*ib.*

UPPER PENN'S NECK, a townſhip of New-Jerſey, Salem county.—*ib.*

UPPER SAURA, a place in North-Carolina, on Dan river, about 200 miles from Haliſax.—*ib.*

UPPER SAVAGE *Iſlands*, in Hudſon's Bay. N. lat. 62 32 30, W. long. 70 48.—*ib.*

UPTON, a townſhip of Maſſachuſetts, Worceſter county, containing 900 inhabitants, diſperſed on 13,000 acres of land, favourable for orcharding, paſturage and graſs. It is weſt of Sherburne in Middleſex county, 15 miles ſouth-eaſt of Worceſter, and 38 ſouth-weſt of Boſton.—*ib.*

UPRIGHT *Bay*, near the weſt end of the Straits of Magellan. S. lat. 53 8, W. long. 75 35.—*ib.*

URACHO, a river on the eaſt coaſt of South-America, is 18 leagues W. N. W. of Caurora river.—*ib.*

URAGUA, a province in the eaſt diviſion of Paraguay, in South-America, whoſe chief town is Los Reyes.—*ib.*

URALIAN Cossacs, a people that inhabit the Ruſſian province of Orenburg in Aſia, on the ſouth ſide of the river Ural. Theſe Coſſacs are deſcended from thoſe of the Don: they are a very valiant race. They profeſs the Greek religion; but there is a kind of diſſenters from the eſtabliſhed religion, whom the Ruſſians called *Roſkolniki*, or Separatiſts, and who ſtyle themſelves *Staroverſki*, or Old Believers. They conſider the ſervice of the eſtabliſhed church as profane and ſacrilegious, and have their own prieſts and ceremonies. The Uralian Coſſacs are all enthuſiaſts for the ancient ritual, and prize their beards almoſt equal to their lives. A Ruſſian officer having ordered a number of Coſſac recruits to be publicly ſhaved in the town of Yaitſk, in 1771, this wanton inſult excited an inſurrection, which was ſuppreſſed for a time; but, in 1773, that daring impoſtor, Pugatchef, having aſſumed the name and perſon of Peter III. appeared among them, and taking advantage of this circumſtance, and of their religious prejudices, rouſed them once more into open rebellion. This being at laſt effectually ſuppreſſed by the defeat and execution of the impoſtor (See Suworow, *Suppl.*), in order to extinguiſh all remembrance of this rebellion, the river Yaik was called *Ural;* the Yaic Coſſacs were denominated *Uralian Coſſacs;* and the town of Yaitſk, *Uralſk.* The Uralian Coſſacs enjoy the right of fiſhing on the coaſt of the Caſpian Sea, for 47 miles on each ſide of the river Ural. Their principal fiſhery is for ſturgeons and beluga, whoſe roe ſupplies large quantities of caviare; and the fiſh, which are chiefly ſalted and dried, afford a conſiderable article of conſumption in the Ruſſian empire. In conſequence of theſe fiſheries, theſe Coſſacs are very rich.

URANO, a river on the north coaſt of S. America, which enters the ocean abreaſt of the weſternmoſt of the Peritas Iſlands, about 3 leagues weſtward of Comana Bay. It only admits ſmall boats and canoes. Otchier Bay is to the weſt of it.—*Morse.*

URBANNA, a ſmall poſt-town of Virginia, Middleſex county, on the ſouth-weſt ſide of Rappahannock river, 22 miles from Stingray Point, at the mouth of the river, 73 ſouth-eaſt of Frederickſburg, 73 eaſt by ſouth of Richmond, 28 from Tappahannock, and 291 from Philadelphia. Wheat is ſhipped from this to Europe, and Indian corn, &c. to New-England, Nova-Scotia, and the Weſt-Indies.—*ib.*

URBINO, a town of Italy, in the territory of the Pope, and capital of the duchy of Urbino, with an old citadel, an archbiſhop's ſee, and a handſome palace, where the dukes formerly reſided. The houſes are well built, and great quantities of fine earthen ware are made here. It is ſeated on a mountain, between the rivers Metro and Foglia, 18 miles ſouth of Rimini, 58 eaſt of Florence, and 120 north-eaſt of Rome. E. Lon. 12. 40. N. lat. 43. 46.

Urbino, a duchy of Italy, in the territory of the church, bounded on the north by the gulph of Venice; on the ſouth, by Perugino and Umbria; on the eaſt, by the marquiſate of Ancona; and on the weſt, by Tuſcany and Romagna. It is about 55 miles in length, and 45 in breadth. Here is great plenty of game and fiſh; but the air is not very wholeſome, nor is the ſoil fertile. Urbino is the capital.

URCEOLA, a lately diſcovered genus of the *pentandria* claſs, and *monogynia* order of plants, ranking immediately after Tabernæ montana (ſee *Encycl.*), and conſequently belonging to the 30th natural order or claſs called *Contortæ* by Linnæus in his natural method of arrangement. One of the qualities of the plants of this order is their yielding, on being cut, a juice which is generally milky, and for the moſt part deemed of a poiſonous nature. The genus is thus characteriſed by Dr Roxburgh; *Calyx* beneath five-toothed; corol one petaled, pitcher-ſhaped, with its contracted mouth five-toothed: nectary entire, ſurrounding the germs; follicles two, round, drupacious; ſeeds numerous, immerſed in pulp. There is but one known ſpecies, which is thus deſcribed by the ſame eminent botaniſt;

Urceola elastica: Shrubby, twining, leaves oppoſite, oblong, panicles terminal, is a native of Sumatra, Prince of Wales's Iſland, &c. Malay countries. *Stem* woody, climbing over trees, &c. to a very great extent, young ſhoots twining, and a little hairy, bark of the old woody parts thick, dark coloured, conſiderably uneven, a little ſcabrous, on which are found ſeveral ſpecies of moſs, particularly large patches of lichen; the wood is white, light and porous. *Leaves* oppoſite, ſhort-petioled, horizontal, ovate, oblong, pointed, entire, a little ſcabrous, with a few ſcattered white hairs on the under

under fide. *Stipulus* none. *Panicles* terminal, brachiate, very ramous. *Flowers* numerous, minute, of a dull greenifh colour, and hairy on the outfide. *Bracts* lanceolate, one at each divifion and fubdivifion of the panicle. *Calyx* perianth, one-leafed, five-toothed, permanent. *Corol* one petaled, pitcher-fhaped, hairy, mouth much contracted, five-toothed, divifions erect, acute, nectary entire, cylindric, embracing the lower two-thirds of the germs. *Stamens*, filaments five, very fhort from the bafe of the corol. Anthers arrow-fhaped, converging, bearing their pollen in two grooves on the infide, near the apex; between thefe grooves and the infertions of the filaments they are covered with white foft hairs. *Piftil*, germs two; above the nectary they are very hairy round the margins of their truncated tops. Style fingle, fhorter than the ftamens. Stigma ovate, with a circular band, dividing it into two portions of different colours. *Per.* Follicles two, round, laterally compreffed into the fhape of a turnip, wrinkled, leathery, about three inches in their greateft diameters—one celled, two valved. *Seeds* very numerous, reniform, immerfed in firm flefhy pulp.

See Plate XLVII. where fig. 1. is a branchlet in flower of the natural fize. 2. A flower magnified. 3. The fame laid open, which expofes to view the fituation of the ftamens inferted into the bottom of the corol, the nectarium furrounding the lower half of the two germs, their upper half with hairy margins, the ftyle and ovate party coloured; ftigma appearing above the nectary. 4. Outfide of one of the ftamens; and, 5. Infide of the fame, both much magnified. 6. The nectarium laid open, expofing to view the whole of the piftil. 7. The two feed veffels (called by Linnæus *follicles*), natural fize; half of one of them is removed, to fhew the feed immerfed in pulp. A portion thereof is alfo cut away, which more clearly fhews the fituation and fhape of the feed.

From wounds made in the bark of this plant there oozes a milky fluid, which on expofure to the open air feparates into an elaftic coagulum, and watery liquid, apparently of no ufe, after the feparation takes place. This coagulum is not only like the American caoutchouc or Indian rubber, but poffeffes the fame properties; for which, fee CAOUTCHOUC, both in the *Encycl.* and *Suppl.*

The chemical properties of this vegetable milk, while frefh, were found by Mr Howifon, late furgeon on Prince of Wales's Ifland, furprifingly to refemble thofe of animal milk. From its decompofition, in confequence of fpontaneous fermentation, or by the addition of acids, a feparation takes place between its cafeous and ferous parts, both of which are very fimilar to thofe produced by the fame proceffes from animal milk. An oily or butyrous matter is alfo one of its component parts, which appears upon the furface of the gum fo foon as the latter has attained its folid form. He endeavoured to form an extract of this milk fo as to approach to the confiftence of new butter, by which he hoped to retard its fermentative ftage, without depriving it of its ufeful qualities; but as he had no apparatus for diftilling, the furface of the milk, that was expofed to the air, inftantly formed into a folid coat, by which the evaporation was in a great degree prevented. He, however, learned, by collecting the thickened milk from the infide of the coats, and depofiting it in a jelly pot, that, if excluded from the air, it might be preferved in this ftate for a confiderable length of time; and even without any preparation he kept it in bottles, tolerably good, upwards of twelve months.

URINARY CONCRETIONS. See *Animal* SUBSTANCES, Suppl.

URTICA. See *Encycl.* where it is obferved that the common nettle, though it has a place in the *materia medica*, is now very little ufed. It has lately been recommended, however, by *Zannetini*, a phyfician who attended the French army in Italy, as a good fubftitute in fevers for cinchona. The fuccefs of fome experiments, which he made with it in tertian and quartan malignant fevers, furpaffed, he fays, his moft fanguine expectation. The nettle often produces a fpeedier effect than bark; for it heats in a great degree, and when the dofe is pretty ftrong, occafions a lethargic fleep. The dofe muft never exceed a dram, and is given in wine two or three times in the courfe of 24 hours. Zannetini found this medicine of great fervice to guard againft that total exhauftion which forms the principal character of malignant fevers; and he recommends a flight infufion of it in wine as an excellent prefervative for thofe who refide in marfhy and infalubrious diftricts. In employing the nettle in fever, Zannetini gives the fame caution as ought to be obferved in regard to cinchona, that is, that it muft not be employed where there is an inclination to inflammation, or where a continued fever, arifing from obftructions, exifts. This difcovery is not unworthy the attention of phyficians, and deferves at leaft to be farther inveftigated, as a great deal would be faved if cinchona could be entirely difpenfed with.

URVAIG, or *Urvaiga*, a province of South-America; bounded by Guayra on the north, the mouth of Rio de la Plata on the fouth, the captainry of del Rey on the eaft, and Parana on the weft, from which it is divided by the river of that name. Its extent is from lat. 25 to 33 20 fouth; the length from north-eaft to fouth-eaft being fomewhat above 210 leagues, and the breadth from eaft to weft, where broadeft, 130, but much narrower in other parts. It is divided by the river Urvaiga, or Uruguay, into the eaft and weft parts. This river runs above 400 leagues, the upper part with a prodigious noife among rocks and ftones, and falls into the La Plata almoft oppofite to Buenos Ayres.—*Morse.*

UTAWAS, a river which divides Upper and Lower Canada, and falls into Jefus Lake, 118 miles fouth-weft of Quebec. It receives the waters of Timmifkamain 360 miles from its mouth: 85 miles above it is called Montreal river.—*ib.*

UTRECHT, *New*, a townfhip of New-York, King's county, Long-Ifland. It has a Dutch church, and contains 562 inhabitants; of whom 76 are electors, and 206 are flaves. It is 7 or 8 miles fouthward of New-York city.—*ib.*

UXBRIDGE, a townfhip of Maffachufetts, Worcefter county, 41 miles fouth-weft of Bofton. It was taken from Mendon, and incorporated in 1727, and Northbridge was afterwards taken from it. It contains 180 dwelling houfes, and 1,308 inhabitants. It is bounded fouth by the State of Rhode-Ifland. Not far from Shoe-log Pond, in the fouth-weft part of the town, there is an iron mine which is improved to confiderable advantage.—*ib.*

W.

WABASH is a beautiful navigable river, of the N. W. Territory, which runs a S. W. and southern course, and empties into the Ohio, by a mouth 270 yards wide, in lat. 37 41 N. 168 miles from the mouth of the Ohio, and 1022 miles below Pittsburg. In the spring, summer, and autumn, it is passable in batteaux and barges, drawing about 3 feet water, 412 miles, to Ouiatanon; and for large canoes 197 miles further, to the Miami carrying-place, 9 miles from Miami village. This village stands on Miami river, which empties into the S. W. part of Lake Erie. The communication between Detroit and the Illinois and Ohio countries, is up Miami river, to Miami village, thence by land 9 miles, when the rivers are high, and from 18 to 30 when they are low, through a level country to the Wabash, and through the various branches of the Wabash to the places of destination. The land on this river is remarkably fertile. A silver mine has been discovered about 28 miles above Ouiatanon, on the northern side of the Wabash. Salt springs, lime, free-stone, blue, yellow, and white clay, are found in plenty on this river. The copper mine on this river, is perhaps the richest vein of native copper in the bowels of the whole earth.—*Morse.*

WABASH, *Little*, runs a course S. S. E. and falls into the Wabash 10 miles from the Ohio.—*ib.*

WACHOVIA, or *Dobb's Parish*, a tract of land in N. Carolina, situated between the E. side of Yadkin river, and the head waters of Haw and Deep rivers, consisting of about 100,000 acres, partly in Stokes and Surry counties. The United Brethren, or Moravians, purchased this tract of Lord Granville, in 1751, and called it Wachovia, after the name of an estate of Count Zinzendorf, in Germany. In 1755, it was made a separate parish, and named Dobb's, by the legislature. The settlement of Bethabara, was begun in 1753, by a number of the Brethren from Pennsylvania. Salem, which is the principal settlement, commenced in 1766, and is inhabited by a number of ingenious tradesmen. This thriving parish lies about 10 miles S. of Pilot Mountain, and contains 6 churches. —*ib.*

WACHQUATNACH, an ancient Moravian settlement in Connecticut, on Stratford river; 23 miles from its mouth.—*ib.*

WACHUSET *Mountain*, in the town of Princetown, Massachusetts, may be seen in a clear horizon, at the distance of 67 miles, being 2,989 feet above the level of the sea.—*ib.*

WADESBOROUGH, the chief town of Anson county, in Fayetteville district, N. Carolina. It contains a court-house, gaol, and about 30 houses, and being seated on a lofty hill, is both pleasant and healthy. It is 76 miles west by south of Fayetteville, and 50 south-east by S. of Salisbury.—*ib.*

WADMELAW, an island in Charleston harbour, S. Carolina.—*ib.*

WADSWORTH, a town of New-York, Ontario county, situated on the east bank of Genessee river; 4 miles west of Conesus Lake, and 13 south-west by south of Hartford.—*ib.*

WADHAM *Islands*, near the N. E. coast of Newfoundland Island. N. lat. 49 57, west long. 53 37. —*ib.*

WAGER's *Strait*, or *River*, in New North Wales, in N. America, lies in lat. 65 23 N. and is about 2 or 3 miles wide. At 5 or 6 miles within its entrance, it is 6 or 8 leagues wide, having several islands and rocks in the middle. It has soundings from 16 to 30 and 44 fathoms; and the land on both sides is as high (according to Captain Middleton's account) as any in England. Savage Sound, a small cove or harbour, fit for ships to anchor in, lies on the northern shore, 13 or 14 leagues up the strait, in long. 87 18 W. All the country from Wager's Strait to Seal river, is in some maps called New Denmark. Capt. Monk was sent thither, in 1610, by the king of Denmark, and wintered at a place called Monk's Winter Harbour, in lat. 63 20 N. which must be a little north of Rankin's Inlet.—*ib.*

WAGER's *Strait*, in N. America, is in about lat. 65 37 N. When Capt. Ellis was in this latitude, the tide ran at the rate of from 8 to 10 leagues an hour. He compares it to the sluice of a mill.—*ib.*

WAITSFIELD, the south-easternmost township of Chittenden county, Vermont, containing 61 inhabitants.—*ib.*

WAIT's *River* rises in Orange county, Vermont, and empties into Connecticut river, at Bradford.—*ib.*

WAJOMICK, an Indian town on Susquehannah river, about 400 miles from the sea. In the spring of 1756, the Indians shot 2 seals here, and they could not sufficiently express their astonishment at the sight of these animals unknown to them.—*ib.*

WAKE, an inland county of Hillsborough district, North-Carolina; bounded N. W. by Orange, and E. and S. E. by Johnson. It contains 10,192 inhabitants, including 2,463 slaves. Chief town, Raleigh.—*ib.*

WAKEFIELD, formerly *East-town* and *Watertown*, a township of Strafford county, New-Hampshire, east of Wolfborough, incorporated in 1774. It contains 640 inhabitants. In the north-east part is a pond which is the source of Piscataqua river.—*ib.*

WAKKAMAW, a beautiful lake, 26 miles in circuit, situated in Bladen county, North-Carolina. The lands on its eastern shores are fertile, and the situation delightful, gradually ascending from the shores; bounded on the north-west coast by vast rich swamps, fit for rice. This lake is the source of a fine river, of the same name, and runs a southerly course, for 70 or 80 miles, and empties into Winyaw Bay, at Georgetown, in South-Carolina.—*ib.*

WALDEN, a township of Vermont, Caledonia county, having Danville on the south-east. It contains only 11 inhabitants.—*ib.*

WALDOBOROUGH, a post-town and port of entry of the District of Maine, in Lincoln county, 12 miles S. by W. of Warren, 10 E. by S. of Newcastle, Waldo, || Wales.

20 eaſt of Wiſcaſſet, and 545 north-eaſt of Philadelphia. This is the port of entry for the diſtrict, lying between the towns of Camden and Northport; and all the ſhores and waters from the middle of Damariſcotta river to the ſouth-weſtern ſide of the town of Northport. The townſhip of Waldoborough was incorporated in 1773, and contains 1210 inhabitants.—*ib.*

WALDO *Patent*, a tract of land forming the ſouth-eaſt part of Hancock county in the Diſtrict of Maine, and on the weſt ſide of Penobſcot river and bay.—*ib.*

WALES, New South, is a country which muſt be intereſting on account of the ſingular colony which was ſettled there in the year 1788. Under the title *New Holland* (*Encycl.*) ſome account has been given of that ſettlement, as well as of the climate and the ſoil about Port Jackſon; but it will probably gratify the curioſity of our readers, if we give a ſhort hiſtory of thoſe European ſettlers, of whom it is to be hoped that they carried not with them, to that diſtant ſhore,

"Minds not to be changed by time or place."

This hiſtory we ſhall take from the accurate *Account of the Engliſh Colony in New South Wales*, by David Collins, Eſq; who went out with Governor Phillip, and continued to execute the offices of Judge-advocate and Secretary till the cloſe of the year 1796; and we ſhall begin our narrative from the diſembarkation of the firſt coloniſts, when his Majeſty's commiſſion to the governor, and the letters patent eſtabliſhing courts of criminal and civil judicature in the territory were read.

The criminal court was conſtituted a court of record, and was to conſiſt of the judge-advocate and ſuch ſix officers of the ſea and land ſervice as the governor ſhall, by precept iſſued under his hand and ſeal, require to aſſemble for that purpoſe. This court has power to inquire of, hear, determine, and puniſh all treaſons, miſpriſions of treaſons, murders, felonies, forgeries, perjuries, treſpaſſes, and other crimes whatſoever that may be committed in the colony; the puniſhment for ſuch offences to be inflicted according to the laws of England as nearly as may be, conſidering and allowing for the circumſtances and ſituation of the ſettlement and its inhabitants. The charge againſt any offender is to be reduced into writing, and exhibited by the judge-advocate: witneſſes are to be examined upon oath, as well for as againſt the priſoner; and the court is to adjudge whether he is guilty or not guilty by the opinion of the major part of the court. If guilty, and the offence is capital, they are to pronounce judgment of death, in like manner as if the priſoner had been convicted by the verdict of a jury in England, or of ſuch corporal puniſhment as the court, or the major part of it, ſhall deem meet. And in caſes not capital, they are to adjudge ſuch corporal puniſhment as the majority of the court ſhall determine. But no offender is to ſuffer death unleſs five members of the court ſhall concur in adjudging him to be guilty, until the proceedings ſhall have been tranſmitted to England, and the king's pleaſure ſignified thereupon. The provoſt-marſhal is to cauſe the judgment of the court to be executed according to the governor's warrant under his hand and ſeal.

Beſide this court for the trial of criminal offenders, there is a civil court, conſiſting of the judge-advocate and two inhabitants of the ſettlement, who are to be appointed by the governor; which court has full power to hear and determine in a ſummary way all pleas of lands, houſes, debts, contracts, and all perſonal pleas whatſoever.

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From this court on either party, plaintiff or defendant, finding himſelf or themſelves aggrieved by the judgment or decree, an appeal lies to the governor, and from him, where the debt or thing in demand ſhall exceed the value of L. 300, to the king in council.

A vice-admiralty court was alſo appointed, for the trial of offences on the high ſeas; and the governor, lieutenant-governor, and judge-advocate, were by patent made juſtices of the peace, with a power in the governor to appoint other juſtices.

The ſituation which Governor Phillip had ſelected for his reſidence, and for the principal ſettlement, was the eaſt ſide of a cove in Port Jackſon, which he called *Sydney Cove*. Its latitude was found to be 33° 52′ 30″ ſouth, and its longitude 152° 19′ 30″ eaſt. This ſituation was choſen without due examination; for it ſoon appeared that the head or upper part of the cove wore a much more favourable appearance than the ground immediately about the ſettlement. From the natives, the new ſettlers met no oppoſition; during the firſt ſix weeks they received only one viſit from them, two men ſtrolling one evening into the camp, and remaining in it for about half an hour. They appeared to admire whatever they ſaw; and after receiving a hatchet (of the uſe of which the eldeſt inſtantly and curiouſly ſhewed his knowledge, by turning up his foot and ſharpening a piece of wood on the ſole with the hatchet) took their leave, apparently well pleaſed with their reception. The fiſhing boats alſo frequently reported their having been viſited by many of theſe people when hauling the ſeine; at which labour they often aſſiſted with cheerfulneſs, and in return were generally rewarded with a part of the fiſh taken.

The firſt labour in which the convicts were employed was that of building huts; and for this purpoſe it was found neceſſary to divide them into gangs, and to appoint an overſeer to each, who ſhould ſee that the proper quantity of work was performed. The proviſions were diſtributed by a weekly ration, and to each man were allowed 7lb. of biſcuit, 1lb. of flour, 7lb. of beef or 4lb. of pork, 3 pints of peaſe, and 6 ounces of butter. To the female convicts two-thirds of this ration were allowed. This was the full ration, which, in many inſtances, it became neceſſary to reduce; and once, in conſequence of the delay of tranſports with a ſupply, the convicts were put on an allowance of which fleſh meat conſtituted no part.

The temporary huts in which the coloniſts lived, for ſome time after their arrival, were formed principally of the cabbage-tree. With this the ſides and ends were filled; the poſts and plates being made of the pine; and the whole was plaſtered with clay. The roofs were generally thatched with the graſs of the gumruſh; though ſome were covered with clay, but ſeveral of theſe failed; the weight of the clay and rain ſoon deſtroying them. In a ſhort time they applied themſelves to the burning of bricks; by which their habitations ſoon became much more laſting and comfortable. The progreſs of the colony, however, towards that degree of convenience which was within its reach, was greatly impeded by the incorrigible vices of thoſe who principally

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pally compofed it. Drunkennefs, theft, robbery, and unconquerable lazinefs, continued to mark the character of the great body of the convicts. Though to fly from the colony, and venture into the interior of the country, was inevitable death in the form of famine or of murder, yet fuch was the invincible antipathy to labour manifefted by fome of thofe people, that they often fled to the woods, from which they feldom returned; fome dying of hunger, and fome being facrificed by the natives. Difinclination to labour produced here, as elfewhere, its natural effect—robbery.

In the month of May 1788, a lad of 17 years of age was tried, convicted, and executed, for breaking open a tent belonging to one of the tranfport fhips; feveral others were taken into cuftody in that month for various thefts and burglaries, and two were afterward tried and executed. One of thefe had abfconded, and lived in the woods for 19 days, fubfifting by what he was able to procure by nocturnal depredations among the huts and ftock of individuals. His vifits for this purpofe were fo frequent and daring, that it became abfolutely neceffary to proclaim him an outlaw. By the negligence of one of thofe fellows who had been intrufted with the care of the cattle, the bull and four cows were loft: he left them in the fields, and returned to his hut to dine; and in the mean time they either ftrayed away or were driven off by the natives. Five years elapfed before thefe cattle were difcovered wild, at a confiderable diftance up the country, and greatly multiplied.

The perpetration of crimes, chiefly theft and robbery, had become fo prevalent before twenty months had paffed fince the colony was eftablifhed, that it was neceffary to think of a fyftem of police. A plan was prefented to the governor by a *convict*, which with fome improvements was adopted on the 8th of Auguft 1789. The following are the heads of the arrangement.

The fettlement was divided into four diftricts, over each of which was placed a watch confifting of three perfons, one principal and two fubordinate watchmen. Thefe being felected from among thofe convicts whofe conduct and character had been unexceptionable fince their landing, were vefted with authority to patrole at all hours in the night, to vifit fuch places as might be deemed requifite for the difcovery of any felony, trefpafs, or mifdemeanor, and to fecure for examination all perfons that might appear to be concerned therein; for which purpofe they were directed to enter any fufpected hut or dwelling, or to ufe any other means that might appear expedient. They were required to detain and give information to the neareft guardhoufe of any foldier or feaman who fhould be found ftraggling after the tattoo had been beat. They were to ufe their utmoft endeavours to trace out offenders on receiving accounts of any depredation; and in addition to their night-duty, they were directed to take cognizance of fuch convicts as gamed, or fold or bartered their flops or provifions, and report them for punifhment. A return of all occurrences during the night was to be made to the judge-advocate; and the military were required to furnifh the watch with any affiftance they might be in need of, beyond what the civil power could give them. They were provided each with a fhort ftaff, to diftinguifh them during the night, and to denote their office in the colony; and were inftructed not to receive any ftipulated encouragement or reward from any individual for the conviction of offenders, but to expect that negligence or mifconduct in the execution of their truft would be punifhed with the utmoft rigour. It was to have been wifhed, fays Mr Collins, that a watch eftablifhed for the prefervation of public and private property had been formed of free people, and that neceffity had not compelled us, in felecting the firft members of our little police, to appoint them from a body of men, in whofe eyes, it could not be denied, the property of individuals had never before been facred. But there was not any choice: The military had their line of duty marked out for them, and between them and the convict there was no defcription of people from whom overfeers or watchmen could be provided. It might, however, be fuppofed, that among the convicts there muft be many who would feel a pride in being diftinguifhed from their fellows, and a pride that might give birth to a returning principle of honefty. It was hoped that the convicts whom we had chofen were of this defcription; fome effort had become neceffary to detect the various offenders who were prowling about with fecurity under cover of the night; and the convicts who had any property were themfelves interefted in defeating fuch practices. They promifed fidelity and diligence, from which the fcorn of their fellow-prifoners fhould not induce them to fwerve, and began with a confidence of fuccefs the duty which they had themfelves offered to undertake.

A fpecies of difturber now infefted the colony, againft which the vigilance of a police could not guard. Rats, in immenfe numbers, had attacked the provifion ftores, and could be counteracted only by removing the provifions from one ftore to another. When their ravages were firft difcovered, it was found that eight cafks of flour were already deftroyed by thefe vermin. Such of thefe animals as efcaped the dogs, which were fet upon them, flew to the gardens of individuals, where they rioted on the Indian corn that was growing, and did confiderable mifchief.

Our author gives the moft melancholy account of the extreme fufferings of the early colonifts from want of provifions, and of the difeafes imported into the country by newcomers, who had either caught them on the voyage or brought them from England. The fettlers on *Norfolk-Ifland* (fee *Encycl.*), to which New South Wales was a mother country, muft have been much more liable than that colony to fuffer from famine, had they not fometimes obtained a temporary fupply from a fource which was unknown at Sydney Cove. On a mountain in the ifland, to which had been given the name of *Mount Pitt*, they were fortunate enough to obtain in an abundance almoft incredible, a fpecies of aquatic birds, anfwering the defcription of that known by the name of the *puffin*. Thefe birds came in from the fea every evening, in clouds literally darkening the air, and defcending on Mount Pitt, depofited their eggs in deep holes made by themfelves in the ground, generally quitting them in the morning, and returning to feek their fubfiftence in the fea. From two to three thoufand of thefe birds were often taken in a night. Their feeking their food in the ocean left no doubt of their own flefh partaking of the quality of that upon which they fed; but to people circumftanced as were the inhabitants of Norfolk-ifland, this leffened not their importance; and while any Mount Pitt birds (fuch being

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ing the name given them) were to be had, they were eagerly fought.

The firft fettler in New South Wales, who declared himfelf able to live on the produce of his farm, without any affiftance from the ftores, was James Rufe; who in April 1790 relinquifhed his claim to any farther fhare of the public provifion. As a reward, the governor immediately put him in poffeffion of an allotment of 30 acres.

In the July of the fame year, the convicts whofe terms of tranfportation had expired were now collected, and by the authority of the governor informed, that fuch of them as wifhed to become fettlers in this country fhould receive every encouragement; that thofe who did not, were to labour for their provifions, ftipulating to work for 12 or 18 months certain; and that in the way of fuch as preferred returning to England no obftacles would be thrown, provided they could procure paffages from the mafters of fuch fhips as might arrive; but that they were not to expect any affiftance on the part of government to that end. The wifh to return to their friends appeared to be the prevailing idea, a few only giving in their names as fettlers, and none engaging to work for a certain time.

That the wifh to return home was ftrong indeed, and paramount to all other feelings, was evinced in a very melancholy inftance fome time before. A convict, an elderly man, was found dead in the woods, near the fettlement; who, on being opened, it appeared had died from want of nourifhment; and it was found that he was accuftomed to deny himfelf even what was abfolutely neceffary to his exiftence, abftaining from his provifions, and felling them for money, which he was referving, and had fomewhere concealed, in order to purchafe his paffage to England when his time fhould terminate!

Of fome convicts whofe terms of tranfportation had expired, the governor eftablifhed a new fettlement in Auguft 1791, at a place which he called *Profpect Hill*, about twenty miles diftant from Sydney Cove; and another refidence was formed at the Ponds within three or four miles of the former. This made the fourth fettlement in the colony, exclufively of that at Norfolk Ifland.

About this time the governor received from England a public feal for the colony: on the obverfe of which were the king's arms and royal titles; and on the reverfe, emblematic figures fuited to the fituation of the people for whofe ufe it was defigned. The motto was "*Sic fortis Etruria crevit;*" and in the margin were the words "*Sigillum Nov. Camb. Auft.*" A commiffion alfo arrived, empowering him to remit abfolutely, or conditionally, the whole or any part of the term for which the felons fent to the colony might be tranfported. By this power he was enabled to beftow on fuperior honefty and induftry the moft valuable reward which, in fuch circumftances, they could receive.

In addition to the calamities under which the fettlement had fo often laboured from being reduced to very fhort allowance of provifions, and the frequency of the ordinary difeafes which were to be expected among a people fo fituated, a new malady of a very alarming nature was perceived about April 1792. Several convicts were feized with infanity; and as the major part of thofe who were vifited by this calamity were females, who, on account of their fex, were not harraffed with hard labour, and who in general fhared largely of fuch little comforts as were to be procured in the fettlement, it was difficult to affign a caufe for this diforder. It feems, however, to have been of fhort duration; for we hear not of it again during the period that Mr Collins's narrative comprehends.

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About this time (1792) the colony had affumed fomething of an eftablifhed form. Brick huts were in hand for the convicts in room of the miferable hovels occupied by many, which had been put up at their firft landing, and in room of others which, from having been erected on fuch ground as was then cleared, were now found to interfere with the direction of the ftreets which the governor was laying out. People were alfo employed in cutting paling for fencing in their gardens. At a place called Paramatta, about 16 miles from Sydney Cove, fituated on a fmall river which runs into Port Jackfon, the people were employed, during the greateft part of the month of May, in getting in the maize and fowing wheat. A foundation for an hofpital was laid, a houfe built for the mafter carpenter, and roofs prepared for the different huts either building or to be built in future.

In December 1792, when Captain Phillip refigned the government, nearly five years from the foundation of the colony, there were in cultivation at the different fettlements 1429 acres, of which 417 belonged to fettlers; that is, 67 fettlers, for there were no more, cultivated nearly half as much ground as was cultivated by the public labour of all the convicts; a ftriking proof of the fuperior zeal and diligence with which men exert themfelves when they have an intereft in their labour. Of free fettlers, whofe exertions promifed fo fairly to promote the interefts of the colony, feveral arrived from England in January 1793, and fixed themfelves in a fituation which they called *Liberty Plains*. To one of thefe, Thomas Rofe, a farmer from Dorfetfhire, and his family of a wife and four children, 120 acres were allotted. The conditions under which thefe people agreed to fettle were, "to have their paffage provided by government (A); an affortment of tools and implements to be given to them out of the ftores; that they fhould be fupplied with two years provifions; that their lands fhould be granted free of expenfe; the fervice of convicts alfo to be affigned to them free of expenfe; and that thofe convicts fhould be fupplied with two years rations and one year's clothing."

Among the great difficulties with which this infant eftablifhment had to ftruggle, not the leaft was that of procuring cattle. Of thofe which were embarked in England and other places for the colony, a very fmall proportion only arrived; for of 15 bulls and 119 cows, which had been embarked for Botany Bay, only 3 bulls and 28 cows were landed at the fettlement. It was not until the arrival of the Endeavour, Captain Bampton, in 1795, that the mode of conveying cattle to the colony,

(A) Government paid for the paffage of each perfon above ten years of age L. 8, 8s. and one fhilling per day for victualling them.

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lony without material lofs was difcovered. In that veffel, out of 130 head which he embarked at Bombay, one cow only died on the paffage, and that too on the day before his arrival.

The fcarcity of cattle naturally raifed their price. Even after this laft importation, an Englifh cow in calf fold for L. 80.

Notwithftanding the various obftacles which induftry had met in the cultivation of this fettlement, it yet made confiderable advances; for in October 1793, the value of land had fo rifen that one fettler fold his allotment of 30 acres for as many pounds; and one farm, with the houfe, &c. fold for L.100. The value of ground, indeed, was confiderably enhanced by government agreeing to purchafe the redundance of the produce of the fettlers at fixed prices. Wheat properly dried and cleanfed was received from the fettlers at Sydney, by the commiffary, at 10s. per bufhel. Some cultivators, however, had devifed another mode of difpofing of their corn. One of them, whofe fituation was near Parramatta, having obtained a fmall ftill from England, found it more advantageous to draw an ardent diabolical fpirit from his wheat, than to fend it to the ftores. From one bufhel of wheat he obtained nearly five quarts of fpirit, which he fold or paid in exchange for labour, at the rate of five or fix fhillings per quart. A better ufe was made of grain by another fettler; who having a mill, ground it, and procured 44lb. of good flour, from a bufhel of wheat taken at 59lb. This flour he fold at 4d. per lb.

By a return of the number of perfons in New South Wales and Norfolk Ifland in April 1794, it appeared that there were in all 4414, including women and children; the annual expenfe of whom, to the mother-country, Mr Collins eftimates at L.161,101. Rapid ftrides, however, were at that time making towards independence, if not towards an ability of repaying to England a part of what the fettlement had coft her. Already the colony lived on grain of its own growth, and an increafe of live ftock was become almoft certain. There were now 4665 acres of ground cleared for cultivation; more than half of which had been effected by thofe who had become fettlers in the courfe of fifteen months.

To this fpirit of improvement fuch a check was given in September 1794, that not more than a third of government ground, and a fifth of ground belonging to individuals, was in cultivation 1795. As this event has been mifreprefented, we fufpect purpofely, by fome of our journalifts, we fhall give the true account of it in the words of Mr Collins himfelf.

"The Francis fchooner (fays he) returned from Norfolk, having been abfent about eight weeks and three days. From Mr King, who commanded in that ifland, we learned that his harveft had been prodigioufly productive. He had purchafed from the firft crops, which the fettlers had brought to market, upwards of 11,000 bufhels of maize; and bills for the amount were drawn by him in favour of the refpective fettlers; but requiring the fanction of the Lieutenant governor, they were now fent to Port Jackfon. Mr King had been partly induced to make this provifional kind of purchafe under an idea, that the corn would be acceptable at Port Jackfon, and alfo in compliance with the conditions on which the fettlers had received their refpective allotments under the regulations of Governor Phillip; that is to fay, that their overplus grain fhould be purchafed at a fair market-price. Being, however, well ftocked with that article already, the Lieutenant governor did not think himfelf juftifiable in putting the crown to fo great an expenfe (nearly L. 3000 Sterling), and declined accepting the bills." This naturally excited fome difcontents in Norfolk Ifland, and one or two fettlers gave up their farms; but immediately on the arrival of Governor Hunter, he paid for the corn, and tranquillity was reftored to the ifland.

Though feveral quarrels had occurred between the natives and individuals among the colonifts, yet it was fuppofed that our people were in general the aggreffors. The governor had taken much pains to infpire the natives with confidence, and had in a great meafure fucceeded. To theft they were naturally and irrefiftibly inclined: but, like other favages, they feemed unconfcious of the crime, and were feldom deterred by detection from mixing with the colonifts. At a fettlement which had early been formed at a river called the *Hawkefbury* (and at which, cultivation having gone on well, there was, in courfe, much grain to ftimulate to depredation), the natives affumed a more formidable appearance.

"At that fettlement (fays Mr Collins) an open war feemed about this time to have commenced between the natives and the fettlers; and word was received over-land, that two people were killed by them; one a fettler of the name of Wilfon, and the other a freeman, one William Thorp, who had hired himfelf to this Wilfon as a labourer. The natives appeared in large bodies, men, women, and children, provided with blankets and nets to carry off the corn, of which they appeared as fond as the natives who lived among us, and feemed determined to take it whenever and wherever they could meet with opportunities. In their attacks they conducted themfelves with much art; but where that failed they had recourfe to force; and on the leaft appearance of refiftance made ufe of their fpears or clubs. To check at once, if poffible, thefe dangerous depredators, Captain Paterfon directed a party of the corps to be fent from Paramatta, with inftructions to deftroy as many as they could meet with of the wood tribe (Bè-diagal); and, in the hope of ftriking terror, to erect gibbets in different places, whereon the bodies of all they might kill were to be hung. It was reported that feveral of thefe people were killed in confequence of this order; but none of their bodies being found (perhaps if any were killed they were carried off by their companions), the number could not be afcertained. Some prifoners, however, were taken, and fent to Sydney; one man (apparently a cripple), five women, and fome children. One of the women, with a child at her breaft, had been fhot through the fhoulder, and the fame fhot had wounded the babe. They were immediately placed in a hut near our hofpital, and every care taken of them that humanity fuggefted. The man was faid, inftead of being a cripple, to have been very active about the farms, and inftrumental in fome of the murders which had been committed. In a fhort time he found means to efcape, and by fwimming reached the north fhore in fafety; whence, no doubt, he got back to his friends. Captain Paterfon hoped, by detaining the prifoners and treating them well, that fome good effect might refult; but

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but finding, after fome time, that coercion, not attention, was more likely to anfwer his ends, he fent the women back. While they were with us, the wounded child died, and one of the women was delivered of a boy, which died immediately. On our withdrawing the party, the natives attacked a farm nearly oppofite Richmond Hill, belonging to one William Rowe, and put him and a very fine child to death; the wife, after receiving feveral wounds, crawled down the bank, and concealed herfelf among fome reeds half immerfed in the river, where fhe remained a confiderable time without affiftance: being at length found, this poor creature, after having feen her hufband and her child flaughtered before her eyes, was brought into the hofpital at Paramatta, where fhe recovered, though flowly, of her wounds."

By the vigorous meafures which were adopted, the colony, towards the clofe of 1796, had acquired a degree of ftrength which feemed to enfure its future profperity. Not only the neceffary edifices were raifed for the habitations of its people, but fome for the purpofes of religion, amufement, &c. A playhoufe had been erected at the expenfe of fome perfons who performed in it for their own emolument, and who admitted auditors at one fhilling each. A convenient church had been built, a printing-prefs had been fet up, the civil court was open for the recovery of debts by action and for proving wills, licenfes had been iffued to regulate the fale of fpirits, and paffage-boats were eftablifhed for the convenience of communication between the different fettlements. In the houfes of individuals were to be found moft of the comforts, and not a few of the luxuries, of life; and, in a word, the former years of famine, toil, and difficulty, were now exchanged for thofe of plenty, eafe, and pleafure.

The quantity of ground at this time in cultivation was 5419 acres; of which 2547 were occupied by fettlers. The number of perfons in New South Wales and its dependencies amounted to 4848. The price of labour, however, compared with the prices of provifions (as given in Mr Collins's Tables), does not appear fo high as to enable the workman to live very comfortably. He who receives but three fhillings for his day's work, and gives two fhillings for a pound of mutton, fifteen pence for a pound of pork, and half of that fum for a pound of flour, will fcarcely derive from his mere labour the fupport neceffary for a family.

That many things are yet wanted to give full effect to the advantages which the colony now enjoys, Mr Collins declares in the following paragraph, with which he concludes his account:

"The want at this time of feveral public buildings in the fettlement has already been mentioned. To this want muft be added, as abfolutely neceffary to the well-being and comfort of the fettlers, and the profperity of the colony in general, that of a public ftore, to be opened on a plan, though not exactly the fame, yet as liberal as that of the Ifland of St Helena, where the Eaft India Company iffue to their own fervants European and Indian goods at 10 *per cent.* advance on the prime coft. Confidering our immenfe diftance from England, a greater advance would be neceffary; and the fettlers and others would be well fatisfied, and think it equally liberal, to pay 50 *per cent.* on the prime coft of all goods brought from England; for at prefent they pay never lefs than 100, and frequently 1000, *per cent.* on what they have occafion to purchafe. It may be fuppofed that government would not choofe to open an account, and be concerned in the retail of goods, but any individual would find it to his intereft to do this, particularly if affifted by government in the freight; and the inhabitants would gladly prefer the manufactures of their own country to the fweepings of the Indian bazars.

"The great want of men in the colony muft be fupplied as foon as a peace fhall take place; but the want of refpectable fettlers may, perhaps, be longer felt; by thefe are meant men of property, with whom the gentlemen of the colony could affociate, and who fhould be thoroughly experienced in the bufinefs of agriculture. Should fuch men ever arrive, the adminiftration of juftice might affume a lefs military appearance, and the trial by jury, ever dear and moft congenial to Englifhmen, be feen in New South Wales."

There is, however, one ferious difficulty which the colony has not yet overcome, and which, until it be overcome, will certainly prevent fuch men from fettling in New South Wales. Till fome ftaple commodity can be raifed for exportation, induftrious free fettlers will never be tempted to emigrate from Europe to a country where their induftry cannot procure the comforts as well as the neceffaries of life. The American colonies, in their infancy did not labour under this difadvantage. Tobacco foon became, and ftill continues to be, an article of fuch importance, that its cultivation afforded the trans-atlantic farmer a ready exchange for European commodities; whilft in New South Wales there feems to be no vegetable production of much value, except New Zealand hemp, which is produced indeed in great abundance in Norfolk Ifland: and which Captain Cook long ago pointed out as an article of great importance to the Britifh navy. This is indeed a valuable plant, and grows in all the cliffs of the ifland, where nothing elfe will grow, in fufficient abundance to give conftant employment to 500 people; yet when Mr Collins left the fettlement, there was no more than one loom on the ifland, and the flax or reed was defigned for coarfe canvas; nor did they poffefs a fingle tool required by flax-dreffers or weavers beyond the poor fubftitutes which they were obliged to fabricate for themfelves. In this defect of neceffaries for the manufacture, only 18 people could be employed in it; and of thefe the united labour in a week produced 16 yards of canvas, of the fize called N°.7.

Befides a ufeful manufactory of this plant, which certainly might be eftablifhed, the colony appears to poffefs feveral important advantages. From Mr Collins's narrative, it appears probable that a feal and perhaps a whale fifhery might be eftablifhed with a fair profpect of fuccefs; good rich earth is found near Sidney Cove; there are immenfe ftrata of coal in the fouthern part of New Holland; Norfolk Ifland abounds with lime; and vaft quantities of fhells, which anfwer the fame purpofe, have been found on the main land. Though the wood in general be not of a durable kind, it appears that there is fome good timber near the Hawkefbury river; and at Norfolk Ifland and New Zealand it is remarkably fine.

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WALES, *New South*, a country of vaſt extent, but little known, lying round the ſouthern part of Hudſon's Bay.—*Morse.*

WALES, *New North*, an extenſive territory of North-America; having Prince William's Land on the north, part of Baffin's Bay on the eaſt, and ſeparated from New South Wales, on the ſouth by Seal river.—*ib.*

WALES, a plantation in Lincoln county, Diſtrict of Maine, 55 miles north-eaſt of Portland, and 180 from Boſton. It contains 439 inhabitants.—*ib.*

WALHALDING, the Indian name of an eaſtern branch of Muſkingum-river, at the mouth of which ſtood Goſchachguenk, a Delaware town, and ſettlement of Chriſtian Indians.—*ib.*

WALLINGFORD, a townſhip of Vermont, Rutland county, eaſt of Tinmouth. It contains 536 inhabitants.—*ib.*

WALLINGFORD, a pleaſant poſt-town of Connecticut, New-Haven county, 13 miles S. W. of Middleton, 13 N. E. of New-Haven, and 195 north-eaſt of Philadelphia. This townſhip, called by the Indians *Coginchauge*, was ſettled in 1671; is divided into two pariſhes, and contains about 2000 inhabitants. It is 12 miles long, and 7 broad.—*ib.*

WALLKILL, a townſhip of New York, Ulſter county, on the creek of its name, about 15 miles N. by E. of Goſhen, 11 weſt of Newburgh, and 58 N. W. of New York city. It contains 2571 inhabitants, of whom 340 are qualified electors, and 103 ſlaves.—*ib.*

WALNUT *Hills*, in the weſtern territory of Georgia, are ſituated on a tract of land formed by Miſſiſſippi river and the Looſa Chitto, and on the north ſide of the latter.—*ib.*

WALLOOMSCHACK, a ſmall branch of Hooſack river, Vermont.—*ib.*

WALLPACK, a townſhip in Suſſex county, New-Jerſey, on Delaware river, about 11 miles weſt of Newtown, and 50 north-weſt of Brunſwick. It contains 496 inhabitants, including 30 ſlaves.—*ib.*

WALPOLE (Horace, Earl of Orford), was the youngeſt ſon of the celebrated Sir Robert Walpole, afterwards Earl of Orford, by his firſt wife, Catharine, daughter of Robert Shorter, Eſq; of Bybrook in Kent. He was born 1716; and was educated, firſt at Eton ſchool, and afterwards at Cambridge. At Eton he formed an intimate aquaintance with the celebrated poet Gray; and they went together on the tour of Europe, in the years 1739, 1740, and 1741. Unhappily they had a diſpute in the courſe of their travels, which produced a ſeparation.

Mr Walpole was able to make a ſplendid figure during the remainder of his deſtined courſe; but poor Gray, after the ſeparation, was obliged to obſerve a very ſevere economy. "This difference aroſe from the difference of their tempers: the latter being, from his earlieſt years, curious, penſive, and philoſophical; the former, gay, lively, and inconſiderate. This, therefore, occaſioned their ſeparation at Reggio. Mr Gray went before him to Venice; and ſtaying there till he could find means of returning to England, he made the beſt of his way home, repaſſing the Alps, and following almoſt the ſame rout, through France, which he had before gone to Italy. In juſtice to the memory of ſo reſpectable a friend, Mr Walpole (ſays Mr Maſon, life of Gray, 4to, p. 4 .) enjoins me to charge him with the chief blame in their quarrel, confeſſing that more attention, complaiſance, and deference, to a warm friendſhip, and ſuperior judgment and prudence, might have prevented a rupture that gave much uneaſineſs to them both, and a laſting concern to the ſurvivor; though in the year 1744 a reconciliation was effected between them, by a lady who wiſhed well to both parties."—This event took place after their return to England; but the *wound* in their friendſhip left a *ſcar* that never was totally effaced.

We do not, indeed, think that Horace Walpole and Mr Gray were formed, either by nature or by habits, to continue long in a ſtate of intimate friendſhip. Gray appears to have been a man of the pureſt moral principles, a friend to religion, penſive, and at leaſt ſufficiently conſcious of his intellectual powers and intellectual attainments. Walpole's morality was certainly of a looſer kind; he ſeems to have had no religion; he was often unſeaſonably gay; and to an equal ſhare of intellectual pride, though without equal reaſon, he added the pride of birth. It can therefore excite no ſurpriſe that a man of Gray's independent ſpirit could not bear the ſupercilious freaks of ſuch a character.

Mr Walpole was nominated to repreſent the city of Norwich, when his father viſited it July 3d, 1733, having acquired conſequence, not only as the ſon of the miniſter, but as having attended the Prince of Orange to England in that year. He was choſen member for Collington, in Cornwall, in the parliament which met June 25th, 1741; was a ſecond time in parliament as repreſentative for Caſtle Riſing, in Norfolk, in 1747; and for King's Lynn in 1754 and 1761; and, at the expiration of that parliament, he finally retired from the ſtage of politics, and confined himſelf wholly to literary purſuits. He held to his death the office of uſher of his Majeſty's exchequer, controller of the pipe, and clerk of the eſtreats. Upon the death of his nephew George, third Earl of Orford, 1791, he ſucceeded to the title and eſtates; but that event made ſo little alteration in his mode of living, that we know not whether he ever took his ſeat in the houſe of peers. During almoſt the whole courſe of his life he was the victim of the gout, which at laſt reduced him to a cripple: but it never impaired his faculties; and, to the very moment of death, his underſtanding ſeemed to bid defiance to the ſhock of Nature. He died at his houſe in Berkeſley Square, in 1796, having juſt entered his 80th year; and was interred in the family vault at Houghton, in a private manner, agreeably to his particular directions.

Horace, Lord Orford, was never married, and, by one of his biographers, his chief miſtreſs through life is ſaid to have been the muſe. It is certain that he devoted the greater part of his life to belles lettres and virtû, though he ridiculouſly affected, in his letters to his friends, to deſpiſe learning and learned men, for which he was very properly reprimanded both by Gray and Hume. It was an affectation peculiarly abſurd in him who was conſtantly publiſhing ſomething, and who wrote with uncommon acrimony againſt all who preſumed to call in queſtion the fidelity of the picture which he had drawn of Richard III. or indeed to controvert any of his opinions. Hence his antipathy to Johnſon, becauſe he was a tory, a Chriſtian, and a rigid moraliſt; whilſt he himſelf was a whig, an infidel, and ſuch a moraliſt as could

could retail, without blushing, all the scandalous anecdotes, whether true or false, of that august family, from whom he acknowledged his whole fortune to be derived. He had, indeed, another reason for disliking Johnson. Lord Orford shone in conversation, and surpassed all his contemporaries in that kind of talk, which, without dazzling by its wit, always delighted; while Johnson, when roused, knocked down, as by a flash of lightning, his Lordship and every one else who had the confidence before him to talk profanely. Johnson's wit was original: Lord Orford's consisted of ludicrous stories and of literary and political anecdotes. His works, of which by far the most valuable part has long been in the hands of the public, were collected in 1798, and published in five volumes, 4to. They resemble his conversation, being rather amusing than profound or instructive.

Walpole, a post-town of New-Hampshire, Cheshire county, on the eastern side of Connecticut river, eleven miles south of Charlestown, 14 N. W. by N. of Keene, 108 west of Portsmouth, and 330 from Philadelphia. The township contains 1245 inhabitants.—*Morse.*

Walpole, a township of Massachusetts, Norfolk county, on the great road to Providence, and 20 miles south-west of Boston. It was incorporated in 1724, and contains 1005 inhabitants.—*ib.*

WALSINGHAM, *Cape*, is on the east side of Cumberland's Island, in Hudson's Straits. N. lat. 62 39, W. long. 77 53. High water, at full and change, at 12 o'clock.—*ib.*

WALTHAM, a township of Massachusetts, Middlesex county, 11 miles north-west by north of Boston. It was incorporated in 1737, and contains 882 inhabitants. —*ib.*

Waltham, or *Westham*, a village in Henrico county, Virginia, situated on the north side of James's river, 4 miles north-west of Richmond.—*ib.*

WAMPANOS, an Indian tribe, allies of the Hurons.—*ib.*

WANASPATUCKET *River*, rises in Gloucester, Rhode Island, and falls into Providence river a mile and an half north-west of Weybosset bridge. Upon this river formerly stood the only powder-mill in this state, and within one mile of its mouth there are a slitting-mill, two paper-mills, two grist-mills with four run of stones, an oil-mill, and a saw-mill.—*ib.*

WANDO, a short, broad river of S. Carolina, which rises in Charleston district, and empties into Cooper's river, a few miles below Charleston.—*ib.*

WANOOAETTE, an island in the S. Pacific Ocean, about two miles in extent from south-east to north-west. It is about 10 miles at north-west by west from the north end of Wateehoo Island.—*ib.*

WANTAGE, a township near the N. W. corner of New-Jersey, Sussex county, 15 miles northerly of Newtown. It contains 1700 inhabitants, including 26 slaves.—*ib.*

WANTASTIC, the original name of West river, Vermont.—*ib.*

WAPPACAMO *River*, a large south branch of Patowmack river, which it joins in lat. 39 39 N. where the latter was formerly known by the name of Cohongoronto.—*ib.*

WAPUWAGAN *Islands*, on the Labrador coast, lie between lat. 50 and 50 5 N. and between long. 59 55 and 60 30 W.—*ib.*

WARD, a township of Massachusetts, Worcester county, 5 miles south of Worcester, and 55 south-west of Boston, and contains 473 inhabitants.—*ib.*

WARDSBOROUGH, a township of Vermont, Windham county, 12 or 15 miles west of Putney, and 27 north-east of Bennington, and contains 753 inhabitants.—*ib.*

WARDSBRIDGE, a post-town of New York, Ulster county, on the Wallkill, 10 miles north of Goshen, 36 south by west of Kingston, and 156 north-east by north of Philadelphia. It contains about 40 compact houses and an academy.—*ib.*

WARE, a small river of Massachusetts which originates in a pond in Gerry, in Worcester county, and in Petersham it receives Swift river, and receiving Quaboag river, which comes from Brookfield, it thence assumes the name of Chicabee, and falls into Connecticut river at Springfield. Its course is south and south-west. —*ib.*

Ware, a township of Massachusetts, in Hampshire county, incorporated in 1701, and contains 773 inhabitants. It is 15 miles N. E. of Springfield, and 70 miles west-north-west of Boston.—*ib.*

WAREHAM, a township of Massachusetts, situated in Plymouth county, at the head of Buzzard's Bay, and on the west side, 60 miles S. by E. of Boston. It was incorporated in 1739, and contains 854 inhabitants. N. lat. 41 45, W. long. 70 40.—*ib.*

WARING (Edward, M. D.), Lucasian Professor of Mathematics in the university of Cambrige, was the son of a wealthy farmer, of the Old Heath, near Shrewsbury. The early part of his education he received at the free school in Shrewsbury; whence he removed to Cambridge, and was admitted on the 24th of March 1753 a member of Magdalen College. Here his talents for abstruse calculation soon developed themselves, and, at the time of taking his degree, he was considered as a prodigy in those sciences which make the subject of the bachelor's examination. The name of Senior Wrangler, on the first of the year, was thought scarcely a sufficient honour to distinguish one who so far outshone his contemporaries; and the merits of John Jebb were sufficiently acknowledged, by being the second in the list. Waring took his first, or bachelor's degree, in 1757, and the Lucasian Professorship became vacant before he was of sufficient standing for the next, or master's degree, which is a necessary qualification for that office. This defect was supplied by a royal mandate, through which he became master of arts in 1760; and shortly after his admission to this degree, the Lucasian Professor.

The royal mandate is too frequently a screen for indolence; and it is now become almost a custom, that heads of colleges, who ought to set the example in discipline to others, are the chief violators of it, by making their office a pretext for taking their doctor's degree in divinity, without performing those exercises which were designed as proofs of their qualifications. Such indolence cannot be imputed to Waring; yet several circumstances, previous to his election into the professorial chair, discovered that there was, at least, one person in the university who disapproved of the antici-

pation

pation of degrees by external influence.—Waring, before his election, gave a fmall fpecimen of his abilities, as proof of his qualification for the office which he was then foliciting; and a controverfy on his merits enfued: Dr Powell, the mafter of St John's college, attacking, in two pamphlets, the Profeffor; and his friend, afterwards Judge Wilfon, defending. The attack was fcarcely warranted by the errors in the fpecimen; and the abundant proofs of talents in the exercife of the profefforial office are the beft anfwers to the farcafms which the learned divine amufed himfelf in cafting on rifing merit. An office held by a Barrow, a Newton, a Whifton, a Cotes, and a Sanderfon, muft excite an ingenuous mind to the greateft exertions; and the new Profeffor, whatever may have been his fuccefs, did not fall behind any of his predeceffors, in either zeal for the fcience, or application of the powers of his mind, to extend its boundaries. In 1762, he publifhed his Mifcellanea Analytica; one of the moft abftrufe books written on the abftrufeft parts of algebra. This work extended his fame over all Europe. He was elected, without folicitation on his part, member of the focieties of Bononia and Gottingen; and received flattering marks of efteem from the moft eminent mathematicians at home and abroad. The difficulty of this work may be prefumed from the writer's own words, "I cannot fay that I know any one who thought it worth while to read through the whole, and perhaps not the half of it."

Mathematics did not, however, engrofs the whole of his attention. He could dedicate fome time to the ftudy of his future profeffion; and in 1767, he was admitted to the degree of doctor of phyfic; but, whether from the incapacity of uniting together the employments of active life with abftrufe fpeculation, or from the natural diffidence of his temper, for which he was moft peculiarly remarkable; the degree which gave him the right of exercifing his talents in medicine was to him merely a barren title. Indeed he was fo embarraffed in his manners before ftrangers, that he could not have made his way in a profeffion in which fo much is done by addrefs; and it was fortunate that the cafe of his circumftances permitted him to devote the whole of his time to his favourite purfuit. His life paffed on, marked out by difcoveries, chiefly in abftract fcience; and by the publication of them in the Philofophical Tranfactions, or in feparate volumes, under his own infpection. He lived fome years after taking his doctor's degree, at St Ives, in Huntingdonfhire. While at Cambridge he married—quitted Cambridge with a view of living at Shrewfbury; but the air or fmoke of the town being injurious to Mrs Waring's health, he removed to his own eftate at Plaifley, about 8 miles from Shrewfbury, where he died in 1797, univerfally efteemed for inflexible integrity, modefty, plainnefs, and fimplicity of manners. They who knew the greatnefs of his mind from his writings looked up to him with reverence everywhere: but he enjoyed himfelf in domeftic circles with thofe chiefly among whom his purfuits could not be the object either of admiration or envy. The outward pomp which is affected frequently in the higher departments in academic life, was no gratification to one whofe habits were of a very oppofite nature; and he was too much occupied in fcience to attend to the intrigues of the univerfity. There, in all queftions of fcience, his word was the law; and at the annual examination of the candidates for the prize inftituted by Dr Smith, he appeared to the greateft advantage. The candidates were generally three or four of the beft proficients in the mathematics at the previous annual examination for the bachelor's degree, who were employed from nine o'clock in the morning to ten at night, with the exception of two hours for dinner, and twenty minutes for tea, in anfwering, *viva voce*, or writing down anfwers to the profeffor's queftions, from the firft rudiments of philofophy to the deepeft parts of his own and Sir Ifaac Newton's works. Perhaps no part of Europe affords an inftance of fo fevere a procefs; and there was never any ground for fufpecting the Profeffor of partiality. The zeal and judgment with which he performed this part of his office cannot be obliterated from the memory of thofe who paffed through his fiery ordeal.

Wifhing to do ample juftice to the talents and virtue of the Profeffor, we feel ourfelves fomewhat at a lofs in fpeaking of the writings by which alone he will be known to pofterity. He is the difcoverer, according to his own account, of nearly 400 propofitions in the analytics. This may appear a vain-glorious boaft, efpecially as the greater part of thofe difcoveries are likely to fink into oblivion; but he was, in a manner, compelled to make it by the infolence of Lalande, who, in his life of Condorcet, afferts that, in 1764, there was no firft-rate analyft in England. In reply to this affertion, the Profeffor, in a letter to Dr Mafkelyne, firft mentions, with proper refpect, the inventions and writings of Harriot, Briggs, Napier, Wallis, Halley, Bruncker, Wren, Pell, Barrow, Mercator, Newton, De Moivre, Maclaurin, Cotes, Stirling, Taylor, Simpfon, Emerfon, Landen, and others; of whom Emerfon and Landen were living in 1764. He then gives a fair and full detail of his own inventions, of which many were publifhed anterior to 1764; and concludes his letter in thefe words.

"I know that Mr Lalande is a firft-rate aftronomer, and writer of aftronomy; but I never heard that he was much converfant in the deeper parts of mathematics; for which reafon I take the liberty to afk him the following queftions:

"Has he ever read or underftood the writings of the Englifh mathematicians: and, as the queftion comes from me, I fubjoin, particularly of mine? If the anfwer be in the negative, as it is my opinion, if his anfwer be the truth, that it will, then there is an end of all further controverfy;—but if he afferts that he has, which is more than Condorcet did by his own acknowledgment, then he may know, from the enumeration of inventions made in the prefaces, with fome fubfequent ones added, that they are faid to amount to more than 400 of one kind or other. Let him try to reduce thofe to as low a number as he can, with the leaft appearance of candour and truth; and then let him compare the number with the number of inventions of any French mathematician or mathematicians, either in the prefent or paft times, and there will refult a comparifon (if I miftake not) not much to his liking; and, further, let him compare fome of the firft inventions of the French mathematicians with fome of the firft contained in my works, both as to utility, generality, novelty, difficulty, and elegance, but wifely as to utility, there is little contained in the deep parts of any fcience; he will find their difficulty

Waring.

difficulty and novelty from his difficulty of underſtanding them, and his never having read any thing ſimilar before; their generality, by the application of them; principles of elegance will differ in different perſons.— I muſt ſay, that he will probably not find the difference expected. After or before this inquiry is inſtituted for mine, let him perform the ſame for the other Engliſh mathematicians; and when he has completed ſuch inquiries, and not before, he will become a judge of the juſtice of his aſſertion; but I am afraid that he is not a ſufficient adept in theſe ſtudies to inſtitute ſuch inquiries; and if he was, ſuch inquiries are invidious, troubleſome, and of ſmall utility."

By mathematical readers this account, which was not publiſhed by the Profeſſor himſelf, is allowed to be very little, if at all, exaggerated. Yet if, according to his own confeſſion, "few thought it worth their while to read even half of his works," there muſt be ſome grounds for this neglect, either from the difficulty of the ſubject, the unimportance of the diſcoveries, or a defect in the communication of them to the public. The ſubjects are certainly of a difficult nature, the calculations are abſtruſe; yet Europe contained many perſons not to be deterred by the moſt intricate theorems. Shall we ſay then, that the diſcoveries were unimportant? If this were really the caſe, the want of utility would be a very ſmall diſparagement among thoſe who cultivate ſcience with a view chiefly to entertainment and the exerciſe of their rational powers. We are compelled, then, to attribute much of this neglect to a perplexity in ſtyle, manner, and language; the reader is ſtopped at every inſtant, firſt to make out the writer's meaning, then to fill up the chaſm in the demonſtration. He muſt invent anew every invention; for, after the enunciation of the theorem or problem, and the mention of a few ſteps, little aſſiſtance is derived from the Profeſſor's powers of explanation. Indeed, an anonymous writer, certainly of very conſiderable abilities, has aptly compared the works of Waring to the heavy appendages of a Gothic building, which add little of either beauty or ſtability to the ſtructure.

A great part of the diſcoveries relate to an aſſumption in algebra, that equations may be generated by multiplying together others of inferior dimenſions. The roots of theſe latter equations are frequently terms called *negative* or *impoſſible*; and the relation of theſe terms to the coefficients of the principal equation is a great object of inquiry. In this art the profeſſor was very ſucceſsful, though little aſſiſtance is to be derived from his writings in looking for the real roots. We ſhall not, perhaps, be deemed to depreciate his merits, if we place the ſeries for the ſum of the powers of the roots of any equation among the moſt ingenious of his diſcoveries; yet we cannot add, that it has very uſefully enlarged the bounds of ſcience, or that the algebraiſt will ever find occaſion to introduce it into practice. We may ſay the ſame on many ingenious transformations of equations, on the diſcovery of impoſſible roots, and ſimilar exertions of undoubtedly great talents. They have carried the aſſumption to its utmoſt limits; and the difficulty attending the ſpeculation has rendered perſons more anxious to aſcertain its real utility; yet they who reject it may occaſionally receive uſeful hints from the Miſcellanea Analytica.

The firſt time of Waring's appearing in public as an author was, we believe, in the latter end of the year 1759, when he publiſhed the firſt chapter of the Miſcellanea Analytica, as a ſpecimen of his qualifications for the profeſſorſhip; and this chapter he defended, in a reply to a pamphlet, intitled, "Obſervations on the Firſt Chapter of a book called Miſcellanea Analytica." Here the Profeſſor was ſtrangely puzzled with the common paradox, that nothing divided by nothing may be equal to various finite quantities, and has recourſe to unqueſtionable authorities in proof of this poſition. The names of Maclaurin, Sanderſon, De Moivre, Bernoulli, Monmort, are ranged in favour of his opinion: But Dr Powell was not ſo eaſily convinced, and returns to the charge in defence of the Obſervations; to which the Profeſſor replied in a letter to the Rev. Dr Powell, Fellow of St John's college, Cambridge, in anſwer to his Obſervations, &c. In this controverſy, it is certain that the Profeſſor gave evident proofs of his abilities; though it is equally certain that he followed too implicitly the deciſions of his predeceſſors. No apparent advantage, no authority whatever, ſhould induce mathematicians to ſwerve from the principles of right reaſoning, on which their ſcience is ſuppoſed to be peculiarly founded. According to Maclaurin, Dr Waring, and others, If $P = \frac{a-x}{a^2-x^2}$, then, when $x = a$, P is equal to $\frac{1}{2a}$; for, ſay they, $\frac{a-x}{a^2-x^2}$ is equal to $\frac{a-x}{a-x} \times \frac{1}{a+x}$; that is, when x is equal to a, $P = \frac{1}{a+x}$, or $\frac{1}{2a}$. But when x is equal to a, the numerator and denominator of the fraction $\frac{a-x}{a^2-x^2}$ are both, in their language, equal to nothing. Therefore, nothing divided by nothing is equal to $\frac{1}{2a}$. In the ſame manner, $\frac{a-x}{a^3-x^3} = \frac{1}{a^2+ax+x^2} \times \frac{a-x}{a-x}$, which, when x is equal to a, becomes $\frac{1}{3a^2}$. Therefore, nothing divided by nothing is equal to $\frac{1}{3a^2}$, or $\frac{1}{3a^2} = \frac{1}{2a}$; that is, $\frac{1}{3a} = \frac{1}{2}$; which is abſurd. But we need only trace back our ſteps to ſee the fallacy in this mode of reaſoning. For P is equal to ſome number multiplied into $\frac{a-x}{a-x}$; that is, when x is equal to a, P is equal to ſome number multiplied into nothing, and divided by nothing; that is, P is, in that caſe, no number at all. For $a-a$ cannot be divided by $a-x$ when x is equal to a, ſince, in that caſe, $a-x$ is no number at all.

If, in the beginning of his career, the Profeſſor could admit ſuch paralogiſms into his ſpeculations, and the writings of the mathematicians, for nearly a century before him, may plead in his excuſe, we are not to be ſurpriſed that his diſcoveries ſhould be built rather on the aſſumptions of others than on any new principles of his own. Acquieſcing in the ſtrange notion, that nothing could be divided by nothing, and produce a variety of numbers, he as eaſily adopted the poſition, that an equation has as many roots as it has dimenſions.— Thus

Thus 2 and —4 are ſaid to be roots of the equation $x^2 - 2x = 8$, though 4 can be the root only of the equation; $x^2 - 2x = 8$, which differs ſo materially from the preceding, that in one caſe $2x$ is added, in the other caſe it is ſubtracted from x^2.

Allowances being made for this error in the principles, the deductions are, in general, legitimately made; and any one, who can give himſelf the trouble of demonſtrating the propoſitions, may find ſufficient employment in the Profeſſor's analytics. Perhaps it will be ſufficient for a ſtudent to devote his time to the ſimpleſt caſe $x^n \pm 1 = 0$; and when he has found a few thouſand roots of + 1 and — 1, the publication of them may afford to poſterity a ſtrong proof of the ingenuity of their predeceſſors, and the application of the powers of their mind to uſeful and important truths. In this exerciſe may be conſulted the method given by the Profeſſor, of finding a quantity, which, multiplied into a given irrational quantity, will produce a rational product, or conſequently exterminate irrational quantities out of a given equation; but if an irrational quantity cannot come into an equation, the utility of this invention will not be admitted without heſitation.

The "Proprietates Algebraicarum Curvarum," publiſhed in 1772, neceſſarily labour under the ſame defects with the Miſcellanea Analytica, the Meditationes Algebraicæ, publiſhed in 1770, and the Meditationes Analyticæ, which were in the preſs during the years 1773, 1774, 1775, 1776. Theſe were the chief and the moſt laborious works edited by the Profeſſor; and in the Philoſophical Tranſactions is to be found a variety of papers, which alone would be ſufficient to place him in the firſt rank in the mathematical world. The nature of them may be ſeen from the following catalogue.

Vol. LIII. p. 294, Mathematical Problems.—LIV. 193. New Properties in Conics.—LV. 143. Two Theorems in Mathematics.—LXIX. Problems concerning Interpolations.—86. A General Reſolution of Algebraical Equations.—LXXVI. 81. On Infinite Series. LXXVII. 71. On Finding the Values of Algebraical Quantities by Converging Serieſes, and Demonſtrating and Extending Propoſitions given by Pappus and others.—LXXVIII. 67. On Centripetal Forces.—*Ib.* 588. On ſome Properties of the Sum of the Diviſion of Numbers.—LXXIX. 166. On the Method of Correſpondent Values, &c.—*Ib.* 185. On the Reſolution of Attractive Powers.—LXXXI. 146. On Infinite Serieſes.—LXXXIV. 385—415. On the Summation of thoſe Serieſes whoſe general term is a determinate function of z, the diſtance of the term of the Series.

For theſe papers, the Profeſſor was, in 1784, deſervedly honoured by the Royal Society with Sir Godfrey Copley's medal; and moſt of them afford very ſtrong proofs of the powers of his mind, both in abſtract ſcience, and the application of it to philoſophy; though they labour, in common with his other works, under the diſadvantage of being clothed in a very unattractive form. The mathematician, who has reſolution to go through them, will not only add much to his own knowledge, but be uſefully employed in dilating on thoſe articles for the benefit of the more general reader. We might add in this place, a work written on morals and metaphyſics in the Engliſh language; but as a few copies only were preſented to his friends, and it was the Profeſſor's wiſh that they ſhould not have a more extenſive circulation, we ſhall not here enlarge upon its contents.

In the mathematical world, the life of Waring may be conſidered as a diſtinguiſhed æra. The ſtrictneſs of demonſtration required by the ancients had gradually fallen into diſuſe, and a more commodious, though almoſt mechanical mode by algebra and fluxions took its place, and was carried to the utmoſt limit by the Profeſſor. Hence many new demonſtrations may be attributed to him, but 400 diſcoveries can ſcarcely fall to the lot of a human being. If we examine thoroughly thoſe which our Profeſſor would diſtinguiſh by ſuch names, we ſhall find many to be mere deductions, others, as in the ſolution of biquadratics, anticipated by former writers. But if we cannot allow to him the merit of ſo inventive a genius, we muſt applaud his aſſiduity; and diſtinguiſhed as he was in the ſcientific world, the purity of his life, the ſimplicity of his manners, and the zeal which he always manifeſted for the truths of the Goſpel, will intitle him to the reſpect of all who do not eſteem the good qualities of the heart inferior to thoſe of the head.

WARMINSTER, a ſmall poſt-town of Virginia, ſituated on the north ſide of James' river, in Amherſt county, about 90 miles above Richmond. It contains about 40 houſes, and a tobacco warehouſe. It is 332 miles from Philadelphia, 21 miles from Charlotteſville, and 9 from Newmarket. There is alſo a townſhip of this name in Buck's county, Pennſylvania.—*Morſe.*

WARM *Spring*, a ridge of mountains bears this name, a part of the Alleghany Mountains, ſituated N. W. of the Calf Paſture, and famous for warm ſprings. The moſt efficacious of theſe, are two ſprings in Auguſta, near the ſources of James' river, where it is called Jackſon's river. They riſe near the foot of the ridge of mountains, generally called the Warm Spring Mountains, but in the maps Jackſon's Mountains. The one is diſtinguiſhed by the name of the Warm Spring, and the other of the Hot Spring. The Warm Spring iſſues with a very bold ſtream, ſufficient to work a griſtmill, and to keep the waters of its baſon, which is 30 feet in diameter, at the vital warmth, viz. 96° of Farenheit's thermometer. The matter with which theſe waters is allied is very volatile; its ſmell indicates it to be ſulphureous, as alſo does the circumſtance of turning ſilver black. They relieve rheumatiſms. Other complaints alſo of very different natures have been removed or leſſened by them. It rains here 4 or 5 days in every week. The Hot Spring is about ſix miles from the Warm, is much ſmaller, and has been ſo hot as to have boiled an egg. Some believe its degree of heat to be leſſened. It raiſes the mercury in Farenheit's thermometer to 112 degrees, which is fever heat. It ſometimes relieves where the Warm Spring fails. A fountain of common water, iſſuing within a few inches of its margin, gives it a ſingular appearance. Comparing the temperature of theſe with that of the hot ſprings of Kamſchatka, of which Krachininnikow gives an account, the difference is very great, the latter raiſing the mercury to 200 degrees, which is within 12 degrees of boiling water. Theſe ſprings are very much reſorted to, in ſpite of a total want of accommodation for the ſick. Their waters are ſtrongeſt in the hotteſt months, which occaſions their being viſited in July and Auguſt principally.

principally. The Sweet Springs, in the county of Botetourt, at the eaftern foot of the Alleghany, are about 42 miles from the Warm Springs.—*ib.*

WARNER, a townfhip of New Hampfhire, Hillfborough county. It was incorporated in 1774, and contains 863 inhabitants.—*ib.*

WARREN, a new county of the Upper Diftrict of Georgia.—*ib.*

WARREN, a county of Halifax diftrict, N. Carolina. It contains 9,397 inhabitants, including 4,720 flaves. —*ib.*

WARRENTON, a poft-town, and the capital of the above-mentioned county, fituated 16 miles E. by N. of Hillfborough, 35 weft of Halifax, 54 north of Raleigh, 83 fouth of Peterfburg in Virginia, and 390 from Philadelphia. The town contains about 30 houfes, and ftands in a lofty, dry, and healthy fituation. Europeans, of various nations, refide in and about the town. Here is a refpectable academy, having generally from 60 to 70 ftudents.—*ib.*

WARREN, a townfhip of Vermont, Addifon county, about 30 miles N. E. by E. of Crown Point.—*ib.*

WARREN, a poft-town of the Diftrict of Maine, Lincoln county, adjoining Camden and Thomafton; 33 miles fouth by weft of Belfaft, 203 N. E. by N. of Bofton, and 557 from Philadelphia. This townfhip is feparated from that of Thomafton, by St George's river; was incorporated in 1776, and contains 642 inhabitants.—*ib.*

WARREN, a townfhip of Grafton county, New-Hampfhire, north-eaft of Orford, adjoining, incorporated in 1763, and contains 206 inhabitants.—*ib.*

WARREN, a poft-town of Rhode-Ifland, in Briftol county, pleafantly fituated on Warren river and the north-eaft part of Narraganfet Bay, 4 miles north of Briftol, 10 S. S. E. of Providence, and 302 from Philadelphia. This is a flourifhing town; carries on a brifk coafting and Weft-India trade, and is remarkable for fhip building. The whole townfhip contains 1122 inhabitants, of whom 22 are flaves. Rhode-Ifland College was firft inftituted in this town, and afterwards removed to Providence.—*ib.*

WARREN, a new townfhip of Herkemer county, New-York. It was taken from German Flats, and incorporated in 1796.—*ib.*

WARREN, a part of the townfhip of Chenengo, in the State of New-York, on Sufquehannah river, bears this name in De Witt's map.—*ib.*

WARREN, a townfhip in Connecticut, in Litchfield county, between the townfhips of Kent and Litchfield. —*ib.*

WARREN, a poft town of Virginia, 10 miles from Warminfter, 21 from Charlottefville, and 326 from Philadelphia.—*ib.*

WARREN'S *Point*, on the coaft of Nova-Scotia, is on the eaft fide of Chebucto Harbour, about 2 miles eaft of the town of Halifax. It is at the entrance of a creek, which receives Saw-Mill river and other ftreams. —*ib.*

WARRINGTON, the name of two townfhips of Pennfylvania; the one in York county, the other in Buck's county.—*ib.*

WARSAW, or *Waffaw*, an ifland and found on the coaft of Georgia, between the mouth of Savannah river and that of Ogeechee. The ifland forms the north fide of Offabaw Sound; being in a N. E. direction from Offabaw Ifland. Warfaw Sound is formed by the northern end of the ifland of its name, and the fouthern end of Tybee Ifland.—*ib.*

WARTON (Jofeph, D. D.) was born either towards the end of the year 1721, or in the beginning of the year 1722. He was the eldeft fon of Thomas Warton, B. D. who had been fellow of Magdalen College, Oxford; poetry profeffor from the year 1718 to 1728, and vicar of Bafingftoke in Hampfhire, and of Cobham in Surrey. Where the fubject of this memoir was born we have not learned, though, were we to hazard a conjecture, we would fay that it was in Oxford, as his father probably refided in that city during his profefforfhip.

Our knowledge of the private hiftory of Dr Warton is indeed extremely limited. We do not even know at what fchool, or in what college, he was educated; though it was probably at Winchefter fchool, and certainly in fome of the colleges in the univerfity of Oxford. For many years he was fucceffively under and upper mafter of Winchefter college; but refigned the laft of thefe offices when he found the infirmities of age coming upon him; and was fucceeded by Dr Goddard the prefent excellent mafter. He was likewife prebendary of the cathedral church of Winchefter, and rector of Wickham in Hampfhire, where he died, aged 78.

His publications are few, but valuable. A fmall collection of poems, without a name, was the firft of them, and contained the Ode to Fancy, which has been fo much and fo defervedly admired. They were all of them afterwards printed in Dodfley's collection. He was alfo a confiderable contributer to the Adventurer, publifhed by Dr Hawkefworth; and all the papers which contain criticifms on Shakefpeare were written by him and his brother Thomas Warton, the fubject of the next article.

The firft volume of his Effay on the Life and Writings of Pope was publifhed, had paffed through feveral editions, and an interval of between 20 and 30 years had elapfed, before he gave a fecond volume of that elegant and inftructive work to the world. He had not only meditated, but had collected materials for a literary hiftory of the age of Leo X: and propofals were actually in circulation for a work of that kind; but it is probable that the duties of his ftation did not leave him the neceffary leifure for an undertaking which required years of feclufion and independence. His laft and late work which he undertook for the bookfellers at a very advanced age, was an edition of Pope's Works, that has not altogether fatisfied the public expectation. He retained, with great propriety indeed, many of the notes of Warburton: but is feverely reprehended by the author of the Purfuits of Literature for fuppreffing the name of that prelate on his title-page, or including it only, as fubordinate to his own, in the general expreffion *others*.

Dr Warton was cheerful in his temper, convivial in his difpofition, of an elegant tafte and lively imagination, with a large portion of fcholarfhip, and a very general knowledge of the Belles Lettres of Europe; it may be prefumed that Dr Warton poffeffed, beyond moft men, the power of enlivening Claffical Society. He was the intimate friend of Dr Johnfon; was feen at the parties of Mrs Montague, as well as at the table of Sir Joſhua Reynolds, and was an original member of the Literary Club. He poſſeſſed a liberal mind, a generous diſpoſition, and a benevolent heart. He was not only admired for his talents and his knowledge, but was beloved for thoſe qualities which are the beſt gifts of this imperfect ſtate.

Warton (Thomas), the brother of the preceding, was born in the year 1728. He received, as we have reaſon to believe, the firſt part of his education at Wincheſter; and at the age of 16 was entered a commoner of Trinity College, Oxford, under the tuition of Mr Geering.

Biog. Dict.

He began his poetical career at an early age. In 1745, he publiſhed five paſtoral eclogues, in which are beautifully deſcribed the miſeries of war to which the ſhepherds of Germany were expoſed. Not long after, in the year 1748, he had full ſcope afforded for the exertion of his genius. It is well known that Jacobite principles were ſuſpected to prevail in the univerſity of Oxford about the time of the rebellion in the year 1745. Soon after its ſuppreſſion, the drunkenneſs and folly of ſome young men gave offence to the court, in conſequence of which a proſecution was inſtituted in the court of King's Bench, and a ſtigma was fixed on the vice-chancellor and ſome other heads of colleges in Oxford. Whilſt this affair was the general ſubject of converſation, Mr Maſon publiſhed his "Iſis," an elegy, in which he adverts to the above-mentioned circumſtances. In anſwer to this poem, Mr Warton, encouraged by Dr Huddesford, the preſident of the college, publiſhed, in 1749, "The Triumph of Iſis," which excelled more in manly expoſtulation and dignity than the poem that produced it did in neatneſs and elegance. With great poetical warmth, and a judicious ſelection of circumſtances, he characteriſes the eminent men who had been educated in Oxford, and draws a ſtriking and animated portrait of Dr King, the celebrated public orator of that time. The whole poem ſhews the early maturity of his genius, and is finiſhed with happy diligence.

In the year 1751, he ſucceeded to a fellowſhip of his college, and was thus placed in a ſituation eaſy and independent, and particularly congenial with his habits of retirement and ſtudy. In 1753, appeared his obſervations on "The Faery Queen of Spencer," in 8vo, a work which he corrected, enlarged, and republiſhed, in two volumes crown octavo, in the year 1762. He ſent a copy of the firſt edition to Dr Johnſon, who, in a letter to him upon the ſubject, expreſſed this handſome compliment: "I now pay you a very honeſt acknowledgement for the advancement of the literature of our native country: you have ſhewn to all, who ſhall hereafter attempt the ſtudy of ancient authors, the way to ſucceſs, by directing them to the peruſal of the books which theſe authors had read."

In 1754, Dr Johnſon viſited Oxford for the firſt time after he had quitted reſidence there. Much of his time was ſpent with Mr Warton; and there appeared to have been a conſiderable degree of confidential intercourſe between them upon literary ſubjects, and particularly on their own works. A pleaſing account of this viſit was communicated by Mr Warton to Mr Boſwell, who has inſerted it in his life of Johnſon.

In 1755, Mr Warton exerted himſelf to procure for his friend the degree of maſter of arts by diploma from the univerſity of Oxford; an honour which Johnſon eſteemed of great importance to grace the title page of his dictionary which he was about to publiſh. In 1756, Mr Warton was elected profeſſor of poetry, which office he held for the uſual term of ten years. His lectures were remarkable for elegance of diction and juſtneſs of obſervation. One of them on the ſubject of paſtoral poetry, was afterwards prefixed to his edition of Theocritus. In 1758, he contributed to aſſiſt Dr Johnſon in the ſubſcription to his edition of Shakeſpeare, and furniſhed him with ſome valuable notes. The Doctor remarks in a letter to him, when ſoliciting his farther aid, "It will be reputable to my work, and ſuitable to your profeſſorſhip, to have ſomething of yours in my notes."

From the Clarendon preſs, in the year 1766, he publiſhed "Anthologiæ Græcæ, a Conſtantino Cephalâ conditæ, Libri tres," in 2 vols, 12mo. He concludes the learned and claſſical preface to this work, which is replete with accurate remarks on the Greek epigram, in the following words, which mark this publication for his own: Vereor ut hactenus in plexendis florum corollis otium nimis longum pertraxerim. Proximè ſequetur, cui nunc omnes operas et vires intendo, Theocritus. Interea quaſi promulſidem convivii Lectoribus meis elegantias haſce vetuſtatis eruditæ propino."

In the year 1770, he conferred a ſimilar honour upon the academical preſs by his edition of Theocritus, in 2 vols, 8vo. He undertook this work by the advice of Judge Blackſtone, then fellow of All-Souls College, and an ardent promoter of every publication that was likely to do credit to the Clarendon preſs. This elaborate publication reflects no ſmall credit on the learning, diligence, and taſte of the editor.

In 1771, he was elected a fellow of the Antiquarian Society, and was preſented by the Earl of Lichfield to the ſmall living of Kiddington in Oxfordſhire, which he held till his death. He likewiſe in this year publiſhed an improved account of "The Life of Sir Thomas Pope, founder of Trinity College, Oxford. In compoſing theſe memoirs, he beſtowed much labour and reſearch, and ſhewed great judgment in the arrangement of his materials. But poſſibly, in his ardour to pay a debt of gratitude, he has not ſufficiently conſidered what was due to his own fame. The ſame ſtrength of deſcription and vigour of remark would have better ſuited the life of ſome eminently diſtinguiſhed character, and extended the reputation of the author as a biographer beyond the circle of thoſe academical readers who are influenced by the ſame feelings of veneration, reſpect, and gratitude which prompted Mr Warton to compoſe this work. The preface contains ſome excellent remarks on biographical writing.

The plan for a hiſtory of Engliſh poetry was laid by Pope, enlarged by Gray: but to bring an original plan nearly to a completion was reſerved for the perſeverance of Warton. In 1774 appeared his firſt volume; in 1778, the ſecond and third; which brings the narrative down to the commencement of the reign of Elizabeth in 1581. This work diſplays the moſt ſingular combination of extraordinary talents and attainments. It unites the deep and minute reſearches of the antiquary with the elegance of the claſſical ſcholar and the ſkill of

Warton.

of the practised writer. The style is vigorous and manly; the observations acute and just; and the views of the subject are extensive and accurate.

In 1777, he collected his poems into an octavo volume, containing miscellaneous pieces, odes, and sonnets. This publication may be considered in some measure original; there being only seven pieces that had before appeared, and near three times that number which were then printed for the first time.

In vindication of the opinion he had given in his second volume of "The History of Poetry," relative to the ingenious attempt of Chatterton to impose upon the public, he produced, in 1782, "An Inquiry into the Authenticity of the Poems attributed to Rowley." In this excellent pamphlet the principles of true criticism are laid down, an appeal is properly made to the internal evidence of the poems; and upon these grounds it is proved, in the most satisfactory manner, that they could not have been written by a monk of the fourteenth century.

The year 1785 brought him those distinctions which were no less honourable to those who conferred than to him who received them. He was appointed poet-laureat on the death of Whitehead, and elected Camden professor of ancient history on the resignation of Dr Scott. His inauguration lecture was delivered in a clear and impressive manner from the professorial chair. It contained excellent observations of the Latin historians, and was written in a strong, perspicuous, and classical style. In his odes, the vigour and brilliancy of his fancy were not prostituted to an insipid train of courtly compliments: each presents an elegant specimen of descriptive poetry, and as all of them have only a slight relation to the particular occasion on which they were written, and have always a view to some particular and interesting subject, they will be perused with pleasure as long as this species of composition is admired.

He made occasional journeys to London to attend the literary club, of which he was some years a member; and to visit his friends, particularly Sir Joshua Reynolds. At his house he was sure to meet persons remarkable for fashion, elegance, and taste.

His last publication, except his official odes, consisted of Milton's smaller poems. A quarto edition appeared in 1790, with corrections and additions. The great object of these notes is to explain the allusions of Milton, to trace his imitations, and to illustrate his beauties.

Until he reached his sixty-second year, he continued to enjoy vigorous and uninterrupted health. On being seized with the gout, he went to Bath, and flattered himself, on his return to college, that he was in a fair way of recovery. But the change that had taken place in his constitution was visible to his friends. On Thursday, May 20, 1790, he passed the evening in the common room, and was for some time more cheerful than usual. Between ten and eleven o'clock he was struck with the palsy, and continued insensible till his death, which happened the next day at two o'clock. On the 27th, his remains were interred in the college chapel with the most distinguished academical honours. The inscription upon the flat stone which is placed over his grave contains only an enumeration of his preferments.

Such was the general conduct and behaviour of Mr Warton as to render him truly amiable and respectable. By his friends he was beloved for his open and easy manners; and by the members of the university at large he was respected for his constant residence, strong attachment to Alma Mater, his studious pursuits, and high literary character. In all parties where the company accorded with his inclination, his conversation was easy and gay, enlivened with humour, enriched with anecdote, and pointed with wit. Among his peculiarities it may be mentioned that he was fond of all military sights. He was averse to strangers, particularly to those of a literary turn; and yet he took a great pleasure in encouraging the efforts of rising genius, and assisting the studious with his advice; as many of the young men of his college, who shared his affability and honoured his talents, could testify. He was bred in the school of punsters; and made as many good ones as Barton and Leigh, the celebrated word-hunters of his day. Under the mask of indolence, no man was more busy; his mind was ever on the wing in search of some literary prey. Although, at the accustomed hours of Oxford study, he was often seen sauntering about, and conversing with any friend he chanced to meet; yet, when others were wasting their mornings in sleep, he was indulging his meditations in his favourite walks, and courting the Muses. His situation in Oxford was perfectly congenial with his disposition, whether he indulged his sallies of pleasantry in the common room, retired to his own study, or to the Bodleian library; sauntered on the banks of his favourite Cherwell, or surveyed, with the enthusiastic eye of taste, the ancient gateway of Magdalen College, and other specimens of Gothic architecture.

The following is a list of Mr Warton's works; 1. "Five Pastoral Eclogues," 4to, 1745. Reprinted in Peach's Collection of Poems. 2. "The Pleasures of Melancholy," written in 1745; first printed in Dodsley's Collection, and afterwards in the Collection of Mr Warton's Poems. 3. "Progress of Discontent," written in 1746. First printed in the "Student," a periodical paper. 4. "The Triumph of Isis, a Poem," 4to, 1750. 5. "Newmarket, a Satire," folio, 1751. 6. "Ode for Music," performed at the theatre in Oxford 1751. 7. "Observations on the Faerie Queen of Spencer," 8vo, 1754. 8. "Inscriptionum Metricarum Delectus," 4to, 1758. 9. "A Description of the City, College and Cathedral, of Winchester," 8vo, no date. 10. "The Life of Sir Thomas Pope," in the 5th volume of the Biographia Britannica," republished in 1772. 11. "The Life and Literary Remains of Ralph Bathurst, M. D. Dean of Wells, and President of Trinity College in Oxford," 1761. 12. "A Companion to the Guide, and a Guide to the Companion," 12mo, 1762. 13. "The Oxford Sausage," in which are several Poems by Warton. 14. "Anthologiæ Græcæ a Constantino Cephalâ conditæ Libri tres," 2 tom. 1766. 15. "Theocritis Syracusii quæ supersunt, cum Scholiis Græcis," &c. 2 tom. 4to, 1770. 16. "History of English Poetry, from the Close of the 11th to the Commencement of the 18th Century," 4to, Vol. I. 1774. Vol. II. 1778. Vol. III. 1781. 17. "Poems," 8vo, 1777. 18. "Specimen of a History of Oxfordshire," 1783. 19. "An Enquiry into the Authenticity of the Poems attributed to Thomas Rowley," 8vo, 1782. 20. "Verses on Sir J. Reynolds's

Reynolds's painted Window in New College Chapel, 4to," 1782. 21. "Poems on several Occasions, by John Milton, with Notes critical and explanatory," 8vo, 1785.

WARWICK, a county of Virginia, bounded north by York county, and south by James' river, which separates it from Isle of Wight, and Nansemond counties. It is the oldest county of the State, having been established in 1628. It contains 1690 inhabitants, of whom 990 are slaves.—*Morse.*

Warwick, a township of Massachusetts, in Hampshire county, incorporated in 1763, and contains 1246 inhabitants. It is bounded north by the state of New-Hampshire, not far east of Connecticut river, and is 90 miles north-west of Boston.—*ib.*

Warwick, the chief town of Kent county, Rhode-Island, situated at the head of Narraganset Bay, and on the west side; about 8 miles south of Providence. The township contains 2,493 inhabitants, including 35 slaves. A cotton manufactory has been established in this town upon an extensive scale. One of Arkwright's machines was erected here in August, 1795; and the yarn produced answers the most sanguine expectation. This town was the birth-place of the celebrated Gen. Green.—*ib.*

Warwick, a township of New-York, Orange county, bounded easterly by New-Cornwall, and southerly by the State of New-Jersey. It contains 3,603 inhabitants; of whom 383 are electors, and 95 slaves.—*ib.*

Warwick, the name of two townships of Pennsylvania; the one in Buck's county, the other in that of Lancaster. In the latter is the fine Moravian settlement called Litiz.—*ib.*

Warwick, a post-town of Maryland, Cecil county, on the eastern shore of Chesapeak Bay; about 14 miles southerly of Elkton, 8 N. E. of Georgetown Cross Roads, and 57 south-west of Philadelphia.—*ib.*

Warwick, a small town of Chesterfield county, Virginia; agreeably situated on the south-west side of James' river, about 7 miles south-south-east of Richmond, and 17 north of Petersburg. Vessels of 250 tons burden can come to this town. In 1781, Benedict Arnold destroyed many vessels in the river and on the stocks at this place.—*ib.*

WASHINGTON (George), one of those few men who have been great without being criminal, was born on the 11th of *February*, 1732, *in the Parish of Washington, Virginia.* He was descended from an ancient family in Cheshire, of which a branch had been established in Virginia about the middle of the last century. We are not acquainted with any remarkable circumstances of his education or his early youth; and we should not indeed expect any marks of that disorderly prematureness of talent, which is so often fallacious, in a character whose distinguishing praise was to be perfectly regular and natural. His classical instruction was probably small, such as the private tutor of a Virginian country gentleman could at that period have imparted; and if his opportunities of information had been more favourable, the time was too short to profit by them. Before he was twenty he was appointed a major in the colonial militia, and he had very early occasion to display those political and military talents, of which the exertions on a greater theatre have since made his name so famous throughout the world.

The plenipotentiaries who framed the treaty of *Aix la Chapelle*, by leaving the boundaries of the British and French territories in North America unfixed, had sown the seeds of a new war, at the moment when they concluded a peace.—The limits of Canada and Louisiana, negligently described in vague language by the treaties of Utrecht and Aix la Chapelle, because the greater part of these vast countries was then an impenetrable wilderness, furnished a motive or a pretext, for one of the most successful but one of the most bloody and wasteful wars in which Great Britain had ever been engaged.

In the disputes which arose between the French and English officers on this subject, Major Washington was employed by the governor of Virginia, in a negotiation with the French governor of *Fort du Quesne* (now Pitsburgh); who threatened the English frontiers with a body of French and their Indian allies. He succeeded in averting the invasion; but hostilities becoming inevitable, he was in the next year appointed lieutenant colonel of a regiment raised by the colony for its own defence; to the command of which he soon after succeeded. The expedition of Braddock followed in the year 1755; of which the fatal issue is too well known to require being described by us. Colonel Washington served in that expedition only as a volunteer; but such was the general confidence in his talents, that he may be said to have conducted the retreat. Several British officers are still alive who remember the calmness and intrepidity which he shewed in that difficult situation, and the voluntary obedience which was so cheerfully paid by the whole army to his superior mind. After having acted a distinguished part in a subsequent and more successful expedition to the Ohio, he was obliged by ill health, in the year 1758, to resign his military situation. The sixteen years which followed of the life of Washington, supply few materials for the biographer. Having married Mrs Custis, a Virginian lady of amiable character and respectable connections, he settled at his beautiful seat of Mount Vernon, of which we have had so many descriptions; where, with the exception of such attendance as was required by his duties as a magistrate and a member of the assembly, his time was occupied by his domestic enjoyments, and the cultivation of his estate, in a manner well suited to the tranquillity of his pure and unambitious mind. At the end of this period he was called by the voice of his country from this state of calm and secure though unostentatious happiness.

The events of that deplorable contest which rent asunder the British empire, are yet perhaps too recent for free and impartial discussion. The connection between Great Britain and America had long been suffered to remain in that uncertain state which is not inconsistent with mutual harmony as long as each party reposes confidence in each other. The supreme authority of the mother country was respected without being definitely acknowledged in its utmost extent. It was not systematically declared, nor rigorously enforced by England—It was not zealously watched nor legally limited by the colonies. England derived increased wealth and prosperity from the growing greatness of America. America was protected by the strength of England, and felt pride in the participation of her liberty. In this happy state of mutual affection, neither party

party harboured fuch diftruft as to prompt them to take fecurity for the authority of one or the privileges of the other. All thofe doubtful and dangerous queftions which relate to the boundaries of power and freedom were forgotten, during this fortunate connection between obedient liberty and protecting authority. The parliament of Great Britain, content with that ftream of wealth which *indirectly* flowed into the Exchequer through the channels of American commerce, had hitherto either doubted their right to tax America, or wifely forborn to exercife that unprofitable and perilous right. The fcheme of an American revenue had been fuggefted to Sir Robert Walpole, but that cautious and pacific minifter declared, " that he would leave it to bolder men."—Men bolder, but not wifer, than Sir Robert were at length found to adopt it. The counfels which predominated at the beginning of the prefent reign were favourable to fuch plans. A fyftem of taxing America by the Britifh parliament was avowed and acted upon.—A ftamp duty was impofed on all the colonies. Whatever may have been the caufes of this unfortunate deviation from the found principles of the ancient American policy, the effects foon became manifeft. The old affectionate confidence of the colonifts was changed into hoftile diftruft; inftead of relying in the benevolence of a paternal government, they began to think of guarding themfelves againft an enemy. The intercourfe of jealous chicane fucceeded to that of generous friendfhip; metaphyfical difcuffions with refpect to the limits and foundation of fupreme power, which feldom difturb the quiet of a happy and well governed people, were for the firft time forced on the attention of the Americans by the indifcretion of their governors. Nothing, however, is more certain, than that the firft views of the American leaders were merely *defenfive;* and that they were far advanced in the refiftance before the idea of independence prefented itfelf to their minds. They did not feek feparation; it was obtruded on them by the irrefiftible force of circumftances. After they had appealed to arms, it was extremely obvious, that their power muft be tottering as long as they acknowledged the lawfulnefs of the power againft whom they were armed; that the zeal of their partizans never could be vigorous till they had cut off all poffibility of retreat; and that no foreign ftate would be connected with them, as long as they themfelves confeffed, that they had neither the right nor the power to enter into a legitimate and permanent alliance. All the paffions, which in violent times are almoft fure to banifh moderate counfels, were at work in America. Thefe confequences always follow in the neceffary courfe of things, from the firft impulfe that throw a people into confufion: moft certainly thefe confequences did not enter into the original plan of the American leaders. There are thofe who remember the horror expreffed by Dr Franklin, before he left England, at the bare mention of feparation: yet Franklin was, perhaps, of all the Americans, the man moft likely to entertain fuch a project. Their leaders were in general men of great fobriety, caution, and practical good fenfe; zealous indeed for the maintenance of their ancient legal rights and privileges; but utterly untainted by that daring and fpeculative character which leads men to feek untried, and perilous paths in politics, for their own greatnefs or for fuppofed public benefit.

The diforders in America had reached their height, and it became perfectly obvious, that the difpute between the two countries could only be decided by arms, when the reprefentatives of the thirteen provinces affembled at Philadelphia, on the 26th of October, 1774. Of this famous affembly Mr Wafhington was one; no American united in fo high a degree as he did military experience, with refpectable character and great natural influence. He was therefore appointed to the command of the army which affembled in the New England Provinces, to hold in check the Britifh army under General Gage, then encamped at Bofton. If thefe circumftances had not called Wafhington forth, he would have lived happy, and died obfcure, as a refpectable country gentleman in Virginia: now the fcene opened which made his name immortal: fo dependent upon accident is human fame, and fo great is the power of circumftances in calling forth, and perhaps even in forming, the genius of men.

In the month of July, 1775, General Wafhington took the command of the continental army before Bofton. To detail his conduct in the years which followed, would be to relate the hiftory of the American war: a moft memorable and inftructive part of Britifh annals, which has not yet been treated in a manner fuited to its importance and dignity. Within a very fhort period after the declaration of independence, the affairs of America were in a condition fo defperate, that perhaps nothing but the *peculiar* character of Wafhington's genius could have retrieved them. Activity was the policy of invaders. In the field of battle the fuperiority of a difciplined army is difplayed. But delay was the wifdom of a country defended by undifciplined foldiers againft an enemy who muft be more exhaufted by time than he could be weakened by defeat. It required the confummate prudence, the calm wifdom, the inflexible firmnefs, the moderate and well balanced temper of Wafhington to embrace fuch a plan of policy, and to perfevere in it; to refift the temptations of enterprize; to fix the confidence of his foldiers without the attraction of victory; to fupport the fpirit of the army and the people amidft thofe flow and cautious plans of defenfive warfare which are more difpiriting than defeat itfelf; to contain his own ambition and the impetuofity of his troops; to endure temporary obfcurity for the falvation of his country, and for the attainment of folid and immortal glory; and to fuffer even temporary reproach and obloquy, fupported by the approbation of his own confcience and the applaufe of that fmall number of wife men whofe praife is an earneft of the admiration and gratitude of pofterity. Victorious generals eafily acquire the confidence of their army. Theirs, however, is a confidence in the *fortune* of their general. That of Wafhington's army was a confidence in his *wifdom.* Victory gives fpirit to cowards, and even the agitations of defeat fometimes impart a courage of defpair. Courage is infpired by fuccefs, and it may be ftimulated to defperate exertion even by calamity, but it is generally palfied by inactivity—A fyftem of cautious defence is the fevereft trial of human fortitude. By this teft the firmnefs of Wafhington was tried. His intrepidity never could have

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have maintained itself under such circumstances, if it had arisen from ambition or vain glory, from robust nerves or disorderly enthusiasm. It stood the test, because it grew out of the deep root of principle and duty. His mind was so perfectly framed, that he did not need the vulgar incentives of fame and glory to rouse his genius. In him public virtue was a principle of sufficient force to excite the same great exertions to which the rabble of heroes must be stimulated by the love of power or of praise.

It is hardly necessary to say, that the courage which flowed from honesty, was tempered in its exercise by humanity. The character of Washington was not deformed by any of those furious passions which drive men to ferocity. His military life was unstained by military cruelty; and if we lamented the severity of some of his acts, we never were at liberty to question their justice. It would be unjust to ascribe the mildness of the American war exclusively to the personal character of Washington.—It must be imputed in a great measure to the sobriety and moderation of the national temper. Never was a civil war so spotless as that which unhappily broke out between the two nations of the English race. Not a single massacre, not a single assassination, no slaughter in cold blood tarnished the glory of conquest or aggravated the shame of defeat. Gallantry and humanity characterized this contest between two nations who amidst all the fierceness of hostility shewed themselves worthy of each other's friendship.

We are well aware that the military critics of Europe, accustomed to the vast and scientific plans, to the complicated yet exact movements, to the daring and splendid exploits of great European generals, may consider the most decisive success in a war like the American as a very inadequate title to the name and glory of an illustrious commander. We feel all the deference which upon every subject is due from the ignorant to the masters of the art. But we doubt the soundness of the judgment of military critics on this subject. To us it seems probable that more genius and judgment are generally exerted by uneducated generals and among irregular armies, than in the contests of those commanders who are more perfectly instructed in military science. It is with the arts of war as with every other art. Wherever any art is most perfected, there is least room for the exertions of individual genius. Where most can be done by rule, least is left for talents. We accordingly find that those surprizes and stratagems which are so brilliant and interesting a part of the history of war in past times, are now infinitely more rare, because vigilance is now more uniform and the means of defence more perfect. It is now much more easy than it was formerly to calculate the event of a campaign from the numbers of the contending armies, the fortresses which they possess and the nature of the country which they occupy. It is impossible that the art of war should ever be so improved, as to obliterate all differences between the talents of generals: but it is certain that its improvement has a tendency to make the inequality of their talents less felt. It cannot be denied that they who best know the power of the *art* are the most sober *admirers* of the talents of generals. But whatever be the justness of these observations, it must be universally allowed, that as much judgment and intrepidity may be shewn among irregular and imperfectly disciplined armies as under the most highly improved system of mechanical tactics. This is sufficient for our purpose; for we are now contemplating the character of him whose least praise is that of being a great commander, whose valour was the minister of virtue, and whose military genius is chiefly ennobled by being employed in the defence of justice.

It is extremely remarkable, that though there never was a civil contest disgraced by so few violent or even ambiguous acts as the American war, yet so pure were the moral sentiments of Washington, that he could not look back on the period of hostilities with unmixed pleasure. An Italian nobleman, who visited him after the peace, had often attempted, in vain, to turn the conversation to the events of the war. At length he thought he had found a favourable opportunity of effecting his purpose; they were riding together over the scene of an action where Washington's conduct had been the subject of no small animadversion. Count ——— said to him, "Your conduct, Sir, in this action has been criticized." Washington made no answer, but clapped spurs to his horse; after they had passed the field, he turned to the Italian and said, "Count ———, I observe that you wish me to speak of the war. It is a conversation which I always avoid. I rejoice at the establishment of the liberties of America. But the time of the struggle was a horrible period, in which the best men were compelled to do many things repugnant to their nature."

So fatal are even the mildest civil commotions to men's morals, and so admirable was the temperament of the man who had too much magnanimity not to take up arms at the call of his country, and yet too delicate a purity to dwell with complacency on the recollection of scenes which, though they were the source of his glory, allowed more scope for the display of his talents than for the exercise of his humanity!

The conclusion of the American war permitted Washington to return to those domestic scenes, from which nothing but a sense of duty seems to have had the power to draw him. But he was not allowed long to enjoy this privacy. The supreme government of the United States, hastily thrown up, in a moment of turbulence and danger, as a temporary fortification against anarchy, proved utterly unadequate to the preservation of general tranquillity and permanent security. The confusions of civil war had given a taint to the morality of the people which rendered the restraints of a just and vigorous government more indispensably necessary. Confiscation and paper money, the two greatest schools of rapacity and dishonesty in the world, had widely spread their poison among the Americans. In this state of things, which threatened the dissolution of morality and government, good men saw the necessity of concentrating and invigorating the supreme authority. Under the influence of this conviction, a convention of delegates was assembled at Philadelphia, which strengthened the bands of the Federal Union, and bestowed on Congress those powers which were necessary for the purposes of good government. Washington was the president of this convention, and afterwards was unanimously elected president of the United States of America, under what was called "The New Constitution," though it might have been called a *reform* of the republican government, as that republican government itself was only a *reform* of

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of the ancient colonial conftitution under the Britifh crown. None of thefe changes extended fo far as an attempt to new-model the whole focial and political fyftem.

There is nothing more ftriking in the whole character of General Wafhington, and which diftinguifhes him more from other extraordinary men, than the circumftances which attended his promotion and retreat from office. Unfought elevation and cheerful retreat are almoft peculiar to him. He eagerly courted privacy, and only *fubmitted* to exercife authority as a public duty. The promotions of many men are the triumph of ambition over virtue. The promotions, even of good men, have generally been eagerly fought by them from motives which were very much mixed. The promotions of Wafhington alone, feem to have been victories gained by his confcience over his tafte. His public virtue did not need the ambiguous aid of ambition to urge its activity. We do not affirm that all ambition is to be condemned; it is perhaps neceffary to ftimulate the fluggifhnefs of human virtue. Thofe who avoid the public fervice from an epicurean love of pleafure and of eafe, from the fear of danger, from infenfibility to honeft fame, are not fo much to be praifed for their exemption from ambition as to be defpifed for bafer vices. But though it be mean to be *below* ambition, it is a proof of unfpeakable greatnefs of mind to be *above* it. This elevation the mind of Wafhington had reached; and unlefs we are greatly deceived, he will be found to be a folitary example of fuch exalted magnanimity. To defpife what all other men purfue; to fhew himfelf equal to the higheft places without ever feeking any; and to be as active and intrepid from public virtue alone, as others are under the influence of the moft reftlefs ambition; thefe are the noble peculiarities of the character of Wafhington.

Events occurred during his chief magiftracy, which convulfed the whole political world, and which tried moft feverely his moderation and prudence. The French revolution took place.

Both friends and enemies have agreed in ftating that Wafhington, from the beginning of that revolution, had no great confidence in its beneficial operation. He muft indeed have defired the abolition of defpotifm, but he is not to be called the enemy of liberty if he dreaded the fubftitution of a more oppreffive defpotifm. It is extremely probable that his wary and practical underftanding, inftructed by the experience of popular commotions, augured little good from the daring fpeculations of inexperienced vifionaries. The progrefs of the revolution was not adapted to cure his diftruft, and when, in the year 1793, France, then groaning under the moft intolerable and hideous tyranny, became engaged in war with almoft all the governments of the civilized world, it is faid to have been a matter of deliberation with the Prefident of the United States, whether the republican envoy, or the agent of the French princes fhould be received in America as the diplomatic reprefentative of France. But whatever might be his private feelings of repugnance and horror, his public conduct was influenced only by his public duties. As a virtuous man he muft have abhorred the fyftem of crimes which was eftablifhed in France. But as the firft magiftrate of the American Commonwealth, he was bound only to confider how far the intereft and fafety of the people whom he governed, were affected by the conduct of France. He faw that it was wife and neceffary for America to preferve a good underftanding and a beneficial intercourfe with that great country, in whatever manner fhe was governed, as long as fhe abftained from committing injury againft the United States. Guided by this juft and fimple principle, uninfluenced by the abhorrence of crimes which he felt and which others affected, he received Mr Genet, the minifter of the French Republic. The hiftory of the outrages which that minifter committed, or inftigated, or countenanced againft the American government, muft be frefh in the memory of all our readers. The conduct of Wafhington was a model of firm and dignified moderation. Infults were offered to his authority in official papers, in anonymous libels, by incendiary declaimers, and by tumultuous meetings. The law of nations was trampled under foot. His confidential minifters were feduced to betray him, and the deluded populace were fo inflamed by the arts of their enemies that they broke out into infurrection. No vexation, however galling, could difturb the tranquillity of his mind, or make him deviate from the policy which his fituation prefcribed. With a more confirmed authority, and at the head of a longer eftablifhed government, he might perhaps have thought greater vigour juftifiable. But in his circumftances he was fenfible that the nerves of authority were not ftrong enough to bear being ftrained. Perfuafion, always the moft defirable inftrument of government, was in his cafe the fafeft. Yet he never overpaffed the line which feparates conceffion from meannefs. He reached the utmoft limits of moderation, without being betrayed into pufillanimity. He preferved external and internal peace by a fyftem of mildnefs, without any of thofe virtual confeffions of weaknefs, which fo much difhonour and enfeeble fupreme authority. During the whole of that arduous ftruggle, his perfonal character gave that ftrength to a *new magiftracy*, which in other countries arifes from ancient habits of obedience and refpect. The authority of his virtue was more efficacious for the prefervation of America than the legal powers of his office.

During the turbulent period of the French revolution, Wafhington was re-elected to the office of the Prefidency of the United States, which he held from April 1789, till September 1796. Probably no magiftrate of any commonwealth, ancient or modern, ever occupied a place fo painful and perilous. Certainly no man was ever called upon fo often to facrifice his virtuous feelings (he had no other facrifices to make) to his public duty. Two circumftances of this fort deferve to be particularly noticed. In the fpring of 1794, he fent an embaffador to Paris with credentials, addreffed to his "Dear friends the citizens compofing the Committee of Public Safety of the French Republic," whom he prays God "to take under his holy protection." Fortunately the American embaffador was fpared the humiliation of prefenting his credentials to thefe bloody tyrants. Their power was fubverted, and a few of them had fuffered the punifhment of their crimes, which no punifhment could expiate, before his arrival at Paris. The dignity of the nature of man was not fo degraded, as that the embaffador of the moft refpectable republic in the world fhould be prefented to ruffians

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ruffians and assassins, who had the incredible effrontery to call their tyranny by the profaned name of republic. But historians who relate heroic sacrifices of feeling to duty, when they tell us, that Brutus thought himself obliged to condemn his son to death, will not forget to add, that Washington was compelled to call Robespierre "his friend!" In the contemplation of such scenes good men for a moment forget their deliberate opinions, and are led to curse civil government itself with all the severe duties which it imposes, and all the cruel sacrifices which it demands.

Another struggle of feeling and duty Washington had to encounter, when he was compelled to suppress the insurrection in the western counties of Pennsylvania by force of arms. But here he had a consolation. The exercise of mercy consoled his mind for the necessity of having recourse to arms. Never was there a revolt quelled with so little blood. Scarcely ever was the basest dastard so tender of his own life, as this virtuous man was of the lives of his fellow citizens. The value of his clemency is enhanced by recollecting, that he was neither without provocations to severity, nor without pretexts for it. His character and his office had been reviled in a manner almost unexampled among civilized nations.—His authority had been insulted.—His safety had been threatened. Of his personal and political enemies some might, perhaps, have been suspected of having instigated the insurrection; a greater number were thought to wish well to it; and very few shewed much zeal to suppress it. *Is habitus animorum fuit, ut pessimum facinus auderent pauci, plures vellent, omnes paterentur.* But neither resentment, nor fear, nor even policy itself, could extinguish the humanity of Washington. This seems to have been the only sacrifice which he was incapable of making to the interest of his country.

Throughout the whole course of his second presidency, the danger of America was great and imminent almost beyond example. The spirit of change indeed, at that period, shook all nations. But in other countries, it had to encounter ancient and solidly established power. It had to tear up by the roots long habits of attachment in some nations for their government, of awe in others, of acquiescence and submission in all. But in America the government was new and weak. The people had scarce time to recover from the ideas and feelings of a recent civil war. In other countries the volcanic force must be of power to blow up the mountains, and to convulse the continents that held it down, before it could escape from the deep caverns in which it was imprisoned:—in America it was covered only by the ashes of a late convulsion, or at most by a little thin soil, the produce of a few years quiet.

To these difficulties were added others, which, if duly weighed, will perhaps dispose us to consider the preservation of America from confusion under the government of Washington, by means so mild, and apparently so inadequate, as either one of the greatest master pieces of civil prudence that ever distinguished an administration, or one of the most fortunate accidents that ever befel a state. To those who may represent it as mere good fortune, we may answer with FONTENELLE, who, when somebody congratulated him on the *good fortune* of his friend *Lamotte*, in the success of his tragedy of "Inez de Castro," answered—"*Oui; mais c'est une* FORTUNE *qui n'arrive jamais aux sots.*"—The names of liberty and republic were so naturally and justly dear to the Americans, that, far from its being difficult to range them under any banners on which these words were inscribed, it was very far indeed from being easy to persuade them, that such sounds could represent any thing but justice, benevolence, and happiness. The government of America had none of those prejudices to employ, which in every other country were used with success to enflame the people against the French revolution. They had, on the contrary, to contend with the prejudices of their people in the most moderate precautions against internal confusion, in the most measured and guarded resistance to the unparalleled insults and enormous encroachments of France. Without zealous support from the people, the American government was impotent. It required a considerable time, and it cost an arduous and dubious struggle, to direct the popular spirit against a sister republic, established among a people to whose aid the Americans ascribed the establishment of their independence. It is probable indeed, that no policy could have produced this effect, unless it had been powerfully aided by the crimes of the French government, which have proved the strongest allies of all established governments; which have produced such a general disposition to submit to any *known* tyranny, rather than rush into all the unknown and undefinable evils of civil confusion, with the horrible train of new and monstrous *tyrannies* of which it is usually the forerunner. But with what justice soever some governments may be accused of having engrafted servility on the rational and generous horror of their subjects against the atrocities of the French revolution, most certain it is, that the administration of Washington cannot be charged with having so perverted such a just and noble sentiment. He employed it for the most honest and praiseworthy purposes; to preserve the internal quiet of his country; to assert the dignity, and to maintain the rights of the commonwealth which he governed, against foreign enemies. He avoided war without incurring the imputation of pusillanimity. He cherished the detestation of Americans for anarchy, without weakening the spirit of liberty; and he maintained, and even consolidated, the authority of government, without abridging the privileges of the people.

Among the many examples of change and vicissitude in political connexion, which are amusing from their singularity, and which would be most useful if they were received as lessons of moderation by contending parties; there is none, perhaps, more remarkable, than that which may be observed in the life of General Washington. In 1776, he was considered in England as a proscribed rebel. In 1796, he was regarded as the leader of the English party in America. In 1776, his destruction was thought the only means of preserving America to Great Britain. In 1796, his authority was thought the principal security against her falling under the yoke of France. In 1776, he looked to the aid of France, as his only hope of guarding the liberties of America against England. In 1796, he must have considered the power of Great Britain as one main barrier of the safety of America against France. Never, perhaps, did twenty years in the life of any individual, produce so striking and so important a change. But there was no inconsistency in his character. There was no change in his *principles* or *objects*. There was a great

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great change of *circumſtances* which required a correſpondent variety in the *means* to be employed for the attainment of his objects, in the aid to be fought, the connexions to be cultivated, the meaſures to be adopted for giving effect to his principles. Means, plans, and connections, muſt always vary with the infinite variety in the ſituations of men and of ſtates. But the principles of public virtue, which were the principles of Waſhington, are immortal and unchangeable. A good man always deſires the liberty and happineſs of his country, and, as far as poſſible, of the whole human race. But a wiſe man varies his means according to the changing circumſtances of the world, to ſecure the attainment of the ſame end. There would be no more real conſiſtency in the oppoſite conduct, that if a man were to continue the ſame precautions againſt being froſt-bitten at Bencoolen, which he had found neceſſary in Greenland; or employ the ſame anxious care to ſave himſelf from a *coup de ſoleil* in Canada, which might have been very prudent in Bengal.

The reſignation of Waſhington in 1796, is one of thoſe meaſures of his life in which his patriotiſm and prudence ſeem the moſt eminently conſpicuous. Nothing was more certain than his re-election, if he had thought it wiſe to offer himſelf as a candidate. In that unſettled ſtate of public affairs, it might at firſt ſight appear, that the man of moſt influence and weight in America ought to have remained at the helm. The conduct which he purſued was, certainly, however the moſt wiſe. All the enemies, and many of the friends, of the American government believed, that it had a ſevere trial to encounter, when the aid of Waſhington's character ſhould be withdrawn from its executive government. Many apprehended, that it had ſcarce vigour enough to ſurvive the experiment. And, if the trial had been delayed till the death of Waſhington, the event might perhaps have been more doubtful. It was neceſſary, that ſo critical an experiment ſhould be performed under his eye. It was fit that the Americans ſhould have an example of a quiet election and a proſperous adminiſtration, apparently independent of the perſonal influence of the great founder of their liberty, though, in reality, ſupported by the whole ſtrength of his character. It was fit, that the world ſhould ſee that the American government *was able to move by itſelf*; but it was alſo fit, that ſo hazardous a trial ſhould be made while that guardian wiſdom was at hand, which could guide and help its movements. The election of the firſt ſucceſſor of Waſhington was the moſt critical event in the hiſtory of the infant republic, and the example was likely to be of great and laſting importance. America and her friends, after the happy iſſue of this trial, may with confidence expect, that a government which has ſtood ſuch a teſt, will maintain itſelf againſt all future ſhocks; and that a people with ſuch an example before them, will ſo exerciſe their great and hazardous right of electing a firſt magiſtrate, as to preſerve the quiet of their country and the protecting power of the laws. In that caſe their fortune will be the more admirable, becauſe we have no authority from the experience of paſt times to expect ſuch a degree of prudence, moderation, and equanimity in any great community, as to make it ſafe for themſelves to be entruſted with that magnificent, but dangerous and generally fatal, privilege. If theſe happy conſequences enſue, America will have as much reaſon to be grateful to Waſhington for the ſeaſonable reſignation of his authority, as for its wiſe and honeſt exertions.

When he reſigned his preſidency, he publiſhed a valedictory addreſs to his countrymen, as he had before done when he quitted the command of the army in 1783. In theſe compoſitions, the whole heart and ſoul of Waſhington are laid open. Other ſtate-papers have, perhaps, ſhewn more ſpirit and dignity, more eloquence, greater force of genius, and a more enlarged comprehenſion of mind. But none ever diſplayed more ſimplicity and ingenuouſneſs, more moderation and ſobriety, more good ſenſe, more prudence, more honeſty, more earneſt affection for his country and for mankind, more profound reverence for virtue and religion; more ardent wiſhes for the happineſs of his fellow creatures, and more juſt and rational views of the means which alone can effectually promote that happineſs. It is difficult for any human compoſition to ſhew more clearly a well-diſciplined underſtanding and a pure heart.

From his reſignation till the month of July 1798, he lived in retirement at Mount Vernon. At this latter period, it became neceſſary for the United States to arm. They had endured with a patience, of which there is no example in the hiſtory of ſtates, all the contumely and wrong which ſucceſſive adminiſtrations in France had heaped upon them. Their ſhips were every where captured, their miniſters were detained in a ſort of impriſonment at Paris; while incendiaries, clothed in the ſacred character of embaſſadors, ſcattered over their peaceful provinces the fire-brands of ſedition and civil war. An offer was made to terminate this long courſe of injuſtice, for a bribe to the French miniſters.—This offer was made by perſons who *appeared* to be in the confidence of M. Talleyrand, who *profeſſed* to act by his authority; who have been ſince, indeed, diſavowed by him; but who never will be believed not to have been his agents, till he convicts them of impoſture by legal evidence, and procures them to be puniſhed for ſo abominable a fraud.

The United States reſolved to arm by land and ſea. The command of the army was beſtowed on General Waſhington; which he accepted, becauſe he was convinced, that "every thing we hold dear and ſacred was ſeriouſly threatened;" though he had flattered himſelf, "that he had quitted for ever the boundleſs field of public action, inceſſant trouble and high reſponſibility, in which he had long acted ſo conſpicuous a part." In this office he continued during the ſhort period of his life which ſtill remained.—On Thurſday the 12th December 1799, he was ſeized with an inflammation in his throat, which became conſiderably worſe the next day; and of which, notwithſtanding the efforts of his phyſicians, he died on Saturday the 14th of December 1799, in the 68th year of his age, and in the 23d year of the independence of the United States, of which he may be conſidered as the founder. The ſame calmneſs, ſimplicity and regularity, which had uniformly marked his demeanor, did not forſake him in his dying moments. He ſaw the approaches of death without fear:—he met them without parade.—Even the perfectly well-ordered ſtate of the moſt minute particulars of his private buſineſs, bore the ſtamp of that conſtant authority of prudence and practical reaſon over his actions, which was a diſtinguiſhing feature of his character. He died with those sentiments of piety, which had given vigour and consistency to his virtue, and adorned every part of his blameless and illustrious life.

His will, which has been published since his death, is, like all his compositions, characteristic of his mind. It has been very well observed by a writer of genius, in a Daily Paper, that those dispositions of the will which regard the future emancipation of the slaves are peculiarly deserving of attention. A commentary on that part of the will would, perhaps, be the best system of rules for rational reform, that has ever been given to the world. The generous and just determination to emancipate the slaves, combined with the sacred regard for law in its harshest regulations, and property in its most odious form; the tender and provident solicitude for the emancipated slaves themselves, for the education of the young, and the support of the infirm; every thing in short indicates that union of benevolence and prudence which constitutes the true character of a Reformer, and which distinguishes him from those restless and fierce disturbers of the world, who usurp the name of Reformers, and bring lasting discredit on the cause of reformation. The reforms of which Washington has furnished so beautiful a model in miniature, are those in which the heart is warm, and the head cool; in which the Reformer not only earnestly desires to do good, but deeply considers the best manner of doing it; in which he pursues his generous end with ardour, but examines with the utmost caution and deliberation the most effectual and the safest means of attaining it; in which he takes a large view of all the relations and tendencies of the change which he is about to introduce, of all its direct and indirect consequences; and guards his reform by every security that human prudence can devise, against any possibility of injury, either from the act or the example, to the rights or the happiness of any human being.

But to return from this digression: it is sufficient to say, that these dispositions of Washington's will bear the mark of his pure, temperate, and sedate character, which was not only free from the gross vices of sordid avarice and selfish ambition, but from the more refined and better disguised, though equally pernicious, vices of inordinate zeal even for good, of a violent passion for glory; in which there was nothing disorderly, nothing precipitate, nothing excessive, nothing ostentatious, of which usefulness was the object, and good sense the guide, and of which the grandeur arises only from the magnitude of the benefits which he conferred on his country. His character is surrounded with no glare.—There is little in it to dazzle. It has nothing to gratify those, who relish only that irregular and monstrous greatness, which fascinates the vulgar of all ranks and in all times. But those whose moral taste is more pure, will always admire in George Washington the nearest approach to uniform propriety, and perfect blamelessness, which has ever been attained by man, or which is perhaps compatible with the condition of humanity.

This imperfect sketch is necessarily defective in those interesting details of private life, which are the most important, as well as the most delightful part, of biography; but these defects will soon be amply supplied by the publication of the life of General Washington, which is now ready for the press. In the mean time the present article has been inserted to preserve in this work some memorial of a man who will always be dear to America, and to the wise and good in all nations.

Washington, a county of the District of Maine, and the most easterly land in the United States. It is bounded south by the ocean, west by Hancock county, north by Lower Canada, and east by New-Brunswick. It is about 200 miles in length, but its breadth is as yet undetermined. It was erected into a county in 1789; but has few towns yet incorporated. The coast abounds with excellent harbours. Although the winters are long and severe; yet the soil and productions are but little inferior to the other counties. The number of inhabitants in this county, according to the census of 1790, was 2758; but the increase since must have been very considerable. Chief town, Machias.—*Morse.*

Washington, a maritime county of the state of Rhode Island; bounded north by Kent, south by the N. Atlantic Ocean; west by the state of Connecticut, and east by Narraganset Bay. It is divided into seven townships, and contains 18,075 inhabitants, including 339 slaves. Chief town, South Kingstown.—*ib.*

Washington, a county of New York; bounded north by Clinton county, south by Rensselaer, south-west by Saratoga, west by Herkemer, and east by the State of Vermont. Until 1784 it was called Charlotte. It contained, in 1790, 14,042 inhabitants, including 742 slaves. In 1796, there were 3,370 of the inhabitants qualified electors. It is subdivided into 12 townships, of which Salem is the chief.—*ib.*

Washington, a county of Pennsylvania; situated in the south-west corner of the State; bounded north by Alleghany county, south by Monongalia county, in Virginia; east by Monongahela river, which divides it from Fayette county, and west by Ohio county in Virginia; agreeably diversified with hills, which admit of easy cultivation quite to their summits. It is divided into 21 townships, and contains 23,866 inhabitants, including 263 slaves. Mines of copper and iron ore have been found in this county.—*ib.*

Washington, the capital of the above county, and a post-town, is situated on a branch of Charter's Creek, which falls into Ohio river, a few miles below Pittsburg. It contains a brick court-house, a stone gaol, a large brick building for the public offices, an academy of stone, and nearly 100 dwelling-houses. It is 22 miles south-south-west of Pittsburg; 22 miles north-west of Brownsville, 60 miles north by west of Morgantown, in Virginia, and 325 west by north of Philadelphia. N. lat. 40 13, W. long. 80 6 40. It is remarkable for its manufactures, for so young a town. There are 3 other townships of the same name in Pennsylvania, viz. in Fayette, Franklin, and Westmoreland counties.

Washington, a county of Maryland, on the western shore of Chesapeak Bay; bounded north by the State of Pennsylvania; east by Frederick county, from which it is divided by South Mountain; south-west by Patowmack river, which divides it from the State of Virginia, and west by Sideling-Hill-Creek, which separates it from Alleghany county. This is called the garden of Maryland, lying principally between the North and South Mountains, and includes the rich, fertile and well cultivated valley of Conegocheague. Its streams furnish excellent mill-seats, and the lands are thought to be the most fertile in the State. Lime-stone and iron-ore are found here. Furnaces and forges have been erected,

erected, and confiderable quantities of pig and bar iron are manufactured. Chief town, Elizabeth-Town.—*ib.*

Washington, a county of Virginia; bounded E. and N. E. by Wythe; north-weft by Ruffell; fouth by the ftate of North Carolina, and weft by Lee. It is watered by the ftreams which form Holfton, Clinch and Powell's rivers. There is a natural bridge in this county fimilar to that in Rockbridge county. It is on Stock Creek, a branch of Pelefon river. It contains 5625 inhabitants, including 450 flaves. Chief town, Abingdon. —*ib.*

Washington, a diftrict of the Upper Country of South Carolina, perhaps the moft hilly and mountainous in the ftate. It lies weft of Ninety-Six diftrict, of which it was formerly a part, and is bounded north by the ftate of North Carolina. It contains the counties of Pendleton and Greenville; has 14,619 inhabitants, and fends to the ftate legiflature five reprefentatives and two fenators. Chief town, Pickenfville. A number of old deferted Indian towns of the Cherokee nation, are frequently met with on the Keowee river, and its tributary ftreams which water this country.—*ib.*

Washington, a county of Kentucky, bounded northeaft by Mercer, north-weft by Nelfon, fouth-eaft by Lincoln, and weft by Hardin.—*ib.*

Washington, a diftrict of the State of Tenneffee, fituated on the waters of the rivers Holfton and Clinch, and is divided from Mero diftrict on the weft by an uninhabited country. It is divided into the counties of Wafhington, Sullivan, Greene, and Hawkins. It contained, according to the State cenfus of 1795, 29,531 inhabitants, including 4693 flaves.—*ib.*

Washington, a county of Tenneffee, in the above diftrict, contained in 1795, 10,105 inhabitants, inclufive of 978 flaves. Wafhington college is eftablifhed in this county by the legiflature.—*ib.*

Washington, a county of the N. W. Territory, erected in 1788 within the following boundaries, viz. beginning on the bank of the Ohio where the weftern line of Pennfylvania croffes it, and running with that line to Lake Erie; thence along the fouthern fhore of that lake to the mouth of Cayahoga river, and up that river to the portage between it and the Tufcarawa branch of Mufkingum; thence down that branch to the forks of the croffing-place above Fort Lawrence; thence with a line to be drawn wefterly to the portage on that branch of the Big Miami, on which the fort ftood which was taken from the French in 1752, until it meets the road from the Lower Shawanefe town to Sandufky; thence fouth to the Sciota river to the mouth, and thence up the Ohio to the place of beginning.—*ib.*

Washington, a county of the Upper Diftrict of Georgia, which contains 4,552 inhabitants, including 694 flaves. Fort Fidus is fituated in the wefternmoft part of the county, on the eaft branch of Alatamaha river. The county is bounded on the N. E. by Ogeechee river. Numbers have lately moved here from Wilkes county, in order to cultivate cotton in preference to tobacco. This produce, though in its infancy, amounted to 208,000lbs. weight, in 1792. Chief town, Golphinton.—*ib.*

Washington, a townfhip of Vermont, Orange county, 12 miles weft of Bradford, and contains 72 inhabitants.—*ib.*

Washington, a townfhip of Maffachufetts, in Berkfhire county, 7 miles fouth-eaft of Pittsfield, 8 eaft of Lenox, and 145 weft of Bofton. It was incorporated in 1777, and contains 588 inhabitants.—*ib.*

Washington, or *Mount Vernon*, a plantation of Lincoln county, Diftrict of Maine, north-weft of Hallowell, and 9 miles from Sterling. It confifts of 16,055 acres of land and water, of which the latter occupies 1641 acres. It contains 618 inhabitants, and was incorporated by the name of *Belgrade* in 1796.—*ib.*

Washington, a townfhip of New-York, in Dutchefs county, bounded foutherly by the town of Beekman, and wefterly by Poughkeepfie and Clinton. It contains 5189 inhabitants, of whom 286 are electors, and 78 flaves.—*ib.*

Washington, a townfhip of New Hampfhire, in Chefhire county, firft called Camden. It was incorporated in 1776, and contains 545 inhabitants; it is 12 or 14 miles eaft of Charleftown.—*ib.*

Washington, a townfhip of Connecticut, in Litchfield county, about 7 miles fouth-weft of Litchfield. —*ib.*

Washington, a port of entry and poft-town of N. Carolina, fituated in Beaufort county, on the north fide of Tar river, in lat. 35 30 N. 90 miles from Ocracok Inlet, 40 from the mouth of Tar river, 61 fouth-fouthweft of Edenton, 38 north by eaft of Newbern, 131 north-eaft by north of Wilmington, and 460 from Philadelphia. It contains a court-houfe, gaol, and about 80 houfes. From this town is exported tobacco of the Peterfburg quality, pork, beef, Indian corn, peas, beans, pitch, tar, turpentine, rofin, &c. alfo pine boards, fhingles, and oak ftaves. About 130 veffels enter annually at the cuftom houfe in this town. The exports for a year, ending the 30th of September, 1794, amounted to 33,684 dollars.—*ib.*

Washington, a poft-town of Kentucky, and the capital of Mafon county, about 3 miles fouth by weft of the landing at Limeftone, on the fouth fide of Ohio river. It contains about 100 houfes, a Prefbyterian church, a handfome court-houfe and gaol; and is faft increafing in importance. It is 62 miles north-eaft of Lexington, 75 north-eaft by eaft of Frankfort, and 709 fouth-weft by weft of Philadelphia. N. lat. 38 40, W. long. 84 30.—*ib.*

Washington *Court-Houfe*, in S. Carolina, is 10 miles from Greenville, and 16 from Pendleton.—*ib.*

Washington, a poft-town of Georgia, and the capital of Wilkes county, 50 miles north-weft by weft of Augufta, 58 north by weft of Louifville, 28 from Greenfborough, and 813 from Philadelphia. It ftands on the weftern fide of Kettle Creek, a north branch of Little river, which empties into Savannah river from the eaftward, about 36 miles E. of the town. It is regularly laid out, and contained, in 1788, 34 houfes, a court-houfe, gaol, and academy. The funds of the academy amount to about 800l. fterling, and the number of ftudents to between 60 and 70. On the eaft fide of the town, a mile and a half diftant, is a medicinal fpring, which rifes from a hollow tree 4 or 5 feet in length. The infide of the tree is covered with a coat of matter an inch thick, and the leaves around the fpring are incrufted with a fubftance as white as fnow. It is faid to be a fovereign remedy for the fcurvy, fcrophulous diforders, confumptions, gout, and every other diforder arifing from humours in the blood. This fpring being

being situated in a fine, healthy part of the State, will no doubt be a pleasant and salutary place of resort for invalids from the maritime and unhealthy parts of Georgia, and the neighbouring states. N. lat. 33 12. —*ib.*

WASHINGTON *City*, in the territory of Columbia, was ceded by the State of Virginia and Maryland to the United States, and by them established as the seat of their government, after the year 1800. This city, which is now building, stands at the junction of the river Patowmack, and the Eastern Branch, latitude 38 53 N. extending nearly 4 miles up each, and including a tract of territory, exceeded in point of convenience, salubrity and beauty, by none in America. For although the land in general appears level, yet by gentle and gradual swellings, a variety of elegant prospects are produced, and a sufficient descent formed for conveying off the water occasioned by rain. Within the limits of the city are a great number of excellent springs; and by digging wells, water of the best quality may readily be had. Besides, the never-failing streams that now run through that territory, may also be collected for the use of the city. The waters of Reedy Branch, and of Tiber Creek, may be conveyed to the President's house. The source of Tiber Creek is elevated about 236 feet above the level of the tide in said Creek. The perpendicular height of the ground on which the capital stands, is 78 feet above the level of the tide in Tiber Creek. The water of Tiber Creek may therefore be conveyed to the capitol, and after watering that part of the city, may be destined to other useful purposes. The Eastern Branch is one of the safest and most commodious harbours in America, being sufficiently deep for the largest ships for about 4 miles above its mouth, while the channel lies close along the bank adjoining the city, and affords a large and convenient harbour. The Patowmack, although only navigable for small craft, for a considerable distance from its banks next the city, (excepting about half a mile above the junction of the rivers) will nevertheless afford a capacious summer harbour; as an immense number of ships may ride in the great channel, opposite to, and below the city. The situation of this metropolis is upon the great post-road, equi-distant from the northern and southern extremities of the Union, and nearly so from the Atlantic and Pittsburg, upon the best navigation, and in the midst of a commercial territory, probably the richest, and commanding the most extensive internal resource of any in America. It has therefore many advantages to recommend it, as an eligible place for the permanent seat of the general government; and as it is likely to be speedily built, and otherwise improved, by the public spirited enterprise of the people of the United States, and even by foreigners, it may be expected to grow up with a degree of rapidity hitherto unparalleled in the annals of cities. The plan of this city appears to contain some important improvements upon that of the best planned cities in the world, combining, in a remarkable degree, convenience, regularity, elegance of prospect, and a free circulation of air. The positions of the different public edifices, and for the several squares and areas of different shapes as they are laid down, were first determined on the most advantageous ground, commanding the most extensive prospects, and from their situation, susceptible of such improvements as either use or ornament may hereafter require. The capitol is situated on a most beautiful eminence, commanding a complete view of every part of the city, and of a considerable part of the country around. The President's house stands on a rising ground, possessing a delightful water prospect, together with a commanding view of the capitol, and the most material parts of the city. Lines, or avenues of direct communication, have been devised to connect the most distant and important objects. These transverse avenues, or diagonal streets, are laid out on the most advantageous ground for prospect and convenience, and are calculated not only to produce a variety of charming prospects, but greatly to facilitate the communication throughout the city. North and south lines, intersected by others running due east and west, make the distribution of the city into streets, squares, &c. and those lines have been so combined, as to meet at certain given points, with the divergent avenues, so as to form, on the spaces *first determined*, the different squares or areas. The grand avenues, and such streets as lead immediately to public places, are from 130 to 160 feet wide, and may be conveniently divided into foot-ways, a walk planted with trees on each side, and a paved way for carriages. The other streets are from 90 to 110 feet wide. In order to execute this plan, Mr Ellicot drew a true meridional line by celestial observation, which passes through the area intended for the capitol. This line he crossed by another, running due east and west, which passes through the same area. These lines were accurately measured, and made the bases on which the whole plan was executed. He ran all the lines by a transit instrument, and determined the acute angles by actual measurement, leaving nothing to the uncertainty of the compass. Washington, or the Federal City, is separated from Georgetown, in Montgomery county, Maryland, on the W. by Rock Creek, but that town is now within the territory of Columbia. It is 42 miles S. W. by S. of Baltimore, 876 from Passamaquoddy, in the District of Maine, 500 from Boston, 248 from New York, 144 from Philadelphia, 133 from Richmond, in Virginia, 232 from Halifax, in N. Carolina, 630 from Charleston, S. Carolina, and 794 from Savannah, in Georgia. —*ib.*

WASHINGTON, *Fort*, in the Territory N. W. of the Ohio, is situated on the north bank of the river Ohio, westward of Little Miami river, and 45 miles north-west of Washington, in Kentucky.—*ib.*

WASHINGTON, *Mount*, a small township of Massachusetts, Berkshire county, in the south-west corner of the state, 150 miles south-west by south of Boston. It was incorporated in 1779, and contains 261 inhabitants. —*ib.*

WASHINGTON, *Mount*, one of the White Mountains of New Hampshire, which makes so majestic an appearance all along the shore of the eastern counties of Massachusetts.—*ib.*

WASHINGTON'S *Islands*, on the north-west coast of North America. The largest is of a triangular shape, the point ending on the southward at Cape St James's, in N. lat. 51 58. Sandy Point, at its north-east extremity, is in lat. 54 22 N. Its longitude west extends from Hope Point, the north-west extremity 226° 37′ to Sandy Point, in 228° 45′. Port Ingraham, Perkins and Magee Sound lie on the western side of the island; on the

Waſkemaſhin, || Watch-work.

the eaſtern ſide are the following ports from north to ſouth—Skeetkiſs, or Skitkiſs Harbour, Port Cummaſhawa, Kleiws Point, Smoke Port, Kanſkeeno Point, Port Geyers, Port Ueah, and Port Sturgis. Capt. Cook, when he paſſed this iſland, ſuppoſed it to be a part of the continent, as the weather at the time was thick, and the wind boiſterous, which obliged him to keep out at ſea, till he made the weſtern cape of the continent in about lat. 55 N. Capt. Dixon diſcovered theſe iſlands in 1787, and named them Queen Charlotte's Iſlands. Capt. Gray diſcovered them in 1789, and called them Waſhington's Iſlands. There are three principal iſlands, beſides many ſmall ones. It is conjectured that they make a part of the Archipelago of St Lazarus.—*ib.*

WASKEMASHIN, an iſland in the Gulf of St Lawrence, on the coaſt of Labrador. N. lat. 50 3, W. long. 59 55.—*ib.*

WATAGUAKI *Iſles*, on the coaſt of Labrador, and in the Gulf of St Lawrence, lies near the ſhore, north-eaſt of Ouapitougan Iſle, and ſouth-weſt of Little Mecatina, about 10 or 12 leagues from each.—*ib.*

WATAUGA, a river of Tenneſſee, which riſes in Burke county, North-Carolina, and falls into Holſton river, 15 miles above Long-Iſland.—*ib.*

WATCH *Point*, lies to the northward of Fiſher's Iſland, in Long-Iſland Sound, and weſt-ſouth-weſt 7 leagues from Block Iſland.—*ib.*

WATCHWORK. Our intention in this article does not extend to the manual practice of this art, nor even to all the parts of the machine. We mean to conſider the moſt important and difficult part of the conſtruction, namely, the method of applying the maintaining power of the wheels to the regulator of the motion, ſo as not to hurt its power of regulation. Our obſervations would have come with more propriety under the title Scapement, that being the name given by our artiſts to this part of the conſtruction. Indeed they were intended for that article, which had been unaccountably omitted in the body of the Dictionary under the words Clock and Watch. But the bad health and occupations of the perſon who had engaged to write the article, have obliged us to defer it to the laſt opportunity which the alphabetical arrangement affords us; and, even now, the ſame cauſes unfortunately prevent the author from treating the ſubject in the manner he intended and which it well deſerves. But we truſt that, from the account which is here given, the reader, who is converſant in mathematical philoſophy will perceive the juſtneſs of the concluſions, and that an intelligent artiſt will have no heſitation in acceding to the propriety of the maxims of conſtruction deduced from them.

The regulator of a clock or watch is a pendulum or a balance. Without this check to the motion of the wheels, impelled by a weight or a ſpring, the machine would run down with a motion rapidly accelerating, till friction and the reſiſtance of the air induced a ſort of uniformity, as they do in a kitchen jack. But if a pendulum be ſo put in the way of this motion, that only one tooth of a wheel can paſs it at each vibration, the revolution of the wheels will depend on the vibration of the pendulum. This has long been obſerved to have a certain conſtancy, inſomuch that the aſtronomers of the Eaſt employed pendulums in meaſuring the times of their obſervations, patiently counting their vibrations during the phaſes of an eclipſe or the tranſits of the ſtars, and renewing them by a little puſh with the finger when they became too ſmall. Gaſſendi, Riccioli, and others, in more recent times, followed this example. The celebrated phyſician Sanctorius is the firſt perſon who is mentioned as having applied them as regulators of clock movements. Machines, however, called *clocks*, was a train of toothed wheels, leading round an index of hours, had been contrived long before. The earlieſt of which we have any account is that of Richard of Wallingford, Abbot of St Alban's, in 1326 (A). It appears to have been regulated by a fly like a kitchen jack*. Not long after this Giacomo Dondi made one at Padua, which had a *motus ſucuſſorius*, a hobbling or trotting motion; from which expreſſion it ſeems probable that it was regulated by ſome alternate movement. We cannot think that this was a pendulum, becauſe, once it was introduced, it never could have been ſupplanted by a balance. The alternate motion of a pendulum, and its ſeeming uniformity, are among the moſt familiar obſervations of common life; and it is ſurpriſing that they were not more early thought of for regulating time meaſurers. The alternate motions of the old balance is one of the moſt far-fetched means that can be imagined, and might paſs for the invention of a very reflecting mind, while a pendulum only requires to be drawn aſide from the plumb-line, to make it vibrate with regularity. The balance muſt be put in motion by the clock, and that motion muſt be ſtopped, and the contrary motion induced; and we muſt know that the ſame force and the ſame checks will produce uniform oſcillations. All this muſt be previouſly known before we can think of it as a regulator; yet ſo it is that clocks, regulated by a balance, were long uſed, and very common through Europe, before Galileo propoſed the pendulum, about the year 1600. Pendulum clocks then came into general uſe, and were found to be greatly preferable to balance clocks as accurate meaſurers of time. Mathematicians ſaw that their vibrations had ſome regular dependance on uniform gravity, and in their writings we meet with many attempts to determine the time and demonſtrate the iſochroniſm of the vibrations. It is amuſing to read theſe attempts. We wonder at the awkwardneſs and inſufficiency of the explanation given of the motions of pendulums, even by men of acknowledged eminence. Merſennus carried on a moſt uſeful correſpondence with all the mathematicians of Europe, and was the means of making them acquainted with each other; nay, he was himſelf well converſant in the ſcience; yet one cannot but ſmile at his reaſonings on this ſubject. Standing on the ſhoulders of our predeceſſors, we look around us, in great ſatisfaction with our own powers of obſervation, not thinking how we are raiſed up, or that we are trading with the ſtock left

* Conradi Geſneri Epitome, p. 604.

(A) Profeſſor Beckmann, in the firſt volume of his *Hiſtory of Inventions*, expreſſes a belief that clocks of this kind were uſed in ſome monaſteries ſo early as the 11th century, and that they were derived to the monks from the Saracens. His authorities, however, are diſcordant, and ſeem not completely ſatisfactory even to himſelf.

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left us by the diligent and fagacious philofophers of the 17th century (B). Riccioli, Gaffendus, and Galileo, made fimilar attempts to explain the motion of pendulums; but without fuccefs. This honour was referved for Mr Huyghens, the moft elegant of modern geometers. He had fucceeded in 1656 or 1657 in adapting the machinery of a clock to the maintaining of the vibrations of a pendulum. Charmed with the accuracy of its performance, he began to inveftigate with fcrupulous attention the theory of its motion. By the moft ingenious and elegant application of geometry to mechanical problems, he demonftrated that the wider vibrations of a pendulum employed more time than the narrower, and that the time of a femicircular vibration is to that of a very fmall one nearly as 34 to 29; and aided by a new department of geometrical fcience invented by himfelf, namely, the evolution of curves, he fhewed how to make a pendulum fwing in a cycloid, and that its vibrations in this curve are all performed in equal times, whatever be their extent.

But before this time, Dr Hooke, the moft ingenious and inventive mechanician of his age, had difcovered the great accuracy of pendulum clocks, having found that the manner in which they had been employed had obfcured their real merit. They had been made to vibrate in very large arches, the only motion that could be given them by the contrivances then known; and in 1656 he invented another method, and made a clock which moved with aftonifhing regularity. Ufing a heavy pendulum, and making it fwing in very fmall arches, the clocks fo conftructed were found to excel Mr Huyghens's cycloidal pendulums; and thofe who were unfriendly to Huyghens had a fort of triumph on the occafion. But this was the refult of ignorance. Mr Huyghens had fhewn, that the error of $\frac{1}{100}$ of an inch, in the formation of the parts which produced the cycloidal motion, caufed a greater irregularity of vibration than a circular vibration could do, although it fhould extend five or fix degrees on each fide of the perpendicular. It has been found that the unavoidable inaccuracies, even of the beft artifts, in the cycloidal conftruction, make the performance much inferior to that of a common pendulum vibrating in arches which do not exceed three or four degrees from the perpendicular. Such clocks alone are now made, and they exceed all expectation.

We have faid that a pendulum needed only to be removed from the perpendicular, and then let go, in order to vibrate and meafure time. Hence it might feem, that nothing is wanted but a machinery fo connected with the pendulum as to keep a regifter, as it were, of the vibration. It could not be difficult to contrive a method of doing this; but more is wanted. The air muft be difplaced by the pendulum. This requires fome force, and muft therefore employ fome part of the momentum of the pendulum. The pivot on which it fwings occafions friction—the thread, or thin piece of metal by which it is hung, in order to avoid this friction, occafions fome expenditure of force by its want of perfect flexibility or elafticity. Thefe, and other caufes, make the vibrations grow more and more narrow by degrees, till at laft the pendulum is brought to reft. We muft therefore have a contrivance in the wheelwork which will reftore to the pendulum the fmall portion of force which it lofes in every vibration. The action of the wheels therefore may be called a *maintaining power*, becaufe it keeps up the vibrations.

But we now fee that this may affect the regularity of vibration. If it be fuppofed that the action of gravity renders all the vibrations ifochronous, we muft grant that the additional impulfion by the wheels will deftroy that ifochronifm, unlefs it be fo applied that the fum total of this impulfion and the force of gravity may vary fo with the fituation of the pendulum, as ftill to give a feries of forces, or a law of variation, perfectly fimilar to that of gravity. This cannot be effected, unlefs we know both the law which regulates the action of gravity, producing ifochronifm of vibration, and the intenfity of the force to be derived from the wheels in every fituation of the pendulum.

The neceffary requifite for the ifochronous motion of the pendulum is, that the force which urges it toward the perpendicular, be proportional to its diftance from it (fee DYNAMICS, n° 103. Cor. 7. *Suppl.*); and therefore, fince pendulums fwinging in fmall circular arches are fenfibly ifochronous, we muft infer that fuch is the law by which the accelerating action of gravity on them is really accommodated to every fituation in thofe arches.

It will greatly conduce to the better underftanding of the effect of the maintaining power, if the reader keep in continual view the chief circumftances of a motion of this kind. Therefore let AC*d* (fig. 1.) reprefent the arch paffed over by the pendulum, ftretched out into a ftraight line. Let C be its middle point, when the pendulum hangs perpendicular, and A and *a* be the extremities of the ofcillation. Let AD be drawn perpendicular to AC, to reprefent the accelerating action of gravity on the pendulum when it is at A. Draw the ftraight line DC*d*, and *ad*, perpendicular to A*a*. About C, as a centre, defcribe the femicircle AFH*a*. Through any points B, K, *k*, *b*, &c. of A*a*, draw the perpendiculars BFE, KLM, &c. cutting both the ftraight line and the femicircle. Then, Plate XLVIII.

1. The actions of gravity on the pendulum, when in the fituations B, K, &c. by which it is urged toward C, are proportional to, and may be reprefented by, the ordinates BE, KL, *be*, *kl*, &c. to the ftraight line DC*d*.

2. The velocities acquired at B, K, &c. by the acceleration along AB, AK, &c. are proportional to the ordinates BF, KM, &c. to the femicircle AH*a*; and, therefore, the velocity with which the pendulum paffes through the middle point C, is to its velocity in any other point B, as CH to BF.

3. The times of defcribing the parts AB, BK, KC, &c. of the whole arch of ofcillation, are proportional to, and may be reprefented by, the arches AF, FM, MH, &c. of the femicircle.

4. If

(B) We are provoked to make this obfervation, by obferving at this moment, in a literary journal, a pert and petulant upftart fpeaking of Newton's optical difcoveries in terms of ridicule and abufe, employing thefe very difcoveries to diminifh his authority. Is it not thus that Chriftianity is now flighted by thofe who enjoy the fruits of the pure morality which it introduced?

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4. If one pendulum defcribe the arch reprefented by AC*a*, and another defcribe the arch KC*k*, they will defcribe them in equal times, and their maximum velocities (viz. their velocities in the middle point), are proportional to AC and KC; that is, the velocities in the middle point are proportional to the width of the ofcillations.

The fame proportions are true with refpect to the motions outwards from C. That is, when the pendulum defcribes CA, with the initial velocity CH, its velocity at K is reduced to KM by the retarding action of gravity. It is reduced to BF at B, and to nothing at A; and the times of defcribing CK, KB, BA, CA, are as HM, HF, HA. Another pendulum fetting out from C, with the initial velocity CO, reaches only to K, CK being = CO. Alfo the times are equal.—If we confider the whole ofcillation as performed in the direction A*a*, the forces AD, BE, KL accelerate the pendulum, and the fimilar forces *ad*, *be*, *kl*, on the other fide, retard it. The contrary happens in the next ofcillation *a*CA.

5. The areas DABE, DAKL, &c. are proportional to the fquares of the velocities acquired by moving along AB, AK, &c. or to the diminution of the fquares of the velocities fuftained by moving outwards along BA or KA, &c.

The confideration of this figure will enable the reader (even though not a mathematician) to form fome notion of the effect of any propofed application of a maintaining power by means of wheelwork: For, knowing the weight of the pendulum, we know the accelerating action of that weight in any particular fituation A of the pendulum. We alfo know what addition or fubtraction we produce on the pendulum in that fituation by the wheel-work. Suppofe it is an addition of preffure equal to a certain number of grains. We can make AD to Dδ as the firft to the laft; and then Aδ will be the whole force urging the pendulum toward C. Doing the fame for every point of AC, we obtain a line $\delta\varepsilon\lambda c$, which is a new fcale of forces, and the fpace DCδ, comprehended between the two fcales CD and Cδ, will exprefs the addition made to the fquare of the velocity in paffing along AC by the joint action of gravity and the maintaining power. Alfo, by drawing a line $\kappa\pi$ perpendicular to AC, making the fpace C$\pi\kappa$ equal to CAD, the point π will be the limit of the ofcillation outward from C, where the initial velocity HC is extinguifhed. If the line $\kappa\pi$ cut the fame circle in θ, one-half the arch θA will nearly exprefs the contraction made in the time of the outward ofcillation by the maintaining power. An accurate determination of this laft circumftance is operofe, and even difficult; but this folution is not far from the truth, and will greatly affift our judgment of the effect of any propofal, even though $\kappa\pi$ be drawn only by the judgment of the eye, making the area left out as nearly equal to the area taken in as we can eftimate by infpection. This is faid from experience.

Since the motion of a pendulum or balance is alternate, while the preffure of the wheels is conftantly in one direction, it is plain that fome art muft be ufed to accommodate the one to the other. When a tooth of the wheel has given the balance a motion in one direction, it muft quit it, that it may get an impulfion in the oppofite direction. The balance or pendulum thus efcaping from the tooth of the wheel, or the tooth efcaping from the balance, has given to the general contrivance the name of SCAPEMENT among our artifts, from the French word *echappement*. We proceed, therefore, to confider this fubject more particularly, firft confidering the fcapements which are peculiarly fuited to the fmall vibrations of pendulums, and then thofe which muft produce much wider vibrations in balances. This, with fome other circumftances, render the fcapements for pendulums and balances very different.

I. *Of the Action of a Wheel and Pallet.*

THE fcapement which has been in ufe for clocks and watches ever fince their firft appearance in Europe, is extremely fimple, and its mode of operation is too obvious to need much explanation. In fig. 2. XY reprefents a horizontal axis, to which the pendulum P is attached by a flender rod, or otherwife. This axis has two leaves C and D attached to it, one near each end, and not in the fame plane, but fo that when the pendulum hangs perpendicularly, and at reft, the piece C fpreads a few degrees to the right hand, and D as much to the left. They commonly make an angle of 70, 80, or 90 degrees. Thefe two pieces are called PALLETS. AFB reprefents a wheel, turning round on a perpendicular axis EO, in the order of the letters AFEB. The teeth of this wheel are cut into the form of the teeth of a faw, leaning forward, in the direction of the motion of the rim. As they fomewhat refemble the points of an old fafhioned royal diadem, this wheel has got the name of the CROWN WHEEL. In watches it is often called the *balance wheel*. The number of teeth is generally odd; fo that when one of them B is preffing on a pallet D, the oppofite pallet C is in the fpace between two teeth A and I. The figure reprefents the pendulum at the extremity of its excurfion to the right hand, the tooth A having juft efcaped from the pallet C, and the tooth B having juft dropped on the pallet D. It is plain, that as the pendulum now moves over to the left, in the arch PG, the tooth B *continues* to prefs on the pallet D, and thus accelerates the pendulum, both during its defcent along the arch PH, and its afcent along the arch HG. It is no lefs evident, that when the pallet D, by turning round the axis XY, raifes its point above the plane of the wheel, the tooth B efcapes from it, and I drops on the pallet C, which is now nearly perpendicular. I preffes C to the right, and accelerates the motion of the pendulum along the arch GP. Nothing can be more obvious than this action of the wheel in maintaining the vibrations of the pendulum. We can eafily perceive, alfo, that when the pendulum is hanging perpendicularly in the line XH, the tooth B, by preffing on the pallet D, will force the pendulum a little way to the left of the perpendicular, and will force it fo much the farther as the pendulum is lighter; and, if it be fufficiently light, it will be forced fo far from the perpendicular that the tooth B will efcape, and then I will catch on C, and force the pendulum back to P, where the whole operation will be repeated. The fame effect will be produced in a more remarkable degree, if the rod of the pendulum be continued through the axis XY, and a ball Q put on the other end to balance P. And, indeed, this is the contrivance which was firft applied to clocks all over Europe, before the application of the pendulum. They were

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were balance clocks. The force of the wheel was of a certain magnitude, and therefore able, during its action on a pallet, to communicate a certain quantity of motion and velocity to the balls of the balance. When the tooth B escapes from the pallet D, the balls are then moving with a certain velocity and momentum. In this condition, the balance is checked by the tooth I catching on the pallet C. But it is not instantly stopped. It continues its motion a little to the left, and the pallet C forces the tooth I a little backward. But it *cannot* force it so far as to escape over the top of the tooth I; because all the momentum of the balance was generated by the force of the tooth B; and the tooth I is equally powerful. Besides, when I catches on C, and C continues its motion to the left, its lower point applies to the face of the tooth I, which now acts on the balance by a long and powerful lever, and soon stops its farther motion in that direction, and now, continuing to press on C, it urges the balance in the opposite direction.

Thus we see that in a scapement of this kind, the motion of the wheel must be very hobbling and unequal, making a great step forward, and a short step backward, at every beat. This has occasioned the contrivance to get the name of the RECOILING SCAPEMENT, the recoiling pallets. This hobbling motion is very observable in the wheel of an alarm.

Thus have we obtained two principles of regulation. The first and most obvious, as well as the most perfect, is the natural isochronous vibration of a pendulum. The only use of the wheelwork here, besides registering the vibrations, is to give a gentle impulsion to the pendulum, by means of the pallet, in order to compensate friction, &c. and thus maintain the vibrations in their primitive magnitude. But there is no such native motion in a balance, to which the motion of the wheels must accommodate itself. The wheels, urged by a determined pressure, and acting through a determined space (the face of the pallet), must generate a certain determined velocity in the balance; and therefore the time of the oscillation is also determined, both during the progressive and the retrograde motion of the wheel. The actions being similar, and through equal spaces, in every oscillation, they must employ the same time. Therefore a balance, moved in this manner, must be isochronous, and a regulator for a time-keeper.

By thus employing a balance, the horizontal position of the axis XY is unnecessary. Accordingly, the old clocks had this axis perpendicular, by which means the whole weight of the balance rested on the point of the pivot Y or X, according as the balance PQ was placed above or below. By making the supporting pivot of hard steel, and very sharp, friction was greatly diminished. Nay, it was entirely removed from this part of the machine by suspending the balance by a thread at the end X, instead of allowing it to rest on the point of the pivot Y.

As the balance regulator of the motion admits of every position of the machine, those clocks were made in an infinite variety of fanciful forms, especially in Germany, a country famous for mechanical contrivances. They were made of all sizes, from that of a great steeple clock, to that of an ornament for a lady's toilet. The substitution of a spring in place of a weight, as a first mover of the wheel-work, was a most ingenious thought. It was very gradual. We have seen, in the Emperor's museum at Brussels, an old (perhaps the first) spring clock, the spring of which was an old sword blade, from the point of which a catgut was wound round the barrel of the first wheel. Some ingenious German substituted the spiral spring, which both took less room, and produced more revolutions of the first wheel.

When clocks had been reduced to such small sizes, the wish to make them portable was very natural; and the means of accomplishing this were obvious, namely, a farther reduction of their size. This was accomplished very early; and thus we obtained pocket watches, moved by a spiral spring, and regulated by a balance with the recoiling scapement, which is still in use for common watches. The hobbling motion of the crown wheel is very easily seen in all of them.

It is very uncertain who first substituted a pendulum in place of the balance (CLOCK, *Encycl.*). Huyghens, as we have already observed, was the first who investigated the motions of pendulums with success, and his book *De Horologio Oscillatorio* may be considered as the elements of refined mechanics, and the source of all the improvements that have been made in the construction of scapements. But it is certain that Dr Hooke had employed a pendulum for the regulation of a clock many years before the publication of the abovementioned treatise, and he claims the merit of the invention of the *only proper* method of employing it. We imagine therefore that Dr Hooke's invention was nothing more than a scapement for a pendulum making small vibrations, without making use of the opposite motions of the two sides of the crown wheel. Dr Hooke had contrived some scapement more proper for pendulums than the recoiling pallets, because certainly those might be employed, and are actually employed as a scapement for pendulum clocks to this day, although they are indeed very ill adapted to the purpose. He had not only remarked the great superiority of such pendulum clocks as were made before Huyghens's publication of the cycloidal pendulum over the balance clocks, but had also seen their defects, arising from the light pendulums and wide arches of vibration, and invented a scapement of the nature of those now employed. The pendulum clock which he made in 1658 for Dr Wilkins, afterwards Bishop of Chester, is mentioned by the inventor as peculiarly suited to the moderate swing of a pendulum; and he opposes this circumstance to a general practice of wide vibrations and trifling pendulums. The French are not in the practice of ascribing to us any thing that they can claim as their own; yet Lepaute says that the *Echappement à l'Ancre* came from England about the year 1665. It is also admitted by him that clock-making flourished in England at that time, and that the French artists went to London to improve in it. Putting these and other circumstances together, we think it highly probable that we are indebted to Dr Hooke for the scapement now in use. The principle of this is altogether different from the simple pallets and direct impulse already described; and is so far from being obvious, that the manner of action has been misunderstood, even by men of science, and writers of systems of mechanics.

In this scapement we employ those teeth of the wheel which are moving in one direction; whereas in the former

former ſcapement, oppoſite teeth were employed moving in contrary directions. Yet even here we muſt communicate an alternate motion to the axis of the pallets. The contrivance, in general, was as follows: On the axis A (See fig. 3.) of the pendulum or balance is fixed a piece of metal BAC, called the CRUTCH by our artiſts, and the ANCHOR by the French. It terminates in two faces B *b* C *c* of tempered ſteel, or of ſome hard ſtone. Theſe are called the PALLETS, and it is on them that the teeth of the wheel act. The faces B *b* C *c* are ſet in ſuch poſitions that the teeth puſh them out of the way. Thus B puſhes the pallet to the left, and C puſhes its pallet to the right. Both puſh their pallets ſidewiſe outward from the centre of the wheel. The pallet B is uſually called the *leading*, and C the *driving* pallet by the artiſts, although it appears to us that theſe names ſhould be reverſed, becauſe B *drives* the pallet out of the way, and C *pulls* or leads it out of the way. They might be called the *firſt* and *ſecond* pallet, in the order in which they are acted on by the wheel. We ſhall uſe either denomination. The figure is accommodated to the inactive or reſting poſition of the pendulum Suppoſe the pendulum drawn aſide to the right at Q, and then let go. It is plain that the tooth B, preſſing on the face of the pallet β B *b* all the way from β to *b*, thruſts it aſide outwards, and thus, by the connection of the crutch with the pendulum rod, aids the pendulum's motion along the arch QPR. When the pendulum reaches R, the point of the tooth B has reached the angle *b* of the pallet, and eſcapes from it. The wheel preſſing forward, another tooth C drops on the pallet face C *c*, and, by preſſing this pallet outward, evidently aids the pendulum in its motion from R to P. The tooth C eſcapes from this pallet at the angle *c*, and now a tooth B′ drops on the firſt pallet, and again aids the pendulum; and this operation is repeated continually.

The mechaniſm of this communication of motion is thus explained by ſeveral writers of elements. The tooth B (fig. 2.) is urged forward in the direction BD, perpendicular to the radius MB of the SWING WHEEL. It therefore preſſes on the pallet, which is moveable only in the direction BE, perpendicular to BA the radius of the pallet. Therefore the force BD muſt be reſolved into two, *viz.* BE, in the direction in which alone the pallet can move, and ED, or BF, perpendicular to that direction. The laſt of theſe only preſſes the pallet and crutch againſt the pivot hole A. BE is the only uſeful force, or the force communicated to the pallet, enabling it to maintain the pendulum's motion, by reſtoring the momentum loſt by friction and other cauſes.

But this is a very erroneous account of the *modus operandi*, as may be ſeen at once, by ſuppoſing the radius of the pallets to be a tangent to the wheel. This is a poſition moſt frequently given to them, and is the very poſition in fig. 3. In this caſe MB is perpendicular to BA, and therefore BD will coincide with BA, and there will be no ſuch force as BE to move the pendulum. It is a truth deducible from what we know of the mechanical conſtitution of ſolid bodies, and confirmed by numberleſs obſervations, that when two ſolid bodies preſs on each other, either in impulſion or in dead preſſure, the direction in which the mutual preſſure is exerted is always perpendicular to the touching ſurfaces, whatever has been the direction of the impelling body (See IMPULSION, *Suppl.* n° 66. MACHINERY, *Suppl.* n° 35. and ſeveral other parts of this Work.) Moreover this preſſure is mutual, equal, and oppoſite. Whatever the ſhapes of the faces of the tooth and pallet, we can draw a plane BN, which is the common tangent to both ſurfaces, and a line HBI through the point of contact perpendicular to BN. It is farther demonſtrated in the article MACHINERY, *Suppl.* n° 35, &c. that the action of the wheel on the pendulum is the ſame as if the whole crutch were annihilated, and in its ſtead there were two rigid lines AH, MI, from the centres of the crutch and wheel, perpendicular to HI, and connected by a third rigid line or rod HI, touching the two in H and I.

For if a weight V be hung at *v*, the extremity of the horizontal radius M *v* of the wheel, it will act on the lever *v* MI, preſſing its point I upwards in the direction IH perpendicular to MI; the upper end of this rod IH will, in like manner, preſs the extremity H of the rod HA, and this will urge the pendulum from P toward R. To withſtand this, the pendulum rod AP may be withheld by a weight *z*, hanging by a thread on the extremity of the horizontal lever A *z*, equal to M *v*, and connected with the crutch and pendulum. The weights V and *z* may be ſo proportioned to each other that by acting perpendicularly on the crooked levers *v* MI, and *z* AH, the preſſures at H and I ſhall be equal, and juſt balance each other by the intervention of the rod HI. When this is the caſe, we have put things into the ſame mechanical ſtate, in reſpect of mutual action, as is effected by the crutch, pallets, and wheel, which, in like manner, produce equal preſſures at B the point of contact, in the direction BH and BI. The weight V may be ſuch as produces the very ſame effect at B that is produced by the previous train of wheel-work. The weight *z* therefore muſt be juſt equal to the force produced by the wheel-work on the point *z* of the pendulum rod, becauſe by acting in the oppoſite direction it juſt balances it. Let us ſee therefore what force is communicated to the pendulum by the wheels.

Let x be the upward preſſure excited at I, and y the equal oppoſite preſſure excited at H. Then, by the property of the lever, we have $\text{MI} : \text{M}\, v = \text{V} : x$, and $x \times \text{MI} = \text{V} \times \text{M}\, v$. In like manner $y \times \text{AH} = \text{Z} \times \text{A}\, z$. Therefore, becauſe $x = y$, and $\text{A}\, z = \text{M}\, v$, we have $\text{V} : \text{Z} = \text{MI} : \text{AH}$. That is, the force exerted by the tooth of the wheel in the direction of its motion is to the force impreſſed on the pendulum rod at a diſtance equal to the radius of the wheel as MI to AH. The force impreſſed on the ball of the pendulum is leſs than this in the proportion of AP to A *z*, or M *v*.

Cor. 1. If the perpendiculars MN, AV, be drawn on the tangent plane, the forces at B and *z* will be as BN to BO. For theſe lines are reſpectively equal to MI and AH.

Cor. 2. If HI meet the line of the centres AC in S, the forces will be as SM to SA; that is $\text{V} : \text{Z} = \text{SM} : \text{SA}$.

Cor. 3. If the face β B *b* of the pallet be the evolutrix of a circle deſcribed with the radius AH, and the face of the tooth be the evolutrix of a circle deſcribed with the radius MI, the force impreſſed on the pen-

dulum

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dulum by the wheels will be conftant during the whole vibration (MACHINERY, n° 36.) But thefe are not the only forms which produce this conftancy. The forms of teeth defcribed by different authors, fuch as De la Hire, Camus, &c. for producing a conftant force in trains of wheel-work, will have the fame effect here. It is alfo eafy to fee that the force impreffed on the pendulum may be varied according to any law, by making thefe faces of a proper form. Therefore the face, from B outwards, may be fo formed that the force communicated to the pendulum by the wheels, during its defcent from Q to P, may be in one conftant proportion to the acceleration of gravity, and then the fum of the forces will be fuch as produce ifochronous vibrations. If the inner part B b of the face be formed on the fame principle, the difference of the forces will have the fame law of variation. If the face $\beta\, b$ be the evolutrix of a circle, and the tooth B terminate in a point gently rounded, or quite angular, the force on the pendulum will continually increafe as the tooth flides from β to b. For the line AH continues of the fame magnitude, and MI diminifhes. The contrary will happen, if the pallet be a point, either fharp or rounded, and if the face of the tooth be the evolutrix now mentioned; for MI will remain the fame, while AH diminifhes. If the tooth be pointed, and $\beta\, b$ be a ftraight line, the force communicated to the pendulum will diminifh, while the tooth flides from β to b. For in this cafe AH diminifhes and MI increafes.

Cor. 4. In general the force on the pendulum is greater as the angle MB b increafes, and as AB b diminifhes.

Cor. 5. The angular velocity of the wheel is to that of the pendulum, in any part of its vibration, as AH to MI. This is evident, becaufe the rod IH moving (in the moment under confideration) in its own direction, the points H and I move through equal fpaces, and therefore the angles at A and M muft be inverfely as the radii.

All that has now been faid of the firft pallet AB may be applied to the fecond pallet AC.

If the perpendiculars C s be drawn to the touching plane o C n, cutting AM in s, we fhall have $V : z = s\,M : s\,A$, as in Cor. 2. And if the perpendiculars M i, A h, be drawn on C s, we have $V : Z = M\,i : A\,h$, as in the general theorem. The only difference between the action on the two pallets is, that if the faces of both are plain, the force on the pendulum increafes during the whole of the action on the pallet C, whereas it diminifhes during the progrefs of the tooth along the other pallet.

The reader will doubtlefs remark that each tooth of the wheel acts on both pallets in fucceffion; and that, during its action on either of them, the pendulum makes one vibration. Therefore the number of vibrations during one turn of the wheel is double the number of the teeth: confequently, while the tooth flides along one of the pallets, it advances half the fpace between two fucceffive teeth; and when it efcapes from the pallet, the other tooth *may* be juft in contact with the other pallet. We fay it *may* be fo; in which cafe there will be no dropping of the teeth from pallet to pallet. This, however, requires very nice workmanfhip, and that every tooth be at precifely the fame diftance from its neighbour. Should the tooth which is juft going to apply to a pallet chance to be a little too far advanced on the wheel, it would touch the pallet before the other had efcaped. Thus, fuppofe that before B efcapes from the point b of the pallet, the tooth C is in contact with the pallet CG, B cannot efcape. Therefore when the pendulum returns from R towards Q, the pallet $\beta\, b$, returning along with it, will pufh back the tooth B of the wheel. It does this in oppofition to the force of the wheel. Therefore, whatever motion the wheel had communicated to the pendulum, during its fwing from P to Q, will now be taken from it again. The pendulum will not reach Q, becaufe it had been aided in its motion from Q, and had proceeded further than it would have done without this help. Its motion toward Q is further diminifhed by the friction of the pallet. Therefore it will now return again from fome nearer point q, and will not go fo far as in the laft vibration, but will return through a ftill fhorter arch: And this will be ftill more contracted in the next vibration, &c. &c. Thus it appears that if a tooth chances to touch the pallet before the efcape of the other, the wheel will advance no farther, and foon after the pendulum will be brought to reft.

For fuch reafons it is neceffary to allow one tooth to efcape *a little before* the other reaches the pallet on which it is to act, and to allow a fmall drop of the teeth from pallet to pallet. But it is accounted bad workmanfhip to let the drop be confiderable, and *clofe fcapement* is accounted a mark of care and of good workmanfhip. It is evidently an advantage, becaufe it gives a longer time of action on each pallet. This freeing the fcapement cannot be accomplifhed by filing fomething from the face of the tooth; becaufe this being done to all, the diftance between them is diminifhed rather than augmented. The pallets muft be firft fcaped as clofe as poffible. This obliges the workman to be careful in making the teeth equidiftant. Then a fmall matter is taken from the point of each pallet, by filing off the back $b\, r$ of the pallet. The tooth will now efcape before it has moved through half a fpace.

From all that has been faid on this particular, it appears that the interval between the pallets muft comprehend a certain number of teeth, and half a fpace more.

The firft circumftance to be confidered in contriving a fcapement is the angular motion that is intended to be given to the pendulum during the action of the wheel. This is ufually called the *angle of fcapement*, or the *angle of action*. Having fixed on an angle a that we think proper, we muft fecure it by the pofition and form of the face of the pallets. Knowing the number of teeth in the fwing-wheel, divide 180° by this number, and the quotient is the angle b of the wheel's motion during one vibration of the pendulum. In the line AM, joining the centres of the crutch and wheel, make SM to SA, and sM to sA, as the angle a to the angle b; and then, having determined how many teeth fhall be comprehended between the pallets, call this number n. Multiply the angle b by $n+1$, and take the half of the product. Set off this half in the circumference of the wheel (at the points of the teeth) on each fide of the line joining the centres of the crutch and wheel, as at TB and TC. Through S and s draw SB and sC, and through B draw βBb perpendicular to SB, for the medium pofition of the face of the firft pallet; that is, for

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for its position when the pendulum hangs perpendicular. In like manner, drawing oCn perpendicular to sC, we have the medium position of the second pallet. The demonstration of this construction is very evident from what has been said.

We have hitherto supposed that the pendulum finishes its vibration at the instant that a tooth of the wheel escapes from a pallet, and another tooth drops on the other pallet. But this is never, or should never be, the case. The pendulum is made to swing somewhat beyond the angle of scapement: for if it do not when the clock is clean and in good order, but stop precisely at the drop of a tooth, then, when it grows foul, and the vibration diminishes, the teeth will not escape at all, and the clock will immediately stop. Therefore the force communicated by the wheels during the vibration within the limits of scapement, must be increased so as to make the pendulum *throw* (as the artists term it) farther out; and a clock is more valued when it throws out considerably beyond the angle of scapement. There are good reasons for this. The momentum of the pendulum, and its power to regulate the clock (which Mr Harrison significantly called its *dominion*), is proportional to the width of its vibrations very nearly.

This circumstance of exceeding the angle of scapement has a very great influence on the performance of the clock, or greatly affects the dominion of the pendulum. It is easy to see that, when the face βb of the leading pallet is a plane, if the pendulum continue its motion to the right, from P toward Q, after the tooth B has dropped on it, the pallet will push the wheel back again, while the tooth slides outward on the pallet toward β. Such pallets therefore will make a *recoiling scapement*, resembling, in this circumstance, the old pallet employed with the crown wheel, and will have the properties attached to this circumstance. One consequence of this is, that it is much affected by any inequalities of the maintaining power. It is a matter of the most familiar observation, that a common watch goes slower when within a quarter of an hour of being down, when the action of the spring is very weak, in consequence of its not pulling by a radius of the fusee. We observe the same thing in the beating of an alarum clock. Also if we at any time press forward the wheelwork of a common watch with the key, we observe its beats accelerate immediately. The reason of this is pretty plain. The balance, in consequence of the acceleration in the angle of scapement, would have gone much farther, employing a considerable time in the excursion. This is checked abruptly, which both shortens the vibration and the time employed in it. In the return of the pendulum, the motion is accelerated the whole way, along an arch which is shorter than what corresponds to its velocity in the middle point; for it is again checked on the other side, and does not make its full excursion. Moreover, all this irregularity of force, or the great deviation from a resistance to the excursion proportional to the distance from the middle point, is exerted on the pendulum when it is near the end of the excursion, where the velocity being small, this irregular force acts long upon it, at the very time that it has little force wherewith to resist it. All temporary inequalities of force, therefore, will be more felt in this situation of the balance than if they had been exerted in the middle of its motion. And although the regulating power of a pendulum greatly exceeds that of the light balances used in pocket watches, something of the same kind may be expected even in pendulum clocks. Accordingly this appears by a series of experiments made by Mr Berthoud, a celebrated watchmaker of Paris. A clock, with a half second pendulum weighing five drams, was furnished with a recoiling scapement, whose pallets were planes. The angle of scapement was $5\frac{1}{2}$ degrees. When actuated with a weight of two pounds, it swung 8°, and lost 15″ per hour; with four pounds, it swung 10°, and lost 6″. Thus it appears that by doubling the maintaining power, although the vibration was increased in consequence of the greater impulse, the time was lessened 9″ per hour, viz. about $\frac{1}{400}$. It is plain, from what was said when we described the first scapement, that an increase of maintaining power must render the vibration more frequent. We saw, on that occasion, that, even when the gravity of the pendulum is balanced by a weight on the other end of the rod, the force of the wheels will produce a vibratory motion, and that an augmentation of this force will increase it, or make the vibrations more rapid. The precise effect of any particular form of teeth can be learned only by computing the force on the pendulum in every position, and then constructing the curve $\delta\epsilon\lambda C$ of fig. 1. The rapid increase of the ordinates beyond those of the triangle ADC, forms a considerable area $DA\pi o$, to compensate the area κoC, and thus makes a considerable contraction $A\pi$ of the vibration, and a sensible contraction $\frac{A\theta}{2}$ of the time.

Mr George Graham, the celebrated watchmaker in London, was also a good mathematician, and well qualified to consider this subject scientifically. He contrived a scapement, which he hoped would leave the pendulum almost in its natural state. The acting face of the pallet abc (fig. 4) is a plane. The tooth drops on a, and escapes from c, and is on the middle point b when the pendulum is perpendicular. Beyond a, the face of the pallet is an arch ad, whose centre is A, the centre of the crutch. The maintaining power is made so great as to produce a much greater vibration than the angle of active scapement aAc. The consequence of this is that, when the tooth drops on the angle a, the pendulum, continuing its motion, carries the crutch along with it, and the tooth passes on the arch ad, in a direction passing through the centre of the crutch. This pressure can neither accelerate nor retard the motion of the crutch and pendulum. As the pendulum was accelerated after it passed the perpendicular, by the other pallet, it will (if quite unobstructed) throw out farther than what corresponds to the velocity which it had in the middle point of its vibration; perhaps till the tooth passes from a to e on the circular arch of the pallet. But although it sustains no contrary action from the wheels during this excursion beyond the angle of scapement, it will not proceed so far, but will stop when the tooth reaches d; because there must be some resistance arising from the friction of the tooth along the arch ad, and from the clamminess of the oil employed to lubricate it: but this resistance is exceedingly minute, not amounting to $\frac{1}{8}$th of the pressure on the arch. Nay, we think that it appears from the experiments of Mr Coulomb that, in the case of such minute pressures

preſſures on a ſurface covered with oil, there is no ſenſible retardation analogous to that produced by friction, and that what retardation we obſerve ariſes entirely from the clamminefs of the oil. We are ſo imperfectly acquainted with the manner in which friction and viſcidity obſtruct the motions of bodies, that we cannot pronounce deciſively what will be their effect in the preſent caſe. Friction does not increaſe much, if at all, by an increaſe of velocity, and appears like a fixed quantity when the preſſure is given. This makes all motions which are obſtructed by friction terminate abruptly. This will ſhorten both the length and the time of the outward excurſion of the pendulum. The viſcidity of the oil reſiſts differently, and more nearly in the proportion of the velocities. The diminution of motion will not be in this proportion, becauſe in the greater velocities it acts for a ſhorter time. Were this accurately the caſe, the reſiſtance of viſcidity would alſo be nearly conſtant, and it would operate as friction does. But it does not ſtop a motion abruptly, and the motions are extinguiſhed gradually. Therefore, although viſcidity muſt always diminiſh the extent of the excurſion, it may ſo vary as not to diminiſh the time. We apprehend, however, that it generally does. But whatever happens in the excurſion, the return will certainly be ſlower, and employ more time than if it had not been obſtructed, becauſe the velocity in every point is leſs than if perfectly free. The whole arch, conſiſting of a returning arch and an excurſion on the other ſide, may be either ſlower or quicker, according as the compenſation is complete or not, or is even overdone.

All theſe reflections occurred to Mr Graham; and he was perſuaded that the time of the tooth's remaining on the arch *a d*, both aſcending and deſcending, would differ very little from that of the deſcription of the ſame arch by a free pendulum. The great cauſes of irregularity ſeemed to be removed, viz. the inequalities in the action of the wheels in the vicinity of the extremity of the vibration, where the pendulum having little momentum is, long in the ſame little ſpace, expoſed to their action. The derangement produced by any force depends on the time of its action, and therefore muſt be greateſt when the motion is ſloweſt. The pendulum gets its impulſe in the very middle of its vibration, where its velocity is the greateſt; and therefore the inequalities of the maintaining power act on it only for a ſhort time, and make a very trifling alteration in the time of its deſcribing the arch of ſcapement. Beyond this, it is nearly in the ſtate of a free pendulum; nay, even though it be affected by an inequality of the maintaining power, and it be accelerated beyond its uſual rate in that arch, the chief effect of this will be to cauſe it to deſcribe a larger arch of excurſion. The ſhortening of the time of this deſcription by the friction will be the ſame as before, happening at the very end of the excurſion; but the return will be more retarded by the friction on a longer arch. And, by this, a compenſation may be made for the trifling contraction of the time of deſcribing the arch of ſcapement.

This circumſtance of giving the impulſe in the middle of the vibration, where its time of action is the ſmalleſt poſſible, and whereby the pendulum is ſo long left free from the action of the wheels, is of the very firſt importance in all ſcapements, and ſhould ever be in the mind of the mechanician. When this is adhered to, the form of the face *abc* is ſcarcely of any moment. Much has been written on this form, and many attempts have been made to make it ſuch that the action of the wheels ſhall be proportional to the action of gravity. To do this is abſolutely impoſſible. Mr Graham made them planes, not only becauſe of eaſieſt execution, but becauſe a plane really conſpires pretty well with the change of gravity. While the pendulum moves from Q to P (fig. 3.), the force of gravity, acting in the direction QP, is continually diminiſhing. So is the accelerating power of the pallet from *a* to *b*. When the pendulum riſes from P to R, a force in the oppoſite direction RP continually increaſes. This is analogous to the continual diminution of a force in the direction PR. Now we have ſuch a diminution of ſuch a force, in the action of the pallet from *b* to *c*, and ſuch an augmentation in the action of the other pallet.

For all theſe reaſons, this conſtruction of a ſcapement appeared very promiſing. Mr Graham put it in practice, and it anſwered his moſt ſanguine expectation, and is now univerſally adopted in all nice clocks. Mr Graham, however, did not think it prudent to cauſe a tooth to drop on the very angle *a* of the pallet. He made it drop on a point *f* of the arch of excurſion. This has alſo the advantage of diminiſhing the angle of action, which we have proved to be of ſervice. It requires, indeed, a greater maintaining power; but this can eaſily be procured, and is leſs affected by the changes to which it is liable by the effect of heat and cold on the oil. Our obſervations on the effects of friction and viſcidity in the arch *a d* ſeem to be confirmed by the obſervations of ſeveral artiſts, who agree in ſaying that a great increaſe of maintaining power increaſes the vibrations, but makes them perceptibly ſlower. When they wrote, much oil was applied to diminiſh the friction on the arch of repoſe; but, ſince that time, the rubbing parts were made ſuch as required no oil, and this retardation diſappeared. In the clock of the tranſit room of the Royal Obſervatory, the angle of action ſeldom exceeds one-third of the ſwing of the pendulum. The pallets are of oriental ruby, and the wheel is of ſteel tempered to the utmoſt degree of hardneſs. This clock never varies a whole ſecond from equable motion in the courſe of five days.

This contrivance is known by the name of the DEAD BEAT, the DEAD SCAPEMENT; becauſe the ſeconds index ſtands ſtill after each drop, whereas the index of a clock with a recoiling ſcapement is always in motion, hobbling backward and forward.

Theſe ſcapements, both recoiling and dead beat, have been made in a thouſand forms; but any perſon tolerably acquainted with mechanics, will ſee that they are all on the ſame principles, and differ only in ſhape or ſome equally unimportant circumſtance. Perhaps the moſt convenient of any is that repreſented in fig. 5. where the ſhaded part is the crutch, made of braſs or iron, and A and B are two pieces of agate, flint, or other hard ſtone, cut into the proper ſhape for a pallet of either kind, and firmly fixed in proper ſockets. They project half an inch, or thereabouts, in front of the crutch, ſo that the ſwing wheel is alſo before the crutch, diſtant about $\frac{1}{10}$th of an inch or ſo. Pallets of ruby, driven by a hard ſteel ſwing wheel, need no oil, but merely to be once rubbed clean with an oily cloth.

Sometimes the wheel has pins inſtead of teeth. They are

are ranged round the rim of the wheel, perpendicular to its plane, and both pallets are on one fide of the wheel, ftanding perpendicular to its plane. One of thefe pins drops from the firft to the fecond pallet at once. The pallets are placed on two arms, as in fig. 6. in which cafe the pins are alternately on different fides of the wheel; or on one, as in fig. 7. By the motion of the pendulum to the right, the pin (in fig. 7.), after refting on the concave arch *d a*, acts on the face *a c*, and drops from *c* on the other concave arch *i g*, which continues to move a little way to the right. It then returns, and the pin flides and acts on the pallet *i h*, and efcapes at *h*; and the next pin is then on the arch of repofe *d a*.

It being evident that the recoiling fcapement accelerates the vibrations beyond the rate of a free pendulum, and it alfo appearing to many of the firft artifts that the dead fcapement retards them, they have attempted to form a fcapement which fhall avoid both of thefe defects, by forming the arches *a d*, *i g*, fo as to produce a very fmall recoil. Mr Berthoud does this in a very fimple manner, by placing the centre of *a d* at a fmall diftance from that of the crutch, fo as to make the rife of the pallet above the concentric arch about one-third of the arch itfelf. Applying fuch a crutch to the light pendulum mentioned in a former paragraph, he found that doubling, and even trebling the maintaining power, produced no change in the time of vibration, though it increafed the width from 8° to 12° and 14°. We have no doubt of the efficacy of this contrivance, and think it very proper for all clocks which require much oil, fuch as turret clocks, &c. But we apprehend that no rule can be given for the angle that the recoiling arch fhould make with the concentric one. We imagine that this depends entirely on the fhare which friction and oil have in producing the retardation of the dead beat.

Other artifts have endeavoured to avoid the inconveniences of friction and oil on the arch of repofe in another way. Inftead of allowing the tooth of the wheel to drop on the back of the pallet, which we called the *arch of excurfion*, and others call the *arch of repofe*, it drops on a detent *o t a* (fig. 8.), of which the part *t a* is part of an arch whofe centre is A, the centre of the crutch, and the part *t o* is in the direction of the radius. This piece does not adhere to the pallet, but is on the end of an arm *o* A, which turns round the axis A of the crutch on fine pivots: it is made to apply itfelf to the back of the pallet by means of a flender fpring *Ap*, attached to the pallet, and preffing inward on a pin *p*, fixed in the arm of the detent. When fo applied, its arch *t a* makes the repofe, and its point *a* makes a fmall portion of the face *a c* of the pallet.

The action of this apparatus is very eafily underftood. When a tooth efcapes from the fecond pallet, by the motion of the pendulum from the left to the right, another tooth drops on this pallet (which the figure fhews to be the firft or leading pallet) at the angle *t*, and refts on the fmall portion *t a* of an arch of repofe. But the crutch continuing its motion to the right, immediately quits the arm *o* A, carrying the pallet *a c r* along with it, and leaving the wheel locked on the detent *o t a*. By and bye the pendulum finifhes its excurfion to the right, and returns. When it enters the arch of action, the pallet has applied itfelf to the detent *o t a*, and withdraws it from the tooth. The tooth immediately acts on the face *a c* of the pallet, and reftores the motion loft during the laft vibration. The ufe of the fpring is merely to keep the detent applied to the pallet without fhaking. It is a little bent during their feparation, and adds fomething of an oppofing force to the afcent of the pendulum on the other fide of the wheel, and accelerates its return. A fimilar detent on the back of the fecond pallet performs a fimilar office, fupporting the wheel while the pendulum is beyond the arch of fcapement, and quitting it when the pendulum enters that arch.

We do not know who firft practifed this very ingenious and promifing invention. Mr Mudge certainly did fo early as 1753 or 1754. Mr Berthoud fpeaks obfcurely of contrivances of the fame nature. So does Le Roy, and (we think) Le Paute. We fay that it is very promifing. Friction is almoft annihilated by transferring it to the pivots at A; fo that, in the excurfion beyond the angle of fcapement, the pendulum feems almoft free. Indeed fome artifts of our acquaintance have even avoided the friction of the pivots at A, by making the arm of the detent a fpring of confiderable thicknefs, except very near to A, where it is made very thin and broad. But we do not find that this conftruction, though eafily executed, and fufceptible of great precifion and fteadinefs of action, is much practifed. We prefume that the performance has not anfwered expectations. It has not been fuperior to the incomparably more fimple dead fcapement of Graham. Indeed we think that it cannot. A part of the friction ftill remains, which cannot be removed; namely, while the arch *t a* is drawn from between the tooth and pallet. Nay, we apprehend that fomething more than friction muft be overcome here. The tooth is apt to force the detent outward, unlefs the part *t a* be a little elevated at its point *a* like a claw, above the concentric arch, and the face of the tooth be made to incline forward, fo as to fit this fhape of the detent. This will confume fome force, when the momentum of the pendulum is by no means at its maximum. Should the clock be foul, and the excurfions beyond fcapement be very fmall, this difturbance muft be exceedingly pernicious. But we have a much greater objection. During the whole excurfion beyond fcapement, there is a new force of a fpring acting on the pendulum, which deviates confiderably from the proportions of the accelerating power of gravity. It does not commence its action till the detent feparates from the arm of the crutch. Then the fpring of the detent acts as a retarding force againft the excurfion of the pendulum, now on the other fide, bringing it fooner to reft, and then accelerating it in its way back to the beginning of the arch of fcapement. In fhort, this conftruction fhould have the properties of a recoiling fcapement. We got a clock-maker to make fome experiments on one which he had made for an amateur, which fully confirmed our conjecture. When the detent fpring was ftrong, an increafe of maintaining power made the vibrations both wider and more rapid. The artift reduced the ftrength of the fpring till this effect was rendered very fmall. It might perhaps be quite removed by means of a ftill weaker fpring: But the fpring was already fo weak that a hard ftep on the floor of the room did fometimes difengage the detent from the wheel. It appears, therefore, that nothing can be reafonably expected from this conftruction that

that is not as well performed by the dead ſcapement of Mr Graham, of much eaſier execution, and more certain performance.

Very ſimilar to this conſtruction (at leaſt in the excurſion beyond the angle of ſcapement) is the conſtruction of Mr Cumming, and it has the ſame defects. His pallets are carried, as in the one deſcribed, by the crutch. The detents preſs on them behind by their weight only: therefore when the tooth is locked on the detent of one pallet, its weight is taken off from the pendulum on that ſide, and the weight of the detent on the other ſide oppoſes the aſcent, and accelerates the deſcent of the pendulum.

Mr Cumming executed another ſcapement, conſiſting, like thoſe, of a pallet and detent. But the manner of applying the maintaining power is extremely different in principle from any yet deſcribed. It is exceedingly ingenious, and ſeems to do all that is poſſible for removing every ſource of irregularity in the maintaining power, and every obſtruction to free motion ariſing from friction and oil in the ſcapement. For this reaſon we ſhall give ſuch an account of its eſſential circumſtances as may ſuffice to give a clear conception of its manner of acting, and its good properties and defects; but referring the inquiſitive reader to Mr Cumming's Elements of Clock and Watch Work, publiſhed in 1766, for a more full account.

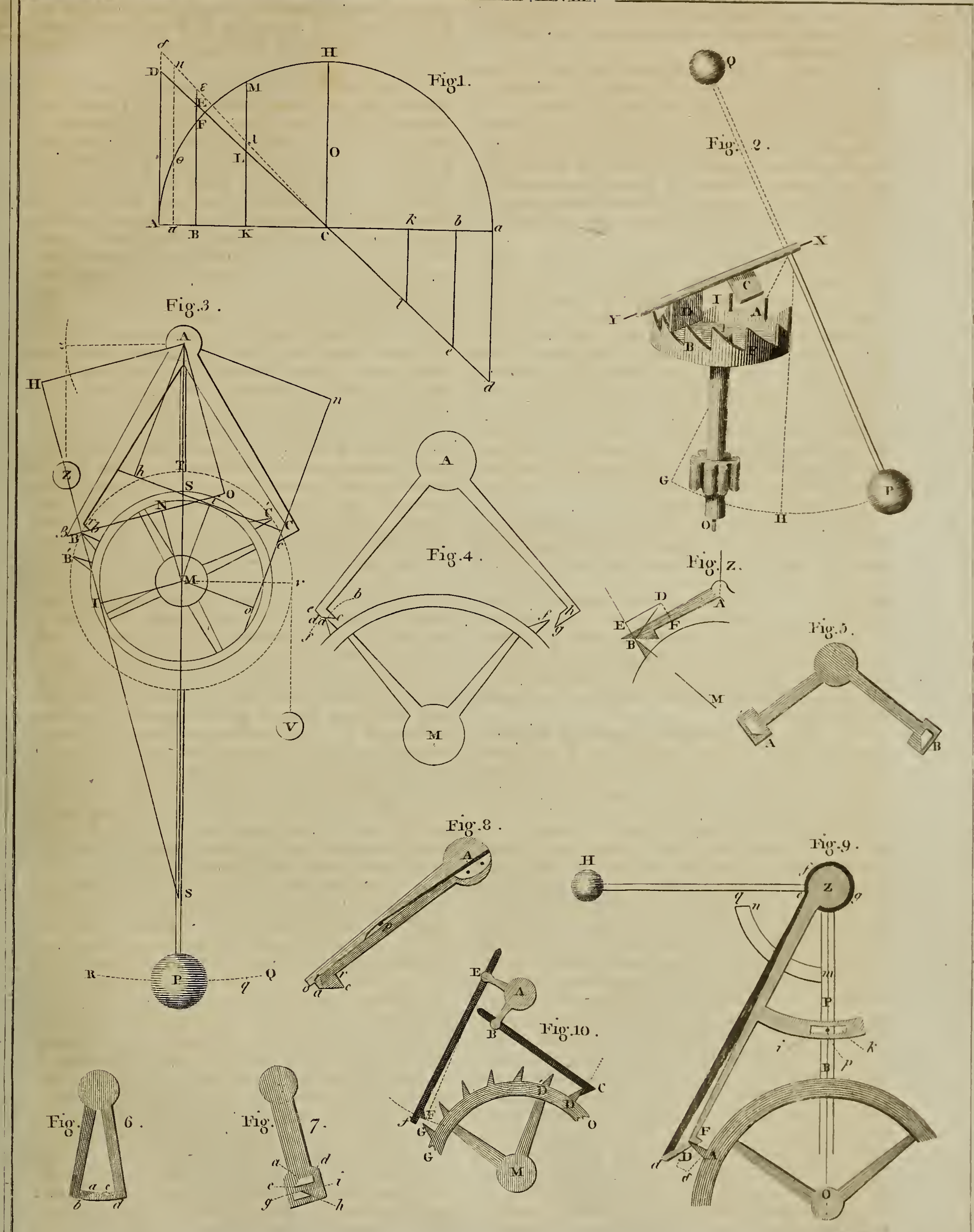
In the ſcapements laſt deſcribed, the pallets were fixed to the crutch and pendulum, and the maintaining power, during its action, was applied to the pendulum by means of the pallets, in the ſame way as in ordinary ſcapements. The detents were unconnected with the pendulum, and it was free during the whole excurſion. In the preſent ſcapement both the pallets and detents are detached from the pendulum, except in the moment of unlocking the wheel; ſo that the pendulum may be ſaid to be free during its whole vibration, except during this ſhort moment.

ABC (fig. 9.) repreſents a portion of the ſwing wheel, of which O is the centre, and A one of the teeth; Z is the centre of the crutch, pallets, and pendulum. The crutch or detent is repreſented of a form reſembling the letter A, having in the circular croſs piece a ſlit *i k*, alſo circular, Z being the centre. This form is very different from Mr Cumming's, and inferior to his, but was adopted here in order to avoid a long deſcription. The arm ZF forms the firſt detent, and the tooth A is repreſented as locked on it at F. D is the firſt pallet on the end of the arm Z *d* moveable round the ſame centre with the detents, but moveable independently of them. The arm *d e*, to which the pallet D is attached, lies altogether behind the arm ZF of the detent, being fixed to a round piece of braſs *e f g*, which has pivots turning concentric with the verge or axis of the pendulum. To the ſame round piece of braſs is fixed the horizontal arm *e* H, carrying at its extremity the ball H, of ſuch ſize that the action of the tooth A on the pallet D is juſt able (but without any riſk of failing) to raiſe it up to the poſition here drawn. ZP*p* repreſents the fork, or the pendulum rod, behind both detent and pallet. A pin *p* projects forward, coming through the ſlit *i k*, without touching the upper or under margin of it. There is alſo attached to the fork the arm *m n* (and a ſimilar one on the other ſide), of ſuch length that, when the pendulum rod is perpendicular, as is repreſented here, the angular diſtance of *n q* from the rod *e q* H is preciſely equal to the angular diſtance of the left ſide of the pin *p* from the left end *i* of the ſlit *i k*.

The mode of action on this apparatus is abundantly ſimple. The natural poſition of the pallet D is at *δ*, repreſented by the dotted lines, reſting on the back of the detent F. It is naturally brought into this poſition by its own weight, and ſtill more by the weight of the ball H. The pallet D, being ſet on the fore ſide of the arm at Z, comes into the ſame plane with the detent F and the ſwing-wheel. It is drawn, however, in the figure in another poſition. The tooth C of the wheel is ſuppoſed to have eſcaped from the ſecond pallet, on which the tooth A immediately engages with the pallet D, ſituated at *δ*, forces it out, and then reſts on the detent F, the pallet D leaning on the tip of the tooth. F is brought into this ſituation in a way that will appear preſently. After the eſcape of C, the pendulum, moving down the arch of ſemivibration, is repreſented as having attained the vertical poſition. Proceeding ſtill to the left, the pin *p* reaches the extremity *i* of the ſlit *i k*; and, at the ſame inſtant, the arm *n* touches the rod *e* H in *q*. The pendulum proceeding, a hair's breadth further, withdraws the detent F from the tooth, which now even puſhes off the detent, by acting on the ſlant face of it. The wheel being now unlocked, the tooth following C on the other ſide acts on its pallet, puſhes it off, and reſts on its detent, which has been rapidly brought into a proper poſition by the action of A on the ſlant face of F. It was a ſimilar action of C on its detent, in the moment of eſcape which brought F into a fit poſition for locking the wheel by the tooth A. The pendulum ſtill going on, the arm *m n* carries the weight of the ball H, and the pallet connected with it, and it comes to reſt before the pin *p* again reaches the end of the ſlit, which had been ſuddenly withdrawn from it by the action of A on the ſlant face of F. The pendulum now returns towards the right, loaded on the left with the ball H, which reſtores the motion which it had loſt during the laſt vibration. When, by its motion to the right, the pin *p* reaches the end *k* of the ſlit *i k*, it unlocks the wheel on the right ſide. At the ſame inſtant the weight H ceaſes to act on the pendulum, being now raiſed up from it by the action of a tooth like B on the pallet D.

Let us now conſider the mechaniſm of theſe motions. The prominent feature of the contrivance is the almoſt complete diſengagement of the regulator from the wheels. The wheels, indeed, act on the pallets; but the pallets are then detached from the pendulum. The ſole uſe of the wheel is to raiſe the little weights while the pendulum is on the other ſide, in order to have them in readineſs at the arrival of the pendulum. They are then laid on the pendulum, and ſupply an accelerating force, which reſtores to the pendulum the momentum loſt during the preceding vibration. Therefore no inequalities in the action of the wheel on the pallets, whether ariſing from friction or oil, has any effect on the maintaining power. It remains always the ſame, namely, the rotative momentum of the two weights. The only circumſtance, in which the irregularity of the action of the wheels can affect the pendulum is at the moment of unlocking. Here indeed the regulator may be affected; but this moment is ſo ſhort, in compariſon with other

WATCH WORK. PLATE. XLVIII.



Lawson, sc.

Watch-work.

other fcapements, that it muft be confidered as a real improvement.

It is very uncandid to refufe the author a claim to the character of an ingenious artift on account of this contrivance, as has been done by a very ingenious univerfity Profeffor, who taxes Mr Cumming with ignorance of the *firft elements of mechanics*, and fays that the beft thing in his book is his advice to fufpend the pendulum from a great block of marble, firmly fixed in the wall*. This is certainly a good advice, and we doubt not but that the Profeffor's clock would have performed ftill better if he had condefcended to follow it. It is ftill lefs candid to queftion the originality of the invention. We know for certain that it was invented at a time and place where the author *could* not know what had been done by others. It would have been more like the urbanity of a well-educated man to have acknowledged the genius, which, without fimilar advantages, had done fo much.

* See *Ludlum's Effay*.

But while we thus pay the tribute of juftice to Mr Cumming, we do not adopt all his opinions. The clock has the fame defects of the former in refpect of the laws of the force which accelerates the pendulum. The fudden addition of the fmall weight, and this almoft at the extremity of the vibration, would derange it very much, if the addition were fufceptible of any fenfible variation. The irregularity of the action of the wheels *may* fenfibly affect the motion during the unlocking, when the clock is foul, and the pendulum *juft* able to unlock; for any difturbance at the extremity of the vibration greatly affects the time. We acknowledge that the parts which we here fuppofe to be foul may not be fo in the courfe of twenty years, thefe parts being only the pivots of the fcapement. The great defect of the fcapement is its liablenefs to unlock by any jolt. It is more fubject to this than the others already mentioned. This rifk is much increafed by the flender make of the parts, in Mr Cumming's drawings, and in the only clock of the kind we have feen; but this is not neceffary: and it fhould be avoided for another reafon; the interpofing fo many flender and crooked parts between the moving power and the pendulum weakens the communication of power, and requires a much more powerful wheelwork.

All thefe, however, are flight defects, and only the laft can be called a fault. The clocks made on this principle have gone remarkably well, as may be feen by the regifters of his majefty's private obfervatory. But the greateft objection is, that they do not perform better than a well-made dead fcapement; and they are vaftly more troublefome to make and to manage. This is ftrictly true, and is a ferious objection. The fact is, that the dominion of a heavy pendulum is fo great, that if *any one* of the fcapements now defcribed be well executed with pallets of agate, and a wheel of hard fteel, and if the pendulum be fufpended agreeably to Mr Cumming's advice, there is hardly any difference to be obferved in their performance. We fhall content ourfelves with a fingle proof of this from fact. The clock invented by the celebrated Harrifon is *at leaft equal* in its performance to any other. Friction is almoft annihilated, and no oil is required. It went fourteen years without being touched, and during that time did not vary one complete fecond from one day to another, nor ever deviated half a minute by accumulation from equable motion: Yet the fcapement, in fo far as it refpects the law of the accelerating force, deviates more from the proportion of the fpaces than the moft recoiling fcapement that ever was put to a good clock. It is fo different from all hitherto defcribed, both in form and principle, that we muft not omit fome account of it, and with it we fhall conclude our fcapements for clocks.

Let GDO reprefent the fwing-wheel, of which M is the centre. A is the verge or axis of the pendulum. It has two very fhort arms AB, AE. A flender rod BC turns on fine pivots in the joint B, and has at its extremity C a hook or claw, which takes hold of a tooth D of the fwing-wheel when the pendulum moves from the right fide to the left. This claw, when at liberty, ftands at right angles, or, at leaft, in a certain determinate angle, with regard to the arm AB; and when drawn a little from that pofition, it is brought back to it again by a very flender fpring. The arm AE is furnifhed with a detent EF, which alfo, when at liberty, maintains its pofition on the arm by means of a very flender fpring.

Let us now fuppofe that the tooth D is preffing on the claw C, while the pendulum is moving to the right. The joint B yields, by its motion round A, to the preffure of the tooth on the claw. By this yielding, the angle ABC opens a little. In the mean time, the fame motion round A caufes the point F of the detent on the other fide to approach the circumference of the wheel in the arch of a circle, and the tooth G at the fame time advances. They meet, and the point of G is lodged in the notch under the projecting heel *f*. When this takes place, it is evident that any farther motion of the point E round A muft puth the tooth G a little backward, by means of the detent EF. It cannot come any nearer to the wheel, becaufe the point of the tooth ftops the heel *f*. The inftant that F pufhes G back, the tooth D is withdrawn from the claw C, and C flies out, by the action of its fpring, and refumes its pofition at right angles to BA; and the wheel is now free from the claw, but is pufhing at the detent F (c). The pendulum, having finifhed its excurfion to the right (in which it caufes the wheel to recoil by means of the detent F), returns toward the left. The wheel now advances again, and by preffing on F, aids the pendulum through the whole angle of fcapement. By this motion the claw C defcribes an arch of a circle round A, and approaches the wheel, till it take hold of another tooth, namely, the one following D, and pulls it back a little. This immediately frees the detent F from the preffure of the tooth G, and it flies out a little from the wheel, refuming its natural pofition by means of

(c) The reader may here remark the manner in which the preffure of the tooth G on the detent is transferred to the joint E by the intervention of the fhank FE, and from the joint E to the pendulum rod, by the intervention of the arm EA. This communication of preffure is precifely the fame that we made ufe of in explaining the common fcapement. MG, FE, and EA, in this fig. 10. are performing the offices which we then gave to the lines MB, BH, and HA, in fig. 3. Harrifon's pallet realifes the abftract theory.

of its ſpring. Soon after, the motion of the pendulum to the left ceaſes, and the pendulum returns; D pulling forward the hook C to aid the pendulum, and the former operation is repeated, &c. &c.

Such is the operation of the pallets of Harriſon and Hindley. Friction is almoſt totally avoided, and oil entirely (D). The motion is given to the pendulum by a fair pull or puſh, and the teeth of the wheel only apply themſelves to the detents without rubbing. There is no drop, and the ſcapement makes no noiſe, and is what the artiſts call *a ſilent ſcapement.* The mechanician will readily perceive, that by properly diſpoſing the arms AB, AE, and diſpoſing the pallets on the circumference of the wheel, the law, by which the action of the wheel on the pendulum is regulated, may be greatly varied, ſo as to harmonize, as far as the nature of ſcapement, alternately puſhing and pulling, will admit, with the action of gravity.

But this is evidently a recoiling ſcapement, and one of the worſt kind; for the recoil is made at the very confines of the vibration, where every diſturbance of the regular cycloidal vibration occaſions the greateſt diſturbance to the motion. Yet this clock kept time with moſt unexampled preciſion, far excelling all that had been made before, and equal to any that have been made ſince. This is entirely owing to the immenſe ſuperiority of the momentum of the pendulum over the maintaining power.

II. *Of Scapements for a Watch.*

THE execution of a proper ſcapement for watches is a far more delicate and difficult problem than the foregoing, on account of the ſmall ſize, which requires much more accurate workmanſhip, becauſe the error of the hundredth part of an inch has as great a proportion to the dimenſions of the regulator as an inch in a common houſe clock. It is much more difficult on another account. We have no ſuch means of accumulating ſuch a dominion (to uſe Mr Harriſon's expreſſive term) over the wheel-work in the regulator of a watch as in that of a clock. The heavieſt balance that we can employ, without the certainty of ſnapping its pivots by every ſlight jolt, is a mere trifle, in compariſon with the pendulum of the moſt ordinary clock. A dozen or twenty grains is the utmoſt weight of the balance, even of a very large pocket watch. The only way that we can accumulate any notable quantity of regulating power in ſuch a ſmall pittance of matter is by giving it a very great velocity. This we do by accumulating all its weight in the rim, by giving it very wide vibrations, and by making them extremely frequent. The balance-rim of a middling good watch ſhould paſs through at leaſt ten inches in every ſecond. Now, when we reflect on the ſmall momentum of this regulator, the inevitable inequalities of the maintaining power, and the great arch of vibration on which theſe inequalities will operate, and the comparative magnitude even of an almoſt inſenſible friction or clammineſs, it appears almoſt chimerical to expect any thing near to equability in the vibrations, and incredible that a watch can be made which will not vary more than one beat in 86400. Yet ſuch have been made. They muſt be conſidered as the moſt maſterly exertions of human art. The performance of a reflecting teleſcope is a great wonder: the worſt that can find a market muſt have its mirrors executed without an error of the ten-thouſandth part of an inch; but we now know that this accuracy is attained almoſt in ſpite of us, and that we ſcarcely *can* make them of a worſe figure. But the caſe is far otherwiſe in watch-work. Here all thoſe wonderful approaches to perfection are the reſults of rational diſcuſſion, by means of ſound principles of ſcience; and, unleſs the artiſt who puts theſe principles into practice be more than a mere copyiſt, unleſs the principles themſelves are perceived by him, and actually direct his hand, the watch may ſtill be good for nothing. Surely, then, this is a liberal art, and far above a manual knack. The ſtudy of the means by which ſuch wonders are ſteadily effected, is therefore the ſtudy of a gentleman.

In the account given above of the ſcapements for pendulums, we aſſumed as one leading principle that *the natural vibrations of a pendulum are performed in equal times, whether wide or narrow.* This is ſo nearly true, when the arches on each ſide of the perpendicular do not exceed four degrees, that the retardation of the wider arches within that limit will not become ſenſible, though accumulated for a long time. The common ſcapement with a plane face of the pallet, helps to correct even this ſmall inequality much better than the niceſt form of the cycloidal checks propoſed by Huyghens.

In watch-work we aſſume a ſimilar principle, namely, that *the oſcillations of a balance, urged by its ſpring, and undiſturbed by all foreign forces, are performed in equal times, whether they be wide or narrow.* This principle was aſſumed by the celebrated mechanician Dr Robert Hooke, on the authority of many experiments which he had made on the bending and unbending of ſprings. He found that the force neceſſary for retaining a ſpring in any conſtrained poſition was proportional to its tenſion, or deflection from its natural form. He expreſſed this in an anagram, which he publiſhed about the year 1660, in order to eſtabliſh his claim to the diſcovery, and yet conceal it, till he had made ſome important application of it. When the anagram was explained ſome years afterwards, it was, "*Ut tenſio, ſic vis.*" Dr Hooke thought of applying this diſcovery to the regulation of watch movements. For, if a ſlender ſpring be *properly* applied to the axis of a watch balance, it will put that balance in a certain determinate poſition. If the balance

(D) Mr Harriſon was at firſt by profeſſion a carpenter in a country place. Being extremely ingenious and inventive, he had made a variety of curious wooden clocks. He made one, in particular, for a turret in a gentleman's houſe. Its expoſure made it waſte oil very faſt, and the maker was often obliged to walk two or three miles to renew it, and got nothing for his trouble. In trudging home, not in very good humour, he pondered with himſelf how to make a clock go without oil. He changed all his pinion leaves into rollers; which anſwered very well. But the pallets required it more than any other part. After various other projects, he contrived thoſe now repreſented, where there was no friction, and no oil is wanted. The turret clock continued to go without being touched till Mr Harriſon left the country.

Watch-work.

lance be turned aside from this position, it seems to follow that it will be urged back toward it by a force proportional to its distance from it. He immediately made the application to an old watch, which he afterward gave to Dr Wilkins, Bishop of Chester. This was in 1658. Its motion was so amazingly improved, that Hooke was persuaded of the perfection of his principle, and thought that nothing was now wanting for making a watch of this kind a perfect chronometer but the hand of a good workman. For his watch seemed almost perfect, though made in a small country town, in a very coarse manner. Mr Huyghens also claims this discovery. He published his claim about the year 1675, and proposed to make watches for discovering the longitude of a ship at sea. But there is the most unquestionable evidence of Dr Hooke's priority by fifteen years, and of his having made several watches of this kind. One of them was in the possession of his majesty king Charles II. Dr Hooke's first balance spring was straight, and acted on the balance in a very imperfect manner. But he soon saw the imperfections, and made several successive alterations; and, among others, he employed the cylindrical spiral now employed by Mr Arnold; but he gave it up for the flat spiral: and the king's watch had one of this kind before Mr Huyghens published his invention. His project of longitude watches had been carried on along with Lord Brouncker and Sir Robert Moray, and they had quarrelled some years before that publication. See WATCH, *Encycl.*

But both Dr Hooke and Mr Huyghens were too sanguine in their expectations. We, by no means, have the evidence for the truth of this principle that we have for the accelerating action of gravity on a pendulum. It rests on the nicety and the propriety of the experiments; and long experience has shewn that it is sensibly true only within certain limits. The demonstrations by which Bernoulli supports the unqualified principle of Mr Huyghens, proceed on hypothetical doctrines concerning the nature of elasticity. And even these shew that the law of elasticity which he assumed was selected, not because founded on simpler principles than any other, but because it was consistent with the experiments of Hooke and Huyghens. Besides, although this should be the true law of a spring, it does not follow that this spring, applied in *any way* to the axis of a balance, will urge that balance agreeably to the same law: and if it did, it still does not follow that the oscillations of the balance will be isochronous; for the force has to move not only the balance but also the spring. Part of the restoring force of the spring is employed in restoring it rapidly to its quiescent shape, and thus enabling it to *follow and still impel* the yielding balance. It is therefore only the surplus which is employed in actually moving the balance, and it is uncertain whether this surplus varies according to the same law, being always the same proportion of the whole force of the spring. We find it an extremely difficult problem to determine the law of variation of this surplus, even in the simplest form of the spring; nay, it is by no means an easy problem to determine the law of oscillation of a spring, unloaded with any balance; and we can easily shew that there are such forms of a spring, that although the velocity with which the different parts approach to their quiescent position be exactly as their excursion from it, this is by no means the law of velocity which this spring will produce in a balance. The matter of fact is, that when the spring is a simple straight steel wire, suspending the balance in the direction of its axis, the motions of it, if not immoderate, are precisely agreeable to Huyghens's and Hooke's rule; and that the motion of a balance urged by a spring wound up into a flat, or a cylindrical spiral, as in common watches, and those of Arnold, deviates sensibly from it, unless a certain analogy be preserved between the length and the elasticity of the spring. If the spring be immoderately long, the wide vibrations are slower than the narrow ones; and the contrary is observed when the spring is immoderately short. A certain taper, or gradual diminution of the spring, is also found to have an effect in equalizing the wide and narrow vibrations. There is also a great difference between the force with which a part of the spring unbends itself, and the action of that force in urging the balance round its axis; and the performance of many watches, good in other respects, is often faulty from the manner in which this unbending force is employed.

But, since these corrections are in our power in a considerable degree, we may suppose them applied, and the true motion (which we shall call the cycloidal) attained; and we may then adapt the construction of the scapement to the preserving this motion undisturbed. And here we must see at once that the problem is incomparably more delicate than in the case of pendulums. The vibrations must be very wide, and the angular motion rapid, that it may be little affected by external motions. The smallest inequalities of maintaining power acting through so great a space, must bear a considerable proportion to the very minute momentum of a watch balance. Oil is as clammy on the pallets of a watch as on those of a clock; a viscidity which would never be felt by a pendulum of 20 pounds weight will stop a balance of 20 grains altogether. For the same reason, it is evident that any impropriety in the form of the pallet must be incomparably more pernicious than in the case of a pendulum; the deviation which this may occasion from a force proportional to the angular distance from the middle point, must bear a great proportion to the whole force.

The common recoiling scapement of the old clocks still holds its place in the ordinary pocket watches, and answers all the common purposes of a watch very well. A well finished watch, with a recoiling scapement will keep time within a minute in the day. This is enough for the ordinary affairs of life. But such watches are subject to great variation in their rate of going, by any change in the power of the wheels. This is evident; for if the watch be held back, or pressed forward, by the key applied to the fusee square, we hear the beating greatly retarded or accelerated. The maintaining power, in the best of such watches, is never less than one-fifth of the regulating power of the spring. For, if we take off the balance spring, and allow the balance to vibrate by the impulse of the wheels alone, we shall find the minute hand to go forward from 25 to 30 minutes per hour. Suppose it 30. Then, since the wheels act through equal spaces with or without a spring, the forces are as the squares of the acquired velocities. (DYNAMICS, *Suppl.* n° 95.) The velocity in this case is double; therefore the accelerating force is quadruple,

ruple, and the force of the fpring is three times that of the wheels. If the hand goes forward 25 minutes, the force of the wheels is about one-fifth of that of the fpring. This great proportion is neceffary, as already obferved, that the watch may go as foon as unftopped.

We have but little to fay on this fcapement; its principle and manner of action, and its good and bad qualities, being the fame with thofe of the fimilar fcapement for pendulums. It is evident that the maintaining power being applied in the moft direct manner, and during the whole of the vibration, it will have the greateft poffible influence to move the balance. A given main-fpring and train will keep in motion a heavier balance by means of this fcapement than by any other. But, on the other hand, and for the fame reafon, the balance has lefs dominion over the wheel-work, and its vibrations are more affected by any irregularities of the wheel-work. Moreover, the chief action of the wheel being at the very extremities of the vibrations, and being very abrupt, the variations in its force are moft hurtful to the ifochronifm of the vibrations.

Although this fcapement is extremely fimple, it is fufceptible of more degrees of goodnefs or imperfection than almoft any other, by the variation of the few particulars of its conftruction. We fhall therefore briefly defcribe that conftruction which long experience has fanctioned as approaching near to the beft performance that can be obtained from the common fcapement. Fig. 11. reprefents it in what are thought its beft proportions, as it appears when looking ftraight down on the end of the balance arbor. C is the centre of the balance and verge. CA and CB are the two pallets; CA being the upper pallet, or the one next to the balance, and CB being the lower one. F and D are two teeth of the crown wheel, moving from left to right; and E, G, are two teeth on the lower part of the circumference, moving from right to left. The tooth D is reprefented as juft efcaped from the point of CA, and the lower tooth E as juft come in contact with the lower pallet. The fcapement fhould not, however, be quite fo clofe, becaufe an inequality on the teeth might prevent D from efcaping at all. For if E touch the pallet CB before D has quitted CA, all will ftand ftill. This fault will be corrected by withdrawing the wheel a little from the verge, or by fhortening the pallets.

The proportions are as follow. The diftance between the front of the teeth (that is, of G, F, E, D) and the axis C of the balance is one-fifth of FA, the diftance between the points of the teeth. The length CA, CB of the pallets is three-fifths of the fame diftance. The pallets make an angle ACB of 95 degrees, and the front DH or FK of the teeth make an angle of 25° with the axis of the crown-wheel. The floping fide of the tooth muft be of an epicycloidal form, fuited to the relative motion of the tooth and pallet.

From thefe proportions it appears that the pallet A can *throw out*, by the action of the tooth D, till it reaches *a*, 120 degrees from CL, the line of the crown-wheel axis. For it can throw out till the pallet B ftrike againft the front of E, which is inclined 25° to CL. To this add BCA, = 95°, and we have LC *a* = 120. In like manner B will throw out as far on the other fide. From 240, the fum of thefe angles, take the angle of the pallets 95°, and there remains 145° for the greateft vibration which the balance can make without ftriking the front of the teeth. This extent of vibration fuppofes the teeth to terminate in points, and the acting furfaces of the pallets to be planes directed to the very axis of the verge. But the points of the teeth muft be rounded off a little for ftrength, and to diminifh friction on the face of the pallets. This diminifhes the angle of fcapement very confiderably, by fhortening the teeth. Moreover, we muft by no means allow the point of the pallet to bank or ftrike on the forefide of a tooth. This would greatly derange the vibration by the violence and abruptnefs of the check which the wheel would give to the pallet. This circumftance makes it improper to continue the vibrations much beyond the angle of fcapement. One-third of a circle, or 120°, is therefore reckoned a very proper vibration for a fcapement made in thefe proportions. The impulfe of the wheels, or the angle of fcapement, may be increafed by making the face of the pallets a little concave (preferving the fame angle at the centre). The vibration may alfo be widened by pufhing the wheel nearer to the verge. This would alfo diminifh the recoil. Indeed this may be entirely removed by bringing the front of the wheel up to C, and making the face of the pallet not a radius, but parallel to a radius and behind it, *i. e.* by placing the pallet CA fo that its acting face may be where its back is juft now. In this cafe, the tooth D would droop on it at the centre, and lie there at reft, while the balance completes its vibration. But this would make the banking (as the ftroke is called) on the teeth almoft unavoidable. In fhort, after varying every circumftance in every poffible manner, the beft makers have fettled on a fcapement very nearly fuch as we have defcribed. Precife rules can fcarcely be given; becaufe the law by which the force acting on the pallets varies in its intenfity, deviates fo widely from the action of the balance fpring, efpecially near the limits of the excurfions.

The difcoveries of Huyghens and Newton in rational mechanics engaged all the mathematical philofophers of Europe in the folution of mechanical problems, about the end of the laft century. The vibrations of elaftic plates or wires, and their influence on watch balances, became familiar to every body. The great requifites for producing ifochronous vibrations were well underftood, and the artifts were prompted by the fpeculatifts to attempt conftructions of fcapements proper for this purpofe. It appeared clearly, that the moft effectual means for this purpofe was to leave the balance unconnected with the wheels, efpecially near the extremities of the vibration, where the motion is languid, and where every inequality of maintaining power muft act for a longer time, and therefore have a great effect on the whole duration of the vibrations. The maxim of conftruction that naturally arifes from thefe reflections is to *confine*, if poffible, *the action of the wheels to the middle of the vibration*, where the motion is rapid, and where the chief effect of an increafe or diminution of the maintaining power will be to enlarge or contract the angular motions, but will make little change on their duration; becaufe the greateft part of the motion will be effected by the balance fpring alone. This maxim was inculcated in exprefs terms by John Bernoulli, in his *Recherches Mechaniques et Phyfiques*; but it had been fuggefted by common fenfe to feveral unletterred artifts before that time. About the beginning of the 18th century watches

Watch-work.

watches were made in London, where the verge had a portion *e d b* (fig. 12.) of a fmall cylinder, having its centre *c* in the axis, and a radial pallet *b a* proceeding from it. Suppofe a tooth juft efcaped from the point of the pallet, moving in the direction *b d e*, the cylindrical part was fo fituated that the next tooth dropped on it at a fmall diftance from its termination. While the verge continues turning in the direction *b d e*, the tooth continues refting on the cylinder, and the balance fuftains no *action* from the wheels, and has only to overcome the minute frictions on the polifhed furface of a hard fteel cylinder. This motion may perhaps continue till the pallet acquires the pofition *f*, almoft touching the tooth. It then ftops, its motion being extinguifhed by the increafing force of the fpring. It now returns, moving in the direction *e d b*; and when the pallet has acquired the pofition *c i*, the tooth *g* quits the circumference of the cylinder, and drops in on the pallet at the very centre. The crooked form of the tooth allows the pallet to proceed ftill farther, before there is any danger of banking on the tooth. This vibration being alfo ended, the balance refumes its firft direction, and the tooth now acts on the face of the pallet, and reftores to the balance all the motion which it had loft by friction, &c. during the two preceeding vibrations.

It is evident that this conftruction obviates all the objections to the former recoiling fcapement, and that, by fufficiently diminifhing the diameter of the cylindrical part, the friction may be reduced to a very fmall quantity, and the balance be made to move by the action of the fpring during the whole of the excurfion, and of the returning vibration. Yet this conftruction does not feem to have come much into ufe, owing, in all probability, to the great difficulty of making the drop fo accurate in all the teeth. The fmalleft inequality in the length of a tooth would occafion it to drop fooner or later; and if the cylinder was made very fmall, to diminifh friction, the formation of the notch was almoft a microfcopical operation, and the fmalleft fhake in the axis of the verge or the balance-wheel would make the tooth flip paft the cylinder, and the watch run down amain.

About the fame time, a French artift in London (then the fchool of this art) formed another fcapement, with the fame views. We have not any diftinct account of it; but are only informed (in the 7th volume of the *Machines approuvées par l'Acad. des Sciences*) that the tooth refted on the furface of a hollow cylinder, and then efcaped by acting on the inclined edge of it. But we may prefume that it had merit, being there told that Sir Ifaac Newton wore a watch of this kind.

A much fuperior fcapement, on the fame principle, was invented by Mr Geo. Graham, at the fame time that he changed the recoiling fcapement for pendulums into the dead beat. Indeed it is the fame fcapement, accommodated to the large vibrations of a balance. In fig. 13. DE reprefents part of the rim of the balance-wheel, A and C are two of its teeth, having their faces *b e* formed into planes, inclined to the circumference of the wheel, in an angle of about 15 degrees; fo that the length *b e* of the face is nearly quadruple of its height *e m*. Suppofe a circular arch ABC defcribed round the centre of the wheel, and through the middle of the faces of the teeth. The axis of the balance paffes through fome point B of this arch, and we may fay that the mean circumference of the teeth paffes through the centre of the verge. On this axis is fixed a portion of a thin hollow cylinder *b c d*, made of hard tempered fteel, or of fome hard and tough ftone, fuch as ruby or fapphire. Agates, though very hard, are brittle. Chalcedony and cornelian are tough, but inferior in hardnefs. This cylinder is fo placed on the verge, that when the balance is in its quiefcent pofition, the two edges *b* and *d* are in the circumference which paffes through the points of the teeth. By this conftruction the portion of the cylinder will occupy 210° of the circumference, or 30° more than a femicircle. The edge *b*, to which the tooth approaches from without, is rounded off on both angles. The other edge *d* is formed into a plane, inclined to the radius about 30°.

Now, fuppofe the wheel preffed forward in the direction AC. The point *b* of the tooth, touching the rounded edge, will pufh it outwards, turning the balance round in the direction *b c d*. The heel *e* of the tooth will efcape from this edge when it is in the pofition *h*, and *e* is in the pofition *f*. The point *b* of the tooth is now at *d*, but the edge of the cylinder has now got to *i*. The tooth, therefore, refts on the infide of the cylinder, while the balance continues its vibration a little way, in confequence of the fhove which it has received from the action of the inclined plane pufhing it out of the way, as the mould board of a plough fhoves a ftone afide. When this vibration is ended, by the oppofition of the balance-fpring, the balance returns, the tooth (now in the pofition B) rubbing all the while on the infide of the cylinder. The balance comes back into its natural pofition *b c d*, with an accelerated motion, by the action of its fpring, and would, of itfelf, vibrate as far, at leaft, on the other fide. But it is aided again by the tooth, which, preffing on the edge *d*, pufhes it afide, till it come into the pofition *k*, when the tooth efcapes from the cylinder altogether. At this moment the other edge of the cylinder is in the pofition *l*, and therefore is in the way of the next tooth, now in the pofition A. The balance continues its vibration, the tooth all the while refting, and rubbing on the outfide of the cylinder. When this vibration, in the direction *dcb*, is finifhed, the balance refumes its firft motion *bcd*, by the action of the fpring, and the tooth begins to act on the firft edge *b*, as foon as the balance gets into its natural pofition, fhoves it afide, efcapes from it, and drops on the infide of the cylinder. In this manner are the vibrations produced, gradually increafed to their maximum, and maintained in that ftate. Every fucceeding tooth of the wheel acts firft on the edge *b*, and then on the edge *d*; refting firft on the outfide, and then on the infide of the cylinder. The balance is under the influence of the wheels while the edge *b* paffes to *h*, and while *d* paffes to *k*; and the reft of the vibration is performed without any *action* on the part of the wheels, but is a little obftructed by friction, and by the clamminefs of the oil. In the conftruction now defcribed, the arch of action or fcapement is evidently 30°, being twice the angle which the face of a tooth makes with the circumference.

The reader will perceive, that when this fcapement is executed in fuch a manner that the fucceeding tooth is in contact with the cylinder at the inftant that the preceding one efcapes from it, the face of the tooth muft be equal to the infide diameter of the cylinder, and that

that the diftance between the heel of one tooth and the point of the following one muft be equal to the outfide diameter. When the fcapement is fo clofe there is no drop. A good artift approaches as near to this adjuftment as poffible; becaufe, while a tooth is dropping, but not yet in contact, it is not acting on the balance, and fome force is loft. The execution is accounted very good, if the diftance between the centres of two teeth is twice the external diameter of the cylinder. This allows a drop equal to the thicknefs of the cylinder, which is about $\frac{1}{20}$th of its diameter.

We muft alfo explain how this cylinder is fo connected with the verge as to make fuch a great revolution round the tooth of the wheel. The triangular tooth *e b m* is placed on the top of a little pillar or pin fixed into the extremity of the piece of brafs *m* D formed on the rim of the wheel. Thus the wedge-tooth has its plane parallel to the plane of the wheel, but at a fmall diftance above it. Fig. B reprefents the verge, a long hollow cylinder of hard fteel. A great portion of the metal is cut out. If it were fpread out flat, it would have the fhape of Fig. C. Suppofe this rolled up till the edges GH and G′H′ are joined, and we have the exact form. The part acted on by the point of the tooth is the dotted line *b d*. The part DIFE′ ferves to connect the two ends. Thus it appears to be a very flender and delicate piece; but being of tempered fteel, it is ftrong enough to refift moderate jolts. The ruby cylinders are much more delicate.

Such is the cylinder fcapement of Mr Graham, called alfo the HORIZONTAL SCAPEMENT, becaufe the balance wheel is parallel to the others. Let us fee how far it may be expected to anfwer the intended purpofes. If the excurfions of the balance beyond the angle of impulfion were made altogether unconnected with the wheels, the *whole vibration* would be quicker than one of the fame extent, made by the action of the balance-fpring alone, becaufe the middle part of it is accelerated by the wheels. But the excurfions are obftructed by friction and the clamminefs of oil. The effect of this in *obftructing* the motion is very confiderable. Mr Le Roy placed the balance fo, that it refted when the point of the tooth was on the middle of the cylindric furface. When the wheel was allowed to prefs on it, and it was drawn 80° from this pofition, it vibrated only during $4\frac{1}{2}$ feconds. When the wheel was not allowed to touch the cylinder, it vibrated 90 feconds, or 20 times as long; fo much did the friction on the cylinder exceed that of the pivots. We are not fufficiently acquainted with the laws of either of thefe obftructions to pronounce decidedly whether they will increafe or diminifh the *time* of the whole vibrations. We obferve diftinctly, in motions with confiderable friction, that it does not increafe nearly fo faft as the velocity of the motion; nay, it is often lefs when the velocity is very great. In all cafes it is obferved to terminate motions abruptly. The friction requires a certain force to overcome it, and if the body has any lefs it will ftop. Now this will not only contract the excurfion of the balance, but will fhorten the time. But the return to the angle of impulfion will undoubtedly be of longer duration than the excurfion; for the arch of return, from the extremity of the excurfion to its beginning, where the angle of impulfion ends, is the fame with the arch of excurfion. The velocity which the balance has in any point of the return is lefs than what it had in the fame point of the excurfion; becaufe, in the excurfion, it had velocity enough to carry it to the extremity, and alfo to overcome the friction. In the return, it could, even without friction, only have the velocity which would have carried it to the extremity; and this fmaller velocity is diminifhed by friction during the return. The velocity being lefs through the whole return than during the excurfion, the time muft be greater. It may therefore happen that this retardation of the return may compenfate the contraction of the excurfion and the diminution of its duration. In this cafe the vibration will occupy the fame time as if the balance had been free from the wheels. But it may more than compenfate, and the vibrations will then be flower; or it may not fully compenfate, and they will be quicker. We cannot therefore fay *à priori*, which of the two will happen: but we may venture to fay that an increafe of the force of the wheels will make the watch go flower: for this will exert a greater preffure, give a greater impulfion, produce a wider excurfion, and increafe the friction during that greater excurfion, making the wide vibrations flower than the narrow ones: becaufe the angle of impulfion remaining the fame, the preffures exerted muft be quadrupled, in order to double the excurfion (fee DYNAMICS, n° 95. *Suppl.*), and therefore the friction will be increafed in a greater proportion than the momentum which is to overcome it. But, with refpect to the obftruction arifing from the vifcidity of the oil, we know that it follows a very different law. It bears a manifeft relation to the velocity, and is nearly proportional to it. But ftill it is difficult to fay how this will affect the whole vibration. The duration of the excurfion will not be fo much contracted as by an equal obftruction from friction, becaufe it will not terminate the motion abruptly. There are therefore more chances of the increafed duration of the return exceeding the diminution of it in the excurfion. All that we can fay, therefore, is, that there will be a compenfation in both cafes. The time of excurfion will be contracted, and that of return augmented.

Now, as the friction may be greatly diminifhed by fine polifh, fine oil, and a fmall diameter of the cylinder, we may reafonably expect that the vibrations of fuch a balance will not vary nearly fo much from ifochronifm as with a recoiling fcapement, and will be little affected by changes in the force of the wheels. Accordingly, Graham's cylindrical fcapement fupplanted all others as foon as it was generally known. We cannot compare the vibrations with thofe of a free balance, becaufe we have no way of making a free balance vibrate for fome hours. But we find that doubling or trebling the force of the wheels makes very little alteration in the rate of the watch, though it greatly enlarges the angular motion. Any one may perceive the immenfe fuperiority of this fcapement over the common recoiling fcapement, by preffing forward the movement of a horizontal watch with the key, or by keeping it back. No great change can be obferved in the frequency of the beats, however hard we prefs. But a more careful examination fhews that an increafe of the power of the wheels generally caufes the watch to go flower; and that this is more remarkable as the watch has been long going without being cleaned. This fhews that the caufe is to be afcribed to the friction and oil operating

operating on the wide arches of excurſion. But when this ſcapement is well executed, in the beſt proportions of the parts, the performance is extremely good. We know ſuch watches, which have continued for ſeveral weeks without ever varying more than 7″ in one day from equable motion. We have ſeen one whoſe cylinder was not concentric with the balance, but ſo placed on the verge that the axis of the verge was at *o* (fig. 13.), between the centre B of the cylinder and the entering edge *b*, and B*e* was equal to the thickneſs of the cylinder. The watch was made by Emery of London, and was ſaid to go with aſtoniſhing regularity, ſo as to equal any time piece while the temperature of the air did not vary; and when clean, was ſaid to be leſs affected by the temperature than a watch with a free ſcapement, but unprovided with a compenſation piece. It is evident that this watch muſt have a minute recoil. This was ſaid to be the aim of the artiſt, in order to compenſate for the obſtruction cauſed by friction during the return of the balance from its excurſions. It indeed promiſes to have this effect; but we ſhould fear that it ſubjects the excurſions to the influence of the wheels. We ſuſpect that the indifferent performance of cylinder watches may often ariſe from the cylinder being off the centre in ſome diſadvantageous manner.

The watch from which the proportions here ſtated were taken, is a very fine one made by Graham for Archibald Duke of Argyle, which has kept time with the regularity now mentioned. We believe that there are but few watches which have ſo large a portion of the cylinder: few indeed have more than one half, or 180° of the circumference. But this is too little. The tooth of the wheel does not begin to act on the reſting cylinder till its middle point A or B touch one of the edges. To obtain the ſame angle of ſcapement, the inclination of the face of the tooth muſt be increaſed (it muſt be doubled); and this requires the maintaining power to be increaſed in the ſame proportion. Beſides, in ſuch a ſcapement it may happen that the tooth will never reſt on the cylinder; becauſe the inſtant that it quits one edge it falls on the other, and puſhes it aſide, ſo that the balance acquires no wider vibration than the angle of ſcapement, and is continually under the influence of the wheels. The ſcapement is in its beſt ſtate when the portion of the cylinder exceeds 180° by twice the inclination of the teeth to the circumference of the wheel.

It would employ volumes to deſcribe all the ſcapements which have been contrived by different artiſts, aiming at the ſame points which Graham had in view. We ſhall only take notice of ſuch as have ſome eſſential difference in principle.

Fig. 14. repreſents a ſcapement invented in France, and called the *Echappement à* VIRGULE, becauſe the pallet reſembles a comma. The teeth A, B, C, of the balance wheel are ſet very oblique to the radius, and there is formed on the point of each a pin, ſtanding up perpendicular to the plane of the wheel. This greatly reſembles the wheel of Graham's ſcapement, when the triangular wedge is cut off from the top of the pin on which it ſtands. The axis *c* of the verge is placed in the circumference paſſing through the pins. The pallet is a plate of hard ſteel *aefdb*, having its plane parallel to the plane of the wheel. The inner edge of this plate is formed into a concave cylindrical ſurface between *o* and *b*, whoſe axis *c* coincides with the axis of the verge. Adjoining to this is the acting face *bd* of the pallet. This is either a ſtraight line *bd*, making an angle of nearly 30° with a line *cbg* drawn from the centre, or it is more generally curved, according to the noſtrum of the artiſt. The back of the pallet *aef* is alſo a cylindrical ſurface (convex) concentric with the other. This extends about 100° from *a* to *f*. The part between *f* and *d* may have any ſhape. The interval *ao* is formed into a convex ſurface, in ſuch a manner as to be everywhere interſected by the radius in an angle of 30° nearly; *i. e.* it is a portion of an equiangular ſpiral. The whole of this is connected with the verge by a crank, which paſſes perpendicularly through it between *f* and *e*; and the plate is ſet at ſuch height on the crank or verge, that it can turn round clear of the wheel, but not clear of the pins. The teeth of the wheel are ſet ſo obliquely, and made ſo ſlender, that the verge may turn almoſt quite round without the crank's banking on the teeth. The part *fdb*, called the horn, is of ſuch a length, that when one pin B reſts on the outſide cylinder at *a*, the point *d* is juſt clear of the next pin A.

When the wheel is not acting, and the balance ſpring is in equilibrio, the poſition of the balance is ſuch that the point *d* of the horn is near *i*, about 30° from *d*. The figure repreſents it in the poſition which it has when the tooth A has juſt eſcaped from the point *d* of the horn. In this poſition the next tooth B is applied to the convex cylinder, a very little way (about 5°) from its extremity *a*. This deſcription will enable the reader to underſtand the operation of the virgule ſcapement.

Now ſuppoſe the pin A juſt eſcaped from the horn. The ſucceeding pin B is now in contact with the back of the cylinder; and the balance, having got an impulſe by the action of A along the concave pallet *bd*, continues its motion in the direction *dgh*, till its force is ſpent, the point of the horn arriving perhaps at *h*, more than 90° from *d*. All this while the following tooth B is reſting on the back *ef* of the cylinder. The balance now returns, by the action of its ſpring; and when the horn is at *i*, the pin gets over the edge *ao*, and drops on the oppoſite ſide of the concave cylinder, where it reſts, while the horn moves from *i* to *k*, where it ſtops, the force of the balance being again ſpent. The balance then returns; and when the horn comes within 30° of *d*, the pin gets out of the hollow cylinder, ſhoves the horn out of its way, and eſcapes at *d*. Beſides the impulſe which the balance receives by the action of the wheel on the horn *bd*, there is another, though ſmaller, action in the contrary direction, while the point of B paſſes over the ſurface *ao*; for this ſurface being inclined to the radius, the preſſure on it urges the balance round in the direction *hdi*.

The chief difference of this ſcapement from the former is that the inclined plane is taken from the teeth of the wheel, and placed on the verge. This alone is a conſiderable improvement; for it is difficult to ſhape all the teeth alike; whereas the horn *bd* is invariable. Moreover, the reſting parts, although they be drawn large in this figure for the ſake of diſtinctneſs, may be made vaſtly ſmaller than Graham's cylinder, which muſt be big enough to hold a tooth within it. By this change, the friction, during the repoſe of the wheel, that

that is, during the excurſions of the balance, may be vaſtly diminiſhed. The inſide cylinder need be no bigger than to receive the pin. But although the performance of theſe ſcapements is excellent, they have not come into general uſe in this country. The cauſe ſeems to be the great nicety requiſite in making the pins of the wheel paſs exactly through the axis of the verge. The leaſt ſhake in the pivots of the balance and balance-wheel muſt greatly change the action. A very minute increaſe of diſtance between the pivots will cauſe the pin B to ſlide from the edge *a* to the horn, without reſting at all on the inſide cylinder; and when it does ſo, it will ſtop the balance at once, and, immediately after, the watch will run down. The ſame irregularities will happen if all the pins be not at preciſely the ſame diſtance from the axis of the wheel.

This ſcapement was greatly improved, and, in appearance, totally changed, by Mr Lepaute of Paris in 1753. By placing the pins alternately on the two ſides of the rim of the balance-wheel, he avoided the uſe of the outſide cylinder altogether. The ſcapement is of ſuch a ſingular form, that it is not eaſy to repreſent it by any drawing. We ſhall endeavour, however, to deſcribe it in ſuch a manner as that our readers, who are not artiſts, will underſtand its manner of acting. Artiſts by profeſſion will eaſily comprehend how the parts may be united which we repreſent as ſeparate.

Let ABC (fig. 15.) repreſent part of the rim of the balance-wheel, having the pins 1, 2, 3, 4, 5, &c. projecting from its faces; the pins 1, 3, 5, being on the ſide next the eye, but the pins 2 and 4 on the farther ſide. D is the centre of the balance and verge, and the ſmall circle round D repreſents its thickneſs. But the verge in this place is crooked, like a crank, that the rim of the wheel may not be interrupted by it. This will be more particularly deſcribed by and bye. There is attached to it a piece of hard tempered ſteel *a b c d*, of which the part *a b c* is a concave arch of a circle, having D for its centre. It wants about 30° of a ſemicircle. The reſt of it *c d* is alſo an arch of a circle, having the ſame radius with the balance-wheel. The natural poſition of the balance is ſuch, that a line drawn from D, through the middle of the face *c d*, is a tangent to the circumference of the wheel. But, ſuppoſe the balance turned round till the point *d* of the horn comes to *d'*, and the point *c* comes to 2, in the circumference in which the pins are placed. Then the pin, preſſing on the beginning of the horn or pallet, puſhes it aſide, ſlides along it, and eſcapes at *d*, after having generated a certain velocity in the balance. So far this ſcapement is like the virgule ſcapement deſcribed already. But now let another pallet, ſimilar to the one now deſcribed, be placed on the other ſide of the wheel, but in a contrary poſition, with the acting face of the pallet turned away from the centre of the wheel. Let it be ſo placed at E, that the moment that the pin 1, on the upper ſide of the wheel, eſcapes from the pallet *c d*, the pin 4, on the under ſide of the wheel, falls on the end of the circular arch *e f g* of the other pallet. Let the two pallets be connected by means of equal pulleys G and F on the axis of each, and a thread round both, ſo that they ſhall turn one way. The balance on the axis D, having gotten an impulſe from the action of the pin 1, will continue its motion from A towards *i*, and will carry the other pallet with a ſimilar motion round the centre E from *h* towards *k*. The pin 4 will therefore reſt on the concave arch *g f e* as the pallet turns round. When the force of the balance is ſpent, the pallet *c d* returns towards its firſt poſition. The pallet *g h* turns along with it; and when the point of the firſt has arrived at *d*, the beginning *g* of the other arrives at the pin 4; and, proceeding a little farther, this pin eſcapes from the concave arch *efg*, and ſlides along the pallet *g h*, puſhing it aſide, and therefore urging the pallet round the centre E, and conſequently (by means of the connection of the pulleys) urging the balance on the axis D round at the ſame time, and in the ſame direction. The pin 4 eſcapes from the pallet *g h*, when *h* arrives at 3; but in the time that the pin 4 was ſliding along the yielding pallet *g h*, the pin 3 is moving in the circumference BDA; and the inſtant that the pin 4 eſcapes from *h* at 3, the pin 3 arrives at 2, and finds the beginning *c* of the concave arch *c b a* ready to receive it. It therefore reſts on this arch, while the balance continues its motion. This perhaps continues till the point *b* of the arch comes to 2. The balance now ſtops, its force being ſpent, and then returns; and the pin 3 eſcapes from the circle at *c*, ſlides along the yielding pallet *c d*, and when it eſcapes at 1, another pin on the under ſide of the wheel arrives at 4, and finds the arch *g f e* ready to receive it. And in this manner will the vibration of the balance be continued.

This deſcription of the mode of action at the ſame time points out the dimenſions which muſt be given to the parts of the pallet. The length of the pallet *c d* or *g h* muſt be equal to the interval between two ſucceeding pins, and the diſtance of the centres D and E muſt be double of this. The radius D*e* or E*g* may be as ſmall as we pleaſe. The concave arches *c b a* and *g f e* muſt be continued far enough to keep a pin reſting on them during the whole excurſion of the balance. The angle of ſcapement, in which the balance is under the influence of the wheels, is had by drawing D*c* and D*d*. This angle *c*D*d* is about 30°, but may be made greater or leſs.

Fig. B will give ſome notion how the two pallets may be combined on one verge. KL repreſents the verge with a pivot at each end. It is bent into a crank MNO, to admit the balance wheel between its branches. BC repreſents this wheel, ſeen edgewiſe, with its pins, alternately on different ſides. The pallets are alſo repreſented edgewiſe by *b c d* and *h g f*, fixed to the inſide of the branches of the crank, fronting each other. The poſition of their acting faces may be ſeen in the preceding figure, on the verge D, where the pallet *g h* is repreſented by the dotted line 2 *i*, as being ſituated behind the pallet *c d*. The remote pallet 2 *i* is placed ſo, that when the point *d* of the near pallet is juſt quitted by a pin 1 on the upper ſide of the wheel, the angle formed by the face and the arch of reſt of the other pallet is juſt ready to receive the next pin 2, which lies on the under ſide of the rim. A little attention will make it plain, that the action will be preciſely the ſame as when the pallets were on ſeparate axes. The pin 1 eſcapes from *d*, and the pin 2 is received on the arch of reſt, and locks the wheel while the balance is continuing its motion. When it returns, 2 gets off the arch of reſt, puſhes aſide the pallet 2 *i*, eſcapes from it when *i* gets to 1, and then the pin 3 finds the point *c* ready

ready to receive it, &c. The vibrations may be increafed by giving a fufficient impulfe through the angle of fcapement. But they cannot be more than a certain quantity, otherwife the top N of the crank will ftrike the rim of the wheel. By placing the pins at the very edge of the wheel, the vibrations may eafily be increafed to a femicircle. By placing them at the points of long teeth, the crank may get in between them, and the vibrations extended ftill farther, perhaps to 240°.

This fcapement is unqueftionably a very good one; and when equally well executed, fhould excel Graham's, both by having but two acting faces to form (and thefe of hard fteel or of ftone), and by allowing us to make the circle of reft exceedingly fmall without diminifhing the acting face of the pallet. This will greatly diminifh the friction and the influence of oil. But, on the other hand, we apprehend that it is of very difficult execution. The figure of the pallets, in a manner that fhall be fufceptible of adjuftment and removal for repair, and yet fufficiently accurate and fteady, feems to us a very delicate job.

Mr Cumming, in his Elements of Clock and Watchwork defcribes (flightly) pallets of the very fame conftruction, making what he conceives to be confiderable improvements in the form of the acting faces and the curves of reft. He has alfo made fome watches with this fcapement; but they were fo difficult, that few workmen can be found fit for the tafk; and they are exceedingly delicate, and apt to be put out of order. The connection of the pallets with each other, and with the verge, makes the whole fuch a contorted figure, that it is eafily bent and twifted by any jolt or unfkilful handling.

There remains another fcapement of this kind, having the tooth of the balance-wheel refting on a cylindrical furface on the axis of the verge during the excurfions of the balance beyond the angle of fcapement, and which differs fomewhat in the application of the maintaining power from all thofe already defcribed

This is known by the name of *Dupleix's fcapement*, and is as follows: Fig. 16. reprefents the effential parts greatly magnified. AD is a portion of the balance-wheel, having teeth *f*, *b*, *g*, at the circumference. Thefe teeth are entirely for producing the *reft* of the wheel, while the balance is making excurfions beyond the fcapement. This is effected by means of an agate cylinder *o p q*, on the verge. This cylinder has a notch *o*. When the cylinder turns round in the direction *o p q*, the notch eafily paffes the tooth B which is refting on the cylindric furface; but when it returns in the direction *q p o*, the tooth B gets into the notch, and follows it, preffing on one fide of it till the notch comes into the pofition *o*. The tooth being then in the pofition *b*, efcapes from the notch, and another tooth drops on the convex furface of the cylinder at B.

The balance wheel is alfo furnifhed with a fet of ftout flat-fided pins, ftanding upright on its rim, as reprefented by *a*, D. There is alfo fixed on the verge a larger cylinder GFC above the fmaller one *o p q*, with its under furface clear of the wheel, and having a pallet C, of ruby or fapphire, firmly indented into it, and projecting fo far as juft to keep clear of the pins on the wheel. The pofition of this cylinder, with refpect to the fmaller one below it, is fuch that, when the tooth *b* is efcaped from the notch, the pallet C has juft paffed the pin *a*, which was at A while B refted on the fmall cylinder: but it moved from A to *a*, while B moved to *b*. The wheel being now at liberty, the pin *a* exerts its preffure on the pallet C in the moft direct and advantageous manner, and gives it a ftrong impulfion, following and accelerating it till another tooth ftops on the little cylinder. The angle of fcapement depends partly on the projection of the pallet, and partly on the diameter of the fmall cylinder and the advance of the tooth B into the notch. Independent of the action on the fmall cylinder, the angle of fcapement would be the whole arch of the large cylinder between C and *x*. But *a* ftops before it is clear of the pallet, and the arch of impulfion is fhortened by all the fpace that is defcribed by the pin while a tooth moves from B to *b*. It ftops at *a'*.

We are informed by the beft artifts, that this fcapement gives great fatisfaction, and equals, if it do not excel, Graham's cylindrical fcapement. It is eafier made, and requires very little oil on the fmall cylinder, and none at all on the pallet. They fay that it is the beft for pocket watches, and is coming every day more into repute. Theory feems to accord with this character. The refting cylinder may be made very fmall, and the direct impulfe on the pallet gives it a great fuperiority over all thofe already defcribed, where the action on the pallet is oblique, and therefore much force is loft by the influence of oil. But we fear that much force is loft by the tooth B fhifting its place, and thus fhortening the arch of impulfion; for we cannot reckon much on the action of B on the fide of the notch, becaufe the lever is fo extremely fhort. Accordingly, all the watches which we have feen of this kind have a very ftrong main fpring in proportion to the fize and vibration of the balance. If we leffen this diminution of the angle of impulfion, by leffening the cylinder *o p q*, and by not allowing B to penetrate far into the notch, the fmalleft inequality of the teeth, or fhake in the pivots of the balance or wheel, will caufe irregularity, and even uncertainties in the locking and unlocking the wheel by this cylinder.

A fcapement exceedingly like this was applied long ago by Dutertre, a French artift, to a pendulum. The only difference is, that in the pendulum fcapement the fmall cylinder is cut through to the centre, half of it only being left; but the pendulum fcapement gives a more effective employment of the maintaining power, becaufe the wheel acts on the pallet during the *whole* of the affifted vibration. In a balance fcapement, if we attempt to diminifh the inefficient motion of the pin from A to *a*, by leffening the diameter of the fmall cylinder, the hold given to the tooth in the notch will be fo trifling, that the tooth will be thrown out by the fmalleft play in the pivot holes, or inequality in the length of the teeth.

With this we conclude our account of fcapements, where the action of the maintaining power on the balance is fufpended during the excurfion beyond the angle of impulfion, by making a tooth reft on the furface of a fmall concentric cylinder. In fuch fcapements, the balance, during its excurfions, is almoft free from any connection with the wheels, and its ifochronifm is difturbed by nothing but the friction on this furface.—We come now to fcapements of more artful conftruction, in which the balance is really and completely free during

during the whole of its excurfion, being altogether difengaged from the wheelwork. Thefe are called DETACHED SCAPEMENTS. They are of more recent date. We believe that Mr Le Roi was the firft inventor of them, about the year 1748. In the Memoirs of the Academy of Paris for that year, and in the Collection of approved Machines and Inventions, we have defcriptions of the contrivance. The balance-wheel refts on a detent, while the balance is vibrating in perfect freedom. It has a pallet ftanding out from the centre, which, in the courfe of vibration, paffes clofe by the point of a tooth of the wheel. At that inftant a pin, connected with this pallet, withdraws the detent from the wheel, and the tooth juft now mentioned follows the pallet with rapidity, and gives it a fmart pufh forward. Immediately after, another tooth of the wheel meets the other claw of the detent, and the wheel is again locked. When the balance returns, the pin pufhes the detent back into its former place, where it again locks the wheel. Then the balance, refuming its firft direction, unlocks the wheel, and receives another impulfion from it. Thus the balance is unconnected with the wheels, except while it gets the impulfion, and at the moments of unlocking the wheels.

This contrivance has been reduced to the greateft poffible fimplicity by the Britifh artifts, and feems fcarcely capable of farther improvement. The following is one of the moft approved conftructions. In fig. 17. *a b c* reprefents the pallet, which is a cylinder of hard fteel or ftone, having a notch *a b*. A portion of the balance-wheel is reprefented by AB. It is placed fo near to the cylinder that the cylinder is no more than clear of *two adjoining* teeth. DE is a long fpring, fo fixed to the watch-plate at E, as to prefs very gently on the ftop pin G. A fmall ftud F is fixed to that fide of the fpring that is next to the wheel. The tooth of the wheel refts on this ftud, in fuch a manner that the tooth *a* is juft about to touch the cylinder, and the tooth *f* is juft clear of it. Another fpring, extremely flender, is attached to the fpring DE, on the fide next the balance-wheel, and clips clofe to it, but keeping clear of the ftud F, and having its point *o* projecting about $\frac{1}{50}$th of an inch beyond its extremity. When the point *o* is preffed towards the wheel, it yields moft readily; but, when preffed in the oppofite direction, it carries the fpring DE along with it. The cylinder being fo placed on the verge that the edge *a* of the notch is clofe by the tooth *a*, a hole is drilled at *i*, clofe by the projecting point of the flender fpring, and a fmall pin is driven into this hole. This is the whole apparatus; and this fituation of the parts correfponds to the quiefcent pofition of the balance.

Now, let the balance be turned out of this pofition 80 or 90 degrees, in the direction *a b c*. When it is let go, it returns to this pofition with an accelerated motion. The pin *i* ftrikes on the projecting point of the flender fpring, and, preffing the ftrong fpring DE outward from the wheel, withdraws the ftud F from the tooth; and thus unlocks the wheel. The tooth *a* engages in the notch, and urges round the balance. The pin *i* quits the flender fpring before the tooth quits the notch; fo that when it is clear of the pallet, the wheel is locked again on the ftud F, and another tooth *g* is now in the place of *a*, ready to act in the fame manner. When the force of the balance is fpent, it ftops, and then returns toward its quiefcent pofition with a motion continually accelerated. The pin *i* arrives at the point *o* of the flender fpring, raifes it from the ftrong fpring without difturbing the latter, and almoft without *being* difturbed by this trifling obftacle; and it goes on, turning in the direction *a b c*, till its force is again fpent; it ftops, returns, again unlocks the wheel, and gets a new impulfion. And in this manner the vibrations are continued. Thus we fee a vibration, almoft free, maintained in a manner even more fimple than the common crutch fcapement. The impulfe is given direct, without any decompofition by oblique action, and it is continued through the *whole* motion of the wheel. No part of this motion is loft, as in Dupleix's fcapement, by the *gradual* approach of the tooth to its active pofition. Very little force is required for unlocking the wheel, becaufe the fpring DFE is made flender at the remote end E, fo that it turns round E almoft like a lever turning on pivots. A fudden twitch of the watch, in the direction *b a*, might chance to unlock the wheel. But this will only derange one vibration, and even that not confiderably, becaufe the teeth are fo clofe to the cylinder that the wheel cannot advance till the notch comes round to the place of fcapement. A tooth will continue preffing on the cylinder, and by its friction will change a little the extent and duration of a fingle vibration. The greateft derangement will happen if the wheel fhould thus unlock by a jolt, while the notch paffes through the arch of fcapement in the returning vibration. Even this will not greatly derange it, when the watch is clean and vibrating wide; becaufe, in this pofition, the balance has its greateft momentum, and the direction of the only jolt that can unlock the wheel tends to increafe this momentum relatively. In fhort, confidering it theoretically, it feems an almoft perfect fcapement; and the performance of many of thefe watches abundantly confirms that opinion. They are known to keep time for many days together, without varying one fecond from day to day; and this even under confiderable variations of the maintaining power. Other detached fcapements may equal this, but we fcarcely expect any to exceed it; and its fimplicity is fo much fuperior to any that we have feen, that, on this account, we are difpofed to give it the preference. We do not mean to fay that it is the beft for a pocket watch. Perhaps the fcapement of Dupleix or Graham may be preferable, as being fufceptible of greater ftrength, and more able to withftand jolts. Yet it is a fact that fome of the watches made in this form by Arnold and others have kept time in the wonderful manner abovementioned while carried about in the pocket.

Mr Mudge of London invented, about the year 1763, another detached fcapement, of a ftill more ingenious conftruction. It is a counterpart of Mr Cumming's fcapement for pendulums. The contrivance is to this effect. In fig. 18. *a b c* reprefents the balance. Its axis is bent into a large crank EFGHIK, fufficiently roomy to admit within it two other axes M and L, with the proper cocks for receiving their pivots. The three axes form one ftraight line. About thefe fmaller axes are coiled two auxiliary fprings, in oppofite directions, having their outer extremities fixed in the ftuds A and B. The balance has its fpring alfo, as ufual, and the three fprings are fo difpofed that each of them

Watch-work.

them alone would keep the balance at reſt in the ſame poſition, which we may ſuppoſe to be that repreſented in the figure. The auxiliary ſprings A and B are connected with the balance only occaſionally, by means of the arms *m* and *n* projecting from their reſpective axes. Theſe arms are catched on oppoſite ſides by the pins *o*, *p*, in the branches of the crank; ſo that when the balance turns round, it carries one or other of thoſe arms round with it, and, during this motion, it is affected by the auxiliary ſpring connected with the arm ſo carried round by it.

Let us ſuppoſe that the balance vibrates 120° on each ſide of its quieſcent poſition *a b c*, ſo that the radius E *a* acquires alternately, the poſitions E *b* and E *c*. The auxiliary ſprings are connected with the wheels by a common dead-beat pendulum ſcapement, ſo that each can be ſeparately wound up about 30°, and retained in that poſition. Let us alſo ſuppoſe that the ſpring A has been wound up 30° in the direction *a b*, by the wheel-work, and that the point *a* of the rim of the balance, having come from *c*, is paſſing through *a* with its greateſt velocity. When the radius E *a* has paſſed *a* 30° in its courſe toward *b*, the pin *o* finds the arm *m* in its way, and carries it along with it till *a* gets to *b*. But, by carrying away the arm *m*, it has unlocked the wheel-work, and the ſpring B is now wound up 30° in the other direction, but has no connection with the balance during this operation. Thus the balance finiſhes its ſemivibration *a b* of 120°, oppoſed by its own ſpring the whole way, and by the auxiliary ſpring A through an angle of 90°. It returns to the poſition E *a*, aided by A and by the balance ſpring, through an angle of 120°. In like manner, when E *a* has moved 30° toward the poſition E *c*, the pin *p* meets with the arm *n*, and carries it along with it through an angle of 90, oppoſed by the ſpring B, and then returns to the poſition E *a*, aſſiſted by the ſame ſpring through an arch of 120°.

Thus it appears that the balance is oppoſed by each auxiliary ſpring through an angle of 90°, and aſſiſted through an angle of 120°. This difference of action maintains the vibrations, and the neceſſary winding up of the auxiliary ſprings is performed by the wheel-work, at a time when they are totally diſengaged from the balance. No irregularity of the wheel-work can have any influence on the force of the auxiliary ſprings, and therefore the balance is completely diſengaged from all theſe irregularities, except in the ſhort moment of unlocking the wheel that winds up the ſprings.

This is a moſt ingenious conſtruction, and the neareſt approach to a free vibration that has yet been thought of. It deſerves particular remark that during the whole of the returning or accelerated ſemivibration, the united force of the ſprings is proportional to the diſtance from the quieſcent poſition. The ſame may be ſaid of the retarded excurſion beyond the angle of impulſe: therefore the only deviation of the forces from the law of cycloidal vibration is during the motion from the quieſcent poſition to the meeting with the auxiliary ſpring. Therefore, as the forces, on both ſides, beyond this angle, are in their due proportion, and the balance always makes ſuch excurſions, there ſeems nothing to diſturb the iſochroniſm, whether the vibrations are wide or narrow. Accordingly, the performance of this ſcapement, under the ſevereſt trials, equalled any that were compared with it, in as far as it depended on ſcapement alone. But it is evident that the execution of this ſcapement, though moſt ſimple in principle, muſt always be vaſtly more difficult than the one deſcribed before. There is ſo little room, that the parts muſt be exceedingly ſmall, requiring the moſt accurate workmanſhip. We think that it may be greatly ſimplified, preſerving all its advantages, and that the parts may be made of more than twice their preſent ſize, with even leſs load on the balance from the inertia of matter. This improvement is now carrying into effect by a friend.

Still, however, we do not ſee that this ſcapement is, theoretically, ſuperior to the laſt. The irregularities of maintaining power affect that ſcapement only in the arch of impulſion, where the velocity is great, and the time of action very ſmall. Moreover, the chief effect of the irregularities is only to enlarge the excurſions; and in theſe the wheels have no concern.

Mr Mudge has alſo given another detached ſcapement, which he recommends for pocket watches, and executed entirely to his ſatisfaction in one made for the Queen. A dead beat pendulum ſcapement is interpoſed, as in the laſt, between the wheels and the balance. The crutch EDF (fig. 19.) has a third arm DG, ſtanding outwards from the meeting of the other two, and of twice their length. This arm terminates in a fork AGB. The verge V has a pallet C, which, when all is at reſt, would ſtand between the points A, B of the fork. But the wheel, by its action on the pallet E, forces the fork into the poſition B *g b*, the point A of the fork being now where B was before, juſt touching the cylindrical ſurface of the verge. The ſcapement of the crutch EDF is not accurately a dead beat ſcapement, but has a very ſmall recoil beyond the angle of impulſion. By this circumſtance the branch A (now at B) is made to preſs moſt gently on the cylinder, and keeps the wheel locked, while the balance is going round in the direction BHA. The point A gets moving from A to B by means of a notch in the cylinder, which turns round at the ſame time by the action of the branch AG on the pallet C; but A does not touch the cylinder during this motion, the notch leaving free room for its paſſage. When the balance returns from its excurſion, the pallet C ſtrikes on the branch A (ſtill at B), and unlocks the wheel. This now acting on the crutch pallet F, cauſes the branch *b* of the fork to follow the pallet C, and give it a ſtrong impulſe in the direction in which it is then moving, cauſing the balance to make a ſemivibration in the direction AHB. The fork is now in the ſituation A *g a*, ſimilar to B *g b*, and the wheel is again locked on the crutch pallet E.

The intelligent reader will admit this to be a very ſteady and effective ſcapement. The lockage of the wheel is procured in a very ingenious manner; and the friction on the cylinder, neceſſary for effecting this, may be made as ſmall as we pleaſe, notwithſtanding a very ſtrong action of the wheel: For the preſſure of the fork on the cylinder depends entirely on the degree of recoil that is formed on the pallets E and F. *Preſſure* on the cylinder is not *indiſpenſably* neceſſary, and the crutch ſcapement might be a real dead beat. But a ſmall recoil, by keeping the fork in contact with the cylinder, gives the moſt perfect ſteadineſs to the motion. The ingenious inventor, a man of approved integrity and judgment, declares that her Majeſty's watch was the beſt pocket

Watch-work, ‖ Watehoo.

pocket watch he had ever feen. We are not difpofed to queftion its excellency. We faw an experiment watch of this conftruction, made by a country artift, having a balance fo heavy as to vibrate only twice in a fecond. Every vibration was fenfibly beyond a turn and a half, or 540°. The artift affured us, that when its proper balance was in, vibrating fomewhat more than five times in a fecond, the vibrations even exceeded this. He had procured it this great mobility by fubftituting a roller with fine pivots in place of the fimple pallet of Mudge. This great extent of detached vibration is an unqueftionable excellence, and is peculiar to thofe two fcapements of this ingenious artift.

Very ingenious fcapements have been made by Ernfhaw, Howel, Hayley, and other Britifh artifts; and many by the artifts of Paris and Geneva. But we muft conclude the article, having defcribed all that have any difference in principle.

The fcapement having been brought to this degree of perfection, we have an opportunity of making experiments on the law of action of fprings, which has been too readily affumed. We think it eafy to demonftrate, that the figure of a fpring, which muft have a great extent of rapid motion, will have a confiderable influence on the force which it impreffes on a balance in *actual motion*. The accurate determination of this influence is not very difficult in fome fimple cafes. It is the greateft of all in the plane fpiral, and the leaft in the cylindrical; and in this laft form, it is fo much lefs as the diameter is lefs, the length of the fpring being the fame. By employing many turns, in order to have the fame ultimate force at the extremity of the excurfion, this influence is increafed. A particular length of fpring, therefore, will make it equal to a given quantity; and it may thus compenfate for a particular magnitude of friction, and other obftructions. This accounts for the obfervation of Le Roy, who found that every fpring, *when applied to a movement*, had a certain length, which made the wide and narrow vibrations ifochronous. His method of trial was fo judicious, that there can be no doubt of the juftnefs of his conclufion. His time-keeper had no fuzee; and when the laft revolution of the main wheel was going on, the vibrations were but of half the extent of thofe made during the firft revolution. Without minding the real rate of going, he only compared the duration of the firft and laft revolution of the minute hand. An artift of our acquaintance repeated thefe experiments, and with the fame refult: But, unfortunately, could derive little benefit from them; becaufe in one ftate of the oil, or with one balance, he found the lengths of the fame fpring, which produced ifochronous vibrations, were different from thofe which had this effect in another ftate of the oil, or with another balance. He alfo obferved another difference in the rate, arifing from a difference of pofition, according as XII, VI, III, or IX, was uppermoft; which difference plainly arifes from the fwagging of the fpring by its weight, and, in that ftate, acting as a pendulum. This unluckily put a ftop to his attempts to leffen this hurtful influence by employing a cylindrical fpiral of fmall diameter and great length.

WATEHOO, an ifland in the South Pacific Ocean; a beautiful fpot, about 6 miles long and 4 broad. N. lat. 20 1, W. long. 158 15.—*Morse*.

Water-Blowing.

WATER-BLOWING MACHINE, called in French *Soufflet d'eau* or *trompe*, is a machine which, by the action of falling water, fupplies air to a blaft furnace. It confifts of an upright pipe, through which a fhower of water is made to fall; and this fhower carries down with it a mafs of air, which is received beneath in a kind of tub, and conducted to the furnace by means of a pipe. The firft idea of fuch a machine was doubtlefs fuggefted by thofe local winds, which are always produced by natural falls of water over precipices, and in the mountains (fee page 577 of volume II.); but perhaps we are indebted for the firft accurate theory of it to Profeffor Venturi.

That philofopher in his experimental refearches concerning the lateral communication of motion in fluids, proves that the water-blowing machine affords air to the furnace, by the accelerating force of gravity and the lateral communication of motion combined together. He begins with an idea, which, he candidly acknowledges, did not efcape the penetration of Leonardo Da Vinci. Suppofe a number of equal balls to move in contact with each other along the horizontal line AB (Plate XLVI. fig. 1.). Imagine them to pafs with an uniform motion, at the rate of four balls in a fecond. Let us take BF, equal to 16 feet Englifh. During each fecond four balls will fall from B to F, and their refpective diftances in falling will be nearly $BC = 1$, $CD = 3$, $DE = 5$, $EF = 7$. We have here a very evident reprefentation of the feparation, and fucceffive elongation, which the accelerating force of gravity produces between bodies which fall after each other.

The rain water flows out of gutters by a continued current; but during its fall it feparates into portions in the vertical direction, and ftrikes the pavement with diftinct blows. The water likewife divides, and is fcattered in the horizontal direction. The ftream which iffues out of the gutter may be one inch in diameter, and ftrike the pavement over the fpace of one foot. The air which exifts between the vertical and horizontal feparations of the water which falls, is impelled and carried downwards. Other air fucceeds laterally; and in this manner a current of air or wind is produced round the place ftruck by the water. Hence the following idea of a water-blowing machine:

Let BCDE (fig. 2.) reprefent a pipe, through which the water of a canal AB falls into the lower receiver MN. The fides of the tube have openings all round, through which the air freely enters to fupply what the water carries down in its fall. This mixture of water and air proceeds to ftrike a mafs of ftone Q; whence rebounding through the whole width of the receiver MN, the water feparates from the air, and falls to the bottom at XZ, whence it is difcharged into the lower channel or drain, by one or more openings TV. The air being lefs heavy than the water, occupies the upper part of the receiver; whence being urged through the upper pipe O, it is conveyed to the forge.

It has been fuppofed by fome eminent chemifts, that the air which paffes through the pipe O is furnifhed by the decompofition of water. To afcertain whether this be the cafe or not, our author formed a water-blowing engine of a fmall fize. The pipe BD was two inches in diameter, and four feet in height. When the water accurately filled the fection BC, and all the lateral

Fig. 11.

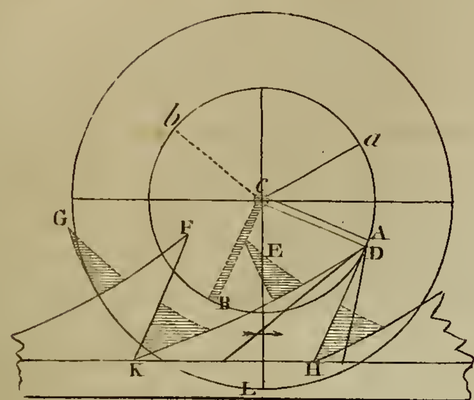


Fig. 12.

Fig. 13.

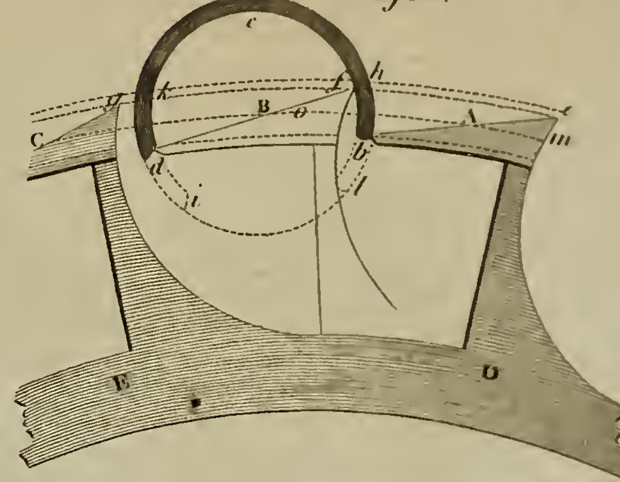


Fig. 14.

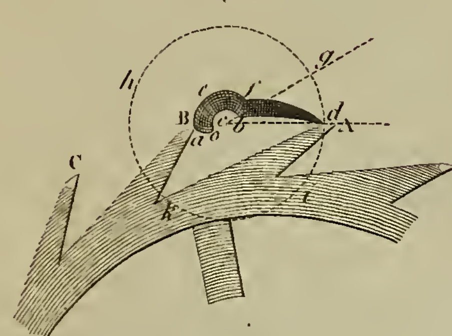


Fig. 15.

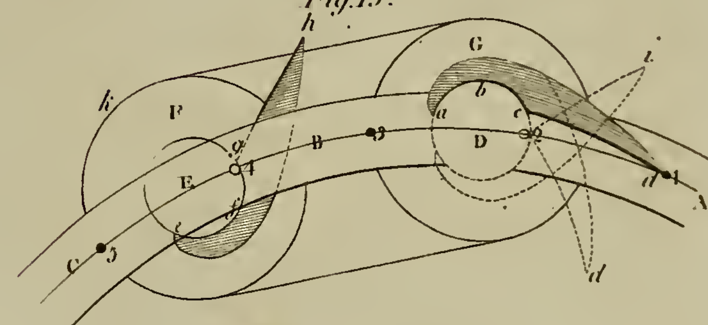


Fig. B.15.

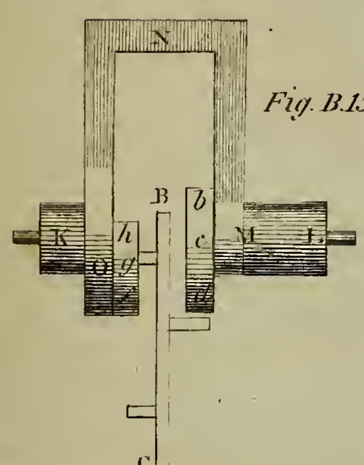


Fig. B.13.

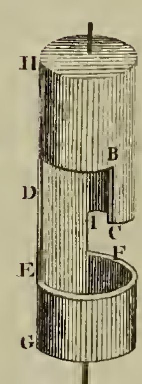


Fig. C.

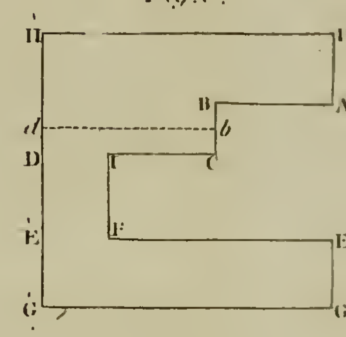


Fig. 19.

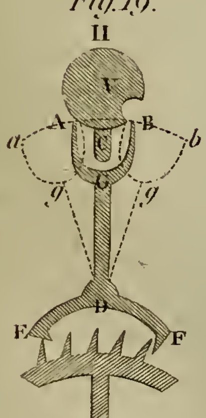


Fig. 16.

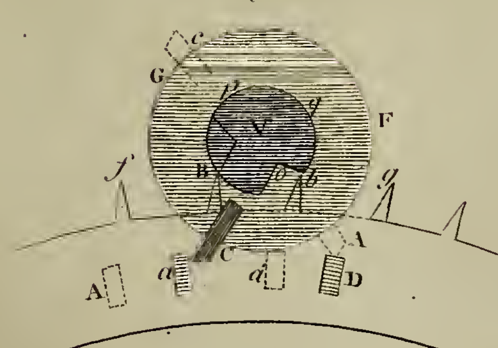


Fig. 17.

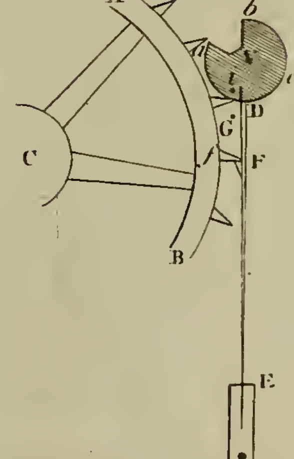
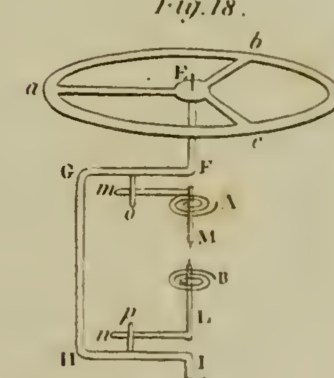


Fig. 18.



Lawson sc.

ral openings of the pipe BDEC were closed, the pipe O no longer offered any wind. It is therefore evident, that in the open pipes the whole of the wind comes from the atmosphere, and no portion is afforded by the decomposition of water. It remains, therefore, to determine the circumstances proper to drive into the receiver MN the greatest quantity of air, and to measure that quantity.

1. To obtain the greatest effect from the acceleration of gravity, it is necessary that the water should begin to fall at BC, (fig. 2.) with the least possible velocity; and that the height of the water FB should be no more than is necessary to fill the section BC. Our author supposes the vertical velocity of this section to be produced by an height or head equal to BC.

2. We do not yet know, by direct experiment, the distance to which the lateral communication of motion between water and air can extend itself; but we may admit with confidence, that it can take place in a section double that of the original section with which the water enters the pipe. Let us suppose the section of the pipe BDEC to be double the section of the water at BC; and, in order that the stream of fluid may extend and divide itself through the whole double section of the pipe, some bars, or a grate, are placed in BC, to distribute and scatter the water through the whole internal part of the pipe.

3. Since the air is required to move in the pipe O with a certain velocity, it must be compressed in the receiver. This compression will be proportioned to the sum of the accelerations, which shall have been destroyed in the inferior part KD of the pipe. Taking KD $= 1{,}5$ feet, we shall have a pressure sufficient to give the requisite velocity in the pipe O. The sides of the portion KD, as well as those of the receiver MN, must be exactly closed in every part.

4. The lateral openings in the remaining part of the pipe BK may be so disposed and multiplied, particularly at the upper part, that the air may have free access within the tube. We will suppose them to be such that 0,1 foot height of water might be sufficient to give the necessary velocity to the air at its introduction through the apertures.

All these conditions being attended to, and supposing the pipe BD to be cylindrical, it is required to determine the quantity of air which passes in a given time through the circular section KL. Let us take in feet $KB = 1{,}5$; $BC = BF = a$; $BD = b$. By the common theory of falling bodies, the velocity in KL will be $7{,}76 \sqrt{(a + b - 1{,}4)}$; the circular section $KL = 0{,}785\, a^2$. Admitting the air in KL to have acquired the same velocity as the water, the quantity of the mixture of the water and air which passes in a second through KL is $= 6{,}1\, a^2 \sqrt{(a + b - 1{,}4)}$. We must deduct from the quantity $(a + b - 1{,}4)$ that height which answers to the velocity the water must lose by that portion of velocity which it communicates to the air laterally introduced; but this quantity is so small that it may be neglected in the calculation. The water which passes in the same time of one second through BC is $= 0{,}4\, a^2 \sqrt{(a + 0{,}1)}$. Consequently, the quantity of air which passes in one second through KL, will be $= 6{,}1\, a^2 \sqrt{(a + b - 1{,}4)} - 0{,}4\, a^2 \sqrt{(a + 0{,}1)}$, taking the air itself, even in its ordinary state of compression, under the weight of the atmosphere. It will be proper, in practical applications, to deduct one-fourth from this quantity; 1. On account of the shocks which the scattered water sustains against the inferior part of the tube, which deprive it of part of its motion; and, 2. Because it must happen that the air in LK will not, in all its parts, have acquired the same velocity as the water.

If the pipe O do not discharge the whole quantity of air afforded by the fall, the water will descend at XZ; the point K will rise in the pipe, the afflux of air will diminish, and part of the wind will issue out of the lower lateral apertures of the pipe BK.

We shall not here examine the greater or less degree of perfection of the different forms of water-blowing machines which are used at various iron forges; such as those of the Catalans, and elsewhere. These points may be easily determined from the principles here laid down, compared with those established in the articles *Resistance of Fluids (Encycl.)*, and Dynamics (*Supplement*).

WATERBOROUGH, a township of the District of Maine, York county, on Mousom river, 15 miles N. W. of Wells, and 110 from Boston. It was incorporated in 1787, and contains 905 inhabitants.—*Morse.*

WATERBURY, a township of Vermont, in Chittenden county, separated from Duxbury on the southwest by Onion river. It contains 93 inhabitants.—*ib.*

Waterbury, the north-westernmost township of New-Haven county, Connecticut, called by the Indians *Matteluck*. It was settled in 1671, and is divided into the parishes of Northbury, Salem, and South-Britain.—*ib.*

WATEREE, a branch of Santee river, South-Carolina.—*ib.*

WATERFORD, a plantation in Cumberland county, District of Maine, south-east of Orangeton, or Greenland.—*ib.*

Waterford, a new township in York county, District of Maine, incorporated February, 1797, formerly a part of Waterborough.—*ib.*

Waterford, a township of New Jersey, in Gloucester county.—*ib.*

Waterford, a neat village of New-York, in the township of Half Moon.—*ib.*

WATERLAND, an island in the South Pacific Ocean, so named by Le Maire. S. lat. 14 46, west long. 144 10.—*ib.*

WATERQUECHIE, or *Quechy*, a small river of Vermont, which empties into Connecticut river in Hartland.—*ib.*

WATERTOWN, a very pleasant town in Middlesex county, Massachusetts, 7 miles west by north-west of Boston. Charles river is navigable for boats to this town, 7 miles from its mouth in Boston harbour. The township contains 1091 inhabitants, and was incorporated in 1630. That celebrated apostle of the Indians, the Rev. Mr Eliot, relates that in the year 1670, a strange phenomenon appeared in a great pond at Watertown, where the fish all died; and as many as could, thrust themselves on shore, and there died. It was estimated that not less than 20 cart-loads lay dead at once round the pond. An eel was found alive in the sandy border of the pond, and upon being cast again into its natural element, it wriggled out again, as fast as it could, and died on the shore. The cattle, accu-

stomed

ftomed to the water, refufed to drink it for 3 days, after which they drank as ufual. When the fifh began to come afhore, before they died, many were taken both by Englifh and Indians and eaten without any injury.—*ib.*

WATERTOWN, a townfhip in Litchfield county, Connecticut. It is about 26 miles N. N. W. of New-Haven.—*ib.*

WATER VLIET, an extenfive townfhip of New-York, Albany county, on the weft fide of Hudfon's river, and includes the village of Hamilton, and the iflands in the river neareft the weft fide. It is bounded weft by the manor of Renffelaerwyck, and contained, in 1790, 7,419 inhabitants, including 707 flaves. In 1796, there were 600 of the inhabitants qualified electors.—*ib.*

WATLAND *Ifland*, one of the Bahama Iflands in the Weft-Indies. The S. point is in lat. 24 N. and long. 74 weft.—*ib.*

WATSON, *Fort*, in S. Carolina, was fituated on the N. E. bank of Santee river, about half way between the mouth of the Congaree and Nelfon's Fort, on the bend of the river oppofite the Eutaw Springs. Its garrifon of 114 men being befieged by Gen. Greene, furrendered in April, 1781. He then marched with his main force againft Camden higher up the river.—*ib.*

WAUKEAGUE, a village in the townfhip of Sullivan, in the Diftrict of Maine, 9 miles from Defert Ifland.—*ib.*

WAWASINK, a village in New-York, on Rondout Kill, a branch of Wallkill, 7 miles weft of New Paltz, and 12 fouth-weft of Efopus.—*ib.*

WAWIACHTANOS, and *Twichtwees*, two Indian tribes, refiding chiefly between Sciota and Wabafh rivers.—*ib.*

WAYNE, a new county in the N. W. Territory, laid out in the fall of 1796, including the fettlements of Detroit and Michilimakkinak.—*ib.*

WAYNE, a county of Newbern diftrict, N. Carolina; bounded N. by Edgcombe, and S. by Glafgow. It contains 6,133 inhabitants, inclufive of 1,537 flaves. —*ib.*

WAYNE, a townfhip of Pennfylvania, fituated in Mifflin county.—*ib.*

WAYNE, *Fort*, in the N. W. Territory, is fituated at the head of the Miami of the Lake, near the Old Miami Villages, at the confluence of St Jofeph's and St Mary's rivers. It is a fquare fort with baftions at each angle, with a ditch and parapet, and could contain 500 men, but has only 300 with 16 pieces of cannon. It is 150 miles north by weft of Cincinnati, and 200 weft by fouth of Fort Defiance. The Indians ceded to the United States a tract of land 6 miles fquare, where this fort ftands, at the late treaty of peace at Greenville.—*ib.*

WAYNESBOROUGH, a poft-town of N. Carolina, 24 miles from Kingfton, 50 S. E. from Raleigh, and 498 from Philadelphia.—*ib.*

WAYNESBOROUGH, a poft-town in Burk county, Georgia, 30 miles fouth of Augufta, 25 north-eaft of Louifville. No river of confequence paffes near this town; yet being the place where both the fuperior and inferior courts are held, it is in a profperous condition. —*ib.*

WEARE, a townfhip of New-Hampfhire, fituated in Hillfborough county, 18 miles fouth-wefterly of Concord, 60 weft of Portfmouth, and 70 north-weft of Bofton. It was incorporated in 1764, and contains 1924 inhabitants.—*ib.*

WEATHERSFIELD, a townfhip of Vermont, Windfor county, on the weft fide of Connecticut river, between Windfor on the north, and Springfield on the fouth. Afcutney Mountain lies partly in this townfhip, and in that of Windfor. It is a flourifhing town, and contains 1097 inhabitants.—*ib.*

WEATHERSFIELD, a poft-town of Connecticut, pleafantly fituated in Hartford county, on the weft fide of Connecticut river, 4 miles S. of Hartford, 11 N. of Middleton, 36 N. by E. of New-Haven, and 218 N. E. of Philadelphia. This town was fettled in 1635 or 1636, by emigrants from Dorchefter in Maffachufetts, and has a fertile and luxuriant foil. It confifts of between 200 and 300 houfes, and has a very elegant brick meeting-houfe for Congregationalifts. The inhabitants are generally wealthy farmers; and befides the common productions of the country, raife great quantities of onions, which are exported to different parts of the United States, and to the Weft-Indies.—*ib.*

WEATHERFORD's *Place, Charles*, an Indian houfe and plantation of that name, on the eaftern fide of Alabama river, above M'Gillivray's fifter's place, and a good way below the junction of Tallapoofee and Coofa rivers.—*ib.*

WEAUCTENEAU *Towns*, Indian villages on Wabafh river, deftroyed by Generals Scott and Wilkinfon in 1791.—*ib.*

WEAUS, or *Weeas*, an Indian tribe whofe towns lie on the head waters of Wabafh river. At the treaty of Greenville they ceded a tract of land, 6 miles fquare, to the United States.—*ib.*

WEAVER's *Lake*, in the State of New-York, is 3 miles north-weft of Lake Otfego. It is 2 miles long and 1½ broad.—*ib.*

WEAVING (fee *Encycl.*) is an operation, which, by means of a well known inftrument called the *weaving-loom*, has hitherto been performed by bodily labour. That labour is pretty fevere; and Mr Robert Millar, an ingenious calico-printer in the county of Dumbarton, Scotland, wifhing to leffen it, invented, fome years ago, a weaving-loom, which may be wrought by water, fteam, horfes, or any other power. For his invention he received a patent, dated June 26th 1796; and though truth compels us to fay, that we do not think it likely to emulate the fpinning machine of Arkwright, it is fufficiently ingenious to deferve notice in a Work of this kind. The following is his own defcription of his patent weaving-loom:

Fig. 1. (Plate L.) reprefents a fide view of the loom, AA, BB, CC, DD, being the frame. *a* is an axis (which we fhall call the fpindle) acrofs the frame. On this axis is a fheeve *b*, two inches thick, having a groove round it, two inches deep, and half an inch wide. The bottom of this groove is circular, except in one part *c*, where it is filled up to the top; a lever *d* refts on the bottom of this groove, and is lifted up by it when the elevation *c* comes round to the fituation reprefented in the figure. By this motion, the lever *d* acts on the ratchet-wheel *e* by the catch *t*, and draws it forward one tooth, each revolution of the fheeve. This ratchet wheel is in an iron frame *gg*, which alfo pro-

perly carries the two catches *t* and *u*, which are connected with it at *v*. The catch *u* holds the ratchet-wheel in its poſition, while the lever *d* and the catch *t*, are moved by the groove *c* in the ſheeve. On the arbor of the ratchet is a ſmall pinion *h*, working in the wheel *f*; this wheel is fixed on the end of the roller *e* of fig. 3. On the ſide of the ſheeve *b* is fixed a wiper *k*, which lifts the treadle *l*. This treadle turns on its joints in the ſheeve E, which is fixed to the ſide of the frame A and D; it is kept preſſing on the bottom of the groove in the ſheeve by a ſpring *m*, fixed to the frame ſide A, and having a ſlender rod *n* from its extremity, joining it with the treadle at *l*. From the point of the treadle there goes a belt *o*, which paſſes over the pulley *p*, which is ſeen edgewiſe in this figure, and is joined to the top of the fly pin *q*, of fig. 2. At the end of the frame A is the ſhort poſt F; on this reſts the yarn beam *j*, having a ſheeve *r*, over which paſſes a cord, having a weight *s* ſuſpended to it. The other end of this cord is faſtened to the ſpring *v*; the weight cauſes the yarn-beam to ſtretch the web from the ratchet wheel *e*, with its catch *u*; and the ſpring *v* allows the rope to ſlide on the ſheeve as the ratchet is drawn round during the working.

Fig. 2. is a front view of the loom. *a a* is the ſpindle which carries the ſheeve *b*, and the wipers *d* and *d*, which move the treadles *w*, *w*, of fig. 1. Theſe uſe the treadles of the headles, with which they are connected by cords from the ſhafts of the headles *s*, *s*. From the upper ſhaft there go two leathern belts *f*, *f*, to the roller *y*, furniſhed each with a buckle, for tightening them at pleaſure. The two wipers *c*, *c*, on the ſhaft *a*, which ſerve for taking back the lay, have the two treadles *x*, *x*, in fig. 3. with a belt from each paſſing over the roller *h* 2 of fig. 1. and fixed to the ſword of the lay. From the ſwords of the lay forward is fixed a belt to each end of the roller *i*; from this roller there goes a cord to the ſpring *j*, which ſerves for taking forward the lay which is hinged on the rocking tree *t*. The ſtar-wheel *b* of fig. 3. and the ſheeve *b* of fig. 1. are fixed to the oppoſite ends of the ſpindle *a* without the frame; and both the wheel and ſheeve have a wiper *k* fixed to them for moving the treadles. In order to drive the ſhuttle, the belts *o*, *o*, go from the points of the treadles, over the pulleys *p*, *p*, to the top of the fly-pin *q*: This turns on a pin joint in a rail *r*, which goes acroſs the loom. From its lower end there go two ſmall cords to the ſhuttle drivers *g*, *g*, which ſlide on the iron rods *n*, *n*. A long iron rod *v* goes acroſs the lay, and is hung on two centres at the ends. In this rod *v* are fixed two ſmall crooked wires *w*, *w*, which are more diſtinctly marked in the little figure *w* above, which repreſents a ſection of the lay. The dot at the lower end of the wire *w*, in this figure, is the ſection of the rod *v*. The ſhuttle paſſes between theſe wires and the lay every ſhot, and lifts them up, cauſing the rod *v* to turn round a little. But if the ſhuttle ſhould not paſs theſe wires, nor lift them, it would be drawn home by the lay, and deſtroy the web. To prevent this, there is fixed on one end of the rod *v* a ſtout crooked wire *z*, having a broad or flat head, which naturally reſts on a plate of iron, marked and fixed to the back of the lay. This plate has a ſlit in its middle about an inch deep. In this ſlit reſts the rod *a* 2 of fig. 3. on which is a ſhort ſtud, which is caught by the wire *z* when the wire *w* is not lifted back by the paſſing ſhuttle. This will ſtop the lay from coming home, and will ſet off the loom.

Fig. 3. is another ſide-view of the loom oppoſite to fig. 1. On the ſpindle *a* is the ſtar-wheel *b*, on the outſide of the loom-frame, on the arms of which wheel is fixed the wiper *k*, as the ſimilar wiper is fixed to the ſheeves on the other end of the ſpindle. The wipers which drive the ſhuttles are fixed on oppoſite ſquares of the ſpindle, and work alternately. Below the ſtar-wheel is a pinion *c*, which is on a round ſpindle, turned by the water-wheel, by means of a wheel on this ſpindle. In a wheel on this ſpindle are two ſtuds, on which the pinion *c* ſlides off and on as the loom is ſet off and on by the lever *d*. At the farther end of this lever is the weight *s*, hanging by a cord which paſſes over a pulley *t*, fixed at the outer end of the ſpring-catch on which the lever *d* reſts; and thus the loom is drawn in at the upper end of the lever *d*. But when the ſhuttle does not lift the wire *z*, it catches on the ſtud on the rod *a* 2, which is connected with the ſpring-catch, and the lever *d* flies off with the weight *s*, and the loom ſtops working. On the head of the poſt F is the yarn-beam. The rollers *e* and *f* are cylinders, preſſed together by a ſcrew-lever, and take away the cloth between them at a proper rate. In the roller *f* is a groove for a band for driving the roller *g*, on which the cloth winds itſelf as it is wrought. Wherever ſprings are mentioned to be uſed in the above deſcription, weights may be uſed in their ſtead, and to the ſame effect, and more eſpecially upon the treadle of fig. 1. for driving the ſhuttle.

WEBHAMET *River*, in the Diſtrict of Maine, is the principal entrance by water to the town of Wells, in York county. It has a barred harbour.—*Morse.*

WECHQUETANK, a Moravian ſettlement made by the United Brethren, in Pennſylvania, behind the Blue Mountains. In 1760, the Bethlehem congregation purchaſed 1400 acres of land for the Chriſtian Indians. In 1763, it was deſtroyed by white ſavages, who inhabited near Lancaſter; they likewiſe murdered many of the peaceable Indians ſettled here. It was finally deſtroyed by the Americans during the late war. It lies about 30 miles north-weſt by weſt of Bethlehem. —*ib.*

WEIGHTS AND MEASURES, in commerce, are ſo various, not only in different countries, but even in different provinces of the ſame country, and this variation is the ſource of ſo much inconveniency in trade, that writers on political and commercial economy have propoſed various methods for fixing an univerſal and immoveable ſtandard of weights and meaſures for all ages and nations. Sir James Stewart Denham's ſpeculations on this ſubject have been noticed in his life publiſhed in this *Supplement;* Mr Whitehurſt's ingenious contrivance for eſtabliſhing a ſtandard of weights and meaſures has been mentioned under the title MEASURE (*Encycl.*); and the new table of weights and meaſures, which the French republicans wiſh to impoſe upon all Europe, is given (*Encycl.*) under the title REVOLUTION, n° 183.

As theſe meaſures occur frequently, even in Engliſh tranſlations of French books of value, we ſhall here give ſuch an account of them as may enable the reader to reduce them with eaſe to the Engliſh ſtandards. They

They are of five kinds; *measures of length, of capacity, of weight, of superficies for land, and of wood for fuel.* For every kind, there are many measures of different sizes, one of which has been taken as the basis of all the rest, and its name assumed as the root of their names. Thus METRE is called the principal measure of length; LITRE, of capacity; GRAMME, of weight; ARE, of superficies of land; and STERE, of wood for fuel. These words being the radical terms of the names of other measures of length, capacity, &c. a relation is hereby preserved between the names.

The measures of length above the *metre*, are ten times, a hundred times, a thousand times, ten thousand times, greater than the metre. The measures of length below the metre, are ten times, a hundred times, a thousand times, less. To form the names of these measures, other words which indicate the relations of *ten times*, a *hundred times*, greater; and of *ten times*, a *hundred times*, less, &c. are placed before the word *metre*. The same annexes have been used to form the names of measures, greater or less, than the *litre*, the *gramme*, &c. It is necessary, therefore, to state in this place the English equivalents of only the *metre*, the *litre*, the *gramme*, the *are*, and the *stere*.

The METRE = 3.28084 feet English.

The LITRE = 61.0243 cubic inches, or $1\frac{103}{141}$ pint ale measure.

The GRAMME, or cubic *centi-metre* of water, at the freezing point, = $\frac{1}{443}$ lb. averd. or $\frac{1}{28}$ of an ounce, or $\frac{26}{45}$ of a dram nearly.

The ARE = $1076\frac{2}{5}$ square feet, or $119\frac{3}{5}$ square yards, or $\frac{1}{40}$ of an acre nearly.

The STERE, or cubic metre = 35.31467 cubic feet.

The most part of the English, not choosing to adopt the weights and measures prescribed to them by the French Convention and the National Institute, Sir George Shuckburgh Evelyn, Bart. turned his attention to this subject, and published, in the Philosophical Transactions for 1798, an account of some endeavours to ascertain a standard of weights and measures. The principles upon which he proceeded are the same with Mr Whitehurst's; but he has carried his experiments much farther than his predecessor, and seems to have conducted them with greater accuracy. His memoir is hardly susceptible of abridgment; and our limits do not permit us to insert it entire. This is indeed unnecessary, if it be true, as another ingenious gentleman alleges*, that we are in the actual possession, and the constant use, of a standard both for weight and measure, as invariable as that now used in France. This standard he finds in the foot measure, and in the avoirdupose, or, as he thinks it ought to be called, the *decade* ounce weight.

* H. Goodwin Esq; in *Nicholson's Journal*, vol. iv. p. 103, &c.

The decade ounce weight of pure rain, or distilled water, at 60° of heat, is generally allowed to be equal in bulk to the one thousandth part of the cubic foot. Were 44.3511 parts out of 10000, or about $\frac{1}{225}$th part added to the present Winchester bushel, that bushel would then contain exactly 10 cubic feet or 10000 oz. of distilled water, at 60° of heat.

Our author then gives comparative tables between this system and that which is now established in France. Taking the metre at 3 French feet, and 11.296 lines †, and the French foot to be to the English as 1 : 1.065752004 ‡, one French foot will be equal to 10.65752004 English decades, or tenths of an English foot: hence he calculates the following

† *Journal de Phys.* vol. v. p. 460.

‡ *Phil. Transf.* 1768, p. 326. and *Connoissance des Temps*, 1795.

COMPARATIVE TABLES, English with French.

LONG MEASURE.

Long decade.		Metre.		Metre.		Long decades.
1	=	0.03047983	ferè	1	=	32.808583358, &c. or inches 39.3703.

SQUARE MEASURE.

Square decades.		Ares,		Ares.		Square decades.
1	=	0.0000092902	ferè	1	=	107640.3142, or sqr. inch. 155002.052448

CUBE MEASURE.

Cube decades.		Litres.		Litre.		Cube decades.
1	=	0.028831637	ferè	1	=	35.3152622, &c. or cub. inch. 61.0247727

WEIGHTS.

Avoird. or decade oz.		Grammes.		Gramme.		Decade oz.
1	=	28.31637	ferè	1	=	0.03531526, &c. or grains, 15.45042625

Long, Square, or Cube, decades are reduced to Long, Square, or Cube, English inches by multiplying by 1.2, 1.44, 1.728, and decade ounces are reduced to grains, containing 7000, or 5760, to the lb. Avoird. Troy, by multiplying the ounce by 437.5 = the number of grains in an avoirdupoise ounce.

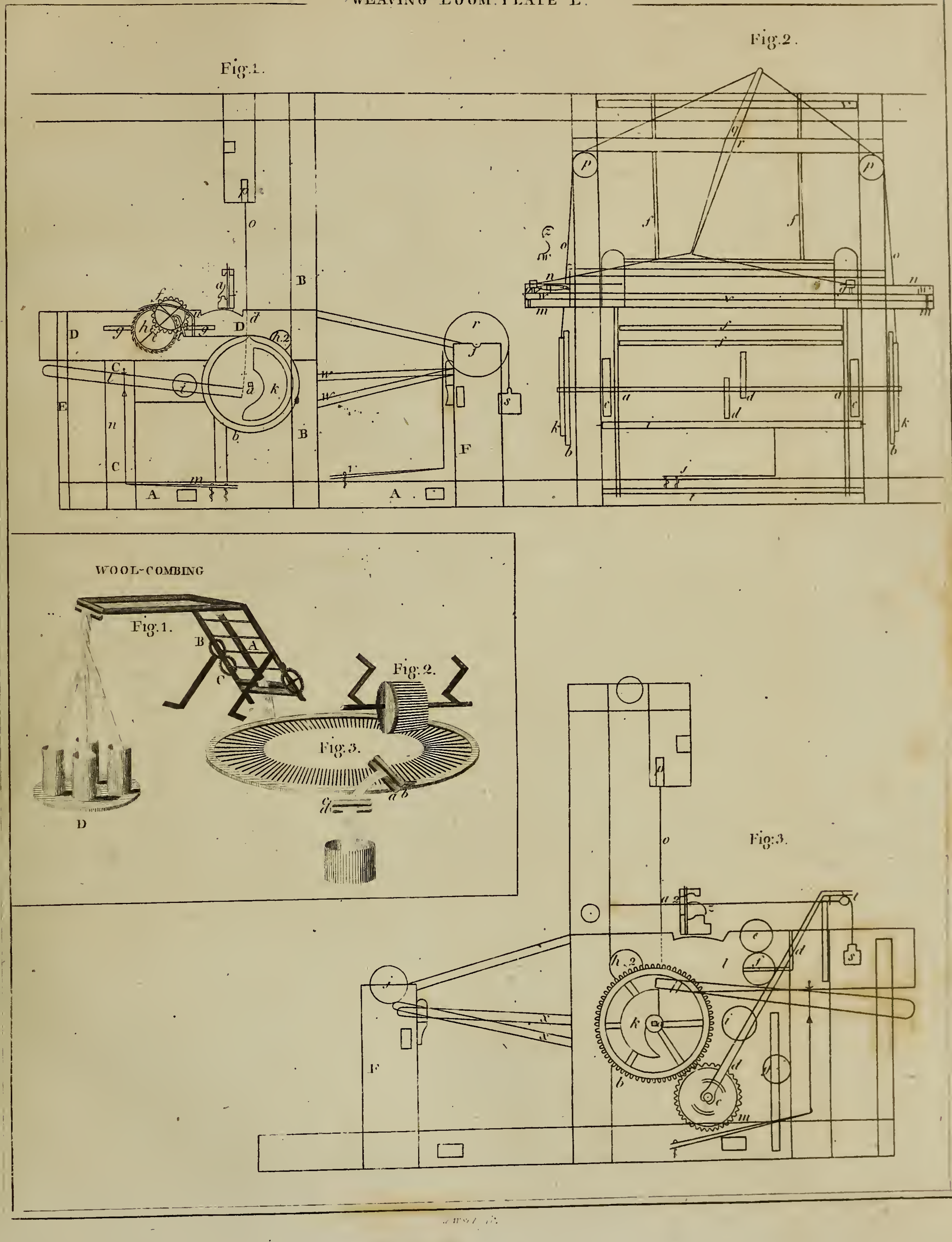
Our author, who seems to have paid much attention to weights and measures, observes, that a standard measure for the purposes of trade, in particular, as well as for others, that would uniformly give an accurate result, and could be easily made, examined, and ascertained, by common mechanics, which neither our present liquid nor dry measures evidently can, would surely be an acquisition of great value. Such an one, he presumes, would be the following: A square pyramid, whose perpendicular height is exactly thrice the length of the side of the base: for such an one, and every section of it, made by a plane parallel to its base, would, in the first instance, possess, and, in every subdivision, retain these remarkable properties.

1st, Similar comparative dimensions to those above given, for the original pyramid, *i. e.* every smaller pyramid, formed by the above-mentioned parallel section, would have its perpendicular height thrice the length of the side of its base; and,

2dly, The length of the side of each base will always indicate, or equal the cube root of the solid content of the pyramid; *e.g.* If the length of the side of the base be 3, the solid content will be the cube of 3, *viz.* $3 \times 3 \times 3 = 27$.

We do not perceive very clearly the great value of this standard; but Mr Goodwyn says, that he has been many years in the habit of using a pyramid measure to examine corn; and is perfectly convinced that such a one will indicate a far more accurate result than can arise

WEAVING LOOM. PLATE L.



arife from the manner in which corn is meafured by the bufhel. This we are bound to believe; for it is abfurd to oppofe theories to a fact afcertained by experience.

WEISENBERG, a townfhip of Pennfylvania, in Northampton county.—*Morse.*

WELCH *Mountains*, are fituated in Chefter county, Pennfylvania. Befides other ftreams, Brandywine Creek rifes here.—*ib.*

Welch *Tract*, a fmall territory of Pennfylvania, fo named becaufe firft fettled by Welchmen. There are a number of fmall towns in it, as Haverford-Weft, Merioneth, &c. It is pretty thickly inhabited by an induftrious, hardy and thriving people.—*ib.*

WELCOME, *Sir Thomas Roes*, or *Ne Ultra*, a bay or ftrait in that part of Hudfon's Bay which runs up to the N. round from Cape Southampton, opening between lat. 62 and 63 N. On the weft or north fhore is a fair head land called the Hope by Captain Middleton, in lat. 66 30 N.—*ib.*

WELLFLEET, a townfhip of Maffachufetts, in Barnftable county, fituated on the peninfula called Cape Cod; S. E. from Bofton, diftant by land 105 miles, by water 60, and from Plymouth light-houfe 8 leagues. The harbour is large, indented within with creeks, where veffels of 70 or 80 tons may lie fafe in what is called the Deep Hole. The land is barren, and its timber is fmall pitch-pine and oak. Before it was incorporated in 1763, it was called the *North Precinct of Eaftham*, and was originally included in the Indian *Skeekcet* and *Pamet*. In 1790, it contained 1117 inhabitants. Since the memory of people now living, there have been in this fmall town 30 pair of twins, befides two births that produced three each. The method of killing gulls in the gull-houfe, is no doubt an Indian invention, and alfo that of killing birds and fowl upon the beach in dark nights. The gull-houfe is built with crotches fixed in the ground on the beach, and covered with poles, the fides being covered with ftakes and fea weed, and the poles on the top covered with lean whale. The man being placed within, is not difcovered by the fowls, and while they are contending for and eating the fifh, he draws them in one by one between the poles, until he has collected 40 or 50. This number has often been taken in a morning. The method of killing fmall birds and fowl that perch on the beach, is by making a light; the prefent mode is with hogs lard in a frying-pan; but the Indians are fuppofed to have ufed a pine torch. Birds, in a dark night, will flock to the light, and may be killed with a walking-cane. It muft be curious to a countryman who lives at a diftance from the fea, to be acquainted with the method of killing black-fifh. Their fize is from 4 to 5 tons weight, when full grown. When they come within the harbours, boats furround them, and they are as eafily driven on fhore, as cattle or fheep are driven on the land. The tide leaves them, and they are eafily killed. They are a fifh of the whale kind, and will average a barrel of oil each: 400 have been feen at one time on the fhore. Of late years thefe fifh rarely come into the harbours.—*ib.*

WELLS, a fmall, but rapid river of Vermont, which, after a fhort S. E. courfe, empties into Connecticut river, below the Narrows, and in the N. E. corner of Newbury. Its mouth is 40 yards wide.—*ib.*

Wells, a townfhip of Vermont, Rutland county, between Pawlet and Poultney, and contains 622 inhabitants. Lake St Auftin lies in this townfhip, and is 3 miles long, and 1 broad.—*ib.*

Wells, a poft-town of the Diftrict of Maine, in York county, fituated on the bay of its name, about half way between Biddeford and York, and 88 miles N. by E. of Bofton, and 441 from Philadelphia. This townfhip is about 10 miles long, and 7 broad; was incorporated in 1653, and contains 3,070 inhabitants. It is bounded S. E. by that part of the fea called Wells Bay, and N. E. by Kennebunk river, which feparates it from Arundel. The fmall river Negunket, perhaps formerly Oguntiquit, has no navigation, nor mills of any value, but noticed, about 150 years ago, as the boundary between York and Wells. The tide through Pifcataqua bay urges itfelf into the marfhes at Wells, a few miles E. of Negunket, and forms a harbour for fmall veffels. Further E. in this townfhip the fmall river Moufom is found coming from ponds of that name about 20 miles from the fea. Several mills are upon the river, and the inhabitants are opening a harbour by means of a canal. Webhamet river is the principal entrance to this town by water.—*ib.*

Wells *Bay*, in the townfhip above mentioned, lies between Capes Porpoife and Neddock. The courfe from the latter to Wells Bar, is N. by E. 4 leagues.—*ib.*

Well's *Falls*, in Delaware river, lie 13 miles N. W. of Trenton, in New-Jerfey.—*ib.*

WENDELL, a townfhip of Maffachufetts, in Hampfhire county, 80 miles N. W. of Bofton. It was incorporated in 1781, and contains 519 inhabitants.—*ib.*

Wendell, a townfhip of New Hampfhire, Chefhire county, about 15 miles N. E. of Charleftown, containing 267 inhabitants. It was called Saville, before its incorporation in 1781.—*ib.*

WENHAM, a townfhip of Maffachufetts, Effex county, between Ipfwich and Beverly; 26 miles N. E. by N. of Bofton. It was incorporated in 1643, and contains 502 inhabitants. Here is a large pond, well ftored with fifh, from which, and its vicinity to Salem, it was, with whimfical piety, called *Enon*, by the firft fettlers.—*ib.*

WENMAN, one of the Gallipago Iflands, on the coaft of Peru, fituated W. of Cape Francifco.—*ib.*

WENTWORTH, a townfhip of New Hampfhire, Grafton county, containing 241 inhabitants. It was incorporated in 1766, and is S. E. of Oxford, adjoining.—*ib.*

WESEL, a village of New-Jerfey, Effex county, on Pafaic river, 2 miles north-weftward of Acquakenunk, and 5 weftward of Hakkenfack.—*ib.*

WEST, or *Wantaftiquek*, a river of Vermont, has its main fource in Bromley, about 3 miles S. E. from the head of Otter Creek. After receiving 7 or 8 fmaller ftreams, and running about 37 miles, it falls into Connecticut river at Brattleborough. It is the largeft of the ftreams on the eaft fide of the Green Mountains; and at its mouth is about 15 rods wide, and 10 or 12 feet deep. A number of figures, or infcriptions, are yet to be feen upon the rocks at the mouth of this river, feeming to allude to the affairs of war among the Indians; but their rudenefs and awkwardnefs denote that the formers of them were at a great remove from the knowledge of any alphabet.—*ib.*

WEST RIVER *Mountain*, in New Hampfhire, in the

the townfhip of Chefterfield, lies oppofite to the mouth of Weft river; and from this part of Connecticut river to Pifcataqua Harbour on the eaft is 90 miles, the broadeft part of the State. Here are vifible appearances of volcanic eruptions. About the year 1730, the garrifon of Fort Dummer, 4 miles diftant, was alarmed with frequent explofions of fire and fmoke, emitted by the mountain. Similar appearances have been obferved fince.—*ib.*

WEST *Bay*, a large bay of Lake Superior, at its wefternmoft extremity, having the 12 ifles at its mouth. It receives St Louis river from the weft.—*ib.*

WEST BETHLEHEM, a townfhip of Wafhington county, Pennfylvania.—*ib.*

WESTBOROUGH, a townfhip of Maffachufetts, Worcefter county, 34 miles weft-fouth-weft of Bofton, and 13 eaft of Worcefter, was incorporated in 1717. Among other fingular occurrences in the Indian wars, the ftrange fortune of Silas and Timothy Rice is worthy of notice. They were fons of Mr Edmond Rice, one of the firft fettlers in this town, and carried off by the Indians on Auguft 8, 1704, the one 9 the other 7 years of age. They loft their mother tongue, had Indian wives, and children by them, and lived at *Cagnawaga*. Silas was named *Tookanowras*, and Timothy, *Oughtforongoughton*. Timothy recommended himfelf fo much to the Indians by his penetration, courage, ftrength, and warlike fpirit, that he arrived to be the third of the fix chiefs of the *Cagnawagas*. In 1740 he came down to fee his friends. He viewed the houfe where Mr Rice dwelt, and the place from whence he with the other children were captivated, of both which he retained a clear remembrance; as he did likewife of feveral elderly perfons who were then living, though he had forgot the Englifh language. He returned to Canada, and, it is faid, he was the chief who made the fpeech to Gen. Gage, in behalf of the Cagnawagas, after the reduction of Montreal. Thefe men were alive in 1790.—*ib.*

WEST *Camp*, a thriving village of New York, containing about 60 houfes, in Columbia county, on the eaft fide of Hudfon's river, 7 miles above Red Hook, and 13 north of New York city.—*ib.*

WEST-CHESTER, a county of New York; bounded north by Dutchefs county, fouth by Long-Ifland Sound, weft by Hudfon's river, and eaft by the State of Connecticut. It includes Captain's Iflands and all the iflands in the found, to the eaft of Frogs Neck, and to the northward of the main channel. In 1790, it contained 24,003 inhabitants, including 1419 flaves. In 1796, there were, in its 21 townfhips, 3,243 of the inhabitants qualified electors.—*ib.*

West-Chester, the chief townfhip of the above county; lying partly on the Sound, about 15 miles eafterly of New York city. It was much impoverifhed in the late war, and contains 1203 inhabitants; of whom 164 are electors, and 242 flaves.—*ib.*

West-Chester, the chief town of Chefter county, Pennfylvania, containing about 50 houfes, a court-houfe, ftone gaol, and a Roman Catholic church. It is about 25 miles weft of Philadelphia.—*ib.*

WESTERLY, a poft-town on the fea coaft of Wafhington county, Rhode-Ifland, and feparated from Stonington in Connecticut by Paucatuck river, 36 miles weft by fouth of Newport, and 256 from Philadelphia. The inhabitants carry on a brifk coafting trade, and are extenfively engaged in the fifheries. The townfhip contains 2,298 inhabitants, of whom 10 are flaves.—*ib.*

WESTERN, a townfhip of Maffachufetts, fituated in the fouth-weft corner of Worcefter county, 18 miles eaft by north of Springfield, 29 in the fame direction from Worcefter, and 73 fouth-weft by fouth of Bofton.—*ib.*

Western, *Fort*, in the Diftrict of Maine, was erected in 1752, on the eaft bank of the fmall fall which terminates the navigation of Kennebeck river. It is 18 miles from Taconnet Fall. It is in the townfhip of Harwington, Lincoln county. A company was incorporated in February 1796, to build a bridge over the river at this place.—*ib.*

Western *Precinct*, in Somerfet county, New-Jerfey, contains 1,875 inhabitants, including 317 flaves.—*ib.*

WESTFIELD, a townfhip of Vermont, Orleans county, fouth of Jay.—*ib.*

Westfield, a pleafant poft-town of Maffachufetts, Hampfhire county, on the river of this name, in a curious vale, 10 miles weft of Springfield, 34 eaft of Stockbridge, 52 fouth-weft of Worcefter, 105 weft-fouth-weft of Bofton, and 260 from Philadelphia. It contains a Congregational church, an academy, and about 50 or 60 compact houfes. The townfhip was incorporated in 1669, and contains 2,204 inhabitants.—*ib.*

Westfield, a fmall river of Maffachufetts, which rifes in Berkfhire county, and runs nearly a fouth-eaft courfe through Middlefield, Weftfield, and Weft-Springfield, where it empties into the Connecticut, by a mouth about 30 yards wide.—*ib.*

Westfield, a townfhip of New York, Wafhington county, bounded foutherly by Kingfbury, and northerly by Whitehall. It contains 2,103 inhabitants, of whom 186 are electors, and 9 flaves. It lies near Lake George.—*ib.*

Westfield, in Richmond county, New York, is bounded northerly by the Frefh Kill, eafterly by Southfield, and wefterly by the Sound. It contains 1151 inhabitants, of whom 131 are electors, and 276 flaves.—*ib.*

Westfield, a fmall town in Effex county, New Jerfey, containing a Prefbyterian church, and about 40 compact houfes. It is about 7 or 8 miles W. of Elizabeth-Town.—*ib.*

WESTFORD, a townfhip of Vermont, in Chittenden county, N. E. of Colchefter, adjoining, and contains 63 inhabitants.—*ib.*

Westford, a townfhip of Maffachufetts, fituated in Middlefex county, 28 miles N. W. of Bofton, and contains 1229 inhabitants. In the year 1792, an academy was eftablifhed here.—*ib.*

WEST-GREENWICH, a townfhip in Kent county, Rhode-Ifland, containing 2,054 inhabitants, including 10 flaves.—*ib.*

WESTHAM, a fmall town of Virginia, Henrico county, on the N. bank of James's river, 6 miles N. W. by W. of Richmond. Here Benedict Arnold deftroyed one of the fineft founderies for cannon in America, and a large quantity of ftores and cannon, in January, 1781.—*ib.*

WESTHAMPTON, a townfhip of Maffachufetts, Hampfhire county, 7 miles wefterly of Northampton, and 109 S. W. by W. of Bofton. It contains 683 inhabitants,

bitants, and lies on the W. fide of Connecticut river. —*ib.*

WEST *Harbour*, on the S. coaft of the ifland of Jamaica, is to the N. of Portland Point. There is good anchorage, but expofed to S. and S. E. winds.—*ib.*

WEST-HAVEN, a parifh of the townfhip of New-Haven, in Connecticut, pleafantly fituated on the Harbour and Sound, 3 miles W. S. W. of the city.—*ib.*

WESTMINSTER, a townfhip of Maffachufetts, fituated in Worcefter county, was granted to thofe who did fervice in the Narraganfet war, or their heirs, in 1728, and was then ftyled *Narraganfet, No.* 2. It was incorporated by its prefent name in 1759; and contains 20,000 acres of land, well watered. It is fituated on the height of land between the rivers Merrimack and Connecticut, having ftreams arifing in the town, and running into both. It is about 55 miles from Bofton to the north of weft, and about 22 miles north from Worcefter, and contains 177 dwelling-houfes, and 1176 inhabitants.—*ib.*

Westminster, a confiderable townfhip of Vermont, in Windham county, on Connecticut river, oppofite Walpole in New Hampfhire. It contains 1601 inhabitants. Sexton's river enters the Connecticut in the S. E. corner of the townfhip. Here is a poft-office 18 miles north of Brattleborough, 18 north-weft of Keen, in New Hampfhire, 59 north of Northampton in Maffachufetts, and 329 north-eaft of Philadelphia.—*ib.*

Westminster, the eafternmoft town of Frederick county, Maryland, about 18 miles E. N. E. of Woodfborough, 26 north-weft of Baltimore, and 47 N. by E. of the city of Wafhington.—*ib.*

WESTMORE, the wefternmoft townfhip of Effex county, Vermont. Willoughby Lake lies in this townfhip.—*ib.*

WESTMORELAND, a county of Virginia, bounded north and eaft by Patowmack river, which divides it from Maryland, fouth-eaft by Northumberland, fouthweft by Richmond, and weft by King George. It contains 7722 inhabitants, of whom 4425 are flaves. This county has the honour of having given birth to George Wafhington, firft Prefident of the United States. The court-houfe in this county is on the fouth bank of Patowmack river, 10 miles N. by E. of Richmond, 16 north-weft of Kinfale, and 289 fouth-weft by fouth of Philadelphia. Here is a poft-office.—*ib.*

Westmoreland, a county of Pennfylvania, bounded north by Lycoming, and fouth by Fayette county, and abounds with iron ore and coal. It contains 11 townfhips and 16,018 inhabitants, including 128 flaves. Chief town, Greenfburg.—*ib.*

Westmoreland, a confiderable townfhip of New Hampfhire, Chefhire county, on the eaftern bank of Connecticut river, between Chefterfield and Walpole, 110 miles from Portfmouth. It was incorporated in 1752, and contains 2,018 inhabitants.—*ib.*

Westmoreland, a townfhip of New-York, in Herkemer county, taken from Whiteftown, and incorporated in 1792. In 1796, it contained 840 inhabitants, of whom 137 were electors. The centre of the town is 6 miles fouth of Fort Schuyler, and 36 north-weft of Cooperftown.—*ib.*

Westmoreland, a tract of land in Pennfylvania, bounded eaft by Delaware river, weft by a line drawn due north and fouth 15 miles weft of Wyoming on Sufquehannah river, and between the parallels of 41 and 40 degrees of north lat. was claimed by the State of Connecticut, as within the limits of their original charter, and in 1754 was purchafed of the Six Nations of Indians by the Sufquehannah and Delaware companies, and afterwards fettled by a confiderable colony, under the jurifdiction of Connecticut. This tract was called *Weftmoreland*, and annexed to the county of Litchfield in Connecticut. The Pennfylvanians difputed the claim of Connecticut to thefe lands, and in the progrefs of this bufinefs there was much warm contention and fome bloodfhed. This unhappy difpute has fince been adjufted.—*ib.*

WESTON, a townfhip of Maffachufetts, in Middlefex county, 15 miles weft of Bofton. It was incorporated in 1712, and contains 1,010 inhabitants. —*ib.*

Weston, a townfhip of Connecticut, Fairfield county, north of Fairfield, adjoining —*ib.*

WEST-POINT, a ftrong fortrefs erected during the revolution, on the W. bank of Hudfon's river, in the ftate of New York, 6 miles above Anthony's Nofe, 7 below Fifh-Kill, 22 S. of Poughkeepfie, and about 60 N. of New York city. It is fituated in the midft of the high lands, and is ftrongly fortified by nature as well as art. The principal fort is fituated on a point of land, formed by a fudden bend in the river, and commands it, for a confiderable diftance, above and below. Fort Putnam is fituated a little further back, on an eminence which overlooks the other fort, and commands a greater extent of the river. There are a number of houfes and barracks on the point near the forts. On the oppofite fide of the river, are the ruins of Old Fort Conftitution, with fome barracks going to decay. A number of continental troops are ftationed here to guard the arfenal and ftores of the United States, which are kept at this place. This fortrefs is called the Gibraltar of America, as by reafon of the rocky ridges, rifing one behind another, it is incapable of being invefted by lefs than 20,000 men. The fate of America feemed to hover over this place. It was taken by the Britifh, and afterwards retaken by ftorm, in a very gallant manner, by Gen. Wayne. Benedict Arnold, to whom the important charge of this fort was committed, defigned to have furrendered it up to the Britifh; but Providenee difappointed the treafonable defign, by the moft fimple means. Major Andre, a moft accomplifhed and gallant officer, was taken, tried, and executed as a fpy, and Arnold efcaped. Thus the Britifh exchanged one of their beft officers, for one of the worft men in the American army.—*ib.*

WESTPORT, a flourifhing townfhip of Maffachufetts, Briftol county, 70 miles foutherly of Bofton. It was incorporated in 1787, and contains 2,466 inhabitants.—*ib.*

WESTRINGIA, a new genus of plants defcribed by J. E. Smith, M. D. prefident of the Linnæan Society of London. It was firft difcovered in New Holland by Dr Solander, who called it *Cunila Fruticofa*, though it is totally different from the Cunila (fee that article, *Encycl.*), and more refembles rofemary, from which, however, it is likewife different. Its peculiar character is: *Calyx femiquinquefidus, pentagonus; corolla refupinata, limbo quadrifido, lobo longiore erecto, bipartito: Stamina diftantia, duo breviora (inferiora) abortiva.* Dr

Smith

Smith affigns it rather to the *didynamia-angiofpermia*, placing it immediately after the *Teucrium*, than to the *diandria* clafs of plants.

WEST-SPRINGFIELD, a townfhip of Maffachufetts, Hampfhire county, on the W. fide of Connecticut river, oppofite Springfield, about 28 miles N. of Hartford, and 100 W. S. W. of Bofton. In the compact part are about 40 dwelling-houfes, and a Congregational church. The townfhip contains 3 parifhes, and 2,367 inhabitants.—*Morse.*

WEST-STOCKBRIDGE, a townfhip of Maffachufetts, in Berkfhire county, adjoining Stockbridge on the weft, and has the New York line on the north-weft, and lies 150 miles from Bofton. William's river, and its ftreams water the townfhip, and accommodate 3 iron-works, a fulling-mill, a grift-mill, and 2 faw-mills.—*ib.*

WEST-TOWN, a townfhip in Chefter county, Pennfylvania.—*ib.*

WEYBRIDGE, a townfhip of Vermont, in Addifon county, feparated from New-Haven on the N. and E. by Otter Creek. It contains 175 inhabitants. Snake Mountain lies nearly on the line between this townfhip and that of Addifon on the weft.—*ib.*

WEYMOUTH, the *Weffagufcus*, or *Waffaguffet*, of the Indians, a townfhip of Maffachufetts, Norfolk county, incorporated in 1635. It lies 14 miles S. E. of Bofton, and employs fome fmall veffels in the mackarel fifhery. Fore river on the N. W. and Back river on the S. E. include near one half of the townfhip. The cheefe made here is reckoned among the beft brought to Bofton market. It is faid to be one of the oldeft towns in the ftate; Mr Wefton, an Englifh merchant, having made a temporary fettlement here in the fummer 1622. It contains 232 houfes, and 1469 inhabitants.—*ib.*

WHALE COVE *Ifland*, in the northern part of N. America, is the moft northerly of two iflands lying to the S. of Brook Cobham, or Marble Ifland, which is in lat. 63 N. Lovegrove, the other ifland, has a fair opening to the weft of it.—*ib.*

WHALE FISH *Ifland*, in the river Effequibo, on the coaft of S. America, is above the Seven Brothers, or Seven Iflands, and below the Three Brothers.—*ib.*

WHALE *Ifland*, at the mouth of M'Kenzie's river, in the North Sea or Frozen Ocean, on the north coaft of the north-weftern part of North America. N. lat. 69 14.—*ib.*

WHAPPING'S *Creek*, a fmall creek which empties through the eaft bank of Hudfon's river, in the townfhip of Fifh Kill, 8 miles fouth of Poughkeepfie, and 72 north of New York city. Here are two mills, at which confiderable bufinefs is performed.—*ib.*

WHARTON, a townfhip of Fayette county, Pennfylvania.—*ib.*

WHATELY, a townfhip of Maffachufetts, in Hampfhire county, 10 miles north of Northampton, and 105 miles from Bofton. It was incorporated in 1771, and contains 736 inhabitants.—*ib.*

WHEAT (fee TRITICUM, *Encycl.*) has for fome years paft been at fo very high a price, that every hint for increafing its quantity or improving its quality is intitled to notice. In the Leicefter Journal for the 6th of December 1799, there is an ingenious paper on the fubject of tranfplanting wheat, as a means of providing againft the expected fcarcity of that neceffary of life. It is recommended "to fow, in dry land, at the ufual feafon, as much corn as may be deemed neceffary to plant in the fpring any number of acres which may be occupied with that article in the following year. When the foil is prepared, a furrow is to be made with a very fmall plough and one horfe, in the centre of the ridge or land, returning back in the fame track (this time only of every ridge); then turn towards the left hand, and plough another furrow, about eight or nine inches from the firft furrow, turning always to the left hand, till the whole ridge is finifhed; it will then be formed into trenches, in parallel lines of about eight or nine inches afunder, and imitate what gardeners term drawing of drills. In thefe furrows the plants are to be laid." Mr John Ainfworth of Glen, the experienced author of this communication, fays he has practifed this method with the moft complete fuccefs.

It has been likewife practifed, on a fmall fcale, with equal fuccefs, but we know not in what county. About the end of Auguft 1783, that gentleman threw a fmall quantity of wheat, which near two years before had been fteeped and limed (fee WHEAT, *Encycl.*) into an unmanured corner of his garden. In the beginning of February following he had a piece of ground (alfo unmanured) dug in an open part of his orchard, and he tranfplanted it on beds of fix rows wide, at nine inches afunder every way. It tillered, and fpread over the ground fo completely, as to prevent even a weed growing among it. It produced admirable corn, and at the rate of near four quarters per acre.

From accurate calculations which he then made, he found that an acre, fuppofing the feed to be very good, and the plants fet at the diftance above menttioned, would require only *half a peck* of feed.

Befides the faving of the feed, there are two other material advantages which attend fuch a method; one is, that fome fuitable crop may be on the ground all the winter for ufe; and the other is, that ploughing the ground fo late as February, will effectually bury and deftroy thofe weeds which were beginning to vegetate; and before others can fpring up, the corn plants have taken to the ground, and fo fpread over it that the weeds cannot rife, by which means there is a very clean crop, and all the cuftomary expenfe for weeding is faved.

This author feems to think that wheat will thrive as well, and produce as full a crop, when fown in the fpring, as if it had been committed to the ground in the preceding autumn. In the fouthern counties of England we doubt not but it may; but the cafe is otherwife in Scotland, where the fpring is not fo early, and where from the narrownefs of the ifland, the froft is feldom fo fevere. We agree, however, with Dr Pike, in thinking it a pity that the way of fetting wheat (as done in Norfolk and Suffolk) is not every where more general. The procefs is indeed tedious and troublefome; and we have often wondered that, among the numberlefs machines lately contrived to leffen manual labour, none has been invented for dibbling wheat expeditioufly and accurately. We are therefore pleafed to learn, that Dr Pike himfelf has turned his attention to the fubject, and hopes in the courfe of this year (1800) to prefent the public with a *method of fetting wheat at* PERFECTLY EXACT *diftances through a whole field, and as* EXPEDITIOUSLY *as the common broadcaft fowing, which can therefore be applied to farms of any magnitude;*

nitude; and when a peck of feed is found to be fufficient for an acre (and in fome land much lefs), the faving on a large farm muft be immenfe. We truft to the liberality of his profeffion, that he will not take out a patent for his invention.

Though we have elfewhere given the ufual recipes for preventing fmut in wheat, it would be improper to conclude this article without mentioning the very fimple one which Mr Wagftaffe of Norwich has uniformly found attended with complete fuccefs. This confifts in nothing more than immerfing the feed in pure water, and repeatedly fcouring it therein, juft before it is fown or dibbled in the foil. Whether well, fpring, or river water be ufed, is indifferent; but repeated ftirring and change of water is effential to remove the particles of infection that may have imperceptibly adhered to the feeds thus purified. The fubfequent crop will be perfect in itfelf, and its feeds, he fays, fucceffively fo likewife, if there are no adjacent fields from whence this contamination may be wafted. He recommends the fame wafhing, and for the fame reafon, of barley and oats before they be fown.

WHEELING, or *Wheelin*, a poft-town of Virginia, fituated at the mouth of a creek on the eaft bank of Ohio river, 10 miles above Grave Creek, 18 fouth-weft of Weft Liberty, and 61 fouth-weft of Pittfburg. Not far from this place, a wall has been difcovered fome feet under the earth, very regularly built, apparently the work of art. It is 363 miles from Philadelphia.—*Morse.*

WHEELOCK, a townfhip of Vermont, in Caledonia county, about 20 miles north-weft of Littleton, and contains 33 inhabitants.—*ib.*

WHETSTONE *Fort* is on the north fide of Patapfco river, and weft fide of the mouth of Baltimore Harbour, in Maryland. It is oppofite Goffuch Point, 2½ miles eafterly from the Baltimore Company's iron-works, at the mouth of Gwinns Falls.—*ib.*

WHIPPANY, a village of New Jerfey, Morris county, on a branch of Paffaick river, nearly 5 miles N. E. of Morriftown.—*ib.*

WHIRL, or *Suck*, in Tenneffee river, lies in about lat. 35 N.—*ib.*

WHITE, a river or torrent iffuing from the mountain of fulphur in the ifland of Guadaloupe, in the Weft-Indies. It is thus named as often affuming a white colour from the afhes and fulphur covering it. It empties into the river St Louis.—*ib.*

White, a river of Louifiana, which joins Arkanfas river, a water of the Miffiffippi, about 10 miles above the fort, which Mr Hutchins reckons 550 computed miles from New-Orleans, and 660 from the fea. It has been navigated above 200 miles in flat-bottomed boats.—*ib.*

White, a fmall river of the N. W. Territory, which purfues a north-weft, and, near its mouth, a wefterly courfe, and enters Wabafh river, 12 miles below the mouth of Chickafaw river.—*ib.*

White, a river of Vermont, which falls into Connecticut river about 5 miles below Dartmouth college, between Norwich and Hartford. It is from 100 to 150 yards wide, fome diftance from its mouth. Its fource is in a fpring, which by means of Onion river, communicates with Lake Champlain. It derives its name from the whitenefs of its water.—*ib.*

White *Cape*, or *Blanco*, on the weft coaft of New Mexico, is 20 leagues to the north-weft of Herradura. This cape, in lat. 10 N. bears with the ifland Canoe, at north-weft by weft and S. E. by E. and with St Luke Ifland at N. E. by N. and fouth-weft by fouth, being about 9 leagues from each.—*ib.*

White *Deer*, a townfhip of Pennfylvania, fituated on Sufquehannah river.—*ib.*

WHITEFIELD, a townfhip of Pennfylvania, in Weftmoreland county.—*ib.*

WHITE *Ground*, a place in the Creek country, 10 miles from Little Tallaffee.—*ib.*

WHITEHALL, a townfhip of Pennfylvania, in Northampton county.—*ib.*

Whitehall, a townfhip of New York, Wafhington county, bounded foutherly by the S. bounds of the tract formerly called Skeenfborough, and northerly by the N. bounds of the county. In 1790, it contained 805 inhabitants. In 1796, 150 of the inhabitants were electors. —*ib.*

WHITE MARSH, a townfhip of Pennfylvania, Montgomery county.—*ib.*

WHITEPAINE, a townfhip of Pennfylvania, Montgomery county.—*ib.*

WHITE PLAINS, a townfhip of New York, Weft-Chefter county, bounded eafterly by Mamaroneck river, and wefterly by Bronx river. It contains 505 inhabitants, of whom 76 are electors, and 49 flaves. It is remarkable for a battle fought here between the American and Britifh forces, on the 28th of October, 1776. It is 15 miles E. by N. of Kingfbridge, 30 N. E. by N. of New York, and 125 from Philadelphia.—*ib.*

WHITE *Point*, in the ifland of Jamaica, lies eaftward of White Horfe Cliffs, about 7 leagues E. of Port Royal.—*ib.*

WHITE'S *Bay*, on the coaft of Newfoundland. N. lat. 50 17, W. long. 56 15.—*ib.*

WHITESTOWN, in Herkemer county, New York, on the fouth fide of Mohawk river, 4 miles weft of Old Fort Schuyler, and 100 weft of Albany. The compact part of this new and flourifhing town lies on one beautiful ftreet, about a mile in length, ornamented with trees. The houfes are generally furnifhed with water, conducted by pipes laid under ground, from the neighbouring hills. At prefent the court-houfe, meeting-houfe, and fchool-houfe, are combined in one building; but it is contemplated fhortly to erect feparate and handfome edifices for thefe feveral purpofes. The foil of this town is remarkably good. Nine acres of wheat in one field, yielded, on an average, 41 bufhels of wheat, of 60 lb. each, an acre. This is no uncommon crop. This town and its neighbourhood has been fettled with remarkable rapidity. All that diftrict comprehended between the Oneida Refervation, and the German Flats, and which is now divided into the townfhips of Whitef-town, Paris, and Weftmoreland, was known, a few years fince, by the name of *Whiteftown*, and no longer ago than 1785, contained two families only, thofe of Hugh White, and Mofes Foot, efquires. In 1796, there were within the fame limits, 6 parifhes, with as many fettled minifters, 3 full regiments of militia, 1 corps of light-horfe, all in uniform. In the whole, 7359 inhabitants, of whom 1190 were qualified electors.—*ib.*

WHITING, a townfhip of Vermont, in Addifon county,

county, feparated from Leicefter on the E. by Otter Creek, and has part of Orwell on the W. It contains 250 inhabitants.—*ib.*

WHITTINGHAM, a townfhip of Vermont, in the fouth-weft corner of Windham county, containing 442 inhabitants.—*ib.*

WHITSUN *Ifland*, in the South Pacific Ocean, is about 4 miles long, and 3 broad; and fo furrounded by breakers that a boat cannot land. S. lat. 19 26, W. long. 137 56. Variation of the needle in 1767, 6° E. —*ib.*

WIANDOTS, or *Wyandots*, an Indian tribe inhabiting near Fort St Jofeph, and Detroit, in the N. W. Territory. Warriors, 200.—*ib.*

WIAPOCO, or *Little Wia*, is an outlet or arm of the river Oroonoko, on the weft fide. It has many branches, which are all navigable.—*ib.*

WICKFORD, a fmall trading village in the townfhip of North Kingftown, Rhode-Ifland, and on the W. fide of Narraganfet-Bay; 24 miles S. of Providence, and 9 or 10 N. W. of Newport.—*ib.*

WIESPINCAN, a river of Louifiana, which empties into the Miffiffippi, 22 miles above the Soutoux village.—*ib.*

WICOMICO, a fmall river of Maryland, which rifes in Suffex county, Delaware, and empties into Fifhing-Bay, on the eaft fhore of Chefapeak Bay.—*ib.*

WIGHCOMICO, a fhort navigable river of Maryland, which is formed by Piles and Allen's Frefh, and, running fouthward, empties into the Patowmac, about 35 miles from its mouth. Cob Neck forms the north limit of its mouth.—*ib.*

WILBRAHAM, a townfhip of Maffachufetts, in Hampfhire county, 10 miles E. of Springfield, 30 N. E. of Hartford in Connecticut, and 89 S. W. of Bofton. It was incorporated in 1763; contains 2 parifhes, and 1555 inhabitants.—*ib.*

WILKES, a county of the upper diftrict of Georgia, feparated from S. Carolina, on the eaftward, by Savannah river, and contains 31,500 inhabitants, including 7,268 flaves. Tobacco is the chief produce of this county, of which it exported about 3000 hhds. in 1788. It is well watered, and is famous for a medicinal fpring, near its chief town, Wafhington.—*ib.*

Wilkes, a county of Morgan diftrict, in the N. W. corner of N. Carolina. It contains 8,143 inhabitants, including 549 flaves.—*ib.*

Wilkes, a poft-town and chief of the above county, 33 miles from Rockford, 45 from Morgantown, and 611 from Philadelphia.—*ib.*

WILKIE (William, D. D.), the author of an heroic poem, entitled the *Epigoniad*, was born in the parifh of Dalmeny, in the county of Weft-Lothian, on the 5th of October 1721. He was defcended of an ancient family in that county, though his father rented only a fmall farm, and was poor and unfortunate through life. He was able, however, to give his fon a liberal education; and that fon, it is faid, difcovered fo early a propenfity to the ftudy of poetry, that he began to write verfes in his tenth year.

As this wonderful prematurity of genius was never heard of during Wilkie's life, it will probably be confidered as a ftory fabricated to raife the Scottifh poet to the fame eminence with Pope, whofe verfification he is allowed to have imitated with fuccefs. We have no doubt but that Wilkie wrote in early life the defcription of a ftorm, which is publifhed in the 9th volume of the Statiftical Account of Scotland; but that he wrote it in his tenth year is not proved, and is highly improbable. The poem difplays a notion—a confufed notion indeed—of the laws of electricity, which a boy in his tenth year, and at a period when electricity was little underftood, could not have acquired.

Having learned the rudiments of the Latin tongue at the parifh-fchool of Dalmeny, young Wilkie was, at the age of thirteen, fent to the univerfity of Edinburgh, where he was foon diftinguifhed by his originality of thought, and by his rapid progrefs in erudition and fcience. Among his fellow ftudents he was moft clofely affociated with Dr Robertfon the hiftorian, Mr John Home the poet, Dr M'Ghie (A), who afterwards obtained the friendfhip of Johnfon, and became a member of the Ivy-lane Club; and a Mr Cleghorn, who promifed to be an ornament to the univerfity, in which he was afterwards a profeffor, but died before he had time to realize the fond hopes of his friends. During the courfe of his education, Wilkie became acquainted with the celebrated David Hume and Dr Fergufon, and at a later period with Dr Adam Smith, the far-famed author of "The Wealth of Nations." Of all thofe men he regarded Dr Fergufon with the greateft affection, and Dr Smith with the greateft admiration. This laft writer he confidered as equal to Robertfon and Hume in erudition, and vaftly their fuperior in originality and invention; and this opinion he cherifhed to the day of his death.

Before he had completed his education, his father died, leaving him no other inheritance than the ftock and unexpired leafe of his farm, and the care of his three fifters. Wilkie, therefore, turned much of his attention to agriculture, in which he became eminent, not merely as a theorift, but as a practical farmer. He had too much fcience to be the flave of ancient prejudice, and too much judgment to be hurried into hazardous experiments by the charms of untried fpeculation. One of his fifters being married to a fkilful, though unlettered farmer, he availed himfelf of his brother's experience; and upon the facts and maxims derived from him built a fyftem of practical farming, which fully anfwered his own expectation, and obtained the applaufe of all his neighbours.

He ftill profecuted his ftudies in the univerfity, and without ceafing to be a farmer became a preacher in the church of Scotland. For fome years this made no alteration in the mode of his living. He preached occafionally for the minifters of his neighbourhood; cultivated

(A) According to Sir John Hawkins, this man bore arms on the fide of government at the battle of Falkirk 1745. After which, taking a degree in phyfic, he went to London in hopes of employment through the intereft of his countrymen, and perhaps in return for his loyalty. He was a learned, ingenious, and modeft man; but fo little fuccefsful in his profeffion, that he died of a broken heart, and was buried by a contribution of his friends.

vated his farm; read the claffics; and, enamoured of the fimple fublimity of Homer, project an epic poem on the Homeric model. The fubject of his intended poem he drew from the fourth book of the *Iliad*, where Sthenelus gives Agamemnon a fhort account of the facking of Thebes; and as that city was taken by the fons of thofe who had fallen before it, Wilkie gave to his poem the quaint title of *Epigoniad*, from the Greek word επιγονοι, which fignifies *defcendants*. It is not our bufinefs to write a criticifm upon this poem. The fubject was ill-chofen; for the learned reader has enough of the heroic ages in the immortal poems of Homer and Virgil, and in thofe ages the unlearned reader can feel no intereft. The Epigoniad, therefore, though compofed in fmooth and elegant verfe, with due attention to ancient manners, and conftructed on the moft regular plan, has fallen into neglect, from which no critic or biographer will ever refcue it.

In the year 1753, Mr Wilkie was ordained minifter of Ratho, in confequence of a prefentation from the Earl of Lauderdale, who knew his worth and admired his genius. Without neglecting his favourite amufements of hufbandry, or the ftudy of the belles lettres, he difcharged with fidelity the duties of a Chriftian paftor, was famed for his original and impreffive mode of preaching, and foon came to be loved as well as efteemed by his rural flock.

In the year 1757 the Epigoniad was publifhed, the refult of fourteen years ftudy and application, which might furely have been more ufefully employed on fome other work; and in 1759 a fecond edition was called for, to which he added *A Dream in the manner of Spenfer*. He was, the fame year, chofen profeffor of natural philofophy in the univerfity of St Andrew's; an office for which it is difficult to conceive how he could have been fitted by the ftudy of epic poetry, and clofe attention to the cultivation of his farm. He was, however, a man of a vigorous mind, and we never heard that he difgraced his electors.

When he removed to St Andrew's, his whole fortune exceeded not L. 200 Sterling; a proof that his Epigoniad had not enriched him. With this fum he purchafed a few acres of land in the neighbourhood of the city, carried his two unmarried fifters with him, and continued to live in the univerfity exactly as he had lived at Ratho. In his profefforial career there was nothing remarkable. He patronifed genius, efpecially poetical genius, in the young men who attended his lectures, and by them was, of courfe, loved and efteemed: (See FERGUSSON in this *Suppl.*). In the year 1768 he publifhed a volume of fables of no great value, previous to which the univerfity conferred upon him the degree of D. D.; and he died, after a lingering illnefs, on the 10th of October 1772.

The manners of Dr Wilkie were fingular, and in fome refpects difgufting. He has been feverely blamed for his penurioufnefs, but, in our opinion, unjuftly. His father had left him in debt, with nothing but the profits which he might make of a fmall farm to difcharge that debt, and to fupport himfelf and three fifters. In him, therefore, rigid economy was, for many years, a virtue; and he knows little of human nature, who can blame a man for not breaking habits which it had been the duty, as well as the bufinefs of a great part of his life to form. Amidft his moft rigid and offenfive economy, he was liberal in his donations to the poor.

He had been feized while minifter of Ratho, with an unformed ague, of which he never got entirely rid. For this complaint he thought an extraordinary perfpiration neceffary, and generally flept, in winter, under twenty-four blankets. He had an utter averfion from clean linen, and has been known to bargain, when he ftaid a night from home, not only for the proper quantity of blankets to his bed, but alfo for fheets, which had been ufed by fome other perfon, and rendered fufficiently dirty to pleafe his feeling. It will eafily be conceived that fuch a man was, to the laft degree, flovenly in his drefs.

Sufpicions have been thrown out by his lateft, and we believe his only, biographer, that Dr Wilkie's belief of the Chriftian religion was neither orthodox nor fteady. Not having had the pleafure of his acquaintance, we cannot pofitively fay that thefe fufpicions are groundlefs; but the writer of this article has converfed much about the author of the Epigoniad with a clergyman who knew him well, and who would have been glad to accufe him of infidelity, if he could have preferred fuch an accufation with truth. He was a very abfent man, apt to forget what he was about even when difcharging the moft folemn parts of his clerical duty, and ufed to fay of himfelf that he never could conduct a facrament. From this abfence of mind, and thofe confeffions of it, may have arifen the fufpicion that he was not a firm believer; but no fuch fufpicion was ever thrown out to this writer by the clergyman already referred to.

He had one very extraordinary defect in a poet: He could not read aloud the fmootheft verfes, fo as to preferve either the meafure or the fenfe of them. Of this Dr Anderfon has produced very compete proof in his life of Wilkie, prefixed to his poetical works in the Edinburgh edition of the Britifh Poets. With all his defects, however, and all his foibles, he was unqueftionably a genius, and, we are inclined to believe, a good man.

WILKSBARRE, or *Wilkfburg*, a poft-town of Pennfylvania, and chief town of Luzerne county, fituated on the fouth-eaft fide of the eaft branch of the Sufquehannah. It contains a court-houfe, gaol, and about 45 houfes. It is 67 miles N. E. of Bethlehem, about the fame diftance above Sunbury, and 118 N. by N. W. of Philadelphia.—*Morse.*

WILLIAM, *Fort*, (now called the *Caftle*) was erected on Caftle Ifland in Bofton harbour, in the reign of king William, by Col. Roemer, a famous engineer. When the Britifh troops evacuated Bofton, in March, 1776, the fortifications were blown up, but were foon after repaired. The buildings are the governor's houfe, a magazine, gaol, barracks, and work-fhops. On this ifland, which contains about 18 acres of land, diftant 3 miles from the town of Bofton, there are a number of convicts, who are fentenced to confinement here for different periods, according to their crimes, and employed in the manufacture of nails and fhoes, and guarded by a company of between 60 and 70 foldiers. The fort, which commands the entrance into the harbour, has 50 pieces of cannon mounted, and 44 others lie difmounted.—*ib.*

WILLIAMS, a town in Northampton county, Pennfylvania.—*ib.*

WILLIAM'S *Sound, Prince*, on the north-weft coaft of N. America. Its E. point is in lat. 60 19 N. and long. 146 53 weft, and Cape Elizabeth which is its weft point, and the E. point of Cook's river, is in lat. 59 10, and long 152 15 —*ib.*

WILLIAMSBOROUGH, a poft-town of N. Carolina, and capital of Granville county, pleafantly fituated on a creek which falls into the Roanoke. It carries on a brifk trade with the back counties, and contains between 30 and 40 houfes, a court-houfe, gaol, and flourifhing academy. It is 17 miles from Warrenton, 48 north-eaft of Hillfborough, 56 weft-north-weft of Halifax, and 407 from Philadelphia.—*ib.*

WILLIAMSBURG, a county of Virginia, between York and James' rivers, and was joined in the enumeration of inhabitants, in 1790, with York county. Thefe together contain 5,233 inhabitants.—*ib.*

WILLIAMSBURGH, a townfhip of Maffachufetts, Hampfhire county, on the weft fide of Connecticut river, having Hatfield on the E. It contains a handfome Congregational church, 159 houfes, and 1,049 inhabitants. In the year 1760, this townfhip was a wildernefs. It lies 7 miles from Connecticut river, 8 northweft from Northampton, and 108 weft of Bofton.—*ib.*

WILLIAMSBURG, a poft-town of New-York, Ontario county, fituated on the E. fide of Geneffee river, near where Canaferago creek empties into that river; 30 miles S. W. of Canandaigua, 40 N. W. of Bath, 98 N. W. of Athens or Tioga Point, and 288 N. W. of Philadelphia.—*ib.*

WILLIAMBURG, called alfo *Joneftown*, a town of Pennfylvania, Dauphine county, at the junction of Little Swatara with Swatara river. It has a German Lutheran and Calvinift church, and about 40 dwelling-houfes. It is 23 miles N. E. by E. of Harrifburg, and 89 northweft of Philadelphia.—Alfo, the name of a townfhip in Luzerne county.—*ib.*

WILLIAMSBURG, a village of Maryland, in Talbot county, 5 miles N. E. of Eafton, and 4 N. W. of King's-Town.—*ib.*

WILLIAMSBURG, a poft-town of Virginia, lies 60 miles eaftward of Richmond, fituated between two creeks, one falling into James, the other into York river. The diftance of each landing-place is about a mile from the town. During the regal government it was propofed to unite thefe creeks by a canal paffing through the centre of the town; but the removal of the feat of government rendered it no longer an object of importance. It contains about 200 houfes, and has about 1,400 inhabitants. It is regularly laid out in parallel ftreets, with a pleafant fquare in the centre of about 10 acres, through which runs the principal ftreet eaft and weft, about a mile in length, and more than 100 feet wide. At the ends of this ftreet are two public buildings, the college and capitol. Befides thefe, there is an Epifcopal church, a prifon, a court-houfe, a magazine, now occupied as a market, and a hofpital for lunatics, calculated to accommodate between 20 and 30 patients, in feparate rooms or cells. The houfe is neatly kept, and the patients well attended; but convalefcents have not fufficient room for free air and exercife without making their efcape. Not far from the fquare ftood the governor's houfe, or palace, as it was called. This was burnt during the war, while it was occupied as an American hofpital. The houfe of the prefident of the college, occupied alfo as an hofpital by the French army, fhared the fame fate. This has fince been rebuilt at the expenfe of the French government. In the capitol is a large marble ftatue, of Narbone Berkley, Lord Botetourt, a man diftinguifhed for his love of piety, literature, and good government, and formerly governor of Virginia. It was erected at the expenfe of the State, fome time fince the year 1771. The capitol is little better than in ruins, and this elegant ftatue is expofed to the rudenefs of negroes and boys, and is fhamefully defaced. A late act of the affembly authorifes the pulling down one half of this building, to defray the charge of keeping the other half in repair. The college of William and Mary fixed here, was founded in the time of king William and queen Mary, who granted to it 20,000 acres of land, and a penny a pound duty on certain tobaccoes exported from Virginia and Maryland, which had been levied by the ftatute of 25 Car. 2. The affembly alfo gave it, by temporary laws, a duty on liquors imported, and fkins and furs exported. From thefe refources it received upwards of 3,000l. The buildings are of brick, fufficient for an indifferent accommodation of perhaps 100 ftudents. By its charter, it was to be under the government of 20 vifitors, who were to be its legiflators, and to have a prefident and fix profeffors, who were incorporated. It was allowed a reprefentative in the general affembly. Under this charter, a profefforfhip of the Greek and Latin languages, a profefforfhip of mathematics, one of moral philofophy, and two of divinity, were eftablifhed. To thefe, were annexed, for a fixth profefforfhip, a confiderable donation by a Mr Boyle of England, for the inftruction of the Indians, and their converfion to Chriftianity. This was called the profefforfhip of Brafferton, from an eftate of that name in England, purchafed with the monies given. A court of admiralty fits here whenever a controverfy arifes. It is 12 miles E. of York-Town, 60 E. of Richmond, 48 N. W. of Norfolk, and 338 S. S. W. of Philadelphia.

Leaft heat here,	6°	0′
Mean heat,	60	8
Greateft heat,	98	0

N. lat. 37 16, weft long. 76 48.—*ib.*

WILLIAMSPORT, a poft-town of Maryland, Wafhington county, on the N. fide of Patowmack river, at the mouth of Conegocheague Creek, 8 miles S. of the Pennfylvania line, 6 fouth-weft of Hagerftown, 37 N. by E. of Winchefter, in Virginia, 28 fouth by weft of Chamberfburg, in Pennfylvania, and 155 W. by S. of Philadelphia.—*ib.*

WILLIAMSON, a townfhip of New-York, Ontario county. In 1796, there were 142 of its inhabitants electors.—*ib.*

WILLIAMSTOWN, a townfhip of Vermont, Orange county, on the height of land between Connecticut river and Lake Champlain, about 45 miles from the former, and 50 from the latter. It is bounded eaftward by Wafhington, and weftward by Northfield, and contains 146 inhabitants. Stephen's Branch, a ftream which runs N. to Onion river, rifes in this townfhip.—*ib.*

WILLIAMSTOWN, a mountainous townfhip of Maffachufetts, in the north-weft corner of the State, and in Berkfhire county, containing 1769 inhabitants. It is well watered by Hoofack and Green rivers, the former of which is here 8 rods wide. On these streams are four grist-mills, three saw-mills, and a fulling-mill. The main county road passes through it. Colonel Ephraim Williams laid the foundation of an academy several years since, and endowed it by a handsome donation of lands. In 1790, partly by lottery, and partly by the liberal donation of gentlemen in the town, a brick edifice was erected, 82 feet by 42, and four stories high, containing 24 rooms for students, a large school-room, a dining-hall, and a room for public speaking. In 1793, this academy was erected into a college, by an act of the legislature, by the name of *Williams College*, in honour to its liberal founder. The languages and sciences usually taught in the American colleges are taught here. Board, tuition and other expenses of education are very low; and from its situation and other circumstances, it is likely, in a short time, to become an institution of great utility and importance. The first public commencement was held at this college in September, 1795. In 1796, the legislature granted two townships of land to Williams College. There were, in 1796, 101 students in the four classes in this college, besides 30 pupils in the academy connected with the college. A company was incorporated the year abovementioned, to bring water in pipes into the town street. It is 28 miles north of Lenox, and 150 north-westerly of Boston.—*ib.*

WILLIAMSTOWN, a post-town and the capital of Martin county, N. Carolina, is situated on Roanoke river, and contains but few houses, besides the court-house and gaol. It is 25 miles from Blountsville, 24 from Plymouth, 55 from Halifax, and 444 from Philadelphia. —*ib.*

WILLIMANTIC, a small river of Connecticut, which runs a south-east course, and uniting with Natchaug river, forms the Shetucket at Windham.—*ib.*

WILLINGBOROUGH, a township of New-Jersey, situated in Burlington county, on Delaware river, about 14 miles from Philadelphia. It has generally a thin soil, but considerable quantities of fruits and vegetables are raised here for the Philadelphia market.—*ib.*

WILLINGTON, a township of Connecticut, in Tolland county, 6 miles east of Tolland, and 35 north-easterly of Hartford, and was settled in 1719. The lands are rough and hilly. The earthquake on sabbath evening, Oct. 29, 1727, was severely felt in this town.—*ib.*

WILLIS, a township in Chester county, Pennsylvania.—*ib.*

WILLIS *Creek*, in Maryland, falls into the Patowmack from the north at Fort Cumberland.—*ib.*

WILLIS *Island*, in the S. Atlantic Ocean, is near the north-west end of South Georgia, and has Bird Island to the north of it. S. lat. 54, west long. 38 30.—*ib.*

WILLISTON, a township of Vermont, in Chittenden county, joins Burlington on the N. W. It contains 471 inhabitants.—*ib.*

WILLOUGHBY *Bay*, near the south-east part of the island of Antigua, in the West-Indies. It is well fortified. Bridgetown lies on its north-eastern side, in St Philips parish, and is defended by Fort William. —*ib.*

WILLOUGHBY *Lake*, in Vermont, in the township of Westmore. It is about 6 miles long and one broad, and sends a stream which runs northward and empties into Lake Memphremagog, in the township of Salem. This lake furnishes fish resembling bass, of an excellent flavour, weighing from 10 to 30 pounds. People travel 20 miles to this lake, to procure a winter's stock of this fish.—*ib.*

WILLS *Cove*, on the north-east side of the isthmus of the island of St Kitts, in the West Indies, to the eastward southerly from North Friar and Little Friar Bays. —*ib.*

WILLS *Creek*, or *Caicuctuck*, a branch of Patowmack river, is 30 or 40 yards wide at its mouth, where Fort Cumberland stood. It affords no navigation as yet, and runs a short course southerly. It is 281 miles N. W. of Williamsburg, 171 from Fredericksburg, and 173 E. by N. of Alexandria.—*ib.*

WILLS-TOWN, an Indian village on the N. E. bank of Muskingum river, 45 miles from its mouth, and 117 south-westerly from Pittsburg, by the Indian path through the Indian town.—*ib.*

WILMANTON, in the State of New-York, stands on Wallkill, between Newburg and New-Brunswick. —*ib.*

WILMINGTON, one of the eastern maritime districts of N. Carolina; bounded north-east by Newbern district, south-east by the Altantic Ocean; south-west by S. Carolina; and north-west by Fayette. It comprehends the counties of Brunswick, New-Hanover, Onslow, Duplin, and Bladen. It contains 26,035 inhabitants; of whom 10,056 are slaves.—*ib.*

WILMINGTON, a port of entry and post town of N. Carolina, capital of the above district, is situated on the east side of the eastern branch of Cape Fear or Clarendon river; 34 miles from the sea, and 100 southward of Newbern. The course of the river, as it passes by the town, is nearly from north to south, and the breadth 150 yards. Opposite the town are two islands extending with the course of the river, and dividing it into three channels: they afford the finest rice fields in N. Carolina. The town is regularly built, and contains about 250 houses, a handsome Episcopal church, a court-house, and gaol. Having suffered much by two fires, one-fourth of the town, which has been rebuilt, is of brick. Its markets are well supplied with fish, and all manner of provisions. A considerable trade is carried on to the West-India Islands and the adjacent States. The exports for one year, ending the 30th of September 1794, amounted to 133,534 dollars. Those of all the other ports of the State, amounted only to 177,598 dollars. It is 90 miles south-east of Fayetteville, 192 south-south-west of Edenton, 198 north-east of Charleston, S. Carolina, and 600 south-south-west of Philadelphia. N. lat. 34 11, W. long. 78 15.—*ib.*

WILMINGTON, a township of Vermont, in Windham county, containing 645 inhabitants, who are chiefly wealthy farmers. It lies on Deerfield river, on the E. side of the Green Mountain, on the high-road from Bennington to Brattleborough, about 20 miles from each. Considerable quantities of maple sugar are made in it; some farmers make 1000 or 1400 pounds a season. The *Hay-stack*, in the north-west corner of this township, is among the highest of the range of the Green Mountains. It has a pond near the top of it, about half a mile in length, round which deer and moose are found. —*ib.*

WILMINGTON, a township of Massachusetts, in Middlesex county, 16 miles from Boston. It was incorporated in 1730, and contains 710 inhabitants. Hops, in great quantities are raifed in this town.—*ib.*

Wilmington, a port of entry and poft-town of the State of Delaware, and the moft confiderable town in the State. It ftands in Newcaftle county, on the north fide of Chriftiana Creek, between Chriftiana and Brandywine creeks, which at this place are about a mile diftant from each other, but uniting below the town, they join the Delaware in one ftream, 400 yards wide at the mouth. The fcite of the principal part of the town is on the fouth-weft fide of a hill, which rifes 109 feet above the tide, 2 miles from Delaware river, and 28 fouth-weft from Philadelphia. On the north-eaft fide of the fame hill, on the Brandywine, there are 13 mills for grain, and about 40 neat dwelling-houfes, which form a beautiful appendage to the town. The Chriftiana admits veffels of 14 feet draught of water to the town; and thofe of 6 feet draught 8 miles further, where the navigation ends; and the Brandywine admits thofe of 7 feet draught to the mills. The town is regularly laid out in fquares fimilar to Philadelphia, and contains upwards of 600 houfes, moftly of brick, and 3,000 inhabitants. It has 6 places of public worfhip, viz. 2 for Prefbyterians, 1 for Swedifh Epifcopalians, 1 for Friends, 1 for Baptifts, and 1 for Methodifts. Here are two market-houfes, a poor-houfe, which ftands on the weft fide of the town, and is 120 feet by 40, built of ftone, and 3 ftories high, for the reception of the paupers of Newcaftle county. There is another ftone building which was ufed as an academy, and was fupported for fome time with confiderable reputation, but by a defect in the conftitution of the feminary, or fome other caufe, it has, of late, been entirely neglected as a place of tuition. There are, however, nearly 300 children in the different fchools in town. About the year 1736, the firft houfes were built at this place; and the town was incorporated a few years afterwards. Its officers are two burgeffes, 6 affiftants, and two conftables, all of whom are annually chofen. N. lat. 39 43 18, W. long. 75 32.—*ib.*

WILMOT, a townfhip of Nova-Scotia, Annapolis county, fettled from Ireland and New-England.—*ib.*

WILSONVILLE, a town of Pennfylvania, newly laid out on the Walenpapeck, at its junction with the Lexawacfein, 120 miles north of Philadelphia. Here are already erected 14 houfes, a faw and grift mill, and a large building for manufacturing fail-cloth. The creek here falls upwards of 300 feet, fome fay 500, in the fpace of a mile; for 17 miles above the falls the creek has a gentle current.—*ib.*

WILTON, a village of Charlefton diftrict, S. Carolina; fituated on the E. fide of Edifto river, 27 miles S. W. of Charlefton.—*ib.*

Wilton, a townfhip of New-Hampfhire, Hillfborough county, S. W. of Amherft, adjoining, about 70 miles wefterly of Portfmouth. It was incorporated in 1762, and contains 1105 inhabitants.—*ib.*

WIMACOMACK, a village of New-York, in Suffolk county, Long-Ifland; 6 miles weft by fouth of Smithtown, and N. E. of Huntingdon, and 44 E. by N. of New-York city.—*ib.*

WINCHENDON, a poft-town of Maffachufetts, in Worcefter county, 7 miles N. of Gardner, 35 north-wefterly of Worcefter, 60 north-weft by weft of Bofton, and 370 north-eaft of Philadelphia. This townfhip was formerly called *Ipfwich Canada*, until it was incorporated in 1764. It is on Miller's river, and contains 950 inhabitants. This place was vifited by a dreadful tornado, on the 21ft of October, 1795, which did confiderable damage.—*ib.*

WINCHESTER, a townfhip of Connecticut, in Litchfield county, about 12 or 15 miles N. of Litchfield.—*ib.*

Winchester, a townfhip of New-Hampfhire, in Chefhire county, eaft of Hinfdale and Fort Dummer, adjoining. It is 110 miles from Portfmouth, and contains 1209 inhabitants.—*ib.*

Winchester, the chief town of Clarke county, Kentucky.—*ib.*

Winchester, or *Fredericktown*, a poft-town of Virginia, and the capital of Frederick county. It is fituated near the head of Opeckon Creek, which empties into Patowmack river; about 36 miles from the celebrated paffage of the Patowmack through the Blue Ridge. It is a handfome flourifhing town, ftanding upon low and broken ground, and has a number of refpectable buildings; among which are a court-houfe, gaol, a Prefbyterian, an Epifcopalian, a Methodift, and a new Roman Catholic church. The dwelling-houfes are about 350 in number, feveral of which are built of ftone. It is a corporation, and contains nearly 2,000 inhabitants. It was formerly fortified; but the works are now in ruins. It is 50 miles eaft by fouth of Romney, 100 north-eaft by north of Staunton, 110 weft-north-weft of Alexandria, 180 north-weft of Richmond, and 192 from Philadelphia. N. latitude 39 17 30, W. longitude 78 39.—*ib.*

WIND *Gap*, a pafs in the Blue Mountains in Pennfylvania; about 9 miles S. W. of Penn's Fort. Although 100 feet higher than the prefent bed of the Delaware, it is thought to have been formerly part of the bed of that river. The Wind Gap is a mile broad, and the ftones on it fuch as feem to have been wafhed for ages by water running over them.—*ib.*

WINDHAM, a county in the fouth-eaft corner of Vermont; having the State of Maffachufetts fouth and Connecticut river eaft, which divides it from New-Hampfhire. It contains 22 townfhips, and 17,693 inhabitants. Chief towns, Newfane and Putney.—*ib.*

Windham, a county in the N. E. corner of Connecticut, having the State of Maffachufetts N. and the State of Rhode Ifland E. It contains 13 townfhips, and 28,921 inhabitants, including 184 flaves. Chief town, Windham.—*ib.*

Windham, the capital of the above county, and a poft-town, is fituated on Shetucket river, 12 miles N. by W. of Norwich, and 31 E. of Hartford. It contains between 60 and 70 compact houfes, a court-houfe, gaol, an academy, and a Congregational church. It is 253 miles from Philadelphia. The river Willimantick from the N. W. and Natchaug from the N. meet in the north-wefterly part of the townfhip, and form the Shetucket, a pleafant river, affording plenty of fifh, particularly falmon, at fome feafons of the year. The townfhip was fettled from Norwich, in 1686, and was incorporated in 1702.—*ib.*

Windham, a townfhip of New-Hampfhire, Rockingham county, is about 25 miles fouth-weft of Exeter, and 40 from Portfmouth. It contains 663 inhabitants.—*ib.*

WINDHAM, a townſhip of the Diſtrict of Maine, Cumberland county, 134 miles north of Boſton. It was incorporated in 1762, and contains 938 inhabitants. —*ib.*

WINDSOR, a townſhip of Nova-Scotia, in Hants county, near the river St Croix, which empties into the Avon. The rivers Kenetcoot and Cocmiguen (ſo called by the Indians) run through this townſhip and empty into the Avon. On theſe rivers are flouriſhing ſettlements and fertile land. Lime-ſtone and plaſter of Paris are found here. The late Potawock (ſo called by the Indians) lies between the head of St Margaret's Bay and the main road from Halifax to Windſor; the great lake of Shubenaccadie lies on the eaſt ſide of this road, about 7 miles from it, and 21 from Halifax.—*ib.*

WINDSOR, a county of Vermont, bounded N. by Orange, S. by Windham, E. by Connecticut river, and W. by Rutland and part of Addiſon county. It contains 22 townſhips, and 15,748 inhabitants.—*ib.*

WINDSOR, a poſt-town of Vermont, and capital of the above county, is ſituated on the weſt bank of Connecticut river, 18 miles N. by W. of Charleſtown, in New-Hampſhire, 45 E. by S. of Rutland, 80 N. E. of Bennington, and 255 from Philadelphia. The townſhip contains 1452 inhabitants. This, with Rutland, is alternately the ſeat of the State Legiſlature.—*ib.*

WINDSOR, a hilly townſhip of Maſſachuſetts, in Berkſhire county, 20 miles N. N. W. of Lenox, and 136 W. by N. of Boſton. The county road to Northampton paſſes through it, alſo the road from Pittsfield to Deerfield. It gives riſe to Houſatonick and Weſtfield rivers, on which are 4 ſaw-mills and 2 corn-mills. It was incorporated in 1771, and contains 916 inhabitants. In the Gore, adjoining Adams and Windſor, are 425 inhabitants.—*ib.*

WINDSOR, a conſiderable and very pleaſant town of Hartford county, Connecticut, on the weſt ſide of Connecticut river, about 7 miles northerly of Hartford. Here Windſor Ferry river, formed by the junction of Farmington and Poquabock rivers, empties into the Connecticut from the weſt. Windſor Ferry river divides the townſhip into the upper and lower pariſhes. —*ib.*

WINDSOR, a townſhip of New-Jerſey, Middleſex county, containing 2,838 inhabitants, including 190 ſlaves. —*ib.*

WINDSOR, a townſhip of Pennſylvania, York county. —*ib.*

WINDSOR, a poſt-town and the capital of Bertie county, N. Carolina; ſituated on Cuſhai river, and contains, beſides a few houſes, a court-houſe and gaol. It is 23 miles W. by S. of Edenton, 18 from Plymouth, 97 from Halifax, and 481 from Philadelphia.—*ib.*

WINDWARD *Paſſage*, a name given to a courſe from the S. E. part of the iſland of Jamaica, in the Weſt-Indies, and extending for 160 leagues to the N. ſide of Crooked Iſland in the Bahamas. Ships have often failed through this channel from the north part of it to the iſland of Cuba, or the Gulf of Mexico, notwithſtanding the common opinion, on account of the current, which is againſt it; that they keep the Bahama ſhore on board, and that they meet the wind in ſummer for the moſt part of the channel eaſterly, which with a counter current on ſhore puſhes them eaſily through it. —*ib.*

WINDWARD *Point*, near the eaſtern extremity of the iſland of St Chriſtopher's, is the eaſt point of Sandy-Hill Bay; about 2 miles to the W. N. W. of St Anthony's Hill Point.—*ib.*

WINEE, or *Black River*, in S. Carolina, riſes in Camden diſtrict, and running ſouth-eaſterly through Cheraws into Georgetown diſtrict, unites with Pedee river, about 3 miles above Georgetown.—*ib.*

WINES (ſee that article, *Encycl.* and *Vegetable Subſtances, Suppl.*) are ſo often adulterated with minerals prejudicial to the health, that various methods have been deviſed for detecting the adulteration. The property which liver of ſulphur (alkaline ſulphures) and hepatic air (ſulphurated hydrogen) poſſeſs of precipitating lead in a black form, has been long ago made public; and this property has been employed to determine the quality of wines by means of the *liquor probatorius Wirtembergenſis*, or Wirtemberg proving liquor. But in trying wines ſuppoſed to have been adulterated, this proof does more hurt than ſervice, becauſe it precipitates iron of the ſame colour as the pernicious lead. Many wine-merchants, therefore, of the greateſt reſpectability, rendered by theſe means ſuſpected, have been ruined.

The following is recommended by M. Hanhemann as a better teſt of ſound wines than the proving liquor of Wirtemberg. Mix equal parts of oyſter ſhells and crude ſulphur in a fine powder, and put the mixture into a crucible. Heat it in a wind furnace, and increaſe the fire ſuddenly, ſo as to bring the crucible to a white heat, for the ſpace of 15 minutes. Pulveriſe the maſs when it is cool, and preſerve it in a bottle cloſely ſtopped.

To prepare the liquor, put 120 grains of this powder, and 120 grains of cream of tartar (acidulous tartarite of potaſh), into a ſtrong bottle; fill the bottle with common water, which boil for an hour, and then let it cool; cloſe the bottle immediately, and ſhake it for ſome time: after it has remained at reſt to ſettle, decant the pure liquor, and pour it into ſmall phials capable of holding about an ounce each, firſt putting into each of them 20 drops of muriatic acid. They muſt be ſtopped very cloſely with a piece of wax, in which there is a ſmall mixture of turpentine.

One part of this liquor, mixed with three parts of ſuſpected wine, will diſcover, by a very ſenſible black precipitate, the leaſt traces of lead, copper, &c. but will produce no effect upon iron, if it contains any of that metal. When the precipitate has fallen down, it may ſtill be diſcovered whether the wine contains iron, by ſaturating the decanted liquor with a little ſalt of tartar (tartareous acidulum of potaſh), by which the liquor will immediately become black. Pure wines remain clear and bright after this liquor has been added to them.

WINHALL, a townſhip of Vermont, in Bennington county, about 25 or 30 miles N. E. of Bennington. It contains 155 inhabitants.—*Morſe.*

WINNIPISEOGEE, a lake in New-Hampſhire, and the largeſt collection of water in the State. It is 22 miles in length from S. E. to N. W. and of very unequal breadth, but no where more than 8 miles. Some very long necks of land project into it; and it contains ſeveral iſlands, large and ſmall, and on which rattle-ſnakes are common. It abounds with fiſh from

6 to 20 pounds weight. The mountains which furround it, give rife to many ftreams which flow into it; and between it and the mountains, are feveral leffer ponds, which communicate with it. Contiguous to this lake are the townfhips of Moultonborough on the N. W. Tuftonborough and Wolfborough on the N. E. Meredith and Gilmantown on the S. W. and a tract of land, called the Gore, on the S. E. From the S. E. extremity of this lake, called Merry Meeting Bay, to the north-weft part called Senter Harbour, there is good navigation in the fummer, and generally a good road in the winter; the lake is frozen about 3 months in the year, and many fleighs and teams, from the circumjacent towns, crofs it on the ice. Winnipifeogee river conveys the waters of the lake into Pemigewaffet river, through its eaftern bank at New-Chefter.—*ib.*

WINLAND, a country accidentally difcovered by Biron or Biorn, a Norman, in 1001; fuppofed to be a part of the ifland of Newfoundland. It was again vifited, and an intercourfe opened between it and Greenland. In 1221, Eric, bifhop of Greenland, went to Winland to recover and convert his countrymen, who had degenerated into favages. This prelate never returned to Greenland; nor was any thing more heard of Winland for feveral centuries.—*ib.*

WINLOCK, or *Wenlock*, a townfhip of Vermont, in Effex county, weft of Minehead.—*ib.*

WINNEBAGO, a lake of the N. W. Territory; weft of Michigan Lake, and fouth-weft of Bay Puan, into which it fends its waters. It is about 15 miles long from eaft to weft, and 6 wide. It receives a large ftream from the fouth-weft called Crocodile river. Fox river enters it from the weft, and by it, through Ouifconfing river, has communication with Miffiffippi river, interrupted by a portage of only 3 miles. The centre of the lake lies in lat. about 43 30 N. and long. 88 10 W.—*ib.*

WINNEBAGOES, an Indian nation inhabiting round the lake of the fame name, who can furnifh 2 or 300 warriors. Their town ftands on an ifland at the E. end of the lake, of about 50 acres extent, and diftant from Bay Puan 35 miles, according to the courfe of the river. The town contains about 50 houfes, which are ftrongly built with pallifades. The land adjacent to the lake is very fertile, abounding fpontaneoufly with grapes, plums, and other fruit. The people raife a great quantity of Indian corn, beans, pumpkins, fquafhes, melons, and tobacco. The lake abounds with fifh, and in the autumn or fall, with geefe, ducks, and teal; and are very fat and well flavored by feeding on wild rice, which grows plentifully in thefe parts. Mr Carver thinks from the refult of his inquiries of the origin, language, and cuftoms of this people, that they originally refided in fome of the provinces of Mexico, and migrated to this country about a century ago. Their language is different from any other yet difcovered; and they converfe with other nations in the Chippeway tongue.—*ib.*

WINNIPEG, or *Winnepeek*, a lake in Upper Canada, north-weft of Lake Superior. It lies between 50 30 and 54 32 N. lat. and between 95 50 and 99 30 W. long. It is 217 miles long, including Bafkefcoggan or Play-Green Lake, its northern arm; and is 100 miles broad from the Canadian Houfe on the E. fide to Sable river on the weft fide. It receives the waters of a number of fmall lakes in every direction, and exhibits a number of fmall ifles. The lands on its banks are faid, by Carver and other travellers, to be very fertile, producing vaft quantities of wild rice, and the fugar-tree in great plenty. The climate is confiderably more temperate here than it is upon the Atlantic coaft, 10° farther fouthward.—*ib.*

WINNIPEG, *Little*, a lake which lies weft of the former, and has communication with Lake Minitoba, on the S. which laft fends the waters of both into Winnipeg Lake, in an E. N. E. courfe. It is 80 miles long and 15 broad. Fort Dauphin is feated on a lake contiguous, on the weft, whofe waters empty into this lake. Dauphin Fort lies in lat. 51 46 N. and long. 100 54 W.—*ib.*

WINNIPEG *River*, runs north-weft into the lake of its name. It is the outlet of the waters of a vaft chain of lakes; the chief of which are La Plue and Lake of the Woods. The lat. of the Provifion Store, at the bottom of the river, is 50 33 12 N.—*ib.*

WINNSBOROUGH, a poft-town, and the capital of Fairfield county, S. Carolina; fituated on a branch of Wateree Creek, which empties into the river of that name. Here are about 25 houfes, a handfome courthoufe, a gaol, and a college called Mount Zion college, which is fupported by a refpectable fociety of gentlemen, and has been long incorporated. The inftitution flourifhes, and bids fair for ufefulnefs. It is 30 miles north-north-weft of Columbia, 130 from Charlefton, and 708 from Philadelphia.—*ib.*

WINSLOW, a poft-town of the Diftrict of Maine, Lincoln county, fituated on Kennebeck river; 18 miles north of Harrington. Fort Halifax was built at this place in 1754, on the point of land at the confluence of Sebafticook and Kennebeck rivers. This town is 88 miles N. by E. of Portland, 211 in a like direction from Bofton, and 559 from Philadelphia. It was incorporated in 1771, and contained, in 1790, 779 inhabitants, and in 1797, about 1500.—*ib.*

WINTERHAM, a place in Amelia county, Virginia. Black lead is found here; but no works for its manufacture are eftablifhed: thofe who want it go and procure it for themfelves.—*ib.*

WINTHROP, a poft-town of the Diftrict of Maine, Lincoln county, between Androfcoggin and Kennebeck rivers, about 10 miles from each; 5 miles eafterly of Monmouth; 10 weft by fouth of Hallowell, now Harrington court-houfe, 57 north of Portland, 185 from Bofton, and 529 from Philadelphia. The townfhip in which it ftands, was incorporated in 1771, and contains 1240 inhabitants.—*ib.*

WINTHROP'S *Bay*, on the north coaft of the ifland of Antigua. Maiden Ifland, a fmall ifle fouth-fouthweft of Long Ifland is due eaft of the fouth-eaft point of this bay.—*ib.*

WINTON, a county of Orangeburg diftrict, S. Carolina.—*ib.*

WINTON, a poft-town of North-Carolina, and capital of Hartford county, on the S. E. fide of Chowan river, a few miles below the place where Meherrin and Nottaway join their waters. It has a court-houfe and gaol, and a few compact houfes. It is 12 miles from Murfreefborough, 15 from the Bridge on Bennet's Creek, 130 S. S. E. of Peterfburg, in Virginia, and 434 from Philadelphia.—*ib.*

WINYAW *Bay*, on the coaſt of South-Carolina, communicates with the ocean 12 miles below George-town.—*ib.*

WISCASSET, a port of entry and poſt-town of the Diſtrict of Maine, Lincoln county, on the weſt ſide of Sheepſcut river, 10 miles S. E. of New-Milford on the E. ſide of Kennebeck river, 13 north-weſt of Bath, 56 north-weſt of Portland, 178 N. E. by N. of Boſton, 525 from Philadelphia, and 1513 from Sunbury in Georgia. It is a part of the townſhip of Pownalborough, and is very flouriſhing. It contains a congregational church, and about 120 houſes. Its navigation is greater in proportion to its ſize and number of inhabitants than any part of Maſſachuſetts. A gazette is publiſhed here, and the county courts are held in it. Wiſcaſſet Point is 3 leagues from Croſs river. The exports for one year, ending the 30th of Sept. 1794, amounted to 23,329 dollars.—*ib.*

WITCHARN *Bay*, is within the great ſound in the Bermudas Iſlands, in the Weſt-Indies; ſituated at the E. part of the bottom or S. part of the Sound, having two ſmall iſlands at the mouth of it.—*ib.*

WOAHOO, one of the Sandwich Iſles, in the North Pacific Ocean, 7 leagues north-weſt of Morotoi Iſland. It is high land, and contains 60,000 inhabitants; and has good anchoring ground, in lat. 21 43 N. and long. 157 51 W.—*ib.*

WOAPANACHKY, the name of the Delaware nation, in their language.—*ib.*

WOAPO, one of the Ingraham Iſlands, leſs in ſize than Chriſtiana. The body of it lies in lat. 9 27 S. It bears north-weſt by weſt, about 20 leagues from Reſolution Bay. It was called *Adams*, by Capt. Ingraham; and a ſmall iſland to the ſouthward of it he called *Lincoln*. Capt. Roberts afterwards diſcovered them and named them from his ſhip and ſchooner; the larger *Jefferſon*, and the leſſer *Reſolution*.—*ib.*

WOBURN, a townſhip of Maſſachuſetts, in Middleſex county, 10 miles north of Boſton. It was incorporated in 1642 by the name of *Wooborne*, and was till then known by the name of *Charleſtown Village*. It contains 1727 inhabitants.—*ib.*

WOLCOTT, a townſhip of Vermont, in Orleans county, ſouth of Craftſbury, containing 32 inhabitants. La Moille river runs N. weſtward through it.—*ib.*

WOLF, a ſmall boatable river of Tenneſſee, which runs weſterly into Miſſiſſippi river, about 19 miles ſouth of Hatchy river, and 55 from Reelfoot. It is 50 yards wide ſeveral miles from its mouth, which is very near the ſouth-weſt corner of the State, in lat. 35.—*ib.*

WOLFBOROUGH, a townſhip of New-Hampſhire, Strafford county, on the E. ſide of Winnipiſiogee Lake, and contains 447 inhabitants. It contains ſome fine farms, and particularly that which formerly belonged to Gov. Wentworth.—*ib.*

WOLVES *Iſlands* lie near Campo Bello Iſland, on the eaſternmoſt coaſt of the Diſtrict of Maine. Between theſe the ſoundings are from 50 to 100 fathoms. N. lat. 44 48, W. long. 66 40. From Grand Manan Iſland to Wolves Iſlands the courſe is N. E. by N. 3 leagues.—*ib.*

WOMELDORF, a poſt-town of Pennſylvania, in Berks county, ſituated on the weſt ſide of a ſmall ſtream which falls into Tulpehocken Creek. It contains about 40 houſes, and a German Lutheran and Calviniſt church. It is 68 miles north-weſt of Philadelphia.—*ib.*

WOODBRIDGE, a poſt-town of New-Jerſey, Middleſex county, on the great road from New-York to Philadelphia, on a ſtream which falls into Arthur Kull, above Amboy. It is about 3 miles N by W. of Amboy, 10 ſouth-weſterly of Elizabeth-Town, and 70 N. E. of Philadelphia. The townſhip contains 3550 inhabitants, including 256 ſlaves.—*ib.*

Woodbridge, a townſhip of Connecticut, New-Haven county, about 7 miles north-weſt of New-Haven city.—*ib.*

WOODBURY, a townſhip of Vermont, in Caledonia county, 15 or 20 miles weſt-north-weſt of Barnet.—*ib.*

Woodbury, a poſt-town of New-Jerſey, and capital of Glouceſter county, ſituated near a ſmall ſtream, which empties into the Delaware below Red Bank. It contains about 80 houſes, a handſome brick court-houſe, a Quaker meeting-houſe, and an academy. Several of the houſes are neat and handſome. It is 9 miles ſouth of Philadelphia, and 11 north-eaſt of Swedeſburg. Alſo, the name of a townſhip of Pennſylvania, in Huntingdon county.—*ib.*

Woodbury, a townſhip of Connecticut, in Litchfield county, 8 miles ſouth of Litchfield. It was ſettled in 1672.—*ib.*

WOOD *Creek*, a ſluggiſh ſtream which riſes in the high lands, a little eaſt of Fort Edward, on Hudſon's river; and after running 25 miles, falls into the head of Lake Champlaine at Skeneſborough. It has a fall at its mouth, otherwiſe it is navigable for batteaux for 20 miles up to Fort Anne.—*ib.*

Wood *Creek* runs weſtward, and empties into Lake Oneida.—*ib.*

WOOD-cuts are engravings on wood, commonly on box, which, in many caſes, are uſed with advantage inſtead of copper-plates. The art of cutting or engraving on wood is undoubtedly of high antiquity; for Chineſe printing is a ſpecimen of it. (See China, n° 127. *Encycl.*) Even in Europe, if credit be due to Papillon, this art was practiſed at a period conſiderably remote; for he mentions eight engravings on wood, entitled, "A repreſentation of the warlike actions of the great and magnanimous Macedonian king, the bold and valiant Alexander; dedicated, preſented, and humbly offered, to the moſt holy father, Pope Honorius IV. by us Alexander Alberic Cunio Chevalier, and Iſabella Cunio, &c." This anecdote, if true, carries the art of cutting in wood back to 1284 or 1285; for Honorius occupied the papal throne only during theſe two years. Even this is not the remoteſt period to which ſome have carried the art in Europe; for the uſe of ſeals or ſignets being of very high antiquity, they imagine that the invention of wood-cuts muſt be coeval with them. The ſuppoſition is certainly plauſible, but it is not ſupported by proof. The earlieſt impreſſion of a wooden-cut, of which we have any certain account, is that of St Chriſtopher carrying an infant Jeſus through the ſea, in which a hermit is ſeen holding up a lantern to ſhew him the way; and a peaſant, with a ſack on his back, climbing a hill, is exhibited in the back ground. The date of this impreſſion is 1423.

In the year 1430 was printed at Haarlem, "The hiſtory of St John the evangeliſt and his revelation, repreſented in 48 figures in wood, by Lowrent Janſon Coſter;" and, in 1448, Jorg Schappf of Augſburg cut in wood the hiſtory of the Apocalypſe, and what was called *The poor man's bible*. (See ENGRAVING, *Encycl.* page 668.)

A folio chronicle, publiſhed 1493 by Schedal, was adorned with a vaſt number of wood-cuts by William Plydenwurff and Michael Wolgemut, whoſe engravings were greatly ſuperior to any thing of the kind which had appeared before them. Wolgemut was the preceptor of Albert Durer, whoſe admirable performances in this department of art are juſtly held in the higheſt eſteem even at the preſent day.

About this period it became the practice of almoſt all the German engravers on copper to engrave likewiſe on wood; and many of their wood-cuts ſurpaſs in beauty the impreſſions of their copper-plates. Such are the wood-cuts of Albert Aldtorfer, Hiſbel Pen, Virgil Soles, Lucas van Cranach, and Lucas van Lyden, the friend and imitator of Albert Durer, with ſeveral others.

It appears that the Germans carried this art to a great degree of perfection. Hans or John Holbien, who flouriſhed in 1500, engraved the *Dance of Death*, in a ſeries of wooden-cuts, which, for the freedom and delicacy of execution, has hardly been equalled, and never ſurpaſſed.

Italy, France, and Holland, have produced many capital artiſts of this kind. Joan. Tornæſium printed a bible at Lyden, in 1554 (a copy of which we have ſeen), with wooden-cuts of excellent workmanſhip. Chriſtopher Jegher of Antwerp, from his eminence in the art, was employed by Rubens to work under his inſpection, and he executed ſeveral pieces which are held in much eſtimation; the character of theſe is boldneſs and ſpirit.

The next attempt at improvement in this art was by Hugo da Carpi, to whom is attributed the invention of the *chiaro ſcuro*. Carpi was an Italian, and of the 16th century; but the Germans claim the invention alſo, and produce in evidence ſeveral engravings by Mair, a diſciple of Martin Schoen, of date 1499. His mode of performing this was very ſimple. He firſt engraved the ſubject upon copper, and finiſhed it as much as the artiſts of his time uſually did. He then prepared a block of wood, upon which he cut out the extreme lights, and then impreſſed it upon the print; by which means a faint tint was added to all the reſt of the piece, excepting only in thoſe parts where the lights were meant to predominate, which appear on the ſpecimens extant to be whitened with white paint. The drawings for this ſpecies of engraving were made on tinted paper with a pen, and the lights were drawn upon the paper with white paint.

There is, however, a material difference between the *chiaro ſcuros* of the old German maſters and thoſe of the Italians. Mair and Cranach engraved the outlines and deep ſhadows upon copper. The impreſſion taken in this ſtate was tinted over by means of a ſingle block of wood, with thoſe parts hollowed out which were deſigned to be left white upon the print. On the contrary, the mode of engraving by Hugo da Carpi was, to cut the outline on one block of wood, the dark ſhadows upon a ſecond, and the light ſhadows, or half tint, upon a third. The firſt being impreſſed upon the paper, the outlines only appeared: this block being taken away, the ſecond was put in its place, and being alſo impreſſed on the paper, the dark ſhadows were added to the outlines; and the third block being put in the ſame place upon the removal of the ſecond, and alſo impreſſed upon the paper, made the dim tints, when the print was completed. In ſome inſtances, the number of blocks were increaſed, but the operation was ſtill the ſame, the print receiving an impreſſion from every block.

In 1698, John Baptiſt Michel Papillon practiſed engraving on wood with much ſucceſs, particularly in ornamental foliage and flowers, ſhells, &c. In the opinion, however, of ſome of the moſt eminent artiſts, his performances are ſtiff and cramped. From that period the art of engraving on wood gradually degenerated, and may be ſaid to have been wholly loſt, when it was lately re-invented by Mr Bewick of Newcaſtle.

This eminent artiſt was apprentice to Mr Bielby, an engraver on metal of the very loweſt order, who was ſeldom employed in any thing more difficult than the cutting of the face of a clock. Application having been made to this man for a wood-cut or two of the moſt trifling deſcription, the job was given to Thomas Bewick; by whom it was executed in ſuch a manner, that Mr Bielby, who was accuſtomed to employ his apprentices in ſuch work, adviſed him to proſecute engraving in that line. The advice was followed; and young Bewick inventing tools, even making them with his own hands, and ſawing the wood on which he was to work into the requiſite thickneſs, proceeded to improve upon his own diſcoveries, without aſſiſtance or inſtruction of any kind. When his apprenticeſhip expired, he went to London, where the obſcure wood-engravers of the time wiſhed to avail themſelves of his abilities, while they were determined to give him no inſight into their art. He remained ſome years in London; and during that time, if we miſtake not, received from the *Society for the Encouragement of Arts, &c.* a premium of conſiderable value for the beſt engraving in wood. Returning to Newcaſtle, he entered into copartnerſhip with his old maſter; and eſtabliſhed his reputation as an artiſt by the publication of his admirable Hiſtory of Quadrupeds. This was followed by his Hiſtory of Birds, of which only one volume has yet (1800) appeared.

John Bewick, brother to Thomas, learned the art of him, and practiſed it for ſeveral years in London with great applauſe. His abilities, however, though reſpectable, were not, by the beſt judges, deemed ſo brilliant as his brother's; and owing to bad health, and the nature of his connection with the bookſellers and others, he ſeems not to have advanced the art beyond the ſtage at which he received it. He died, three or four years ago, at Newcaſtle.

Mr Neſbit, who executed the admirable Hudibras publiſhed by Vernor and Hood(A), and Mr Anderſon,

(A) The deſigns were by Thornton; and the cuts from them have been compared to Holbein's far-famed Dance of Death.

Wood-cuts. fon, whofe beautiful cuts adorn the poem entitled *Grove Hill*, were the next, and hitherto have been the laft of Thomas Bewick's pupils, who have appeared before the public as artifts. By thefe gentlemen we are authorized to fay, that the method practifed by the ancient engravers on wood, whofe works are ftill admired, muft have been different from that of Bewick and his pupils. What that method was feems to be altogether unknown. Papillon, who writes the beft hiftory extant of the art, gueffes indeed in what manner the old engravers proceeded fo as to give to their works the fpirit and freedom for which they are famed; but that his gueffes are erroneous feems evident from the ftiffnefs of his own works. The principal characteriftic in the mechanical department of the productions of the ancient mafters is the croffing of the black lines, which Papillon has attempted with the greateft awkwardnefs, though it feems to have been accomplifhed by them with fo much eafe, that they introduced it at random, even where it could add nothing to the beauty of the piece. In Bewick's method of working, this crofs hatching is fo difficult and unnatural, that it may be confidered as impracticable (B).

The engravers of Bewick's fchool work on the end of the wood which is cut acrofs the trunk of the tree, in pieces of the proper thicknefs. As wood-cuts are generally employed in the printer's prefs amidft a form of types, this thicknefs muft be regulated by the height of the types with which they are to be ufed. The tools employed are nearly the fame with thofe ufed in copperplate engraving, being only a little more deep, or lozenge, as engravers call it. They muft have points of various degrees of finenefs for the different purpofes to which they are applied, fome of them being fo much rounded off at the bottom as to approach to the nature of a goodge, whilft others are in fact little chiffels of various fizes. Thefe chiffels and goodges, to which every artift gives the fhape which he deems moft convenient, are held in the hand in a manner fomewhat different from the tool of the engraver on copper, it being neceffary to have the power of lifting the chips upwards with eafe. To attempt a defcription of this in writing would be in vain; but it is eafily acquired, we are told, by practice.

The pupils of the fchool of Bewick confider it as quite improper to fpeak of his invention as a revival of the ancient art. Some old prints, it is true, have the appearance of being executed in the fame way with his; but others have certainly been done by a method very different. It is therefore not fair to appreciate the prefent art by what has been done, but by what may be done; and that remains yet to be fhewn. The art is in its infancy; and thofe who are difpofed to compare it with the art of engraving on copper, ought to look back to the period when copperplate engraving was of as recent invention as Bewick's method of engraving on wood. Marc Antonio, who engraved under the direction of the great painter Raphael, thought it no mean proof of his proficiency in his art, that he was able to imitate on copper plates the wood cuts of Albert Durer; and Papillon is highly indignant that there fhould have been perfons fo very blind as to miftake the copies for the originals. If copper has its advantages over wood in point of delicacy and minutenefs, wood has, in its turn, advantages not inferior in regard to ftrength and richnefs. Thofe prints which were executed under the aufpices of Titian and Rubens, will always remain a monument of the fpirit and vigour natural to wood-engraving; and if there be not found in them all the attention to *chiaro fcuro*, which the prefent age demands, it muft not be attributed either to defect in the art, or to want of abilities in the artifts, but to the tafte of the times when *chiaro fcuro* was little underftood. It remains for fome enterprifing artift to fhew that the vigour of the ancient art may be attained by the prefent one, and at the fame time to add to that vigour thofe gradations of fhade which are fo much admired in good copperplates. As there feems to be a more perfect, or at leaft a more pleafant black produced by wood than by copperplate printing, and certainly a more perfect white (C), who will fay that any intermediate fhade whatever may not be produced by wood-cuts? To attempt this on a fmall fcale would indeed be vain, becaufe the flighteft variation, produced by a little more or lefs ink, or a harder preffure in printing, bears fuch a proportion to a very fhort line, as muft neceffarily render the attempt abortive.

Wood-engraving, therefore, muft always appear to difadvantage while it is confined to fmall fubjects, and will never reach its ftation *as a fine art*, till thofe who are engaged in its cultivation improve upon the difcoveries of one another, and apply to fubjects to which it is properly adapted. As an *economical art* for illuftrating mechanics and other fubjects of fcience, it is too little employed even in its prefent ftate.

The works of Bewick and his pupils which have hitherto been publifhed, are not numerous. Befides his quadrupeds and birds, the Hudibras by Nefbit, and the Grove Hill by Anderfon, which have been already noticed, we are acquainted with none but the following:—Goldfmith's *Traveller* and *Deferted Village* with elegant plates, all by Thomas Bewick, except one or two which were executed by John; Somerville's *Chace* by the fame artifts, executed in a ftyle of elegance which perhaps has never been furpaffed; a View of St Nicholas's Church, Newcaftle, 15 inches long, by Mr Nefbit, who received for it a filver medal from the Society for the Encouragement of Arts, and an honorary letter from the Society of Antiquaries.

Wood-cuts, Woods.

WOODFORD, a county of Kentucky, on Ohio river, between Kentucky and Licking rivers. Chief town, Verfailles.—*Morfe.*

Woodford, a townfhip of Vermont, eaft of Bennington, adjoining. It contains 60 inhabitants.—*ib.*

WOOD *Ifland*, on the fea-coaft of the Diftrict of Maine, 5 leagues north-eaft of Cape Porpoife, and fouth-weft by fouth 4 leagues of Richman's Ifland.—*ib.*

WOODS, *Lake of the*, the moft northern in the United

(B) Mr Nefbit has indeed introduced fomething of it into two or three of his pieces, merely to fhew that he *could* do it; but fo great was the labour, and fo little the advantage of this improvement, if fuch it can be called, that probably it will not be attempted again.

(C) The parts of the print intended to be white are not even touched by the wood-block.

United States, is so called from the large quantities of wood growing on its banks; such as oak, pine, fir, spruce, &c. This lake lies nearly east of the south end of Winnipeg Lake, and is supposed to be the source or conductor of one branch of Bourbon river. Its length from east to west is said to be about 70 miles; and in some places it is 40 miles wide. Other accounts say it is 36 leagues in length. The Killistinoe Indians encamp on its borders to fish and hunt. This lake is the communication between the lakes Winnipeg, Bourbon, and Lake Superior.—*ib.*

WOODSTOCK, one of the principal towns of Windsor county, Vermont. It has a court-house and about 50 dwelling-houses. It lies north-west of Windsor, adjoining, and contains 1665 inhabitants. Waterquechie river passes through the centre of the town, on the banks of which stand the meeting-house and court-house.—*ib.*

Woodstock, a township of New-York, in Ulster county, bounded easterly by Kingston, Hurley and Marbletown, and westerly by Delaware river. It contains 1025 inhabitants, including 15 slaves. In 1796, according to the State census, 160 of the inhabitants were qualified electors.—*ib.*

Woodstock, a small town of N. Carolina, on the E. side of Pamplico river.—*ib.*

Woodstock, a post-town of Virginia, seat of justice and capital in Shenandoah county. It contains between 60 and 70 houses, a court-house and gaol. The inhabitants are mostly Germans and their descendants. It is 12 miles from Strasburg, 40 from Rockingham court-house, and 222 from Philadelphia.—*ib.*

Woodstock, a considerable and pleasant township of good land, in the N. E. corner of Connecticut, Windham county, divided into 3 parishes. This township, which is 7 miles square, was granted by the general court of Massachusetts, 7th Nov. 1783, and was settled by 39 families from Roxbury in 1688. This town remained under the jurisdiction of Massachusetts till about the year 1760, since which time it has been considered as belonging to Connecticut. It is 66 miles S. W. of Boston, 45 N. E. of Hartford, 22 S. W. of Worcester, 33 N. W. of Providence, and about the same distance N. of Norwich.—*ib.*

WOODSTOWN, a post-town of New-Jersey, Salem county, and contains about 40 or 50 houses. It is 12 miles N. by E. of Salem, 31 north by west of Bridgetown, and 26 S. S. W. of Philadelphia.—*ib.*

WOODY *Point*, one of the limits of Hope Bay, on the north-west coast of North-America, as Breaker's is the other. It is in about lat. 50 N. and long. 128 west. —*ib.*

WOOL-combing, a well known operation, which, when performed by the hand, is laborious, tedious, and expensive. The expense of it through all England has been calculated at no less a sum than L. 800,000; and to lessen this expense, the Rev. Edmund Cartwright of Doncaster in Yorkshire bethought himself some years ago, of carding wool by machinery. After repeated attempts and improvements, for which he took out three patents, he found that wool can be combed in perfection by machinery, of which he gives the following description:

Plate L. Fig. 1. Is the crank lasher. A is a tube through which the material, being formed into a sliver, and slightly twisted, is drawn forward by the delivering rollers. B, a wheel fast upon the cross-bar of the crank. C, a wheel, on the opposite end of whose axis is a pinion working in a wheel upon the axis of one of the delivering rollers.

Note, When two or more slivers are required, the cans or baskets, in which they are contained, are placed upon a table under the lasher (as represented at D), which by having a slow motion, twists them together as they go up.

Fig. 2. Is the circular clearing comb, for giving work in the head, carried in a frame by two cranks. Fig. 3. The comb-table, having the teeth pointing towards the centre, moved by cogs upon the rim, and carried round upon trucks, like the head of a windmill. *a*, *b*, the drawing rollers. *c*, *d*, callender, or conducting rollers.

Note, Underneath the table is another pair of rollers, for drawing out the backings.

In the above specification, we have omitted the frame in which the machine stands, the wheels, shafts, &c. Had these been introduced, the drawing would have been crowded and confused; besides, as matters of information, they would have been unnecessary, every mechanic, when he knows the principles of a machine, being competent to apply the movements to it.

The wool, if for particular nice work, goes through three operations, otherwise two are sufficient: the first operation opens the wool, and makes it connect together into a rough sliver, but does not clear it. The clearing is performed by the second, and, if necessary a third operation. A set of machinery, consisting of three machines, will require the attendance of an overlooker and ten children, and will comb a pack, or 240lb. in twelve hours. As neither fire nor oil is necessary for machine-combing, the saving of those articles, even the fire alone, will, in general, pay the wages of the overlooker and children; so that the actual saving to the manufacturer is the *whole* of what the combing costs, by the old imperfect mode of hand-combing. Machine-combed wool is better, especially for machine-spinning, by at least 12 *per cent.* being all equally mixed, and the slivers uniform, and of any required length.

WOOLWICH, a township of Gloucester county, New-Jersey.—*Morse.*

Woolwich, a township of Lincoln county, District of Maine, on the E. side of Kennebeck river, S. of Pownalborough, containing 797 inhabitants.—*ib.*

WOONSOKET *Falls*, on Bluestone river, in Smithfield township, Rhode-Island.—*ib.*

WORCESTER, a large and populous county of Massachusetts. It contains 50 townships, 53 Congregational churches, 510,236 acres of unimproved land, and 207,430 under cultivation, and 56,807 inhabitants. It is about 50 miles in length, from north to south, and about 40 in breadth; bounded south almost equally by the States of Connecticut and Rhode-Island, and north by the State of New-Hampshire. On the east it is bounded chiefly by Middlesex county, and west by Hampshire county.—*ib.*

Worcester, a post-town of Massachusetts, and capital of the above county. It is the largest inland town of New-England, and is situated about 45 miles west of Boston, 52 north-east of Spring-field, and 299 north-east of Philadelphia. The public buildings in this town are two Congregational churches, a court-houfe, and a ftrong ftone gaol. The inhabitants, upwards of 2000 in number, have a large inland trade, and manufacture pot and pearl afh, cotton and linen goods, befides fome other articles. The compact part of the town contains about 150 neat houfes, fituated in a healthy vale, principally on one ftreet. Printing in its various branches, is carried on very extenfively in this town by Ifaiah Thomas, Efq. who in the year 1791, printed two editions of the Bible, the one the large royal quarto, the firft of that kind publifhed in America, the other a large folio, with 50 copper-plates, befides feveral other books of confequence. His printing apparatus confifts of 10 printing-preffes, with types in proportion; and he is now making preparations for the printing of Bibles of various fmaller kinds. His printing apparatus is reckoned the largeft in America. This townfhip, part of what was called *Quinfigamond* by the Indians, was incorporated in 1684; but being depopulated by Indian hoftilities, the firft town-meeting was held in 1722. It is propofed to open a canal between Providence, in Rhode-Ifland, and this town. N. lat. 42 23, W. long. 71 44.—*ib.*

Worcester, a townfhip of Pennfylvania, in Montgomery county.—*ib.*

Worcester, the fouth-eafternmoft county of Maryland, having Somerfet county and Chefapeak Bay on the weft, Sinepuxent Bay on the eaft, which opens to the N. Atlantic Ocean, and Accomac county, in Virginia, on the fouth. It is well watered by Pocomoke, Affatigul, and St Martin's river. It contains 11,640 inhabitants, including 3836 flaves. Chief town, Snowhill.—*ib.*

Worcester, a townfhip of Vermont, in the eafternmoft part of Chittenden county, abount 25 miles eaft of Burlington.—*ib.*

WORTHINGTON, a poft-town of Maffachufetts, in Hampfhire county, 19 miles weft by north of Northampton, 25 eaft by fouth of New-Lebanon, in New-York State, 120 wefterly of Bofton, and 289 from Philadelphia. It was incorporated in 1768, and contains 1116 inhabitants.—*ib.*

WRENTHAM, the *Wollomonuppouge* of the Indians, a confiderable townfhip of Norfolk county, Maffachufetts, on the poft-road from Bofton to Providence, 27 miles fouth-fouth-weft of Bofton, and 18 north-eaft of Providence, containing 1767 inhabitants; formerly a part of Dedham, incorporated in 1661. There is a curious cavern in this town, called *Wampom's Rock*, from an Indian family of that name who lived in it for a number of years. It is about 9 feet fquare, and 8 feet high, leffening from the centre to about four feet. It is furrounded by broken rocks, and now ferves as a fhelter for cattle and fheep, as do feveral others here, formerly inhabited by Indians.—*ib.*

WRIGHTSBOROUGH, a fmall fettlement or village on Little river, a branch of the Savannah, about 30 miles from Augufta. It was fettled by Jofeph Mattock, Efq. one of the Friends, who named it after Sir James Wright, then governor of Georgia, who promoted its eftablifhment.—*ib.*

WRIGHTSTOWN, in Buck's county, Pennfylvania, 4 miles N. of Newtown, and 4 W. of Delaware river.—*ib.*

WYACONDA, a river of Louifiana, which falls into the Miffiffippi 34 miles below Riviere du Moins, —*ib.*

WYALUSING, a townfhip of Pennfylvania, Luzerne county.—*ib.*

WYALUXING *Creek*, in Luzerne county, Pennfylvania, falls into the Eaft Branch of Sufquehannah river from the north-eaftward, and north-weftward of Mefhoppen Creek, which is 33 miles fouth-eaft of Tioga Point.—*ib.*

WYMOA *Road*, in the North Pacific Ocean, a place of anchorage at Atooi Ifland, one of the Sandwich Iflands, in lat. 21 57 north, and long. 159 47 weft. It is at the fouth-weft fide, and about 6 miles from the weft end of the ifland. The ifland is about 10 leagues long, and 25 leagues north-weft of Woahoo Ifland.—*ib.*

WYONDOTTS, or *Wiandats*, an Indian nation refiding near Fort Detroit, in the neighbourhood of the Ottawas and Putawatimes, whofe hunting grounds are about Lake Erie. The number of warriors, 20 years ago, were, Wyondotts 250, Ottawas 400, Putawatimes 150. Another tribe of the Wyondotts live near Sandufky, among the Mohickons and Caghnawagas, who together have 300 warriors. At the treaty of Greenville, in confequence of lands ceded to the United States, the latter agreed to pay them a fum in hand, and in goods to the value of 1000 dollars a year forever.—*ib.*

WYNTON, the chief town of Hertford county, Edenton diftrict, North-Carolina.—*ib.*

WYOMING, a general name formerly given to a tract of country in Pennfylvania, fituated on Sufquehannah river, above Wilkfbarre. In the year 1778, the fettlement which was known under this name, confifted of 8 townfhips, each containing 5 miles fquare, fettled from Connecticut, and originally under its jurifdiction, and produced great quantities of grain of all forts, fruit, hemp, flax, &c. inhabited by about 1000 families, who had furnifhed the continental army with near 1000 foldiers, befides various fupplies of provifions, &c. In the month of July, all thefe flourifhing fettlements were reduced by the Indians and tories to a ftate of defolation and horror, almoft beyond defcription. In the vicinity of Wyoming is a bed of coal, of the open burning kind, which gives a very intenfe heat. Wyoming Falls lie about 2 miles above Wilkfbarre, and 8½ miles above Nantikoke Falls. N. lat. 41 14, W. long. 75 53. —*ib.*

WYONOKE *Creek*, in N. Carolina, lies within or about lat. 36 30 N. The charter of Carolina, in 1664, extended the bounds eaftward as far as the north end of Currituck Inlet, upon a ftraight line wefterly to this creek.—*ib.*

WYTHE, a county of Virginia, faid to be 120 miles in length, and nearly 50 in breadth; bounded north by Kanhaway, and fouth by the ftate of North Carolina. Its population in 1790 was included in Montgomery county. There are lead mines in this county, on the Great Kanhaway, 25 miles from the line of N. Carolina, which yield from 50 to 80lbs. pure lead from 100lbs wafhed ore, but moft commonly 60 to 100. Two of them are worked by the public; the beft of which is 100 yards under the hill; and although there are not more than 30 labourers generally employed, they might employ 50 or 60 to advantage. The labourers cultivate their own corn. Twenty, twenty-

twenty-five and ſometimes ſixty tons of lead have been extracted from theſe mines in a year. Chief town, Evanſham. The court-houſe is on the poſt-road from Richmond to Danville, in Kentucky, 301 miles from the former, and 323 from the latter. It is 46 miles from Montgomery court-houſe, 57 from Abingdon, and 454 from Philadelphia. A poſt-office is kept here.—*ib.*

X.

XAGUA, a harbour on the S. E. coaſt of the iſland of Cuba, and one of the fineſt ports in the Weſt-Indies. It lies between the Iſlands of Pines, or Pinez, and Spirito Santo.—*Morse.*

XAINTES, Santos, or *All Saints Iſlands,* ſo named from their being diſcovered on that Holy Day, by the Spaniards, on the S. E. ſide of the iſland of Gaudaloupe, and in its juriſdiction. The moſt weſterly of theſe three iſles is called Terre de Bas, or the Low Iſland, and the moſt eaſterly Terre de Haut, or the High Iſland. The third, which lies exactly in the middle between the other two, is little other than a barren rock, and helps to form a very good harbour.—*ib.*

XALISCO, a province of New-Spain, and the moſt ſoutherly on the coaſt of Guadalajara audience. It is bounded S. and W. by the South Sea; E. by Guadalajara Proper, and Mechoacan, and divided from Chiametlan, on the N. by a narrow ſlip of land belonging to Guadalajara, extending into the ſea. It is not above 150 miles in extent either way. It has ſilver mines, and abounds with Indian wheat, but has few cattle. The oil of the *Infernal Fig-tree,* as the Spaniards call it, is brought from this province. It is ſaid to be efficacious in diſſolving tumors, expelling of wind, and all cold humours, by anointing the belly, and taking a few drops of it in a glaſs of wine, as alſo by clyſters. It is alſo ſaid to cure ulcers in the head, and deafneſs. The Indians are numerous here, and are reckoned braver and more polite than their neighbouring countrymen. The Xaliſco, an ancient city, is the capital, yet the moſt conſiderable place in it is Compoſtella.—*ib.*

XARAYES, *Laguna de los,* a large lake of Paraguay, in S. America, formed by the river Paraguay, in its courſe from north to ſouth.—*ib.*

XERES *de la Frontera,* a town in the ſouthernmoſt part of Zacatecas, a province of Guadalajara audience, in New Spain, in N. America. It is garriſoned for defending the mines againſt the hoſtile Indians.—*ib.*

Y.

YABAQUE, one of the Lucayos or Bahama Iſlands, ſituated ſouth-weſt of Meguana Iſland. N. lat. 22 30.—*Morse.*

YADKIN, a conſiderable river of N. Carolina, which riſes in the Alleghany Mountains, running E. about 60 miles, then turning to the S. S. E. paſſes the Narrows, a few miles above Rocky river; thence directing its courſe through Montgomery and Anſon counties, enters S. Carolina. It is about 400 yards broad where it paſſes Saliſbury, but it is reduced between 2 hills, about 25 miles to the ſouthward of that town, to the width of 80 or 100 feet. For 2 miles it is narrow and rapid, but the moſt narrow and moſt rapid part is not above half a mile in length. In this narrow part, ſhad are caught in the ſpring of the year, by hoop nets, in the eddies, as faſt as the ſtrongeſt men are able to throw them out. Perhaps there is not in the United States a more eligible ſituation for a large manufacturing town. Boats with 40 or 50 hogſheads paſs eaſily from theſe Rapids to Georgetown. The late war, by which N. Carolina was greatly convulſed, put a ſtop to ſeveral iron-works. At preſent there are 4 or 5 furnaces in the State that are in blaſt, and a proportionable number of forges. There is one in Guilford county, one in Surry, and one in Wilkes, all on the Yadkin. From the mouth of Rocky River to the ocean, the ſtream aſſumes the name of *Great Pedee.*—*ib.*

YAGARCHOCA, a lake of Quito, within the limits of the juriſdiction of San Miguel de Ibarra. It is famous for having been the ſepulchre of the inhabitants of Otabalo, when taken by Huayna Capac, the 12th Inca; who, inſtead of rewarding their magnanimity with clemency, was irritated at the noble reſiſtance which they made againſt his army, ordered them all to be beheaded, and their bodies to be thrown into the lake; hence its name, which ſignifies a lake of blood.—*ib.*

YAGO, *St,* or *St James,* an ancient town on the N. ſide of St Domingo Iſland, founded before 1504, and the country round is reckoned as healthy as any in the iſland. It is ſituated on the high road from La Vega to Daxavon; 10 leagues weſt by north of the former, and 28 eaſterly of the latter, and about 10 from the anchoring-place of St Yague, and nearly as far from

Port de Plate. It ftands on the northern fide of the river Yaqui, in a favannah commanding the river. The town is open, and regularly laid out, and contains above 600 houfes. It is 52 leagues N. N. W. of St Domingo city, 34 weft by north of the bottom of Samana Bay, and 22 N. W. of Cotuy. The territory of St Yago, or Jago, contains 28,000 fouls, and is very fertile in mines. The fand of Green and Yaqui rivers is mixed with gold. Mercury is found at the head of the latter river, and copper is alfo found in this territory. The tree, guatapana, which retains its Indian name, is found here. It bears a fort of grain or pod, from which is extracted a very fine black dye. —*ib.*

YAGUACHE, a lieutenancy of Guayaquil jurifdiction, in South-America. It lies at the mouth of the river of the fame name, which empties into that of Guayaquil on the fouth fide, and has its fource from the fkirts of the Cordilleras, fouth of the river Bamba. Within its jurifdiction are 3 towns; the chief of which is that where the cuftom-houfe is erected, and called San Jacint de Yaguache; the 2 others are Naufa and Antonche. It produces wood, cocoa, cattle, and cotton.—*ib.*

YAMACRAW, the ancient Indian name of the fpot where Savannah, in Georgia, is erected.—Alfo the name of a tribe of the Creek Indians.—*ib.*

YAQUE, *Port St*, vulgarly called *Old Port*, a fmall anchoring-place on the N. fide of the ifland of St Domingo; fituated between Padrepin on the weft, and Macoris Point on the eaft.—*ib.*

YAQUI, *Grand*, or *Monte Chrift River*, a river of the north part of the ifland of St Domingo, which runs a weft-north-weft courfe, and empties into the Bay of Monte Chrift. It might be afcended in canoes or fmall boats, for 15 leagues, were it not for the limbs of trees which lodge in it. All its numerous branches are from the fouthward.—*ib.*

YARDSLEY's *Ferry*, on Delaware river, is 3 miles north-wefterly of Trenton, in New-Jerfey, and 5 below M'Crankey's Ferry.—*ib.*

YARI, a town in Amazonia, South-America, at the head of a branch of Amazon river, fouth-wefterly from Macapa.—*ib.*

YARMOUTH, a poft-town of Maffachufetts, Barnftable county, on the neck of the peninfula of Cape-Cod, 4 miles E. of Barnftable, 12 E. by S. of Sandwich, 110 fouth-weft of Bofton, and 427 from Philadelphia. The townfhip extends from fea to fea. It was incorporated in 1639, and contains 2,678 inhabitants.—*ib.*

Yarmouth, a townfhip of Nova-Scotia, in Queen's county, fettled by New-Englanders. It lies at the head of a fhort bay, 8 miles fouth-eaft of Cape St Mary.—*ib.*

YARUQUI, a plain 4 leagues north-eaft of the city of Quito, and 249 toifes lower than it. Near it is a village of the fame name. This fpot was pitched upon as the bafe of the whole operations for meafuring the length of an arch of the meridian, by Ulloa.—*ib.*

YAZOO *River*, in Georgia Weftern Territory, confifts of 3 large branches which run a fouthern courfe, and near its mouth thefe unite and purfue a fouth-weft courfe a few miles, and the confluent ftream enters the eaftern bank of the Miffiffippi, by a mouth upwards of 100 yards wide; according to Mr Gauld, in lat. 32 37 N. and by Mr Purcel, in 32 28.—*ib.*

Yazoo *Cliffs*, or *Aux Cotes*, lie $7\frac{1}{2}$ miles from the river Yazoo, and $39\frac{3}{4}$ miles from Loufa Chitto, or Big Black river.—*ib.*

YBAGUE, a city of New-Granada, in Terra Firma, South-America.—*ib.*

YCA, or *Valverde*, or the *Green Vale*, from a valley of the fame name planted with vines, which is 6 leagues long, and produces plenty of wine. It is about 41 miles fouth-eaft of Pifco, in Peru, and is inhabited by 500 Spaniards. It is a beautiful and rich town, having a large church, 3 convents, and an hofpital. About 6 leagues from the town is its port, called Puerto Quemada.—*ib.*

YCAQUE, or *Icaco*, the northern point of the bay of Mancenilla, in the ifland of St Domingo.—*ib.*

YLO, a port of Peru, in Los Charcos, convenient for loading and unloading, in lat. 18 S. The town of the fame name, lies about a quarter of a league to the windward of the river, and is inhabited by Indians. Frezier calls it *Hilo*.—*ib.*

YOHOGANY, the principal branch of Monongahela river, called alfo *Toughiogeny*, and *Toxhiogeni*, purfues a north-wefterly courfe, and paffes through the Laurel Mountain, about 30 miles from its mouth; is, fo far, from 300 to 150 yards wide, and the navigation much obftructed in dry weather by rapids and fhoals. In its paffage through the mountain it makes very great falls, admitting no navigation for 10 miles, to the Turkey-foot. Thence to the Great Croffing, about 20 miles, it is again navigable, except in dry feafons, and at this place is 200 yards wide. The fources of this river are divided from thofe of the Patowmack, by the Alleghany Mountain. From the falls, where it interfects the Laurel Mountain, to Fort Cumberland, the head of the navigation to the Patowmack, is 40 miles of very mountainous road. The country on this river is uneven, but in the vallies the foil is extremely rich. Near to Pittfburg the country is well peopled, and there, as well as in Redftone, all the comforts of life are in the greateft abundance. This whole country abounds with coal, which lies almoft on the furface of the ground.—*ib.*

YONKERS, a townfhip of New-York, in Weft Chefter county, bounded eafterly by Bronx river, and wefterly by the county of York and Hudfon's river. It contains 1125 inhabitants, of whom 139 are electors, and 170 flaves.—*ib.*

Yonkers, a poft-town of New-York, 114 miles from Philadelphia.—*ib.*

YORK, a river of Virginia, which takes its rife near the Blue Ridge, and empties into the Chefapeak, a little to the S. of Mobjack Bay. At York-Town it affords the beft harbour in the State, which will admit veffels of the largeft fize. The river there narrows to the width of a mile, and is contained within very high banks, clofe under which the veffels may ride. It has 4 fathoms water at high tide, for 20 miles above York, to the mouth of Poropotank, where the river is a mile and a half wide, and the channel only 75 fathoms, paffing under a very high bank. At the confluence of Pamunky and Mattapony it has but 3 fathoms depth, which continues up Pamunky to Cumberland, where the width is 100 yards, and up Mattapony to within 2

 miles

miles of Frazer's Ferry, where it becomes 28½ fathoms deep, and holds that about 5 miles.—*ib.*

YORK, a river of York county, Diftrict of Maine, which runs up 7 or 8 miles, and affords a tolerable harbour for veffels under 200 tons. The rocks, however, render it fomewhat difficult and hazardous for ftrangers.—*ib.*

YORK, a maritime and populous county of the Diftrict of Maine, bounded E. and N. E. by Cumberland, S. by the ocean, W. by New-Hampfhire, from which it is feparated by Salmon Fall River, and N. by Canada. It is well watered by Saco, Moufom, and other ftreams, and is divided into 27 townfhips, and contains 28,821 inhabitants. Chief town, York.

YORK, a poft-town of the Diftrict of Maine, in York county, 9 miles N. E. of Portfmouth, in New-Hampfhire, 20 S. of Wells, 48 S. by W. of Portland, 75 from Bofton, and 421 from Philadelphia. N. lat. 43 16. It is a port of entry and capital of the county. The river of its name empties into York harbour at the town. It is navigable for veffels of 250 tons. About a mile from the fea is a wooden bridge acrofs the river, 270feet in length, which was erected in 1761. Before the war, 25 or 30 veffels were employed in the Weft-India trade, and coafting bufinefs, but their veffels were taken or deftroyed, and little marine bufinefs is now done, except that a fmall fifhery is fupported. This townfhip was fettled in 1630, and called *Agamenticus*, from the hill of that name which is a noted land-mark for mariners. In 1640, Sir Ferdinand Gorges incorporated a great part of it by the name of *Georgiana.* In the year 1692, the Indians took the town by furprife, and burnt moft of the houfes, and 150 perfons were killed or captivated. It contained, according to the cenfus of 1790, 2900 perfons. Fifh of various kinds frequent the rivers and fhores of the fea contiguous. In a calm feafon, in the fummer, one may ftand on the rocks of the fhore, and catch them, in the fea, with a line, or even with an angling rod, and a fathom or two of line.—*ib.*

YORK, a county of Pennfylvania, bounded E and N. E. by Sufquehannah river, which feparates it from Lancafter and Dauphine counties, and S. by the State of Maryland. It contains 29 townfhips, and 37,747 inhabitants.—*ib.*

YORK, a poft-town and capital of the above county, fituated on the eaft fide of Codorus Creek, which empties into the Sufquehannah. It contains about 500 houfes, feveral of which are of brick. The town is regularly laid out; the public buildings are a court-houfe, a ftone gaol, a record-office, handfomely built, an academy, a German Lutheran, a German Calvinift, a Prefbyterian, Roman Catholic, and Moravian church, and a Quaker meeting-houfe. It is 22 miles W. S. W. of Lancafter, 51 N. W. by N. of Hartford, in Maryland, 199 N. E. of Staunton, in Virginia, and 88 W. of Philadelphia.—*ib.*

YORK, a county of S. Carolina, in Pinckney diftrict; bounded E. by Catawba river, N. by the State of North-Carolina; S. by Chefter county, and W. by Broad River, which divides it from Spartanburg, and is one of the moft agreeable and healthy counties in the State, and well watered by Catawba and Broad rivers, and their tributaries. It contains 6604 inhabitants, of whom 5652 are whites, and 923 flaves. Here are extenfive iron-works. This county fends three reprefentatives and one fenator to the State Legiflature.—*ib.*

YORK, a county of Virginia, bounded north by York river, which divides it from Gloucefter county, fouth by Warwick; eaft by Elizabeth City county, and weft by that of James City. It contains 5233 inhabitants, of whom 2760 are flaves.—*ib.*

YORK, or *Yorktown*, a port of entry and poft-town of Virginia, and capital of York county. It is agreeably fituated on the fouth fide of York river, where the river is fuddenly contracted to a narrow compafs, oppofite to Gloucefter, and a mile diftant, where there is a fort fronting that on the York fide, about 11 miles weft by fouth of Toes Point, at the mouth of the river. The banks of the river are very high, and veffels of the greateft burden may ride clofe under them with the greateft fafety. It contains about 60 or 70 houfes, a gaol, an Epifcopal church, and a tobacco ware-houfe. In 1790, it contained 661 inhabitants, of whom 372 were flaves. Its exports, in the year 1794, amounted to 71,578 dollars. It will ever be famous in the American annals for the capture of Lord Cornwallis and his army by the combined force of the United States and France, which took place on the 19th of October, 1781. It is 12 miles E. by S. of Williamfburg, 21 N. W. of Hampton, 72 E. S. E. of Richmond, and 350 S. S. W. of Philadelphia. N. lat. 37 22 30, W. long. 76 52. —*ib.*

YORK, a town of Upper Canada, fituated on the north-weftern fide of Lake Ontario, and is defigned to be the future feat of government of that province. The public buildings are erecting. It is 40 miles N. by W. of Niagara Fort, and 120 W. S. W. of Kingfton. N. lat. 43 57, W. long. 80 35.—*ib.*

YORK *Bay* is 9 miles long, and 4 broad, and fpreads to the fouthward before the city of New-York. It is formed by the confluence of Eaft and Hudfon's rivers, and embofoms feveral fmall iflands, of which Governor's Ifland is the principal. It communicates with the ocean through the *Narrows*, between Staten and Long Iflands, which are fcarcely 2 miles wide. The paffage up to New-York, from Sandy Hook, the point of land that extends furtheft into the fea, is fafe, and not above 20 miles in length. The common navigation is between the eaft and weft banks, in about 22 feet water. The light-houfe at Sandy-Hook is in lat. 40 30 N. and long. 74 2 W.

YORK *Fort*, on the S. W. fhore of Hudfon's Bay, at the mouth of Port Nelfon river, is 160 miles wefterly of Severn Houfe. N. lat. 57 1 51, W. long. 92 46 40. —*ib.*

YORK *Ifle*, or *Iflands*, lie in S. lat. 50 37, about 50 leagues from the coaft of Patagonia, in South-America, and are inhabited. Trinity Ifle lies due eaft of them, near the main land.—*ib.*

YORK *Ledge*, on the coaft of the Diftrict of Maine. From York Harbour to York Ledge, the courfe is S. E. 2 leagues.—*ib.*

YORK *Minfter*, on the S. coaft of the ifland Terra del Fuego, is 19 leagues at E. S. E. from Gilbert Ifland. S. lat. 55 26, W. long. 70 25.—*ib.*

YORK *Road*, or *Bay*, in the Straits of Magellan, in S. America, is 10 miles from Cape-Crofs Tide. S. lat. 53 39, W. long. 73 52.—*ib.*

YORKTOWN,

Yorktown, || Yucatan. YORKTOWN, a townſhip of New-York, Weſt-Cheſter county, bounded weſterly by the town of Cortland, and northerly by Dutcheſs county. In 1790, it contained 1609 inhabitants, including 40 ſlaves. In 1796, according to the State cenſus, there were 210 of the inhabitants electors.—*ib.*

YUCATAN, one of the ſeven provinces of the audience of Mexico, in New Spain. The Britiſh had a right to cut logwood and carry it away, by the treaty of 1783, in the tract between Rio Honde and Balize rivers.—*ib.*

Yuna. YUNA, a river of the iſland of St Domingo, which runs an E. S. E. and E. courſe, and empties into the W. end of the Bay of Samana. It riſes near Monte Chriſt river. It is navigable no farther than Cotuy, 13 leagues from its mouth.—*ib.*

Z.

Zacatecas, || Zemindars. ZACATECAS, a province of New-Spain, bounded by New Biſcay on the N. by Panuco on the E. Mechoacan, Guadalajara, and Chiametlan, on the S. and by part of Chiametlan and Culiacan on the W. It is well inhabited, and abounds with large villages. The mines here are reckoned the richeſt in America.—*ib.*

ZACATECAS, the capital of the above province, ſituated under the tropic of Cancer, 40 leagues N. of Guadalajara, and 80 N. W. of Mexico. Its garriſon conſiſts of about 1000 men, and there are about 800 families of ſlaves, who work in the mines and other laborious work. N. lat. 23 29, W. long. 103 20.—*ib.*

ZACATULA, a ſmall ſeaport-town of the province of Mechoacan, ſituated at the mouth of the river of the ſame name, on the coaſt of the Pacific Ocean. N. lat. 17 22, W. long. 104 58.—*ib.*

ZACHEO, or *Deſechio*, a ſmall iſland, 8 or 9 leagues to the N. E. by N. of Mona, between the iſland of St Domingo and that of Porto Rico. It is nothing more than a green mountain, 800 or 1000 yards long.—*ib.*

ZAMINY, in the language of Bengal, ſecurity.

ZAMORA, a city of Peru, in S. America, 200 miles ſouth of Quito, which is pretty large, and the houſes well built of timber and ſtone. The church and convent of Dominicans, are both elegant ſtructures. There are ſeveral gold mines in the neighbourhood of the city, but few of them are worked. S. lat. 4 10, W. long. 77 5.—*Morse.*

ZAPOTECHAS, a river of New-Spain which runs north-eaſtward into the Gulf of Mexico. A fort of the ſame name ſtands on the N. W. bank of the river, about 250 miles S. E. from the city of Mexico.—*ib.*

ZELITO, or *Ziltio*, one of the forts for the protection of the harbour of Carthagena, on the N. coaſt of S. America.—*ib.*

ZEMINDARS, the great landholders of Bengal. This is the original ſenſe of the word; but it is now more ſtrictly applicable to thoſe who have their title conſtituted or confirmed by a patent or charter from government, by which they hold their lands or Zemindaries upon certain conditions. As far as can be aſcertained from the narrations of hiſtory, it appears that, in times prior to the irruptions of the Mahomedans, the rajahs who held their reſidence at Delhy, and poſſeſſed the ſovereignty of Hindoſtan, deputed officers to collect their revenues (Kheràje), who were called in the Indian language *Choudheries*. The word *Zemindar* is Perſian, and that language can have had no currency in the countries of India, until it was introduced by the people of Perſia. When the Emperor Shehâb-ul-Dien Ghory conquered the empire of Hindoſtan (A), he left Sultan Cutub-ul-Dien to be his viceroy at Delhy, and adminiſter the government of Hindoſtan. From that time the cuſtoms and practices of the Mahomedans began gradually to be eſtabliſhed in India; their armies were ſent into the countries of the reduced Rajahs, under the command of Omrahs, in order to preſerve the conqueſt; and lands were allotted to them to defray the expenſe. From hence aroſe the ſyſtem of Jaghiredarry in Hindoſtan. But when theſe Omrah Jaghiredars had eſtabliſhed their own ſtrength, ſeveral of them rebelled againſt the imperial authority, and aſpired at the crown. Thus circumſtanced, the emperors, in order to obviate theſe miſchiefs, thought it would be more politic to commit the management of the country to the native Hindoos, who had moſt diſtinguiſhed themſelves by the readineſs and conſtancy of their obedience to the ſovereign power.

Zemindars. In purſuance of this plan, diſtricts were allotted to numbers of them under a reaſonable revenue (Jummah Monâſib), which they were required to pay in money to the governors of the provinces, deputed from the Emperor. And in caſe any one of the Omrahs or provincial governors ſhould ſwerve from his allegiance, the Zemindars of that country were to exert themſelves in ſuch a manner as ſhould check rebellion, and reſtore good government. For this purpoſe, grants of Zemindary were ſeverally conferred upon ſuch of the Hindoos as were obedient; deſcribing their apportionment of the country; and every perſon who had received a grant under the authority of the crown was thereby fully inveſted with the functions of Zemindar.

The functions of a Zemindar are, 1ſt, The preſervation and defence of their reſpective boundaries from traitors and inſurgents; 2dly, The tranquillity of the ſubjects, the abundance of cultivators, and increaſe of his

(A) This event took place towards the cloſe of the 12th century. N. B. *Kheràje* ſignifies ſpecifically the tribute paid by a conquered country.

Zemindars. his revenue. 3dly, The punifhment of thieves and robbers, the prevention of crimes, and the deftruction of highwaymen. The accomplifhment of thefe objects is confidered in the royal grant as the difcharge of office to the fovereign; and on that account the word *office* (Khidmut) is employed in the Dewanny Sunnud for a Zemindary.

It was a rule in the times of the ancient emperors, that when any of the Zemindars died, their effects and property were fequeftrated by the government. After which, in confideration of the rights of long fervice, which is incumbent on fovereigns, and elevates the dignity of the employer, Sunnuds for the office of Zemindary were granted to the children of the deceafed Zemindar; and no other perfon was accepted, becaufe the inhabitants could never feel for any ftranger the attachment and affection which they naturally entertain for the family of their Zemindar, and would have been afflicted if any other had been put over them. For this reafon, the emperors, confidering it as a means of conciliating the minds of the people, gracioufly fixed and confirmed the children of the deceafed Zemindar in the office of their fathers and grandfathers, by iffuing new funnuds to transfer the poffeffion to them. By degrees Zemindaries became truly heritable property, which, however, could be transferred by gift or fale from one family to another. They could likewife be forfeited to the fovereign, by the Zemindar's deviating from his allegiance, neglecting to pay his tribute, or to difcharge the duties of his ftation.

It is univerfally known, fays Sir Charles Roufe Boughton, that, when the three provinces of Bengal, Bahar, and Oriffa, were ceded to the Britifh Eaft-India Company, the country was diftributed among the Zemindars and Talookdars (fee that article in this Vol.), who paid a ftipulated revenue, by twelve inftalments, to the fovereign power or its delegates. They affembled at the capital in the beginning of every Bengal year (commencing in April), in order to complete their final payments, and make up their annual accounts; to fettle the difcount to be charged upon their feveral remittances in various coins for the purpofe of reducing them to one ftandard, or adjuft their concerns with their bankers; to petition for remiffions on account of ftorms, drought, inundation, difturbances, and fuch like; to make their reprefentations of the ftate, and occurrences of their diftricts: after all which they entered upon the collections of the new year; of which, however, they were not permitted to begin receiving the rents from their own farmers, till they had completely clofed the accounts of the preceding year, fo that they might not encroach upon the new rents, to make up the deficiency of the paft. Our author proves, we think completely, the right of the Zemindars to transfer their poffeffions, either by inheritance to their children, or, with the confent of the fovereign, to other families; and he argues ftrenuoufly and fuccefsfully againft the bad policy, as well as injuftice, of interfering with thofe rights, as long as the Zemindars difcharge the duties of their feveral ftations. Zemindars, || Zonefhio.

ZINOCHSAA, the original name of a river of New-York, which runs through Onondago, the chief town of the Six Nations.—*Morse*.

ZITAR, a town of Terra Firma, S. America, near to and fouth from the head of the Gulf of Darien.—*ib*.

ZOAR, a plantation in Berkfhire county, Maffachufetts, containing 78 inhabitants.—*ib*.

ZONCOLCUCAN, mountains in Guaxaca, in New-Spain, which give rife to Papalo-apain or Alvarad river.—*ib*.

ZONESHIO, the chief town of the Seneca Indians, 2 miles N. of Seneca Lake.—*ib*.

APPENDIX.

APPENDIX.

THE importance of every invention which tends to facilitate Navigation is fuch as to entitle it to be recorded for the benefit of mankind, particularly in Commercial Nations. In this view the accounts of the Artificial Horizon and the New Log are prefented to our readers from the Specifications of the Patents obtained by Chefter Gould, the Inventor of the *Artificial Horizon*. He fays, "My invention confifts in applying a fluid or fluids coloured, or otherwife, to the quadrant or fextant, fo as to obtain a level for the purpofe of taking the altitudes of celeftial and other fubjects, on land or water, without the affiftance of the natural horizon. This I perform in the manner following: that is to fay, I make a circular tube or ring of brafs, or of other proper fubftance, from two to three inches in diameter, or more or lefs, as convenience may direct, in which I fit four tranfparent glaffes, directly oppofite to, and parallel with, each other, fo that the furfaces of the fluid contained in the tube may be diftinctly feen by the obferver. The infide of this tube, which is to contain the fluid, may be equal in area to a tube of about one-fourth part of an inch in diameter, or even more, and when in ufe fhould be about half filled with fome tranfparent fluid, and it fhould be fixed to a fmall apparatus made of brafs or other proper fubftance, with fuch joints and adjuftments as are neceffary to bring it to its true pofition on the quadrant or fextant.

" The artificial horizon, reprefented in the annexed drawing, I confider to be moft proper for general ufe.

" Fig. A, in the drawing (fee Appendix, Plate III.), reprefents the whole inftrument with the artificial horizon put together; *m*, reprefents the fcrew which binds the cramp *n* to the frame of the quadrant or fextant, fo that the ring or tube of the artificial horizon will ftand directly behind the fore horizon glafs. The pofition of the tube or ring ought to be fuch, that its plane will be parallel to the plane of the quadrant or fextant, and fo alfo that the centre of its glaffes and the hole of the forefight vane of the quadrant or fextant, which is intended to be ufed, fhould form a line parallel to the chord of the arch, and to the plane of the quadrant or fextant at the fame time. Its true pofition on the quadrant or fextant being obtained, and the ring or tube being filled as is above defcribed up to the centre of its glaffes, and the quadrant or fextant being held in a vertical pofition, the furface of the fluid may be brought to form a perfect level with the eye of the obferver. This being done, the object whofe altitude is to be taken is then reflected down to this fluid level, in the fame manner as when altitudes are taken by a fea horizon.

" The whole inftrument may be varied in its form, fcale and proportion, the tube may be filled with mercury, but I prefer a tranfparent fluid; and, in order to retard the too fudden motion of the fluid, I make an adjuftment in the bottom of the tube (either fixed or moveable) by which the motion of the fluid is obftructed and regulated at pleafure. I have in fome inftances ufed coloured glaffes, but for general ufe I prefer the plain; in either cafe the furfaces fhould be well ground and finely polifhed. I have alfo ufed two tubes or rings, fo placed, that, when the inftrument is in ufe, the level is formed by an apparent contact of one of the furfaces of the fluid in each tube, but I think a fingle tube or ring to be much preferable.

" I prefer the artificial horizon made and ufed as above defcribed, but it may be fo conftructed as to be connected with a telefcope, fuch as is frequently applied to quadrants or fextants, by which means the furfaces of the fluid, and their contact with the image of the fun or any other body, may be more exactly determined, and this may be effected whether the inftrument is intended to be fitted up with two rings or with one only. As the form of the telefcope and of the artificial horizon as well as the mode of connecting them together admit of great variety, I inftance the following examples; that is to fay,

"The firft example fhall be where only one ring or tube is ufed. In this cafe I make the tube of fuch a figure, that one pair of the glaffes occupy the field of the telefcope, between which glaffes one of the furfaces of the fluid appears, and the other furface of the fluid is put fo much out of the axis of the telefcope, as not to obftruct the light from the object glafs, and by placing a horizontal wire, or by drawing a horizontal line acrofs one of the glaffes, the inftrument being previoufly adjufted, and fo held or placed, that the furface of the fluid in the tube between the glaffes and the wire or line is made to correfpond. The image of the fun or other object may be brought to touch the wire or line at the fame time by moving the index of the quadrant or fextant, and the altitude may be read off upon the arch as in common cafes.

" The fecond example fhall alfo be with one tube or ring only, and where both the furfaces of the fluid fhall appear as in the field of the telefcope. In this cafe, I cut off one half of the object glafs of the telefcope commonly ufed, fuppofing it to be divided by a line parallel to the plane of the inftrument, and inftead of the part taken away I place half of another object glafs, whofe focus is equal to one half of the focus of the original object glafs, and I encreafe the diftance between the furfaces of the fluid to twice the focal diftances of the original glafs, and by placing one furface of the fluid in the field of the telefcope, as in the firft example, and the other furface in the axis of the telefcope produced, the inftrument being adjufted, that furface of the fluid neceffarily placed behind the object glafs will appear to meet the furface of the fluid placed in the field of the telefcope, and to which the image of the fun can be made to coincide as in the firft example.

" The laft example fhall be where two tubes or rings are ufed. In this cafe I place one of the rings or tubes as in the firft example, that is to fay: one of the furfaces of the fluid in the field of the telefcope, and the other out of the axis of the telefcope and towards the object glafs, and I place the fecond ring or tube with one fur-

face

face in the field of the telefcope as near to the firft as poffible, and the other furface of the fecond ring or tube out of the axis and towards the eye-glafs of the telefcope, the inftrument being adjufted, and held or placed, fo that the two furfaces placed in the field and both brought into contact with the wire or horizontal line, the image of the fun or other object may be made to coincide, and the altitude read as in the two preceding examples.

"Although the foregoing defcription of the artificial horizon is agreeable to the form in which I now make it, and which in my opinion is the beft, yet there are other forms in which it may be made fo as to produce nearly the fame effect, for a fluid will become level in a tube made in the form of a fquare, parallelogram, or triangle, or any other form, but a circular tube being more eafily made, I give it the preference; and notwithftanding I fix the ring of the artificial horizon at the back-fide of the fore horizon glafs of the quadrant or fextant, it being fuited to the ufe of both thefe inftruments, yet a good effect may be produced by fixing it to the other parts of thefe inftruments, provided the furfaces of the fluid are diftinctly feen by the obferver, either directly or by reflection."

The new log for afcertaining a fhip's diftance at fea, for which Mr Gould has alfo obtained a patent, confifts of a rotator or adjuftable fly, connected by a line or chain, with a regifter which may be kept on board the veffel. The fly is compofed of four vanes or wings placed both angularly and conically, fo as to produce a rotary motion round the centre piece adjufted by a regulator. "This fly (fays the inventor) on which accuracy of meafurement by the log wholly depends, is compofed of regular figures, fuch as planes and fquares, which admit of the greateft uniformity of workmanfhip; and its effential parts, together with the angular pofition of the vanes, admit of ftrict examination, by the application of inftruments in common ufe, fuch as the fquare, the compaffes, and parallel rulers, by which very trifling errors may be eafily difcovered, without the trouble of experience by water. The general form of this fly being conical, it is not liable to obftructions at fea, from fea weeds, or other floating fubftances. It is alfo detached from the regifter for purpofes hereafter mentioned. By the conical pofition of the vanes, I mean that pofition which is caufed by moving their broadeft ends from the centre in a direction with their planes, while their narrow ends remain fixed; and by the angular pofition I mean, that pofition which is caufed by feparating the broad ends of the vanes from the centre, (and confequently from each other), in a direction at right angles with the former pofition, while the narrow ends remain fixed, as in Fig. 1, in the drawing hereto annexed, (fee Plate I.); or, in other words, the conical pofition of the vanes determines the diftance between *a* and *b*, in the fame figure; and their angular pofition determines the diftance between *c* and *d*, in the fame figure. The conical pofition of the vanes being varied, increafes or diminifhes the rotary power or ftrength of action of the fly, and their angular pofition being varied, increafes or diminifhes the number of its revolutions made in any given diftance. The fly is conftructed in manner following; the centre piece, or virtual axis, has at its head end an eye-hole, or other convenience for faftening the line to it, and the other end terminating in a fcrew, of fufficient length to vary the adjuftment of the fly, fo as to anfwer fuch purpofes as it is intended for. It paffes through a collar, having a fmooth hole through its centre, fufficient to receive the axis upon which it fhould turn freely, and to which it is fecured by a collet and pin. This collar muft have the fame number of flats or fides as the number of vanes intended for it; and it muft terminate conically towards its head. The regulator fhould have the fame number of fides with the former, and fhould alfo terminate conically from its bafe, anfwering to the conical form of the fly. It has a tapped hole through its centre, to fit the fcrew on the end of the axis, on which it fhould move uniformly the whole length of the fcrew. The vanes are to be attached by their narrow ends to the fides or flats of the collar, by fcrews or otherwife, having in each of them a flit or opening, to admit the fcrews which bind them to the regulator, as in Fig. 1, in the fame drawing. I make a fcale, which I graduate into fundry parts, anfwering to the turns of the axis through the regulator; and when the fly is put together, as in Fig. 1, the fcale refts upon the regulator, and fhews how far the regulator is moved either way in adjufting the fly. After having, by the affiftance of the regulator, found the true pofition of the vanes, which would give the true diftance failed, I have fometimes made the fly a fixture throughout; but I prefer the adjuftable fly.

"The regifter I ufe is conftructed in manner following: that is to fay: Fig. 2, in the aforefaid drawing, reprefents the regifter in one of its forms. It may be carried either in the veffel's cabin, or be fufpended over the ftern, by the ears *a* and *b*, in the fame Fig. 2, fo as to turn freely towards the fly at all times. Fig. 3, in the fame drawing, reprefents the infide movement or train of wheels with its dial. This is fixed within the cylinder Fig. 2, and turns the index on its dial. The pinion *d*, in the fame Fig. 3, has upon its inner end eight leaves, which moves the firft or contrate wheel *b*, which has forty-eight teeth; and by its pinion of fix leaves it moves the fecond wheel *c*, which has fixty teeth. This wheel *c*, by its pinion of fix leaves, moves the third wheel *d*, of fixty teeth. This wheel *d*, by its pinion of fix leaves, moves the fourth wheel *e* of fixty teeth; and this wheel *e*, by its pinion of fix leaves, moves the fifth wheel *f*, of fixty teeth, which carries the index *g* on the end of its pinion. Its dial is graduated into one hundred divifions, each of which anfwers to one mile, and is numbered 10, 20, 30, 40, 50, 60, 70, 80, 90, 100; and, by the addition of more wheels, in like manner, the regifter will be capable of fhewing any neceffary diftance whatever. An endlefs fcrew would produce the fame effect in giving motion to the regifter as the pinion *d*, but I give the preference to the pinion. Fig. 4, in the faid drawing, reprefents the regifter in another form. It has a fimilar train of wheels as the former, with the addition of one more wheel of fixty teeth, which extends the calculation of the diftance the veffel fails to a thoufand miles. The form of this regifter, by a circular difpofition of the wheels, is round, and is enclofed in a round cafe, which is graduated for the purpofe of fhewing the fhip's lee way, as will be fhewn hereafter. This regifter has three dials on its face; one of which is

graduated

graduated into ten parts, anfwering to tenths of miles, and is numbered 1, 2, 3, 4, 5, 6, 7, 8, 9, 10. The index on this dial moves round once every mile the veffel fails, each divifion counting one-tenth of a mile. The large dial is fimilar to the dial on Fig. 3, defcribed above. The other of the laft-mentioned three dials is alfo divided into ten parts, and is numbered 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000. The index on this dial moves round it once every one thoufand miles, each divifion anfwering to one hundred miles. This regifter has an arm or cramp *a*, fixed at one of its ends to the bottom of the box, by a fcrew or otherwife, fo as to admit of the regifter's turning freely upon it: and by the other end of this arm or cramp the regifter is fecured to fome convenient part of the veffel. On one-half of the outfide of the circumference of the box is graduated thirty-two equal divifions, correfponding with the divifions of the compafs, and an index, which is joined at one of its ends to the cramp, is brought to the edge of the box, and turned up, fo as to anfwer the purpofe of an index. When the veffel makes lee-way, the fly commonly falls to windward, nearly in proportion to that lee-way, and by the fly being to windward, the pinion of the regifter is turned the fame way, and brings a correfponding figure or point which is marked on the box to the beforementioned index, and this denotes the number of points the veffel makes to leeward.

" The form and portions of the regifter may be fo varied as to exprefs, in other denominations of fea-meafure, the diftance failed, if found to be more convenient than the above. And the form, fize, and proportions of the fly may be alfo varied fo as to accommodate it to a regifter of any calculation. So alfo may the fhape of the vanes be varied, if their true pofition be ftrictly attended to, for they are all capable of variation, from any given dimenfions, and the effential principles are ftill retained.

" The pinions of the regifter I generally make of bell-metal, and the other parts of the machine of brafs. Thefe materials I give the preference to; yet other materials will anfwer, provided they are of fuch kind as will endure the effects of friction and of falt water. For the better illuftration and defcription of the fly which I ufe, and which I prefer, I have in the annexed drawings defcribed one of four vanes, and its correfponding parts, fhewing the proportions they bear to each other.

" Fig. 1, in the faid drawing, reprefents the centre piece or virtual axis. This is fix inches and an half long, and about one-fifth of an inch in diameter. On one end is a fcrew, about two inches long, and at the other is an eye hole, to faften the line to, as in Fig. 1. And at the diftance of about one inch and an half from the eye hole is a collet and pin, which fecures the collar-piece to its place.

" The collar-piece is about three-fourths of an inch long, and half an inch thick at the largeft end, having its fides at right angles with each other, and terminating conically at its head end. It has a hole through its centre large enough to receive the centre piece or axis, to which it is fcrewed by the collet and pin, fo that it may turn freely on the axis.

" The regulator or adjuftment is about one-fourth of an inch thick. Its largeft furface is an inch and an eighth of an inch over, and being a little tapering, its fmalleft furface is left an inch over. It has a tapped hole through its centre, fitted to the fcrew on the end of the axis, where it belongs.

" The four vanes are all of equal ftrength, and about a fixteenth part of an inch thick; they refemble in form a right-angled triangle, whofe bafe is eight inches, and whofe perpendicular is three inches. A piece is cut off from the acute angle, which leaves the end about half an inch wide. A piece alfo muft be cut out from the right angle, running nearly parallel with the bafe, fufficient to prevent the vanes croffing the centre, and thereby counteracting each other. The piece cut from the fly I am defcribing is about one inch and three-fourths of an inch long, and half an inch wide; and muft be varied according to the proportions of the fly. The vanes muft be perfectly flat, and uniformly alike.

" I make a fcale, on which are the Figs. 2, 4, 6: under which figures are twenty divifions, anfwering each to one turn of the axis through the regulator or adjuftment; and when the outer edge of the regulator or adjuftment ftands at the divifion againft Fig. 4, in the aforefaid fcale, the fly is fuppofed to be rightly regulated or adjufted; but if, on trial, it is found otherwife, then, by turning the axis, the regulator or adjuftment is moved, and the motion of the fly altered at pleafure. Moving the regulator or adjuftment towards Fig. 6, in the fcale, increafes the motion of the fly: and moving the regulator or adjuftment towards Fig. 2, in the fcale, diminifhes the motion. Every turn of the axis, either way, alters the motion of the fly about three miles in an hundred. The opening in the vanes fhould be of fufficient length to give freedom to the fcrews which bind the vanes to the regulator or adjuftment when it is moved.

" The fly being thus completed, the vanes ftand both in a conical and angular pofition, with regard to their centre or axis, and incline the fly to turn but one way; and as their angular pofition is increafed or diminifhed, fo will be the number of revolutions of the fly in failing any given diftance.

" For particular purpofes the motion of the fly may be increafed two, three, and even four times fafter than is ufual. This may be done either by enlarging the regulator or adjuftment, or moving it farther towards the collar piece, fo as to extend the broad ends of the vanes farther from the axis or centre, that is, farther afunder; in which cafe the fame regifter will ftill anfwer, if read accordingly. If the fly is conftructed agreeably to the fize and proportions here given, and is accurately regulated or adjufted, fo as to give the true diftance failed, the broad ends of the oppofite vanes will be an inch and three-eighths of an inch afunder. And in cafe of any accident that the fly may meet with at fea, or otherwife, the above diftance, being examined by a pair of compaffes, will be a direction to the mariner how to reftore the fly to its former accuracy of meafurement, the narrow ends of the vanes that are attached to the collar piece remaining fixed.

" The line, which I prefer to a chain, fhould be made of good materials, be well twifted, and about the fize of a common log line. The line connects the fly and regifter together. Its length fhould be in proportion to the fize of the veffel, that the fly may be fo far diftant from the ftern of the veffel as not to be affected by the

the eddy of the veſſel's wake, which is often found to extend from fifteen to twenty-five fathoms aſtern. One end of the line is faſtened to the pinion of the regiſter, which, in Figs. 2 and 4, is marked *d*, and the other end is faſtened to the head end of the fly. See Fig. 1.

"The fly is towed perpetually after the veſſel at ſea, and its revolutions are communicated to the regiſter by the line, and theſe in exact proportion to the velocity of the veſſel through the water.

"There ſhould be no impediment or obſtruction about the line to prevent its turning freely, or about the regiſter to prevent it from turning the pinion to which the line is faſtened in a direction with the fly, eſpecially when the veſſel's lee-way is neceſſary to be known.

"The log, as now improved, and uſed, has the properties and advantages over my former log, hereinafter mentioned; that is to ſay:

"The fly of the improved log has an eaſy and efficacious mode or principle of regulation, by which its motion may be altered at pleaſure, and with great uniformity and preciſion. But my former log did not poſſeſs theſe advantages in ſo perfect a degree.

"The fly of the improved log, on which all accuracy of meaſurement depends, is, as beforementioned, compoſed of regular figures, ſuch as planes and ſquares, which admit of the greateſt uniformity and exactneſs in the workmanſhip of it; and its eſſential parts, and their true poſitions, admit of ſtrict examination by the application of inſtruments in common uſe, ſuch as the ſquare, compaſſes, and parallel-ruler: and, by the help of theſe, trifling errors may be diſcovered and corrected without the trouble of experiments by water. Theſe conveniencies my former log was quite deſtitute of. The improved log has a fly particularly adapted to very ſlow motion of the veſſel, when ſhe ſails leſs than two miles an hour, which is alſo to be uſed when the veſſel is lying to the wind in bad weather, and drifting, to give the diſtance ſhe drifts an hour, as is above deſcribed, and the ſame regiſter anſwers for this fly alſo. But my former log being heavier, was inclined to ſink in ſlow motion, and was alſo deficient in its power of action in ſlow ſailing, which could not be remedied without enlarging the machine too much for common uſe, or without increaſing the friction to a degree that would wear out the machine in a ſhort time. The improved log may have two or more flies with one regiſter, the fly being an inconſiderable part of the expenſe of the whole machine, in which caſe, if one fly is loſt, it may be eaſily replaced; but if an accident of this kind happened to my former log, the injury could not eaſily be repaired. This circumſtance renders the improved log much more convenient in practice, and its moſt expenſive part, namely the regiſter, leſs liable to be loſt, and leſs liable to accidents. It is alſo more durable, as the train of wheels or regiſter is kept clean and dry. It is alſo more certain in its performance, not being ſo liable as my former log to obſtructions at ſea, by ſea weeds, or other floating ſubſtances. The improved log is more portable and convenient for conveyance, its conſtruction is leſs expenſive, and it is more eaſily underſtood and repaired by common mechanicks.

"When there is no obſtruction between the fly and the box, it ſhews on the box of the regiſter the number of points lee-way the veſſel makes; but this valuable acquiſition could not be derived from my former log. The regiſter of the improved log is kept on-board the veſſel, in which the diſtance ſailed can at all times be ſeen. Whereas the whole of my former log went in the water, and the regiſter of it could not be ſeen without taking it into the veſſel."

FINIS.

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ADVERTISEMENT

By the Rev. Dr GLEIG *to the* EDINBURGH EDITION.

It would ill become me to dismiss these Volumes from my hands without acknowledging that, from many of the most valuable disquisitions which they contain, I can claim no other merit than that of having ushered them into the world.

Those who have read, and who understand, the articles in the Encyclopædia Britannica, which were furnished by Professor Robison of Edinburgh, can hardly need to be informed, that to the same eminent philosopher I am indebted for the valuable articles Arch, Astronomy, Carpentry, Centre, Dynamics, Electricity, Impulsion, Involution, *and* Evolution *of Curves*, Machinery, Magnetism, Mechanics, Percussion, Piano-*Forte*, *Centre of* Position, Temperament *in Music*, Thunder, *Musical* Trumpet, Tschirnhaus, and Watchwork, in this Supplement. Of a friend and co-adjutor, whose reputation is so well established as Dr Robison's, I am proud to say, that, while I looked up to him, during the progress of this Work, as to my master in mathematical and physical science, I found him ever ready to support, with all his abilities, those great principles of religion, morality, and social order, which I felt it my own duty to maintain.

To Thomas Thomson, M. D. of Edinburgh, a man of like principles, I am indebted for the beautiful articles Chemistry, Mineralogy, and *Vegetable*, *Animal*, and *Dyeing* Substances ; of which it is needless for me to say any thing, since the Public seems to be fully satisfied that they prove their author eminently qualified to teach the science of chemistry.

The account of the French Revolution, and of the wars which it has occasioned, has been continued in this Supplement by the same Gentlemen by whom that account was begun in the Encyclopædia ; and, owing to the cause assigned in the article, probably with the same merits and the same defects.

My thanks are due to Dr William Wright for his continued kindness in communicating much curious botanical information: and to Mr Professor Playfair of the university of Edinburgh, for lending his assistance, occasionally, in the mathematical department; and for writing one beautiful article in that science, which is noticed as his in the order of the alphabet.

In compiling this Supplement, I have made very liberal use of the most respectable literary and scientific journals, both foreign and domestic; of all the late accounts of travels and voyages of discovery, which have obtained, or seem indeed to deserve, the regard of the Public; of different and opposite works on the French revolution, and what are emphatically called *French principles;* and even of the most approved Dictionaries, scientific and biographical. From no Dictionary, however, have I taken, without acknowledgment, any articles, except such as are floating everywhere on the surface of science, and are the property, therefore, of no living author.

After all my labour and industry, which, whatever be thought of my other merits, I am conscious have been great, no man can be more sensible than myself, that the Encyclopædia Britannica, even with the addition of this Supplement, is still imperfect. It would continue to be so, were another Supplement added to this by the most learned and laborious man on earth; for perfection seems to be incompatible with the nature of works constructed on such a plan, and embracing such a variety of subjects.

No candid reader will suppose that, by expressing myself thus, I mean to censure the plan of the Encyclopædia Britannica in particular; for, to the general excellence of that plan I have elsewhere borne my testimony, which I have yet seen no reason to retract. Experience has indeed led me to think, that it is susceptible of such improvements as would enable the principal Editor to carry the work *nearer* to perfection, even with less trouble to himself; but the purchasers of the third edition and this Supplement need not regret the want of those improvements, for they are such as few would discern, who have not paid the same attention that I have done to dictionaries of arts, sciences, and literature.

Before I take leave of the reader, I must account for the omission of one or two articles (chiefly biographical) which I had given him reason to expect

pect in these volumes. It was my intention at first to introduce into the Supplement articles on every subject which had been admitted into the Encyclopædia itself; and hence in the first supplementary volume will be found biographical sketches of men whose characters, though in some respects remarkable, have very little connection with science, arts, or literature. From this part of the original plan I was soon obliged to deviate. So many applications were made to me to insert accounts of persons who, whatever may have been their private virtues, were never heard of in the republic of letters, that I was under the necessity of excluding from the second volume the lives of *all* such as had not either been themselves eminent in literature, or in some liberal art or science, or been conspicuous as the *patrons* of science, arts, and literature, in others. Hence the omission of the life referred to from AUBIGNE in the first volume, and of one or two others, to which references are made in the same way. The life of Mr James Hay Beattie of Aberdeen, whose originality of genius, ardent love of virtue, and early and extensive attainments in science and literature, raise him almost to the eminence of BARRETIER, of whom we have so pathetic an account from the pen of Johnson, I omitted with regret; but I thought not myself authorized to publish what his father had then only distributed among a few particular friends. For the omission of the life of Soame Jenyns I can make no apology: it was the consequence of forgetfulness.

FOR the *errors* of these two volumes, whether typographical or of a nature more important, I have perhaps no occasion to solicit greater indulgence than will be voluntarily extended to me by a generous public. The progress, however, of science, and of the revolutionary events in Europe, has been such, since great part of them was printed, that I must request the reader, in justice to myself, to proceed directly from the article GALVANISM to TORPEDO, and from REVOLUTION to the life of Marshal SUWOROW.

UNDER the title TRANSLATION, both in the Encyclopædia and in the Supplement, expressions are made use of, which may lead the reader to suppose that Mr Fraser Tytler was indebted for the general laws of the art, which he so ably illustrates, to Dr Campbell's Preliminary Dissertations to his Translation of the Gospels. It is but justice to declare my perfect

perfect conviction, as it was that of Dr Campbell himself, that Mr Tytler and he were equally intitled to the merit of having discovered those laws; and that however coincident in opinion, neither of them, when composing their separate works, had the smallest suspicion that the other had ever employed his thoughts on the subject. The only difference seems to have been in the mode of their discovery: Mr Tytler having deduced the laws of the art by regular analytical inference from his own description of a perfect translation; whereas Dr Campbell appears to have fortunately discovered them without that process of deduction.

The publisher begs leave to add to the foregoing, that the different Geographical articles so far as relate to America are taken from the Rev. Dr Morse's American Gazetteer. The article *United States* is extracted from the new Edition of Dr Morse's Universal Geography, and the article *New England* was written by the same author on purpose for this Supplement. The account of the Lucernal Microscope under the head of *Optics* was furnished by the Rev. Dr John Prince, the author of the improvements. The description of the *American Air Pump* in the article *Pneumatics*, was likewise inserted by permission of Dr Prince, the inventor. The corrections of the account of this Pump which was published in the Encyclopædia, are original. The observations on Vision by Dr Hosack of New York were published by his permission. The two articles of *Artificial Horizon*, and the *New Log* are published in an appendix by permission of Mr Gould the Patentee.

SUPPLEMENT

TO THE

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OR

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ARTS, SCIENCES,

AND

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