

Ventilation of the Guildhall, London, and report on the ventilation of the London Custom House.

Contributors

Royal College of Physicians of Edinburgh

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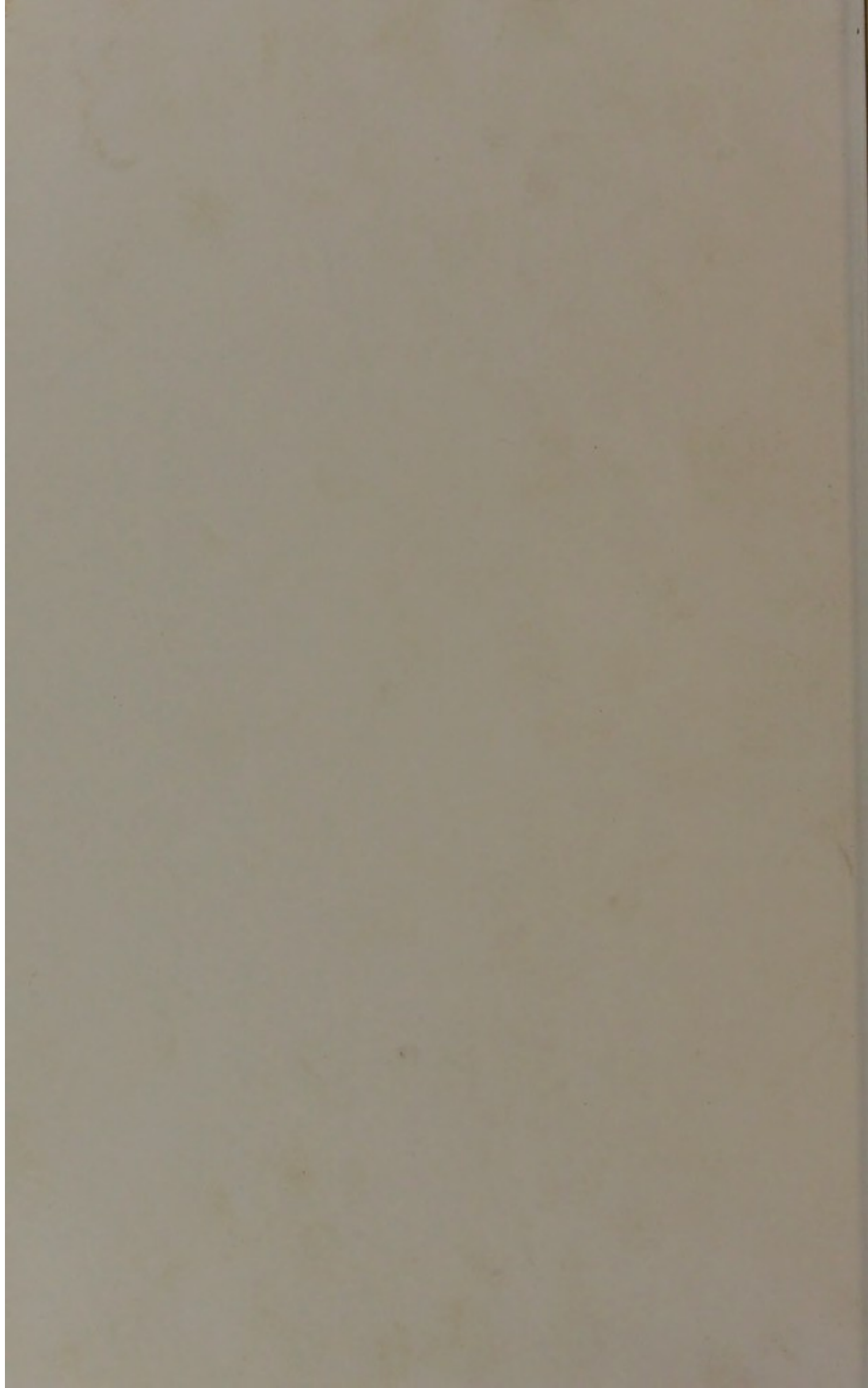
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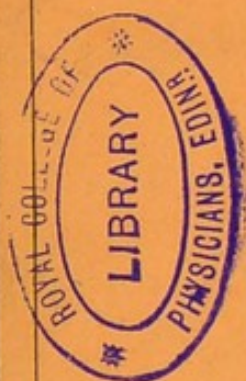
VENTILATION
OF THE
GUILDHALL, LONDON,

AND

Report on the Ventilation

OF THE

London Custom House.



LONDON

ROBERT BOYLE & SON, 64, HOLBORN VIADUCT, E.C.
GLASGOW: 110 BOTHWELL STREET.

1882.

VENTILATION
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1882.

UNCLE TOBY—"Now let us have a little ventilation;
but not a draught. I *hate* a draught."

TRISTRAM SHANDY.

VENTILATION

OF THE

GUILDHALL, LONDON,

(*Architect*, Nov. 4th, 1882.)

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 is 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 has been one of the worst ventilated apartments for its size, as a public one, in the metropolis. We say "has been," for a new system of ventilation has recently been completed that promises to surpass all previous attempts to introduce fresh air and exhaust the vitiated, and one that after many severe tests has received the approbation of all concerned in the carrying out of the plan. Smarting under the annoyances they had long laboured under, the City Architect, by the direction of the Corporation of London, requested Messrs. Robert Boyle & Son, of Holborn Viaduct and Glasgow, whose success as ventilating engineers has become matter of world-wide notoriety, to submit to him 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 Messrs. Boyle's expense.

Thus the contract was entered upon on the principle of "no cure, no pay." Confident in their system, the firm accepted the terms, and the guarantee, which was of a very stringent character, was drawn up by the Corporation themselves, and was of such a nature as would put Messrs. Boyle's system to a most severe and crucial test. In January last the chamber was handed over to them to commence operations, and as we have carefully watched the progress of the work, and were present only a few days since—it now having passed through the ordeals prepared for it—we have much pleasure in adding our testimony to its satisfactory results. It has received the approbation of the City Architect, the committee, and we may add of the public. Messrs. Boyle have had the privilege accorded them of inviting as many as they pleased to witness the results, and a large number of invitations were issued by them, in which they included those gentlemen they considered interested in the question of ventilation and competent to pass an opinion upon the work, and also competitors in their own profession, advocates of totally different systems. Amongst those who accepted the invitation were Dr. C. W. Siemens, F.R.S.; Captain Douglas Galton, C.B., F.R.S.; Professor Corfield, London University College; Captain McHardie, R.E., Home Office; Dr. Steele, Guy's Hospital; Mr. Ernest Hart; Major-General F. C. Cotton, R.E.; Mr. A. Billing, Surveyor to Guy's Hospital and St. Olave's Board of Works; Mr. H. Currey, Surveyor to St. Thomas' Hospital; Mr. Alexander Graham, F.R.I.B.A.; Dr. Sedgewick Saunders, Medical Officer of Health to the City of London; Dr. Lavies, Medical Officer of Health for Westminster; Mr. Thornhill, Surveyor to London Hospital; Mr. W. Butterfield, Architect; Mr. E. J. Hansom, F.R.I.B.A.; Mr. E. F. Griffith, C.E.; Mr. C. W. Pugin, Architect; and Mr. G. A. Bruce, C.E.; besides numerous other Architects, Civil Engineers, and Medical men.

The application of the system adopted may be described as follows:—Nine of Messrs. Boyle's patent self-acting air-pump ventilators are fixed on the top of iron shafts, standing at various heights above the roof, to clear them of obstruction. Four of these shafts, viz., two at each end of the chamber, are of 13-inch diameter, branching off a little above the ceiling into two 10-inch pipes, communicating with openings in the ceiling 2 feet in diameter, concealed by means of ornamental centre flowers, or ceiling plates. On the top of each shaft is fixed a 2-foot air-pump ventilator. At the east end of the chamber a shaft 18 inches in diameter is carried through the roof, having a 30-inch ventilator on its top. This shaft expands at the bottom to 2 feet 6 inches by 2 feet 3 inches, covering an opening of the same dimensions in the ceiling. At the west end, a shaft 30½

inches by $20\frac{1}{2}$ is brought into requisition, and is carried up a considerable height to the top of an adjoining building, surmounted with a 3-foot ventilator. A shaft 16 inches diameter, that is connected with the large "sunlight" gas-burner in the lantern over the central dome of the chamber, is also run into this shaft, the ventilation of the body of the room being partially effected by this means. On the top of the outer casing of the lantern three 13-inch shafts are fixed at equi-distant spaces, and crowned with 20-inch ventilators, the shafts communicating with openings in the interior of the lantern by means of expanded iron hoppers, and these complete the arrangements for the extraction of the vitiated air from the chamber. It may be mentioned *en passant* that a portion of these shafts formed part of the old system of so-called ventilation, and were then surmounted with revolving cowls.

For the supply of fresh air to the chamber Messrs Boyle have turned to account, with certain alterations, some of the modes of ingress they found existing when the work was entrusted to them, and that were then of but little use. On the south side of the chamber four vertical air tubes or brackets are fixed against the walls, two of these being of the size of 2 feet by $2\frac{1}{2}$ inches by 3 feet, the other two, which are placed a little higher up the wall, measuring 18 inches by 4 inches by 2 feet. The tubes communicate direct with the outer atmosphere by holes cut through the walls and covered with cast-iron gratings. The air inlets are fitted with Messrs Boyle's patent heaters, which are now so generally known amongst the profession as to render description here unnecessary. These are, of course, added for the purpose of warming the incoming air to any temperature required as it enters the building. The north wall is similarly treated, with the addition of an extra tube at the end by the Lord Mayor's seat. At the public end of the chamber three more inlet tubes are fixed, similarly fitted with the air-warmers, while others, amounting in the aggregate to sixteen, are fixed in other positions, completing the arrangements for the fresh air supply. We may add that an abundant quantity is admitted, and the tests have shown that the air can be warmed in cold weather to a temperature of from 60 deg. to 120 deg., thus entirely preventing cold draughts, the usual attendant on most methods of admitting cold air to a building where provision is not made for warming it.

Referring to the extraction of the vitiated air, it is not necessary to give the full table of results from January until the present time: we need only say that the average quantity 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 the firm would have been called upon to remove their appliances, and their 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.

Previous to Messrs. Boyle undertaking this work great complaints had been made of the amount of draught always present in the chamber, but since the completion of their arrangements lighted candles have been placed in various parts of the room, the flame has been watched, and it has been clearly demonstrated that they were in all instances perfectly steady, showing that the draughts had ceased to exist.

After six months' practical experience, Mr Horace Jones, City Architect, and President of the Royal Institute of British Architects, has certified that all the conditions have been fulfilled, and that the ventilation is successful ; and, as we before observed, this has been endorsed by the committee, and Messrs. Boyle have received their account. Thus another public building has been added to the long list of those that the firm have successfully ventilated.

The following letters have been received by Messrs. 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 grateful 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 & Son 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 Messrs. Boyle for the benefits they have derived, from a healthful point of view, from the application of their system. From a large number of equally favourable letters received by the firm from independent sources we abstract the following from an eminent London physician and sanitarian, whose name for certain reasons is suppressed :—

"After thoroughly testing and examining your system of venti-

lation 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 a result of Messrs. Boyle's success here and at the Custom House they have received orders for the ventilation of over 300 public buildings, the more recent being the Reform Club, Lloyd's, Royal Exchange, Claremont, the residence of His Royal Highness Prince Leopold, New Royal Courts of Justice Chambers, the Imperial Mint, St. Petersburg, Portland Prison, Stonyhurst College, and Royal Naval College, Greenwich Hospital. It is also being applied to Mr. Gordon Bennett's steam yacht *Namouna*.

"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 Messrs. Boyle have applied to this and other public buildings in London and the provinces. . . . Messrs. Boyle and Son's system is extremely simple, and may be described to be the application of means by which the natural law of ventilation can be effectively brought into operation. . . . Our examination of the up-draught in the shafts has shown the efficiency of the ventilators."—*Building News*, Nov. 3rd, 1882.

EXPERIMENTS

AT THE

LONDON CUSTOM HOUSE

WITH BOYLE'S SYSTEM OF VENTILATION.

(*Industry*, January 22nd, 1881.)

The Long-room of the London Custom House—one of the largest rooms in the world—has recently been ventilated by Messrs. Robert Boyle & Son, Ventilating Engineers, of London and Glasgow, under the direction of Her Majesty's Office of Works. The system applied by them is a combination of their well-known air-pump ventilators and vertical tube air inlets. As the Long-room of the Custom House has long been notorious for being one of the worst ventilated rooms in London, and was so officially reported to be by Professor Faraday and Dr. Ure so far back as thirty years ago, considerable interest has been displayed amongst those skilled in sanitary science as to the result of Messrs. Boyle's effort to remedy the evil. Accordingly, on the completion of the work, a series of experiments were instituted to test the efficiency of the system. These experiments extended over five days, beginning on Wednesday, the 5th inst., and terminating on Monday, the 9th. A large number of scientists and others attended those experiments, amongst whom were Dr. B. W. Richardson, F.R.S.; Captain Douglas Galton, C.B., F.R.S.; Dr. Corfield, Professor of Hygiene, London University College; Sir John Monckton, Town Clerk; E. Sheppard, Collector H.M. Customs; Ernest Turner, F.R.I.B.A.; Rogers Field, C.E.; Bailey Denton, C.E.; A. Murray, City Architect's Office; and a large number of representatives of the public press. The room is 194 ft. in length, 60 ft. wide, and 54 ft. in height, and is lighted by

about 200 large argand burners fixed at about the level of the head. When the gas was lighted, owing to the position of these burners, the heat and sulphurous vapour was intolerable, and the source of great discomfort and injury to the occupants of the room. The heating arrangements consisted of two large double open stove fires placed in the centre of the room. The number of the clerks employed in the room is about 140, with a constant influx of the public having business with the department. Messrs. Boyle have fixed six 3-ft. diameter air-pump ventilators on the roof, which are connected with the interior of the room by means of an iron shaft, 18-in. diameter, led down from each to an opening in the centre of the ceiling, an iron one, of the same diameter as the pipe. These shafts equally divide the ceiling. For the admission of air there are twelve vertical tubes, each 10 in. by 8 in., placed in the bays of six of the windows on the south side of the room, and communicating with the outer air through openings 2 feet by 1 foot, cut in the wall under the centre of each window; these are the only air inlets to the room, as it was not considered advisable to admit air from the north side, taking into consideration the odoriferous character of the atmosphere usually found in Thames-street. On testing the air-tubes, an abundant supply of air was found to be passing into the room, which will prove, and especially in summer, of great benefit to the occupants.

Proceeding to the roof the air-pump ventilators were then tested, and on Wednesday were found to be extracting at the rate of 800 cubic feet per minute, making a total for the six of 4,800 cubic feet, or 288,000 cubic feet per hour. The wind was N.E.E., an unfavourable direction for the ventilators, and putting them to a severe test: the air inlets facing the south. On Thursday forenoon the ventilators were extracting 900 cubic feet per minute; total for the six, 5,460 cubic feet, or 324,000 cubic feet per hour. Wind in same direction, but strong. Thursday, 4.45 p.m., tested by Dr. Richardson, extracting $1,347\frac{1}{2}$ cubic feet per minute; total for six, 8,085 cubic feet, or 485,700 cubic feet per hour. Wind in same direction, but stronger. Friday, experiments conducted by Professor Corfield and Mr. Rogers Field, Ventilators extracting $612\frac{1}{2}$ cubic feet per minute; total for six, 3,675 cubic feet, or per hour, 220,500 cubic feet. Wind N.E. and fluctuating, average speed, as tested by Mr. Rogers Field, 525 feet.

The old system of ventilation was then put in operation and tested, the result being a strong down-draught, which proved so annoying to those in the room underneath, that they energetically signalled for the openings to be closed. Mr. Field then tested with an anemometer an enormous extracting shaft, having a monster

lobster-back cow1 on the top of it, and communicating with the space between the ceiling and the roof, into which a plentiful supply of air was admitted, but found that the air in it was almost stagnant, being another proof that this form of ventilator, when it is not acting as a downcast, at all events fails to act as an extractor. This shaft, with another of a similar size, formed part of the old system of ventilation. Saturday, experiments conducted by Mr. E. Turner, F.R.I.B.A., and Mr. Bailey Denton, C.E., Ventilators extracting 595 cubic feet per minute ; total for six, 3,570 cubic feet, or 214,200 cubic feet per hour. Wind N., and very light, the most unfavourable direction for the ventilators, added to which, the room was almost air-tight on the north side, on which side alone the wind blew, and Mr. Turner had caused all the air inlets on the other side to be closed ; so that the action of the ventilators under such conditions, and in spite of the enormous fires burning in the room, necessarily causing a great suction towards them and away from the ventilators, was the more remarkable. On comparing the action of the ventilators, with the room in this closed state, with their action when the inlets were open, a difference of 25 feet per minute only was discernible. The temperature in the room was 60 degrees, and outside about 40 degrees. On Monday, the 10th, the ventilators, owing to the dull, cold, foggy weather, were put to a most severe test, the instrument showing that the ventilators were each drawing 560 cubic feet per minute, or 3,360 for the six, 202,600 per hour ; and it is interesting to notice, in connection with this day, that between the hours of seven and eight, when a dense fog prevailed outside, the atmosphere of the Long Room remained quite clear, and continued so throughout the day. During the whole of the experiments there was not the slightest down-draught discernible in the air-pump ventilators, even when all the inlets were closed. All those present at the experiments expressed themselves highly satisfied with the results obtained, and the air-pump ventilators have in this instance been put to a series of the most severe and searching tests by men the best qualified for such work in this country, and they have undoubtedly maintained, in the most satisfactory and conclusive manner, the high reputation they have long enjoyed as the most efficient foul-air extractors in existence. They have also been so tested under conditions more than usually unfavourable to their action, viz., in the middle of winter, with a frosty external atmosphere, and at a time when most so-called self-acting ventilators are usually closed up, to prevent the down-draught they would otherwise admit, as notoriously was the case in this very room, under the old ventilating *regime*. With regard to the

improvement which the introduction of Messrs. Boyle's system has effected in the atmosphere of the room, those occupying it testify to, in the most marked manner—one gentleman, who has been for over thirty-four years engaged in the room, stating that, compared with the past, the present condition of the room was as heaven to the nether regions. Before Messrs. Boyle's system was applied there used to be a perpetual haze or cloud hanging below the ceiling. This has since entirely disappeared, the air above being now as clear as that outside. In foretime, when a fog got into the room, it was several days before it found its way out, even though windows and doors were kept open. On entering the room on the Monday morning, after the dense Sunday fog of three weeks ago, it was found to be perfectly clear, not a trace of fog being discernible within. A number of clerks engaged in the room informed us that, under the old arrangement, before the day was half over, they suffered from severe headaches and general prostration caused by the vitiated atmosphere, but since the application of Messrs. Boyle's system they felt almost as fresh when they left in the evening as when they came in the morning, and that they do not now suffer from headaches is a most convincing proof certainly of the efficiency of the ventilation. Sea captains, we are informed, visiting the room, used to complain loudly of the foul state of the atmosphere in which they transacted their business, and now we are given to understand they speak as decidedly in favour of the improvement which has been effected. Messrs. Robert Boyle & Son are to be congratulated upon the success they have achieved, and the London Custom House may proudly be added by them 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 that they are prepared to guarantee the efficient ventilation of any building entrusted into their hands, no matter how many other systems may have been previously tried and found unsuccessful. We understand that they are about to give another proof of their ventilating skill in an essay on the Council Chamber of the Guildhall, the system of ventilation which was adopted there some two years ago having proved a failure. Sir John Monckton and Mr. A. Murray watched the experiments at the Custom House, with a view to the application of Messrs. Boyle's system to the said Council Chamber, for the ventilation of which that firm has already instructions to send in plans and estimates.

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 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 and 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*, the accredited organ of the Civil Service, March 19th, 1881.

"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*, March 25th, 1881.

"An important application of the principles of ventilation, introduced by Robert Boyle & Son, of Glasgow and London, has been recently made in the Long-room of the Custom House, in Thames-street, and a series of experiments to test the efficiency of the system are being made, the results of which, as far as we have tested it, are very satisfactory. . . . The atmosphere before the new system was applied was insufferably oppressive and warm, and we hear from two or three of the clerks themselves that they often suffered from headache in consequence. . . . Facts are worth more than theories, and it is one of the best recommendations of the system we have mentioned, supported by those engaged in the room, that since the introduction the room has become more pleasant to work in, and the feeling of oppression has not been experienced. Architects interested in the subject, and there are few that are not, cannot do better than test for themselves the action of the system, as applied to one of the largest public rooms in London."—*Building News*, January 7th, 1881.

"Last week we referred to the system of ventilation known as that of Messrs. Boyle, which has been applied to the Long Room of the Custom House, and we then remarked upon the decided success of the system as far as we had opportunity of examining the action. . . . On Monday also, when a foggy atmosphere prevailed, the ventilators acted freely, and the Long Room was quite clear of the fog—a condition of things which contrasts favourably with former experience. Those present at the experiments were highly satisfied with the results obtained under such trying conditions of wind and weather."—*Building News*, January 14th, 1881.

"The experiments (to which we may return) seem to have demonstrated the perfect success of Messrs. Boyle's work."—*Builder*, January 15th, 1881.

"The Long Room has been notorious for its defective ventilation, and was reported to be one of the worst rooms in London by Professor Faraday thirty years ago. . . . During the whole of the experiments there was not the slightest down-draught perceptible in the air-pump ventilators."—*Architect*, January 22nd, 1881.

TESTIMONIALS.

“Since these excellent Ventilators have been introduced we have now got *perfect* methods of ventilation.”—Dr. B. W. RICHARDSON, F.R.S.

From the late SIR GILBERT SCOTT, Architect.

“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.”

From ARTHUR CATES, Esq., F.R.I.B.A., Architect to the Crown, &c.

“I have used your Air-Pump Ventilator with satisfactory result. Those fixed under my direction at the Library of the Inner Temple 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.”

From Sir WILLIAM THOMSON, F.R.S.

“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.”

From Professor GRANT, LL.D., Glasgow University.

“They are constructed on sound scientific principles, act in strict accordance with the laws of nature, and cannot fail to operate.”

From the late Professor MACQUORN RANKIN, Professor
of Engineering, Glasgow University.

“There is no time throughout the whole year but when there is a sufficient movement of the atmosphere at the level of the house-tops to cause the Air-Pump Ventilator to act.”

OPINIONS OF THE LONDON PRESS.

"The long experience of Messrs. Robert Boyle & Son, as pioneers of sanitary ventilation, has taught them to effect the desired end by the simplest of means. . . . Their patent air-pump ventilators have now established themselves beyond a doubt as the nearest to perfection of anything of the kind before us. . . . To all those who are desirous to improve the ventilation of their premises, we would say, consult Messrs. R. Boyle & Son."—*Architect*.

"The name of Boyle in connection with ventilators has come to be on a somewhat similar footing as that of Chubb in connection with locks."—*British Architect*.

"The designs show that Messrs. Boyle are desirous of making their ventilators artistic accessories to buildings, and some of them are quite in accordance with the soundest canons of architectural taste. The increasing use of them is a sufficient guarantee of their value."—*Building News*.

"A system of ventilation that appears to meet all requirements is the one invented by Messrs. Robert Boyle & Son, the well-known ventilating engineers."—*Engineering*.

"The Air-Pump Ventilator secures a continuous upward current."—*The Engineer*.

"It will thus be seen that we have here a practical system of perfect ventilation, which meets all the requirements of the case."—*Iron*.

"The system that appears most perfect is that of Messrs. Robert Boyle & Son. This system seems to be the highest form of ventilation yet produced."—*United Service Gazette*.

"This firm is justly celebrated for its system of ventilation."—*Land and Water*.

"The prestige of success which has attended the various sanitary patents brought out by Messrs. R. Boyle & Son would attract attention to almost any novelty introduced under their auspices."—*Inventors' Record*.

"Messrs. Robert Boyle and Son, as founders of the profession of ventilating engineers, have raised the subject to the dignity of a science."—*Industry*.

"All obstacles appear to have been met by Messrs. Boyle's Patent Ventilators. The secret of their success lies in these ventilators being constructed on sound scientific principles."—*Naval and Military Gazette*.

"Simplicity and economy are the guiding principles of Messrs. Boyle's system."—*Broad Arrow*.

"It might have been said that no introduction of new improvements in the way of sanitary arrangements could add to the already high reputation enjoyed by Messrs. Robert Boyle & Son, the well-known ventilating engineers of Glasgow and London."—*European Mail*.

"Messrs. Robert Boyle and Son are simply men of scientific attainments, and of great practical experience. They deserve the greatest praise for their ingenuity in devising so simple, yet so effective and perfect an invention, which is bound to be universally adopted, and to become so great a boon to us all."—*British Mail*.

LATEST AWARDS.

FIRST PRIZE,

(SILVER MEDAL.)

NORTH EAST COAST EXHIBITION, TYNEMOUTH,

October, 1882.

GOLD MEDAL,

(HIGHEST PRIZE.)

INTERNATIONAL EXHIBITION OF MEANS AND
APPLIANCES FOR THE PROTECTION AND
PRESERVATION OF HUMAN LIFE,

London, July, 1882.

£50 PRIZE,

(ONLY PRIZE OFFERED.)

INTERNATIONAL VENTILATION COMPETITION,

London, May, 1882.

SILVER MEDAL,

(HIGHEST PRIZE.)

EASTBOURNE SANITARY EXHIBITION,

August, 1881.

FIRST PRIZE,

(ONLY ONE AWARDED TO ROOF VENTILATORS.)

INTERNATIONAL MEDICAL AND SANITARY
EXHIBITION,

London, July and August, 1881.



