UNIVERSITY OF TORONTO
3 1761 00176832 4

ROBERT BOYLE

INVENTOR & PHILANTHROPIST

A BIOGRAPHICAL SKETCH.

Q
143
B77
S38

NCE SAUNDERS.

Yours truly
Robert Boyle Senr

INK-PHOTO. SPRAGUE & Co LONDON.

Yours truly

Robert A. Boyle

N.Y. PHOTO. GRAGUE & CO. LONDON

Digitized by the Internet Archive
in 2007 with funding from
Microsoft Corporation

http://www.archive.org/details/robertboyleinven00saunuoft

ROBERT BOYLE,

INVENTOR AND PHILANTHROPIST.

A BIOGRAPHICAL SKETCH.

BY

LAWRENCE SAUNDERS.

LONDON:
GILBERT WOOD & CO., 175 STRAND.
1885.

LIBRARY
UNIVERSITY OF TORONTO
JUN
25
1982
Q
143
B77538

TO

CAPT. DOUGLAS GALTON, C.B., F.R.S., F.R.G.S., &c.,

AS A TRIBUTE OF ESTEEM FOR HIS DISINTERESTED AND UNTIRING EFFORTS IN THE CAUSE OF SANITARY SCIENCE AND THE PUBLIC WEAL,

This Little Work

(WITH HIS KIND PERMISSION)

IS RESPECTFULLY INSCRIBED.

"In Science there is work for all hands more or less skilled, and he is most fit to occupy the higher posts who has risen from the ranks, and has experimentally acquainted himself with the nature of the work to be done in each and every, even the humblest, department."
—J. T. Forbes.

PREFACE.

As a just tribute of respect to an Inventor and Philanthropist, whose life had been spent in good and useful work, some portions of the matter contained in the following pages were contributed five years ago to the columns of the "Inventor's Record."

Of emperors and princes, ministers of state, and heroes of the sword we have ample knowledge. History and biography keep pace with the world's adoration of temporal power and the semi-barbaric love of pageantry and pomp, but modern civilization has been built up by stout hearts and strong hands, nobly devoted to a greater revolution than ever sceptre or sword can accomplish. In the field of industry hundreds of men come and go, leaving behind them memorials of their conscientious toil in the form of substantial and permanent benefits conferred on future generations.

However humble their path of life, however unpretentious their labour, such men have a claim to some little niche, where the memory of their faithful service may be kept green.

A friend once wrote to Dr. Samuel Smiles, the author of "Lives of the Engineers"—"I do not begrudge destructive heroes their fame, but the constructive ones ought not to be forgotten, and there is a heroism in skill and toil belonging to the latter class worthy of as grateful record, less perilous and romantic it may be than that of the other, but not less full of the results of human energy, bravery, and character. The lot of labour is indeed often a dull one, and it is doing a public service to endeavour to lighten it up by records of the struggles and triumphs of our most illustrious workers, and the results of their labour in the cause of human advancement."

The life of Mr. Robert Boyle was not distinguished by any highly sensational or stirring vicissitudes: it was a simple career of very hard work, always directed to one end —the public good. Yet, comparatively barren though it be of exciting incidents, the record of his labours has a special claim to attention. It exhibits very forcibly many sound

and practical lessons: it reminds us that "work is the medicine of the soul," and

> "He that by the plough would thrive,
> Himself must either hold or drive."

As an inventor, never weary, never beaten, firmly and cheerfully confronting stubborn opposition and ignorant prejudice, the story of his life is one which may convey some useful lessons to workers of this class. "*La carrière ouverte aux talents,*" said Napoleon, and therein lies the secret of all success in life. No tools are so durable as those of knowledge, but none need more skilful handling. The adroit and successful application of means to a desirable end has won many victories in the battle of industrial progress.

If this little sketch of a singularly active and earnest career—inspired from early boyhood to the grave by the sacred proverb, "Take fast hold of instruction, let her not go; keep her, for she is thy life"—should serve to strengthen the purpose or direct the efforts of students and toilers anxious to render a good account of their Master's talents, my task will not have been altogether unprofitable.

I have endeavoured in the compilation of these pages to place on record some interesting evidence of the substantial

service done by Robert Boyle, and continued by his son, in the cause of sanitary science. They have accomplished so much in popularizing the subject of healthy homes, and in bringing it from the region of theory to simple practice, that I have taken special pleasure in collecting facts to illustrate their successful progress. In doing so I have departed somewhat from the strict limits of a biographical sketch, but the exceptional circumstances must be my excuse. The late Mr. Robert Boyle left many great schemes but partly developed, and it remained for his son to carry them out. He has virtually lived again in the genius of his successor, and we can only measure the practical outcome of the late Mr. Robert Boyle's industrious life by following the undertakings which he initiated, until we reach the extraordinary developments of to-day.

L. S.

CONTENTS.

CHAPTER I.

Early Career.

PAGE

Youthful Studies—The Power of using Knowledge—First Appearance in Public Affairs—An Unsophisticated Loaf—A Mysterious Warning—The Bread Riot—Another Remarkable Preservation—The Restless Spirit of Revolution—Miraculous Escape at Paisley—Lectures on Missionary Work—Constructs his own Lenses, &c.,—Hard Work an excellent Medicine—Robert Boyle's Power as an Orator, - - - - - - - - 13

CHAPTER II.

Philantbropic Enterprises.

Importance of Technical Education—He organizes an Industrial Museum — Dr. Livingstone and African Missions—Change of Plans—Nature and Art—Discovery of a new Explosive—Trial of the Explosive Shell—H.R.H. The Duke of Cambridge approves it—The Official Extinguisher—Injustice to Inventors—A New Ink; - - - - - - - - - - - - 27

CHAPTER III.

Father and Son.

PAGE

Synchronism of Ideas—Strange Phenomena—Nothing Impossible—Practical Duties of Life—Among the Slums—Efforts of Scientists—A Simple Remedy required—Working to Extend the Span of Life—A Problem to Solve, 36

CHAPTER IV.

A Great Invention.

Comparative Experiments—Sir William Thomson's Opinion—Invited by the Royal Society—Nature does the Work—The Library of the Inner Temple—Sir Gilbert Scott recommends the Invention—Public attention aroused—Capt. Galton and the Government Departments—The Rev. Newman Hall—Experiences of the Russian Government—Professor Grant and Professor Rankin—Local Authorities and their Duties—The First Sea Lord of the Admiralty—The "Black Hole"—Royal Commendation—A Proud Moment—The Rewards of Genius—Death of Robert Boyle—His taste for Works of Art—What was thought of him—His Bright Example—His Son carries on the Good Work, - - - - 46

CHAPTER V.

Pursuit of Knowledge.

Travelling Abroad in Pursuit of Knowledge—New Inventions—Sir Chas. W. Siemens—Smoke a Nuisance of the Past—Improvements in Steel Manufactures, - 68

CHAPTER VI.

Science and Practice.

PAGE

Professor Faraday's Report—Commended by H.M. Board of Works—Gratitude of the Officials—A Difficult Problem Solved—The Subject raised to the dignity of a Science —"The Biter Bit"—The Forum of the City Fathers—A Crucial Test—The President of the R.I.B.A.—Official Thanks—Experiments by an Eminent London Physician—The Reform Club—The Ex-Chief Commissioner of Works, ... 74

CHAPTER VII.

Advance of Sanitary Science.

The Hospital Ship *Castalia*—Visit of Sir Charles Dilke—"Nothing succeeds like Success"—A Hurricane in the House—Australian Experiences—The Mission of Father and Son—Hungry Vultures—The "Kew Farce"—The Homes of the Poor—Business a Pleasure—The Beautiful in Nature and Art—"All Work and no Play," &c.—Literary Work—The Good Cause Prospers —Overthrow of the Subtle Destroyer—A Great Profession of the Future—The "Silent" System—Striving after Perfection, ... 87

"I wisdom dwell with prudence, and find out knowledge of witty Inventions."—PROVERBS viii. 12.

ROBERT BOYLE.

CHAPTER I.

Early Career.

"'Twere a concealment
Worse than theft, no less than a traducement,
To hide your doings; and to silence that
Which, to the spire and top of praises, vouched,
Would seem but modest."—*Coriolanus.*

LOOKING back over a period of fifty years, we are bewildered by the magnitude, the rapid changes, the onward rush, of modern progress. When poor Henry Thomas Buckle sat down to write the "History of Civilisation," he must have had a stout heart to face the gigantic proportions of his task. His brain and hand were still and cold ere he had finished the introduction to his stupendous theme, and yet he had filled a ponderous volume. But the difficulties which he encountered in recording the earlier events of our social, political, and material advancement were trifles in comparison with the complicated details of development, the accumulated results of inventive genius, scientific

research, skilled labour, and indomitable energy, which, within the space of half a century, have put a new face on the civilized world. On the *rôle* of the many who have contributed to this great impetus of progress, we may fairly inscribe the name of Robert Boyle. Original genius allied to physical power—a clear, keen, active mind, backed by a firm will, are the attributes of men who leave "footprints on the sands of time." Robert Boyle gave evidence of these qualities at the dawn of his useful life, and through his maturer years they left behind him a long track of good work. His steadiness of purpose and remarkable activity won many a laurel beyond the reach of lesser men. He demonstrated by fifty years of unflinching industry that

"The best and sweetest far are toil-created gains,"

and all his efforts were directed by a deep religious faith and a broad benevolence of heart.

Robert Boyle was born at Hamilton, N.B., in the year 1821. He was the son of a surgeon who had obtained considerable celebrity as an inventor, and whose name is perpetuated in several medical works as the discoverer of a green ointment, very successful in the treatment of wounds. At an early age the subject of our memoir exhibited an exceptional quickness of intelligence, and devoted hours,

usually spent by boys of his age in purposeless sport, to the construction of mechanical models and to artistic work. His thirst for knowledge and remarkable facility of comprehension rendered study an intense pleasure. Almost every branch of science was eagerly entered upon with a passionate love of learning seldom exhibited in one so young. It was this broad and varied field of elementary knowledge, acquired in the springtime of life, which formed the basis of later studies prolific in practical results. The mind naturally powerful and endowed with a strangely sensitive delicacy of perception was happily trained in habits of arrangement and order, so that knowledge, instead of being a chaos of facts, was to him like a carefully-ordered store-house, with every article classified and ready for immediate use. "Successful men," says Carlyle, "possess the great gift of a methodical, well-balanced, arranging mind; they are men who cannot work in disorder, but will have things straight and know all the details, which enables them so to arrange the machinery of their affairs that they are fully cognizant alike of its strength, weakness, and capability, and they judiciously and discreetly exercise all its power to the uttermost." Every day of our lives we see the practical evidence of these truths. It is not the mere book-worm who achieves anything for the good of his fellow men—the mere accumulation of knowledge is as useless as

the hoarded treasures of the miser. The power of *using* knowledge is the power which has civilized the human race, and its *usefulness* is proportionate to the facility with which it is brought to the surface when wanted.

Young Boyle, bending for hours over his books, or enthusiastically engaged on a mechanical model, an experiment in chemistry, electricity, hydraulics, or optics, out in the green fields examining the structure of plants, or studying, with the soul of an artist, the forms and tints of Nature, was gathering knowledge under the influence of one predominant desire—to render a good account of it in the future.

It is quite unnecessary to follow the course of these early studies. The seed was sown on good ground, and we shall see what kind of fruit it brought forth.

His first appearance in public affairs was at Glasgow, where, observing the bad and impure quality of the bread supplied by the bakers of the town, he resolved to start a bakery for the manufacture of unadulterated bread. Two depots were opened—one in Crown Street, and another in Milton Street, Cowcaddens. The task required no ordinary qualities of mind to accomplish with success. People were quite as apathetic in those days as they are now in matters affecting their general welfare, and nothing but the vigour with which he plunged into this enterprise, a vigour which

characterized everything he did, awakened the public to a proper appreciation of the important reform he was effecting. When they thoroughly understood this, the bold undertaking met with enthusiastic support from all classes, and crowds of people thronged the thoroughfares on Saturday nights to secure an unsophisticated loaf.

He must have worked very hard, for the pure bread business was only one of many philanthropical undertakings with which he identified himself at that period. He was not only busily engaged in lecturing and in Sunday-school teaching, but gave many hours to close study and practical experiments in various branches of science.

During this period of his life we are told that he escaped, by an astonishing manifestation of mental warning, from a disaster which hurried many unfortunate people to a shocking death.

An all-wise Providence preserved Robert Boyle for a life of public usefulness. We may well ask with Tennyson—

> "Do we move ourselves, or are we moved
> By an unseen hand at a game?"

The dreadful catastrophe on the Clyde, caused by a boiler explosion in a steamer, sent at the time a thrill of horror through the country. Overwrought in nerve and brain by the numerous scientific and philanthropical pursuits

which at that period fully occupied his mind, he resolved to try the effects of a trip down the Clyde to recruit his health. He accordingly boarded the new steamer *Telegraph* with that object, but had not been long on deck when a mysterious feeling of uneasiness crept over him, a feeling of impending danger which he could not in any way account for. Unable to find a reason for this nervous sensation, and believing it to be the result of overwork, he strove to battle against it.

His efforts were all in vain ; the feeling of uneasiness grew uncontrollable, and he was obliged to go ashore. When on the quay, however, this vague sense of insecurity entirely left him, and believing it was some mental delusion, he again went on board the *Telegraph*, but no sooner did so than he was attacked by a nervous fit of greater intensity. Unable in spite of his great strength of will to bear up against these alarming symptoms, he left the steamer, impelled by an invisible and irresistible force. There happened to be another boat advertised to start at the same time, but she was a very old, crazy vessel, so crazy, in fact, as to be unsafe. This boat Robert Boyle, against his reason, actually boarded, feeling utterly ashamed at being conquered by nervous feelings so unreasonable.

At last the bell rang for the *Telegraph* to start, and, resolving to be master over his own reason, he made a

dash to board the steamer a third time. Again he was thwarted. Seized with a kind of paralysis, he stood motionless on the gangway until he was forced to retire and return to the other boat. It was very vexatious to witness the *Telegraph* gracefully skimming the waters like a sea-bird while the miserable craft in which he found himself creaked and groaned behind "like a rusty signboard."

Landing at Greenock, he took a long walk, but returning to the shore he was surprised to observe a large crowd gazing anxiously across the water in the direction of Helensburgh.

A loud explosion had been heard, and the news was soon after brought by a tug that an appalling accident had happened. The boiler of the *Telegraph* had burst and torn the ill-fated steamer to pieces!

About six years later, the popularity of the young philanthropist preserved him in an equally miraculous manner, when the whole town of Glasgow was suddenly thrown into a paroxysm of wild excitement by the notorious bread riot on 6th March, 1848. The furious mob, delirious with passion, surged through the streets, wrecking every shop on their way. With mad yells they rushed up Crown Street, in which one of Boyle's bread stores was situated, and armed with every conceivable form of weapon broke into the shops, leaving a long trail of ruin behind them. On arriving at the bread stores, however, an extraordinary scene occurred. A few

of the more reckless rioters were proceeding to treat it in the same manner, when suddenly there was a murmur amongst the crowd, and rushing to the front a number of men, amongst whom were several of the ringleaders, drove back their fellow rioters and formed a barrier before the shop. Thus checked, the people had time to reflect, and they acknowledged their true friend by leaving his shop unmolested. His goodness to the poor shone forth as a beacon of salvation over the tempest of human passion.

When we remember the nature of the riot, it is evident that the work of the philanthropist had been "thorough," and had won its way to the very hearts of the masses. It was the *practical* philanthropy of substantial benefits conferred—not the miserable cant of empty words—and it was understood.

Another instance of his remarkable preservation from danger, or perhaps death, occurred at Paisley, where he went to deliver a lecture illustrated by the oxy-hydrogen light. Before the doors of the church were opened, in accordance with his usual custom he proceeded to test the light, to do which he had occasion to sit with his legs over the front of the gallery, the gas bags being immediately behind him. Instantly, on applying the light, a violent explosion took place, which partially destroyed the roof, and blew out every window and door in the building. The gas bags had

burst, and such was the terrific force that the fifty-six pound weights with which they were loaded were whirled through the air, wrecking and destroying everything in their course.

Mr. Boyle was rendered momentarily unconscious, but on recovering his senses he was astonished to find himself, instead of being blown into the body of the building, as might have been expected, stretched out at full length on the front seat of the gallery. His head and face were slightly scorched, and his hair was singed, but he sustained no other injury. He naturally considered his escape as miraculous, and, falling on his knees, offered up thanks to God for mercifully preserving him in so great a peril. Had the accident happened but ten minutes later the church would have been crowded with people, and the loss of life through the effects of the explosion, and the panic which must certainly have ensued, would have been too terrible to contemplate. The church-keeper, who happened to be under the gallery at the time, received such a shock to his nervous system through the fright he sustained, that he was confined to his bed for a considerable time afterward. There is but one step from the sublime to the ridiculous. A Sunday-school teacher, on entering immediately afterwards, innocently enquired if it always did that.

Robert Boyle studied social problems with an excep-

tionally keen interest, and he preserved an independence of judgment which kept him free from the trammels of mere party politics. There was much to excite the mind of an intelligent man in those days, when the air was thick with the dark Spirit of Insurrection, and Revolution threatened every country in Europe. They were anxious times. In London and every large town in England the Chartists were maintaining a dangerous agitation. In Ireland popular irritation was even more demonstrative. Insurrectionary rifle clubs were formed, and the passions of poor Pat were inflamed by violent leaders.

Political agitation on the Continent excited a baleful influence everywhere. The supporters of old-world despotism and the champions of liberty were face to face. Italy was making its first feeble effort to throw off the Austrian yoke, and men were lashed into fury by political antagonism. The Lombardo-Venetian provinces were in open revolt, and Marshal Radetzky, in command of the Austrian troops, cheered on the Imperial soldiers by the assurance that "The efforts of fanatics and a false spirit of innovation would be shivered against their courage and fidelity like glass striking against a rock."

At Berlin the people were restless and threatening. More than a hundred men and women were shot down at the gates of the royal palace, and the work of slaughter was

scarcely over when King Frederick William issued a proclamation stating that his "faithful soldiers had only cleared the court yard at a walking pace, with their weapons sheathed, and that the *guns had gone off of themselves*, without, thanks to God, causing any injury." At Munich the people had captured the arsenal, and only restored the arms on satisfaction of their demands. The workmen of Paris were parading the streets in thousands, and Prince Louis Napoleon was making every effort to win the confidence of France.

Thus far we have glanced at the surrounding aspect of affairs, to show how much there was to excite the sympathies and claim the attention of a man gifted with quick intelligence and philanthropical instincts. These events simply had the effect of strengthening Robert Boyle's conviction that popular education, based on a pure Christian faith, was the real bulwark of society, and he resolved to devote the best part of his life to this work.

What he had to do he did with all his might, and for a certain period of his life he devoted his whole time to lecturing on behalf of great missionary undertakings. His lectures on missionary work in the South Sea Islands were illustrated by dissolving views, with the aid of the oxy-hydrogen light, the whole of the apparatus, even to the grinding and polishing of the lenses, being the work of his own hands. There are many now engaged in the earnest

battle of life who will remember the Sabbath school in connection with the late Dr. Beattie's church, and who still carry with them the vivid impression of truths forcibly inculcated by an earnest teacher—Robert Boyle.

A very practical philosopher of modern times has said that "work kills half the ills that flesh is heir to." So thought Robert Boyle when overtaken by a severe illness which kept him for a time from active labour.

On one occasion, when confined to bed with a severe illness, he so chafed at his enforced idleness, that at last he devised a novel means of propagating the knowledge he could not orally impart. He collected and arranged a number of striking facts relating to missions, heathen manners, customs, &c., and had them condensed and manufactured in the form of small wafers, so that booksellers might distribute them to be used instead of seals for letters. At that time envelopes were not generally used, and almost all letters were sealed or wafered; the consequence was that these wafers became very popular. They were a ready means of conveying gospel truths far and wide, and, to extend their influence for good, they were translated into several different languages. The sale of these attractive little messengers of "good tidings" ultimately realised an amount sufficient to build a large boat, which was appropriately named *The Wafer*, and was specially designed and

fitted for the service of missionaries on the rivers of the West Coast of Africa.

The religious ceremonies and customs of India had been illustrated at the Royal Polytechnic, London, by a very beautiful collection of views, and, an opportunity being afforded to purchase them, Robert Boyle at once secured these valuable and attractive aids to the work of instruction. His lecture on this subject was one of the most popular he ever delivered, and bore good fruit in directing attention to the moral, social, and religious position of millions of human beings in the bondage of ignorance and cruel superstitions.

The success of this lecture, as indeed of all his efforts on the platform, was in no small measure enhanced by his earnestness, the natural dignity of his demeanour, and a force of character which gleamed through every movement of his features. He possessed a power of the eye and voice which chained the attention of his audience.

Remembering how great an influence he possessed over the minds of thousands who attended his lectures, it is almost to be regretted that he had not selected the pulpit for his special work in life. Had he done so he would have been a very famous preacher, for ready wit, great persuasive power, and intense earnestness were prominent characteristics of his oratory.

Perhaps he was right in selecting a more general field of work. He was an inventor, and apart from religious teaching he was always striving to invent ingenious appliances for the convenience and benefit of his fellow men. Had he undertaken the duties of a minister of the Gospel, he was much too sincere a man to have neglected his spiritual work for temporal concerns, and the world might have lost one of the most useful sanitary inventions of the Victorian age.

He was singularly skilful in the construction of apparatus, and possessed acquaintance with a great variety of handicrafts. One day he would be a skilled optician, designing an optical instrument of the most complicated description; another, he was an electrician, preparing batteries and working out elaborate circuits; the next he would be a chemist, solving the mysterious action of gases and the laws which govern explosive compounds.

CHAPTER II.

Philanthropic Enterprises.

"The generous spirit, who, when brought
Among the tasks of real life, hath wrought
Upon the plan that pleased his childish thought."

To a man so eminently fitted for the work of instruction, and so deeply impressed with the national importance of technical education, it is not surprising that the backwardness of the country in this respect should have been a matter for much anxious thought. He foresaw with prophetic certainty the approaching struggles of trade—the incoming tide of foreign competition, and he knew that the best safeguard against a rapid decline of national prosperity would be the encouragement of technical training. Convinced of the extreme urgency of the case, he could not rest until practical steps were taken to provide such instruction in Glasgow.

In conjunction with the Lord Provost, and leading promoters of the temperance movement in Glasgow, he organized in 1854 an Industrial Museum and Hall of Science and Art, the first institution of the kind in Scotland. The museum contained specimens of natural produce and

manufactures from all parts of the world, samples of artistic industry, and a picture gallery; lectures were delivered on various subjects within the range of practical science, and Robert Boyle laboured most assiduously, almost always constructing his own apparatus for the effective demonstration of his lectures. The museum was located in the large block of buildings at the juncture of Trongate and Brunswick streets. The energetic promoter spared neither toil nor money to collect instructive objects for exhibition, and it is believed that he expended a very large sum of money on the undertaking. Notwithstanding every effort, however, to make it a permanent success, the museum had to be closed at the expiration of three years. The industrial classes were not sufficiently impressed at that time with the need of intellectual culture; they could not be raised from the apathy of gross ignorance; education had not been doing its work as a national system, and the number of supporters were consequently insufficient to maintain such an institution. During all this time Robert Boyle was vigorously carrying on the work of practical instruction in other parts of Glasgow and the neighbourhood, notably at the City Hall, where he frequently lectured to large audiences on electricity, chemistry, natural philosophy, astronomy, etc. The lectures on astronomy were illustrated by a large orrery, which he made himself, and which was a wonderful

example of mechanical ingenuity. He also made at this time a complete apparatus for electric telegraphy and the electric light. An apparatus, still preserved, was invented by him, which shows that he had fully conceived the idea of the fixed electric light.

It was natural that, being a personal friend of Dr. Livingstone, his attention should be attracted to that great traveller's exploits, and we find him hard at work painting the scenery of African deserts, forests, lakes, etc., and illustrating the principal incidents of the explorer's missionary labours. He visited every part of the country with this lecture, and accomplished much towards awakening a greater sympathy for the benighted races of the Dark Continent. A substantial result of these lectures was the consignment of large quantities of clothing and other necessaries for distribution at missionary stations in Africa. He really intended to go himself, and join those soldiers of the Cross who faced the danger of African wilds in the great cause. Every preparation was made for the journey—and had he carried out his intentions, his indomitable energy of mind and body would probably have won for him a distinguished name among African explorers.

His soul was stirred by the contemplation of that great continent plunged in the gloom of ignorance and left behind for long centuries in the triumphant march of human

progress. With the pastoral bard who sang "The Seasons," he pitied their savage isolation.

> "Ill-fated race! the softening arts of peace,
> Whate'er the humanising muses teach;—
> The godlike wisdom of the tempered breast;
> Progressive truth, the patient force of thought;
> Investigation calm whose silent powers
> Command the world; the light that leads to Heaven;
> Kind equal rule, the government of laws,
> And all-protecting Freedom which alone
> Sustains the name and dignity of man;—
> These are not theirs."

They would have found in Robert Boyle a courageous messenger of light, a patient, vigorous and resolute pioneer of civilization. But he was destined for less adventurous, though no less important work. The sudden illness of his wife changed all his plans, and we are perhaps indebted to this domestic trouble for the valuable inventions by which he has benefited this country.

There were pleasant periods of rest from the lecture room and the platform, when the love of Nature, and the quick perception of the beautiful, seem to have had full sway over the subject of our memoir, for we find him bending with painstaking diligence over the easel, studying art with all the ardour of innate genius. One of the best of his art productions was an allegorical picture representing the marriage of the Prince and Princess of Wales.

He always watched with lively interest the passing events of his day, and to the last pursued knowledge with persistent zeal. Thus it was that he conceived the idea of diminishing the number and duration of wars by making war more terrible. Believing in this doctrine, he went to work with his characteristic enthusiasm to invent a missile of most destructive power, and succeeded in manufacturing a detonating powder of awful explosive force, and yet possessing the recommendation of being quite safe to handle or move about. In combination with this powder he designed a shell, which was admitted by experienced military men to be an improvement on everything of the kind then in use.

It is a curious coincidence that while he was engaged in perfecting this invention, Professor Faraday gave a lecture on explosives, in which he hinted at the possibility of an explosive force being devised by a combination of bodies capable of instantaneous and vast expansion. No process had as yet been discovered by which the combination could be effected. This was exactly what Robert Boyle accomplished, and what had baffled hundreds of experimentalists before his time. Interesting experiments were made at Glasgow in the presence of Lord Provost Blackie, Mr. Dalglish, M.P., Colonel Carter, and other officers of the 63rd regiment, and a large assembly of practical and scientific men, who unanimously proclaimed

the success of the invention. We find the following report of one of these experiments in the *North British Daily Mail*, of Oct. 13, 1866 :—

"Yesterday at Muirhouses Brickfield, head of Eglinton Street, some interesting experiments took place with the view of testing the power of a new description of detonating powder, prepared by Mr. Robert Boyle, Glasgow, well known for his missionary lectures in this city and throughout Scotland. There were present on the occasion the Lord Provost, Mr. Dalglish, M.P., Colonel Carter of the 63rd regiment, Colonel Dreghorn, and other officers and gentlemen. A cast-iron tube, 9 inches in length, and $2\frac{1}{2}$ inches thick, with a bore three-fourths of an inch in diameter, and closed at one end, was filled with Kames crystal gunpowder, medium No. 2, while into another tube of similar size and character was inserted a cartridge containing only $2\frac{1}{2}$ drachms of the detonating powder. On being discharged, the tube which had been filled with the ordinary gunpowder was left uninjured, while the other tube was shattered to pieces, some of which were forced deep into the soil and others thrown to a considerable distance in different directions. Colonel Carter and the other gentlemen present expressed themselves completely satisfied with the result. The powder is designed to be applied to the purposes of war, in connection with a new description of shell which

Mr. Boyle has likewise invented. The shell consists of two parts, which are screwed together, one end being conical. Within the other part is a chamber for containing the explosive compound. The shell may be termed an electric ball, there being another substance in the chamber besides the powder, by junction with which, as of two electric poles, the explosive power is increased threefold. The powder has at the same time the great advantage of being safe, as compared with all detonating substances, and it stands a great amount of friction, as Mr. Boyle convinced all present by grinding a portion to dust between two irons. We understand that means are being adopted, through the instrumentality of those who have examined and approved of the invention, to have it ultimately brought under the notice of Government. Mr. Boyle, as his career has shown, is a man of peace, and has been long under the conviction that the individual who could invent the most destructive missile of war would be the greatest friend of peace."

It was afterwards tested and reported upon favourably by the principal military authorities, including H.R.H. the Duke of Cambridge, who expressed a wish to see it adopted at Woolwich. His Grace the Duke of Argyll introduced Robert Boyle to the Minister of War, from whom he received similar assurances of approval. Mr. Abel, the government chemist, issued a report testifying to its special merits, and

told the inventor that he knew of nothing so powerful and yet so safe. The official encomiums were encouraging, but they were the stereotyped preface to an old, wearying and monotonous story—a story of invention crippled, crushed, and driven out of the country by red-tape obstructiveness! The inventor who depends on such favours

> "Swims with fins of lead
> And hews down oaks with rushes."

With a droll inconsistency the select Ordnance Committee informed Robert Boyle that his invention was not suitable for the British service! The disappointment was probably great. Few inventors can bear with equanimity the cold shade of neglect. Intelligent industry must have scope and purpose, but it has neither the one nor the other when it meets the dead wall of prejudice. The inventor can never be

> "A man that fortune's buffets and rewards
> Has ta'en with equal thanks."

Enthusiasm, hope, and faith are the vital principles which direct and sustain his energy in the struggle against stubborn obstacles, in the eager search for the unknown, in the patient determination to pick up a thread that has been recklessly trampled over by hurrying generations through the long line of centuries. To cool enthusiasm by apathetic neglect, to crush hope with official barriers, and to shake

faith by gross injustice has been too long the disastrous policy of England towards inventors.

This is more to be lamented because, although we have been called "a nation of shopkeepers," the history of civilization proves us to be a nation of inventors.

It is not our duty here to discuss the merits of Boyle's powder and shell. We believe that his son is acquainted with the secret of their manufacture, and may yet succeed in obtaining from the War Office some result more consistent than that which *approved* his father's invention and *rejected* it. There are other inventions which Robert Boyle devoted much time in submitting to her Majesty's Government, and it is hoped that their public utility will yet be recognised. Amongst them we may mention an ink which is perfectly inerasable, and which successfully stood the most severe tests made by the Royal College of Chemistry on behalf of the Government. This ink is of great commercial value: it can be used also by artists as a paint in place of sepia or Indian ink, and is invaluable for important documents deeds, etc., as it preserves the paper upon which it is written, the unwritten portion of which might fade away, but that written upon would still remain as sound as ever.

CHAPTER III.

Father and Son.

"That Talbot's name might be in thee reviv'd
When sapless age and weak unable limbs
Shall bring thy father to his drooping chair."—*Henry VI.*

Fortunately Robert Boyle was sustained in the work of his later life by the valuable assistance of his son. He had trained his boy with the affectionate solicitude of a wise and good father. He had cultivated that close intimacy and mutual confidence by which a father may control and hold the affections of a young man entering the world. He reaped his reward in the faithful and able co-operation which lightened the cares of later years. So closely were parent and child bound together in heart and mind by the frank and frequent interchange of ideas, that there became manifest a most remarkable phenomenon, for which we can find no better name than synchronous thought. At the same instant they would both be engaged with a similar train of ideas. Through all his lectures, experiments, and undertakings, Robert Boyle's son acted in the capacity of private secretary and "business man." A few instances of

the remarkable sympathetic unison between them will suffice to show its effects—its cause we cannot penetrate.

> "Who shall tempt, with wandering feet,
> The dark, unfathomed, infinite abyss,
> And through the palpable obscure find out
> His uncouth way?"

On one occasion Robert Boyle and his son were sitting in the dining room of their coast residence at Kamesburgh, when the father broke the silence by exclaiming that he had hit upon a plan which might be the means of saving many lives in the event of vessels striking on the rocks. His son remarked that it was a curious circumstance, for he was at that moment meditating on something of the same kind. On comparing notes, they found to their amazement that they had both conceived the same idea, and worked it out precisely in the same manner, even to the minutest detail. The subject had not been so much as hinted at during any previous conversation. A yet more remarkable coincidence occurred when Robert Boyle, noticing in the papers the records of numerous robberies of Post Office pillar-boxes, designed an improved pillar letter-box, from which it was impossible for letters to be stolen. He submitted his invention to the Duke of Montrose, then Postmaster-General, who at once acknowledged the improvement, but blandly informed him that the *thieves were captured*. The force of

his remark as a reason for not adopting the invention was not apparent to the inventor, so he thanked His Grace for having honoured him with an interview, and returned to Glasgow. On arriving there, to his utter astonishment, he found his son had made, with the aid of some old battery cells, a model of a letter-box, which was identical in principle with his own, and this had been accomplished without any previous knowledge of what had already been done.

Another instance deserving record was a startling simultaneous unison of ideas, in connection with the famous Air-Pump Ventilators. Mr. R. Boyle, jun., has laboured with the utmost diligence in building up for the first time in this country the distinct profession and business of ventilation engineering. From the age of eleven he had acted as his father's confidential agent in business matters, and when a youth of sixteen had actually given elementary lectures on the Sciences to large public audiences. He was, therefore, thoroughly trained to co-operate in the development of such an important reform—a reform affecting the health of the whole community. It was while examining a plan of the Air-Pump Ventilator that father and son silently discovered at the same instant a means of greatly increasing the power of the apparatus.

There is no doubt that these and other mysterious manifestations of an unknown agency, influencing thought

and action, were subjects for frequent meditation and much speculative thought. They are, more or less, attractive to all active minds; nor are such apparently supernatural problems to be cast carelessly aside to the realm of the impossible—which, after all, is merely an undiscovered country. There is a spiritual essence pervading the universe, and in close relationship with matter, of which we know nothing, but here and there highly sensitive natures are supposed to feel its presence. In the graphic words of Göethe, translated by Mr. Theodore Martin, we find the idea of one subtle force governing the life of the material world beautifully set forth—

"In the currents of life, in action's storm,
I wander and I wave;
Everywhere I be!
Birth and the grave
An infinite sea;
A web ever glowing
Thus at Times' whizzing loom I spin
And weave the living vesture that God is mantled in."

We have said that the region of the impossible is merely an undiscovered country. It is this faith which has given the world its grandest discoverers and greatest inventors.

Very truly has Herschel said: "The perfect observer in any department of science will have his eyes, as it were, opened, that they may be struck at once by any occurrence

which according to received theories *ought not to happen*, for these are the facts which serve as clues to new discoveries." Nor is Herschel alone in this opinion. The most successful scientists of the Victorian age have given us similar advice. "The word 'impossible' is not, to my mind, applicable to matters of philosophy," wrote Professor Huxley; "that the possibilities of Nature are infinite is an anachronism with which I am wont to worry my friend." Again, Mr. William Crookes, the discoverer of the radiometer, has given us a very clearly expressed argument against what Humboldt called "presumptuous scepticism." He writes, "I prefer to enter upon enquiry with no preconceived notions whatever as to what can or cannot be, but with all my senses alert, and ready to convey information to the brain; believing as I do that we have by no means exhausted all human knowledge or fathomed the depths of all physical forces." Faraday, too, has left on record words which no student of Nature should forget: "Nothing is too wonderful to be true if it is consistent with the laws of Nature, and in such things as these experiment is the best test of such consistency."

It was in this spirit of unprejudiced enquiry that Robert Boyle noted and often communicated to his personal friends the mental phenomena we have mentioned. The practical duties of life absorbed too much of his time to leave much

opportunity for the collection of any connected evidence which might throw additional light on those psychological problems which still puzzle the world, but may some day be satisfactorily solved.

In the long rambles which he was in the habit of taking, through the by-ways and squalid labyrinths of our great towns, seeking for opportunities of improving the condition of the poor, he was painfully impressed with the want of sanitary precautions in thickly populated districts, where poverty, dirt, and vice were in grim alliance. Sanitary reformers had delivered learned discourses to the fashionable audiences of learned societies, pointing out the conditions of health and exposing our deficiencies in the matters of pure air and water: but there was no real attempt to place within the reach of the people a substantial remedy for these evils.

Robert Boyle believed, and rightly, that pure air was the first of all sanitary conditions, and he had observed the general neglect of this condition in the construction of public and private buildings.

He knew that the time was not far distant when a very great change for the better would be necessary, to meet the requirements of a public better educated on such vital questions, and he felt that every effort should be made to find a simple method of ventilation which would, with

certain modifications, be applicable to almost every building from the palace to the cottage.

Accustomed to view such subjects from a common-sense point of view, he at once arrived at the conclusion that any apparatus to be generally adopted and always efficient must be as permanent as the building to which it would have to be connected, and with this guiding principle to direct his efforts he resolved to exert his inventive faculties in search of the much-needed ventilator.

It was no easy task; but with the assistance of his son he succeeded beyond his most sanguine expectations.

To find a suitable remedy for the poisoned air which thousands—nay, millions—of people were daily inhaling was probably the lesser half of the great work to be accomplished.

To convince the world of its fatal errors; to make people understand the presence of deadly influences, which they cannot see and do not immediately feel; to arouse the public mind to a proper appreciation of the grave consequences resulting from imperfect ventilation—these were tasks which required no ordinary ability, energy, and singleness of purpose to accomplish.

Thanks to the efforts of Dr. Richardson, Prof. Du Chaumont, Prof. Corfield, and other distinguished men of science, we have no excuse for continued apathy on such matters; but even now it is terrible to contemplate the

fearful penalty we are paying for the neglect of simple sanitary precautions.

Dr. Whitmore, the Medical Officer of Health for Marylebone, in his reports to the Vestry on the unhealthiness of the six districts into which the parish is divided, stated that, owing to its wide streets and large and well-ventilated houses, the Cavendish Square district had a death rate of only 14·1 per thousand, while, owing to its narrow streets and small and *badly-ventilated houses*, that of Christchurch district was 21·7 per thousand, but even this was an improvement, for owing to the perseverance of the sanitary officials there was an annual saving of about 300 lives.

We might fill ten thousand pages with such facts.

The remedy for that procrastination which permits great districts of "poor neighbourhoods" to fester in the heart of our cities, must be found in some very simple and efficient system of ventilation—a system within the reach of all classes, as effective in purifying the air of a church or a theatre, as in removing the foul air from crowded workshops and the confined dwellings of the industrial classes.

It was this consideration which influenced Robert Boyle to avoid all complications in working out the problem of ventilation, and with the assistance of his son, such determined and vigorous efforts were made to provide simple

and reliable apparatus for the better ventilation of public and private buildings that the subject rapidly gained favour with architects, and assumed the aspect of a distinct branch of scientific engineering. So far as one can trace the history of ventilation in a practical and scientific form, it appears that Robert Boyle and his son are entitled to take a foremost place as pioneers of such progress as we can now boast. Referring to their labours in this direction, *Industry*, in its "biographical sketches of eminent men," says: "The Messrs. Boyle, as founders of the profession of ventilating engineers, have raised the subject to the dignity of a science." They grappled with the difficulties of the subject and faced the characteristic apathy of the nation in matters of public health, in the true spirit of philanthropy.

Where men with narrow views might have fallen back faint-hearted, they were strengthened in their work by a higher aim than mere trade. It was a glorious prospect for the contemplation of the practical philanthropist—the prospect of adding a year or two to the span of life of thousands—nay, tens of thousands—of fellow-beings. Here, indeed, was a noble legacy to leave to future generations. Others might strive to snatch the honour and dispute the service; but truth finds its way on the page of history and finds a chink to shine more brightly through the unclean rubbish of falsehood.

Robert Boyle and his son never contemplated building up a great business by supplying people with the means of breathing pure air. It was a matter which directly affected the welfare of teeming millions, and this was enough for the enthusiastic inventors, who, in the midst of scientific researches and the fascinating labour of peering into the grand mysteries of nature, never forgot that the true value of knowledge was to be found in its application to the wants of their fellow men. A powerful and constant *exhaust*, which would unceasingly pump the foul air out of buildings, without requiring any attention, was the principal problem to solve. The result of investigation and experiments in this direction was the famous Air-Pump Ventilator.

CHAPTER IV.

A Great Invention.

"Since at contrivements we are skilful both,
For dexterous sleights, 'mongst mortals thine's the prize."
—*Homer.*

This ventilator was originally a revolving one, but finding from experience that any ventilator having a mechanical movement was liable to get out of order, and prove to be a nuisance rather than a boon, this form was quickly and wisely discarded in favour of the fixed ventilator, which, since its introduction, has effected the almost complete rejection by architects and experts of revolving and other forms of mechanical ventilators. To test the comparative merits of the fixed and revolving ventilator, a series of experiments were conducted in Glasgow under the inspection of Sir William Thomson, the eminent electrician, and a large and distinguished body of scientists, including professors from several of the principal colleges in the kingdom, architects, engineers, and medical men, when the superiority of the fixed ventilator was fully demonstrated.

Sir William Thomson, after further experiments with the Air-Pump Ventilator, and prolonged observation of its

action, presented Mr. Boyle with the following testimonial:—"I have seen several different forms of Mr. Boyle's Air-Pump Ventilator in actual operation, and have much pleasure in testifying to their efficiency. They thoroughly realise the favourable anticipations which I formed from experiments on models shown to me by Mr. Boyle. Having one fitted up in my yacht, I find it has caused a very decided improvement in the draught." This opinion, from one of the most eminent scientific men of the day, and whose inventions have revolutionised almost every department of science, was essentially of the greatest value to Robert Boyle, for the practical knowledge and scientific attainments of Sir William Thomson render his opinion a power, and no one was more competent to judge of the value of such an invention. Sir William Thomson possessed too high a reputation to be lightly compromised by any hasty or uncertain conclusions, and hence public confidence was largely increased in Robert Boyle's simple ventilator, and the work of ventilating buildings received a new impulse. He was invited by the Royal Society to explain his invention to the members, who unanimously approved it, and orders were given through the Architect, Mr. Charles Barry, to have it at once applied to the laboratory of the Society at Burlington House.

It might certainly be looked upon as a good omen for

the success of the Air-Pump Ventilator that it should have received the approval of the Society, and that almost its first application should be to the Institution founded by an illustrious namesake, Robert Boyle, Earl of Burlington.*

There have since appeared numerous exhaust ventilators which act on the same principle, but they are all more or less appropriations of Robert Boyle's original invention, cunningly varied in detail to avoid infringement of patent rights. Continued experiments extending over many years have brought the construction of the ventilator so very near perfection that these imitations in every instance appear to lose in efficiency proportionately as they deviate from the form of the original.

The leading principle in the Air-Pump Ventilator is the utilization of a great and ever varying natural force—the motion of the atmosphere—to extract foul air from the interior of buildings. Nature has provided a proper ventilation for the surface of the earth in the restless current of the air.

> "The circling typhoon whirled from point to point
> Exhausting all the rage of all the sky,"

---

* "Why need I name Boyle, whose search amid the dark recesses of his works the greater Creator sought?"—*James Thomson.*

"Who shall grace, or who improve like Boyle?"—*Pope.*

"Recommend the good we owe a Boyle."—*Sir Samuel Garth.*

"Thy Boyle in wisdom found content."—*Lord Lyttleton.*

which within the sultry region of the tropics sweep and cleanse

> "The swampy fens,
> Where putrefaction in life ferments
> And breathes destructive myriads;"

or nearer home, within the temperate zone, the cold "north east," and those circling waves of air, the rough and noisy Boreas and the "ever fanning breeze" or soft warm zephyr of a summer day, constitute Nature's grand system of ventilation, without which the fair world would be a pestilential waste.

By arresting the natural circulation of the air within the walls of rooms, by artificial heat, by exhalations from the lungs and body, by fumes from burning gas or oil, by subtle poisons escaping from the sewers and other sources of impurity, we repudiate the immutable laws of Nature, and are punished by enfeebled health, disease, and death.

It is evident we cannot do better than render the interior of houses and public buildings as healthy, so far as purity of the air is concerned, as the open fields. Is this possible? This is a question which Robert Boyle answered for us in the affirmative.

The inventor knew perfectly well that if people could be persuaded to have appliances for the extraction of the hot, poisoned air from their houses, they would never

submit to the trouble of looking after them. It was, therefore, necessary that the apparatus should not only be self-acting, but *never failing*, and dependent solely for its action on the ever benevolent energies of Dame Nature.

However satisfactory such apparatus may be in theory, we know by many experiences that we must rely on the evidence of actual practice before an opinion on its results may be safely expressed. An opportunity for the patent Air-Pump Ventilator to "speak for itself" was afforded by the utter failure of many attempts to ventilate the Library of the Inner Temple. Robert Bóyle, upon being invited to deal with the difficulty, applied his apparatus in perfect confidence that the problem which had baffled architects and engineers would be promptly solved by its simple action. He was right. It was a complete success, and the stifling hot air of the great Library was at once exchanged for cool fresh air without any inconvenient draughts. "Those fixed under my direction at the Library of the Inner Temple," wrote Mr. Arthur Cates, architect to the Crown, "have realised my expectations, and completely fulfil the object which I had in view. I consider this application of them a severe test, and the success which has attended it confirms the statements which you make as to their efficacy."

The late Sir Gilbert Scott was equally delighted with the

simplicity and thorough efficiency of this form of ventilator, and in a testimonial which he presented to the inventors—the value of which may be conceived when it is mentioned that it is the only one he was ever known to give—he says: "Gentlemen,—I have used your Patent Self-Acting Air-Pump Ventilators with complete success. From experience of them in my own house and other buildings—public and private—where they have been applied under my direction, I can confidently and will always have great pleasure in recommending them." This eminent architect fully realised the public importance of the invention when he departed from his rule of reticence to offer such emphatic public testimony to its merits. While most encouraging to Robert Boyle that his invention should be esteemed worthy of such distinguished notice, a vast amount of good was done by Sir Gilbert's frank avowal of its merits, in stimulating architects to adopt systems of ventilation hitherto regarded as impracticable. His son, John Oldred Scott, alluding to a ventilator put up at St. Margaret's Church, Brighton, wrote to Messrs. Boyle a letter with this significant sentence: "*Medical men recommend their patients to attend this church because of the purity of its atmosphere.*"

Perhaps the most gratifying proof that the invention is one of extraordinary merit and great public

usefulness may be found in the fact that the distinguished judges at the International Medical and Sanitary Exhibition held in London in 1881, awarded it the highest and only prize given for roof ventilators. Wherever exhibited the Air-Pump Ventilators and System of Ventilation carried off the palm of victory, notwithstanding an ever-increasing host of competitors. At the Mining Institute of Cornwall, the Cork International Exhibition, the North-East Coast Exhibition, Tynemouth, the International Exhibition of Means and Appliances for the Protection and Preservation of Human Life, the International Ventilation Competition, the Eastbourne Sanitary Exhibition, and other competitions, first prizes were won by the unanimous verdicts of the judges. Had the subject of this memoir lived to receive them with his own hand, such a display of medals and honours would have been a pleasing reward for much anxious thought; but more gratifying than these testimonies of approval would have been the substantial evidence of having aroused public attention to the important necessity of efficient ventilation.

One of the first gentlemen in London to appreciate the beneficial results likely to result from Robert Boyle's sanitary inventions, was that very able sanitarian, Captain Douglas Galton, C B., F.R.S., who was then chief adviser to H.M. Board of Works. When the Air-Pump Ventilator was

brought under his notice he instantly recognised its practical value and the correctness of the principles upon which it was designed, and being satisfied with the merit of the invention he lost no time in submitting it to the notice of the executive committees of several Government departments, who received it most favourably. To these introductions by Captain Galton, Messrs. Boyle have reason to express themselves considerably indebted, for the ventilators are now extensively used by all the departments.

The example encouraged influential men to give the subject of ventilation their attention, and thus we may give Captain Galton a prominent place among the pioneers of this important sanitary reform. Another good friend to the cause was the late Sir Randall Martin, chairman of one of the committees in the War Department, who took not only a great liking to the invention but to the inventor, to whom he accorded his warmest friendship.

A description of the various sanitary inventions of Mr. Boyle and his son is to be found in the excellent books on ventilation, sanitation, and heating, written by Capt. Galton. The inventions are also described in over fifty different works; indeed, we do not know any modern book treating upon ventilation which does not contain some reference to Messrs. Boyle's work on behalf of public health.

Our churches are still so badly ventilated that congrega-

tions are either half suffocated with foul air and heat, or subjected to dangerous draughts; but the popularity of Mr. Boyle's invention has led to its adoption in a great many places of worship.

One of the first churches in London to which the Air-Pump Ventilator was applied was the Rowland Hill Memorial Church. The Rev. Newman Hall after several years' experience of it says:—"I consider our ventilation very successful."

When the ventilator, which is 6 feet diameter, was tested by the architect and others it was found to be extracting the foul air at the rate of 360,000 cubic feet per hour, with only a gentle breeze, and there was not the slightest down-draught.

Mr. Spurgeon's new college in connection with the Tabernacle, Newington Butts, is ventilated with the Air-Pump Ventilators; and as indicating Mr. Spurgeon's satisfaction with them, it may be mentioned that he has recently adopted them for the new Tabernacle which is being built in Auckland, New Zealand, for his son, the Rev. Thomas Spurgeon.

Mr. Alfred Waterhouse, A.R.A., the eminent Architect, in a letter to Mr. Boyle, referring to his appliances in use at Eaton Hall, says:—"I am glad to hear good reports of your Cowls fixed at the Duke of Westminster's house." The

Chapel of Caius College, Cambridge, is ventilated by Mr. Boyle's system, under the direction of Mr. Waterhouse.

The chapel of Emanuel College, Cambridge, and St. Mary Redcliffe, Bristol, are also ventilated by the system, under the direction of Mr. Arthur W. Blomfield, who uses the Air-Pump Ventilator extensively for churches, and with so much success that he has presented Mr. Boyle with the following testimonial:—"I have used the Air-Pump Ventilators of Messrs. Robert Boyle & Son with satisfactory results. I believe the system to be a sound and good one and capable of varied application."

Saint Paul's Cathedral, the Bank of England, and the Royal Exchange are in the long list of public edifices supplied with Mr. Boyle's apparatus.

The system of ventilation was applied by the Russian Government to the Imperial Bank Note Manufactory, St. Petersburg, and the experiment was found to be so successful that it was also applied to the Imperial Mint, and the Imperial State Papers Manufactory. The Russian officials state that it is the only system they have ever tried which has proved efficient and fully met their requirements.

Wishing to test the opinion of the architectural profession with respect to his system of ventilation, Mr. Boyle recently wrote to each architect requesting that if any of his appliances had been used, he (the architect) would state his experience.

In response to this appeal Mr. Boyle received within the space of six weeks testimonials of the most valuable nature from nearly one-fourth of the architectural profession in the United Kingdom, and in this voluminous list are to be found the names of almost every leading architect in the country.

Professor Grant, Glasgow University, says of the Air-Pump Ventilator:—"It is constructed on sound scientific principles. Acts in strict accordance with the laws of nature, and cannot fail to operate."

The late Professor Macquorn Rankin, Professor of Engineering, Glasgow University, has given his report to the effect that—"There is no time throughout the whole year but when there is a sufficient movement of the air at the level of the house tops to cause the Air-Pump Ventilator to act." No higher authority on engineering could be quoted than Professor Rankin, and the opinion expressed being the result of actual personal experiment, we feel justified in accepting it as conclusive.

Thus far we may award to Robert Boyle and his son the full measure of credit for having settled a very important question, and we may be satisfied with the fact that, for all ordinary purposes, the problem of extracting foul air from buildings has been reduced to the most simple, economical, and reliable form. We say *reliable*, because if this ventilator could not be relied upon for constant action, the whole

system of ventilation would break down, as is frequently the case where ventilators are used having mechanical movements, or where the expensive processes of steam, water power, or artificial heat is applied to produce an up-draught.

The application of the Air-Pump Ventilator to the ventilation of soil pipes, drains, and sewers is one which should be better understood by district surveyors and officers of health. The cost is so small, and the precaution so important to public health, particularly in densely-populated neighbourhoods, that we hope soon to see some vigorous steps taken for their more general adoption. Our builders are not sufficiently under the control of the local authorities; but although we move slowly, very slowly, on the road of reform, the time must come when the health of the people will be guarded by more practical and systematic measures.

If apparatus of a very costly character, and liable to frequent or even occasional disarrangement, were needful to provide us with the means of getting rid of sewer gas, there might be some excuse for the extraordinary neglect of such precautions by our builders.

Mr. W. Eassie, C.E., author of "Healthy Houses," &c., &c., recording his experience of Mr. Boyle's invention, says:—"I have often made use of the Air-Pump Ventilator for soil pipes, and consider it most admirable. Its action is continuous, and it cannot possibly get out of order. It is

decidedly the most efficient fixed foul-air withdrawing medium that I ever met with."

Mr. Ernest Turner, F.R.I.B.A., author of several well-known sanitary works, writes:—"Boyle's Patent Self-Acting Air-Pump Ventilator is the best soil-pipe ventilator that I know of."

For the ventilation of ships the Air-Pump Ventilator is invaluable, for it never requires trimming, and is always in action under every condition and variation of weather. Being perfectly watertight it does not require to be removed during rough weather, as is the case with other ship ventilators. It is now extensively used by all the leading steamship companies in Europe, and in the British and foreign navies.

Admiral Sir Hastings Reginald Yelverton, G.C.B., First Sea Lord of the Admiralty, says respecting it:—"I have great pleasure in recommending Mr. Boyle as sole inventor of a ventilator which I found of the greatest use during my three years' command in the Mediterranean, on board Her Majesty's Ship *Lord Warden*."

The ventilation of ships is a question of the deepest concern. It is a question affecting the health and lives of thousands of brave mariners, and also touches directly the food and fuel supply. The shippers of cattle must suffer to a large extent through the cattle being lessened

in value by injury from the poisonous atmosphere of the holds. Coal-laden ships are frequently destroyed by fire from spontaneous combustion from want of adequate ventilation through the coal.

The subject indeed is one urgently demanding the most earnest attention of all who claim to have the welfare of humanity at heart, while it also appeals to those who desire to mitigate the tortures of animals during transport. The amount of suffering and destruction which has occurred, and we fear will yet occur for a considerable time to come, on board emigrant, cattle, and coal-laden ships through the want of proper ventilation is too appalling for description. In some instances when, owing to stress of weather, every opening is battened down and made both water-tight and air-tight, the horrors of the "Black Hole" were trifles in comparison. During bad weather the old-fashioned ventilators commonly used on board ship have to be removed.

With the view of finding, if possible, a remedy for this deplorable state of things, the Worshipful Company of Shipwrights offered a prize of £50, which, to his honour be it mentioned, was generously presented by ex-Sheriff Burt for the best system of ventilating ships which might be submitted to them. Mr. Robert Boyle, jun., grappled with the problem, determined as usual to succeed. A complete system of ventilation that would be perfectly self-acting, require no

attention, could not get out of order, and, above all, which would be perfectly water-tight, and able to be kept in operation in all conditions of weather, was no easy task. Yet without these essentials his experience told him no system of ventilation intended for ships could be permanently successful or capable of universal adoption. He ultimately succeeded in devising a scheme to his satisfaction, and submitted it to the Company at their exhibition held at the Fishmongers' Hall, May, 1882. There were ten competitors in all, comprising the leading ventilating engineers in this country and America, the competition being international. After most carefully considering and examining into the merits of the different systems, the judges awarded the prize to Mr. Boyle. The award was taken exception to by one of the American competitors, and out of courtesy, we presume, to a stranger, the judges agreed to reconsider their decision, with the result, according to their report, of becoming more fully convinced of the superiority of Mr. Boyle's system, and of the justness of the decision they had arrived at.

His Royal Highness the Duke of Edinburgh, who is a member of the Company, on the occasion of his visit to the exhibition evinced considerable interest in the system, and warmly expressed his approval of it, particularly commending its extreme simplicity. It also received the approval of many distinguished experts and authorities on naval matters,

including the Royal Commissioners appointed to report on the ventilation of ships. The Marquis of Ailsa, a practical shipbuilder himself and a member of the Company, was so pleased that he at once gave an order for it to be applied to his new yacht. The public press, both English and foreign, took the subject up with considerable enthusiasm, and the articles which were written and published at the time, all with special reference to Mr. Boyle's system, would fill several bulky volumes. The invention has since met with great encouragement. It is rapidly increasing in favour, being adopted on a number of the large lines and foreign navies, and Mr. Boyle has received numerous very valuable testimonials certifying to the complete success of the system.

From what has already been done, we should say there is a great future before it, and that the talented inventor will reap the reward he has so well earned. The knowledge that he has conferred upon the world an invention which, so long as men go down to the sea in ships, will help to alleviate human suffering is in itself an ample recompense. It was a proud moment in his life when, upon the occasion of the distribution of the prizes at the Fishmongers' Hall, in the presence of a distinguished and noble company, he was invited to the platform to receive at the hands of Lady John Manners (the gifted wife of the

noble president of the Company) the prize he had so well won, in the form of a cheque for £50, accompanied by a diploma. Lady Manners congratulated him upon having so successfully solved a problem which had baffled other inventors, and on the benefits it would confer, thanking him in the name of the Worshipful Company, the community, and herself, who were all deeply indebted to him for his valuable invention. The inventor replied with characteristic brevity, 'I hope to live to see it effect all the good I wish," and, thanking her ladyship, returned to his seat amidst the cordial applause of the brilliant company present. We are pleased to put on record this little episode, because such encouragements are few and far between in the career of inventors. The reception usually accorded to them by the public is not, as a rule, of a cheering character. Poverty, old age, and death, under the cold shade of apathetic neglect, are their usual fate. Mr. Boyle, as with other inventions, has been very fortunate with his system of ventilating ships. He has been awarded a number of gold medals and first prizes at different international exhibitions and competitions, and in every instance where it has been exhibited or put in competition it has carried the first prize—in the majority of cases the only prize offered for competition.

Within a short period of his death Robert Boyle, sen., laid another important invention connected with war weapons

before the Government. It was received with approbation. He was requested to make improvements with a view to its perfection, and when all had been done he received the stereotyped form that it "was not suitable." The vexation and disappointment at so much anxious labour lost, and the preying sense of a great injustice, shattered his constitution and hastened his death. He was engaged in introducing an excellent invention to prevent explosions in mines, which alone would have entitled him to a high position as a benefactor to his species, when he was struck by paralysis, and died on the 2nd of September, 1878. His last words whilst he still retained the faculty of speech were, "I will think no more."

He had been an exceptionally active member of society through a period which must occupy a most important chapter of the world's history; the quarter of a century which saw him in the full vigour of manhood was fraught with great events. Mighty changes had taken place since he struggled to arouse public interest in his museum at Glasgow, and when his career came to a close he had the satisfaction of knowing that many reforms which he urged in his younger days were accomplished, and many great things for the intellectual elevation of the masses for which he had yearned were realized.

Almost the only recreation he permitted himself was the

agreeable occupation of collecting works of art, confining himself chiefly to the old masters, of whose works he was allowed to be an excellent judge. He made such good use of this valuable talent, and of the opportunities which presented themselves, that he has been enabled to leave behind him a very large collection of old masters, which his family have most laudably determined to keep together in its entirety in loving remembrance of their esteemed father.

The press, and especially the representative organs of the constructive arts, paid a great tribute to the memory of this zealous philanthropist and successful inventor.

The *North British Daily Mail* announced his death to the citizens of Glasgow thus :—"There has gone from our midst one whose life has been one series of efforts to benefit his fellow-creatures. A more thoroughly genuine or single-minded man never existed, and he combined a nature simple and unsophisticated as a child's with the most powerful energy and indomitable perseverance which nothing could daunt or shake, his masterly genius nobly battling against and overcoming all difficulties. He was beloved and esteemed by all who knew him, and he leaves a large circle of friends who deeply mourn his loss."

The *Architect* said :—"It would be difficult to say whether Mr. Boyle was more eminent as a philanthropist or an inventor. One thing is certain, few men of

our times have done more in the way of practical benevolence. Throughout his life he was animated by an engrossing idea of duty, and he followed it steadily without deviation."

Alluding to his improvements in ventilating apparatus, the *Mercantile World* said:—"When we think of the extraordinary success which has attended the use of this appliance, we cannot refrain from including in the list of public benefactors the late Mr. Robert Boyle, for by his inventive genius a system of ventilation has been devised which meets every test to which it can be subjected, and in such a satisfactory and perfect manner as has never been equalled by any other system."

The *British Architect* in a long memoir said:—"The name of Boyle in connection with ventilators has come to be on a somewhat similar footing to that of Chubb in connection with locks. . . . . His life was uncommon alike in its laboriousness and usefulness, and there is left behind, not merely the name of a successful inventor, but the bright example of a life honestly and thoroughly lived in the truest sense of the word."

It would be quite unnecessary to quote any further the numerous obituary notices which appeared in newspapers and periodicals. Although he had never courted popularity, he was widely known by his practical and universal labour

in behalf of the public good. Wherever he went he left the undeniable impression of his strength of character and goodness of heart. His bright example kindled into action many a sluggish mind, and his sound advice fell broadcast like seed upon good ground, springing up and bearing fruit a hundredfold.

Wherever Robert Boyle came in contact with his fellowmen he won their respect and love by his simplicity of manner, frank cordiality, and intellectual attainments. His sonorous voice, power of expression, and self-command contributed to his success as a lecturer; while his indefatigable industry, his *thoroughness* in all he undertook, and his natural genius, gained for him a prominent place among inventors of the Victorian age.

The simple and expressive lines written by the Princess of Wales on the death of Admiral Sir Carr Glyn might with all truth be applied to him :—

> "Life's work well done,
> Life's race well run,
> Now comes rest."

Industry, in its biographical sketches, describing the life and work of Robert Boyle, says :—"The founder of the eminent firm of sanitary engineers—Messrs. Robert Boyle & Son—has a double claim to be included in the gallery of portraits grouped under the above heading; for not only did

he establish and direct a very important industrial establishment, but as an inventor he has left, without undue exaggeration of terms, his mark on modern industrial history. He died the victim of overworking his brain. Recommended on many occasions by his family and friends to take some rest, as it was but too evident that the excess of mental labour which he imposed upon himself was telling upon his constitution, he always replied that whilst he laboured for the benefit of humanity he gladly devoted his life to that good cause. It is satisfactory to notice that the mantle of the father has fallen upon a worthy son. Mr. Robert Boyle, jun., who had no small share in the perfecting of the Air-Pump Ventilator, directs the firm, of which his father was the founder, with an ability worthy of the honoured name which he bears. It is not generally known that for some years before his death Mr. Boyle, sen., took but little active share in the affairs of Messrs. R. Boyle & Son, and that it was really Mr. Boyle, jun., who gave the business its present industrial status, extended its ramifications, and established its affluence."

CHAPTER V.

Pursuit of Knowledge.

"Home-keeping youth have ever homely wits."

* * * * * *

"I rather would entreat thy company
To see the wonders of the world abroad,
Than, living dully sluggardized at home,
Wear out thy youth with shapeless idleness."

—*The Two Gentlemen of Verona.*

It would have been unfortunate if the death of Robert Boyle had arrested the progress of the sanitary work of which he was such a skilful and indomitable pioneer. His genius and energy survived in his son, who continued the great conflict against foul air with renewed vigour. As an inventor, too, he has already made his mark, his name being connected with a number of ingenious inventions connected with practical sanitation. During a period of fifteen years he has attentively studied every phase of sanitary science, and has acquired such a high reputation in his profession that he has been employed to ventilate buildings in nearly every European country, and even at the Antipodes. Some of these tasks have been executed under trying conditions,

which, however, his genius has always been successful in defying. Mr. Robert Boyle, jun., has visited nearly every civilized country in the world for the purpose of studying the different systems of ventilation in use, and ascertaining if they satisfactorily fulfilled the requirements which the climate of each country demanded. In the pursuit of these studies he naturally gained a vast amount of information respecting existing sanitary appliances, and from actual experience of them was enabled to discover their defects. These his inherent inventive powers enabled him to rectify, the result being the long list of valuable sanitary improvements with which his name is identified, and which have made him conspicuous as a sanitarian and as one of the most prolific inventors of the present day. Among the best known of his inventions may be mentioned the double-action system of soil-pipe ventilation, which utilizes the natural motion of the atmosphere so as to exert a double power in the soil pipe. With this system the air is admitted as well as extracted above the roof. There being no air inlet at the ground level it is impossible for poisonous gases to escape excepting at the top of the pipe. This system has now been thoroughly tested, having been subjected to very severe trials, and is pronounced by the most competent authorities to be the best and safest system of soil-pipe ventilation which has yet been brought out. Its chief merit

is its safety, for in most other systems the gases are apt to escape at the ground level, with fatal consequences to health.

An old Spanish proverb says: "The two greatest evils in life are a cold draught and a scolding wife." Mr. Boyle determined to baffle the first evil. Observing that in most cases where fresh air inlets were provided in both public and private buildings they were generally kept closed in cold weather, and the ventilation thus seriously interfered with, he devised an extremely simple arrangement, by means of which the air passing through the inlet tubes can be raised to any temperature required, thus effectually doing away with cold draughts, and obviating the necessity of closing the inlets and so arresting the ventilation. The apparatus consists of a round copper pipe placed in zigzag fashion in the inlet tube, and connected with a chamber at the bottom. In this chamber is fixed a Bunsen burner, the flame of which ascends the tube, the products of combustion being condensed and conveyed outside the building by a small pipe let through the air-hole in the wall.

The invention was first practically tried at the Guildhall, London, and afterwards in a more improved form at "Lloyd's," Royal Exchange, the Reform Club, Pall Mall, and other public buildings, with very satisfactory results. Mr. Boyle, however, is indebted for several improvements in this appliance to the Right Honourable Acton Smee Ayrton,

ex-Chief Commissioner of Works, who, with the inventor, carried out a series of experiments, extending over several months, with the view of making the apparatus as perfect as possible. The late Sir Charles W. Siemens, the eminent electrician and inventor, took considerable interest in this invention, and after practical tests expressed his high approval of it, specially commending its extreme simplicity. There is really no limit to the value of this apparatus. We not only need pure air, but we also want to regulate its temperature, and Mr. Boyle may certainly be congratulated upon having met these wants in such a simple and yet effective manner.

The pestiferous state of the atmosphere in public buildings and private rooms, after the gas has been lighted for some time, is known to be an evil more dangerous and disastrous to health than the consumption of unwholesome food, but very little seems to have been done towards remedying it until Mr. Boyle conceived the idea of conveying the products of combustion directly away from the gas without permitting them to mix, or come into contact, with the air of the room. This was accomplished by the use of concentric tubes, which, while clearing the atmosphere of the products of combustion, also prevented the radiation of heat, keeping the room cool and agreeable, however numerous might be the lights. Considerable notice was taken of this

invention when it was brought out, by the professional and scientific press, and it seemed to be the almost unanimous opinion that it was destined to revolutionise our present stereotyped gas-fitting arrangements. It came into collision, however, with many interests, and we regret to say the invention has not met with that recognition which its usefulness and importance to the health of the community should have commanded.

The extraction of foul air from our dwellings and from the cabins of ships is a matter of the first importance, but next to it we may class the prevention of smoke. Mr. Boyle has perfected an arrangement for this purpose, which is simple and effective. It is no exaggeration to assert, that if applied to every factory and steamer in the kingdom, the atmosphere would not only be rendered purer and sweeter, and smoke from these sources be a nuisance of the past, but a saving of *many millions* annually would be effected in the cost of fuel, the arrangement having been proved by a number of trials to be a valuable fuel economiser. The inventor holds testimonials and reports fully confirming this statement.

Mr. Boyle, we are informed, has also a process which, if applied to the steel manufactures of Sheffield only, would, according to his calculations, effect a saving of over a million annually on the cost of production, a superior quality of steel

being at the same time produced. Unfortunately for the success of this invention, its adoption necessitates an almost entire change in the present plant of steel-works, the process being a complete revolution in the manufacture. One or two of the leading firms in Sheffield have been sounded as to the encouragement it would be likely to receive, but their opinion is that the objection mentioned would be an insurmountable obstacle to its adoption. Time will prove whether they are entirely correct in this supposition; but as matters stand in connection with the steel trade, especially the competition and quality of goods put out by American manufacturers, we are of opinion that some move must soon be made, or English steel manufacturers will find their occupation gone. There are numerous other inventions of practical utility for which the public are indebted to Mr. Boyle, but we have no space in these pages to refer to them. Our main object is to assist in the progress of practical sanitation by doing full justice to Mr. Boyle's inventions for that purpose.

CHAPTER VI.

Science and Practice.

"I always find theoretical men rather inclined to look with a certain amount of disdain upon practical men, and to think that practical men know nothing about their subject unless they follow the dictates of theorists. But they are now paying much more attention to the teachings of experience."—*W. H. Preece, F.R.S.*

THE proper ventilation of public buildings is a matter in which we are all personally interested; for who has not suffered at some time or another from the polluted and poisonous atmosphere which is usually found in every church, hall, or theatre in the kingdom? It is true that many efforts have been made to remedy this deplorable state of things, but from one cause or another they have generally proved abortive.

To show, however, that it is not impossible to effectually ventilate a large building, we may mention a striking instance in the case of the London Custom House, the bad ventilation of which was long notorious; indeed, so far back as thirty years ago, when a Royal Commission, composed of the most eminent scientific and practical men

of the day, including Professor Faraday and Dr. Ure, was appointed to examine and report upon the ventilation, it was reported to be the worst-ventilated building in London, and to have the foulest atmosphere. This report specially referred to the Long Room, said to be the largest room in the world. Many attempts had been made to ventilate the building; and afterwards the highest scientific and engineering talent in the country was engaged in endeavouring to remedy the evil. Thousands of pounds were expended in the different attempts without success, and the most elaborate appliances employed. It was the old story of complication and failure. At last the case became desperate. The health and constitutions of the clerks were injured by breathing the pestiferous air, and the authorities decided to seek the advice of Mr. Boyle. He received instructions from Her Majesty's Board of Works to examine the Long Room and furnish a report, submitting a scheme of ventilation. Having examined the room and sent in a report and plan, Mr. Boyle was asked to meet Mr. John Taylor, head of Her Majesty's Office of Works, who plainly pointed out the difficulties which would have to be faced, and with some scepticism assured him that he was entering upon an undertaking in which eminent engineers and scientists had failed. Mr. Boyle replied that he had perfect confidence in the system he proposed to apply and was prepared to

guarantee success. Mr. Taylor accepted Mr. Boyle's offer with an expression of incredulity, and said if he was prepared to subscribe to such a guarantee, to be drawn up by himself (Mr. Taylor), he would there and then adopt the plan and estimate as furnished. Mr. Boyle signifying his assent, the matter was settled, and the work proceeded. The result is now a matter of world-wide celebrity in the annals of sanitary engineering history, and has earned for Robert Boyle's son the reputation of being the most skilful ventilating engineer in this or indeed any country. On the completion of the work it was submitted to a series of severe tests, under most trying conditions, by a number of gentlemen interested in the subject, including eminent scientists, engineers, architects, and medical men, who expressed themselves completely satisfied with the results. This opinion, after a sufficient trial of the system, was endorsed by Her Majesty's Board of Works and by the occupants of the room, who in the warmest manner expressed their gratitude to Mr. Boyle for the great benefit he had conferred upon them. With a view to put on record the evidences of success, we give a few extracts from journals of the period :—

"The advantages of Messrs. Boyle's system have been rendered obvious to the most superficial observer. The atmosphere of the room is now clear and pure, and the old

Long Room headache is a thing of the past. The clerks declare that they do not feel the prostration which was formerly the result of a day spent in a foul atmosphere, but they leave their work as fresh as when they commenced in the morning. . . . . We are in a position to testify from personal experience to the great benefits derived by the application of Messrs. Boyle & Son's system of ventilation to the Long Room. Messrs. Boyle are to be congratulated upon having successfully grappled with a grave difficulty, which had almost become a public scandal."—*Civilian, 19th March, 1881* (accredited organ of the Civil Service).

"It is very many years ago since we first drew attention to the very defective state of the ventilation of the Custom House, and particularly of the Long Room. . . . . Experiments have been tried from time to time with more or less success, and various schemes have been proposed, but it has been reserved for Messrs. Robert Boyle & Son, the well-known ventilating engineers, of London and Glasgow, to solve satisfactorily what was undoubtedly a difficult problem—how to effectively ventilate the Custom House, or rather the Long Room there. . . . . The Long Room now is thoroughly ventilated, and we are glad to receive both written and oral testimony to the efficient manner in which it has been done, and also how greatly the comfort

and health of the clerks have been improved. . . . . It is a satisfaction to us to know that a matter we have constantly 'ventilated' in these columns is now no longer a subject for complaint. At the same time, the eminent firm who have so ably dealt with this evil are undoubtedly to be congratulated on their success."—*Civil Service Gazette, 25th March, 1881.*

"Messrs. Robert Boyle & Son are to be congratulated upon the success they have achieved, and the London Custom House may proudly be added to the long list of public buildings successfully ventilated by them, and which bear testimony to the soundness of the principle they advocate. As founders of the profession of ventilating engineers, they have raised the subject to the dignity of a science, and brought their system to such a state of perfection that we understand they are prepared to guarantee the efficient ventilation of any building entrusted to their hands, no matter how many other systems may have been previously tried and found unsuccessful."—*Industry.*

After the lapse of fifteen months Mr. Boyle, who would make no application until he considered the occupants of the Long Room had had sufficient experience of the system during all seasons of the year, received the following official report:—

REPORT FROM H. HANCOCK HOOPER, ESQ., CHAIRMAN OF THE LONG ROOM VENTILATION COMMITTEE.

"LONG ROOM, H.M. CUSTOMS, LONDON,
"*28th March, 1882.*

"GENTLEMEN,—In reply to yours of the 27th inst., I have to inform you that I have conferred with the other members of the Long Room Ventilation Committee, and to state that we are unanimously of the opinion that your ventilation appliances have been a success.

"It is evident that no system of ventilation in so large a space as the Long Room can be rendered so perfect as to suit all idiosyncrasies and temperaments, but I confidently assert that we have enjoyed, since your appliances have been in action, a purity and clearness of atmosphere to which we had long been strangers.—I am, &c.,

"H. HANCOCK HOOPER.

"To Messrs. R. BOYLE & SON."

The notorious "Seddon" correspondence, which appeared in the columns of the *Builder*, attacking the ventilation of the Custom House, nearly fifteen months after it was completed, will yet be fresh in the memory of many. The indignation which it excited called forth severe censure at the time. A more unjust and indecent attack it would be difficult to conceive, and the representations made, without having the slightest foundation in fact, were so recklessly impudent that one can only charitably suppose the author was at the time under the influence of some mental hallucination. This gentleman, an architect, was the advocate of a rival system of ventilation which had proved

a failure in a large public building, and was superseded about that time by Mr. Boyle's. When the correspondence was brought to a close, poor Mr. Seddon had only succeeded in exposing his own absurd delusions, and the Editor stated in a foot-note—"From the evidence submitted we must consider the matter terminated in Mr. Boyle's favour."

At the time the experiments were being conducted at the Custom House, a deputation from the Corporation of London examined the system with a view to its application to the Council Chamber at the Guildhall.

Any ordinary observer who has had the privilege of entering the Council Chamber of the Guildhall, London, even when devoid of occupants, would be almost sure to ask himself the question as to how the room was ventilated. It is one of those apartments that appears to strike the mind that a something more than can be seen is necessary for the healthful comfort of those whose civic duties compel them to pass a portion of their time in it, and if the stranger has had an opportunity of being present when the City parliament have been holding their debates, he would have soon found that the atmosphere was anything but inviting; and had he asked any of the officials, or even the members of the Council themselves, he would have heard dissatisfaction expressed on all hands, for it was notorious that, spite of

different attempts to remedy it, including what we may term an elaborate system introduced no later than three years since, the room in which the City Fathers hold their conclaves was one of the worst-ventilated apartments for its size, as a public one, in the metropolis. Smarting under the annoyances they had long laboured under, the City Architect was finally instructed by the Corporation to request Mr. Boyle to submit a system of ventilation adapted to the requirements of the chamber, but on the conditions that it would only be accepted after exhaustive trials had proved to the City Architect and a committee that it was successful; and if not to their satisfaction, every vestige of it was to be removed within a specified time, and everything made good, at Mr. Boyle's expense.

Thus the contract was entered upon on the principle of "no cure, no pay." Confident in his system, Mr. Boyle accepted the terms, and the guarantee, which was of a very stringent character, was drawn up by the Corporation, and was of such a nature as would put the system to a most severe and crucial test. At the tests that were made after the completion of the work we need only mention that the average quantity of vitiated air withdrawn amounted to 500,000 cubic feet per hour, and that during the whole of the experiments, official and otherwise, not the slightest down-draught was experienced; had it been otherwise the

conditions would not have been complied with, and Mr. Boyle would have been called upon to remove his appliances, and the system would have been pronounced a failure, one of the principal conditions being that down-draughts should be entirely absent, and that a continuous and powerful up-draught should be maintained.

After six months' practical experience, Mr. Horace Jones, City Architect, and President of the Royal Institute of British Architects, certified that all the conditions had been fulfilled, and that the ventilation was successful; and Mr. Boyle received payment of his account. A large number of distinguished scientists, representatives from the different Government departments, and scientific and learned societies, repeatedly tested the system during the six months the experiments lasted, and they unanimously expressed their satisfaction with the results. Even ventilating engineers, who were invited to be present on such occasions, expressed their approval, the success of the system being so evident as to place it quite beyond cavil.

While these experiments were being conducted, Mr. Boyle received letters from their Royal Highnesses the Dukes of Edinburgh and Connaught and the late lamented Prince Leopold, expressing their interest in his efforts to advance

the cause of sanitary science. It may be mentioned that Mr. Boyle's system of ventilation is in use at Claremont, the residence of the late Prince Leopold, and other royal residences.

The following letters have been received by Mr. Boyle from Sir John Monckton, the Town Clerk of the City of London :—

"Guildhall, E.C., July 10, 1882.

"Dear Sirs,—I gladly give you the enclosed letter of introduction to my friend Mr. Whichcord, and hope that his high professional position may make it of use to you. You have the permission you ask to copy it for use elsewhere, for really I am personally gratefu for the alleviation we now experience in the condition of the air we have to breathe for so many hours together.

"Faithfully yours,

"(Signed) John B. Monckton."

"Guildhall, E.C., July 10, 1882.

"My Dear Whichcord,—I am asked by Messrs. Boyle to state my personal experience of the recent ventilation of the Council Chamber. I can do so in very few words. Until the present year I never knew what it was to leave the Guildhall on a "Common Council day" without a headache. I now do not know what a headache is. In fact the palpable alteration for the better in the atmosphere, even on crowded days, is very satisfactory, and it appears to me—a non-expert—that Messrs. Boyle's system is eminently valuable and practicable.

"Yours very obediently,

"(Signed) John B. Monckton."

In addition, the officials of the Court and many members

of the Council have personally thanked Mr. Boyle for the benefits they have derived, from a healthful point of view, from the application of the system. From a large number of equally favourable letters received from independent sources we abstract the following from an eminent London physician and sanitarian :—

"After thoroughly testing and examining your system of ventilation as applied to the Council Chamber of the Guildhall, I have great pleasure in being able to say that I am in every way satisfied with the result. It is, in my estimation, the most perfect system yet introduced, and I greatly doubt there being any room for improvement upon it. The fact of your appliances being entirely self-acting and having no movable parts liable to get out of order after having been placed is a great boon, as it renders any after-cost or attention unnecessary. During the time that I have devoted to testing your appliances I have always found them entirely free from down-draught, a feature I have not found in any other system, and which I opine to be of the greatest advantage, as it not only serves to ventilate the building more thoroughly, but furthermore maintains an even temperature therein, which no sudden change of weather can affect. My pursuits have rendered me practically acquainted with many systems of ventilation now in use, both automatic and otherwise, and after careful examination I have arrived at

the conclusion that your system is not only the simplest but the most efficacious I have yet met with. This opinion is, in so far as the Council Chamber is concerned, also shared by some friends of mine who are members of the Council, and who pronounce the application of your process simply faultless."

As samples of the opinion of the press we select two short extracts from the *Builder* and *Building News*, as they are representative papers and recognised authorities on such subjects :—

"We have had an opportunity of being present in the Chamber during a meeting of the Common Council, and being aware, from personal experience, of the bad state of the atmosphere which used to prevail on Court days, we are in a position to say that a marked improvement has been effected—so decided a change for the better, in fact, that we can quite endorse the favourable opinion of it which has been given by Sir John Monckton, the Town Clerk, in a letter to Mr. Whichcord."—*Builder*, Nov. 18th, 1882.

"We have witnessed the operation of the system, and can now speak from personal experience of the merits of the principle which Mr. Boyle has applied to this and other public buildings in London and the provinces."—*Building News*, Nov. 3rd, 1882.

Several attempts had been made to ventilate the

Reform Club, but without much success, and Mr. Boyle was ultimately invited to submit a scheme of ventilation. The task presented many difficulties, but Mr. Boyle grappled with them in his usual self-reliant manner, finally presenting a carefully thought-out plan which was approved by the Committee and architects, the order being given for the work to be forthwith executed. After a lengthened trial and a series of test experiments under the supervision of the Right Honourable Acton Smee Ayrton, ex-Chief Commissioner of Works, and the ventilation committee, of which Sir James Caird was chairman, it was agreed that all the conditions of the guarantee had been fulfilled and that the ventilation was satisfactory. During the final completion of the work, Mr. Boyle was considerably indebted to Mr. Ayrton for the assistance which he rendered him, and for the valuable suggestions which, from that gentleman's great practical knowledge of the subject, he was enabled and was good enough to make. Without such help Mr. Boyle frankly confesses that though the ventilation might have fulfilled the requirements mentioned in the agreement, yet it would not have been the success it proved to be. Mr. Boyle has since been presented with a valuable testimonial from the Architects, expressing their entire satisfaction with the system.

CHAPTER VII.

Advance of Sanitary Science.

"I can't help feeling a hope that I may fight a good fight yet before I die."—*Charles Kingsley.*

We cannot within the small scope of this little work attempt to give even a portion of the list of public buildings in almost every country in the world to which Mr. Boyle has applied his system of ventilation during the past fifteen years. The Government buildings in this country alone constitute a goodly number, the system being extensively used by all the departments of the Government, Metropolitan, Local, and other Boards, besides the corporations and school boards of most towns in the United Kingdom. One of the largest and most important contracts which Mr. Boyle has ever undertaken was the ventilation of the *Castalia*, which, having been acquired by the Metropolitan Asylums Board, has been converted into a small-pox hospital.

The Board paid most careful attention to the ventilation, and after minute examination of many different plans, aided by scientific experts such as Professor Du Chaumont, Mr. Boyle's system was finally adopted. with

the approval and sanction of the Local Government Board. The work was completed in April last, and is pronounced to be the most unique and successful example of ventilation in this country.

Her Majesty's Chief Inspector of Hospitals, after repeated experiments, has expressed his entire satisfaction with it; and the results of the tests instituted and carried out by the Asylums Board, show that the air in the different wards is entirely changed every five minutes without the slightest draught or inconvenience being experienced. The Air Pump Ventilators, as tested with the anemometer, were found to be extracting five million cubic feet of air per hour. Sir Charles Dilke and other members of the Royal Commission on the Dwellings of the Poor, and a large number of representative gentlemen, interested in these matters have examined with keen interest the arrangements on the *Castalia*, and have expressed their entire approval. The work was executed under a special guarantee of success, and the fact that payment of the account was made immediately after the tests were completed sufficiently proves the satisfaction of the Board with Mr. Boyle's system as applied to the *Castalia*. Full particulars and drawings of this hospital ship, showing how the system of ventilation is applied, may be found in the June numbers of the *Graphic*, *Illustrated London News*, *Pictorial World*,

and other journals. Such triumphs have won for Mr. Boyle a deserved fame, and as a consequence great confidence is placed in him as a consulting engineer on ventilation. His advice is sought by the first architects and engineers in Europe and America. In the latter country his suggestions have been adopted for some of the most important public buildings, handsome fees being paid for his practical advice. "Nothing succeeds like success!" A pamphlet on Ventilation, published by Mr. Boyle when at Melbourne, met with a reception which clearly demonstrates the growing interest on this vital question. As is usual with new publications, copies were sent to the press for review, and in due course Mr. Boyle received over two hundred newspapers and journals, circulating in different places, from Singapore on the one side to San Francisco on the other, containing extracts and reviews. Several journals reprinted the pamphlet *in extenso*, and devoted several columns to useful and favourable comments.

Thus the great mission of pure air prospered in the Far West and in the Antipodes.

This pamphlet was illustrated with engravings, and the editor of the Journal of the Royal Agricultural Society of New South Wales deemed the subject sufficiently important to incur the heavy expense of reproducing them.

If the English press would only deal with the question in

the same frank, liberal, and courageous spirit displayed by their colonial contemporaries, the cause of sanitary science would advance as far in one month as it now does in twelve. The House of Parliament in Melbourne is ventilated with Mr. Boyle's system after the failure of several costly plans, another convincing proof that wherever mechanical appliances are used requiring attention, failure is the inevitable result. Indeed the whole secret of the uniform success of Mr. Boyle's system is to be found in the fact that it is perfectly self-acting, requires no attention, has no movable parts, and cannot get out of order—essentials without which, all experience has proved, no system of ventilation can ever be permanently successful. On the completion of the work at the Parliament House, and after the first sitting of the session, the Melbourne *Punch*, a publication which might compare favourably with its London contemporary, devoted the leading cartoon to a delineation of the power of the Air-Pump Ventilators. It was entitled "A Hurricane in the House," and represented the extracting power of the ventilators as being so great as to draw up every loose article in the building—hats, umbrellas, papers, quill-pens, ink bottles, the speaker's and other officials' wigs even, flying in the air. The cartoon in the next issue represented the Right Honourable Mr. Woods, Minister of Public Works and Railways (his politics were not in harmony with *Punch's*),

with an air-pump ventilator on his head, accompanied with the remark, "the right thing on the right place." Mr. Woods had been one of the strongest advocates in the House for the adoption of Mr. Boyle's system. The system was afterwards applied to a large number of Government and other public buildings in Melbourne and the principal towns in Australia, for which valuable testimonials have been received. If we consider the state of apathy which existed with regard to the all-important question of ventilation and sanitation when Robert Boyle and his son first began to move in the matter fifteen years ago, some idea may be formed of their perseverance and industry in raising the subject to the prominent position it now occupies. To their indefatigable exertions and unconquerable determination to continue the good fight against ignorant prejudice and chilling apathy we are indebted for a great progress which, at the risk of being monotonously eulogistic, it is the object of these pages to encourage and promote. They drew attention to the question in its relation to the health of the masses, and to their efforts may be attributed, to a very considerable extent, the present position of sanitary science. The difficulties which had to be encountered by these pioneers during the first stages of their crusade against the foul-air demon, and the disheartening indifference and postponements with

which all their efforts were received, even by those who should have been their warmest allies, would have crushed the spirits of less resolute men. But these brave and tried champions of health, supported with the knowledge that they were fighting in a good cause—a cause which, in spite of all reverses, must ultimately triumph—were not to be daunted or turned aside from their purpose. Encouraging each other by example of patient and persistent work, they continued the fight until, step by step, ignorance and prejudice fell before their attack, and "Hygeia," the "Queen of Health," was restored to her throne and dominion.

The leading principle which actuated the life of the late Mr. Robert Boyle—namely, the welfare of his fellow-men—has been faithfully adhered to by his son, whose principal aim in developing the great business of which he is now the head has not been so much to amass wealth, as to practically inculcate the lessons of sanitary reform. By laying a sure foundation for future generations to profit by, he has laboured in the hope that it may yet be within the range of the possible to practically realize Dr. Richardson's "City of Health," and banish for ever the dread fevers and diseases which at present scourge the earth. If the acquisition of money had been Mr. Boyle's or his father's object in life, they had opportunities presented them

of finding it more easily in other spheres of work; but being men of modest desires, and having no craving after mere worldly aggrandisement or display, they preferred to keep to the path they had chosen. They have expended in the cause of sanitary science and in the practical development of new sanitary inventions enormous sums of money—not less we are informed than one hundred thousand pounds—during the past fifteen years.

A successful invention is invariably followed by a host of imitations. Like hungry vultures the greedy plagiarists hover around to prey upon the inventor's brains and pluck a dishonest living at his expense. It would have been an extraordinary exception to the rule if the subject of this memoir and his son had escaped from the persecution of these selfish and ravenous opponents. That they were not so fortunate is evident from the numerous contrivances which have from time to time been put forward to impose upon the public—being "got up" to resemble externally as nearly as possible the "Air-Pump Ventilator."

These people would not be worth notice but for the lamentable injury they inflict on a good cause. They foist utterly useless apparatus on innocent purchasers, and bring discredit upon sanitary science. Fortunately these adventurers have generally a very brief existence, and they disappear into that region of obscurity from whence like

unclean things they emerged to fatten on the genius and labour of earnest and honest men. "Cheapness" is a snare in such matters as ventilation. Efficiency is the only test of economy. The notorious "Kew experiments" are a striking example of the pernicious effects of tests being made by unqualified persons, the results of these experiments having the effect of bringing sanitary science into ridicule, and doing the cause an incalculable amount of injury.

The *Times*, in a withering criticism of these tests, says:—"The method of testing was incorrect, and therefore the tests are valueless. . . . Neither in the case of either of the cowls nor the tubes was their true value as extractors ascertained."

Mr. Boyle has had special reasons to study methods of ventilation at small cost, because he has always been deeply interested in providing healthier homes for the crowded poor. He fully realized the very important fact that they needed pure air more than their better-fed and better-clothed brethren. The importance and urgency of the matter was forcibly brought under his notice by Mr. Edwin Chadwick, C.B., a sanitarian justly styled by Dr. Richardson "the father of sanitary reform;" and Mr. Boyle resolved to work out a scheme of ventilation which would meet the requirements of the poorer class of dwellings. The result

was the introduction of an economic system of ventilation for workmen's houses by which a small dwelling consisting of four apartments can be most efficiently ventilated without draught at a cost of four guineas. The secret of the low price of this system is not difficult to discover, as it is provided by Mr. Boyle at cost price, *solely for the use of the working classes.*

It may be a very great achievement to accomplish successfully the ventilation of an important public building, and very encouraging to receive the congratulations and testimonials of distinguished scientists; but the most urgent need for sanitary reform is in the densely crowded slums of our great cities, and the enthusiastic sanitarian naturally desires to carry on his useful work in such directions.

The Royal Commission on the Dwellings of the Poor will probably examine very carefully the various means of cheaply admitting pure air, without injurious draughts, to the small tenements of the labouring classes, and the subject is one which is not likely to escape the keen observation of His Royal Highness the Prince of Wales, in his capacity of president.

A little judicious help and co-operation in furthering such a scheme as that proposed by Mr. Boyle would go a great way towards popularising the movement of applying at once practical remedies for the fever dens of our great towns.

Before closing these pages it may be of some interest to the many people, in various parts of the globe, who know the famous ventilating engineer by name only, to learn something of the surroundings and daily life of the present Robert Boyle.

He inherited from his father not only the exceptional faculty of adapting means to an end, but also that innate delicacy of perception and sympathetic appreciation of form and colour which constitute a refined and elevated taste for art. This passion for the truly beautiful has induced him to decorate even his offices in a purity of style rarely met with in business circles. His private room at the Glasgow office is unique as an example of decorative taste, and its charm is enhanced by the costly pictures, examples of the old masters—Rubens, Titian, Correggio, Bellini, Paul Veronese, Rembrandt, and many others—which cover the walls.

The lesson is a good one, for there is no reason why business men should move in gloomy and unhealthy offices. The mind achieves more under the influence of higher inspirations, and a cheerful spirit is maintained by the presence of the beautiful.

Mr. Boyle's home affords everywhere the same striking evidence of a singularly cultivated taste. His *bijou* residence, "Ranfurly," situated in the "Garden of England"

—Kent—is a model of refinement in artistic decoration and arrangement. The furniture of the public rooms was designed by himself, and the carpets were specially woven to match the rare specimens of tapestry hangings and Oriental fabrics.

Everywhere selected works of art of unusual merit, pictures, sculpture, and rare china, are arranged with admirable knowledge of the poetry of light and shade and colour, and in the midst of them spring graceful palms and rare exotics, blending their emerald leaves with the rich hues of subdued light falling through the stained-glass windows.

We mention Mr. Robert Boyle's faith in the beautiful because art in its purest and most truthful aspect has undoubtedly an influence for good in many ways allied to sanitary progress. A healthy mind is necessary to physical vigour, and it is the conscientious practice of the doctrines he preaches which elevates Mr. Robert Boyle to the rank of a true reformer. Not only in his daily surroundings, but also in his occupations, he endeavours to prove by example the lessons by which health may be maintained and enjoyed. Few men get through a larger amount of really useful work. Conducting correspondence on sanitary matters with engineers and architects in almost every part of the civilized world, and managing with great administrative ability his

now colossal business; he nevertheless finds time for recreation, and although he has not imitated the Prime Minister by selecting timber felling for the renovation of brain and muscle, he contrives in the intervals of work to take in copious draughts of fresh energy by change of scene and air. Skimming over the sea under the broad white canvas of his yacht, tramping through the stubble with his gun, or leaping ditch and fence on his well-trained hunter, he restores the vital forces of nerve and tissue. Manly exercises and recreations are necessary to successful work, and it is fitting that a prolific inventor of sanitary appliances and a devoted champion of Hygeia should demonstrate in his daily life the important lessons necessary to robust health in these days of high pressure.

It has frequently been remarked that success in life depends more on energy than genius. On examining the papers and memoranda from which many of the facts for this biographical sketch have been collected we are disposed to give Mr. Boyle credit for the possession of both those qualities. As a writer on widely different subjects he has especially exhibited that versatility of talent which in a high degree distinguished the career of his father. The pages of a large number of publications at home and abroad have been enlivened by his pen. His contributions on scientific subjects are well known, and we understand that

he is at present engaged on a work which will be a valuable addition to the literature of sanitary science. This work will embrace the important questions of ventilation and heating, and will probably attract considerable attention, by throwing much new light upon the subject and upsetting many theories hitherto accepted as correct. We have seen many seemingly sound theories fall to pieces under the test of practical work, and for this reason Mr. Boyle's statements will be received by true scientists with an impartial spirit of inquiry, and his arguments will doubtless have the weight which his intimate knowledge of the subjects under discussion should give them.

In the lighter regions of literature where the pleasures of imagination and the subtle art of word painting are permitted scope and license, forbidden in the close logical limits which bind within hard and fast lines the scientific essayist, Mr. Boyle's innate ability has asserted itself by many agreeable flashes of luminous and effective touches of pathos.

In these essays, some of them written at a very early age, a correct observation of man and manners has been supplemented by a very happy style of descriptive writing. Of these entertaining sketches we may mention "Two Hours in a Back Slum," "Saturday Night in the

Bridgegate,"* "Humours of the Bird Market," "The Solomons of Jail Square." The last named is a satirical paper on the self-satisfied philosophers who met to discuss the religious and political topics of the day, More serious but equally entertaining contributions were "Paris Before and After the Commune," "First Impressions of the Continent," "French and English Characteristics — A Contrast," "Australian Experiences," "The Future of Australia," etc.

Since Mr. Robert Boyle made London his headquarters, his business has developed to an extent which clearly indicates the real progress made in popularizing sanitary appliances. The offices in Mansion House Buildings, where the London business had been carried on for nearly ten years, afforded insufficient accommodation for the rapidly increasing connections, and the firm was consequently induced to remove to the extensive and handsome premises on Holborn Viaduct. But the requirements quickly outgrew the capacity of even that spacious establishment, and it became necessary to take in equally extensive premises adjoining. At the same time the firm established London works to relieve the increased pressure on the Glasgow manufactory, and suitable buildings were found and fitted for the purpose in the neighbourhood

* One of the lowest quarters of Glasgow.

of Euston Road. Still the business grew apace, orders multiplied, from every part of the world the mails brought fresh commissions, the owners of mansions, churches, factories, and workshops anxiously sought the firm to rescue them from the miseries of bad ventilation, and thus the resources of the works were in time insufficient to meet the growing strain, and a more spacious factory has now been provided, the Glasgow works being also enlarged four times its former capacity.

Such an extraordinary development demonstrates beyond all question a steady improvement in sanitary matters, and at the same time reflects great credit on Mr. Robert Boyle's administration. The welfare of his business means the welfare of the public, and its practical development means the overthrow of that subtle destroyer—vitiated and poisoned air. For this reason, many distinguished persons in this and other countries, anxious to encourage the movement, have honoured Mr. Boyle with special marks of approval. Quite recently, we understand, H.R.H. the Crown Prince of Sweden has expressed great interest in the inventions; and during his visit to this country, the Prince of Montenegro also evinced his gratification at their ingenuity, having made an examination of them with a view to their adoption in his own country.

It is satisfactory to learn that Mr. Robert Boyle has no

intention of resting content with this most encouraging success, but proposes to avail himself of his professional influence and admirably-organized business to extend his sphere of sanitary work. He is making arrangements to deal with the more general and complete sanitation of dwellings, and drainage of towns on improved lines. The question of regulating the temperature of air in buildings is one of great importance to health, and, at the urgent request of architects, he is now engaged in the preparation of a scheme for efficiently combining heating and ventilation in a scientific and practical form, which will insure greater economy and, by the application of heat to the proper parts of the building, effectually prevent the cold draughts which are experienced in most public edifices. The chilling currents which have a deadly effect on delicate people are chiefly caused by the defective methods of heating at present in use. Mr. Boyle's plan will save architects the trouble and inconvenience of calling in a separate firm to do the heating, and better results must necessarily follow from the harmony and comprehensiveness of the arrangements. We may safely predict in this department a most extensive and profitable business. Ventilating and sanitary engineering is now only in its infancy, but it is undoubtedly destined to become one of the most important professions.

Mr. Boyle has recently invented an ingenious system of

ventilation adapted to the peculiar requirements of prisons. This system is called the "silent" system of ventilation for prisons, being devised to meet the necessity of isolating the cells from each other, and yet providing a continuous change of air. The advantage of this system is that every cell is separately and equally ventilated, perfect isolation being at the same time secured; for no sound can possibly be conveyed from one cell into another through the ventilating openings, though as many as from ten to twenty cells are ventilated with the one pipe, and three or four of these lead into one upcast shaft, there also being no valves whatever used.

Notwithstanding the complete success of the Air Pump Ventilator, the innate restlessness of inventive genius has led Mr. Boyle to discover an improvement, which he has recently patented, and which is said to surpass the present ventilator both in efficiency and simplicity. The improved form of ventilator will, we understand, entirely supersede that hitherto supplied, as it is not considered desirable to submit to the public apparatus of this kind, however efficient, while better results are attainable. In the course of time it is very probable that even the new and improved form will in its turn be superseded, for Mr. Boyle refuses to sit down with self-satisfied triumph. Onward, ever onward, searching for the perfect, adding

improvement to improvement, and regarding each achievement as but a stepping-stone to others, the fertile brain of a true scientist never rests. Although Dr. Richardson informs us that "since these excellent ventilators have been introduced, we have now got *perfect* methods of ventilation," we have reason to anticipate some startling discoveries as the results of Mr. Boyle's ceaseless experiments and strivings after perfection.

No apology is necessary for these commendations. Professional success of no ordinary kind, and public work carried out with remarkable ingenuity and thoroughness, justify us in setting forth this young man as an example worthy of note. Better than all the platform platitudes of sanitary reformers is the actual work accomplished. He has worthily followed in the footsteps and carried on the unfinished labours of his distinguished father, and we regard with lively hope the prospect of a life begun so well, and devoted with such singleness of purpose to the public weal.

AIRD AND COGHILL, PRINTERS, GLASGOW.

LIBRARY
JUN
25
1982
OF TORONTO

PLEASE DO NOT REMOVE
CARDS OR SLIPS FROM THIS POCKET

UNIVERSITY OF TORONTO LIBRARY

P&A Sci.