REPORTS

ON

SANITARY ENGINEERING IN HOUSES,
HOSPITALS, AND PUBLIC
INSTITUTIONS.

BY WILLIAM EASSIE, C.E.

X.—WARMING AND VENTILATION.—(Concluded.)

It would be presumptuous in any engineer to explain in a journal such as this what is meant by ventilation. The medical profession has made this a study, nothing being of more consequence than the removal of impurities from the atmosphere of a sick room or a hospital-ward. The whole matter has, moreover, been exhaustively treated by Dr. Parkes in his most valuable work.* My remarks will simply refer to the ventilation consequent upon the combustion of fires and lights. A sound general knowledge of the best means for the withdrawal of the foul air which these engender is not common amongst us. There are thousands of dwellings in every town and city constructed as if man had been created expressly for the house, not the house for a man. It is especially so with fireplaces; the air would appear to have been intended for the use of the grate, not for the benefit of the occupants of the house.

We may at once assume that both fresh-air inlets and foul-air outlets are required in every room. Where inlets are unprovided in a room heated by a common fireplace, the air to support combustion is drawn down to the fire through the flue which was intended for the withdrawal of the smoke; and when this incoming air is *blown in* by the wind, the ascending smoke is puffed into the room. But inlets of cold air from without at carpet-level prove intolerable, and unwarmed air is best brought in about eighteen inches below the ceiling. The inlets may be distributed round the room; but none of them should be so close to the foul air outlet as to cause the fresh air to be at once led off. There is less risk of draughts if the main inlet be placed in the wall opposite the fireplace, but a great deal depends upon whether the air is led into the room direct from the outer air or borrowed from a passage. The best inlet is the upturned louvre pattern, fitted with a suitable regulator. If these pure-air inlets be made equal to twice the sectional area of the flue, there will be no chance of draughts.

A room heated from an ordinary or unventilating fireplace by radiation only, greatly varies in temperature at different parts of the room, and, according to Dr. Parkes, as much as from 4 deg. to 6 deg. Fahr. The variation of temperature in the different portions of a room heated by warm air from the Galton stove does not exceed 1 deg. Fahr. This is a strong recommendation of the ventilating grates. With the latter grates, there is also a perfect intermingling of the air in the room with the warm air passed in from the air-chamber. As a general rule, the thermometer will read the same at floor, at window, and at ceiling heights. It is very different with an ordinary fireplace. An experiment was made in February last year by Dr. Russell of St. Bartholomew's Hospital, in a room 15 ft. by 13½ ft. by 10½ ft. high (2,126 cubic feet of space), with the roughly fitting doors and windows closed, and with a fire and three gas-burners alight. Two persons only were in the chamber making observations, and thus the conditions were exactly the same as in thousands of houses during the winter season. After three hours had elapsed, the temperature at nine inches below the ceiling had risen 17.5 deg., at five feet above the floor-line it had risen 15 deg., and at floor-level 4 deg. above the temperature taken before the doors and windows were shut, and when the room was filled with fresh air.

A room requires, as well as an inlet, a foul-air outlet to be provided, which should be as near the ceiling as possible, otherwise the air will be respired over and over again. Such an outlet would be an Arnott's or other valve fixed in the chimney-flue at the top of the room. This is not quite an automatically working cure; and there is, moreover, a danger of cold air and even smoky down-draughts when the smoke-flue is pierced. A brick air-flue, say 9 in. by 4 in., should therefore be built alongside the smoke-flue, curving with it and terminating with a suitably large air-brick under the chimney-cap. If such a separate flue be fitted up with a grating near the ceiling, the rarefied air in the flue will maintain a constant ventilating action. The products of combustion

from the gaseliers can also be led into the same flue. At *b*, fig. 103, is represented on plan a terra cotta smoke-flue and foul-air shafts combined, which is much used, especially in the North, where stone is abundant, and where they can be inserted in thick walling. They would quite divide an ordinary brick-wall and destroy the bond. When these are piled up sufficiently high in the work, a length is introduced, having a piece cut out, in order to receive a valve or grating, as shown in elevation at *a*.

Fig. 103.

Such outlets in the smoke or foul-air flues are not, according to some, absolutely necessary when ventilating grates are adopted, because most of the foul air is burnt in the grate; they will, however, be found indispensable in the summer time, when the fires are not lighted, and should, indeed, be always provided when building a house. Sometimes a tenant will not use ventilating grates, but will replace them with more showy registers, in which case he would have to insert a valve in the smoke-flue, but with a certainty of blackening his cornice. A separate foul-air shaft, which properly takes advantage of the heat passing up the chimney, cannot be built afterwards, except at a very considerable expense.

Another wise thing is to provide in the walls, at various parts of the room, a shaft four or five inches square, leading up to the top of the house, and terminating outside with an air-brick or down-draught preventing valves. These flues are easily built, by the bricklayer drawing up a piece of wood scantling as the work proceeds. If a room be very large, and there be only one ordinary fireplace, the outlet at the chimney-breast will be insufficient to remove the respired air on a close summer day; and these auxiliary flues, fitted up with a valved opening at ceiling, can be made to assist in this work by simply lighting a jet of gas in one or two of them just above floor-line. In a bitterly cold winter, too, such a large room cannot be heated by one unventilating fireplace, and such a shaft will suit admirably for the accommodation of the gas calorigen, which I gave at fig. 102. I have frequently seen large rooms thoroughly heated in this way, a common radiating grate being supplemented by a scientifically constructed ventilating stove.

The ventilating fireplaces do not seem to interfere with the natural currents of air in a room. In a place heated by a good ordinary fireplace, and when doors and windows are closed, the air rushes from the foot of the door along the floor towards the fire; part passing to the fire itself and part being carried up the chimney-breast, then across the ceiling, down the walls opposite, and across the floor to the fire again. When the fire is fed with exterior air, by way of the underside of the grate, etc., the current of fresh air from the door is not required, and part of the air which enters from under the grate passes up the chimney, the remainder being circulated in the room in the manner before mentioned. When ventilating fireplaces are in use, the air follows the same course. For instance, the entering air, warmed in the chamber behind the Galton grate (fig. 97), is passed into the room through the ventilator near the ceiling, and this freshly warmed air is then blown along the ceiling to the walls opposite, down which it descends and flows along the floor to the fire. The warmed air takes a similar course, whether it proceeds from the front of the chimney-piece, as drawn at fig. 98, or from the orifice on the top of the calorigen, sketched at figs. 100 and 102.

The foregoing remarks will apply to house or cottage alike, whether the ordinary grate, air-supplied grate, or ventilating grate be adopted; but it may be called *single room treatment* only. The majority of the better class of houses are now provided with entrance halls, etc.; and if the cold air be allowed to fill them each time the front door is opened, this cold air will penetrate into the sitting-rooms, and much of the benefit to be derived from the use of improved contrivances within them will be lost. There can be no question, then, that in winter, rooms should receive their air-supply from a general lobby constantly replenished with pure warmed air. When the door of a room is open, there can then be no sudden rush of cold air upon the inmates. It might not be necessary to build a fireplace or erect a stove in the vestibule, as well as in the hall, in order to prevent a rush of cold air into the lobby when the front door is opened; but it is certain that to render a house comfortable in winter, the air in the passages should be heated by a contingent of warm air. The best stove for the purpose would be a calorigen stove, but coils of hot water would afford the completest means of heating hall and passages. If considered advisable, such heat could be led into the adjoining rooms at skirting level through suitable gratings. When coils are used, they are always covered over with fixed ornamental gratings, and the dust drives through the openings, and, lodging on and around the heated pipes, taints the air. These casings should run on wheels or castors, and so enable the servants to sweep all round the pipes.

* *Manual of Practical Hygiene*. Fourth edition. London: Churchill. 1873.

I have noticed *single room* heating, and also the warming of a few chosen rooms from a general lobby or hall. The ventilation of each of such rooms will, however, require separate attention, and cannot be made general. It remains now to notice a system of warming and ventilating which shall include the whole house, and which shall not depend upon the individual action of any particular portion of such house, besides being to a great extent automatic. There has been no lack of inventions, both at home and abroad, which claim to have accomplished all this; but many of them are based upon untried calculations, and appear, moreover, to be too costly for general use. The most sensible system of whole-house treatment which I have noticed is that explained by Drs. Drysdale and Hayward,* who have erected residences in Liverpool, in which the system is carried out. For the details, however, the work itself must be consulted. Fig. 104, which is a reduced

Fig. 104.

section of Dr. Hayward's house, will explain this plan of which I speak. We will suppose that pure fresh air has been admitted by the primary inlet, filtered through a canvas screen, and heated by a coil of hot-water pipes in the basement or in the lobby. The next thing is the question of the inlets of this air into the rooms, and these are provided directly from the lobby, and controllable by valves, in order to temper the supply to the varying number of occupants. The foul-air exits are situated at the top of the rooms, and take the form of flues, which run up an inner wall to a foul-air chamber at the top of the house, connected with which is a common shaft kept permanently heated. The air in this common abstraction-shaft or flue can be kept at a proper temperature by a jet of gas, or a few coils of hot-water pipes brought from the boiler which heated the coil in the lobby. In the sketch given, this flue, after collecting the vitiated air from each room, closet, and gaselier, is brought down to below the floor of the kitchen, and carried up behind the fire, round the smoke-flue, and out at the chimney-top. An indispensable matter is the emptying of all the flues of the house into the intermediate foul-air chamber, and thence into the permanently heated abstraction-shaft, which sucks equally from every room, and is so proportioned to the size of the house as to change the air in it every twenty minutes. A study of the arrowings will render sufficiently clear much which I have not explained.

Another method of ventilating the whole of a house by means of a single apparatus has been introduced in New York by Dr. Griscom. It consists in utilising the chimney of the hot-air stove for the withdrawal of the foul air into supplementary flues adjoining those which convey the warmed air. As seen in fig. 105, each hot-air opening occurs near the skirtings of the rooms—viz., at points 1, 1, 2, 2. Sliding apertures are also fixed close to the ceilings, which act as outlets for the vitiated air which is contained in the gradually enlarging flues, and which is on its passage to the chimney-top.

If simple flues were employed to renew the air of a room, it is thought that the air which they would contain might be either colder or heavier than that of the rooms themselves, and might, consequently, pro-

duce an effect contrary to that wished for. The chief advantage claimed for the above system is the ease with which a constant action is maintained. It has also the advantage of being independent for each room in the house, of working during the night, owing to the heat stored up

Fig. 105.

in the stove, and of acting in summer and winter alike, if only the inlets and outlets are attended to. It must be borne in mind that this attention on the part of some one or another is indispensable. As I have elsewhere said, with reference to the whole house system of warming and ventilation, the condition of pure comfort and perfect healthfulness is dependent upon the supervision of the owner or servants, according as the varying weather, the wind, or the atmospheric pressure, makes such attention necessary. Some one must govern the working of warming apparatus in proportion to the coldness

outside, attend to the valves which regulate the current, according to the number of inmates; know how to occasionally isolate rooms, and how at times to divest the bulk of the fresh warmed air, for instance, into the bedrooms during a severe winter night.

I have not referred to the quantity of fresh air required in order to insure good health; but it may be taken for granted that the following is a safe scale for this country.

	Cubic feet of space required per head.	Cubic feet of fresh air required per head, per hour.
In dwellings	750	3000
In schools (per scholar)	250	1000
In workshops	Various	2000
In stables (per horse)	1500	2500
In cow-houses (per cow).....	1000	1500

This air, as we have seen, is moved and changed either by natural or artificial ventilation: a great deal depends upon the size of the inlets through which the air is allowed to enter. In deciding upon the size of the inlets, care has to be taken that they are not so small as to cause the air to rush in too quickly and so engender draughts. The air should be changed at least four times an hour—that is, a quantity of fresh air equal to the cubic contents of the room should find its way in and out of the house or room every twenty minutes. The proper size for the outlets which lead into the abstraction-flues have also to be carefully computed. The superficies, height, and shape of a room, must always be taken into consideration.

Dr. Parkes deploras that there is no agreed standard amongst medical men as to the amount of fresh air required under varying circumstances and conditions either by man or beast. The public may be certain that unless such a standard is arrived at by the faculty, and fixed by the legislature, that considerable blunders will continue to be made by the constructive professions. Surely an uniformity is as much wanted upon this question as upon weights and measures, and upon coinage.

THE CASE OF MR. JACKMAN.

THE following subscriptions have been received by the Rev. J. Reed of Swimbridge up to February 7th:—

	£	s.	d.
Sums under £1 received in the district	6	18	0
Dr. H. T. Sylvester	5	0	0
J. N. Pyke-Nott, Esq., Bydown	3	3	0
T. Law, Esq., Barnstaple	3	3	0
Dr. H. Kinglake, Taunton	3	3	0
John Smyth, Esq., Swimbridge	2	2	0
Sir W. Jenner, M.D., London	2	2	0
Dr. Shapter, Exeter	2	2	0
T. Smyth, Esq., London	2	2	0
Dr. James Ford	2	2	0
Rev. J. Russell, Swimbridge	1	1	0
Dr. James Duncan	1	1	0
T. Carr Jackson, Esq.	1	1	0
Dr. Walshe, London	1	1	0
Dr. E. B. Gray, Oxford	1	1	0
H. Morgan, Esq., Lichfield	1	1	0

* *Health and Comfort in House-building* (London: Spon. 1872); "Some of the non-Medical Duties of the Physician", paper by Dr. Hayward, 1873.

E. Nason, Esq., Bampton	1	1	0
Dr. Prance, Plymouth	1	1	0
Rev. R. K. Kestell-Cornish, Landkey.....	1	0	0
T. Mock, Esq., Barnstaple	1	0	0
S. C. Gray, Esq., Oxford	1	0	0
J. Questior Tamlyn, Esq., Horswell	1	0	0
S. J. Noake, Esq.	0	10	6
Dr. Sydney Ringer, London	0	10	0
A Brother Practitioner	0	10	0
Rev. A. W. Loveband	0	10	0
R. Greene, Esq.....	0	10	0
In small sums of five shillings and under	1	8	0

£48 3 6

The following sums have been received at the office of the JOURNAL.

Dr. W. C. Begley.....	£	s.	d.
F. Le Gros Clark, Esq.	2	0	0
Dr. Connel	1	1	0
Dr. Eastwood.....	1	1	0
J. Ewens, Esq., Cerne Abbas.....	0	5	0
J. W. Jeans, Esq., Grantham.....	0	10	0
Messrs. Norton	1	10	0
Dr. A. P. Stewart.....	0	10	6
A. T., per Dr. Stewart.....	0	7	0

ASSOCIATION INTELLIGENCE.

NORTH WALES BRANCH.

THE next intermediate general meeting of this Branch will be held on Tuesday, the 24th instant, at 11.30 A.M., at Cambrian Hotel, Pensarn, Abergele, under the Presidency of R. Davies, Esq., Llanfairtalhain. The dinner will take place at 2.30 P.M. Tickets, 6s. 6d. each, exclusive of wine.

Gentlemen having papers or cases to communicate, and who purpose dining, will be good enough to send early intimation to the Honorary Secretary.

D. KENT JONES, *Hon. Sec.*

Beaumaris, February 3rd, 1874.

CORRESPONDENCE.

INSTRUCTION OF MIDWIVES: POST PARTUM HÆMORRHAGE.

SIR,—If you will permit me, I will answer in a single communication two letters contained in a recent number of the BRITISH MEDICAL JOURNAL referring to me. One from Dr. Aveling, and the other from Dr. Barnes; the former disapproving of my remarks on the subject of the education of midwives; the latter referring to what I wrote about the treatment of *post partum* hæmorrhage.

In answer to Dr. Aveling, I must repeat that I cannot understand anything more derogatory to the position of the Obstetrical Society, as a scientific body, more contrary to its functions, or more offensive to the medical profession, than the desire to reintroduce the attendance of women in midwifery, which was so many years ago repudiated as bad. Any one having the least knowledge of the world will be aware how easily women possessing any kind of certificate can impose upon the credulous; and I can imagine no greater nuisance to the medical men practising there than the presence of such women in a country town. It is true that the poor are at present unfortunately obliged to be attended by women, but, as their attendance is confined to the most natural labours, and as the promoters of the better education of midwives profess to desire to restrict these women within the same limits, there is no need of Government coercion or of the authority of the Obstetrical Society in order that they may be educated enough to perform their duties. If a little further education be really necessary, let it be obtained in the hospitals, where now, in my view, they are amply taught; and do not let us see the humiliation of medical men of position recording their testimony to the efficiency of women as medical advisers, which in fact they will be doing. Whatever explanation may be given, it is nothing less than the reintroduction of women to midwifery practice, and can any one doubt the combination of the two circumstances—this movement, and the one for the introduction of female practitioners as Fellows of the Obstetrical Society? My belief is that the movement has already, with other undoubted circumstances, irreparably damaged

the Obstetrical Society, and that no long time will elapse before the Society collapses. Let the question be tested by the opinion of its Fellows or of medical men at large, and I am certain my opinion will be confirmed. Although a very humble Fellow of the Society, having greater regard for my own reputation than the Society has for its position, I have ceased to belong to it; and I will call on all who have any regard for the dignity of their class, to oppose any such steps as those now being advanced. Let them take the thing in hand, and show by their opposition that they are not intending to allow a retrograde movement to detract from the position they hold as members of a profession of the highest order.

In answer to Dr. Barnes, I will ask him to look again at my paper to which his letter is the reply, and he will find that, although I wrote that I had witnessed the mischief of the use of perchloride of iron, I did not write that I had seen death result from it. I cannot therefore describe the *post mortem* appearances in the order he suggests; but as it appears that he himself, fortunately for science but not for his patients, has really had opportunities, such as he imagined I had had, of witnessing the fatal effects of the perchloride, it would be most interesting if he would record the *post mortem* appearances of all his cases in the order he proposes. Dr. Barnes writes, "who has not seen women die bleeding and swallowing brandy to the last?" To this I can only reply, that I myself have never seen a woman die from uterine hæmorrhage when under my own care, either in hospital or in private practice, under any circumstances whatever; and if Dr. Barnes had used brandy, as advocated by me *at the first*, he would not have witnessed so many dying women drinking it "*at the last*". In making this reply to Dr. Barnes, I am unable to resist alluding to Dr. Snow Beck's able papers upon the subject of perchloride injection, and thanking him for them. He is well able to defend himself from any accusation of inaccuracy. No one will disbelieve his statements. His arguments on the use of the perchloride are based on the clearest conviction, and his exposition of his views is too clear and too convincing not to be appreciated by all who read it.

I am, etc.,

G. T. GREAM, M.D.

THE OBSTETRICAL SOCIETY OF LONDON AND MIDWIVES.

SIR,—Dr. Aveling has devoted so much time and labour upon what may be called "the midwife question," that anything from him on the subject deserves careful consideration. I have, however, the misfortune to differ so widely from some points in his letter, that I feel bound to notice them. My sympathies are quite with Dr. Gream and Dr. Tyler Smith, that "midwives are a mistake," and an attempt to enforce their education, examination, and legal recognition, if it succeed, will prove "derogatory alike to the profession, to science, and to the Obstetrical Society." I base my opinion upon the full and able disquisition on the subject published by Dr. Tyler Smith in 1849, confirmed, as it has been, by my subsequent opportunities of observation in this populous town. Dr. Aveling admits that Dr. Smith's "argument against midwives was a good one," but adds, that "he completely altered his opinion on the subject." Surely, in changing his mind, he does not necessarily change a good argument into a bad one.

Dr. Aveling assumes "that midwives are a necessity," because they are so largely employed; but that is begging the whole question. As well might he affirm that prescribing druggists, bonesetters, and other pseudo-practitioners, are a necessity, and ought to be improved and licensed because many persons will seek their aid.

I fail to see the analogy of the comparison between obstetric practitioners and workers in the church or in the army; and, as regards the latter, I would remind him that, although it is true that every soldier is not a general, yet every private is, or ought to be, a trained and competent soldier; and likewise, although every accoucheur cannot be in the first rank of the profession, he ought to be, for the safety of his patient, a properly educated and competent practitioner. But we are told that midwives are only to be entrusted with natural labour. Now, as no labour can be defined to be natural until it is completed; and, as some of the most perilous complications arise suddenly at various stages of its course, how can it be predicted, with any reasonable certitude, that a given case under the care of a midwife will prove a natural labour?

In flooding, occurring, as it generally does, suddenly, the life or death of the woman would often mainly depend upon the competency or incompetency of the practitioner by her bedside at the moment. It has been my misfortune to be called by midwives, as fairly qualified as such women can be made by the Obstetrical or any other society, only in time to see the patient die from hæmorrhage, which, *perhaps, at least*, might have been controlled by the prompt treatment which an educated practitioner alone can apply with efficiency.