SIMPLE JEWELLERY

VEL E MINIMIS
PULCHRITUDO

Fig. 93.
A SILVER PENDANT AND CHAIN WHICH IS AN EXAMPLE OF A DESIGN OBTAINED BY ARRANGING SMALL UNITS IN GROUPS.

BY THE AUTHOR.

SIMPLE JEWELLERY

A PRACTICAL HAND-BOOK DEALING WITH CERTAIN ELEMENTARY METHODS OF DESIGN AND CONSTRUCTION WRITTEN FOR THE USE OF CRAFTSMEN, DESIGNERS, STUDENTS AND TEACHERS

BY

R. LL. B. RATHBONE.

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PREFACE

People with whom I have talked about this little book during its inception and progress, when I have tried to explain its scope and objects, have sometimes said—"Oh yes, I see. You mean it for amateurs."

My answer to this is both yes and no. For, while not unmindful of the just claims of serious amateurs, to whom I certainly hope it may be useful, and in spite of the fact that I have tried to write the technical chapters in such a way that they may be intelligible even to those who are entirely without any actual knowledge or the subject, it is really the young beginner in the trade workshop with whom I am most anxious to get into touch.

Different people mean to describe such entirely different qualities when they talk about amateurs. So much depends on the tone of the voice, and on the mental habit of the speaker, whether he uses words loosely, or with some reference to their original derivation. When the trade worker uses the word "amateur" he generally means a trifler; other people often use it to describe those who are not entirely dependent for their living on the art or craft in question; while a few unreasonable individuals here and there may perhaps still try to preserve its older and more literal meaning; but they would as a rule be better understood if they said "enthusiast."

A shade of meaning slightly different from any of these, and yet one which the word is often intended to convey, is perhaps best expressed as describing a worker who is deficient in experience and technical skill in his craft as a whole, though proficient enough in one or more of its processes. I doubt whether in this sense it is ever applied to trade workers, most probably not; but I think it very well might be.

However, in case that should lead any reader to expect that he will find the whole craft of jewellery exhaustively treated in the following pages, let me draw his attention to my sub-title, from which he will see that I am only treating of just a few elementary methods and processes.

On the other hand, I can readily believe that many readers may find, what will appear to them to be quite unnecessary explanations of elementary facts which "every school boy" knows, and in relation to these I can only say, that some of these elementary facts are apt to be very soon forgotten, and that the pages which deal with them are easily skipped by those who feel that their intelligence is thereby insulted.

Some considerable portions of the book, and many of its illustrations, have already appeared in the pages of the *Art Journal*, and for permission to republish these I am indebted to Messrs. Virtue & Co.

I have, however, added a great many new chapters, which are now published for the first time, and they contain a number of new illustrations.

It would be a matter of some difficulty and complication to particularise in every case the sources from which the objects illustrated have been borrowed, owing to the fact that a single illustration perhaps includes many small things which were kindly lent for the purpose by, in some instances, as many as five or six different owners.

I wish, therefore, to acknowledge my indebtedness in this connection to the Board of Education, to the Keeper of the Metal Work Collection at the Victoria and Albert Museum, to the Keepers of the Gold Ornament Room and of the Mediæval Room at the British Museum, to Mr. H. B. Bompas, Miss E. A. Bostock, Messrs. Calipé, Dettmer & Co., The Chelsea Furniture Co., Mrs. J. R. Davies, Messrs. E. Gray & Son, Mrs. T. T. Greg, Messrs. G. Jennens & Co., Mr. C. Krall, Miss E. Lamport, Miss V. Ramsay, Mr. G. Salting, Mrs. J. Tweed and to my wife.

R. LL. B. R.

CHELSEA,
Oct. 1909.

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SIMPLE JEWELLERY

CHAPTER I.

INTRODUCTORY.—THE EDUCATIONAL POINT OF VIEW.

The thought has probably occurred to many of those who have taken up the teaching of a handicraft professionally, that it is a strange thing how very little there is in the way of a traditional or generally recognized system of education available for the use and guidance either of students or of teachers.

It seems to have been left to chance and the judgment of the teacher to decide what should come first, what next, and how the beginner should be led on, from stage to stage, through the many processes which go to compose the mental and manual equipment of a capable worker in any one craft.

Yet it will hardly be denied that it is of the utmost importance to the welfare, commercial as well as artistic, of all countries, that the crafts should be taught in a thoroughly intelligent and efficient way, calculated to develop not only the manual dexterity but also the inventive powers of the learners.

In connection with crafts which have fallen into disuse, so that no living tradition has been kept up, the absence of any such system is not at all strange ; nor is it surprising in those other cases where anything of the kind which may have survived has only done so by reason of the enthusiasm, or even the conservatism, of just a few isolated workers. But that is not the case with jewellery as a whole, although it is true that, in this country at all events, certain branches of this craft lie quite outside the experience of all but a very few workers.

Still, jewellery is practised everywhere. It was carried on with amazing skill even in such remote times as during the early Egyptian dynasties, and it has never been in any danger of becoming a lost art. On the contrary, its educational value was so fully realised in mediæval Italy, that the goldsmith's workshop was in those days regarded as the best primary school for a student of the fine arts. Nor can it be said that as a craft it lacks suggestions for suitable exercises. By no means. I very much doubt if there is any other craft whatever, which offers such obvious and ample opportunities for the learner to acquire much of the experience necessary, merely by following, under suitable guidance, the dictates of common sense ; and to acquire his experience, moreover, in such a way that, while ostensibly learning its practical side, his attention is necessarily called at the same time, to the scientific and artistic aspects of what he is doing.

No, the more probable explanation ot the absence of any recognised educational system is that until recently the crafts have not been taught outside of the workshops in which they are regularly practised, and in these an elaborate educational system is not so very necessary.

Undoubtedly the workshop is the ideal place in which to learn a craft, and in a thriving workshop there will always be plenty ot elementary work to be done, on which the apprentice can practise.

Under the guidance ot a wise and skilful master, the ordinary round of work will provide all the experience a student needs, to teach him those things which he cannot learn alone—so long, that is, as his employer himself is really a master craftsman, and not merely a master *of* craftsmen.

But even here, when such a happy state of things occasionally survives, the exigencies of business will probably result at times in unsuitable work being given to the neophyte, more perhaps, because his master cannot at the moment spare the time to think out and arrange for what ought to come next, than from any deliberate desire to combine the education of his pupil with immediate profit to himselt.

The growth of commercialism, moreover, has robbed us of much of our due inheritance in these matters, and in many crafts it has certainly undermined, if it has not absolutely swept away, the whole fabric of apprenticeship. However, it has given us fresh opportunities in exchange, and has imposed new conditions. If it has made it difficult for a youth to obtain a thorough all-round training in a manufacturer's workshop, it has at least done something towards removing the barriers which formerly preserved the mysteries of each craft as impenetrable secrets, only to be revealed to those who were bound by indentures to serve through a long term of years at merely nominal wages.

The art student of to-day who turns his attention to jewellery, enamelling or silversmithing, will not easily realise how all but impossible it was for his predecessor of a generation ago to obtain anything like a fair insight into even the rudiments of these crafts, but, as I have just said, the passing of the system of apprenticeship, however greatly it is to be regretted, has, at least, made it a good deal easier for outsiders to learn the practice of the crafts.

I do not propose here to discuss the relative merits of the old system of apprenticeship and of that new one which is gradually taking its place; where the employer is under no obligation to teach any more than it suits his interests to teach ; where the learner is free to leave one employer for another, as frequently as he may be tempted to do so ; and where the serious student must rely on technical schools, and on books, for education in all branches of his craft, except those which are accessible from that narrow path, along which commercialism would like to compel him to walk—in blinkers—all the days of his life.

Accepting facts as they are, we must recognise (i) that it is only by chance here and there that a good all-round training may still occasionally be obtainable in a manufacturer's workshop ; (ii) that technical schools exist or are growing up in order to bring such training in the crafts easily within the reach, not only of those who are already engaged in these crafts, but also of any who may desire to learn ; and that they offer us the best chance we have of rescuing from oblivion those traditional methods and processes, for which modern commercial conditions find no place ; (iii) that the supply of new facilities for learning, has created a new demand for instruction in handicrafts, on the part of highly-educated students of the arts, who, a generation ago, would either have confined their attention to painting, sculpture, or architecture, or else would have adopted some entirely different career, perhaps practising their favourite craft in a limited way, just as a hobby ; (iv) that the all-round training which technical schools provide, having been unhappily divorced from the reality and variety of the everyday work of a manufacturer's shop, there is much need of a more thoroughly elaborated and systematised curriculum.

CHAPTER II.

SCOPE OF EXERCISES AND METHODS OF STUDY.

In attempting to formulate a system of training, I shall devote the greater part of my space to the explanation of the evolution and nature of a series of first exercises, based on the principle that design and workmanship must act and react on each other. In my opinion these exercises will give the beginner a useful and interesting introduction to a few of the simpler artistic aspects of jewellery, and at the same time they will afford him ample opportunity of mastering some of the most essential rudiments of its technique. But I shall only deal with certain methods of acquiring a few of the most elementary processes in this technique, for which some amount of personal instruction is very desirable, and nowadays is happily accessible almost everywhere. For instruction and guidance in the more advanced processes, no student can afford to be without Mr. Henry Wilson's most inspiring and helpful book, "Silver Work and Jewellery."

Such a curriculum as seems to me to be

wanted, should be based on a study of the material to be used from two points of view —the scientific and the artistic—and I name them in that order because the artistic treatment of any material presupposes an intelligent appreciation of its distinctive qualities. That is to say, it is necessary that we should have some familiarity with the elementary scientific facts concerning our material, before it is possible fully to appreciate its artistic capabilities ; on the side of technique also the same dual point of view is no less important.

In order to obtain good results science and art must act and re-act on each other. The observation of some scientific axiom relating to his material reveals to the artist a suggestion of design, and in pursuing this idea processes of manipulation are developed and invented, which will lead in all probability to the acquisition or understanding of other axioms. These, again, are sure to be full of artistic possibilities, always ready to remind us of the great truth that the inherent qualities of materials constitute one of the most precious possessions of the artist, for in them will be found to dwell sources of design which can never be exhausted.

It is probably at the moment when an interesting process in craft-work is first acquired that the mental seed is sown from which in due season ideas of design will grow, and it is therefore most important for the student of jewellery to begin by acquiring a knowledge of the principal attributes of the precious metals, and the way in which they have been turned to account at different times. By such study the mind will be prepared to receive and to fertilise those seeds of ideas which are caught by an alert perception subconsciously, while the student is busily occupied in mastering the various handicraft processes. And so it is necessary to study any examples of good work that are accessible, and from that point of view certain kinds of jewellery are very much richer in suggestion than others. Thus, as it will be convenient to refer to examples which illustrate the various characteristic treatments when these are described, it would seem well first of all to mention briefly those other types of work which, however interesting they may be in some ways, are not likely to be especially helpful to beginners when on the look-out for suggestions such as I have just indicated.

In this way, by means of a process of elimination rather than by attempting an exhaustive description, I think it will be easier to indicate the type of work which I wish to recommend to the particular notice of the student, and I shall also have an opportunity of giving my reasons for not dealing at greater length with other types, among which must be classed many of the most celebrated productions of the great jewellers of various times.

To proceed then with the process of elimination, let us first dispose of that which is easiest described, and so clear the ground by excluding from any detailed consideration the jewellery of ordinary commerce, the sight of which is only too familiar to us in countless thousands of shop windows. We are tempted to wish that a great deal of it could be swept away into the limbo of forgotten things as easily as we are now dismissing it from these pages, but it would not be just to suggest that it all deserves such uncompromising treatment, or to say that it is by any means all hopelessly bad and inartistic.

Still there is no denying that the great majority is quite trivial and uninteresting in design, that it is hard, mechanical and lifeless in execution, and that it generally aims either at mere flashiness and ostentation, or else at aping the latest extravagances of L'Art Nouveau, unless it is content to be frankly ugly, or at all events to make no perceptible effort at being beautiful.

Not that the workmanship is wanting in skill. On the contrary it is often most amazingly clever, and almost always reaches a high standard of efficiency. But it fails to give us the pleasure it ought to do, because its ways are not those which bring out and accentuate the special and individual beauties characteristic of the precious metals, and because its methods of using precious stones are generally vulgar and aggressive. As a rule there is nothing to suggest that it is the work of human fingers rather than that of some diabolically clever machine ; and as a matter of fact a great deal of it is almost entirely machine made. But in spite of that there is an abundance of very accomplished workmanship available in trade workshops, if only it were given a chance ; if only the great buying public could be got to see that a profusion of showy stones does not make a rubbishy and unimaginative design into a thing of beauty ; that clever workmanship is utterly lost and wasted when it is made to imitate the work of a machine ; and that the precious metals *look* precious when they are used daintily, rather than when the chief object appears to be to suggest that a considerable weight of bullion has been used.

These strictures, however, must be most freely qualified by the admission that nowadays there are notable exceptions. Admirable efforts at better things have been and are being made, and quite beautiful pieces of jewellery may be found, which have been produced under ordinary commercial conditions. But the stubborn facts remain, that ordinary commercial conditions are not favourable to the growth of artistic work, and that most of the ordinary commercial jewellery we see is a deplorable evidence of the essential ugliness and vulgarity of our times.

FIG. 1.

By permission of
George Salting, Esq.

Gold Pendant, enamelled and
set with precious stones.
Italian. 16th century.

CHAPTER III.

PICTORIAL AND SCULPTURESQUE JEWELLERY.

LET us now consider for a little an entirely different type of jewellery—that which is treated in a pictorial or a sculpturesque way—a type of work which consequently can only be well done by a craftsman who is not only a good jeweller, but a fairly accomplished modeller or painter also. Figs. 1 to 6 are fine examples of this type of work, and obviously it is not from such advanced craftsmanship as they contain that the most helpful suggestions of methods and treatments suitable for beginners are to be derived.

The gold pendant shown in Fig. 1 is a rich, sumptuous piece of design, very perfectly executed, but if the original* be compared with the photograph, I think it will be felt that the enamelling of the figures does not really add to their value. It is interesting to note that the artist has used the enamel with

* This pendant may be seen at the Victoria and Albert Museum, being one among the many artistic treasures lent to the nation by Mr. Salting. The pendant is in reality considerably smaller than it appears in the illustration.

a considerable degree of reticence, allowing the gold to show through in many places ; but, even so, the design gains by being seen in black and white, and the colours of the precious

FIG. 2.

Victoria and Albert Museum.

Silver Badge, parcel-gilt, with enamelled back ground, and a border set with pink coral and green malachite. German. 1528.

stones would have appeared richer, had there been less competition with them on the part of the surrounding enamels.

In Fig. 2 the enamel is used with admirable effect, solely for the background, which seems to represent the forest in which St. George has encountered the dragon, and it adds much beauty and mystery to the design. The frame also is full of beauty and invention. It has a row of little pieces of pink coral which, with the three projecting bosses of malachite, completes a pleasant arrangement of colour. The settings which carry the malachite are cunningly devised so as to keep in its place the cord by which the badge was suspended from the neck of the wearer, this cord having evidently been passed through the space beneath these settings, in a groove which surrounds the frame.

FIG. 3.
Gold Pendant, enamelled and set with precious stones. French. 17th century (British Museum.)

The lower part of Fig. 3 is a dainty and beautiful design, charmingly executed, but the upper portion seems to have been added by another and less accomplished hand, and it is out of keeping with the rest.

It is astonishing how often the work of jewellers of the late Renaissance makes but little appeal to the craftsman, and fails to be satisfactory as a whole. We are apt to feel that the designer's interest was too much centred in the figure, and that he was impatient and bored when he came to work at the details of enrichment and construction.

The frame of scrolls or foliage which surrounds or supports the figures is so often commonplace and uninteresting. Instead of being essentially derived from the special qualities which belong to the precious metals, it is much more frequently a mere imitation of carved woodwork, or of architectural stonework, or an uninspired direct rendering of natural forms—so put together that the whole thing either lacks cohesion and unity, or else looks as if it had been cast in one piece, instead of having been built up in true jeweller's fashion out of many parts, each one separately constructed out of sheet or wire, or tiny grains of metal. Very probably this may have been due, in part at least, to the designs having been prepared by men who were not themselves familiar with the details and suggestiveness of the jewellers' craft, although they may have been painters or sculptors of ability and originality.

Figs. 4, 5 and 6, though charming in some respects, suggest that their designs may have had

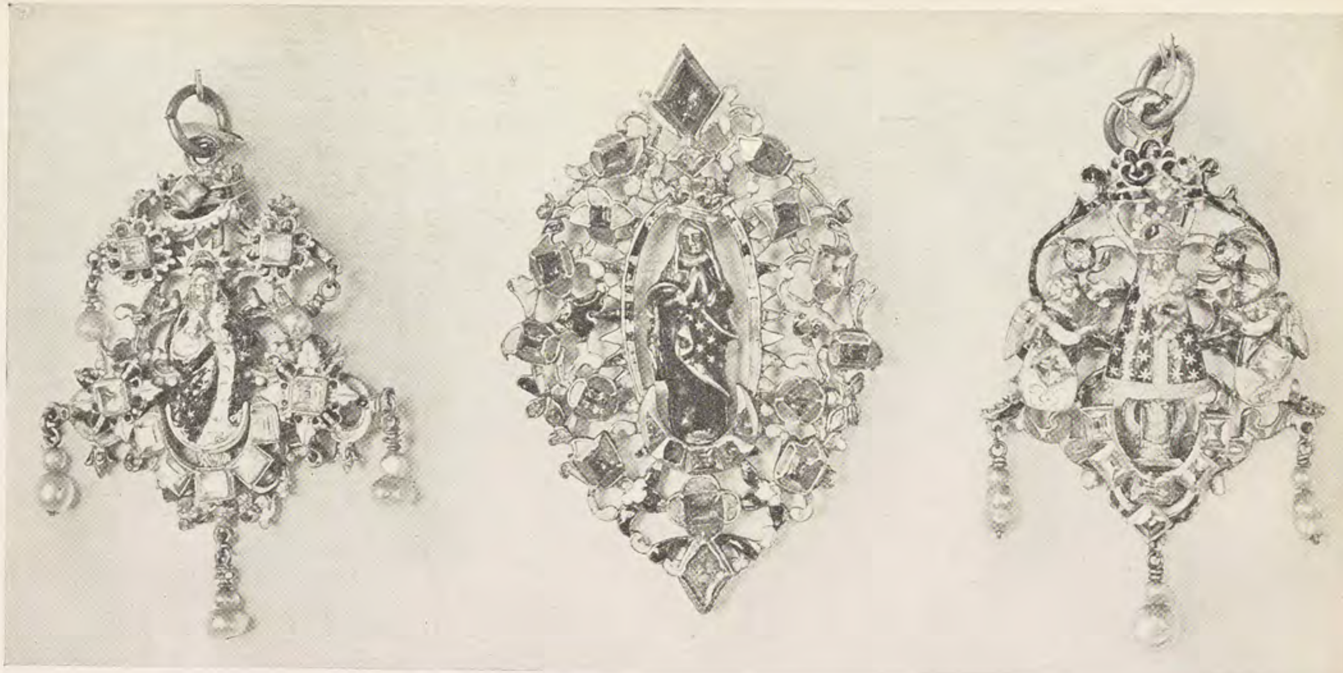

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Fig. 5.
Gold Pendant, enamelled and set with crystals and pearls. Spanish. 17th cent.

Fig. 4.
Gold Pendant, enamelled and set with emeralds. Spanish. 16th century.
Victoria and Albert Museum.

Fig. 6.
Gold Pendant, enamelled and set with crystals and pearls. Spanish. 17th cent.

that kind of origin. But the settings of the stones, especially in Fig. 4, are quite interesting.

Even if the student is already well qualified to deal with figure subjects in design he will do well to postpone their introduction into jewellery until he has arrived at an adequate understanding and appreciation of the exquisite materials in which it is his privilege to work.

There is still another type of jewellery which must not be forgotten or overlooked, but which is not particularly helpful in suggesting suitable exercises and treatments for beginners—that type of work, I mean, which exists mainly in order to provide an unobtrusive setting for a precious stone or enamel of some very exceptional and rare beauty—where the jeweller deliberately effaces himself and reduces the setting to a minimum.

In such cases the design and workmanship, even if in themselves quite perfect and full of subtlety and daintiness, do not lend themselves to illustration for the present purpose. Jewellery of this type must be handled, or one might rather say "fingered," and examined closely, before its own special charms can be appreciated at their full worth, for the sense of touch is capable of receiving a keen æsthetic pleasure from the subtle modelling, delicate proportions, and perfect finish of things, which at the first glance may seem to be merely nice, simple pieces of good workmanship. However, this subtlety and delicacy and this perfection of finish are attainments not likely to be achieved without a long previous training, through all the many processes from which the master craftsman will, perhaps, have selected only two or three for the production of such an object as I have been trying to indicate. In order to select the right processes all must be intimately known. Our immediate quest must be for those which offer the most valuable training as first steps for beginners, and we have not yet arrived at a definition of the kind of jewellery which will be likely to lead us to the discovery of what these are and of what can be done with them.

CHAPTER IV.

CRAFTSMANSHIP THE ESSENTIAL THING.

HAVING now rejected several types as unsuitable for our purpose, it is time to consider what remains.

There is still that kind of jewellery in which craftsmanship, in the fullest sense of the word, is everything ; for if it is liberally interpreted the word must imply and include design, from which, indeed, true craftsmanship cannot be entirely separated. Let us, therefore, look for examples of jewellery whose beauty lies in the skilful and appropriate use of forms, which, whether they be simple or elaborate, have arisen directly out of an intelligent and characteristic handling of the precious metals, and are all united and held together by workmanship that expresses a well-considered, well-constructed, and well-balanced design. There may also be precious or semi-precious stones or enamel, or there may be fanciful enrichments in repoussé, casting, piercing, engraving, carving, damascening, or niello, or even, perhaps, in some cases, all of these together ; but, where craftsmanship is supreme, the object may be lovely and interesting without any one of these additions.

Such jewellery it is within the power of any

FIG. 7.

British Museum. Gold Ornaments, Greek and Roman. 2nd century B.C. to 2nd century A.D.

ordinary person to make, if only he cares enough about it, and there is no real need for it to be costly. This type was produced in great perfection by the ancient Grecian, Roman, Byzantine, Anglo-Saxon and Celtic goldsmiths, and there are many beautiful examples both in the British and the Victoria and Albert Museums, of some of which I am able to give illustrations through the courtesy of their custodians. Many of these objects formed part of the splendid collections made by Sir A. W. Franks and Signor Castellani, and to the memory of these enthusiasts we owe a large debt of gratitude.

Most of the small pendants in Fig. 7 contain a little simple repoussé work, but otherwise they are entirely built up out of golden wires and grains and pieces of plate, twisted and beaded and coiled and clustered and soldered together, with the happiest results and a sense of perfect completeness.

The large gold brooch in Fig. 8 owes some of its beauty to its filling of enamel, and to the subtle way in which the various parts of the design are made to give relief and contrast to each other. The proportions are of the very simplest, and all the main outlines are circular, but the alternation of the smooth surfaces of rich and varied but quiet colour, with the somewhat intricate ornaments of encrusted filigree work, set with pearls, provides a full measure of interest. The cruciform design of the centre part is pleasantly echoed by the disposition of the enamelled discs in the outer band. The two earrings above and below it respectively, no doubt derived much richness from the row of

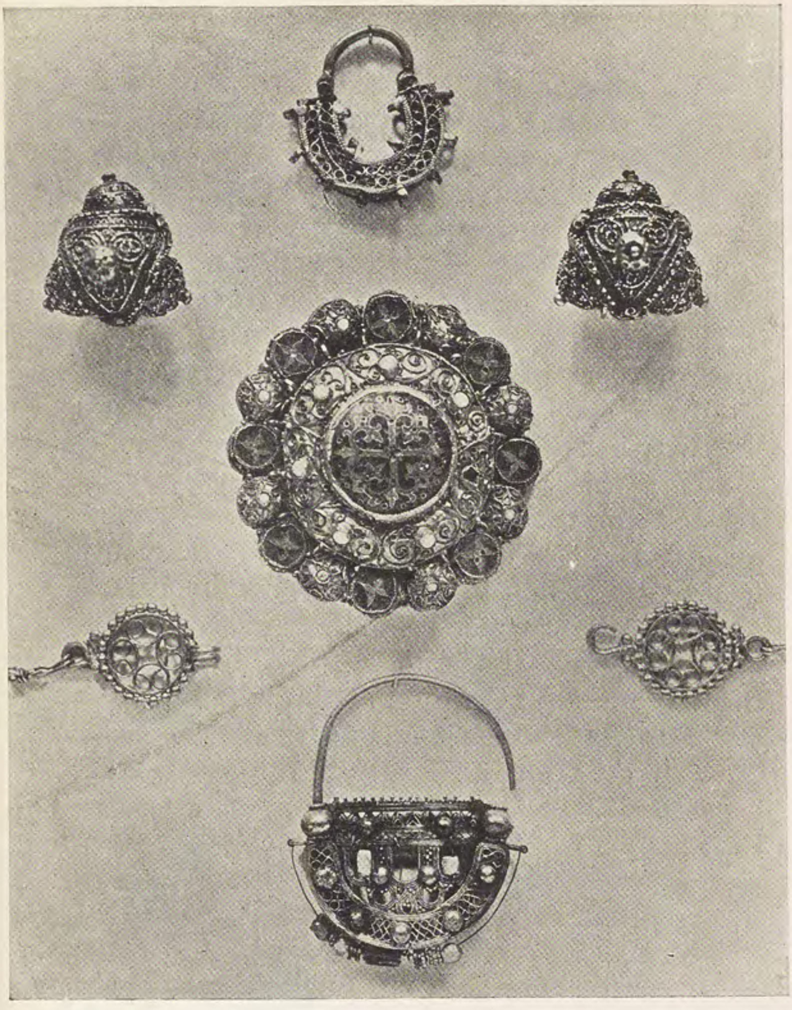


FIG. 8.
Gold Earring. Byzantine. 7th century.
Pair of Gold Knobs, with granulated ornament. Date and origin unknown.
Gold Brooch, with Cloisonné enamels. Probably 10th or 11th century.
Two ends of Gold Necklace. Sardinian.
Gold Earring. Byzantine.
British Museum.

coloured beads and pearls which surrounded their outer curves; but, apart from what little now remains of these accessories, the lower earring especially is a most lovely object, composed as it is entirely of very simple forms, produced by quite elementary processes. The brilliant effect of light and shade in this earring is one of its most attractive features, and the contrast of the reflecting surfaces of its bosses with the deep specks of dark shadow behind the network border, produces a most happy effect. This is helped by the firm and decided lines of the main framework, whose severity is so admirably relieved by the daintily fine twists which compose it, and the cresting of grain clusters along its top. Other similar clusters enrich the middle part, but some of them seem to have got broken away. No one seems to know how the two triangular golden knobs in the same illustration were used—perhaps they may have hung at the ends of a girdle—but they also illustrate my present point, though perhaps the photograph scarcely succeeds in making their bulbous form clear.

There is something peculiarly satisfactory about what remains of the small Anatolian clasp illustrated in Fig. 9. Anyone who examines it at all closely, will probably agree that here is a piece of unmistakable craftsmanship, conceived and carried out by the same man. It looks at first sight as if it represented an intricate design of grapes, or some other cluster-fruiting plant, and yet, when it is analysed, it proves to be only a filling of spaces with coils of filigree work, and a subsequent laying on, here and there, of

Victoria and Albert Museum.

FIG. 9.
Silver-gilt Clasp, set with turquoise.
Anatolian. 19th century.

clusters of round grains in two sizes and arrangements, with small, plain, flat discs amongst them, put just where they seemed to be wanted, in the freest way, but with excellent judgment. How entirely right is the absolute simplicity of the forms which so rigidly enclose and confine these fanciful pieces of decoration !

CHAPTER V.

MORE EXAMPLES OF CRAFTSMEN'S DESIGNS.

The handsome Turkish clasp (Fig. 10) is also satisfactory in quite a different way, though it is equally characteristic as a specimen of an effective design, arising directly out of craftsmanship, through intimate understanding of the material; but here similar elementary parts are associated symmetrically, in order to compose a very definite geometric design.

Quite similar again are the silver bosses of the rosary (Fig. 11) and the tiny, but very pretty beads, used to separate its larger ones, which latter, by the way, are beautifully constructed of ebony and ivory in alternate segments. The cross is an admirable piece of filigree work, treated with reserve and distinction, pleasant in design, and well knit together, and free from any tendency to the sprawliness which is so often the besetting sin of the filigree worker. It is an excellent rendering of a traditional idea, on sound lines of design and workmanship, by a contemporary craftsman.

The lesser clasp in Fig. 12 is another characteristic bit of filigree work, enriched, in this case, by twisted wire, and a surrounding border

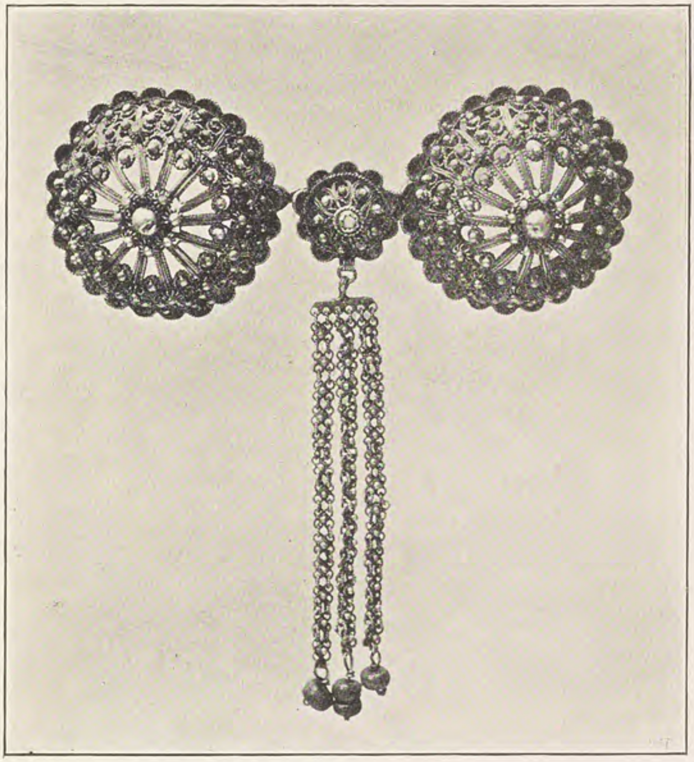


FIG. 10.

Victoria and Albert Museum.

Silver Clasp. Turkish. 18th century.

of very simple repoussé work, engraved and pierced. The larger one just above it also displays the richness of twisted wire, especially when fine twists are used to emphasize the bolder

FIG. 11.

By permission of Mrs. R. Rathbone. Rosary of ebony and ivory beads, with bosses and cross of silver. Austrian Tyrol. 20th cent.

ones, but the filling of the large heart-shaped spaces is not successful. That kind of filling must either be closer and more compact, so that the forms used are not individually noticeable, or else these must be beautiful in themselves and in the combinations they make when repeated. In this case they are coarse, and too large for the spaces they are intended to decorate, so that there is not enough room to repeat them in numbers sufficient to obtain a rhythmic pattern, and where they do not fill the spaces, the methods adopted to avoid gaps are clumsy, and show a want of invention and resourcefulness.

In Fig. 13 there are various patterns of silver buttons from four or five different countries, most of which have features in common, and each one of which is a thoroughly characteristic and charming little example of craftsmanship in simple jewellery. In three instances a pair of buttons of the same pattern will be seen illustrated in two different positions, one above the other, in order that their form and construction may be understood. A comparison of those which are composed of repeated twists and coils, will show how greatly the effect is improved in these, when a few straight lines are introduced at regular intervals, so as to counteract the monotonous effect of the otherwise too insistent curves.

These last seven illustrations exemplify a considerable variety of treatments, in all of which

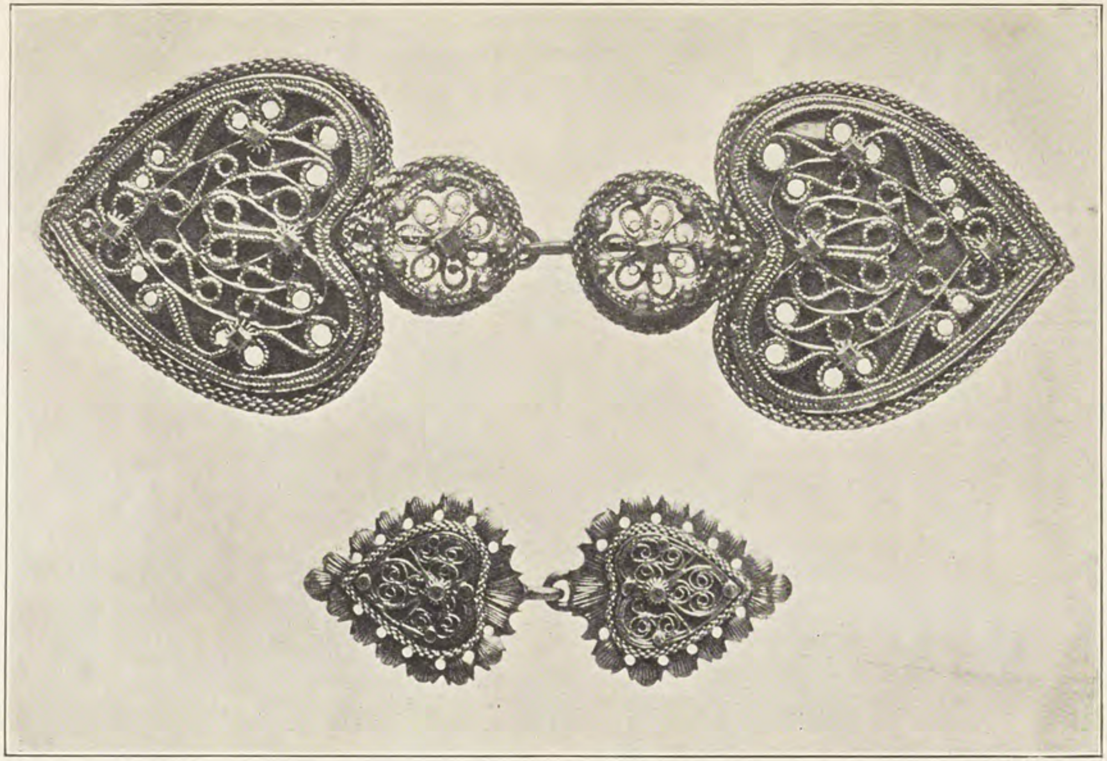


FIG. 12.

By permission of
H. B. Bompas, Esq.

Silver Clasps.
Norwegian.

craftsmanship is the essential thing, and they may serve to indicate the type of jewellery to

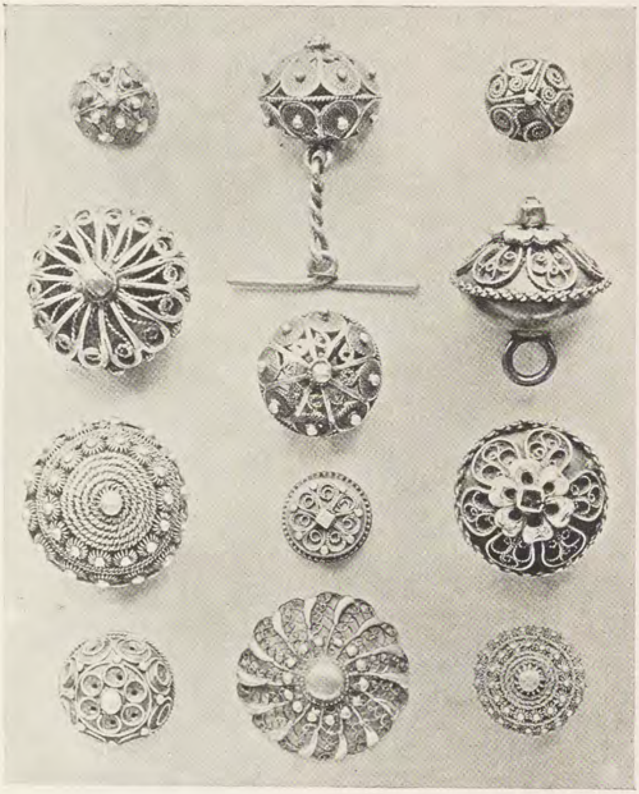


FIG. 13.
Silver Buttons from Norway, Spain and other countries.

which, in my opinion, the student should devote his closest attention, especially during the early part of his training. Many other illustrations of work that comes under the same heading will be found on later pages, but they are reserved for special reference in connection with details of construction or design where these happen to occur.

CHAPTER VI.

PEASANT JEWELLERY—ITS CHARMS AND ITS FAILINGS.

When searching for a title or phrase whereby to label jewellery of this type, so important to students of the craft, it was natural to think of "peasant jewellery" as a convenient expression. For peasant jewellery is nearly always distinguished by just those very characteristics enumerated on page 20, and several of the objects in those illustrations to whose salient features I have just been drawing attention, *e.g.*, figs. 12 and 13, would be rightly so described.

But a little thought shows that this title would be quite too limited for the present purpose, since it would exclude not only historic examples which, in their day, have doubtless been among the most cherished possessions of kings and queens, of popes and archbishops, but those other numerous ornaments, which, although they may be of somewhat less importance, were yet, in all probability, never intended for the decoration of peasants.

At the same time it is quite worth while to consider why peasant jewellery is generally so pleasant and interesting to look at and to handle —not always of course—but much more often than not ; and to consider, moreover, why it is frequently so much more satisfactory than the ambitious pieces designed for the adornment of great ladies. The reason seems to be that the craftsman whose vocation has required him to design and make jewellery for the use of peasants, in restricting himself so as to keep within reasonable bounds in the matter of expense, has had to find beauty, and interest, and richness of effect, rather in making the very most of the simpler and less costly of his materials, than in a lavish display of rare and valuable stones, and of much gold and enamels.

The tradition has been handed down to him by his teachers and forerunners, that certain pleasant ornamental effects are easily produced by quite elementary processes, familiar to every jeweller—effects to which the precious metals naturally lend themselves ; and that when these are suitably used, and contrasted one against another, they will make pretty ornaments, even without the added charm of precious stones or enamels, or even of representations of natural forms.

Some of the traditional methods of using these elementary processes have been seen to give effects of great richness and interest. But peasant jewellery, though so often delightful and charming, is also frequently very disappointing. The peasant jeweller has followed a well-established traditional method, both of design and workmanship—the collective experience of generations of craftsmen behind him. Now that is a fine thing to use as a ladder, but it is dangerous to allow it to assume the likeness of a carriage, in which to jog along over an easy well-worn road, with the minimum of personal effort. He has been too apt to use methods just as they were handed down to him, without realising at all how they were evolved; without seeing how to carry them further, and thereby to make his material surrender some of its secrets to him also; without, in fact, attempting to enrich and enlarge the tradition by his own experience, before passing it on to the next generation, but merely leaving it behind him rather the worse for wear. He has just selected a few ornamental treatments, used them blindly, and worn them threadbare.

Such work as bears this kind of evidence on its face, often gives us an unpleasant sense, not only of monotony, but also of waste—waste of energy, of time, of patience, of precious material—in repeating endlessly the same few little tricks, trying to make an over-lavish use of two or three pretty details of workmanship, supply the place of variety and contrast and invention. But these defects are by no means peculiar to peasant jewellery. The same kind of thing is quite equally apparent in much very ambitious work.

There is a form of necklace which was evidently a favourite with the ancient Greek and Etruscan goldsmiths, and many people consider it very beautiful. The distinguishing feature is a whole long row, or even sometimes two or more rows, of small vase shaped drops, each one laboriously made exactly like its neighbours. The forms may be individually charming, but when used by the score or even by the hundred, the whole thing inevitably suggests that it was designed by someone who had no proper respect for the shortness of human life, and no appreciation of the deadening and deteriorating effect of endless repetition.

A lavish expenditure of human labour on a work of art, where the effect of the individual contributions of numbers of craftsmen is lost in the immensity of the whole, is right and proper where the whole really is immense, in size, in grandeur of conception, in importance in the widest sense of the word ; as, for example, in a great cathedral.

A small piece of dainty craftsmanship, however, should surely be rich in effect, without exciting thoughts of compassion for the monotonous toil involved in making it what it is.

Inexhaustible patience ? Yes, certainly, as much as you will, so long as the conception is genuinely worth it ; but the feeling aroused in the mind of one who examines the object, should be envious delight at the pleasure expressed in masterly craftsmanship, rather than pity for the poor human machine, condemned to endless repetition of a trivial idea.

CHAPTER VII.

VARIOUS METHODS OF DESIGNING JEWELLERY.

HAVING now passed in review several different, typical varieties of jewellery, in order to select that kind which seems to offer the greatest help to students who are beginning the practice of this craft, it becomes necessary to devote our careful attention to the question of designing.

It is a common complaint among beginners, and also occasionally among those who are no longer beginners, that they cannot think of good designs. When a jeweller finds himself in that case, there are various well-recognised ways out of the difficulty. If certain definite precious stones are to be used, he may get an idea from them, either from the mythology associated with them, or even from merely grouping them together into an arrangement. Possibly the name of the person who is to wear the object, or some circumstance connected with owner or donor, may come to the rescue. Otherwise he will probably either make a variation of something he has seen and liked, or else he will take a natural form and make a design out of that.

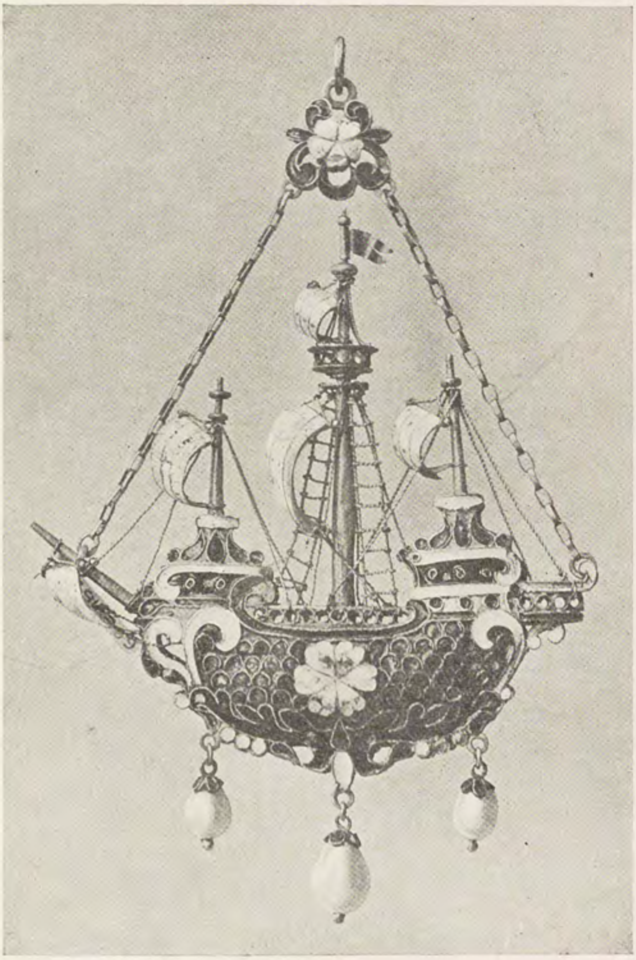


FIG. 14

Victoria and Albert Museum.

Gold Pendant, enamelled and set with pearls. Italian. 16th century.

British Museum.

FIG. 15.
Gold Earring, enamelled and set with pearls.
Adriatic. 17th cent.

These are all good ways, especially the two first ; but making variations may easily degenerate into mere copying, and direct reference to nature often results similarly in efforts to copy or imitate natural forms, rather than in taking an inspiration for a decorative treatment from them.

There is also the terribly-abused method of basing the design on some familiar object of human invention. The horse-shoe and the motor-car, lawn tennis racquets and golf-clubs, the implements of diabolo, and, for aught I know to the contrary, even the aeroplane, have all been thus commandeered by the designer of jewellery, with results of more or less uniform monstrosity. But, after all, perhaps it is mainly a question of how it is done, whether with or without imagination. Figs. 14 and 15 belong to the last-named category, and represent free and imaginative renderings of ships, incorrect, from the mariner's point of view almost to the verge of absurdity, but both of them fine decorative pieces of jewellery. They are designed with a sense of breezy exuberance, suggesting some pompous and magnificent Doge of Venice sailing forth, in the midst of gorgeous pageantry, to perform the ceremony of wedding the Adriatic.

FIG. 16.
Gold Pendant. Set with pearls and rubies. Italian. 17th cent. British Museum.

Fig. 1 is also an example of a design an important part of which was clearly based on so familiar an object of human invention as a building, and in many other pieces, where this derivation is less obvious and unmistakable, it is still easy to feel that the design owes much to architectural traditions, as, for example, in the Byzantine earring at the foot of Fig. 8.

The upper part of the Italian pendant (Fig. 16) suggests that it probably occurred to the designer that here was an opportunity for turning the symbolism of his main idea to good account. The arrangement of the gems at once suggests the cross of St. George, who is represented on his horse in the act of slaying the dragon below, and the appropriate colours are expressed in the white pearls and the rubies which, though not indeed very red, yet help to confirm this interpretation. On the other hand, if the upper portion had been a separate ornament by itself, it might have been taken to illustrate an effective design, successfully resulting from a natural arrangement of these pearls and rubies, supposing that they had been entrusted to a craftsman, in order that he might use them to make a brooch or pendant, of any design he pleased.

Most of the Norwegian betrothal clasps (Fig. 88, p. 241) suggest so unmistakably, circumstances connected with both owner and donor, that it is unnecessary to explain them in detail.

CHAPTER VIII.

DESIGNS INSPIRED BY NATURAL FORMS.

In the last chapter I alluded to the dangers of designing by direct reference to nature, but as an instance of a fine design *inspired* by natural forms, rather than copied from them, we might look far indeed to find the equal of the lovely old French brooch shown in Fig. 17, with its subtle suggestion of waves swirling and breaking against rocks, rendered by means of simplest leaf and flower forms, made out of bits of wire, and protected from injury by the high, rock-like conical settings which give the whole design such a strong individual character.

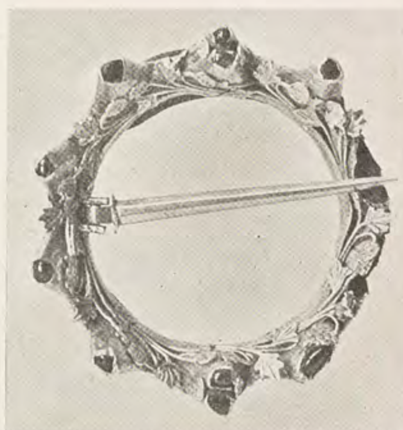


Fig. 17.
Victoria and Albert Museum. Gold Brooch, set with rubies and sapphires. French. 13th century.

Another very charming design, based in a general way on natural forms, was illustrated in the Anatolian clasp (Fig. 9) described on pp. 24, 25, and the free conventional treatment of the birds and bunches of grapes in Fig. 15 is entirely successful. In the Anglo-Saxon pendant and Teutonic brooch (Figs. 18, 19) the birds' heads and the fish, although very much conventionalised, as was necessary for expression in the difficult medium of thick glass inlay, are yet full of vigorous character. The student should note, in passing, the beauty of the simple but interesting background of the first-named of these.

FIG. 18.

Gold Pendant, set with garnets and coloured glass. Anglo-Saxon. About 7th century. British Museum.

Very different in treatment is the extremely dainty and elegant little 17th century pendant, with its enamelled doves and eagles (Fig. 20), so minute in scale, yet so true in drawing and modelling—altogether a very perfect and accomplished bit of work,

FIG. 19.

Gold Brooch, originally set with glass. Teutonic. British Museum.

charmingly designed, while an extremely conventional treatment of bird form is used with fine decorative effect in the filigree pendant representing the imperial double-headed eagle (Fig. 21). However, these last examples (Figs. 14—21), although instructive to study, are not really suitable as models for the student on which to base his early exercises and experiments in technique, except, perhaps, Figs. 18, 19 and 21. But the exercises and experiments, while educating his mind and fingers in matters technical, should simultaneously provide him with a graduated training in design ; and so, in searching for suitable stepping stones, by which to approach an understanding of processes, it is essential that we should keep a sharp lookout for every hint of design concealed therein, and, wherever possible, be guided by these hints in the choice of the direction to be selected for the next step. Even at the risk of tedious reiteration I must once again insist that, wherever mental and manual activities are closely associated, they are sure to act and re-act each on the other, and to supply fresh ideas

FIG. 20.
Gold Pendant, enamelled and set with pearls and garnets. Probably French. 17th cent. Victoria and Albert Museum.

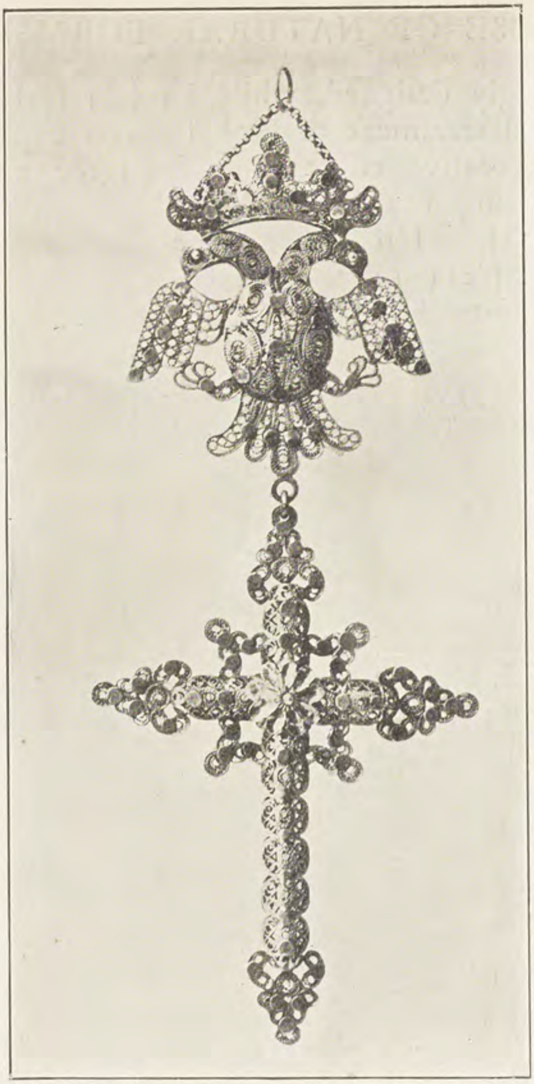


Fig. 21.

Victoria and Albert Museum.

Gold Filigree Pendant. Probably German. 18th cent.

alternately ; and these ideas will be the surest guides to progress along the dual path.

For this reason, if for no other, the copying of old or modern examples, even when they are entirely good and desirable as models, is obviously to be condemned. Probably we must all do a certain amount of copying, however sincerely we may try to restrain this very natural and human tendency, but it is a pity to copy deliberately or consciously if we have any inventive or originating faculty at all ; and surely no one ever felt impelled to try and design of his own accord, without at least some faint consciousness of the possession of a spark of the divine creative gift.

Methods and processes we must copy, for they are the common heritage of all craftsmen, ordained and fixed by natural laws, and it is not to be supposed that we can all of us discover fresh applications of these laws, nor, for the matter of that, can we expect to keep them for our own exclusive use, even if we should be so favoured.

It is perfectly reasonable that any such new applications of old laws should be copied.

CHAPTER IX.

THE EASIEST WAY FOR BEGINNERS.

If we are conscious of possessing an inborn power of design, then after the elementary methods and processes have been, at all events, partially mastered, we may perhaps decide to start with a mental picture of an effect we have determined to aim at, and if so, we must then proceed to consider how this can be attained with the materials at our disposal. But that implies a considerable amount of experience and knowledge, and our first business is to acquire this knowledge of processes.

Instead of cudgelling the brain for ready-made designs, I am sure that for most beginners it is very much easier just to take the material in its various forms, and to make experiments with it—to construct a variety of simple shapes or groups of shapes, and then to try by different arrangements of these, what designs we can arrive at, or how we can realise in concrete form any mental picture we may have started with. One great advantage of this method is that it is not at all necessary for the craftsman to wait until he is conscious of having a definite mental picture to translate into actuality. The manipulation of the material is so suggestive, that designs will come of themselves if only he sets about handling it in the right way, and diligently cultivates the faculties of observation and selection.

Whichever way we may set to work to arrive at designs, this much at least must be admitted, that no one can expect to design well until after he has practised what may be called the alphabet and grammar of his craft sufficiently to have some degree of familiarity with its essentials; —*i.e.*, to know what are the distinguishing characteristics of his materials, what treatments these characteristics most naturally suggest, and which of these treatments are most useful in bringing to light those charms and beauties which lie hidden in an unworked lump of silver or gold.

The alphabet of jewellery may be taken to mean the units or elements out of which simple designs may be constructed, while its grammar signifies the various methods by which the construction of designs out of these units is effected, how the units may be combined and associated, harmonised and contrasted. And for the purpose of acquiring technical skill I am quite sure that there can be no sounder way than by beginning with a series of graduated exercises in such an alphabet and grammar.

Now some crafts seem to have a very obvious syntax, while in others such an idea might no doubt seem to be rather far-fetched. Consider for a moment needlework and embroidery, and think of the charming and beautiful samplers which little girls used to make in order to learn, and to have by them afterwards a record of all the various stitches and processes of their craft. And jewellery really lends itself even more readily than needlework to the "sampler" method of education.

The variety of forms to be obtained from the simple practice of a few elementary working methods, directly proceeding from the distinctive qualities of the precious metals, will exceed the belief of anyone who has not made a determined attempt to exhaust them.

Moreover, there is at least one immense advantage peculiar to this system of education when it is applied to jewellery, in that when you have made your supply of units, and are ready to begin constructing designs with them, there you have your alphabet ready to your hand to play with, just as a child plays with a handful of letters, moving them about and arranging them in different ways, until at last they suddenly leap into their inevitable places—and there you have the basis of a design, as it were, revealed to you. Then, too, just as a child playing with letters will discover among the words that may be constructed out of those letters, some words which in all probability he would not have found by a purely mental effort; so may the jeweller, by arranging units and groups of units drawn from *his* alphabet, arrive at designs which might never have been suggested to his mind by merely thinking of those units in the abstract.

Scientists and metaphysicians are fond of insisting on the patent fact that one cannot make something out of nothing, and so it is in designing jewellery or anything else. We *must* have our elementary forms and processes easily accessible, and it is a tremendous help if they are available for quick and easy reference in such a way that the effect may be tried first of one, then of another, so as to ascertain which of them yield the pleasantest harmonies and contrasts when associated together.

Nothing but repeated experiments will teach the designer what an extraordinary difference it makes—how one feature or member is related to another, how the insertion or removal of this or that apparently quite insignificant detail, whether of ornament or of plain surface, may suddenly transform a dull, monotonous design into one that delights the eye and mind with a sense of rhythmic inevitableness.

In any kind of craft it is undoubtedly a very real advantage if it is possible to try these experiments in the actual materials in which the design is being executed, though of course in very big work, like architecture, for example, such procedure is generally out of the question, and the experiments must be tried either in models or by means of drawing.

In jewellery, however, the component parts are often so minute, and so much of the effect depends on the play of light on metal surfaces, that many of the variations possible in the arrangement of the parts may be too subtle to be at all readily expressed in drawing, even from the completed object, let alone from an imaginative mental picture of how it would look with or without this or that tiny feature. And so the first step seems to be to analyse, to resolve the examples under examination into their various constituents.

Let us think, then, of some of the traditional methods and favourite ornamental details belonging to jewellery of that type in which the evidence of craftsmanship is strongest, and let us see if we can discover how these methods and details may have been evolved. Let us also consider whether the theory of their evolution at which we may arrive suggests that they are still capable of further development, that there is more to be found where these came from. I think we shall find that there is. What, then, are the elements which the jeweller has at his disposal out of which to build up designs?

CHAPTER X.

FIRST STEPS TOWARDS DESIGNING BY ARRANGEMENT.

In order to answer more clearly the question put at the end of the last chapter, let us first consider what are the distinguishing qualities of the jeweller's chief materials—that is to say, of the precious metals.

1. They are easily melted.

2. They are quickly hammered out thin and flat, and the resulting plate or sheet is readily embossed.

3. They are easily drawn out into wire of various sections.

They have other notable characteristics, of course, but these three are enough for the present purpose.

From the scientific point of view the above order is no doubt incorrect, but in this instance it is convenient to take the characteristic of fusibility first.

If we melt a fragment of gold or silver on a smooth piece of charcoal, what happens? The metal first shrinks and shrivels, then gradually gathers itself together, and as it reaches the melting point it trembles and quivers until, finally, it rushes into a perfect globular form, glowing all over its brilliantly smooth, rounded surface. In this way small grains or balls, which are almost perfectly spherical, can be made quite rapidly after a little practice, and in the same way the end of a piece of wire can be made to run up into a ball without being allowed to drop off.

No doubt this is all quite easily explained scientifically, but he must be hard indeed to move who is not fascinated by watching the wonderful beauty of that miraculous transformation.

Put one of these round grains on a smooth steel surface, and give it a few taps with a hammer, and it will have become a flat disc, thick or thin according to the amount of hammering ; and if the disc is made fairly thin it is easily converted, with the help of a rounded punch, into a hollow dome or cup.

Again, if the ball remains attached to the end of a piece of wire, it can soon be hammered and shaped into the form of a leaf, of which the wire represents the stalk ; and this same quality of malleability enables us to obtain sheets of any degree of thinness from a bar or ingot, produced by pouring the melted metal into a mould. If the mould is of such a form as to yield a fairly slender rod this can soon be drawn out into wire of almost any section, and as fine as a hair if necessary.

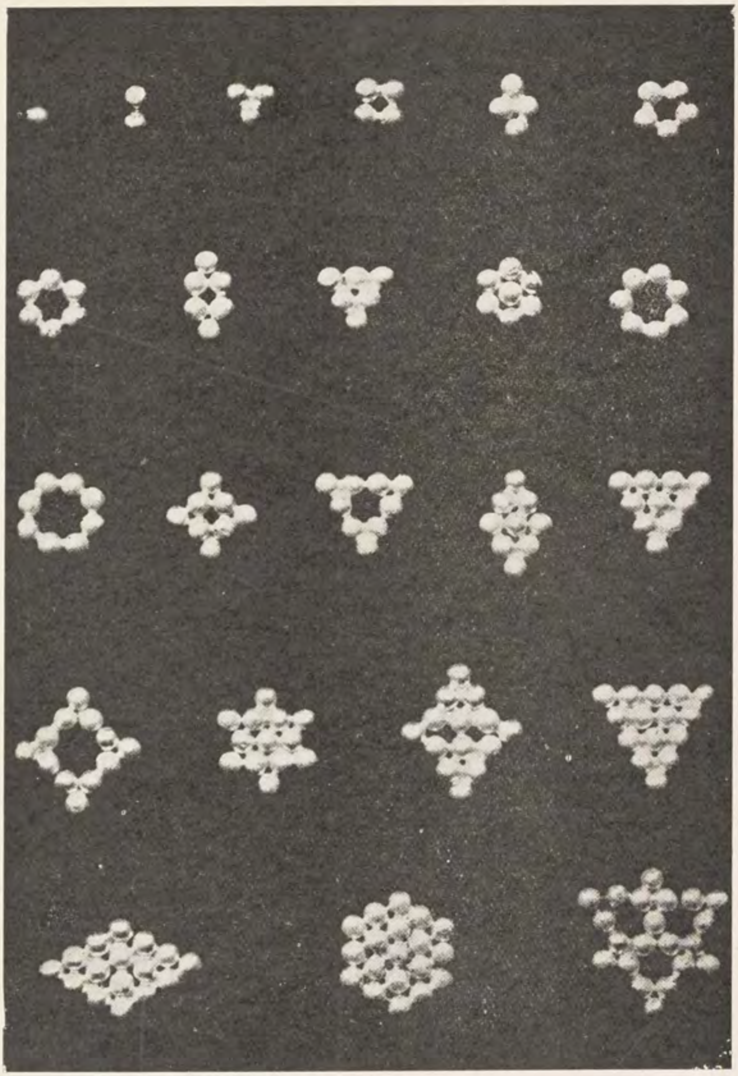


FIG. 22.

By the Author.

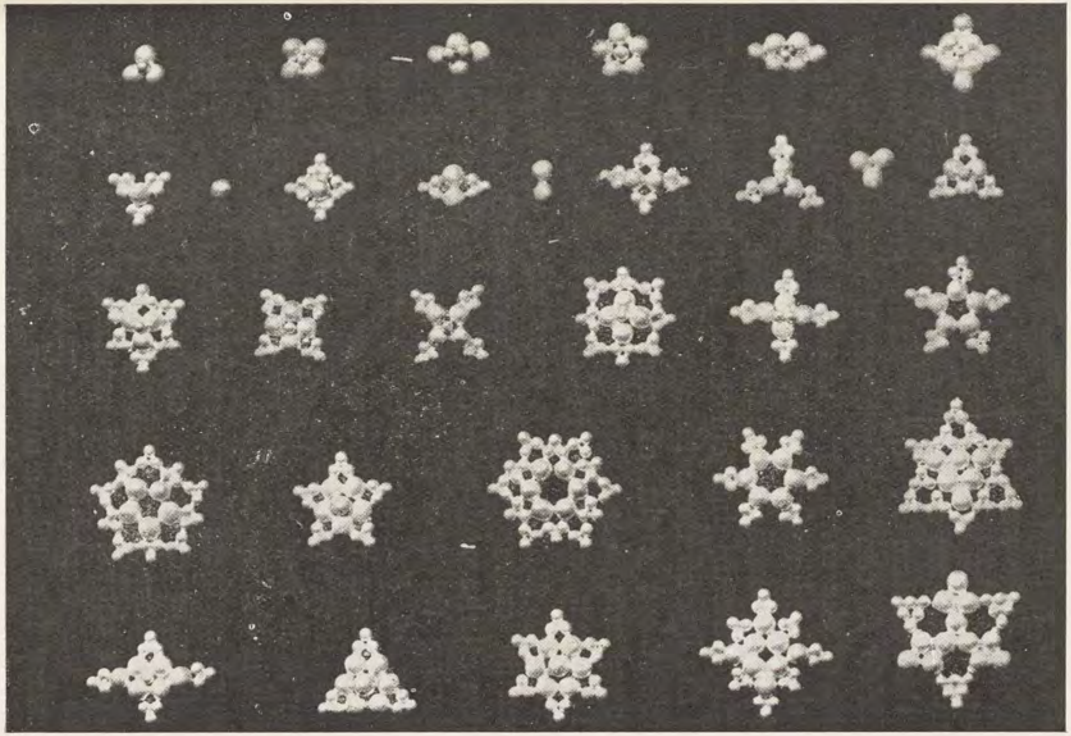
Clusters of spherical Silver Grains of one size (enlarged).

Now these three qualities provide the jeweller with a perfectly inexhaustible fund of opportunities when taken in conjunction with the fact that, by mixing a very small proportion of silver with gold, or of brass with silver, the resulting alloy, called solder, will melt at a slightly lower temperature than the unalloyed metal, and will join together any pieces we wish to unite, to all intents and purposes invisibly.

Now let us suppose that we have made a quantity of little spherical grains in, say, three different sizes, the largest as big as a mustard seed, the smallest as little as a poppy seed, and let us first take the largest only, and solder them together in groups (Fig. 22). Some of these extremely simple arrangements are of the utmost value to the jeweller, the pyramids of three, six and ten grains, and the cluster of seven, in which six grains surround a central one, being perhaps the most useful of all.

But, if we introduce contrast and proportion by using the two smaller sizes as well as the largest, we can obtain more interesting results, and in Fig. 23 some of the clusters in Fig. 22 will not at once be recognised now that they are enriched by the addition of smaller grains, either singly or in groups.

Thus in the second row each cluster has alongside of it the large grains which form the basis of the arrangement. The first two have a single large grain with, respectively, three



By the Author.

FIG. 23.

Clusters of Silver Grains, of various sizes, all spherical (enlarged).

and four triple clusters of small grains grouped around. The next two have two large grains each, and the other two have three each, to which there are added in each case two or more of the clusters of three small grains, whose addition so completely alters the appearance of many of the arrangements taken from Fig. 22. In the third row in Fig. 23 the second, third and fourth examples are all of them elaborations of the same original cluster of four large grains, and the last of these becomes quite an elaborate figure when eight of the small clusters are grouped around it.

The last example in this plate is rather interesting, as showing a variation of the corresponding example in the previous illustration, where all the grains are of one size, whereas by replacing three of the triple clusters by three clusters of six grains each, small enough to occupy about the same space as the large ones which they replace, a valuable element of contrast is introduced and a more interesting design is obtained.

Some of these forms are rather suggestive of the patterns of snow crystals as revealed by the microscope, and this is only one of many instances showing how nature teaches us that, when we want to make patterns, all that is necessary is to take a number of units of simple form, and group them together judiciously ; as, for example, in such things as the spider's web, the honeycomb, pine-apples, fir cones, scaly fish and snakes, and many varieties of flowers and of seed vessels, almost every one of which is constructed on a regular geometric plan by the repetition of a number of straight lines, simple curves, or circles.

CHAPTER XI.

EXAMPLES OF THE USES OF GRAINS.

SOME examples occur, in Figs. 24 and 25, of ancient jewellery in which clusters of grains form an essential part of the design, as also in Figs. 7, 8, 9 and 11.

The Pyramid form, built up out of grains, will be recognised in many of the objects illustrated in those plates. The small cylindrical object near the top of Fig. 24 has a triple row of them towards each end, forming zigzag borders, separated and relieved by bands of plain and beaded wire. Although the minute workmanship whereby this simple effect is produced does not tell in the illustration, an examination of the object itself will show that, in spite of its plainness, it is full of dainty charm. No doubt it was once one of the beads of a necklace.

The earrings on either side of it owe much to the decorative value of the crestings of grain-clusters which surround the top edges of their lower drops, while similar, but larger and detached, pyramidal clusters play an important

FIG. 24.

Pair of Gold Earrings and various small Ornaments with granular decorations. Greek and Græco-Roman. 4th to 3rd century B.C.

Pair of Gold Earrings with Cloisonné enamel, and clusters of grains. Byzantine. 6th to 9th century A.D.

Three small Gold Pendants, with granular ornaments. Byzantine. 6th to 9th century A.D.

British Museum.

part in the design of the big earrings just below them, and other arrangements of beads contribute in a greater or less degree to the structure and ornamentation of most of the other objects illustrated in this plate. Several of the ancient rings also, as shown in Fig. 25, are excellent examples of what can be done in the way of fine decoration with the help of grains, especially the three in the second row from the bottom. The one in the middle of that row is a particularly happy example of a graceful and delicate bit of ornamentation, derived from a judicious disposition of small grains in rows, pyramids and clusters.

Pendant clusters, again, give a great air of finish to most of the little ornaments in Fig. 7, but in several of these they have got badly bent out of place. Groups of three grains supply the decoration of the bosses on the gold knobs in Fig. 8, and small clusters of seven, alternating with larger ones of nine, are accountable for much of the richness of the Anatolian clasp (Fig. 9), while the pyramid form of cluster occurs once more most effectively in the angles of the filigree cross (Fig. 11).

Many of the examples that have been referred to show that the use of grains of various sizes gives a valuable sense of contrast and proportion, but this is felt even more strongly where some of the grains are hammered flat, as illustrated in the pendant and cross (Fig. 21), which shows their usefulness to relieve the somewhat monotonous intricacy of filigree work.

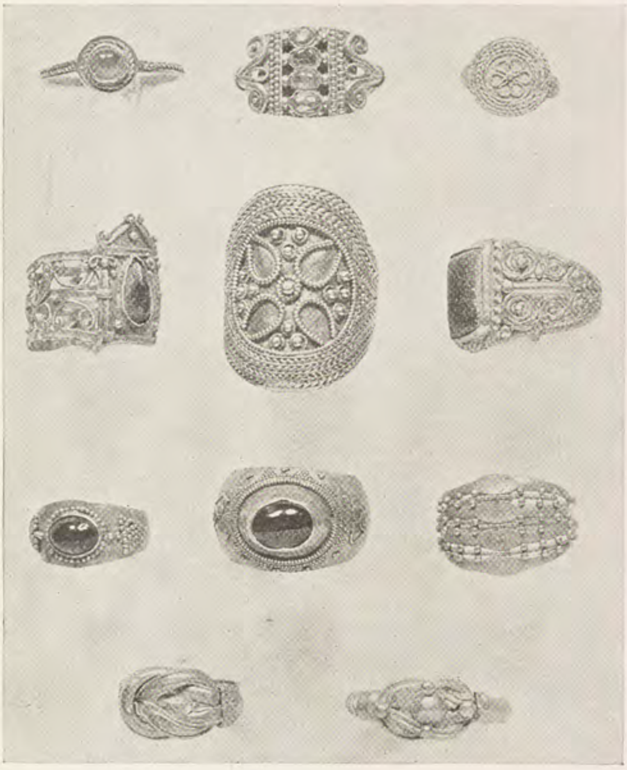


FIG. 25.

British Museum

Ancient Gold Finger-rings, ornamented with grain clusters and twisted wire.
Egyptian, Greek, Roman and Anglo-Saxon.

Flattened grains are also introduced effectively in the openwork button at the top of Fig. 26, and they save it from a look of weakness which it might otherwise have had ; and to refer yet once

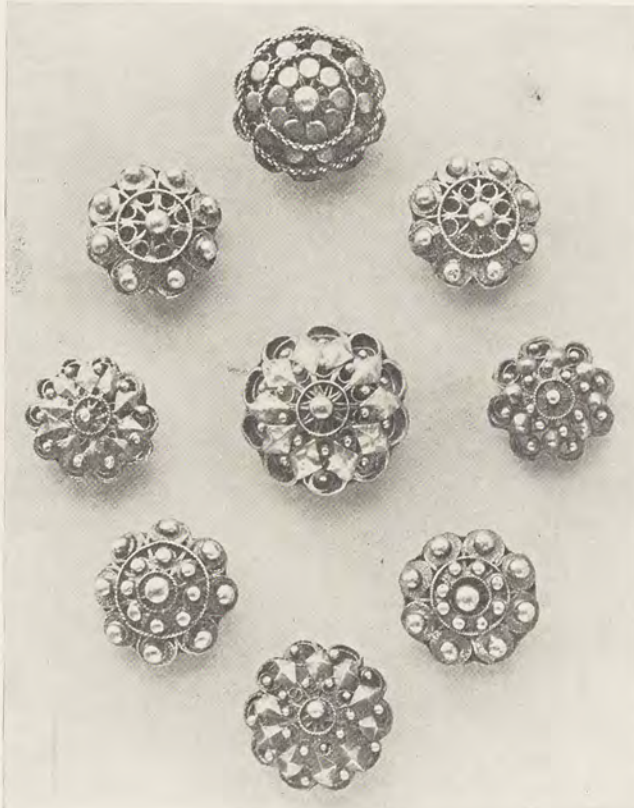


FIG. 26

By permission of the Chelsea Furniture Co.

Silver-gilt openwork Buttons
Spanish. 18th or 19th cent.

again to the Anatolian clasp (Fig. 9), here also we find these same flattened grains unobtrusively supplying quiet resting places of plain smooth surface, where, without them, the eye

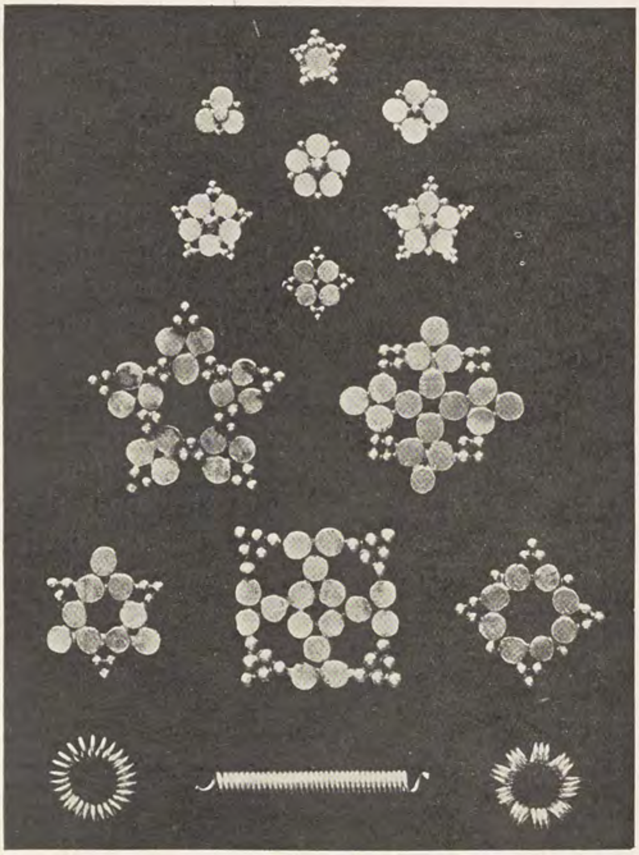


FIG. 27.

By the Author.

Clusters of Silver Grains of various sizes, both spherical and flattened, and examples of the evolution of rings.

would have been wearied by overmuch intricacy and richness of scrollwork.

Anything in the nature of a background treatment will nearly always acquire additional decorative value and interest if it is interrupted occasionally by some dissimilar features, which, while not in themselves aggressive, will serve a useful purpose by concealing small portions of the design proper.

A design does not gain by being too obvious, but it is, on the contrary, rather pleasant to the eye and to the intelligence to trace the re-appearance of a line which has for a moment been covered or broken.

Fig. 27 shows a series of simple arrangements made by the combination of spherical grains with others which have been hammered flat. In the large square-shaped cluster near the foot of this plate the flattened grains which are used were, before they were hammered, of the same size as the others which have been left spherical.

CHAPTER XII.

ORNAMENTS COMPOSED OF CIRCULAR FORMS.

In order to make a number of grains each of exactly the same size—a matter of importance when they are to be used conspicuously in clusters and in symmetrical arrangements like those shown in Fig. 22—it is necessary to measure, with a considerable degree of accuracy, the bits of metal which are going to be melted for this purpose. This is particularly essential when the grains are small, as very slight variations in size are then quite perceptible.

The grains are made from bits of wire cut off into equal lengths, or a sheet of the metal which is being used may be cut up into squares of a given size. It is much easier, however, to obtain the necessary degree of accuracy by using wire rather than sheet, especially if the wire is wound round a small steel rod into a close spiral, which, when the rod is removed, is easily cut up into rings. In each one of these rings the length of wire used will of necessity be exactly the same so long as the cutting up of the spiral is done accurately.

There is a further advantage in this method, in that the wire, if cut up into straight lengths, is very liable to roll about in a troublesome way under the blow-pipe flame when being melted, whereas if it is in the form of a ring it will lie still until it fuses.

Chapters XIV. to XXVII. are devoted to some practical hints on the use of the blow-pipe and various other technical matters, which I will not pursue further just now, as I wish, first, to point out some other uses of the spiral coil of wire.

The first and most obvious of these is to cut them up for rings, which not only provide the means of linking together flexibly chains and other pieces of jeweller's work, but also give us a fresh element of design capable of being treated in a way similar to that already employed for grains and discs, either separately or in conjunction with these, as illustrated in Fig. 28, in which are shown simple ornaments in some variety, most of them constructed out of arrangements into whose formation all three of these elements of design enter.

When a length of wire is wound round a rod in order to make rings there is no need for the rod to be round in section. Oval, oblong, square and triangular links are made in the same way, by using a rod of the required section.

Let us now, however, return for a moment to the spiral coil of wire and consider another way of using it.

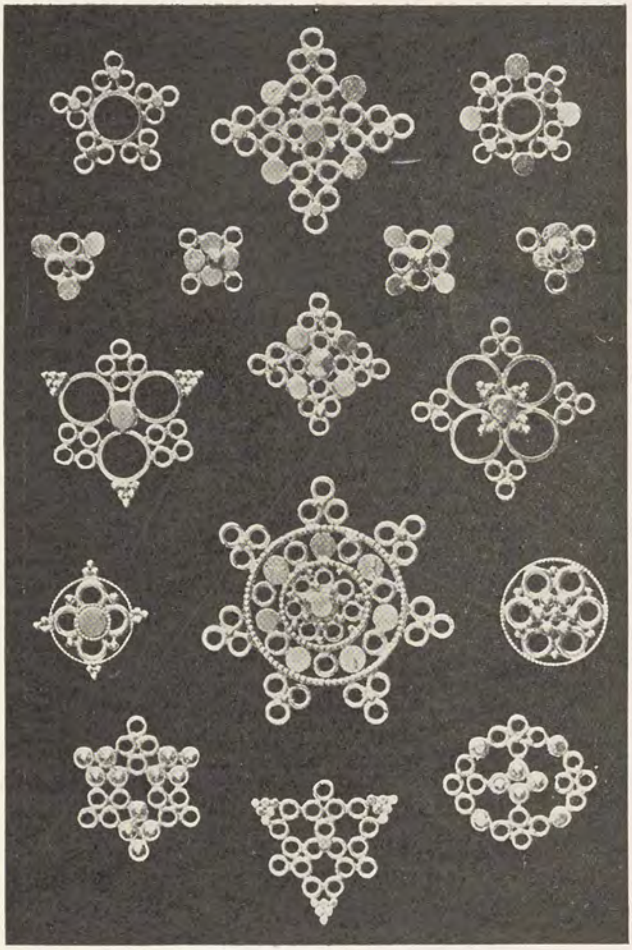


Fig 28.

By the Author.

Silver Ornaments, composed of grains, discs and rings.

At the foot of Fig. 27 a short, straight length of such a coil is illustrated, and on the left-hand side of this is shown the effect obtained by bending this coil round, so as to form what we may call a ring of rings, whereby a further and most useful element of design is evolved. These circular coils will be found in the jewellery of almost all countries and periods. A close examination of the objects shown in Figs. 10 and 11 will prove that coils enter largely into the constructive schemes there, but more conspicuous instances occur in the buttons illustrated in Fig. 29. These are fine examples of traditional forms in which coils, grains, and domes and rings of twisted wire are lavishly used ; but fine though they are, the coil idea in some cases is rather overdone, and there is a lack of variety and invention—an instance of tradition running to seed. But in several of the examples we can see how the craftsman appears to have profited by a lucky accident, which has enabled him to relieve his design from monotony. Instead of opening out the turns of his coil quite evenly all the way round when he made it into a ring he has divided them into sections, closing all the wires of each section into a compact group, and thus obtaining those triangular specks of dark shadow which are so valuable where they occur. Furthermore, the coil so treated forms an octagonal or polygonal member, contrasting pleasantly with the circles around it. It is also worth noting that, where this method of obtaining variety is not adopted, nature occasionally steps

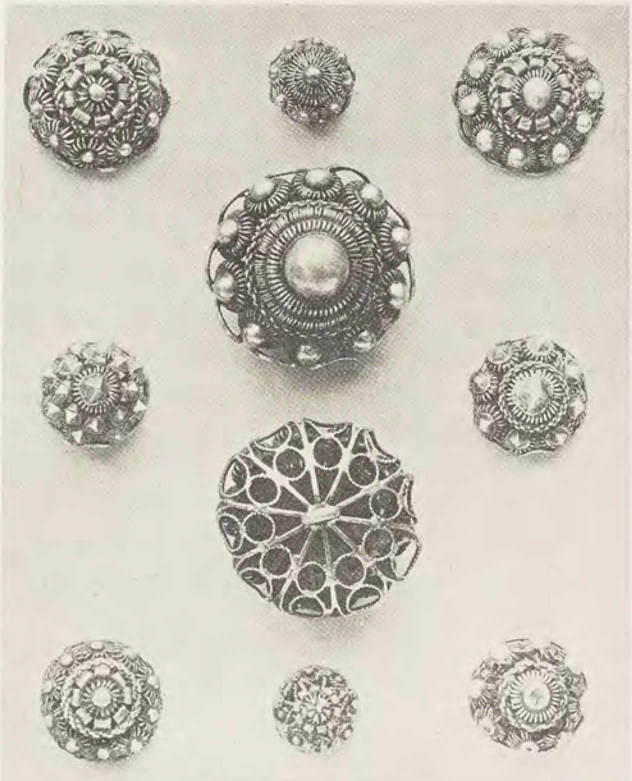


FIG. 29.
Silver Buttons, composed mainly of rings, coils and domes. From Friesland and Norway.

in, and saves the objects from excessive and tiresome monotony by the trifling and unintentional irregularities which, fortunately, are so often incidental to the work of human fingers.

The big button in the middle of this plate is shown twice, so as to give the back view as well as the front, the method of construction here displayed being not only strong and light, but also extremely decorative. Most buttons of this type are built up on an open framework such as this, but occasionally the back is made of a hollow cup or boss of sheet metal, and the other parts are soldered to this.

Smaller bosses or domes of this kind also enter into the design of the fronts of these buttons and of those illustrated in Fig. 26, and they make an admirable contrast to the wire-work upon which they are laid. In this simple kind of jewellery they take the place of precious stones or pearls. Further variety may be obtained by occasionally reversing the domes, and in some of the ornaments in Figs. 30 and 31 there are examples of this treatment, as well as of the use of several little cups of different sizes, one inside the other, with finally a round grain inside the smallest.

The comparatively large rings of small grains, which play rather an important part in a few of these ornaments, are not, as a matter of fact, built up out of separate grains, but are made of what is called beaded wire—that is to say, wire which is given this form by means of pressure between two steel tools, in which corresponding grooves have been made, each groove being really a row of little round hollows. In its

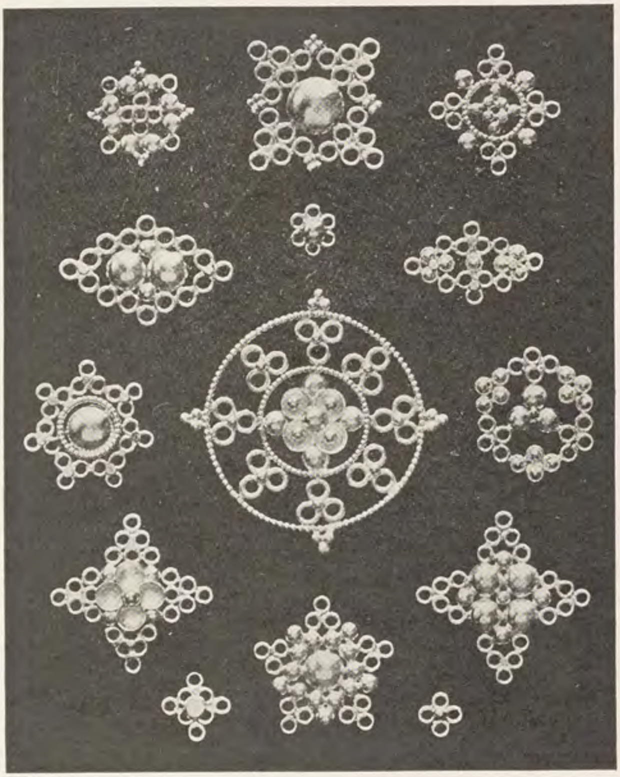


FIG. 30.

By the Author.

Silver Ornaments, composed entirely of circular forms.

smaller sizes, especially, this fine beaded wire is most useful to the jeweller for giving a dainty finish to work which might otherwise be too plain or too heavy looking.

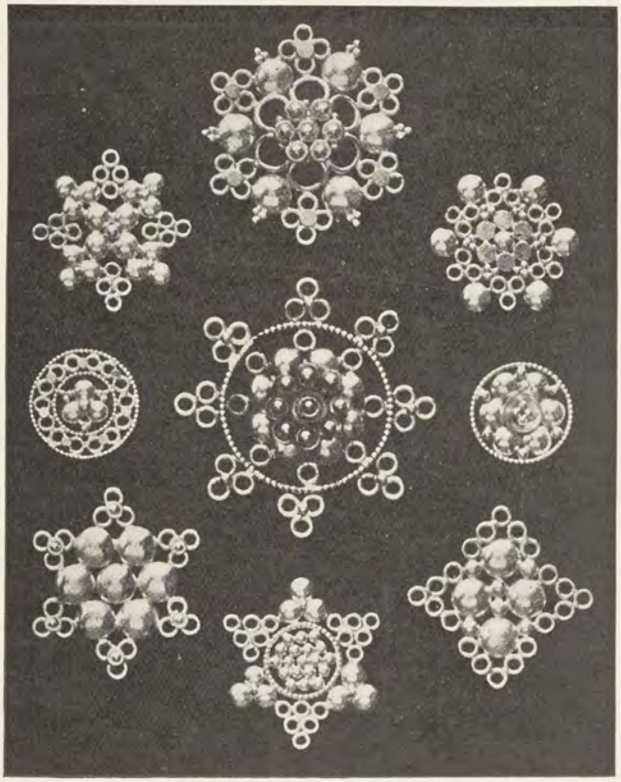


FIG. 31.

By the Author.

Silver Ornaments, composed entirely of circular forms.

The silver-gilt Spanish buttons illustrated in Fig. 32 belonged originally to families of bull-breeders, by whom they were greatly prized, and regarded almost as heirlooms. They are beautiful bits of delicate craftsmanship, and are especi-

FIG. 32.
Silver-gilt Buttons, ornamented entirely with various circular forms. Old Spanish.

ally interesting to the designer as showing the astonishing variety of charming patterns that can be devised with the use of nothing but circular forms. In every one of these buttons there is a circular ring enclosing a dome or boss, which is decorated with a design—differing in every case—and yet entirely constructed out of other rings or domes or grains, but all of them circular. Many of the very small rings are made out of a fine spiral coil of very thin wire, which of course gives a much richer and daintier effect than that of a solid wire of the same size as the coil. The larger rings will be seen to be made of twisted wires.

CHAPTER XIII.

FROM THEORY TO PRACTICE.

THERE cannot be much doubt that the designs, which we have just been considering (Fig. 32), of quite elaborate patterns, entirely composed of various circular forms, were arrived at by experimental arrangements of a store of the grains and rings and bosses, used after the manner of a child playing with a handful of letters, rather than by sheer mental effort assisted only by pencil and paper. Certainly the patterns illustrated in Figs. 27, 28, 30 and 31 came about in that way, and it would be found extremely difficult to express quickly in a rough pencil sketch, the many different effects of these various circular forms before the imaginary arrangement of them faded from the mental vision.

The variations are so slight, that in these very small objects it would require a remarkably expert draftsman to represent the difference in appearance between a cluster of small spherical grains and a similar cluster of flattened grains of the same size. When these clusters have to be repeated several times in order to express the design, and it is a question of deciding which give the best effect, it is obviously quicker and surer to judge from the things themselves than from drawings. Even the photographs do not always succeed in conveying by any means the full value of these apparently trifling differences, which may nevertheless prove to be quite important in the work itself. It is necessary to look very closely at the illustrations in order to realise which of the domes have been reversed and used as hollow cups, and whether their curvature is bold and full or slight and subtle. But it is in choosing rightly between such alternatives as these that the craftsman finds his opportunity of making his work interesting instead of commonplace and obvious.

The buttons illustrated in Fig. 33 may perhaps scarcely come within the province of the jeweller, but they are very nearly akin to his work, which they closely imitate, and they are also interesting here as being further examples of pleasant designs built up out of a quantity of small separate pieces—most of them circular—pieces very similar in character to those whose uses we have been considering, although it is true that here they are produced in a way entirely different from those followed in the working of the precious metals. These buttons were made of cut and punched steel, for the decoration of Court suits. The best of them are quite beautiful, and particularly characteristic of the costly and elaborate, if rather insincere, elegance of Court life in the eighteenth century. Fig. 33 shows a selection from an original set

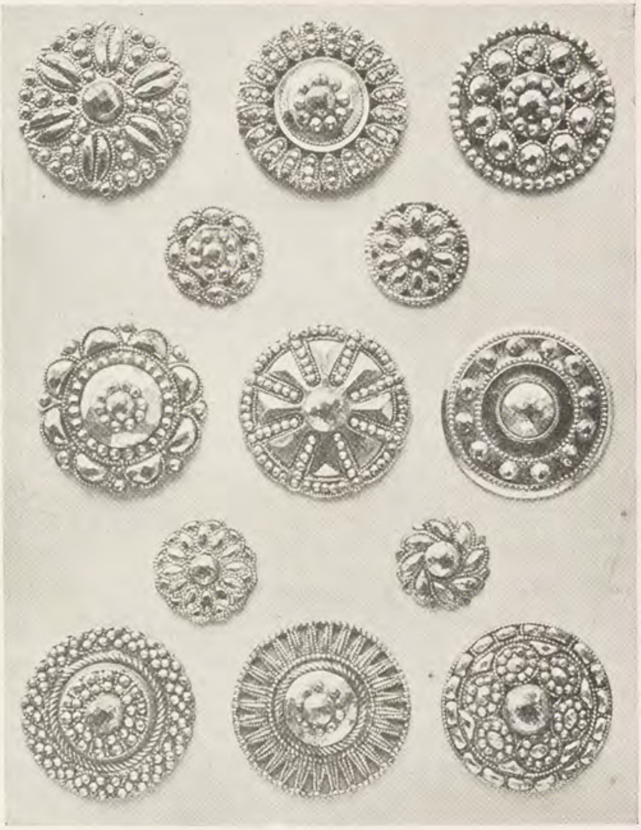


FIG. 33.

By permission of Messrs. Jennens & Co.

Cut Steel Buttons. English. 18th cent.

of manufacturers' samples still in existence; but the cases in which they are mounted are almost dropping to pieces with extreme old age, and their antiquity is also indicated by the fact that the ink in which the number and price were written under each one has become almost invisible. Similar buttons are still made, and one shudders to think of the endless labour involved in cutting, and polishing, and fitting, and riveting all the minute particles of steel, of which, in some cases, there would be over a hundred in a single button, each particle containing goodness knows how many facets. Most of the designs were obviously suggested by the idea of faceted gems in mille-grain settings, the latter effect being obtained by stamping the grains in the thin steel plates to which the faceted parts were riveted.

The designs whose evolution has been traced, in this and part of the two preceding chapters, as illustrating the most elementary treatments which are suggested by a consideration of the three distinguishing characteristics of the precious metals instanced on p. 53, in the light of selected work of past craftsmen, have been strictly limited to circular forms. They are offered as suggestions for a course of elementary practice lessons suitable for beginners, and before proceeding to follow these up with rather more advanced exercises, for which other forms and treatments are required, it may be well to devote a few chapters to practical and technical considerations.

These chapters are intended to facilitate and to supplement the work of the personal teacher rather than to take his place. Where first-rate personal teaching can be had there is nothing else so good, but the beginner will derive much additional benefit from such lessons if he studies the subject in the intervals between them with the help of a carefully prepared text-book, in which detailed explanations of the processes are given as the result of the author's own personal experience.

The question as to whether it is possible for anyone to learn the practice of a craft from such a text-book alone, without any personal instruction at all, is one which, in my opinion, depends not a little on the determination of the student.

The following chapters only attempt to deal with a few elementary processes, and to provide certain recommendations and useful memoranda which it should be helpful for the beginner to have at hand for reference, when he is providing himself with the necessary outfit, as also when, in proceeding from one exercise to another, he is likely to encounter fresh difficulties.

I shall now and then give information which, though it may not actually be wanted for the exercises in hand, is nevertheless led up to by the instructions which the exercises do require, and is likely to be useful on other occasions. In this way it may often be easier for the student to gain an intelligent view of the whole process under consideration than if the point of view was limited strictly to the bare necessities of the moment. Therefore it is always desirable to begin by reading through the whole chapter or section to the end before actually setting to work upon the exercise which it describes. In some instances there will be alternative methods, between which the student must choose for himself which one to adopt, his choice being perhaps limited by the tools and appliances at his disposal.

CHAPTER XIV.

USES AND ACTION OF THE BLOW-PIPE.

One of the first things the beginner should do when starting to learn the practice of jewellery is to acquire the knack of using the blow-pipe, and he should try experiments with the flame produced by it until he realises and understands something of its different properties.

Whole books have been written about the blow-pipe, but from the point of view of the jeweller a page or two should suffice to enable him to use the flame intelligently.

The object of the blast of air which it is the business of a blow-pipe to provide is twofold. Firstly, it increases the heat of the flame used by introducing into it a steady stream of oxygen from the air ; and secondly, it enables the craftsman to direct the flame against the exact place where the heat is required.

The heat of a blow-pipe-flame varies in its different parts and according to the shape of the flame produced.

Blow-pipes for work of any size are generally made for a gas flame, the gas being delivered through a metal tube, inside of which is a lesser tube ending in a small nozzle, through which the stream of air comes with whatever degree of force is required, from a pair of bellows or other mechanical source.

An apparatus of this kind (Fig. 34), which is very convenient for jewellers, is made with a small foot-blower, and a movable stand for the blow-pipe, so arranged that the flame can be directed at any angle, and the gas and air supplies are regulated by taps, which make it possible to set the flame and keep it at a definite size and power. This apparatus is also convenient, in that it leaves both hands quite free for manipulating the work while under the flame, and relieves the operator from the, at first, rather tiring necessity of supplying a stream of air through a mouth blow-pipe from his own lungs.

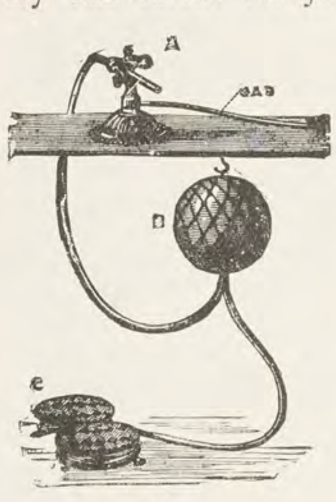


FIG. 34.
Standing's Foot-blower and the Duresme Blow-pipe.

It is desirable, nevertheless, that the student should at least begin with a mouth blow-pipe, which many jewellers always use in preference to any other apparatus, and it is by far the cheapes kind. In course of time and with sufficient practice the mouth blow-pipe can be kept in position without assistance from the hands, and an expert jeweller even uses it sometimes to adjust the objects which are being soldered if they have got moved out of place.

A mouth blow-pipe can be used with a gas flame or with a spirit or even an oil lamp, but whichever of these is selected, the burner must be of a special kind made for the purpose. The gas flame is the most convenient, and is so arranged that when the burner (Fig. 35) is swung round to one side, out of the way, the flame is automatically lowered by that movement, just enough being left to keep it alight, so that it is ready whenever wanted.

FIG. 35.
Jeweller's Soldering Burner for gas.

Where gas is not available a spirit-lamp makes a good substitute, but it should be provided with two flames—one a very large one for the blow-pipe to act on, and the other quite a small one, which always remains ready to light the large one when wanted, this latter being extinguished by a hinged cover each time it is done with. Fig. 36 represents one of the best forms of this kind of spirit-lamp.

The mouth blow-pipe is simply a tapered brass tube (Fig. 37, L). The butt end is about the size of a lead pencil, and this is tinned where it is held in the mouth, while the small end is bent round so as to direct the flame sideways, and is reduced at its extremity till the hole is only about big enough to admit an ordinary pin of medium size. A similar pipe of larger size is also occasionally necessary.

FIG. 36.
Jeweller's Soldering Lamp for spirit.

Only quite a moderate pressure of air is necessary to control and heat the flame for ordinary small jewellery work, and beginners often blow much too hard. If the stream of air is too big and too violent in proportion to the size of the flame, then, instead of making it hotter it will actually chill it.

The first important thing is to learn how to keep up a gentle pressure steadily.

Fill the cheeks with air ; let this slowly escape through the blow-pipe, and try to take in fresh air through the nostrils at the same time. The tongue must be used as a valve in order to prevent the air in the cheeks from being drawn down into the lungs whenever a fresh breath is taken through the nostrils, and this breath should always be taken before the need for it is felt, and while there is still a good reserve pressure of air in the cheeks.

This knack will be acquired much quicker if it is practised by itself for a considerable period without the distraction of looking after the flame at the same time. Moreover, if the first attempts at using the mouth blow-pipe are made directly on the flame, it is not improbable that the flame itself may sometimes be unin-

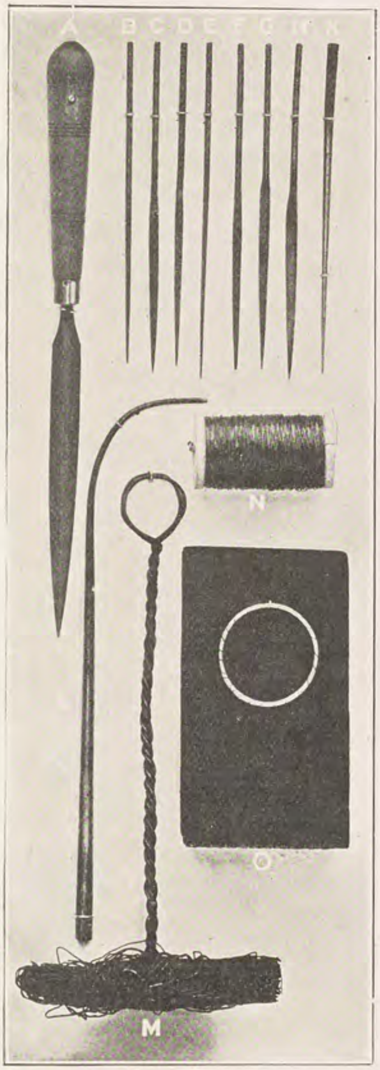


FIG. 37.

A. Six-inch half-round superfine file.
B—H. Needle files: viz.—
B. Rat-tail needle file
C. Half-round do.
D. Sage-leaf do.
E. Square do.
F. Three-square do.
G. Donkey-back do.
H. Knife-edge do.
K. Steel point.
L. Mouth blow-pipe.
M. Soldering wig.
N. Reel of binding wire.
O. Prepared charcoal block, upon which is shown a coil of very fine silver wire, which has been bound round with fine iron binding wire, ready for annealing (see p. 96).

tentionally inhaled, and that is an unpleasant experience.

Having then got your apparatus ready for use, and having attained some proficiency in the use of the blow-pipe, the next thing to be done is to try experiments with the flame which it produces. If the nozzle of the blow-pipe is held just against the side of the flame, and if a gentle stream of air is then blown through it, a long sharp-pointed tongue of blue flame will at once shoot out. Put some small bits of wire on a smooth charcoal block (Fig. 37, o), not too near together, (thin copper wire will do), and if they are curled round a little that will stop them from rolling about. Then direct the pointed flame towards one of them, and gradually bring it nearer until the inner tongue, or jet, which you will see within the main flame touches the wire, which will then quickly melt. If it does not do so the tip of the inner tongue of flame is not touching it, or else your flame is too small or your wire too thick ; but it is possible to melt copper wire an eighth of an inch thick, on a piece of charcoal in this way with quite a gentle current of air, making a tongue of flame about two inches long, and it can be melted in half a minute.

When you have succeeded in melting several bits of wire, which should run up into grains as described on pp. 53, 54, try to melt the remaining pieces with other parts of the flame—both nearer to the blow-pipe and further away from it—until you have proved to yourself that the tip of the inner tongue of the flame does it the quickest and most certainly. Learning this fact by experiment will also teach you that when soldering thin or slender pieces together you must be careful not to let the hot tip of that inner tongue touch them, or they may be melted before you have time to realize what is happening.

In order to avoid that danger it is best when soldering, to make a less pointed flame, and this is done by keeping the nozzle of the blow-pipe a little distance away from the flame. Try this, and you will find that with a space of from a quarter to half an inch between flame and blow-pipe, and with a gentle current of air, you can make a soft, silent flame with a rounded end which will heat the work without being so liable to melt it, although it will melt the more fusible solder readily enough.

By blowing harder and with rather more space between the flame and the blow-pipe you will produce a roaring, ragged and very hot flame, which is liable to melt any small bits of silver it touches, but is useful for heating and soldering rather large, solid pieces of work.

These three different kinds of flame should now be produced repeatedly, and studied until their qualities and differences are perfectly familiar.

When a foot-blower and pipe on an adjustable stand (Fig. 34) are used, variations in the quality and shape of the flame produced, are obtained by regulation of the taps controlling the supplies of gas and air. The tube through which the air comes, being fixed inside the larger tube which conveys the gas, cannot be moved about like the mouth blow-pipe, and this is a disadvantage which has to be set against the conveniences and greater range of power belonging to the mechanical blow-pipe. The flame of the latter cannot be varied and changed in character with quite the same rapidity that is possible with the mouth blow-pipe, but with practice these changes can be made as quickly as is necessary, or the object may be moved away out of range of the flame.

CHAPTER XV.

WIRE-DRAWING AND ANNEALING.

In order to proceed with some exercises in circular forms (which will also provide practice in soldering) it will be necessary to have a supply of silver wire in several different sizes, and this affords an opportunity of learning how to draw out wire—that is to say, to make it thinner.

The thickness of wire is generally measured by the imperial standard wire gauge (Fig. 38, A), but the whole question of gauges being a rather complicated matter, it is dealt with in Appendix B (p. 264), because it would cause too great a digression to do so in this chapter. It is very desirable that before purchasing a gauge the beginner should study that Appendix carefully, as it may influence him in deciding which kind of gauge to buy.

For the present it is enough to add that when referring to the one mentioned above, it is usual and convenient to use an abbreviation, such as I.S.G. or S.W.G.

Personally I prefer I.S.G., because the other

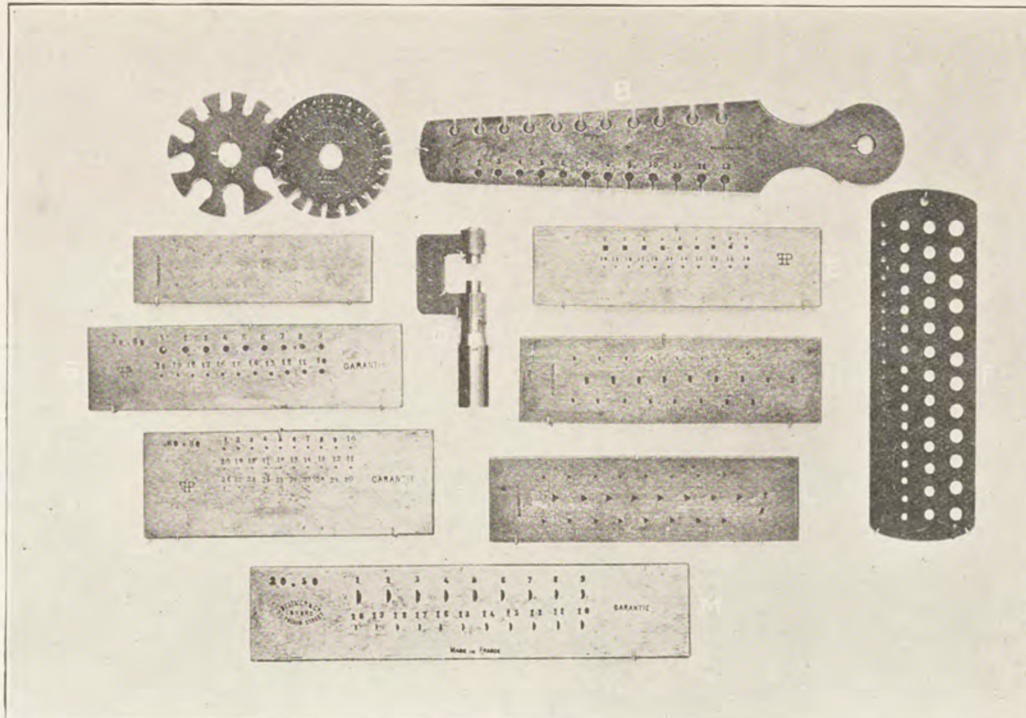


FIG. 38.

A. Imperial Standard Wire Gauge.
B. Birmingham Metal Gauge.
C, G, K. Draw-plates for round wire.
D. Micrometer Gauge.
E. Draw-plate for square wire.
F. Twist-drill Steel-wire Gauge.
H. Draw-plate for flat wire.
L. Draw-plate for triangular wire.
M. Draw-plate for half-round wire.

initials are easily confused with B.W.G., which is the abbreviation for the Birmingham wire gauge, whose sizes, though very nearly the same as those of the I.S.G., differ enough to cause trouble.

Assuming that you have bought a small coil of standard silver wire of, say, No. 18 I.S.G.

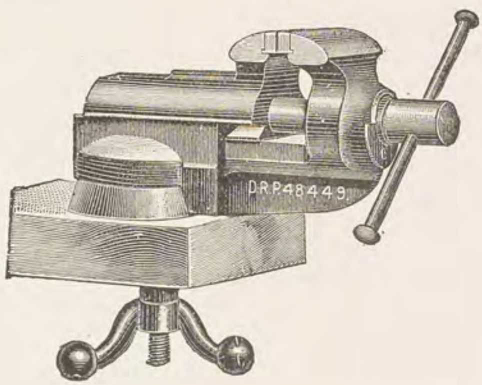


FIG. 39.
Revolving Parallel Vice.

cut off a length of, say, ten feet,* and file one end to a fairly long point. Then take the "round" draw-plate (60—90,† Fig. 38, K) and grip it in the vice (Fig. 39), so that the side on which the numbers are punched is towards you. It is not absolutely necessary to have a vice, though for wire-drawing especially it is a very

* This would weigh just about one ounce (Troy).

† The figures 60—90 indicate that there are 30 holes in that plate, the largest of which is known as hole 61, and the smallest as hole 90.

great convenience. However, the draw-plates can be held securely enough in other ways, as, for instance, by means of four stout bits of wood firmly screwed down to the top of the bench, in pairs, with a space between them to receive the ends of the plate, which will then be supported while resting with its lower edge on the bench.

If the student decides to get a vice, but is obliged to observe strict economy, a cheaper one than that illustrated will do so long as it is reasonably strong.

Now fill the holes of the draw-plate with tallow from the further side, that on which the larger openings are, and push the pointed end of the wire through the hole marked No. 1 (*i.e.*, No. 61) from the far side, so that the point comes through to the side of the plate which is towards you. Take hold of the pointed end firmly with a pair of strong pliers and steadily pull the wire through. If it comes through without requiring the exertion of any force try it in a smaller hole until you find one through which it requires some force to pull it beyond the part where it is pointed.

The uncertainty as to whether No. 18 wire will go through hole No. 61 in the draw-plate is due to the fact that draw-plates and gauges are both liable to wear with constant use, and the No. 18 wire you buy from one dealer may be a shade thinner or thicker than wire sold as of the same size by another dealer ; also, the gradations from hole to hole in the draw-plate being so very slight, an almost imperceptible variation in the size of the wire may make a difference of perhaps two holes in the draw-plate.

Moreover, the gauge number is only an approximate measurement, and the wire may be either an easy or a tight fit, and still be properly designated by that number. For instructions in more exact methods of measurement see Appendix B.

Assuming, however, that your No. 18 wire will not quite pass through hole No. 61, push the pointed end through, and then draw the wire through that hole and the next one (62).

Before reducing its thickness any more, cut off a length of about two feet, being careful to leave the pointed end on the remainder. Put the short piece aside, and go on drawing the rest down until it has been through hole 65, and now cut off three feet from that. Similarly cut off three feet again when the wire has passed through hole 69, and the same after holes 73, 76, 80 and 86, and take what is left on until it has passed through the smallest hole, filing the point again whenever necessary. The various lengths that have been cut off make a total of twenty feet, but there should still be three feet left, and after this piece has been drawn through the last hole (90) it will have extended to about twice that length, for wire stretches rapidly when it is drawn out fine.

Including what remains of the original coil, you now have a small stock in nine different thicknesses, but the wire has been made hard in the process of drawing, and in order to wind it up easily into small spiral coils (as illustrated in Fig. 27) you must now soften it. This is done by heating it with a soft flame from a blow-pipe until it is faintly red, but if you attempt to do this while the wire is lying loose you would be pretty certain to melt it, especially in the case of the finer sizes.

In order to avoid any risk of that kind, the length of wire must first be wound up into a comparatively large coil, say about two inches in diameter, and care must be taken that it all fits closely together. When you have got one piece neatly coiled up, bind it with a short length of iron binding wire, so that it forms a compact ring with no loose ends or loops. In Fig. 37 a coil of fine wire is shown on the charcoal block (g) bound ready for softening. Now heat this with the soft blow-pipe flame as described on p. 89, on the charcoal block or on the soldering was illustrated on the same page, until it shows a *faint* redness, and be sure that it is evenly heated all round and all through. It is not necessary that it should be red-hot everywhere at the same moment, but unless it is heated to about the same degree in every part it will not be evenly softened.

This is called annealing. Treat all the pieces you have drawn down in the same way, and then cool them in water, and unwind and remove the binding wire. The silver wire which, when you coiled it round was very springy, will now remain a close coil, with no tendency at all to unwind itself. The next process is to wind the wire round steel rods so as to obtain small coils like the one in Fig. 27, but if this is done without taking a necessary precaution, it would be almost impossible to get the coil off the rod when wound tight and close as it should be. First, therefore, cut some narrow strips of thin tough paper—ordinary MS. paper will do—but it must be thin. The strips should be about a quarter of an inch wide, and six or eight inches long. Moisten one of these and wrap it spirally round the largest steel rod,* No. 40 (I.S.G. No. 12, easy). To do this properly requires a little practice, as the wrapping must be close and quite smooth, and the edges must not overlap too far or else there will be too much thickness of paper.

Let the turns of the spiral be from right to left. The easiest way is to place the moistened strip of paper on the palm of the left hand, with the end resting on the first finger. Put the end of the steel rod down on the corner of the paper, so that the angle between the rod and the strip of paper is about 30°. Then roll the rod on the paper between finger and thumb, backwards and

* Useful sizes for these are given at the end of this chapter.

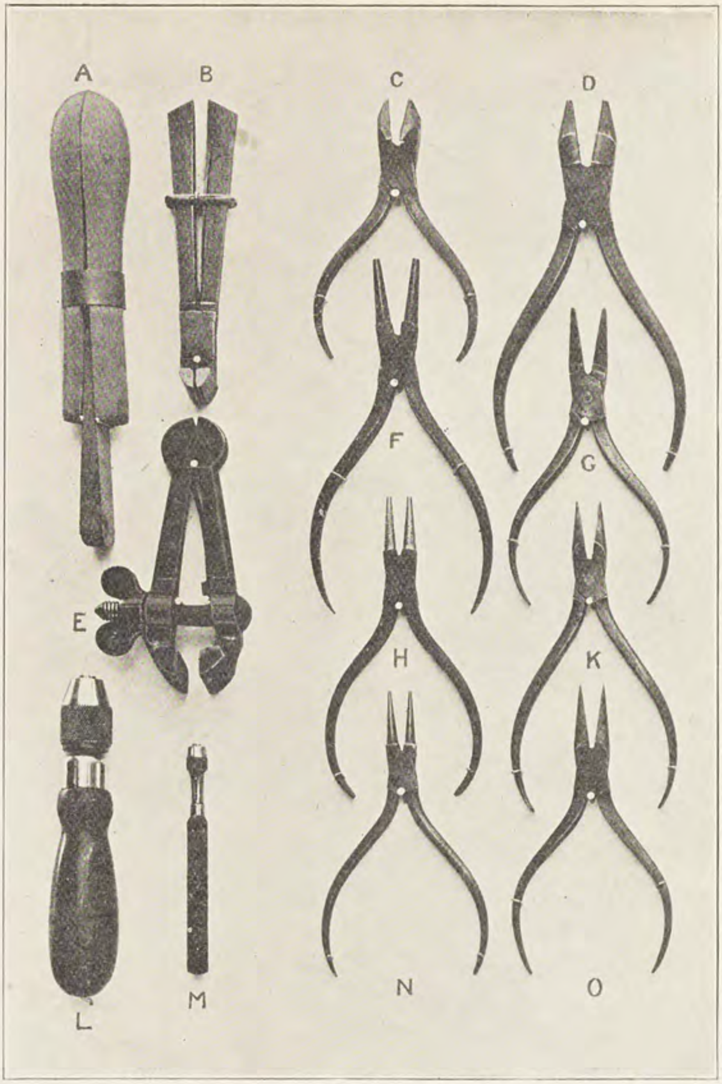


FIG. 40.

A. Wooden Clams.
B. Lancashire Slide-tongs.
C. Skew Nippers.
D Tapered Bell-pliers.
E. Hand-vice.
G. Smooth Flat Pliers.
K. Snipe-nosed Pliers (blunted).
O. do. do. (pointed).
L. Universal Holder.
M. Pin Tongs.
F, H, N. Round-nosed Pliers, 3 sizes.

forwards, until the paper begins to wrap itself round the rod, and continue the spiral wrapping until three or four inches of the rod are covered, when it can be kept fast with a few turns of the finest iron binding wire,* and the loose end of the paper can be torn off.

Now curl the end of your No. 18 (I.S G.) silver wire with the round-nosed pliers (Fig. 40, H) until the curled part will only just slip over the end of the rod where it is covered with paper. The silver wire must be curled from right to left, in the same way as the paper, and when the end has been started with the round-nosed pliers as described, and slipped on to the end of the steel rod, they must be gripped together with the big flat-nosed pliers (Fig. 40, D) and turned round while the loose part of the silver wire is held tight, so that a few turns of this are made round the rod. These will now keep together while secured in the universal holder (Fig. 40, L), if you have one, or if not in a hand-vice (Fig. 40, E), or failing that in a pair of clams (Fig. 40, A).

The steel wire generally used as a core for making coils is sold in 12-inch lengths, and its thickness is measured by the twist-drill steel-wire gauge (Fig. 38, F), the size of each wire being indicated by the number of that hole in the gauge into which it fits.

The sizes required for this exercise are Nos. 40, 46, 50, 54, and 58. See Appendix C., Table II.

* See Appendix A., p. 264.

CHAPTER XVI.

COILING WIRE FOR MAKING RINGS AND GRAINS.

It will now be an easy matter to complete the coiling, with the universal holder (or substitute) in the right hand and the wire in the left. The reason for coiling the wire from right to left will now be apparent, because it permits the rod to be turned in the easy and natural way, that is to say, from left to right. There is also another important reason, which is, that this keeps the screw of the universal holder chuck tight, whereas if the winding was done in the opposite direction the chuck would always be coming unscrewed. If the paper had not also been wound on from right to left it would now have had a constant tendency to unwind and get loose.

In order to wind the wire tightly round the steel rod, it must be kept well strained, and this cannot be done without something firm to pull against. A simple and efficient arrangement is an ordinary smooth brass cup hook, screwed into the edge of the table or bench just in front of where you sit. The pressure of this must not come against the paper wrapping, but against the last few turns of the silver wire which have already been wound. Then, as the coil advances, it can be supported all the time by the cup hook just below the straight part of the wire, which is held in the left hand and kept tightly strained. All that the right hand has to do is to turn the rod round and round so as to continue the coiling.

The value of this arrangement will be appreciated fully when the smaller coils are made, for then the steel rod is itself only a very slender wire which is quite easily bent, and it is therefore unable to resist the pull necessary to stretch the silver wire tight unless it is supported just where the pull comes. But the arrangement described is equally necessary in the case of the larger sizes too, for the thicker silver wire naturally requires a stronger pull to wind it closely round the steel rod. Care must, however, be taken not to strain the silver wire *too* tightly, especially when it is a thin wire, or else the paper wrapping will be cut through, and then there will be great difficulty in getting the coil to come off the rod.

The rings into which this first coil will presently be cut up are not likely to be wanted in large numbers, so it will not be necessary to make a long coil ; $1\frac{1}{2}$ inches should do. When this is done, cut off the rest of the wire and anneal the coil you have just made, exactly as it is, on the rod. The paper will burn away, and now the coil will slip off quite easily.

Coils of all the other sizes of wire which you have drawn should now be made in the same way, care being taken to use a steel rod of the right size in each case, according to the table (p. 272), in which the sizes of the silver wires and the steel rods are given according to their plate or gauge numbers, and in decimals of an inch. It is much less confusing if both can be measured with the same gauge, and although the I.S.G. only gives an approximate indication of size, still for merely making sure as to which is which, such measurement is near enough, if a micrometer gauge (Fig. 38, D) is not at hand.

A short length of the second coil (No. 46 rod) will be enough—say 1½ inch as the last—but from 2 to 3 inches had better be made of all the others.

When all the coils have been made, they must be cut up into rings, and the most accurate and reliable way of doing this is with the piercing saw (Fig. 41, G). That, however, is a rather slow and tedious job, and it is usual, when the rings are going to be melted into grains, to cut them with snips (Fig. 42, A), for if care be taken it is quite possible to cut them in that way with sufficient accuracy. The essential thing is to keep the flat side of one blade of the snips close against the end of wire left by the last cut, otherwise the part cut off the coil is likely to be less than a complete ring.

FIG. 41.

A. Sliding Callipers, or Sliding Gauge.

B. Steel Square. C. Straight Steel Burnisher.

D. Small Repoussé (or Chasers') Hammer.

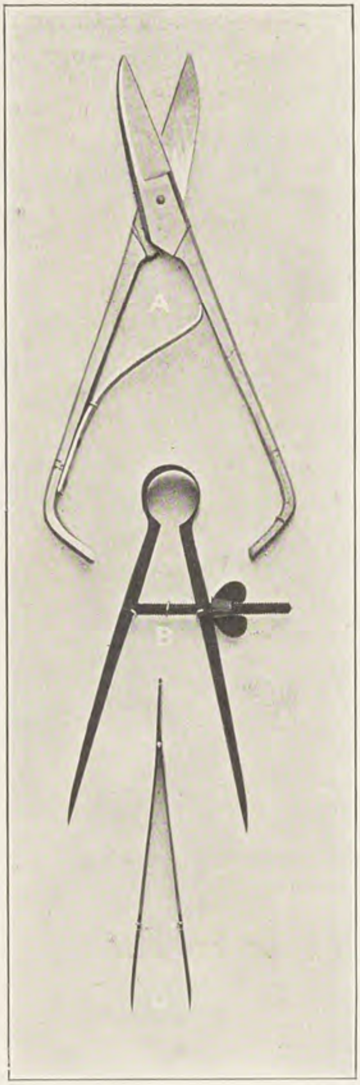
E. Large do. do. do.

F. Jewellers' Hammer. G. Jewellers' Piercing Saw.

H. Spitsticker. K. Sparrowhawk.

L. Bullsticker. M. Flat Scorper.

N. Lead Cake. O. Horn Mallet.



When the rings are going to be soldered together as part of an ornament, they must be cut with the piercing saw, for if the snips are used the cut ends will not be flat, and so the joints will be liable to show. A very fine saw should be used (No. 00) in order not to reduce the size of the ring unnecessarily, and in order, too, that the cuts may not be jagged, as they would be if a coarse saw was used.

For holding the coil firmly while the rings are being sawn apart, which is a troublesome matter, the beechwood clams are useful (Fig. 40, A. Take the wedge out

FIG. 42.
A. Dentists' Snips (straight).
B. Spring Dividers.
C. Tweezers.

of the clams, slip the coil in across one end, and put back the wedge at the other end, so that the coil is gripped securely, but not pinched out of shape. The clams can now be held firmly against the edge of the bench (steadied by the filing pin (Fig. 43) if you have one), while the coil is sawn down one side. Be very careful not to cut right through the coil to the other side, and, as soon as you have cut through a few turns, pull away the rings with the tweezers, if they have not already fallen out of themselves. The board-pin is fitted into a slot cut in the front edge of the bench, so that the sloping end projects forwards at right angles with the bench.

FIG. 43.
Board-pin or filing-pin.

Take care to keep the rings separate, according to their sizes. Small round tin boxes with glass lids, about $1\frac{1}{2}$ inch wide by $\frac{1}{2}$ inch deep, are very convenient, and can be bought for about 9*d.* a dozen ; or empty wooden match-boxes will serve. But perhaps the most convenient arrangement is what is called a division box, *i.e.*, a shallow box divided up into a number of small square spaces.

Each box or division should have a label pasted on to it with the sizes of silver wire, steel rod, of the ring itself, and of the grain resulting from this ring when melted. The small amount of time occupied in arranging and keeping little things or this kind methodically is afterwards saved over and over again. Any pieces of coil not cut up into rings when made should be kept in the same box with the rings cut from it, in order to save the trouble of measuring the next time it is wanted, for the difference in size between one coil and another is slight enough to make confusion very easy

The coils made of wire numbered 20, 23, and 25 I.S.G. will be used for making grains, and these may be cut up with the snips (Fig. 42, A), so long as due care is taken to cut the rings of the full exact size by keeping the cut end of the coil close to the flat side of one blade of the snips each time; otherwise the rings will be slightly less in size than they should be and the grains will be sure to vary.

The snips must have sharp points, or they will not do for cutting up small coils. These, however, can often be cut quite well with a pair of ordinary strong nail scissors. Of course the cutting up of coils with snips or scissors is more easily done if very fine wire is used, this being wound into coils of correspondingly larger diameter, and then there is also less danger of the rings varying in size; but it is not quite so easy to melt them into grains if the wire is very fine and the ring comparatively large. Not by any means that the thin wire does not melt easily, but that it is apt to divide and form into two or more grains, instead of only one, when the ring is comparatively large in diameter and is made of very thin wire.

In order to make the grains as nearly spherical as possible, small hollows the size of the grain are made in the charcoal block with a ball punch, and the rings, when melted, are caused to run into these. But if the ring is comparatively large, then, when melted into a grain, it is apt to run anywhere rather than into its own hollow. If grains are made on a flat surface of charcoal instead of in a hollow, the side on which they rest will be quite flat. Sometimes this does not matter, or is even an advantage, as, for instance, when they are to be hammered in order to make discs ; but for making clusters it is very important that the grains should be as nearly as possible spherical, so that it may not matter which side is uppermost.

If you have not got ball punches of the right size for making the hollows in the charcoal block, these *can* be made with the grains themselves ; but then it is not very easy to regulate their depth, and, if they are too deep, they will not answer their purpose properly. The hollows should not be deeper than half the thickness of the grain. If they are made with a grain which has been melted on a flat surface, care must of course be taken to make the hollow by pressing the *rounded* side of the grain into the charcoal. The hollows should be about three-eighths of an inch apart, and those for the different sizes of grains should be kept quite separate, a group of, say, twelve hollows for each size being neatly arranged in rows. But do not make a number of hollows until you have ascertained the right depth by experiment.

Use a gentle flame of moderate size for making grains, so as not to burn away your charcoal block unnecessarily, and remember that the silver should melt instantly when the inner tongue of flame touches it, and that a very little wind is all that is necessary to make the flame melt these small rings quickly. Probably it will appear to be a slow business at first, but after a little practice, grains of medium size should be made at the rate of from 150 to 200 an hour, including the preliminary stage of making rings.

CHAPTER XVII.

THE PROCESSES OF SOLDERING AND PICKLING.

ONE result of melting standard silver is to turn the surface black, and before the grains can be soldered together they must be cleaned by immersion in "pickle," *i.e.*, weak acid. An old kitchen teaspoon will be useful for this, especially if the handle is bent so that the bowl of the spoon will remain level when it is laid in a small vessel containing the pickle.

The vessel may be of fireproof earthenware, but those usually sold for the purpose are made of copper, and are called "boiling-out pans." The copper gets gradually corroded away by the acid, but on the other hand the fireproof earthenware vessels are liable to get broken, and they must not be exposed, as the copper ones may, to a strong, sudden heat; so it is a matter of choice which kind of vessel you use.

For silver work the usual pickle is made of sulphuric acid (vitriol), and it must be handled carefully.* The student who is beginning jewellery work only needs to have quite a small quantity at a time, say 4 ounces or even less,

* If any of the strong acid gets on the fingers, they must instantly be washed with plenty of clean water to avoid burns.

and it should be kept in a stoppered bottle. Measure half a pint of water (10 fluid ounces, see Appendix C, p. 273), and pour *into* this about half an ounce (4 tea-spoonfuls) of sulphuric acid. Of course it would not do to use a teaspoon for measuring the acid; for this purpose you will need a small measuring glass.

Remember particularly that the acid must be poured *into* the water; *never* the other way round. The process of mixture generates heat rapidly, and even four teaspoonfuls of sulphuric acid will make half a pint of water warm when poured in, while if water were poured into the acid there would be an explosion which might even blind you.

Now put the old teaspoon containing the grains into the pickle, and they will soon get quite clean and white; or, if the pickle is made hot, the cleaning will be almost instantaneous.

When the grains have been well rinsed in clean water in order to remove all traces of acid, they will be ready for soldering together.

You will now need some borax, either in the crystal or, which is better, in its compressed form as sold for jewellers (Fig. 44, M); a piece of slate, or one of the rough stoneware saucers which are made for the purpose (Fig. 44, N); a small water-colour paint-brush, and some silver solder.

Get the best quality hard silver solder, rolled fairly thin—say, No. 4 or 5, Metal gauge,

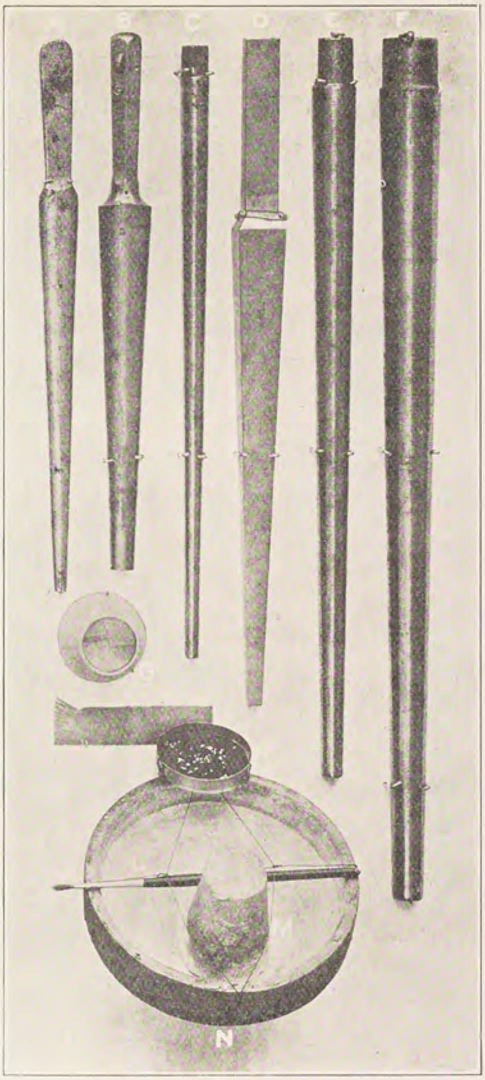


FIG. 44.

A. Thin Oval Triblet.
B. Thick do. do.
C. Small Round do.
D. Square do.
E. Med. Round do.

F. Large Round Triblet.
G. Eyeglass.
H. Strip of silver-solder showing method of cutting.

K. Box-lid containing solder cut up ready for use.
L. Borax Pencil.
M. Compressed Borax.

N. Borax Saucer.

i.e., equivalent to No. 28 or 30 I.S.G., of which half an ounce will last a good while. Cut off a strip about half an inch wide, and cut a series of slits up one end of this, each slit being about one thirty-second of an inch from the next one, and let the slits extend as far up the strip as you can easily cut at one stroke (Fig. 44, H). Then cut across these slits close to the end of the strip, so as to obtain a number of minute oblong pieces of solder (Fig. 44, K).

In order to prevent these from being scattered about and lost as they are cut, the strip is held between the thumb and the side of the middle finger of the left hand in such a way that the end of the strip presses against the ball of the first finger of the same hand while the bits are being cut off, and, after each stroke of the snips, all the bits which have been cut off are found lying on the ball of the first finger, from which they should be transferred to one of the boxes (Fig. 44, K) mentioned on p. 105.

It is better not to expose them to the air unnecessarily for any great length of time, as, if they become tarnished, they will not solder so easily or so surely.

Now take a piece of borax, and having moistened the slate with a little water, rub that with the borax until you have produced a white cream, which must still be fairly liquid. Take up some of this with the brush and apply it to the grains where they are to be soldered together. This will presently help the solder to melt and to unite with the silver, acting as a flux, and in the meantime it keeps the grains in contact.

Now take up one ot the little bits of solder on the tip of the brush, which is just moistened with borax-water, and transfer it to the nick formed by the two grains where they touch each other. Touch it again with the borax brush so that it may have a coating of borax water all over it, and it is now ready for the flame.

Apply the heat gradually, because, if the moisture is evaporated too rapidly the solder is likely to be displaced, but if this should happen moisten the solder again and put it back into the nick.

The grains must now be heated on the side remote from where the solder is, because this will get hot much quicker than they can do owing to its being such a minute thin fragment, and, if it is made ready to melt before the surrounding parts have reached the same temperature which the solder has attained, it will melt into a round grain, sticking perhaps to one or other of the larger ones, but not uniting them. The heat therefore should be conveyed to the solder *through* the parts which are to be united. This is also desirable for another reason. When solder melts, it will always have a tendency to run in the direction of any adjoining part which is hotter than itself.

When no adjoining part is hotter or hot enough, it will, as I have just said, gather itself together into a round grain. Therefore the thing to aim at, is to make the parts which are to be united hotter than any other place, so that, when they are so hot as to cause the solder to melt, it will have a natural tendency to run in between them and unite them.

From what has been said it will be evident that if one of the grains is allowed to get hotter than the other, the solder, when it melts, will be likely to spread itself over the hotter one without reaching the other at all.

It is very important to remember *that*, whatever it is that you are soldering.

CHAPTER XVIII.

MORE DETAILS ABOUT SOLDERING.

THE process of soldering should never be hurried, but, on the other hand, the heat should be got without unnecessary delay. The surface of the charcoal block will get red immediately, and the heat that is reflected from this is most useful.

Another important thing is to keep up a certain amount of movement, either of the flame itself, or of the charcoal block on which the work is resting. That reduces the likelihood of one part getting unintentionally hotter than the rest. In cases where the bits of solder are unavoidably liable to catch the heat of the flame too soon, then as soon as they are beginning to get too hot, they must be given time to cool a little by moving the flame off them for a second, and some of the heat is then drawn from them by the natural attraction of the larger pieces of metal which are in contact with them.

It is well to try and understand the reasons of these things from the beginning, even if much of their application will only come with more advanced work, because each scrap of knowledge of this kind makes it easier to account for the failures which must occur at first, and an understanding of the probable causes of failure makes the accompanying discouragement much less trying. Moreover, with these ideas in the mind, a habit will be implanted of steering clear of dangers unconsciously, and that will be especially valuable later on, when in more complicated work there are many other things to be watched and remembered at the same time.

In connection with the use of silver solder another point should be mentioned here. The small proportion of brass which it contains in order to enable it to melt at a lower temperature than standard silver, is injuriously affected by long exposure to heat ; for brass is a mixture of copper and zinc, and zinc is a volatile metal, that is to say it vaporises into gas and burns away when a certain temperature is reached and maintained long enough. If this is allowed to happen, the solder will no longer melt at its proper temperature, and that is why, if the solder begins to glow with heat before the surrounding parts are hot enough, it must be given a second or two to cool a little. Also the small quantity of lead which is often contained in silver solder has an objectionable power of eating away silver with which it remains in contact at a high temperature.

In order to prove this, put a bit of solder on a silver grain, and melt it very slowly by heating it gradually to a dull red without increasing the temperature enough to melt the solder, until it has been exposed to the heat for some little time. Afterwards clean it in the hot pickle, and you will probably find that the solder has eaten away a little hollow in the silver. Similarly, if a joint which has been silver-soldered is afterwards exposed to the action of the blow-pipe flame too much, while other joints are being made near it, it will become spongy or porous, owing to the formation of tiny holes where particles of zinc have been burnt away.

Apart from being careful not to continue the heat too long, there are two ways of avoiding this last trouble. The previously made joint may be painted with borax-water, in which case the solder will "flush" or "run" again and be uninjured; or if this cannot be allowed for fear of the pieces that have been united coming apart again, the old joint may be coated with a paste of jewellers' rouge and water or loam and water, which if it is fairly thick, will prevent the heat from attacking the solder. But no rouge must get near the spot where the new joint is to be, or else the solder will not run properly, and it is best to wash away all the rouge with water, after the soldering is done, before putting the work in the pickle, as this would be spoilt by the rouge.

The beginner who has read through these

somewhat detailed recommendations connected with the use of the blow-pipe flame and of silver solder, may perhaps feel rather bewildered with such a multiplicity of directions and cautions, and I do not recommend him to do more than just read them through at this stage ; but, having done so, when difficulties and failures occur later on, he will perhaps have a vague recollection that there was something bearing upon the difficulty he has encountered, and then will be the time to re-read these passages more carefully in the light of his experience. The index at the end of the book should make it quite an easy matter to turn up the particular passage, of whose existence the student has been reminded by some difficulty which he has encountered in his exercises.

CHAPTER XIX.

CONSTRUCTIVE USES OF GRAINS AND CLUSTERS.

To return, then, to the first exercise in soldering, that of uniting two grains.

As soon as this has been accomplished successfully, it should be repeated at least a dozen times. Then try and add a third grain to some of the pairs. You will probably find that the third grain sometimes gets united to one only of the other two, instead of to both.

A close examination of Fig. 22, p. 55 (especially if you look at it through a magnifying glass), will show you that this has happened in several of the clusters, and that the appearance of the cluster is thereby considerably spoilt. The last cluster but one in the top row illustrates this point clearly. In this group the four grains ought to form a symmetrical lozenge shape, but the solder which unites the lowest grain to the others has run all to one side, and has carried the grain with it, so that it leaves an ugly open joint on the other side, and disturbs the symmetry of the arrangement. This, and the many other similar defects in the other clusters, resulted simply from hurrying the process of soldering, in consequence of which the grains were not all of them evenly heated at the moment when the solder melted—that is the essential point.

In a series of examples like those illustrated in Figs. 22 and 23, these defects are not of any serious consequence ; they are indeed useful as object lessons of things that must be avoided, but in ornaments that are intended for use they would not only be a constant eyesore, after they had once been detected, but would also seriously impair the strength of the object.

Grains are very often used in jewellery almost as much for constructive as for decorative reasons. Take for example the quadruple ring in Fig. 25, p. 63, in the lowest row but one. The four rings are joined together by being all soldered to alternating rings of beaded wire, with which they are in contact where they broaden out in front, and similarly at the back, where the points of contact are more extended ; but if they were separate everywhere else there would be an undue strain on these joints, and the ring as a whole would feel springy and weak. In order to give it a satisfactory feeling of rigidity, it is important that all the grains which are used to bridge across the spaces, should be securely soldered to both of those parts which they touch. Apart altogether from their constructive value, these grains also give this ring its characteristic individuality.

The same remark applies to the ring next above the latter in the illustration, and perhaps most of all to the one in the middle of the top row. Here the four settings which hold the precious stones are soldered together so as to form a central band across the front of the ring, but this band depends for its attachment to the rest of the ring on the eight beads which form the connection. Of course the settings might have been soldered directly to the beaded wires which terminate the ends of the hoop, but then those six dark spaces which help so much to make the design interesting, would have been mere pin holes, and they would moreover have been in considerable danger of being filled up with solder, owing to their smallness.

Now look for a moment at the filigree cross in Fig. 11, p. 28, and take note of the constructive and decorative value of the grain clusters at the angles of the cross. It is difficult to decide from which point of view they are most essential; and yet, closer examination shows that here it is the decorative value which is on the whole the most essential. For the cross is pretty strongly constructed in itself, and might hold together without the grain clusters—but not so the design—and, further, it looks as if the grains were not quite perfectly joined to the cross in one of the angles, and in contrast to this how very much even the appearance gains where the connections are obviously sound and perfect.

As a final instance of grain clusters which are absolutely essential from the point of view of strength, I must refer to the chain in Fig. 90, p. 245. The triple link whereby chain and pendant are connected, and the twin links through which the twisted ones are threaded, would probably not stand a single month's wear and tear, if it were not for the grain clusters filling the angles between the rings which form these links. Therefore it is most necessary that these clusters should not only be securely soldered to the parts which they connect together, but also that each grain should be perfectly united to any other grains with which it may be in contact, so that there may be no weak place anywhere.

To do this securely is not especially difficult. The difficulty consists in doing it perfectly ; that is, in making the connection absolutely secure without using an undue amount of solder, and that is one reason why the solder is cut into such tiny pieces. The size and thickness of these varies considerably according to the thickness and size of the objects to be united, and, if there is a considerable bulk and weight of silver to be heated through, the solder must be correspondingly thick, so that it may not melt prematurely. However, in these first exercises we are dealing with small objects, some of them minute, and as the tendency of beginners is generally to use too much solder, it will be well to aim at using the smallest quantity which will suffice.

When a few of the twin clusters have been successfully converted into triple ones, the next stage is to learn how to make these latter at one soldering. Moisten three separate grains with borax-water so that they remain in contact on the charcoal block, and place a somewhat larger bit of solder than those you have hitherto been using in the hollow at the centre of the cluster. Dry up the moisture carefully, and then direct a gentle, silent flame as nearly as possible vertically, downwards on to the cluster in such a way that this is altogether enveloped in flame. Watch the solder carefully to see that it does not get heated too quickly, and keep up a slight movement to ensure the three grains being all heated to the same extent.

When the solder melts it should spread evenly into all three of the joints between the grains, and unite them together quite securely. If it does not do so, it must be for one of the following reasons : (i) the amount of solder used may not have been sufficient ; (ii) the solder may have been displaced by the evaporation and expansion of the borax-water ; (iii) the grains may have become slightly separated by this same cause ; (iv) the heat may have been too sudden ; or (v) unevenly distributed ; or (vi) too slow, causing the solder to perish.

CHAPTER XX.

DEVICES FOR MAKING CLUSTERS OF GRAINS.

A FEW trials will probably enable you to see which of the reasons given in the previous chapter accounts for any failures you may have, and a few more should enable you to avoid failure, when once you have determined its cause. Don't be satisfied until you have made at least a dozen clusters of three grains quite perfectly. You will very soon use them all up and wish you had made more. All other clusters or groups are best made from groups of two or three, previously soldered together, with the addition of single grains afterwards where required; for more than three grains are not easily united, at one soldering, in any required arrangement. They have a way of moving into different arrangements when the solder is in the act of melting. They will even sometimes roll around each other and mount up into a pyramid, by force of capillary attraction, if the flame is kept on them a moment too long. But when a large group is made up of several twin or triple clusters, and it is only a case of soldering these clusters together, there is no great difficulty in avoiding these troubles. It is, however, important to remember to paint the previously made solder-joints with borax-water, before uniting them with new ones, so as to avoid the risk of burning the solder in the first joints (as described on p. 116).

The cluster in the middle of Fig. 22, formed by three triple clusters leaving a hole in the middle, and the last example in the same plate, which is made up of seven triple clusters, are both quite easily made in those two stages, but it would be extremely difficult to make either of them at one soldering. Again, even the group of four grains in the middle of the top row in the same plate, which looks so very simple, is not at all easy to make in one soldering, though it comes readily enough when two previously soldered pairs are placed alongside and are then united into one cluster.

Rings of grains, such as those in the second and third rows, are also much easiest made out of a number of twin clusters with the addition of one single grain where odd numbers are to be used. If such an arrangement requires the use of a good many twin clusters, it is best to make a shallow circular groove in the surface of the charcoal block, either with dividers or with a ring punch, but only just deep enough to keep the grains from rolling about. Such a groove is not likely to be exactly the right size to take just the full number of grains to be used without leaving any space over, but that does not matter so long as the space that is left is not considerable.

All the pairs are soldered together, except where the space is left, and when they are cool this space is closed up by carefully bending the ends of the string of beads together, after which the last joint is soldered. Similarly, if the groove is slightly too small so that a grain has to be omitted, one open space is left, and this is then gently opened until there is just room enough for the last grain. As a matter of fact, large rings of beads are usually made as described on pp. 72, 73, but the above method is useful for small rings composed of comparatively large beads, when the rings are still too large to be made passably true without some guide to keep the grains in the right curve.

The clusters of grains in Fig. 23 are, all of them, first made as in Fig. 22, and then smaller grains are soldered to these groups, either singly or in twos, threes or other arrangements, as may be required. The methods employed are for the most part those already described, but where clusters of grains of *varying* sizes are soldered together, it must be done in a slightly different way.

In such cases it is generally desired that the large grains should stand up above the smaller ones, *i.e.*, that the grains should all be about level at the back, or else that the large ones should project beyond the small ones equally before and behind. Whichever effect is desired, it is best to do the soldering in this case, as indeed in almost all cases, from the back; and so, when the cluster of large grains has been made and cleaned ready for the addition of the small groups, it is pressed down a little way into the charcoal block with the flat end of the tweezers until the small clusters, when laid against it on the charcoal, will touch the large grains at the right level.

This method of pressing the work down until it is partially embedded in the charcoal, is also sometimes useful for keeping several small parts in place during soldering, but, unless they are very small, trouble ensues from the expansion of the metal when heated, because the charcoal does not expand, and so, when the metal is heated, there is not enough room for it in the hollow which contained it when cold. Consequently it rises up and the arrangement may be completely disturbed, and all the little bits of solder will then most probably have been displaced.

CHAPTER XXI.

MAKING AND USING DISCS AND DOMES.

THE next stage consists in making clusters like those shown in Fig. 27, p. 65, and, in order to do this some of the large grains are

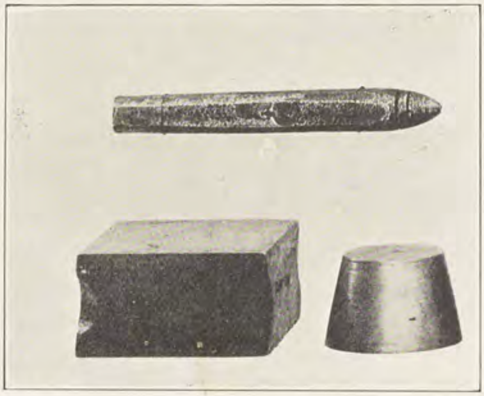


FIG. 45.
A. Round Cutting Punch. B. Flat Stake.
C. Cup- (or Bell-) pattern Troy Weight, used as a triblet for setting rings true.

hammered flat. A few sharp strokes of the hammer while the grain rests on the polished surface of the flat steel stake (Fig. 45, B) are all that is necessary. Take care, however, not to hit the stake itself with the edge of the hammer, or it will get dented, and any such marks will be reproduced on the silver discs themselves if they happen to be lying on the dents when struck.

The face of the hammer should be parallel with that of the stake when the grains are struck, so that the upper and under surfaces of the discs (into which the grains are converted) may also be parallel. A disc whose surface slopes down to one side never looks well. Also such a disc is not likely to be truly circular in outline, as the sloping surface proves that one side has been made to bulge out unduly, by being hammered more than the other parts.

If the discs show a tendency to split at their edges while being hammered down, as they will do sometimes, this shows that they will not stand so much hammering without an intermediate stage of annealing. If this annealing is done before any sign of a split appears, the hammering may be continued so as to increase the size of the disc, while at the same time its thickness is still further diminished.

It is not very easy to solder the edges of these discs together without allowing any of the solder to "flush" on to the flat tops, which seem to have a peculiarly strong attraction for the melted solder. However, if the precautions given above (pp. 113—116) are carefully observed, it can be done; but it is best to solder from behind whenever possible, and for this reason the discs should be examined before they are soldered, in case they look better on one side than on the other. Then, provided that the best surface is always turned downwards, it will not matter so much if the solder does happen to spread over the upper surfaces of some of the discs, because these surfaces will eventually be at the back.

When a disc is to be soldered on to the top of a cluster, as a centre of a small group for example, it is best to melt a little solder on to one of its flat surfaces, so that the solder spreads out nearly all over that surface. Then put some fresh borax-water on to it, and place it where it is desired to fix it, with the soldered face turned downwards, and warm the whole mass carefully, keeping the heat off the disc itself as much as possible, or else the solder on this will not adhere to the parts below. The lower part must be made the hottest, so that it may draw the solder down when it melts.

For making thin discs, circular steel cutting punches (Fig. 45, A) will be required, and some sheet silver and something to punch it on. The best thing for this purpose is a cake of zinc, or of bronze, which should not be less than half an inch thick—preferably twice that thickness—and 3″ × 3″ × 1″ is a handy size. But such a cake of metal has to be specially cast for the purpose, and, though it is convenient to have one, yet for punching a few small discs such as are now required, all that is necessary is to protect the surface of the steel stake with an old halfpenny which has got worn quite smooth, the coin being laid down on the stake with a pinch of modelling wax between in order to keep it from moving about. On this, discs can be cut perfectly well, even out of comparatively thick sheet silver if required, and, as "coppers" are really made of very hard bronze, one will last a long time.

The steel stake itself, though very frequently wanted, is not absolutely necessary if an old flat-iron can be found. This will make a good substitute, if it is mounted between two stout pieces of wood of equal width, rather broader than the projection of the handle of the iron, and about the same length as the iron itself. They should be fixed together by a couple of long screws, or, better still, bolts, so that one board is on each side of the handle of the iron, which is thus supported between them on their edges, with its bottom turned upwards. If this surface is not bright, rub it well with fine emery cloth.

Any fairly solid piece of iron or steel will do for hammering grains, etc., upon, so long as it has a smooth flat surface, which with emery cloth can soon be polished.

Where it is an object to minimise noise, the stake should be laid on a leather sand-bag (Fig. 46, B), or on some loose sand in a box or tray, or even on a thick pad of folded newspapers, by which means the sound is effectively deadened and greatly mitigated.

"Straw pads," made of corrugated straw-board coiled up into mats, are also sold for this purpose.

Here it is perhaps necessary to say that the small silversmith's hammer, which ought to have a perfectly smooth and brightly polished face, must *never* be used for striking steel punches, unless with the side. Any ordinary hammer will do, and is all the better for being rather heavy. A big repoussé hammer is, perhaps, the most convenient if you happen to have one (Fig. 41, E). It is best to give the punch a number of rather light taps, taking good care to hold it firmly in one place, but swaying it slightly first to one side and then to another, so that after a circular mark has been made, the actual cutting through is done, as it were, bit by bit rather than all the way round at once.

In order to convert the discs into domes or cups they are laid one at a time in a hollow in the doming-block (Fig. 46, C), into which they will just drop fairly easily, and they are then driven down into the hollow with the hammer and a ball-faced- or doming-punch of suitable size. A large doming-block is rather expensive, but a jeweller very rarely needs the large hollows, and if the block has only small hollows, its cost is

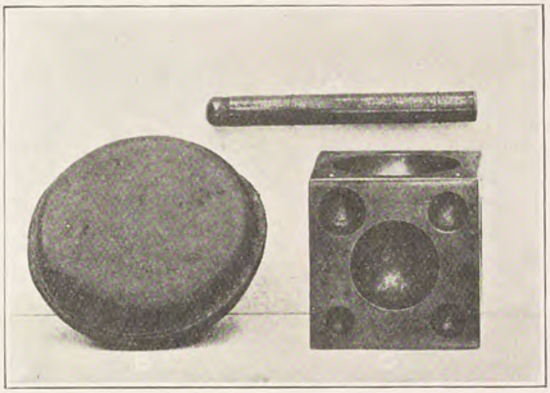


FIG. 46.
A. Doming Punch. B. Sand-bag.
C. Doming Block.

very much reduced. Moreover, thin discs can be domed quite well in hollows made with hammer and punch in a cake of lead (Fig. 41, N), or even a piece of wood if it is pretty hard.

CHAPTER XXII.

MORE DETAILS ABOUT MAKING WIRE RINGS.

Assuming, then, that a fairly complete stock of all these different circular forms has been prepared, each form being repeated in a considerable variety of sizes, the next step will consist in uniting some of them into pairs and threes, in order to facilitate the composition of designs by experimental arrangements.

In dealing with the rings, each one must first be carefully set, so that its ends are brought close together until they press against each other, care being of course taken to preserve the perfect circle of each ring. In the case of the smaller ones, a plan that answers very well is to put them on the flat stake, and press them down one by one with the broad flat end of the tweezers until the ends of each ring are in one plane (when cut off the coil, each ring formed part of a spiral), and then to close the ends together, gently but firmly, with the snipe-nosed pliers. But the closing must be done by giving the ring a slight squeeze with the pliers, first across one way and then across the reverse way, for otherwise it will be liable to get squeezed out of shape. If it once begins to lose its circular form it will yield suddenly to the pressure of the pliers, and double up and be wasted.

The larger-sized rings should be closed by gripping them flat-wise near their cut ends with two pairs of snipe-nosed pliers, by means of which the ends are easily brought together in the same plane. All those rings which are to be reserved for use singly must have their joints soldered at this stage ; but great care must be taken not to use more solder than will just fill the joint nicely. If there is too much solder, it will, of course, make that part of the ring thicker than it ought to be, and will spoil its shape. The solder can be filed or cut away, but that is troublesome, and the effect will not be nearly so good as if the amount which is used is only just sufficient. When the soldering is done, a further element of variety may be obtained by lightly hammering some of the rings on the flat stake, so as to make their upper and under surfaces flat.

In the illustrations of ornaments constructed out of circular forms (Figs. 28, 30, 31, pp. 69, 73, 74), some of the rings are larger in diameter than admits of their being conveniently made by coiling a length of wire round a steel rod, as described on p. 99. Theoretically, there is no limit to the size of rings which can be made in this way, though for any except the small sizes already treated of, *steel* rods are not essential, tubes of brass, copper, or iron being nearly as good; but the jeweller does not, as a rule, want enough of these larger rings for it to be worth his while to make many of them at once, or to keep such a variety of rods or tubes as would be necessary to meet every emergency.

The usual method, when only two or three are required, is to bend a piece of wire with the pliers, or, if it is large enough, with the fingers, so as to ascertain the exact length necessary for the required ring; to cut this off, file the ends flat, and solder them together; and to leave the final perfecting of the circular form until after this has been done. This final adjustment of shape is called "setting," or "truing," and in order to set rings of varying sizes, most jewellers have several tapered mandrels or triblets (Fig. 44, A to F).

One of the objects, however, of these elementary technical chapters is to enable beginners to learn how to make simple ornaments with the most limited and inexpensive outfit of tools, and tapered mandrels or triblets are rather costly.

One small triblet is almost necessary, but for those who must observe strict economy it is generally possible in a town of any size to pick up a few second-hand cotton-spinners' spindles for a trifling sum, and they will serve very well. These and many other most useful odds-and-ends can often be found on the barrows of hawkers who ply a trade in tools in the poorer quarters of most big towns on Saturday nights. An old steel "heckler's tooth," though less often found, is also very handy to a jeweller. It is simply a piece of the best round steel squared at the butt end, and evenly tapered down to a fine point, the total length varying from five to nine inches (Fig. 37, K).

In order to "set" a ring true after it has been soldered, it is slipped on to the triblet (or substitute) as far as it will go, and this is then laid flat on the bench so that the butt end, which is held in the left hand, projects over the edge of the bench from the place where the ring binds. The ring is thus pressed against the edge of the bench while the triblet is rotated, and the ring is tapped with a mallet, and encouraged to slide along the triblet until it fits this closely all round. It is then truly circular, and is slipped off.

If you want to "set" a ring which is larger than your triblet, there are various substitutes. Perhaps you may have a "sparrow-hawk," which is a sort of miniature smith's anvil, made as small as four or five inches long (Fig. 41, K). One end of this is roughly tapered round, and, although the ring will not fit it like it does the triblet, it can be set true by tapping it while it is slowly revolved, at the place where the curve of the sparrow-hawk is the same as that of the required circle. Bell-shaped Troy weights

(Fig. 45, c) are also very useful. Failing either of these, you may find it possible to make shift with the handle of a pair of pliers or some other tool, but for a ring measuring say $\frac{3}{4}$-inch or more in diameter, a more reliable method is to spring it on to a disc of sheet brass, or copper, or iron, and anneal both together, after which the ring will retain its circular form when taken off the disc. Halfpennies, pennies, and washers are all useful for this purpose, or you can strike a circle of the required size on a piece of fairly thick sheet brass, and afterwards cut and file it to this line.

This method is very useful for other shapes, such as ovals, heart-shapes, etc., which you are likely to want as you progress to more advanced work, and it applies particularly to slender wire rings or frames. Thick ones can be set with the pliers, which are then used to straighten or to bend the wire according as it is curved too much or too little in different places. But when annealing a slender ring or frame, on a disc or otherwise shaped piece of sheet metal, you must remember that the sheet metal will expand as it gets hot, and that this and the surrounding wire must be heated evenly, or else the expansion of the former may burst the ring.

If you are making a ring of beaded wire, like those shown in Figs. 28, 30, 31, take care that the wire is properly annealed before you bend it. As sold, it is generally quite hard, and when bent in this state, the nicks between the beads make it very liable to break.

Unless the wire of which a comparatively large ring is formed is very thin indeed, its ends can be made to press close against one another while they are being soldered, just as was done with the small ones, except that it may first be necessary to close up the ring a little until the ends pass each other, and then spring it open until the two ends are pressed firmly together. But if the wire is so thin that this is difficult, it may be secured to the charcoal block with a few ordinary pins, so that the ends are kept properly in position. The pins should not be too near the joint, or they will be liable to get melted, or the solder may stick them to the wire.

All jewellery which is built up out of a number of separate pieces soldered together needs "boiling out," from time to time, in hot pickle, so as to remove the borax, and to restore a perfectly clean surface to the silver. When a joint is soldered, the borax melts into a kind of yellowish glass, which is so hard, that if you try to remove it with a file, this will be spoilt, but it is dissolved very quickly by hot pickle. Boiling out does not improve the silver, so that it should not be done oftener than is necessary, nor should the process be continued after the borax has been removed. Generally a minute is long enough ; but as soon as the pickle has done its work, the silver will have assumed a dead pearly white colour all over, and then it should be well rinsed in clean water so as to remove all traces of the acid. If a second joint has to be made very near to a previous one, boiling out is advisable before the second soldering, because if a nick is already full of vitrified borax, it is obvious that there will be no room there for solder as well.

CHAPTER XXIII.

ON THE DRAWING OF FLAT WIRE.

In Chapters X., XI. and XII. I treated of the variety and beauty of designs which are within the reach of a jeweller, even if he restricts himself to the use of circular forms only, such as grains, discs, domes and rings. But fortunately there is no necessity for imposing any such limitation, though it is true that it does stimulate the invention, and that it ensures a sense of unity in the designs that are produced.

Now, however, let us consider what other shapes can be made out of short bits of wire, and because it is easier for bending, and because, too, the objects made will thus have a pleasanter and more interesting appearance, let us use flat wire instead of round. So long as we have suitable draw-plates it is just as easy to make wire whose section is oblong, or square, or triangular, or half-round, or oval, as it is to make it round.

There is no special advantage in always drawing your own wire, but when you want some of a size you have not got, it is often very satisfactory to be able to draw it at once yourself, instead of having to put up with the interruption and delay of getting it from a dealer, who also may not have any of that particular size or section in stock. In any case the beginner should at least draw enough wire to realise how much it is possible to do by hand, and just how to do it.

Although silver is nowadays very much cheaper than it used to be, it is still a great deal too expensive for any ordinary craftsman who works on a small scale, to keep a stock of it, in sheet and wire of all sizes.

From time to time stout wire will be wanted in small quantities, perhaps round, perhaps flat, at other times half round, or it may be square or triangular, so that if the stock of spare silver has to be a modest one, it is best to have a length of round wire of say No. 12 I.S.G. for such purposes, and to cut pieces off this for drawing down when required.* The round wire can soon be hammered either flat or approximately square on the steel stake, or if it is to be half-round or triangular, it may be quickly hammered into a groove of the right shape filed across a suitable solid piece of iron or brass, and then, if you have the necessary draw-plates, you can soon convert a piece of it to the particular size and section which you happen to want. However, if you know beforehand definitely just what jobs you are going to do, it will be decidedly more economical to buy the silver in the form and size

* A length of No. 12 I.S.G. standard silver wire weighing one ounce (Troy) would measure very nearly two feet.

in which you are going to use it, if your own time is of more than very slight pecuniary value. Wire which is really stout cannot be drawn by hand, and in a fully equipped workshop there will be a draw-bench for drawing it by mechanical means, and similarly a flatting mill for reducing the thickness of sheet. But these technical chapters are intended more particularly for the help of beginners, who have very few tools, and none that costs more than a few shillings.

Draw-plates are among the most expensive of these, but I will assume that you have three of them, two for round wire and one for flat wire. The largest of those for round wire (Fig. 38, G), should have two rows of holes, and should draw wire from No. 12 I.S.G. (No. 41 on the draw-plate), to No. 19 I.S.G. (No. 60 on the draw-plate).

The second plate (Fig. 38, K) which follows the one last mentioned, has three rows of holes and draws the wire from No. 19 I.S.G. to No. 27 I.S.G. (No. 90 on the draw-plate). The third plate (Fig. 38, H), has two rows of holes for flat wire from 12 × 17 I.S.G. to 19 × 24 I.S.G.

Wire which will just pass through the largest hole in the first plate, *i.e.*, No. 12 I.S.G., is about as thick as can be comfortably drawn by hand and then only if it is annealed first.

Draw-plates are commonly described by the shape of their holes, as for example, round, flat (or oblong), square, half-round or triangular, as the case may be, but the plates themselves are generally rectangular and oblong.

If you cannot afford to buy the three plates above-mentioned, they are not absolutely essential, even to the practice of the exercises in making simple ornaments out of wire, which are explained in this book, because any dealer will supply you with the wire ready for use in whatever sizes you need it.

For the following exercises you will want a considerable quantity of flat wire, of say 19 × 24 I.S.G. size, and for the sake of economy such exercises may very properly be carried out in brass or copper.

You will, however, want to use silver in the more advanced exercises, for many of the objects may be used later on as the bases of complete pieces of jewellery. But the results of the earlier exercises should be kept for future reference, on the sampler principle, so that it would be unnecessarily extravagant to use silver for these.

Roughly speaking, if a certain length of copper wire costs 1d., the same length of silver wire would cost about four shillings and fourpence.

Whatever metal you are going to use, the wire will be produced and worked in the same sort of way, and one of the most natural methods is to take a few feet of stout flat wire, measuring in width and thickness about 12 × 17 I.S.G., and to draw it down to the required size. This method is necessary if you are wanting one of the larger sizes of flat wire, say any of the sizes given by the first three or four holes in your flat-wire draw-plate (Fig. 38, H), and it is the obvious method to adopt if you have a supply of stout flat wire in stock. If you have no stout flat wire, you can soon flatten some round wire by hammering it on the steel stake. No. 13 I.S.G. round wire, when hammered flat, should go through the first hole in the plate for flat wire; but try a short piece first, in order to make sure that it is right, and, if it is still too large, draw the wire down another hole or two before flattening it.

You will naturally avoid drawing down the wire unnecessarily small while it is still round, because there will be a greater length of it to hammer flat. If you begin with flat wire which just fills the biggest hole, it will have been stretched to about six times its original length when it has been pulled through all the holes, down to the smallest one.

Another plan often adopted when flat silver wire is wanted, is to cut a narrow strip off a piece of thick sheet; but that can only be done with big shears, and even then it is far from easy; and moreover, a beginner, if he had any sheet of the necessary thickness, would probably only have quite a small piece, which would not provide a long enough strip to be worth the trouble of drawing down.

Yet another alternative, that of casting a slender ingot, is also beyond the scope of the beginner.

It is quite possible to draw flat wire from a piece of ordinary round wire which has not been flattened at all, but very great care has to be taken in the early stages to avoid twists, for after a piece of round wire has been pulled through one flat hole it is flattened so slightly that it is quite likely to turn when pulled through the next hole, and if this happens it will probably break later on. Even if it does not break the wire will probably be useless wherever such twists occur.

The easiest way to prevent twists, and to keep the wire from getting entangled, is to make it pass between two pieces of wood, between which it is fairly tightly pinched, at a distance of a few inches from the back of the draw-plate.

CHAPTER XXIV.

HOW TO DISCOVER UNITS OF DESIGN.

ASSUMING that the wire has now been drawn down to the right size, and carefully annealed (see page 96), the next thing is to cut it up into short pieces, all of exactly the same length.

There is a useful little engineer's tool called a sliding gauge (Fig. 41, A), which combines the functions of a short measuring rule with those of inside and outside callipers, and, if you happen to have one of these, all you need do is to set the sliding arm, so that it leaves the end of the rule projecting by exactly the length to which the wires are to be cut; and then you hold the flat wire on this projecting end of the rule, with your left thumb, so that the end of the wire presses against the sliding arm where it crosses the rule, and then you cut the wire with the side-nippers (Fig. 40, C), working them against the end of the rule.

A very simple makeshift appliance can easily be devised to serve the same purpose. Take two flat strips of fairly stout sheet metal, equal in width, and see that their ends are square and smooth. Then bind them together with fine wire, so that one piece projects beyond the other by the exact amount that the pieces of wire which you are going to cut ought to measure, and use it as described above. The exact size of the strips of metal for this appliance is unimportant, but what is commonly known as brass tape $\frac{3}{8}$-inch wide by $\frac{1}{16}$-inch thick is a convenient size to hold, and one piece might be 5 inches long and the other, say, an inch less. The only really important thing is that the ends should be filled carefully, so as to be truly at right angles with the length. Otherwise the projecting end will vary in length at different parts of its width. If you have a small steel square like that illustrated in Fig. 41, the thin blade of that will provide one of these slips.

A long length of wire will be easier cut up into short pieces if it is first divided into moderate lengths of, say, three or four feet each, and if these are firmly stretched with two pairs of pliers, until they are perfectly straight and free from any tendency to curl up. They can then be laid flat across the bench or table, under a book or other moderate weight, to prevent the wire from shooting away each time a bit is cut off, as it would otherwise do. In order to straighten wire by stretching, it must first be properly annealed.

A convenient length for the bits of wire

Fig. 47.
Gold Brooch, set in silver frame, with coloured glass inlay.
Anglo-Saxon. Found at Faversham.
British Museum.

Fig. 48.
Gold Brooch, set in silver frame, with coloured glass inlay.
Anglo-Saxon. Found at Faversham.
British Museum.

FIG. 49.
Gold Pendant, set with garnets and coloured glass inlay. Anglo-Saxon. Found at Faversham. British Museum.

which have now to be cut, in order that they may be bent into units, is thirteen-sixteenths of an inch. That may seem an arbitrary and unnecessarily precise measurement; but when once the sliding gauge, or its makeshift substitute, is set, there is no more trouble about it. However, there is probably no special virtue in that particular length, and I give it merely because when I cut my wire into lengths in order to make the units illustrated in a later chapter, I happened to choose a length which subsequently proved to give that measurement.

And now, when the wire has been cut up into equal lengths, let us make from these pieces as many different forms as we can by bending the wire with pliers.

FIG. 50.
Gold Pendant, set with a garnet and coloured glass inlay. Anglo-Saxon. Found at Faversham. British Museum.

At the first attempt it may not seem possible to think of very many, but, by carefully watching the action of the pliers when making those forms which at once occur to the mind, almost endless variations will gradually suggest themselves. Three or four of the most interesting of these appear in Figs. 47 to 51, inclusive, and a close examination of other antique jewellery and of traditional peasant work will frequently result in the discovery that such simple little forms as these have played quite an important part in the design.

FIG. 51.
Gold Brooch, set with garnets and with coloured glass inlay. Anglo-Saxon. Found at Dover. British Museum.

Examples of this appear in Figs. 8, 18, 25, and 89. But the same forms recur again and again, and they are much more often used just as a filling for backgrounds than as units out of which to build up patterns. Looking at them from this latter point of view, many variations which when taken singly appear too incomplete to be worth consideration, may yet, if repeated and used in conjunction with other forms, prove to be not only admissible, but even to be of the greatest value as material for pattern building.

CHAPTER XXV.

THE METHOD OF CURLING WIRE INTO SCROLLS.

Now take the small round-nosed pliers (Fig. 40, N) and curl the ends of some of the wires, and bend them into all the forms you can think of, making regular stages in the bending, so that the results vary in evenly-graduated sequences, the pliers being turned each time through, say, 90°, *i.e.*, through one right angle, that amount being easily gauged by the eye. In some cases, no doubt, the difference may seem too slight to be regarded as a fresh form, but in others half that variation, or even less, will be found to be well worth recording. Generally speaking, the degrees of variation should be smallest when the form is mainly composed of straight lines. But do not let yourself be bound by rules in these matters. Use your own judgment, only, always prove to yourself by experiment that it is correct. Thus, when you feel uncertain whether a variation is worth recording, make three or four duplicates, and place them one against another in different ways, and you will know directly whether the form in question is a useful one or not.

When you have made all the forms which the round-nosed pliers will give, and have exhausted, for the time being, any suggestions of ideas which may have been aroused in your mind by the action of the pliers or of the wire, it will be time to begin using a pair of flat-nosed pliers, and it will be best to take the snipe-nosed ones next (Fig. 40, K). If you have two pairs of these, take the larger pair with the blunt ends. If you could not buy any with blunt ends, select the pair whose ends are the least pointed, and gently rub the ends on a piece of F.F. emery-cloth while this is stretched over the flat stake, until the flattened ends measure one-sixteenth of an inch across. To do this the closed pliers must be held quite vertical, so that the ends may be ground square and true. Very little pressure will be required, as the emery-cloth cuts keenly.

Now practice rolling up the ends of some of the wires into close scrolls, as shown in Figs. 52 to 55 inclusive, having first curled them round through two right angles with the round-nosed pliers. It requires a lot of practice to make close scrolls perfectly, and unless they are almost perfectly made they will never look well, their essential characteristic being that they are *curled* not *bent*. In order to achieve this, the preliminary curl, given with the round-nosed pliers, must now be closed in very gradually by a number of rather gentle squeezes, each one of which takes effect on a slightly different part of the wire. The first squeeze (Fig. 52) must reduce the size of the *outer* half of the curl, so that the end begins to turn towards the straight part of the wire, after which it will be found

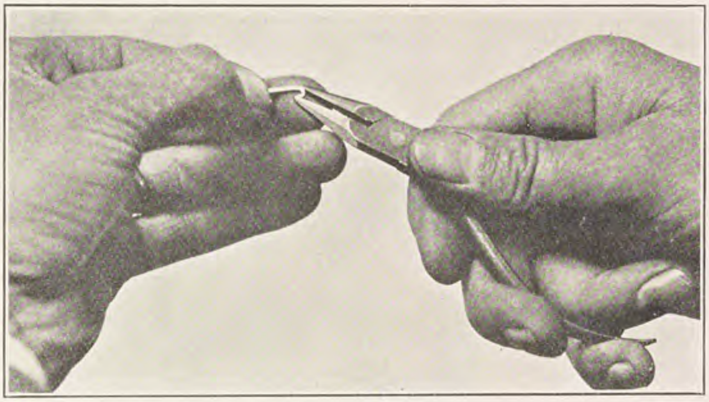


FIG. 52.
Curling Flat Wire into a Close Scroll.

possible at the next squeeze to grip a smaller bit of the end of the curl, until it is almost doubled round, and the closing in of the extreme end is completed at the following squeeze (Fig. 53), when a still smaller bit is gripped. The end of the wire should then appear as shown in Fig. 54.

These first stages are the important ones, and if they are successfully accomplished any further scrolling is easy. But the danger is that if you exert a very little too much pressure at first, the wire will *bend* instead of curling, and then your scroll will be hunchbacked.

In order to avoid this danger, each of these early stages must in reality comprise several distinct squeezes, and for each squeeze the

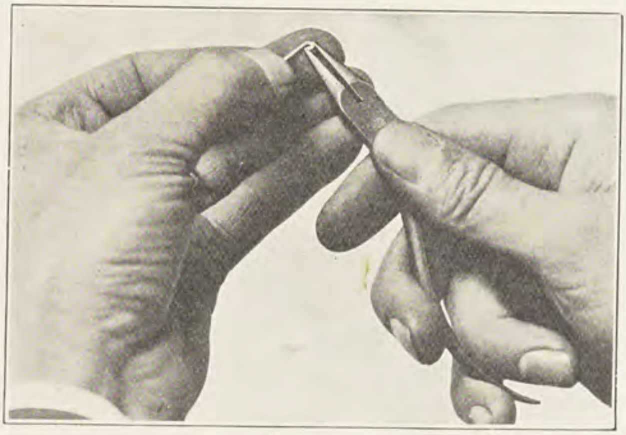


FIG. 53.
Curling Flat Wire into a Close Scroll.

position and grip of the pliers must be very slightly varied. Thus, to alter the end of the scroll from the form shown in Fig. 52 to that represented in Fig. 53, there should be three distinct stages, after each one of which the scroll is gripped with the pliers afresh, and each time it must be a slightly smaller piece of the curl which is gripped.

When the squeeze, for which Fig. 54 shows the preparation, is exerted, it will be observed that it has the effect of causing the scroll to *roll*

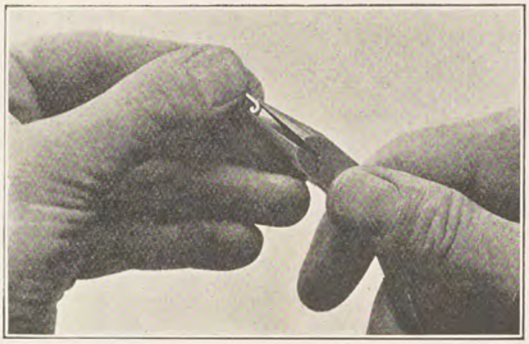


FIG. 54.
Curling Flat Wire into a Close Scroll.

itself up tight into the form shown in Fig. 55, after which, any further curling that may be desired, is done by gripping the scroll as shown in that illustration, and then by pulling the pliers round

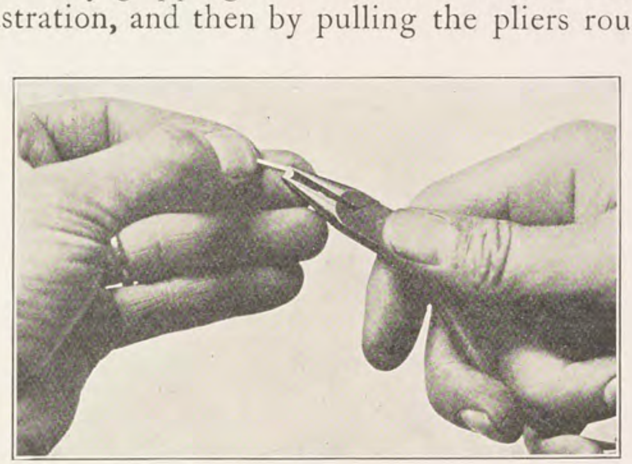


FIG. 55.
Curling Flat Wire into a Close Scroll.

towards the left hand, while the rest of the wire is securely held between the left thumb and forefinger.

When you have succeeded in starting a few scrolls without "breaks" or sharp bends, continue the curling until the wire is completely rolled up into a neat spiral. This will prove how far the first stages were successful, for the finished spiral cannot look perfect unless it was begun right, and you will be able to see at once whether the line that divides one fold of the wire from that next to it, forms a true spiral or not.

CHAPTER XXVI.

AN ALPHABET FOR JEWELLERS.

In order to appreciate fully the importance of this process, on which I have laid so much stress, it will be well at this point to look ahead for a few minutes, and to examine Figs. 66 to 69 attentively. Anyone who does so can hardly fail to realise that the close curling of the end of a wire, enters more frequently into the composition of those designs than does any other characteristic.

It is very probable that in making these scrolls, you will have found that the roughened surfaces of the pliers, with which you have gripped the wires, have marked these in an ugly way. If so, it will be necessary to take off a little of the roughness, by rubbing the inner faces of the pliers with emery cloth. But be very careful not to make them *too* smooth. Take off very little at a time, and keep trying the pliers until you find that they will grip the curled wires securely enough to make the scrolls, without too great a tendency to slip off, and without marking them overmuch. At their broader part near the joint of the pliers, these faces should be *quite* smooth, and it is with these smooth parts that the forms you make by scrolling and bending, can most conveniently be "set" flat when, as frequently happens, some parts project beyond the rest, sideways.

When the scrolling or bending has been completed, the forms made may be laid down on the polished steel stake (Fig. 45, B, or some substitute*), and tapped lightly with the polished face of the hammer, in order to "set" them more effectually, and to give what is called a "planished" surface to the edges of the wire, which have now become the upper and under surfaces of the units that have been constructed. But the planishing must not be overdone, because it will be repeated after the units are soldered together. They will usually be "spread" by the planishing, and will want a little closing up and adjusting with the pliers afterwards.

The student will now be able to make a very large number of different units with the two pairs of pliers so far used, and he will do well to restrict himself to these two pairs alone, until he finds himself unable to obtain any more variations with them. If, while engaged upon these exercises, he scrupulously avoids any reference to illustrations of units so made, and relies on his own invention and the experience gained from trying experiments with the pliers, the benefit derived will be very much greater than if he

* See p. 131.

laboriously imitates the forms shown in Fig. 60, or in other plates in which such units occur. At the same time he will also find the exercises less tedious and very much more interesting, if he invents them for himself as he goes on, than if he merely copies. The units should be arranged in sets, in an orderly way, as fast as they are made, and whenever a new form, suggesting a fresh series of variations, is accidentally produced, or incidentally thought of during the progress of making another set, it should be put aside by itself, as a reminder that it requires development later on.

A reference to Fig. 60, p. 173, will explain what I mean by arranging the units in "sets." Thus, taking the first line of units in Fig. 60, B, it will be seen that the first three units in this line represent one "set"; the amount of variation between each one and the next, being that given by turning the bit of wire which is gripped in the pliers through one right angle.

The variation might quite well have been slighter, in which case there would have been more than three units in that set.

Moreover, while working out that set, it might occur to one that by treating only one end of the wire, and by leaving the other end straight, or in any of the many other forms into which it could be bent, instead of treating both ends alike, a whole series of other sets become possible, in all of which there would be a family resemblance to those referred to above. It is in such a case as the one here suggested, that it is so great a help to make memoranda for future use.

From time to time one of the units should be repeated, until a little stock of duplicates has been accumulated, out of which to build up arrangements and patterns. This will provide a pleasant interlude of relaxation when the pattern-building stage is reached, and the interest and amusement of that process should supply a fresh incentive to the elaboration of other units.

In order to keep the units arranged in sets and groups so as to be convenient for easy reference, and similarly to keep records of any arrangements or patterns when such are made, it will be found a good plan to get some soft modelling wax, and to spread thin layers of this, as smoothly as possible, on, say, pieces of ordinary tinned sheet, such as the lids of cigarette boxes or biscuit tins. Stiff cardboard will do, but is not so good, as the oily moisture of the modelling wax gets gradually absorbed by it. Real modelling wax should be used rather than the cheaper substitutes, most of which very quickly stain and corrode any metal that is kept in contact with them. A twopenny stick of the best soft modelling wax can be spread out to cover about 16 square inches, but it *must* be soft, in order that it may be easily spread, and that it may retain the units in place when they are pressed down into it.

If you have access to an ordinary office copying press, that will enable you to spread the wax smoother and quicker than can be done by hand, but even then the preliminary spreading should be done with the fingers. After this it should be covered with a sheet of tracing paper which has been very slightly greased with vaseline, so that when the wax has been pressed flat, the tracing paper may come away without bringing any of the wax with it.

The units can then be arranged in rows, and kept in position by a very little pressure on each one to imbed it in the wax. Designs made by arrangements of units can be recorded similarly, or if you want to use the same units for other purposes, you can first make a permanent record of the pattern in one of the methods explained in Chapter XXVII.

CHAPTER XXVII.

RECORDING IDEAS FOR FUTURE USE.

After the units have all been pressed into the wax they can be carefully removed, one by one, with the tweezers, leaving the design impressed in the surface of the wax. This can be put away for future reference, but in that case, no further use can be made of that piece of wax without destroying the record. If this is an objection, a cast can be taken with plaster-of-paris, mixed rather thin, so that it may run into all the impressions. Or if the wax has been spread thin enough, so that when the wire units are pressed down into contact with the tinned sheet, their upper edges remain clear above the wax surface, a black carbon print can be taken on white paper by simple pressure. To do this, first spread over the pattern a thin sheet of very slightly greased tracing paper, with the greased side towards the wax. Then lay a piece of carbon paper on that, *with the black side up.* Then a sheet of clean white paper to take the print, and over that several thicknesses of blotting, or other soft paper, and finally a piece of stout cardboard. If these are all squeezed together in a copying press, a good print of the design will be obtained (see Fig. 56), but it is difficult to spread the wax out thin enough, and, unless there is something of this nature to keep the units from moving about, the pattern would be sure to get disarranged when the layers of paper were put over it, or while it was being transferred to the copying press.

In order to obviate this difficulty, the units may be arranged on any smooth, flat surface, and may then be kept temporarily in position by carefully laying down upon them a piece of cardboard or stiff paper, whose under surface is wet with strong paste or gum. Seccotine spread very thinly with a palette knife answers admirably. In a few minutes the cardboard may be lifted up, with all the units sticking to it in the exact positions in which they were arranged, if the cardboard has been well pressed down upon them. Then when the mucilage is perfectly dry, a carbon print can be taken as before, and there will be no necessity for using tracing paper now, so that a sharper impression will be obtained.

Fig 56 shows a carbon print which was taken by that method, with the help of an ordinary office copying press. A close examination of this illustration, will show that there is a very fair suggestion of the close scroll into which one end of each of the wire units had been curled. It is also quite possible to get a tolerable carbon-print record, by simple pressure with a small hand roller, but this is more difficult.

Another way of obtaining a record is to arrange the units in position on a piece of white

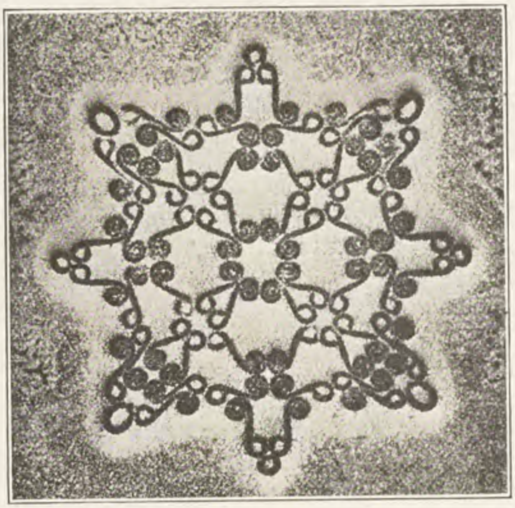


FIG. 56.
Record of an arrangement of *loose* units, made with black carbon paper.
By the Author.

paper, and then to direct a spray of ink over them, until the paper is shaded over with minute specks. When the units are removed, the design appears on the paper in white (Fig. 57), and the spray should be so fine that it actually gets through between the turns of the scrolls in places. The best way of producing the spray is with an old tooth-brush and an ordinary coarse comb, a little ink being taken up in the brush and rubbed across the teeth of the comb over the paper, and for this ordinary writing ink will do. It is, however, rather a messy job, and of

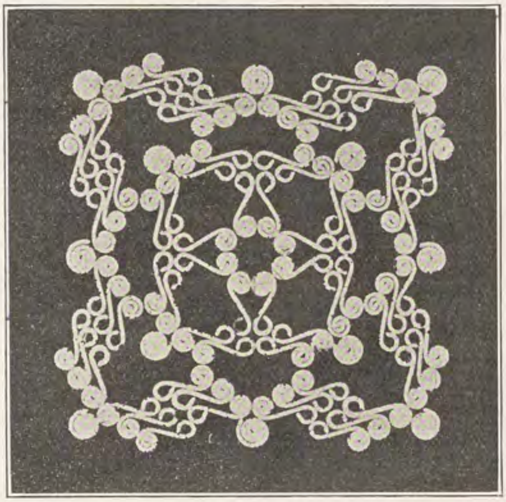


Fig. 57.
Record of an arrangement of *loose* units, made with ink spray.
By the Author.

course the units must be washed and dried after being sprayed. But, on the other hand, it is quick, effective and permanent.

It might very naturally be suggested that the simplest way of recording patterns is to draw them, but the fact is that it is really very difficult to express quickly with pencil and paper, the charm of designs built up out of the frequent repetition of one or more wire units, of perhaps rather complicated form. For it is not enough to give only the main lines of the arrangement. I have tried making rough pencil notes of these arrangements, which I have then put aside to remind me to make them up at some future time. Then, some other day, I have looked through them with a view to using them, and have wondered why I should have thought it worth while making memoranda of such uninteresting designs. The explanation really proved to be that my sketch had failed to express the charm resulting from such things as the rhythmic repetition of parallel curves, the actual proportionate relations between the width of the wires and the spaces enclosed by them, or even from the regular symmetrical disposition of a form, which was perhaps not very easy to draw correctly once, let alone a dozen or more times.

If the time required to solder the units together then and there cannot be spared, then I think the best method of recording the patterns is to keep the units in the position in which they are arranged. If the units for these trial patterns are made of brass or copper wire, the value of the material is insignificant, and, by making the arrangement on some smooth, flat, clear surface, the design can be preserved well enough by coating the surface of a bit of cardboard with strong paste, or seccotine, as already described, and then putting this surface down on to the units, and leaving it there under a weight until dry. If the units are not otherwise required they remain gummed to the cardboard as a lasting record of the design.

If, instead of pasting the cardboard it is made thoroughly damp and soft by exposure to steam, or by soaking it in boiling water, and if it is then left on the units under a heavy weight for some time, a clear mould of the pattern will be impressed permanently in the surface of the cardboard (Fig. 58). But the cardboard must be of rather a soft kind, and the weight must be very considerable. A simple press made of two smooth pieces of fairly hard wood drawn together by a sufficient number of strong screws round the edges does very well. Fig. 59 shows a record made by squeezing the loose units into soaked cartridge paper in a copying press.

It would naturally seem as if the simplest plan would be to solder each arrangement of units as soon as it was designed, but in practice I do not think that this is workable. Each arrangement that is made has a delightful way of suggesting during the actual progress of the work, variations of itself, or sometimes quite different arrangements. The units that compose the design will generally have to be soldered together into several groups or clusters first, just as was the case with the ornaments made from clusters of grains, and when these preliminary groups are ready, it will often become apparent that the design in hand is only one out of many different compositions, which these same groups will give by being turned about and associated otherwise. My own experience is that it does not do to rely entirely on the memory to preserve all the fleeting ideas that follow one another so rapidly at these times, nor even, as I have already explained, can we rely on pencil memoranda, while soldering is much too slow. And so I like to have an ample reserve ready of whatever units I am dealing with, and to make notes with these of every idea at the actual moment when each one occurs, with the least possible interruption of the work in hand, so that nothing may be lost. "Gather ye rosebuds while ye may."

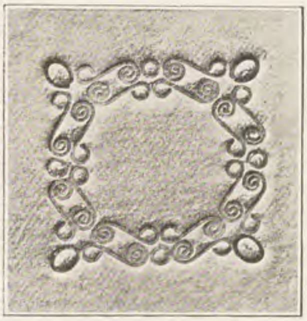


Fig. 58.
Record of an arrangement of loose units impressed into wet cardboard under weights.
By the Author.

The permanent record of all these variations need not necessarily be made then and there. If the bench gets littered with memoranda in loose units awaiting attention, so that there is a danger of their being disturbed before there is time to transfer them to permanency, they may be covered over with pieces of cardboard which are secured with drawing pins to the bench, and in that way the arrangements are kept safely enough for a time ; or a piece of glass with a thin slice of cork gummed under each corner answers the same purpose, and so it is possible to finish the

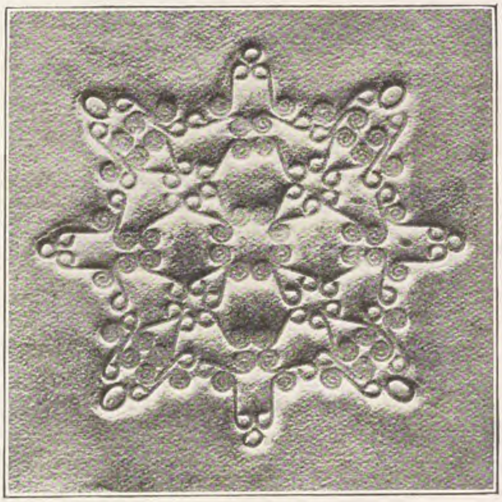


FIG. 59.
Record of an arrangement of loose units impressed into cartridge paper in a press.
By the Author.

work in hand with the minimum of disturbance, and the next day, perhaps, it may be easier to spare an hour or so, for giving the memoranda that have been made some degree of permanence by whatever method we may find most convenient.

CHAPTER XXVIII.

AN INEXHAUSTIBLE SOURCE OF DESIGN-MOTIFS.

THE fascination of that part of the subject treated of in the last chapter, has led me on to anticipate exercises which the student should hardly have got to as yet, and it is time for him to return to the completion of his alphabet of units.

After a while the want will probably be felt of the pointed pair of snipe-nosed pliers (Fig. 40, K), in order to give shorter and sharper bends than the others will produce, and equally so when the need occurs to grip the wires quite close to the scrolls or loops which have been made with the round-nosed pliers.

The larger size of round-nosed pliers (Fig. 40, F), and those with broad flat ends (Fig. 40, G), will also facilitate the growth of further variations. The latter kind are especially useful in making units such as those illustrated in the sections of Fig. 60 which are marked D and E, as well as for various other types, such as those in the fifth row of section B. All the units in section E are made by first doubling

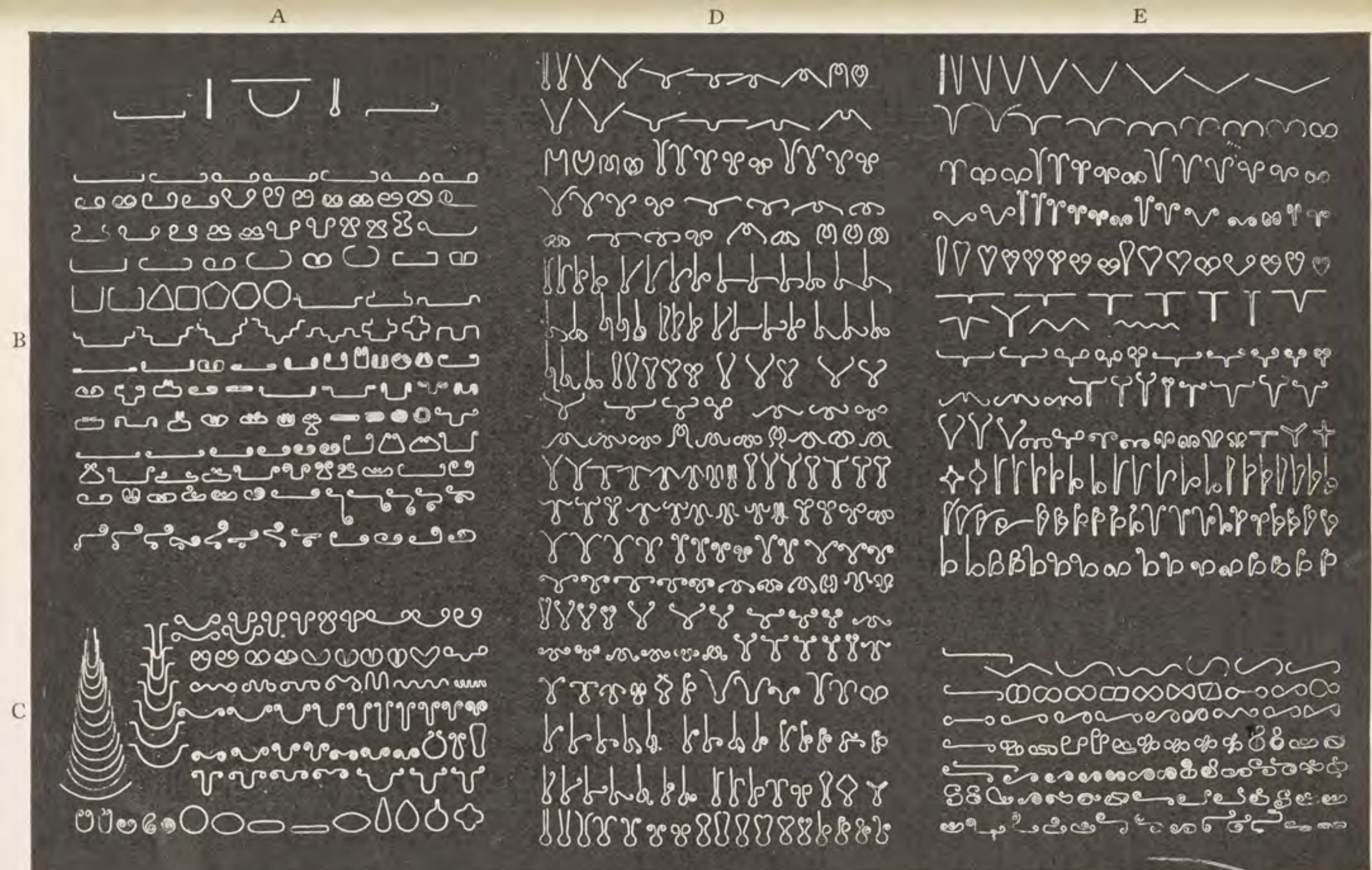


Fig. 60.

By the Author.

Seven Hundred Units of form made from wires of a given length.

the unit in half, as shown in the first example of that series, because, when this is properly done, it ensures the two parts being equal in length—an important matter in the symmetrical arrangements. Those of this type which have subsequently to be opened out to any considerable extent at the bend, may very likely require annealing so as to avoid fracture.

All the units in section D are first doubled up into the cottar-pin shape of the first example in that group, the loop at the bottom being of course obtained by gripping the middle of the wire with the round-nosed pliers, while the ends are bent round to meet each other, and they are then gradually pinched together either with the blunt, snipe-nosed pliers or else with the flat, square-ended ones. Those in the lowest row have their loops made with the larger round-nosed pliers, but in all the rest the loops were made with the small pair, and that one section of the illustration shows considerably more than 200 units which may be all described as being direct descendants of the cottar-pin form, nor do they by any means exhaust the possibilities of that one type.

Moreover, Fig. 60 does not make any claim to be in the least degree a complete series of all the possible forms which may be arrived at by these processes, from pieces of wire of the chosen length ; in fact, it is most certainly very far removed from being so. However, it contains some 700 units of form, all made from bits of wire of one and the same length and section. The variety of forms thus obtainable must to some extent depend on what pliers are used, and on the length of the wires in proportion to their thickness. Greater length would admit of more complicated forms being made, but then there would be a tendency for the simple ones to look thin and sprawly. Some exceedingly simple forms will be found very useful in practice, and so it is best to select a length of wire which, when bent into a simple form, such, for example, as a figure of eight, produces a fairly compact figure of pleasant proportions.

Some few of the forms here illustrated (Fig. 60) are decidedly difficult to make, and so are not of very much practical value, but it is nevertheless well worth while making such an exercise as this as complete as possible, as otherwise it is pretty certain that good things will be missed.

It will be seen that the forms are for convenience roughly divided into five groups or types, the distinguishing characteristics of which are expressed in Fig. 60, A, and it will further be noted that variations of these types and developments of those variations follow along more or less regular, systematic courses. This results in the same forms being arrived at sometimes by two or more quite different methods, and in such cases some of these methods will generally be much easier than others. Again, it is often quite difficult to foresee what will be the result of the next stage of bending, or what other treatments may be suggested thereby ; and, furthermore, it is not always the simple forms which occur to one first, and it is good training for the faculty of invention, to carry an exercise of this kind as far as one is able to do. I know that I for one began by doubting whether there were more than a few dozen forms to be made out of that bit of wire, and when I had made a hundred, I thought that must surely include nearly all the practicable ones. Returning to the quest later on, fresh avenues of development gradually appeared, and I would not now venture to say that the seven hundred might not possibly be increased even to seven thousand ! In any case, I am quite certain that one thousand might easily be reached. Almost all of those which are illustrated, have been made with one or more out of five different pairs of pliers, and most of the work was done with the help of only two of these.

Pliers of various kinds are among the most useful tools which the jeweller possesses, and the bending of wire into a great number of different shapes, affords an excellent way of learning how to handle them ; how much it is possible to do with them ; and how much useful knowledge of the first elements of design may be thereby acquired. To bend a piece of wire into definite shapes by means of pliers is not always as easy as it looks.

Generally there is one right way of doing it, and several wrong ways ; and by the time a student has followed out all the variations that occur to him—not laboriously copying forms that other people have made, but patiently finding them out for himself—he should not only have acquired a considerable amount of general knowledge that will be useful to him both technically and artistically, but he should also have provided himself with an unfathomable mine of ideas, to which he can at any moment refer when he wants to produce a new design.

To the casual observer, most of these little pothooks and other forms are quite obvious and uninteresting, and they are perhaps more suggestive of an alphabet of shorthand, or of a sample-card of haberdashery, than of anything else, but there are very few of them, if, indeed, any at all, which cannot be made to become the germ of a beautiful pattern. Several of them, already indicated, will be recognized at once by anyone familiar with ancient jewellery, as being very old favourites, which have done valiant service as motifs of designs for thousands of years.

But the surprising thing is that where such forms as these occur, so very few varieties have hitherto been used, and so little advantage has been taken of their readiness to compose themselves into patterns, almost without effort on the part of the designer.

CHAPTER XXIX.

THE EVOLUTION OF DESIGN FROM UNITS.

By way of demonstrating the way in which the readiness of these small units of design to form patterns may be exploited, let us select one of the simpler shapes ; say, for example, the third in Fig. 60, B, where the ends of the wire are curled round into loops turned towards each other, leaving a straight bar between them.

Let us now make a considerable number exactly like it, and let us then arrange them in clusters or groups, of two and three and four, in every variety of position that we can think of (Fig. 61).

The soldering together of groups of units is done in the same way as was described for groups of circular forms (Chapters XVII. and XVIII.). When the joints have been soldered and afterwards "boiled-out" clean, the cluster of units will probably need setting flat, as it lies on the steel stake, with a few light taps of the hammer. If any of the joints are faulty, this hammering will probably cause them to open, and if it does, they must be neatly closed and re-soldered before proceeding further.

It may perhaps be said that Fig. 61 does not carry us very much nearer to interesting designs, but if we now take a number of repetitions of any one of these arrangements, and again group those arrangements together, it will be seen from

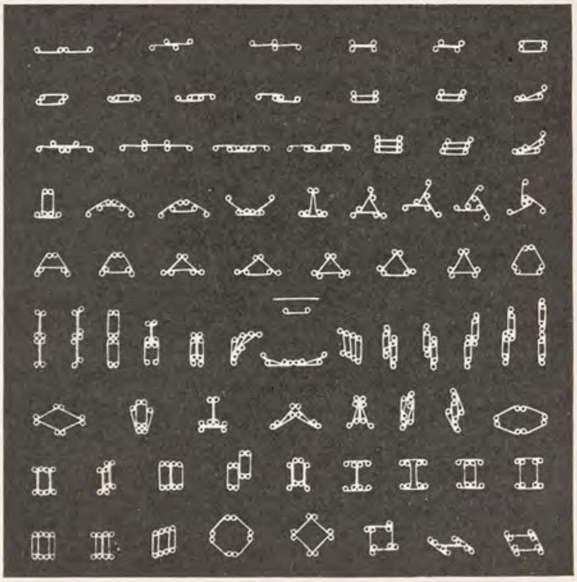


FIG. 61.

By the Author.

One selected unit arranged in sets of two, three and four.

Fig. 62 that our little unit of form begins to show us something of what it can do in the way of pattern designing quite by itself, if given a chance.

But the truth is that it is not really quite by itself, for one of the essential characteristics of these patterns is that we always have not only the units themselves, but also the space enclosed by that particular arrangement of the three units,

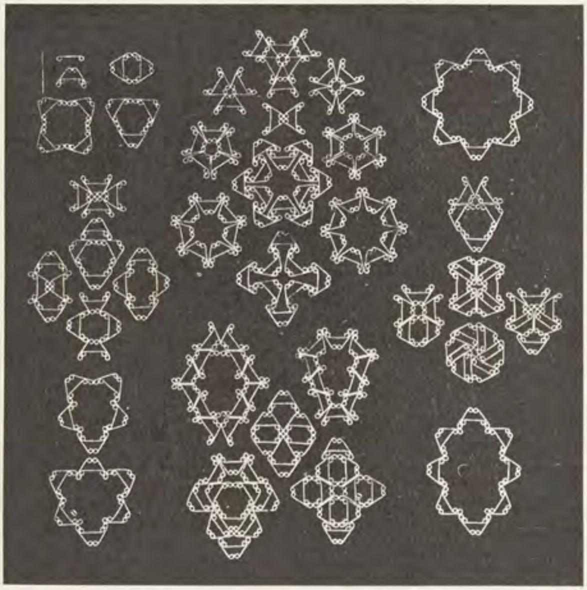


FIG. 62.

By the Author.

Designs arranged by grouping repetitions of one of the arrangements in Fig. 61.

and it is the rhythmic repetition of these units and spaces, contrasting, which makes the designs interesting. Besides which, spaces of other shapes and proportions are automatically produced and repeated, again rhythmically, as a necessary consequence ot the systematic grouping of the clusters.

It should be noted at this point :—

(i.) That the series of designs developed trom a chosen arrangement, as here illustrated (Fig. 62), resulted entirely from moving the objects about, and disposing them in groups, not from copying designs drawn on paper " out of one's head."

(ii.) That a considerable amount of variety and of interest is obtained, without using any other element of design whatevei (except spac e). How much more then might there not be, if we selected from all the other elements of design accessible to the jeweller, those best calculated to enrich, clothe, and contrast with the forms and lines so far obtained ?

(iii.) That every one or those patterns is composed solely of that particular arrangement of three of the units chosen, and that if some of the other arrangements were introduced as well, and if, moreover, the same unit was also used singly, the effect ot these patterns would be materially altered—perhaps improved, perhaps not—but certainly altered.

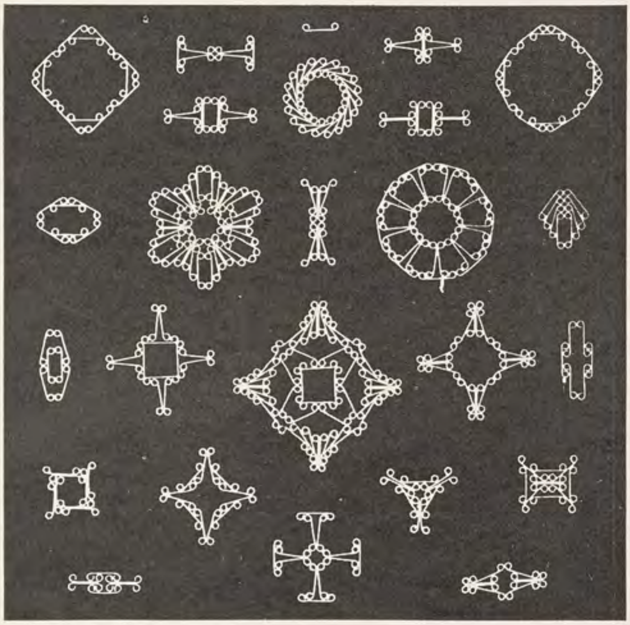
(iv.) That this method of using nothing at all but repetitions of a small group, such as the one selected, ensures the preservation of a strong sense of unity in the resulting patterns, comparable with that obtained by a painter when he limits himself to two or three colours. And

(v.) A very important point. While it

certainly imposes rigid limitations, it does actually suggest arrangements which it is unlikely that the designer would think of if he was dealing with the unit singly, instead of always in that particular arrangement ; or if he was relying upon his imagination, assisted only by pencil and paper, instead of by the visible results of experiments made with the help of units in tangible form.

Experimental trials of the effects to be obtained by the repetition of any given group or cluster of units, such as that selected for Fig. 62, may also be made in the following way. First solder together the units which are required to form the arrangement, whose utility for design you wish to test, and then solder the group on to a scrap of thin sheet metal, just big enough for it to lie on, and trim off any sheet that may project outside of the units.

Punch a small hole through the sheet wherever it covers a space enclosed by the wires of the units, and then solder a piece of fairly stout wire so that it stands up, from the middle of the sheet metal backing, to form a handle. You can then use this as a stamp, either to make impressions on a waxed sheet, or to print with on paper, and so repeat the design in any arrangement you like, experimentally. The holes are to let air in when drawing the stamp away from an impression made on a waxed surface, as this makes the wax less likely to stick to the stamp. For printing on paper, an ink pad may be used, or the face of the stamp may be blackened in a smoky flame, following the method used by bookbinders, when



By the Author.

FIG. 63.
Other Designs obtained by grouping repetitions of the same unit.

they make designs of ornamentation with the tools themselves.

It seems possible that while the jeweller takes a hint from the bookbinder, the process may also work the other way round too, and that a bookbinder wanting new designs for his punches, might find them by bending units out of wire. A craftsman can almost always learn something useful from the methods employed in other crafts,

FIG. 64

By the Author.

Further variations, resulting from the introduction of a second unit.

even when they are widely different from his own.

Fig. 63 shows a few of the designs which teem to result most naturally from employing this unit singly, and it will be seen at once that they are quite unlike the patterns in Fig. 62.

It will also be noticed that, with only one exception, these patterns, if they are analysed, show a symmetrical repetition of one or other of the groups in Fig. 61, excluding that used in Fig. 62.

Fig. 64 gives some examples in which the same unit is associated with one but slightly differing from it, the latter being also used alone in some of the patterns.

It may be useful to emphasize the fact that the designs in Figs. 62, 63, and 64 only utilize two out of the 700 units in Fig. 60, and that they only give a few of the most obvious patterns to be made by their use.

Only quite a small proportion of the groups in Fig. 61 enter at all largely into their construction, so that it is obvious that large numbers of other designs could be drawn from these same two units. Making full allowance for the probability that many of the other units in Fig. 60 would be less prolific, but remembering how much variety results from first composing a small group and then repeating it, as in Fig. 62, it is hardly to be denied that the permutations and combinations to be derived from the remainder, offer a truly inexhaustible source for designs of this kind.

CHAPTER XXX.

OF DESIGNING APART FROM DRAWING.

THOSE craftsmen who are handicapped by having no special facility for drawing, will be interested to know that not only the patterns in the last three plates, but also all the other designs I have made to illustrate this book, came about entirely from moving the units or groups of units about, and in fact from playing with them, until designs manifested themselves, and that this manifestation of designs almost always occurred directly experiments in arrangement were made with the units.

In the same way, when making the variety of forms to be obtained by bending a given length of wire, it is by trying the different ways in which the various pliers can be made to bend it, that the great majority of the shapes are suggested to the mind, and anyone who tries to draw these units on paper "out of his head," will often find that a very highly cultivated faculty of mental calculation is required, to determine whether the particular length of wire which is available, will suffice to make the forms imagined.

One has heard of extraordinarily gifted accountants, who can add up long columns of pounds shillings and pence, taking all three columns at once, instead of adding up first the pence, and then the shillings, like ordinary mortals, and no doubt if anyone who was equipped with mental apparatus of that magical description was interested in these exercises, small problems of mental calculation such as those indicated would merely provide him with a little pleasant relaxation. However, for the ordinary mind those are very real difficulties, and to ordinary people the material and the tools for working it will always be more suggestive than pencils and paper, useful and indispensable as these are. And that calls to mind a passage in that most admirable and fascinating book on *Silverwork and Jewellery*, by Mr. Henry Wilson, which, however well-known it may be, and ought to be, is so pregnant with interest in this connection, that I cannot forbear to quote it. It runs :—

"Not only does the study of methods, and the quality of materials, enable the student to give expression to an idea, it is absolutely the most fruitful source of ideas, and those which are suggested by process are invariably healthy and rational. The hand and the brain work together, and the outcome of their partnership is a sanity of conception which is greatly to seek in most even of the best work of to-day. The reason is, perhaps, that the zeal of the artist has not been tempered by knowledge. The reason of this, again, is that for more than a century the painter and the sculptor have stood before the public as the sole representatives of the Arts, and, in consequence, all the crafts and arts have been approached pictorially, even by those who practise them, as if each were only another form of picture-making. This is not wholly untrue, only the methods of the painter do not always apply in the crafts. Take as the simplest example a Rhodian ear-ring. What is it ? a rough pearl, a skeleton cube of gold wire, a tiny pyramid of beads, and a hook. What could be more simple ? Yet the cunning collocation of these elementary forms has produced a thing of beauty that cannot now be surpassed. No amount of fumbling with a pencil could ever lead to a like result. The material was there in front of the craftsman, and on the material the creative idea engendered the work of Art."

Well, that passage contains great consolation for any craftsman who is conscious of *fumbling* when he gets hold of a pencil. Let him take heart of grace, and remember that although a want of facility in drawing does handicap him very seriously, and although it is of the utmost importance that such a deficiency should be corrected and overcome by every means in his power, yet it is not *of necessity* a bar to the production of good designs.

Before proceeding to rather more complex patterns arrived at by arrangement of units, we may note how some of the old Byzantine craftsmen employed a few of these same units very

Fig. 65.

British Museum.

Gold Earrings and Pendants.
Byzantine. 6th to 10th cent.

simply in their bold filigree work (Fig. 65), and especially how rich a border they made for the thimble-shaped ornaments of their ear-rings, with nothing more than a number of figure-of-eight units, laid side by side and soldered together, a favourite device, this, of Russian peasant jewellers also.

Figs. 66, 67, 68, and 69 give some suggestions of what can be done with a few of the other units from Fig. 60, used both separately, and in conjunction with one another, though in these ornaments, as a matter of fact, there are never more than five different units in any one design. In a few instances small round or oval rings have been allowed, where they seemed to be wanted, although, of course, these were made from shorter lengths of wire than the other units.

In several cases where the pattern constructed took the shape of a frame or wreath, another smaller arrangement was placed inside when the examples were laid out for photographing ; but this does not necessarily mean that they were designed to be associated together in this way, the object having often been merely the economy of space in the photograph.

Many of these, and especially the arrangements in Figs. 62, 63, and 64, make no pretence of being much more than mere skeletons ; but they do claim to be skeletons from almost any one of which a pleasant piece of jewellery might easily be made. They are, however, flat skele-

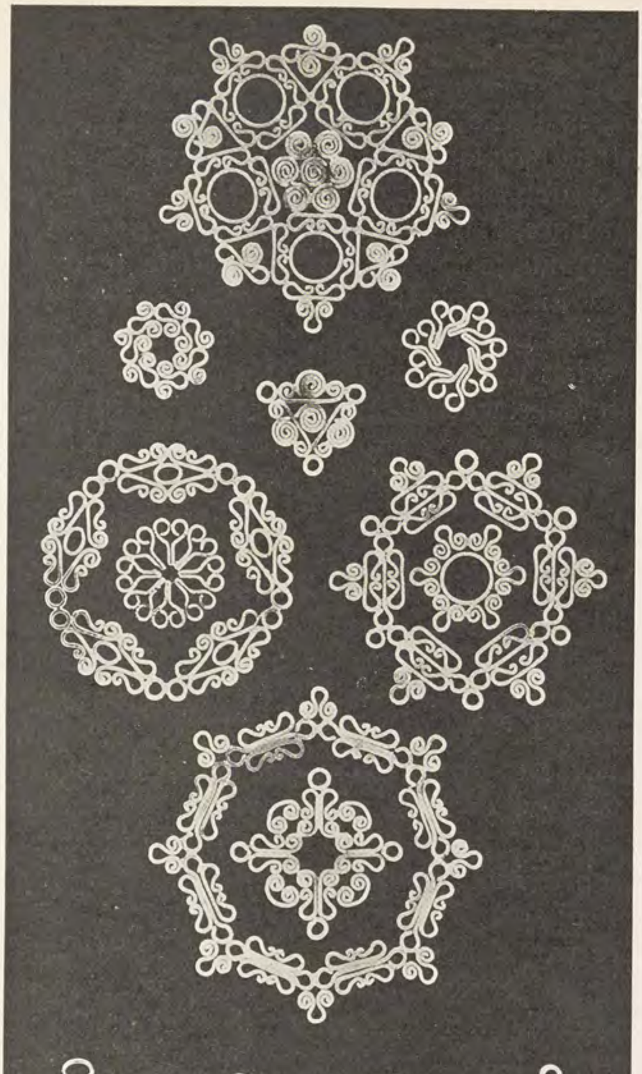


FIG. 66.

By the Author.

Silver Ornaments composed of units taken from Fig. 60.

tons, and they need the introduction of other contrasting planes, and of an element of mystery, to be obtained by occasional interruptions of their lines, and by the partial covering of their bones and joints with some of the many other forms in which the jeweller can employ the precious metals, or else with some of the other materials which are at his disposal.

In constructing the more varied ornaments up to the stage at which they are illustrated in Figs. 66 to 69 inclusive, the only units of design which have been used in addition to those selected from Fig. 60 are, with one exception, small round rings; and without going further afield than is necessary to obtain the various other circular forms, whose evolution was traced in Chapters X. and XI., a judicious use of grains, discs, and domes, in various sizes, might be made to do much towards completing them. Moreover, convenient places are generally left for the setting of precious stones by the way in which the units repeat themselves in the formation of patterns, and, in some cases, nothing more would be necessary thoroughly to knit the design together, and to provide centres or points of special interest, than a few precious stones in appropriate settings.

The flatness of these combinations of units is not at all essential to their construction, though, of course, it is easiest to solder them together when they are lying on a level surface of char-

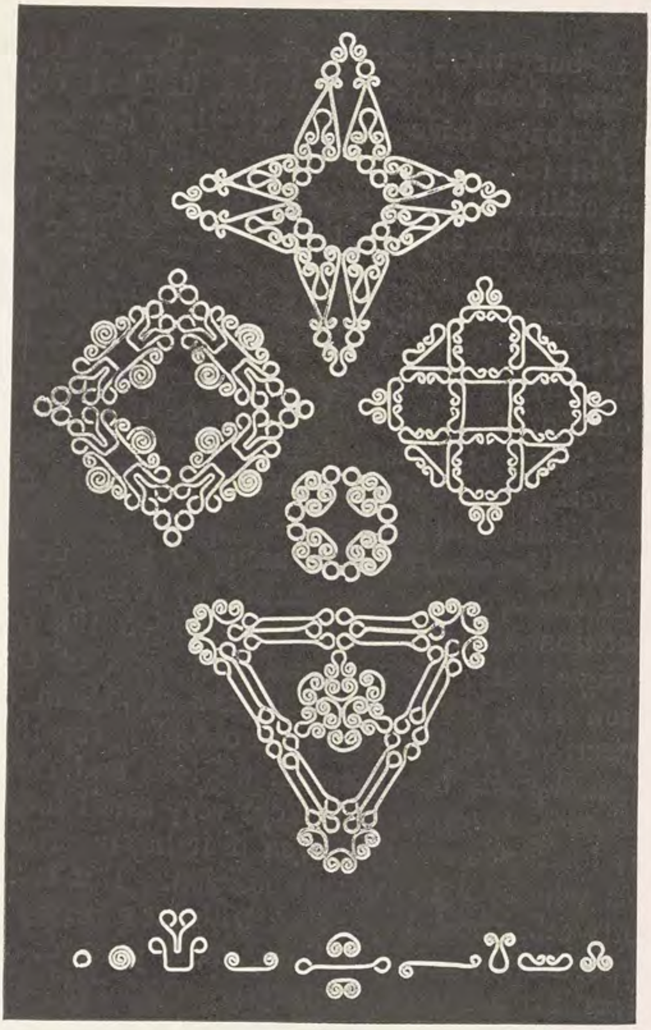


FIG. 67.

By the
Author.

Silver Ornaments composed
of units taken from Fig 60.

coal; but there are various other ways of building them up so that the finished object will perhaps have several varying degrees or relief in its composition, apart from any extraneous additions, such as discs, domes, stones, etc., which may be applied to the surfaces here and there.

Moreover, a slight degree of curvature is easily given to such objects as these after soldering, by careful tapping on the sand-bag, or in one of the larger hollows of the doming block; and it is astonishing how very much the work may be altered and improved by even a very little doming.

It will be observed that many of these designs strike the eye most noticeably, by reason of the repetition of any straight lines which the units employed may contain, and that most of those which have come out best, are strong in this respect. A design made up out of a repetition of small units based on an obvious and simple geometric form, if it is kept very small indeed, may look well enough, even if it has no straight lines whatever in its composition. But it is a pretty safe general rule that without a reasonable proportion of straight lines, most patterns will be restless and unsatisfactory.

Sometimes it is possible to arrange units containing no actual straight lines of their own, in such a way that there is nevertheless a distinct suggestion of interrupted straight lines running

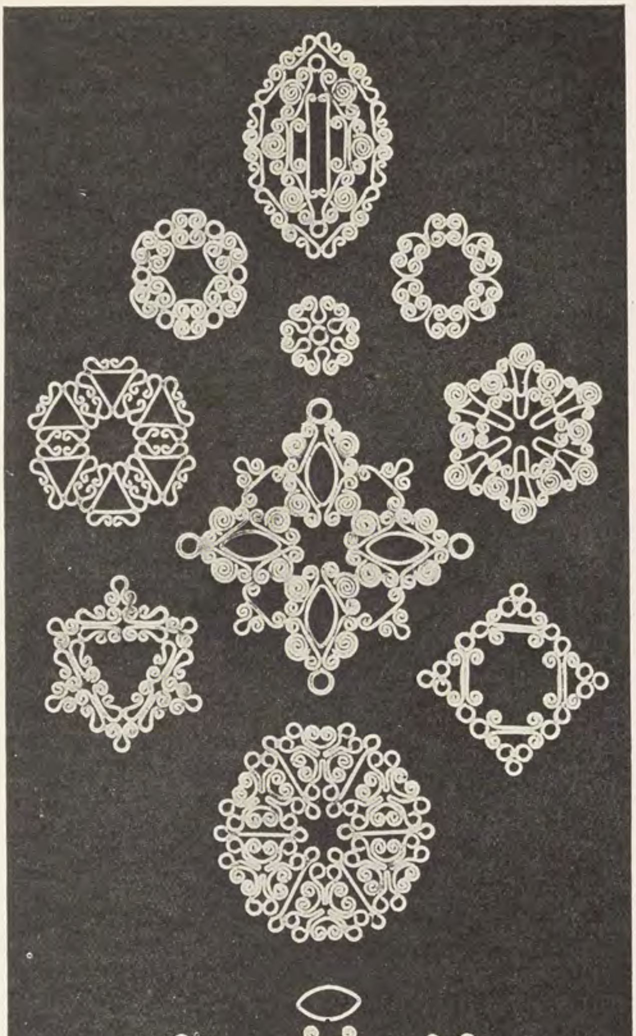


FIG. 68.

By the Author.

Silver Ornaments composed of units taken from Fig. 60

through the design—a suggestion which gives it a steadying effect ; or, where the unit which is repeated to form the pattern has a line which, though it is not actually straight, yet does approach straightness, these units may be so disposed as to emphasize this line.

The patterns illustrated in Figs. 66—69, and others similarly obtained, are also very suitable for enrichment with enamel, providing, as they do, a variety of cells for the reception of different colours. From that point of view, and, indeed, from the point of view of the designing of ornament generally, this method of inventing and constructing patterns is, I believe, capable of wide application.

The illustrations, shown as they are, for convenience sake, in white upon a dark ground, seem at once to suggest inlaid work, or, from the jeweller's and metal-worker's point of view niello-work. This process is generally used for filling engraved plates with a black metallic composition, which may either represent the forms of the designs themselves, or the background which expresses them, if this has been cut away ; and there does not seem to be any reason why units made of silver wire should not be given a background in this way also. The niello composition, being itself partly composed of silver, is naturally rather expensive ; but that would only mean that the spaces left between the units must be small, as also the objects so

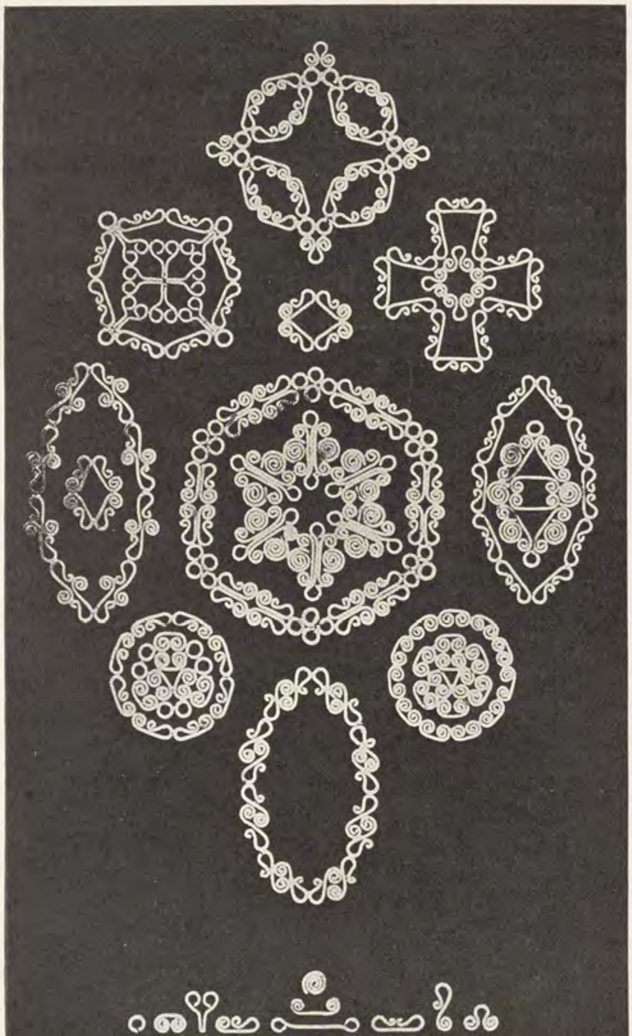


FIG. 69.

By the Author.

Silver Ornaments composed of units taken from Fig. 60.

constructed or decorated; and that the units must be made of thin wire, so that the background filling of niello composition shall be thin.

A simpler application of the same idea, is to use these forms and the patterns produced by means of them for the ornamental inlaying of woodwork in the Indian manner.

CHAPTER XXXI.

OF VARIOUS KINDS OF CHAIN.

Now, of course, anyone can see that in order to try a considerable number of experiments with one of these or similar units, a very great many of them have got to be made, and that a considerable amount of rather monotonous toil must be faced in doing this.

But it is comparatively easy to bear with the tedium of repeating the same thing a large number of times, when you are buoyed up by the exciting anticipation of how you are going, presently, to use these tiresome little units in playing, in however small a way, at the great and glorious, and altogether absorbing game of discovery, or invention, or composition—call it what you will—in which these units, so dull in themselves, are going to be endowed with vigorous life; are going to dance together in all sorts of intricate measures and figures; are going finally, to crystallise of a sudden, into undreamed-of patterns, and to lead you goodness knows how far away from the original starting point.

Moreover, the making of these units is such a convenient little job to fill up spare moments with, at times when it is pleasant to have your fingers occupied. A supply of plain lengths of wire, and a pair of pliers in your pocket, and you can turn to at any time, and get a little stock of units ready for subsequent use ; in your armchair by the fireside, on a long journey, or during a wet holiday, or even in bed if you are recovering from an illness !

There is, however, in the jeweller's craft another branch of tedious work which does not seem to have any corresponding alleviation ; for the process of chain-making can hold out no such alluring reward to those who toil at making and joining together endless numbers of links.

No doubt it may fairly be said that far too much is used of the ordinary chains, in which every link is just a tiny circle or oval, exactly like its neighbours, and that in many cases, a less mechanical pattern of chain not only looks more decorative and interesting, but may actually be quicker made, and with but a fraction of the tedium and monotony of the other case.

But, after all that has been admitted, the fact remains that there are many instances where a perfectly even monotonous chain does really look best, and unhappily that is most frequently so in the case of the smallest sizes, which are of course not only by far the most laborious to make, but also, one must fear, ruinous to the eyesight.

Well, in the first place we may rejoice to

Fig. 70.
Gold Chains. Roman. 1st to 4th century. (British Museum.)

think that even in the field of this minute labour, machines do relieve human eyes and fingers of much of the more tedious processes, and further, we may reasonably believe that there must always be numbers of people who, while they can with patience and application, learn how to do one or two comparatively difficult processes perfectly, have not got it in them to master an entire craft. Moreover, there is always a pleasure in doing that which we are conscious of being able to do well, and as to the minutest kinds of chain, so trying to the eyesight—well, let us be careful only to use them when we are quite sure that they are necessary to the design in hand.

In other cases the little units of form are always ready to come to our aid. Russian peasant jewellers make extremely effective and satisfactory chain out of some of these units or others similar, and in Fig. 71 are a number of different patterns mostly composed out of units from Fig. 60, with the addition of small round and oval links to connect them. Below each length of chain, the unit or units from which the design grew are shown separately, and each design resulted from placing the units together experimentally, until a satisfactory combination appeared.

When a number of such links have been made ready for connecting together, it is well worth while to try arranging the links together in various ways, until they again suggest more elaborate designs, from which it will often be easy to develop quite interesting pendants and necklaces.

Most of the objects in Figs. 66 to 69 inclusive, came about in that way, and if they are compared with Fig. 71, it will be seen that several of them are composed of the same identical links which, in the latter illustration, appear as chain.

In Fig. 72 there are further examples of similar though different ornamental chains, built up out of a few units selected from Fig. 60.

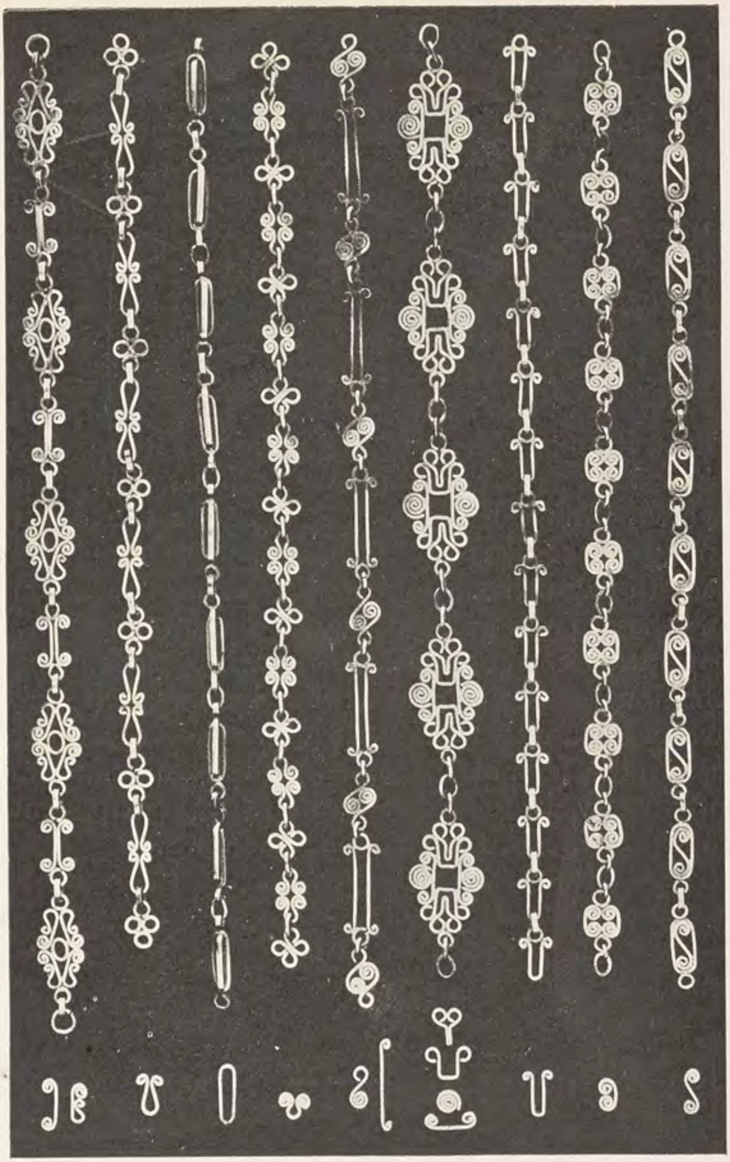


FIG. 71.

By the Author.

Silver Chains made from units taken from Fig. 60.

The piece in the middle, (E) is interesting as being in the main composed entirely out of repetitions of a single unit, the only element of variety introduced (other than the small circular rings which connect the links), being in every alternate one of the smaller links, these being made out of a pair of units of a different pattern, in order to escape excessive monotony.

The two chains A and K at the sides of this illustration will be seen to be composed, as to their longer links, of the same units, and it is worth noting how entirely different the effect may be according to whether the units are placed face to face or back to back. A further variation of these two patterns would be obtained by separating the central units of the longer links by the long straight wire with a loop at each end, which is used in that way in two of the other examples (C and G), which are again instances of variety in effect, although the component parts are the same in their larger links.

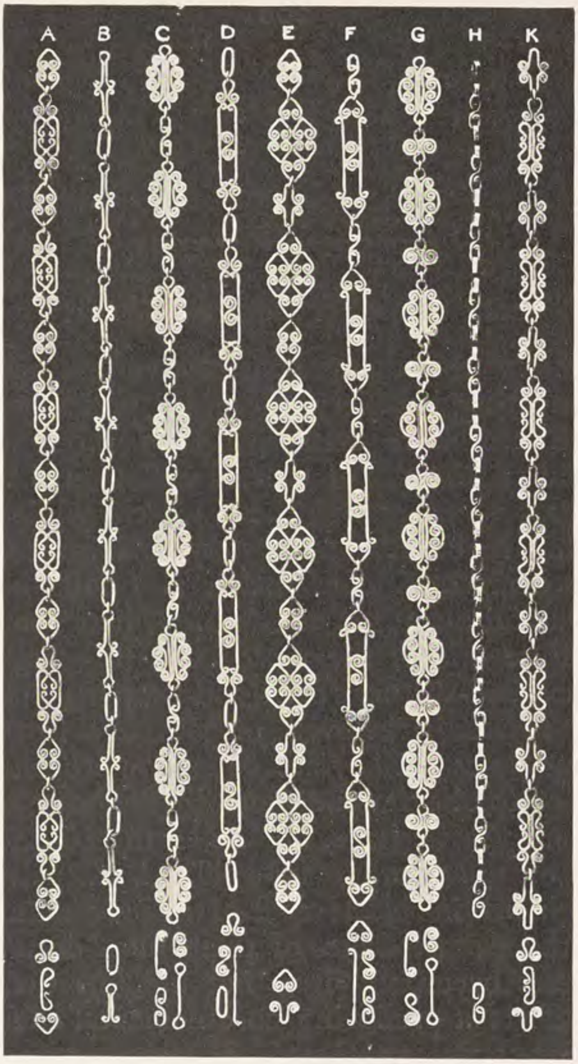


FIG. 72.

By the Author.

More Silver Chains, made from units taken from Fig. 60.

CHAPTER XXXII.

SOME USES OF TWISTS AND PLAITS.

Among the many constructive methods of ornamenting jewellery, there are probably none which are more attractive than those which depend on the use of twisted and plaited wires, elements of decoration these, which, while they are rich in beauty and variety, and most essentially characteristic of metal, also contribute a very useful quality of strength. These processes constitute one of the most fascinating branches of the metal-worker's craft, and they have always been especially beloved of jewellers from the earliest times. They are equally appropriate to most of the harder and more ductile metals, and they are the heritage, no less of the blacksmith than of the worker in gold. But, naturally enough, it is in objects made of the precious metals that the daintiest uses of these most decorative processes occur, and it is not unlikely that the first efforts at producing an ornamental effect by twisting strips or threads of metal, may have been made in gold.

Referring back for a moment to some of the illustrations in the earlier chapters, we find in

FIG. 73.
The Loch Buy Brooch. Silver, set with rock crystal and pearls. Scottish. Early 16th cent.

British Museum.

Fig. 7, p 21, that twists of gold wire form a very essential part of the designs in almost all or those beautiful little examples of ancient Greek and Roman jewellery.

Good instances of the remarkable usefulness, both decorative and constructive, whether of simple or of compound twists, are provided by the Turkish clasp (Fig. 10, p. 27), and in a still more marked degree by those from Norway (Fig. 12, p. 30). Several of the rings in Fig. 25, p. 63, and notably the big Anglo-Saxon one, with its broad border of right-and-left-handed twists, alternating with fine plain wires, and finally Figs. 73 to 79 inclusive in this and the next chapters, all repeat the same lesson.

The Loch Buy Brooch (Fig. 73) is, like many of the ancient Scottish brooches, rather massive as a piece of personal jewellery, but used as it no doubt was, on occasions of high ceremonial, to secure a heavy plaid, wrapped round the shoulders, it must have looked rather splendid. It has an interesting history, having been made about the year 1500, out of silver ore found on the Loch Buy estate in the Island of Mull, and according to the inscription engraved on the back, it was made by a tinman. It is wonderful that this mediæval tinker in a remote island should have had the intimate knowledge of jeweller's work which this brooch displays, but there is strong evidence that the design was his own, at least in its main ideas, in the resemblance borne by the central portion and its surrounding turrets, to forms which we are in the habit of associating peculiarly with the tinman's

FIG. 74.

British Museum.

Gold Buckle, set with garnets and coloured glass. Anglo-Saxon. Found at Taplow Bucks craft,—forms which were evidently equally familiar 400 years ago.

It is easy to say that the middle part looks very like a pastry cutter, that the others resemble miniature pepper pots, and that the whole thing rather suggests a jelly mould ; but if the tinman did base his design on simple shapes he knew by heart, he shows that he knew how to use them nobly, and to decorate them sumptuously. Almost all the enrichments are made of wire, sometimes twisted simply, sometimes most elaborately, and the rich effect thereby obtained is skilfully used to contrast with the plain surfaces of silver, and with the great smooth mass of rock-crystal, which so grandly dominates the whole design.

In the gold buckle ot Anglo-Saxon workmanship (Fig. 74), we have another instance where great richness results from the massive border of twists, though perhaps we may venture to think that a little more reticence and variety in their use would have been an improvement. But there is something decidedly touching on the evidence borne by this object, that the beauty of these twists had so fascinated the craftsman who designed it, that having determined to make his buckle as magnificent as he knew how, he expended his labour with lavish prodigality in producing and building up all that rich store of twisted wire out of which he constructed his border.

Fig. 75 shows how admirably decorative may be the effect of a pair of plain twists of round wire, separated by a plain round wire in between them, when one twist turns from right to left

Fig. 75.

Victoria and Albert Museum.

Silver Bracelet. Syrian. 19th cent.

and the other the opposite way; especially when three or more bands, constructed in this manner, are plaited together as in this simple, almost primitive, though quite modern bracelet. The ring (Fig. 76) is almost too small for its construction to be realised from the illustration, but it is practically the same as that of the bracelet, and is on so small a scale, and the twist is so fine and smooth, that it might probably not be uncomfortable to wear on the finger.

Fig. 76.
Gold Ring. Syrian. 19th cent.
Victoria and Albert Museum.

CHAPTER XXXIII.

MORE ABOUT THE USES AND FORMATION OF TWISTS.

The examples illustrated in Fig. 77 contain some very pretty twists, and they are charming pieces of craftsmanship ; but the use of that kind of decoration is not really appropriate on rings, as they would be most uncomfortable, not to say painful to the wearer, if they were carried on the finger. However, it is fairly obvious that if these rings were worn at all, it can only have been in a purely ceremonial way, as the twisted wire borders are by no means the only, nor the greatest, projections.

They are illustrated here in order that the effect of compound twists, as ornamental borders or frames for jewellers' work, may be realised more fully ; but, from the point of view of finger rings, they must be regarded rather as examples of what not to do. Projecting twists might, however, be used after this fashion, on tie-rings, especially if the rings were made oval instead of circular in plan, so as to reduce their bulkiness ; and there are other things which a jeweller may occasionallv be asked to make, such as napkin

Fig. 77.

British Museum

Gold Betrothal Rings.
Jewish. 16th or 17th cent.

rings, mounts for sticks, umbrellas, or scent bottles, for the borders of which the twisted enrichments of these rings might quite properly suggest ideas.

Compound twists such as those which are used to form the borders of these rings, are also admirably adapted for certain ornamental objects which are intended to be securely gripped in the hand, though it is no doubt true enough that these cannot properly be called jewellery. Sometimes, however, they may be the *work* of jewellers none the less, and on that account it is perhaps admissible, while dealing with the uses of ornamental twists, to allude briefly, in passing, to such things as sword hilts, dagger and knife handles, and so forth.

Many of the beautiful "dress" swords of the eighteenth century had very elaborate handles of silver or gold, sometimes jewelled, and very frequently the part which was to be grasped was covered with a spiral sheathing of twisted wire, bound round in such a way as to afford a most efficient and particularly comfortable grip, which would never be liable to slip or to turn round in the hand at a critical moment. This was partly due to the uneven projection of the various constituent parts of the twists, but even more so to the fact that each turn of twisted wire was in such cases generally separated from the previous and succeeding turns by a thin plain member of much slighter projection, running parallel with the twists, and providing a comparatively plain hollow on each side of them. This feature not only improved the efficiency of the handle from the point of view of the person who had to grasp it firmly, but it also provided a plain dark band of shadow to contrast pleasantly with the bright sparkle on the prominent parts of the twists.

Even if the jeweller does not often have to pay very much attention to the utilitarian aspect of things, that is no reason why he should not take full advantage of any interesting and pleasant effects which may have been accidentally discovered, through the observance of practical requirements in kindred crafts.

An exceedingly fine and rich traditional design, which has for centuries been a great favourite among Scandinavian jewellers, is well represented in Fig. 78, and this Norwegian brooch or clasp owes a great deal to its bold rings of compound twists, within which are other much smaller ones of simple right and left-handed twists laid together in pairs. The chain-like effect of the large outer rings which surround the six principal ornaments, and the central hole, is obtained by compound twists made as described on p. 222. The centres of these six ornaments are particularly interesting and successful examples of the decorative value of wire coils ; one open one, with a lozenge-shaped centre, being enclosed by a much finer coil treated hexagonally, with its six sub-divisions closed up tightly, so that though one coil is placed inside another, they are so entirely different, as to form an admirable contrast. The border of flattened

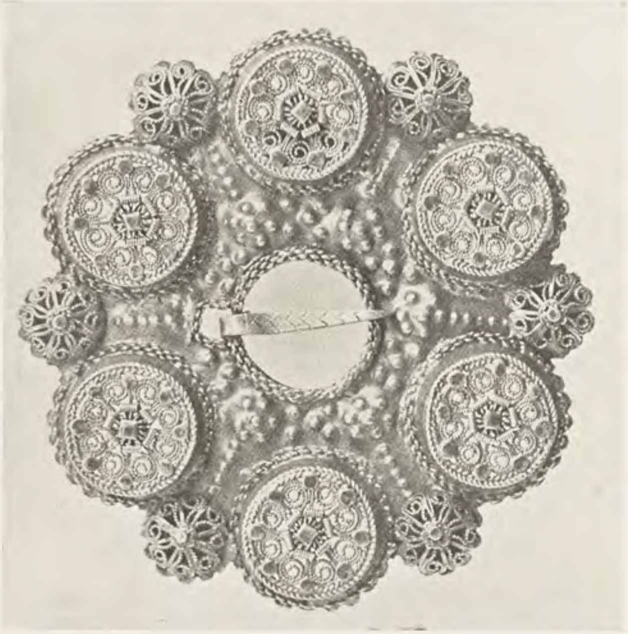


FIG. 78.

Victoria and Albert Museum.

Silver-gilt Brooch. Norwegian. 18th cent.

grains on these same parts is also worth noting, but the repoussé decoration of the back plate is very poor and slovenly in execution.

The seventeenth century rock-crystal pendant, illustrated in Fig. 79, shows how valuable twists may be in the lightest and daintiest work, and how they may sometimes, as is in fact the case

Fig. 79.

Victoria and Albert Museum.

Gold and Rock Crystal Pendant, set with enamels and pearls, and with miniature paintings. Spanish. 17th century.

in this instance, provide nearly all the construction. The rich and varied play of light on these delicate gold twists, interrupted as it is by the numerous specks and lines of dark shadow between the wires, is just what is wanted to contrast with the luminous smoothness of the clear mass of rock crystal, which is, as it were, encased by the wire work. A necessary element of solidity and of colour is admirably provided by the four foliated clasps or clips, by which the gold-work is secured to the rock crystal, and by the oval frame surrounding the miniature painting. All these parts are filled with enamels, outlined and divided by very small twists and bound together by twists also.

CHAPTER XXXIV.

SAMPLES OF VARIOUS TWISTS AND PLAITS.

FIGS. 80 to 83 inclusive represent a number of trial patterns, made of wires of different sizes

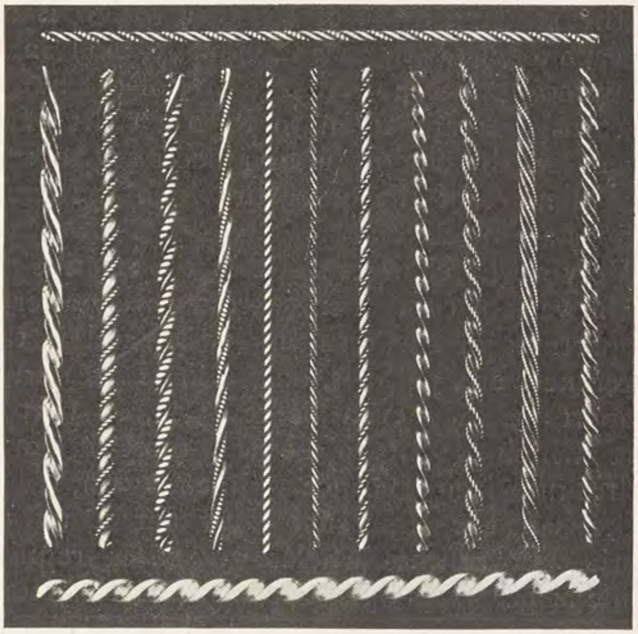


FIG. 80.

By the Author.

Simple and Compound Twists of Silver Wire.

and sections, twisted either singly or in groups of two or more, and they may perhaps give some idea of the almost unlimited number of variations which may be obtained by these processes.

The opportunities for variation are incidentally demonstrated, by the fact that it is often quite astonishingly difficult to repeat a compound twist accurately, unless the most careful and detailed notes are always made, not only of the exact sizes of all the component parts, but also of the precise degree of twisting which is used in each one of them individually, and in the group collectively ; that is to say, of the number of turns that are taken to form a twist of any given length ; and it is also necessary to make careful notes of the order in which the combinations are made.

Very slight changes made in the relative sizes of the various component wires entirely alter the proportions of the resulting twist, and if these differences are, perhaps, only a little greater, the proportions may even be reversed, so that the part which ought to be the most important retires into insignificance. Then, again, it often makes all the difference how far a twist is carried—sometimes a close twist is required, while at others an open one looks much better—and it is often quite difficult to believe that two different examples are really composed of an equal number of wires of the same size, the only variation being in the degree of twisting.

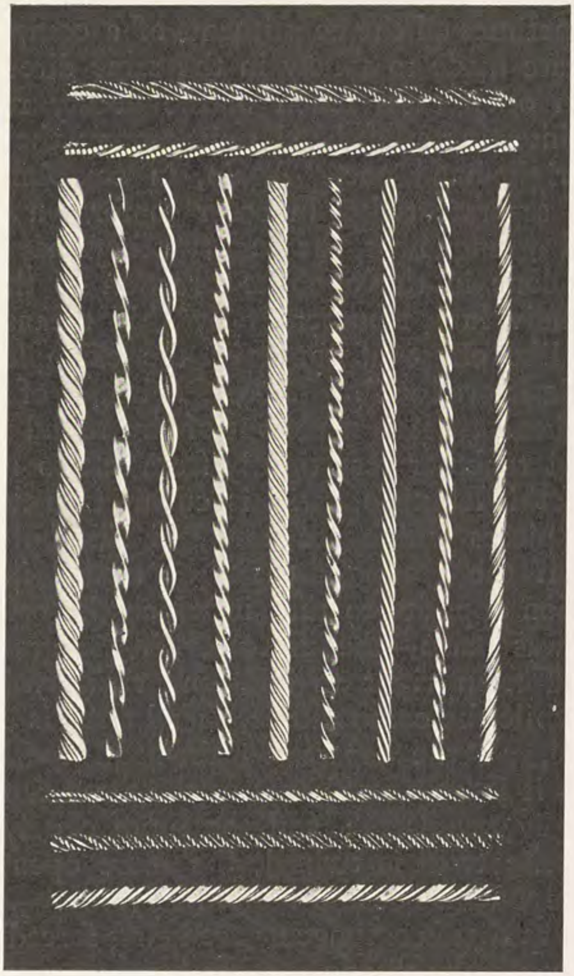


FIG. 81.

By the Author.

Simple and Compound Twists of Silver Wire.

Sometimes all the constituents of a compound twist are made to follow in the same direction, but in other cases much of the beauty results from inserting a left-hand twist among the coils of a right-hand one. Again, in combining a set of separate twists in order to form a compound arrangement, the final twisting may need to be done in the opposite direction to that of the individual members. By this means the chain-like effect of some of the examples in Fig. 82 is produced. Thus, if a length of plain right-hand twist is made out of two round wires twisted together very tightly from left to right, and if this length of twist is cut up into two or more pieces which are now laid side by side, then, if the group of twists be turned in the direction opposite to that in which the original twist was made—that is to say, if the group is twisted from right to left—the result will be that while the composite left-hand twist is being formed, all the separate right-hand twists of which it is composed will at the same time be gradually *un*twisted ; and the more closely the composite twist is twined, the more open will its components become individually.

But as these components are being forced into close contact with one another by the process of composite twisting, it follows that they are not individually free to open out equally in all directions, and so it comes about that they expand in that direction only, in which they *are* free—that is to say, from the centre outwards, and thus it is that the outside turns of the

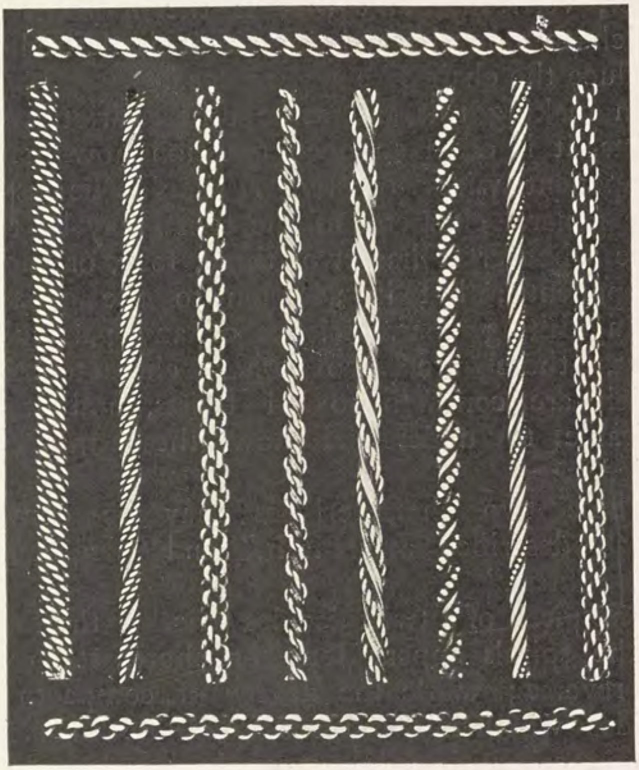


FIG. 82.

By the Author.

Compound Twists of Silver Wire.

separate wires bulge out in the manner which is apparent in several of the twists illustrated in Fig. 82.

There is a certain stage in the formation of this particular kind of compound twist when all of these bulging turns come into line with each other, vertically, and that is the moment at which to stop the twisting, if it is desired to produce the chain-like appearance.

In making this and some other varieties of twists, it is often an open question how many component wires or twists should be used. The general character of the twist may be the same whether it has two, three, four, or more components; but in addition to the general distinguishing characteristics of any particular twist, there are two other characteristics which are common to all twists, and it is desirable to understand how these may be varied.

These two characteristics may be conveniently described as "pitch," and "degree of compactness."

The pitch of a twist decides whether the lines of the spirals appear long or short, steep or the reverse; while the degree of compactness decides whether the turns shall be in close contact one with another, or whether they shall be separated by spaces. But there are instances where the degree of compactness is better described by the character of a *section* of the twist which is under consideration. In such cases, when the twist is cut through, it will show a section varying between a circle and an oblong, according as the degree of compactness is great or little. For example, a twist made of seven round wires of the same size will be circular in section, but one made of the same

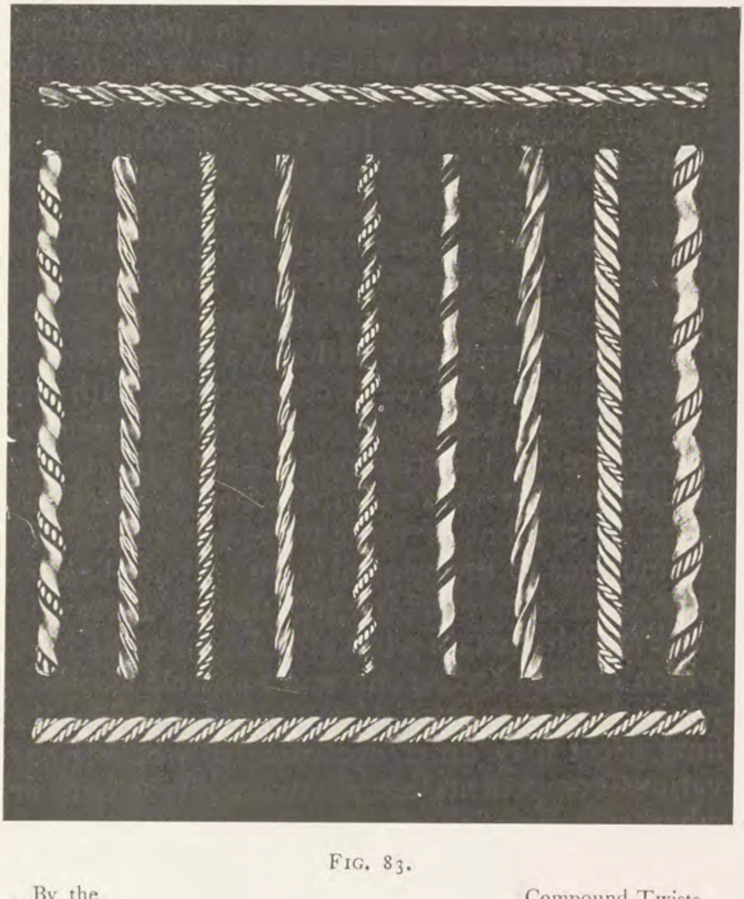


FIG. 83.

By the Author.

Compound Twists of Silver Wire.

wires, laid side by side, will give a thin oblong in section.

If two round wires are twisted together, but not tightly, the pitch will be steep, and the degree of compactness slight ; and in proportion as the degree of compactness is increased by further twisting, so will the steepness of the pitch be diminished.

Now, sometimes a plain twist of this kind is wanted which shall have a very full, round, compact appearance, and one which shall at the same time have quite a steep pitch. To obtain this effect, three or four or even more wires are twisted together instead of only two. The addition of one extra wire will make a considerable difference in the degree of compactness, with any given amount of twisting, and yet the general appearance of the resulting twist will remain similar to that obtained from two only of the same wires ; but if more wires are added, the resemblance to the original twist will not be very close. In compound twists, that is to say in those which contain wires of different sections, or which contain some plain wires as well as others which have previously been twisted together, the final effect may differ according to whether the various components are all twisted together, or whether some of them are inserted afterwards.

The examples in Figs. 84 and 85 are mostly selected from those already illustrated in the four preceding plates, but they are altered in appearance very considerably by a little hammering. In such cases it is sometimes of the greatest importance to unwind some of the small components

FIG. 84.

By the Author.

Simple and Compound Twists of Silver Wire, flattened.

after the compound twist has been made, but before any hammering has been done. When the small members have been removed, the large twist may be flattened without disfiguring the smaller wires, and these may afterwards be replaced uninjured. In this way a pleasant contrast is obtained.

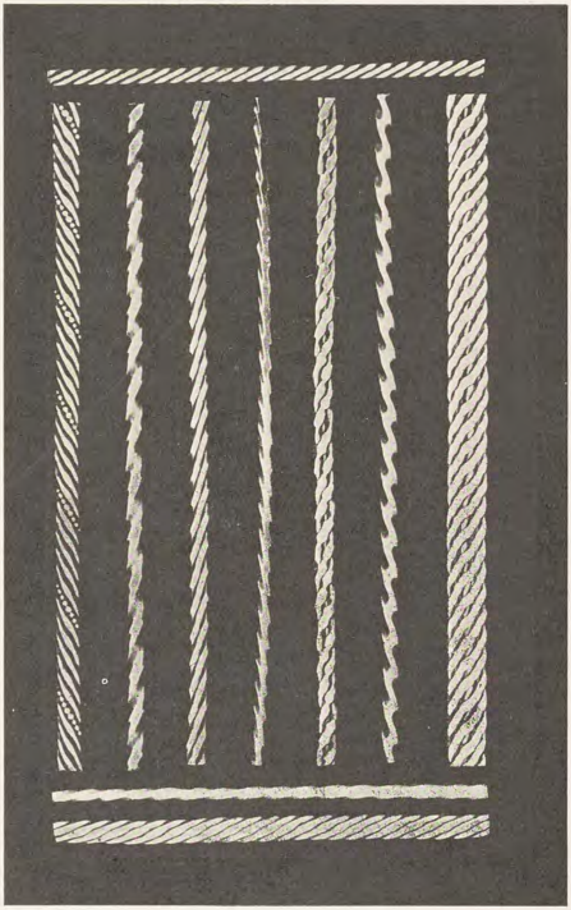
In other cases a particular effect can only be obtained by inserting a fine twist *after* it has been hammered flat, in a space which has been prepared for it in a compound twist.

The strain which is exerted upon a wire in the process of twisting is so great, that compound twists when they include beaded wire must first be made with plain wire of the same diameter as the beaded wire. The plain wire is unwound and removed after the twisting is finished, and the beaded wire is then inserted in the space left by it, without any risk of breakage.

In addition to the many variations which are possible with simple and compound twists, there is also much that is interesting and beautiful to be done by plaiting wire. Some examples are shown in Fig. 86, where a few are illustrated both before and after having been hammered flat.

This produces an exceedingly decorative effect in some plaits owing to the fact that the spreading of the wires under the hammer varies in amount according as to whether another wire crosses underneath or not.

But apart from the alterations produced by different amounts of hammering, quite consider-



By the Author.

FIG. 85.
Simple and Compound Twists of Silver Wire, flattened.

able variations are obtainable from equal numbers of the same kind and size of wire, merely by changing the ways in which the wires are grouped. Thus twelve plain round wires may

FIG. 86.

By the Author

Plaits of Silver Wire, some of them flattened.

be plaited together as three sets of four, or as four sets of three, or as six sets of two each. Moreover, if six sets of two wires each, be plaited together, there are at least three different ways of doing it, and each of these ways produces a distinctly different pattern of plait.

It will also be observed that one of the sample plaits illustrated in Fig. 86 displays the decorative value obtained by introducing fine twists between plain wires in a broad plait, while in another a bold rich effect results from a similar use of beaded wire.

CHAPTER XXXV.

SOME PRACTICAL CONSIDERATIONS.

THE student, who with patience and intelligence has followed the exercises which I have outlined or suggested up to this point, will not need many working instructions to enable him to pursue investigations into the methods of making twists and plaits; but there are a few essential points which it may perhaps be well to enumerate.

In the first place, it will be readily appreciated that in order to make an even, regular twist, whatever wire or wires are used, they must all be thoroughly and evenly annealed, before the twisting is begun. It will also be evident that, if the twist is to be a close one, that is to say, one which has a great many turns, it is quite possible that one or more additional annealings may be necessary as the work progresses, in order to prevent any of the wires from snapping asunder under the very severe strain that can easily be put upon them by torsion. The wire, too, must be made perfectly straight, before the twisting begins, either by stretching it, or, in the case of beaded wires which will not stand much stretching, by light tapping with a wooden or horn mallet on a flat bench.

Any wire which has one or more flat sides will give a decorative effect when twisted by itself; but, in order to produce an effect with round wire, at least two lengths must be twisted together.

Where a considerable number of wires are to be twisted together, it is often necessary to solder them all together just at the two ends, before twisting. It is also often necessary to bind all the wires together, temporarily, while they are in straight lengths, with fine iron binding wire, or with thread, in order to make sure that they shall all be kept in their proper relative positions during the early stages of the twisting, when otherwise there might be a danger of their "crossing." When this is done, if iron wire is used it must be wound round in the direction *opposite* to that which the twist will take, so that as the twist progresses the iron wire comes gradually loose. If it was bound the same way as the twist, it would get tighter at each turn, and would cut the surface of the silver wires, and permanently disfigure them.

The very smallest twists are generally made of pure unalloyed silver, ordinarily described as "fine" silver; and the reason for this is that these very minute twists are apt to melt while being soldered, whereas fine silver will stand exposure to a higher temperature than standard silver will bear, before it will be liable to melt.

Fine silver is also used for plaits when it is desired to make them very close, because it is so much softer than standard silver, which is much more springy. But it must be borne in mind that the softness of fine silver makes it unsuitable for parts which will be exposed to any considerable amount of wear and tear. These remarks as to the use of fine silver apply equally to fine gold.

When the smallest twists are being soldered, "easy" solder is sometimes used—that is to say, a kind which will melt at a rather lower temperature than best hard solder.

In soldering bands or rings of these small twists, to more solid parts, care must be taken to heat the work gradually and evenly. If the twist catches the heat too suddenly, it will become red-hot in an instant, and it will expand so much quicker than the surrounding parts, that there will be a great danger of its bulging out loose, and it is impossible to solder small twists neatly unless they fit quite tightly round the parts they encircle. But, while keeping the flame from heating the twist suddenly, this must not be allowed to remain too cool, or else the expansion of the parts within may easily burst it.

A length of fine twist which is to encircle a more solid part, should always have its ends securely soldered together before it is applied to the part to which it is going to be attached, and the ring so made should be slightly too small, so that it must be stretched a little in order to spring it on to its place. If the ring of twisted wire is to be soldered around a band or collar which has a projecting rim of some kind that forms an angle for the twist to lie in, then its own springiness will keep it in position while it is being soldered.

But if there is no projection of that kind, or if the twist has to be soldered on to the edge of a disc or of another wire, then a very slight nick must be filed or cut for the twist to lie in.

The solder for securing *very* fine twists may be applied in the form of dust, which is produced by filing a piece of the solder; for otherwise it is difficult to put it on in small enough quantities, and if there is too much solder the twist will be "blinded," that is to say, it will be flooded with solder, and will no longer look like a twist.

Wires for very small twists may be conveniently held in the pin-tongs or slide tongs while being twisted. Larger wires will often require a hand vice to hold them securely enough for this purpose, but beechwood clams will serve for most of the twists which the jeweller is likely to need, if a hand vice is not available.*

* The above-mentioned tools are all illustrated in Fig. 40, p. 98

When a long length of plain twist has to be made, if no lathe or polishing spindle is available for rotating it quickly, then the best plan is to fix one end in a vice, or even by a few turns round a nail in the bench. When one end has been secured, the free end has a loop made in it, which is passed through a short bit of tube held in the left hand, and this loop is threaded on to any small straight rod from three to six inches long, which will prevent the wire from slipping back through the tube. This rod can then be spun round and round with the first finger of the right hand, so as to twist the wire very rapidly. If the tube is small in diameter, a long French nail will do very well for the rod.

CHAPTER XXXVI.

OF CERTAIN OTHER ORNAMENTAL PROCESSES.

These and the other methods of constructing ornamental details which have been illustrated in the preceding chapters, are the bequest of the experience of ages, to which I have endeavoured to add, here and there, some small contribution derived from personal experience, and from individual experiments which have interested and helped me. I believe that such methods must always be valuable, especially to those jewellers whose abilities lie rather in the handling of materials, and in the composition of designs by means of selection and arrangement, than in the more abstract methods of the sculptor or the painter.

Those who approach jewellery from these latter points of view, will generally find their best opportunities in some of its other branches, which I have not attempted to touch upon, such as repoussé and chasing, carving, modelling and casting, engraving, damascening, enamelling, and niello-work. But to them also the more constructive processes are of the utmost value in design, as well as for acquiring some very essential parts of the jeweller's technique, and on the other hand, a limited use of all the other treatments just enumerated above, is perfectly well within the reach of any intelligent craftsman, even though he does not attempt to produce jewellery of a sculpturesque or of a pictorial type. At the same time, it is perhaps hardly necessary to add that they can only be carried to their highest perfection by those who have gifts of a very different order from the accomplishments of the ordinary craftsman.

The various punches of the repoussé worker may be used in different ways, and although when handled with sufficient skill, they will render the most subtle modelling, or the most masterly drawing, without leaving any impress of their own shape, yet the more primitive method of handling them, whereby numerous separate impressions, made by these punches, gradually produce an ornamental pattern, is not to be despised.

A few fairly good examples of this kind of treatment occur in the buttons shown in Fig. 87, which are examples of the simple charm to be obtained by a "bossy" treatment of sheet silver, and of the value of very direct and even rude methods of decoration. Comparison with Fig. 29 will show how in two cases the decorative effect of constructional wire-work has given the repoussé worker an idea for a design, but these examples do not give any idea of the very dainty and beautiful borders and other enrichments which may not only be produced, but may even be suggested and originated in this way.

FIG. 87.
Dome-shaped Buttons made of sheet silver. Dutch and Italian.

Such ornaments need not necessarily be geometric, although the tools are particularly appropriate to that kind of treatment, but pleasant simple designs, suggestive of creeping plants, with leaves and flowers branching out from undulating stalks, occur naturally to the craftsman when he begins to learn how to use the punches, and the patterns which arise from making clusters of grains, and from bending and interlacing wire, are easily imitated in repoussé work with satisfactory results.

Fig. 88 contains a series of examples of simple cast silver ornaments of good traditional forms; but in many of them there is an unfortunate tendency to imitate designs which belong really to objects constructed out of wire and sheet and grains—a practice which cannot be defended.

On the other hand, it is a mistake to imagine that there is no craftsmanship in casting, or that it is a process which should always and without exception be avoided by the jeweller. There are many dangers in the path of any jeweller who becomes too fond of it; the occasions on which its use is legitimate or necessary for him are infrequent; and certainly the student who is beginning to learn this craft, should not meddle with casting at all, until he has mastered all the alternative "building up" methods, and is a sufficiently expert workman to be able to make his own patterns, (from which the castings will be made), well enough to be sure of obtaining good clean results.

Quite a simple use of enamels, such as is well within the reach of those whom one may perhaps conveniently and without offence describe as

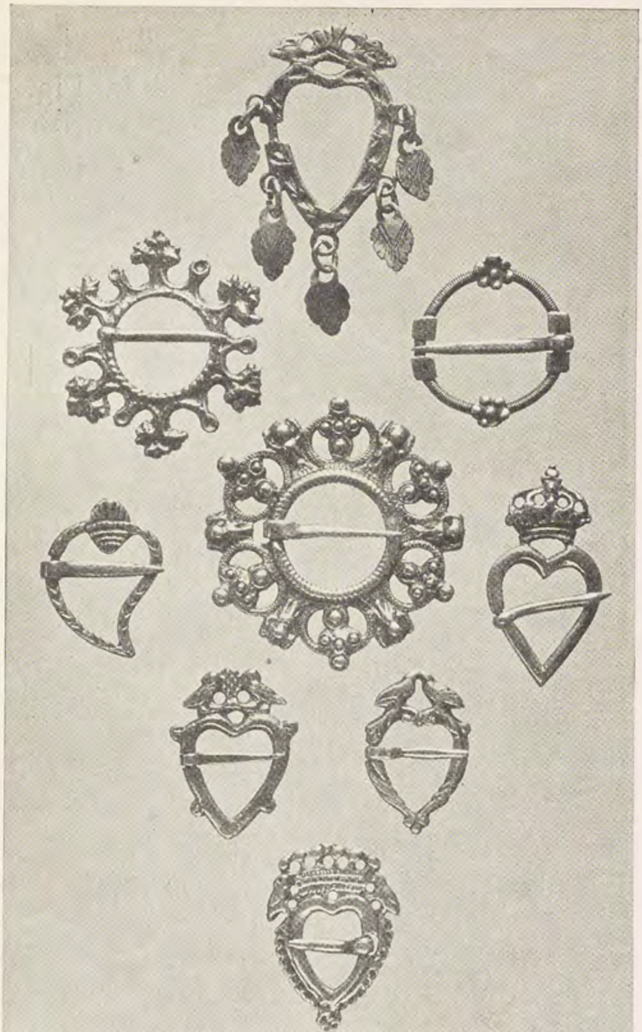


FIG. 88.

By permission of
H. B. Bompas, Esq.

Silver Betrothal Clasps.
Norwegian.

R

plain craftsmen, is well exemplified in Fig. 89, where the enamel contrasts pleasantly with the light open-work surrounding the flowers. The filigree-work of this necklace is fairly restrained in design, but without the added interest of the enamelled parts it might be rather monotonous, and these, moreover, introduce not only a fresh element of charm in the design, but also a valuable contribution of strength and stiffness in the construction.

If I refrain from dealing in a more detailed way with these and the other treatments mentioned above (p. 237), it is because I think that they should only come after the student has passed through a course of training such as I am here endeavouring to sketch out, and because their practice is not so directly suggestive of decorative patterns ; nor does it inevitably yield so rich a harvest of motifs for design as does the handling of wire. Nevertheless, elementary repoussé work should come quite early in the craftsman's training, and I think I have said enough about it just to show that it is susceptible of methods which are not so very different from those employed in producing the patterns composed of circular forms illustrated in Figs. 27, 28, 30, and 31, or even from those built up out of the other small units illustrated in Fig. 60.

FIG. 89.

Victoria and Albert Museum.

Silver Necklace, enamelled. Swiss. 17th century.

CHAPTER XXXVII.

THE SETTING AND USE OF PRECIOUS STONES.

One other process which is absolutely essential to every jeweller must at least be given a bare mention, and that is the setting of precious stones, which really includes several processes; but illustrations of all the various different ways of doing this hardly come within the scope of this little book, which aims principally at giving an analysis of one or two of the most simple methods of design, and a few suggestions as to ways of tackling such elementary processes as are necessary to the practice of these methods, and to the making of the ornaments thereby suggested.

The main principle of most of the methods by which stones are set, is that the under side of the stone rests on a ledge, or on the shoulders of a number of small projecting pieces, and that it is kept in position, either by a collar of metal standing up from the ledge, fitting closely round the stone, and pressing it home as a result of the top edge of the collar being contracted, and this is called a plain collet setting; or else the small projecting pieces stand up in a similar way

By the Author. FIG. 90. Silver Pendant and Chain.

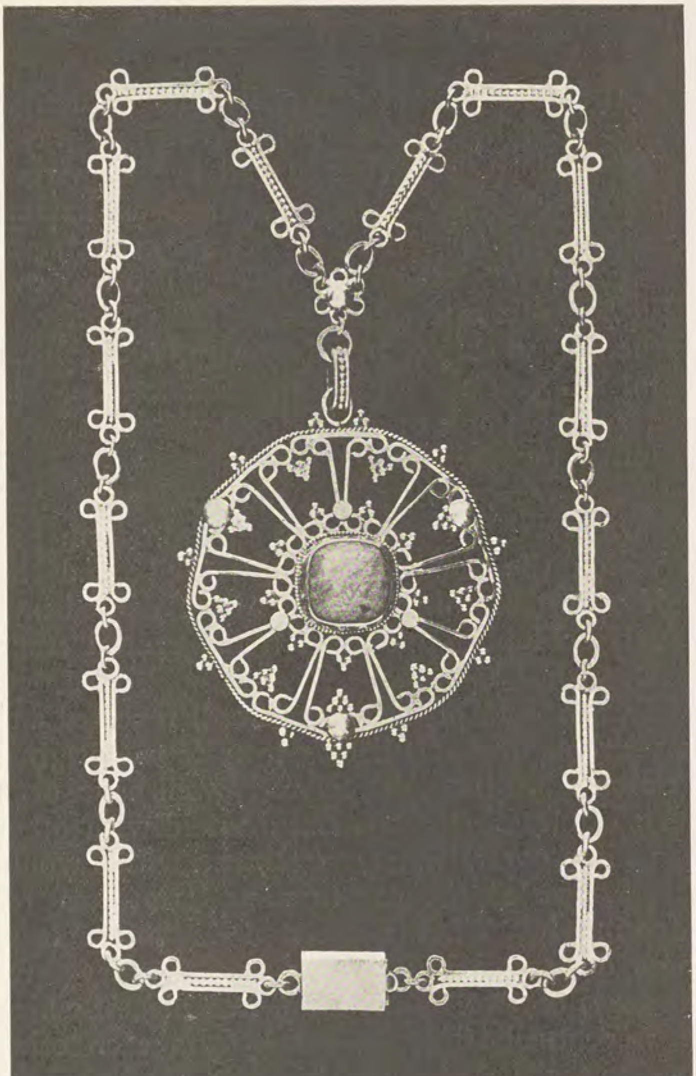
around and slightly above the stone, and their tips are then bent down until they press firmly on it, in which case it is called a coronet or claw setting. These methods are capable of many interesting variations and elaborations, and often form important features in the whole design.

Another method, probably the most primitive of all, is to drill a hole right through the stone and pass a wire through it, the end of the wire being spread out, or twisted into a knot. This method, or a modification of it, in which the hole is only drilled part way through, and the wire is secured on the principle of a dove-tailed joint, is much used for pearls, and for stones which are intended to hang as drops.

Pearls, pierced and hung from wires passed through them occur in several of the illustrations in the early chapters, *e.g.*, Figs. 1, 3, 5, 6, 14 and 20 (pp. 12 to 45), and the big Byzantine ear-rings in Fig. 24 illustrate particularly well what may be called peg setting, for many of the pearls have come off, leaving the pegs, which once held them in place, now bare.

Most of the illustrations of jewellery in which other precious stones occur give examples of collet settings, either quite plain, as in Figs. 90, 91, 92 and 93, or serrated, as in Fig. 73 (p. 207), or otherwise made ornamental, as in Figs. 2 and 4 (pp. 14 and 17).

Figs. 90 to 93 show how patterns resulting



By the Author. FIG. 91. Silver Pendant and Chain.

from the arrangement of small units of design may be combined, and enriched in various ways, including the use of twisted and beaded wires; and these objects will be recognised as having already appeared, in their more elementary stages, in Figs. 62, 63, 67, 68 and 69 (pp. 180 to 197).

Fig. 90 illustrates a pendant made out of one of the designs shown in Fig. 62 (p. 180) with a chain, whose links are composed alternately of circular forms and of right-and-left-hand twists, separated by plain wire.

Beaded wire, twists, discs and domes are used to enrich and strengthen the skeleton form out of which the pendant is constructed; and the middle part of this skeleton is itself domed into a fairly bold boss, upon which the central stone is set.

Here the lines of the design are all repeated and emphasised, so that it is easy to trace the original skeleton; but it might perfectly well have been treated quite differently, and overlaid with other forms in a contrasting arrangement, which would have concealed the construction instead of re-inforcing it. Thus a skeleton design, such as those developed in Chapter XXIX., may form the basis of two or more finished pieces, which may eventually differ so much from each other that, to a casual observer, it would not be easy to see that at an earlier stage they were identical.

In Figs. 91 and 92 the lines of the original designs from which the pendants are developed

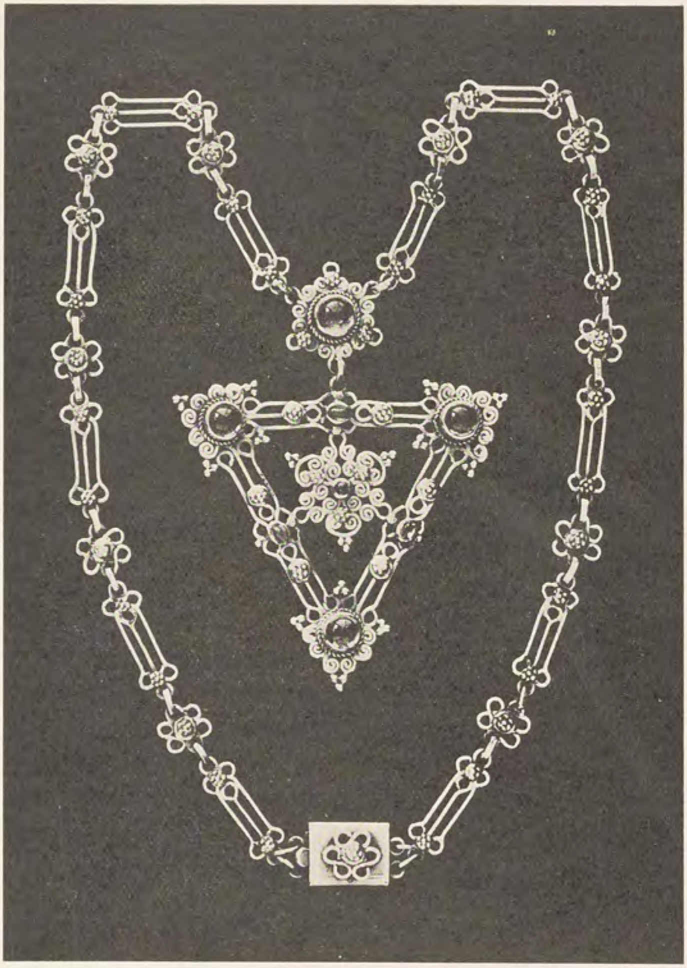


FIG. 92.

By the Author. Silver Pendant and Chain.

have been somewhat interrupted and concealed, by the addition of domes, discs and clusters of grains in the case of Fig. 91, and of stones, twists and clusters of grains in Fig. 89 ; hence their derivation, especially in the case of Fig. 91, which was built up from one of the skeleton designs in Fig. 63, is not quite so obvious. On the other hand, Fig. 93 (Frontispiece) did not seem to need that its lines should be either emphasised or interrupted, and the units out of which it was built up seemed to have in themselves enough variety and richness to be left without other additions than some precious stones and a few isolated grains and discs.

In such a case, however, it becomes necessary to make other additions behind, in order to supply that strength and stiffness without which such an ornament would be unable to resist the strain of ordinary wear and tear ; but these, important as they are constructively, have nothing to do with the design, and are, in fact, invisible from the front. The collets in which the stones are set, as also the discs and grains which cover or fill in some of the joints, all help to stiffen and strengthen the construction, but they are not enough by themselves.

CHAPTER XXXVIII.

THE QUESTION OF LOCAL INDUSTRIES.

Anyone who has examined and thought about the kind of jewellery to which I have devoted most of my space in this work, will probably agree that it is largely a matter of judicious selection and arrangement ; and that is one reason why it is such a fascinating craft. While it offers endless scope to the skill and invention and ideas of the most accomplished artists, it does also provide a most attractive outlet for the abilities and industry of the humblest lover ot the arts, if he has a moderate capacity for using tools. And here I venture to throw out a suggestion which I believe may be, in some degree, capable of realisation.

In most foreign holiday resorts there is some, more or less artistic handicraft, which is practised as a local industry, dependent mainly on the custom of visitors ; and I think that most people, when they go away for a holiday, do like to find local productions which excite their interest, and offer them opportunities of buying small trifles, directly connected with the place, to take back with them as presents for friends at home. If the crafts practised in these places, are of such a nature that the visitors can actually watch the things being made, so much the better, for an inspection of the workshops may then be added to the list of local attractions.

There are, of course, instances of this kind, mostly successful, in England, such as those at Tunbridge Wells, Buxton, Keswick, and Barnstaple, and the efforts of the Home Arts and Industries Association, and of various energetic and public-spirited individuals, have done much to foster the growth and revival of local arts here and there. But I think it is true that provision is most frequently made in a way familiar to most of us, in the form, say, of a mug, or an ash tray, proclaiming the fact that it is a present from Margate, or Blackpool, as the case may be; though one suspects that it really comes from Germany, like some of the imitation precious stones sold to unsuspecting travellers by the persuasive Oriental. Perhaps one reason why our holiday resorts are deficient in local crafts, is that, as a nation, we seem never to have had, or to have wanted, any peasant jewellery of our own, though it is just peasant jewellery which, at foreign places, often makes the most successful appeal to the purchasing section of the visitors.

No doubt the Anglo-Saxon race is, for the most part, stolidly indifferent to the pleasure to be derived from cultivating the æsthetic faculties, blindly content to live in ugliness, and lazily averse to spending its leisure industriously, or productively. But the determined efforts that are being made to establish handicrafts all over the country and to revive such few traditions as we can boast of, have already begun to show how much artistic ability there is latent.

The great difficulty, however, is apt to be—designing—and as I have had full personal experience of that difficulty myself, I am the more inclined to believe that the method upon which I happen to have stumbled, whereby designs suitable for simple jewellery, with a certain degree of freshness and interest, grow of themselves in an apparently unlimited number in nature's own way—I believe that this method does present a possible solution.

Most holiday resorts have either a pier or else public gardens, where it would seem quite natural to find a kiosk containing a display of local productions offered for sale; and such a kiosk might surely be financed by local support, the expenses being, of course, paid out of commission on sales, which should easily provide a sufficient sum. Then, as to production. Where no craftwork of the kind is already made, the best chance of success would doubtless lie in avoiding ambitious work. Buttons and clasps, muff chains and simple pendants, can be made by quick students who have a natural facility for handling tools, after a very few months' training under a capable teacher, especially if no precious stones are used. Indeed, if the training is continued steadily from day to day, I would substitute "weeks" for "months."

Moreover, such things can perfectly well be made by some of those who are physically unable to follow more active pursuits; and that applies particularly to the small wire units illustrated in Fig. 60, which require only strong fingers, tolerable eyesight, and patience; and they appear to me to provide admirable work for cripples having those qualifications.

Except during the period of learning, when the student should carry each exercise right through from start to finish, I see no harm in a moderate amount of division of labour, when large numbers of the same unit are required.

In the course of a year a few travelling instructors could teach the making of wire units to some of the cripples in each of a large number of different places, and even the more difficult arts of soldering, and mounting, and stone-setting could be acquired in the same way, or by a few selected students being sent to the nearest good technical school for a few months. The outfit required is not very expensive, and the benefits might be far-reaching.

I believe most firmly that craftsmen whose special bent lies in the direction of jewellery, but who find that they have not got the faculty of inventing fine designs for important works, may yet produce charming and beautiful and useful things, if they will only allow their materials, their tools, and their common sense to guide them. But I doubt if any one who takes up this work seriously, on some such lines as those I have indicated, and enjoys it, can possibly fail to develop some power of design, so long as the mind is kept constantly alert to seize every suggestion of design offered by the material, and so long also as the mind—and fingers—are not allowed to continue repetitions to the point of making the work mechanical. We must not go on repeating the same arrangement for long without considering what alternatives or variations are possible. But on the other hand, it is at least doubtful if there is any advantage in courting disappointment by premature efforts after originality. Once again, we cannot make something out of nothing.

Those who are beginning, and tnose who, having begun, may have become conscious of a want of ideas for design, will do well to limit their practical work to exercises for a while, taking care at the same time to lose no opportunity for the study of old work—a study which no artist is ever too great to keep up. In the foregoing pages I have tried to show that the exercises need not be dull, and moreover that their results may be developed later on into actual finished pieces, if they are not required for permanent reference.

Take any simple unit (such as the little bit of wire treated of in Chapter XXVIII.) and try what you can make of it. Don't trouble about pencil and paper for that, whether you can draw with ease or not; take the thing itself, and try every way you can think of using it, with the help of a few simple tools. Follow each way and each by-way right out to its logical conclusion. When you think you have done so—when you think you have exhausted every possibility—just put it away for a few days; take up something else, and when you come to a standstill over that, go back to the other exercise, and you will probably find fresh by-ways opening out and leading you along quiet, unfrequented paths, which pencil and paper would never have revealed to you. Don't say, "Haven't I done nearly enough of these variations?" but rather, "Is there no other possible permutation or combination which I might try now?" The early ones will doubtless have some nice things amongst them, but so also in all probability will the later and less obvious ones reward your perseverance no less richly.

It is not unlikely also, for that matter, that some arrangements or combinations which, when made, look ridiculously obvious, will only occur to you after you have begun to wonder whether you have not about exhausted that particular idea. It has been well said, "Simplicity is the end of Art,—by no means the beginnining."

CHAPTER XXXIX.

MECHANICAL AIDS TO ARTISTIC PRODUCTION.

The recommendation that these ideas be followed right out to their logical conclusion was, perhaps, rather venturesome, because I know that to some artists logic is an offence—a thing mechanical.

Some years ago, at a discussion on "Mechanical Aids to Artistic Production," a certain artist for whom I have a very great respect and admiration, summed up the matter in rather a brilliant way, something like this :—He wasn't going to attempt to answer all the arguments that had been advanced in favour of mechanical aids, for he was too much lost in admiration of the perfect logic of the opening paper. He would venture to say it was even too logical ; he thought that perhaps logic might be said to be—well, to be a mechanical aid—to thought !

I found no opportunity just then to consider quietly whether I really agreed or not ; but in a calmer moment it did occur to me to wonder whether a mechanical aid to thought might not really be rather a desirable thing. Having got that far paves the way to making a much more heretical confession, and it would really only be contemptible hypocrisy to conceal the fact that for my part I want not only mechanical aids to thought, but even aids to design, which in that sense of the word may also be said to be mechanical. Not mechanical aids in their most obvious sense, such as compasses and other instruments, which are, of course, necessary enough at times; but those which are mechanical in the sense that they enable us to make patterns by the physical handling of tangible units of design such as those which have been illustrated, by moving them about and arranging them on an ordinary table with the fingers and with tweezers, as opposed to the pure abstract method of arranging them with elusive, will-o'-the-wisp, imaginary fingers, on the shadowy and treacherous tablets of the mind.

And now I should like to state, with all possible clearness, what I think may be expected, and what, on the other hand, I am sure must not be expected, of these small units, which seem to be offered to us as material for pattern-building, by the action of processes incidental to the manipulation of the precious metals.

I think we may expect two good results, if the units are made and utilised intelligently, and with due patience.

(i.) A steady and natural growth of sound, able craftsmanship.

(ii.) An increased power of design.

But we must not look for either of these results, except where there exists a real desire for their acquisition, and an *increased* power of design implies that some such power is already latent.

Moreover, I do not for one moment suggest that the units in themselves are enough to bring about the birth of great works of fine art. By no means—though even here they may perhaps prove to be useful accessories.

It is well to remember that arts which are not "fine," but only—shall we say—pleasant, serve useful purposes. They train the eye, the hand, the memory, the patience, and they foster the growth and development of any imaginative or inventive faculty which their practitioners may possess.

They are easy to understand, they educate the æsthetic perceptions, and gradually they enable us more fully to understand and appreciate things that are above them, the works of great artists. Some of these lesser arts fulfil another useful function, for they provide a pleasant, innocent, and sometimes even a moderately profitable occupation for those who, while they are not without some degree of artistic sensibility, must yet admit the possession of that object of derision to many artists—I mean a mechanical mind. However serious a limitation that may be, it is a possession of which no one need really feel ashamed, or, rather, I would say, it is one of which no one has any excuse for feeling ashamed. Probably the possession of a mechanical mind is, as a rule, a bar to the attainment of success in the higher walks of art, although the very greatest artists have had minds so big, that the perfect development of all their artistic faculties has still left plenty of room for a fairly complete mechanical section too.

An ability to turn things mechanical to artistic account is a gift to be accepted and tended in all gratitude and humility, and in its cultivation there may be a great store of happiness.

Everyone, who has ever produced and developed an original idea, well knows that it is no exaggeration to describe the early period of conception as one of black misery and depression, lightened though it is from time to time by dazzling moments of intangible hope, as a vague suggestion of what is coming flits across the mental vision ; moments of exaltation which are generally all too brief and rare.

Now this kind of thing may be gone through for what may seem to other people to be of singularly small interest or importance, and may be none the less real and painful for that. And to those who experience something of this kind every time they struggle after an original design, I would say : Stop a moment. If you are aiming at something truly great, then by all means accept the necessity for the struggle bravely, well knowing that the reward for anything even remotely approaching success will compensate abundantly—not so much in ultimate realisation as in the joy of the conflict, when you first begin to lay hold of what you have been striving after. But if what you want is only a fresh design for a trifling thing, a small trinket, or what not, don't cudgel your brains too much for an original idea, vaguely, until you have considered whether for that kind of "artistic production" there does not perhaps exist, what I have been rash enough to describe as a mechanical aid.

APPENDIX A.

A LIST OF THE TOOLS AND APPLIANCES MOST NECESSARY FOR A BEGINNER.

MOUTH blow-pipe (Fig. 37, L).
Jewellers' burner (Fig. 35) or spirit lamp (Fig. 36).

Note.—There are other cheaper spirit lamps made for jewellers, which, though not so convenient as the one which is illustrated, will answer well enough.

Prepared charcoal block (Fig. 37, O).
Borax saucer (Fig. 44, N) or a piece of slate.
Compressed borax (Fig. 44, M) or a few borax crystals.
Small brush (Fig. 44, L).
Best hard silver solder—say ¼ oz. or less.
*Pair of snips (Fig. 42, A). Cheaper ones or even an old pair of nail scissors will do for cutting solder.
Pointed tweezers (Fig. 42, C).
*4-inch skew nippers (Fig. 40, C).
*4½-inch round-nosed pliers (Fig. 40, N). The ends should be nicely rounded, and should measure about 50 thousandths of an inch across.
*5-inch blunt-ended snipe-nosed pliers (Fig. 40, K).
A light hammer with a smooth bright face (Fig. 41, F).
A small flat stake, or "board steady" (Fig. 45, B). Need not be so large as the one illustrated. For substitute, see p. 131.
Small bottle of common sulphuric acid (vitriol).
Small measuring glass to show teaspoons or drops.
One 12-inch length of round steel wire of each of the following numbers, which refer to the twist-drill wire gauge. Nos. 40, 46, 50, 54, 58.
Some standard silver wire (for sizes see Chapters XV. and

* It is bad economy to save a few pence by buying foreign tools. English snips and pliers are very much better than the foreign ones which are sold in London.

XXIII). Two ounces of silver wire in different sizes would last some little time, for exercises.

Some flat copper or gilding-metal wire for practising first exercises. Size 19 × 24 I.S.G.

Some best charcoal-iron binding wire. This can be had in $\frac{1}{4}$ lb. reels (Fig. 37, N). Size 30 is a useful medium size, but it is an advantage to have it in several sizes, as, say, 26, 30 and 35. If only two sizes, then 28 and 34.

The above-mentioned tools and materials, which should cost about 25s. altogether, would enable a beginner to *make a start*. The *most important* of the other tools mentioned in Chapters XIV. to XXV., could be got for another £4.

APPENDIX B.

GAUGES.

MEASUREMENTS of the thickness of metal sheets and wire are amazingly complicated and puzzling, owing to the number of different gauges which there are in use, and to the altogether arbitrary arrangement of numbers by which the various sizes measured are distinguished. There seems to be no valid reason why thickness should not always be measured by the same gauge, whatever the metal, and whether it is of sheet or of wire; nor why the number which represents this thickness, should not always indicate that the thickness in question measures just that number of thousandths of an inch, as Sir Joseph Whitworth many years ago urged that it ought to do. But, unfortunately, gauges are rather expensive things, and perhaps it is natural that people who have spent money on buying the old-fashioned ones should prefer to go on using them, and so the old arbitrary measurements remain in general use and in pretty general confusion.

It is not my purpose to add to the bewilderment of the beginner by giving particulars of all the different thickness gauges which are in use in various trades, but there are four, of which it is almost necessary for him to have some knowledge. The dealers who supply jewellers' materials are busy people, and if a purchaser cannot ask for the material he wants, in the sizes of the gauge by which it is usually measured, he is likely to be kept waiting.

But I do not advise those who are obliged to study economy to buy any one of those four gauges, for no one of them would be sufficient by itself, and none of them is cheap. If the money can be spared, it will certainly be convenient to have a standard wire gauge and a Birmingham metal gauge (sometimes called the Birmingham plate gauge); but a small and simple micrometer gauge (Fig. 94) can be bought for considerably less (the one illustrated cost 3s. 6d.), and with this and the comparative table in Appendix C, p. 269, you are independent of the rest. Moreover, with the micrometer gauge there is never any doubt about a thickness, whereas with the other gauges, if accuracy is necessary, various qualifications have to be used, such as very easy, easy, exact, tight, or very tight, especially in connection with the larger sizes. But on the other hand it does require a slight mental effort to learn how to read measurements from the micrometer gauge, and if it is used carelessly, mistakes are liable to occur.

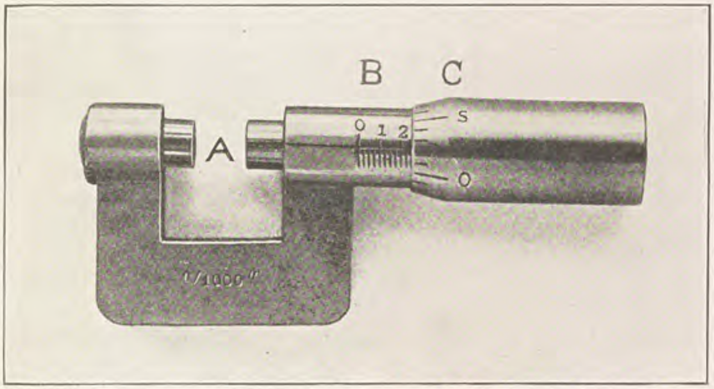


Fig. 94.
Micrometer Gauge.

Referring to the illustration of the micrometer gauge (Fig. 94), which is shown slightly larger than it actually is, for the sake of clearness; the object to be measured is placed in the gap A, which is opened or closed as required by turning the handle C towards you or away from you, as the case may be. The divisions on the handle C represent thousandths of an inch, and it will be seen that on this part between the 0 and the figure 5 there are five spaces, each one of which represents one-thousandth. There are 25 of these spaces in the circumference of this handle, so that each time the handle makes one complete revolution, it either increases or reduces the gap by 25 thousandths of an inch. When it is turned, it moves along the part B, horizontally, to the extent of one of the divisions marked on this part for each complete revolution. Each such revolution represents 25 thousandths of an inch, so that four of the divisions on the part B represent four times 25 thousandths, *i.e.* 100 thousandths, and the figures visible on B thus represent 1 and 2 hundred-thousandths. As the gauge is illustrated it is set at rather more than $\frac{252}{1000}$ of an inch, and if the line 0 on the handle C had been exactly level with the horizontal line which runs along the part B just below the figures 1, 2; then the measurement indicated would have been $\frac{250}{1000}$, *i.e.* $\frac{1}{4}$ of an inch. When the gauge is closed, so that there is no longer any gap at A, the "sleeve" of the handle C conceals all the divisions on the part B, and the line 0 on the handle C is level with what remains exposed of the horizontal line on the part B, and the gauge is at zero.

To give some indication of the meaning of the small measurements registered by this gauge to those who are not familiar with these things—$\frac{1}{1000}''$ is the thickness of ordinary tissue paper; $\frac{3}{1000}''$ that of a 1d. postage stamp; $\frac{13}{1000}''$ that of a thin visiting card; $\frac{16}{1000}''$ that of a stout postcard; $\frac{45}{1000}''$ that of a well-worn halfpenny.

These measurements would ordinarily be expressed as decimals—·001″, ·003″, ·013″, ·016″, and ·045″ respectively.

Now the measurements of any thickness-gauge can be expressed in thousandths of an inch, that is to say, in three places of decimals, and conversely, a measurement given by a micrometer gauge in thousandths of an inch, can be converted to the nearest equivalent in the scale of any other thickness-gauge, by reference to a comparative table, such as that given on p. 269.

The Birmingham Wire Gauge, the Birmingham Metal Gauge (or Plate Gauge), and the Standard Wire Gauge are all of them moderately thick steel plates, with a series of notches of varying widths cut in their edges, each notch being distinguished by a number, which has no other significance than that the notch indicated by any given number, is one size larger or smaller than the one which bears the next consecutive number (Fig. 38, A, B). The variations in the sizes measured by the Birmingham Wire Gauge are very irregular, and the Standard Wire Gauge, which is more systematically graduated, is slowly taking its place. But as both are in use, it is not sufficient to give an order for such-and-such a size, *wire gauge*, without specifying *which* wire gauge is referred to; for the differences, though in many of the sizes quite trifling, are in other sizes considerable, and nearly always sufficient to be troublesome. Moreover, there are various other wire gauges, such as the Lancashire Gauge, and the special gauges used for measuring "needle-wire" and "music-wire." The Twist-Drill Steel-Wire Gauge (Fig. 38, F) is merely a steel plate with circular holes in graduated sizes drilled through it, and numbered consecutively. It is used for measuring the fine tool-steel wire used for making drills. This does not particularly concern the jeweller, but what does concern him in connection with it, is that he needs some of this wire in various sizes for making rings, as described on p. 99, and it is a great convenience to be able to give the numbers by which the sizes are distinguished, when ordering.

These three gauges for measuring wire, all of them denote the larger sizes by the lower numbers, so that size 1 is larger than size 2.

But this order is reversed in the Birmingham Metal Gauge (Fig. 38, B), by which gold and silver sheet are generally measured, so in this gauge size 1 is smaller than size 2. If you are afraid of not being able to read the measurements of the Micrometer Gauge correctly, and are only able to afford to buy one gauge, then perhaps the Standard Wire Gauge will be the most useful. The usual pattern, whose finest notch is No. 30, will not measure the three thinnest sizes of sheet which the Metal Gauge gives places for; but on the other hand, the thickest wire which the Metal Gauge will measure is only half the size of the largest notch in the Wire Gauge, and although you are not likely to need silver wire as thick as that, you probably will occasionally have to use steel wire for making rings, which could not be measured by the Metal Gauge. Moreover, the Standard Wire Gauge can be obtained with finer notches going on to No. 36, and with these you can measure the thinnest sheet you will ever need. Only such a gauge is expensive.

Whether you have a Standard Wire Gauge or a Micrometer Gauge, the table on p. 269 enables you to ascertain the nearest equivalent to any given measurement in any of the other gauges mentioned in that table.

Some examples are given on pp. 270, 271 to explain the method of using the table.

APPENDIX C.

COMPARATIVE TABLES.

TABLE I.

Co'umnA. Distin-guishing Numbers.	Column B. I.S.G. Imperial Standard Wire Gauge. Parts of an inch.	Column C. B.W.G. Birmingham Wire Gauge. Parts of an inch.	Column D. M.G. Birmingham Metal Gauge. Parts of an inch.	Column E. T.D.G. Twist-drill Steel-wire Gauge. Parts of an inch.	Col umnF Distin-guishing Numbers.	Column G. T.D.G. Twist-drill Steel-wire Gauge. Parts of an inch.
1	·300	·303	·008	·228	37	·104
2	·276	·280	·009	·221	38	·1015
3	·252	·258	·010	·213	39	·0995
4	·232	·238	·012	·209	40	·098
5	·212	·218	·014	·2055	41	·096
6	·192	·200	·016	·204	42	·0935
7	·176	·182	·019	·201	43	·089
8	·160	·165	·021	·199	44	·086
9	·144	·149	·023	·196	45	·082
10	·128	·134	·027	·1935	46	·081
11	·116	·120	·031	·191	47	·0785
12	·104	·107	·035	·189	48	·076
13	·092	·095	·038	·185	49	·073
14	·080	·084	·042	·182	50	·070
15	·072	·073	·047	·180	51	·067
16	·064	·065	·051	·177	52	·0635
17	·056	·058	·055	·173	53	·0595
18	·048	·050	·060	·1695	54	·055
19	·040	·043	·063	·166	55	·052
20	·036	·037	·065	·161	56	·0465
21	·032	·034	·068	·159	57	·043
22	·028	·030	·072	·157	58	·042
23	·024	·027	·077	·154	59	·041
24	·022	·025	·082	·152	60	·040
25	·020	·023	·090	·1495		
26	·018	·021	·100	·147		
27	·0164	·019	·112	·144		
28	·0148	·017	·124	·1405		
29	0136	·015	·136	·136		
30	·0124	·014	·150	·1285		
31	·0116	·010		·120		
32	·0108	·009	...	·116		
33	·0100	·008	...	·113		
34	·0092	·007	...	·111		
35	·0084	·005	...	·110		
36	·0076	·004	...	·106		

See footnote on page 272 *re* measurements involving 4 places of decimals.

Examples to explain the use of Table I.

Question 1.—To find the I.S.G. number most nearly equivalent to No. 54 T.D.G.

Method of Procedure.

No. 54 in column F = ·055 inch in column G (T.D.G.). In column B (I.S.G.) the measurement nearest to ·055 is ·056 = No. 17 I.S.G. Answer.

Question 2.—To find the I.S.G. number most nearly equivalent to No. 40 T.D.G.

Method of Procedure.

No. 40 in column F = ·098 inch in column G (T.D.G.). In column B (I.S.G.) the measurements nearest to ·098 inch are ·092 inch and ·104 inch, each of these being equally near to ·098 inch, and they are respectively equivalent to Nos. 13 and 12 I.S.G. (see column A).

But ·092 inch means that slot No. 13 I.S.G. is 92 thousandths of an inch thick.

Therefore a wire which is 98 thousandths of an inch thick cannot enter that slot.

Therefore No. 12 I.S.G. whose measurement is ·104 is the I.S.G. number nearest to No. 40 T.D.G., and the answer should be expressed, No. 12 I.S.G. *Very easy.*

Now a glance at columns F and G shows that from ·092 to ·104 inclusive, there are no less than six T.D.G. sizes against which the I.S.G. column (B) only shows two (Nos. 12 and 13), and as the smallest of these six T.D.G. sizes (No. 42) is one thousandth of an inch thicker than No. 13 I.S.G., it follows that they all belong to No. 12 I.S.G., and that the only way in which they can be measured with the I.S.G.

is by a complicated system of verbal qualifications, as follows:—

T.D.G.		I.S.G. Equivalent.		
Numbers.	Sizes in decimals of an inch.	Number.	Size in decimals of an inch.	Qualifications.
37	·104	12	·104	Tight.
38	·101			Rather easy.
39	·099			Easy.
40	·098			Very easy.
41	·096			Loose.
42	·093			Quite loose.

This example shows pretty clearly that such a system of measurement, if system it can be called, is itself quite hopelessly loose and unreliable, and that the use of the Micrometer Gauge provides the obvious alternative.

The T.D.G. sizes selected for the two examples given on p. 270 could also in the same way be converted into the nearest equivalents in the B.W.G. and M.G. respectively, if desired, and the answers would be as follows:—

No. 54 T.D.G. = { No. 17 B.W.G. *easy* or No. 17 M.G. *tight.* }

No. 40 T.D.G. = { No. 12 B.W.G. *quite loose.* or No. 26 M.G. }

TABLE II.

This table gives the outside diameter (in decimals of an inch, measured by the Micrometer Gauge), of various small silver rings of useful sizes, made by coiling silver wire of the specified size round steel wire of another given size. It also states the diameter of the grains which may be made by melting these rings :—

SILVER WIRE.		COILED ROUND STEEL WIRE ...	GIVES RINGS ...	AND THESE RINGS WILL MELT INTO GRAINS.
No. of Hole in draw-plate (Fig. 38, K).	Thickness of Wire.	No. of Hole in T.D.G. (Fig. 38, F).	Diameter of Rings.	Diameter of Grains.
86	·018 inch	58	·084 inch	·048 inch
80	*·0205 „	58	·088 „	·055 „
76	·026 „	58	·090 „	·062 „
73	·0275 „	58	·107 „	·071 „
69	·0315 „	54	·125 „	·080 „
65	·0335 „	50	·142 „	·091 „
62	·0385 „	46	·162 „	·101 „
59	·048 „	40	·185 „	·114 „

TABLE III.

WEIGHTS, MEASURES AND STANDARDS.

Troy Weight—for Gold and Silver.

24 grains . . .	1 pennyweight (dwt.).
20 pennyweights . .	1 ounce (oz.).
12 ounces . . .	1 pound (lb.).

An ounce (Troy) is *heavier* than an ounce (Avoirdupois)

* The small cheap micrometer gauge (Fig. 94) does not register anything less than one-thousandth of an inch, *i.e.*, three places of decimals, but for fine wire greater accuracy is needed. It is easy to see when a measurement comes about halfway between two of the divisions on the sleeve (c) of the gauge (Fig. 94), and this half-thousandth is expressed by a figure 5 in the fourth decimal place, and it represents $\frac{5}{10000} = \frac{1}{2000} = \frac{1}{2}$ of $\frac{1}{1000}$.

the former containing 480 grains, and the latter 437½ grains. A grain is the English unit of weight, and it does not vary.

A pound (Troy) is *lighter* than a pound (Avoirdupois), but the pound weight is not used by jewellers. It is, however, well to remember that a pound (Avoirdupois) weighs only a trifle more than 14½ oz. (Troy). The exact equivalent is 14 oz. 11 dwts. 16 grs.

A carat is the unit of weight for precious stones, but the less valuable stones are sold by the pennyweight.

---

1 carat contains *approximately* 3 grains.

1 dwt. (Troy) contains *approximately* 7½ carats.
1 oz. (Troy) do. do. 152 carats.

A carat in relation to the purity of gold means simply one twenty-fourth part of the gold.

Thus, "fine" gold contains 24 carats of pure gold, and no alloy metal.
22-carat gold contains 22 carats of pure gold, and 2 carats of alloy metal.
18-carat gold contains 18 carats of pure gold, and 6 carats of alloy metal.
15-carat gold contains 15 carats of pure gold, and 9 carats of alloy metal.
9-carat-gold contains 9 carats of pure gold, and 15 carats of alloy metal.

Twelve ounces (Troy) of Standard (or Sterling) Silver contain 11 ounces and 2 pennyweights of pure (or "fine") silver and 18 pennyweights of alloy metal.

For measuring acids and other liquids the beginner will find a teaspoon to be a convenient unit for rough measurements. It is equivalent to a drachm.

60 drops . . .	1 teaspoon.
4 teaspoons . . .	1 tablespoon.
2 tablespoons . .	1 fluid ounce.
20 fluid ounces . .	1 pint.

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