REPORTS

ON

SANITARY ENGINEERING IN HOUSES, HOSPITALS, AND PUBLIC INSTITUTIONS.

By WILLIAM EASSIE, C.E.

VIII.—DAMPNESS.

Damp-Proof Courses.—Every one is aware of the dangers which might arise from residing in a house that is constantly damp, and how important it is to provide against this enemy to health and comfort. Perhaps the best way to form a just estimate of this subject will be to follow mentally the erection of a dwelling from its foundation upwards, and notice what evils might arise, and how they may be averted.

A residence designed by me, and which is now being completed, in the neighbourhood of London, contains 180 rods of brickwork, or rather over four-fifths of a million bricks. Allowing for the lime, sand, and water, the space taken up by the walls is over 54,000 cubic feet. The foundations under the ground-line occupy about 8,000 cubic feet, and represent 115,000 bricks, presenting an upright surface of about 5,000 superficial feet to possibly damp earth. Under favourable circumstances, the foundations up to the ground-surface will at first contain about 5,000 gallons of water; and if the subsoil were very humid and the bricks poor and porous, the latter might absorb and retain 7,000 gallons, *plus* the water contained in the mortar. If no damp course had been laid just above the ground-line, this wet would be continually striking up into the walls of the house above ground—by capillary attraction, exerted over a horizontal surface of 2,400 superficial feet below ground. Dampness from this source has several times been traced up thirty feet in height above ground. The cure would therefore consist in laying down 2,400 feet (superficial) of damp course on the top of the walls the moment that the foundations rose above the ground level, and thus build the real walls of the house upon an impervious stratum, cutting them off from the possible 5,000 gallons of water.

There are various kinds of suitable damp courses used by architects. Sometimes a double course of slates, or one course of sawn Welsh slate bedded in cement, is laid along the top of the walls when they have emerged above the ground-line. Some, again, interpose there a layer of sheet-lead, weighing four pounds to the foot superficial. Another system is the paying over the tops of the walls with a coat of hot bastard asphalt or bitumen mixed with sand. There is also a kind of so-called asphalt damp-proof course sold in sheets ready for laying on the walls; but the hot layer is generally considered preferable.

A course or two of enamelled bricks, or ramped glazed bricks, are also occasionally laid, in order to arrest the rising damp; but the best article devised up to the present time is a vitrified stone-ware tile, made in thicknesses from one to one-and-a-half inches, and perforated in order to ventilate the space between the ground and the joists of floor, and also to prevent dry rot in the timbers. A view of this last contrivance is given at fig. 94.

The proper place at which to insert the damp-proof course is a foot or so above the ground, or high enough to obviate the effects of splashing and dripping after heavy rains. Some architects also surround the base of the house with a piece of stone-flagging about a foot in width, and slightly tilted up towards the walls, in order to prevent soakage; and the plan is a good one. Where a damp course is used, the reason why it should not be laid too near the surface of the ground is, because in time it is apt to be covered by the earth, which always accumulates there, as the paths are re-gravelled, or fresh *humus* is laid to the roots of the plants. Creeping or trailing plants should, moreover, derive their sustenance from the ground, and should be attached to the walls by means of lattice-work or wires. A thin wall, in which the suckers of ivy penetrate, is necessarily always damp.

In adopting a damp-proof course, care should be taken that the article chosen should be able to resist the superincumbent weight of walls. Sheets of prepared asphalt will not, for instance, resist the immense pressure of a tall tower, whilst lead will. The power necessary to crush the perforated stone-ware course (drawn at fig. 94) can hardly be reached by any building; but it is the most expensive of all the systems.

Fig. 94.

In cases where old buildings are unprotected from rising dampness, it is quite easy to cut out for and insert a damp-course, such as is drawn at fig. 94. Many houses which had once proved uninhabitable have been rendered perfectly healthy in this way.

Dry Areas, etc.—A great many old and a great many new houses both in town and in country have their basement or cellar-floor built without dry areas of any kind, the walls simply abutting against the water-saturated earth; and the consequence of this folly is, that the interiors are always damp and uncomfortable. A way to cure this state of things is to construct a dry area wall on the outside, leaving a space between that and the basement-walls—and even a few inches will afford sensible relief. A brick or a half-brick wall connected with the main wall of building up to the ground-line, by means of an occasional brick stretching between the two, is the common system adopted; but this is not altogether to be recommended, as ordinary brick stretchers still act as partial conductors of the wet. Fig. 95 represents an arrangement to be recommended; and here again are used the vitrified stone-ware tiles drawn as flat damp courses, as at fig. 94, only that they are now placed perpendicularly. A still better method is to construct a second or area wall, which shall be unattached to the main wall save just above the ground-line. The best device is of course to build an independent wall to the requisite height, and then cover the intermediate space by an iron grating; but this is an expensive remedy, and might also prove unsightly.

Fig. 95.

In erecting a dry area, care should be taken to ventilate the open space between the walls, or the air there will become foul. A small air-shaft, rising up to six inches above the ground-line and covered by a grating, will generally suffice. The bottom of the area should also be concreted over and drained, and proper steps should be taken to prevent the inroad of rats. Constructing these areas outside or inside the house is always preferable to battening the inside basement-walls of an old and damp dwelling-house with wood and then boarding over it. It sometimes occurs, however, that little else can be done—as, for instance, in a house where there is a basement on one side of a party-wall and none on the other, or where another inside wall is an objection. Even then the narrow space between wall and boarding should be ventilated. Some are content with ventilating it into the room itself by means of occasional perforations, but this is not a commendable plan. A special shaft might in most cases be constructed so as to lead the close air outside. Instances, I think, will also occur where the space may with benefit be ventilated by way of the chimney-flue.

Hollow Walls, etc.—A building which stands in an exposed situation is generally built with extra thick walls, in order to resist the effects of drifting rains; but it has been more customary to run them up first with the usual minimum amount of materials, and, if then found pervious, to slate over the walls having exposed aspects. That this outer casing was positively necessary, will have been noticed by those who have inhabited some sea-side villas. The slating of exterior walls in this way prevents the rain from being beaten into the walls by boisterous winds, and also prevents the more constant saturation which follows an ordinary wet season; and if some ventilating spaces be left where the slates lap, the remedy is not a bad one. A visit to some of the littoral towns in the north will enable one to remark also many other cures for this evil—its damp wall patches and its mildewed paper-hangings. There more especially also will be observable outer walls which have been treated with hot, boiled, and sulphurous oils; gas and pine tars; pitch; asphaltes; chemical and other paints; lime, concrete, and mastic cements; silica, encaustic, and other impenetrable solutions; water-glass, soap and alum, and scores of other damp resisting preparations. Sometimes also may be noticed walls built with glazed bricks, and also cased with washable enamelled tiles. These will all keep out the external wet, but they will also keep in the wet generated in the interior, which will prove a greater source of mischief in the end.

All these remedies for damp walls are wrong in principle. They shut up the pores of the wall-substance outside, just as much as if they were filled with water. There remains, therefore, only the walling inside these paints for the absorption of the water which is collected there from the air of the house, and such accommodation cannot last for ever. If a new house were originally built of ordinary brick or stone, and coated over with an "impenetrable" solution, however well dried before being inhabited, by means of forced fires and commensurate ventilation, it would not be very long occupied before the walls, by condensing the watery vapour given off by the inmates in breathing, cooking, etc., would be rendered perfectly damp again; the reason

being that the walls are then without porosity, and could not pass the moisture which was developed inside the house to the exterior of the wall, where it might evaporate. The Professor of Hygiene at Munich was perhaps the first to take this view of the functions of a wall, and to compare the building of impervious walls to the wearing of India-rubber textures. Both protect from the exterior wet; but as they impede the exchange of air between the inside and outside, they generate a wetness in the interior—upon the skin or upon the walls of the room.

Such are the reasons why all damp-proof paints for the exterior of house-walls are even dangerous. Buildings built with vitreous slag, like some cottages which I have seen in the iron districts of South Wales, or those constructed with glazed bricks, are of course still more reprehensible. Better build with very porous bricks, provided that the superstructure will not crush them, than with bricks which cannot absorb water at all, nor transmit the air. Sandstones in which the siliceous grains have been cemented together with durable deposits, free working limestones, magnesian limestones, and most granites (if their absorption of water be never followed by disintegration), and even some artificial stones—these are all porous to a certain extent, and consequently commendable. Concrete walls, when the concrete contains just a sufficiency of binding medium, may also be made eligible. I speak now of solid, not cavity, walls.

The same general rule as to the desirability of permeable walls applies to all the interior walls of a house, for these bear some such relationship to the exterior walls that under-clothings do to outer garments. If it be unhealthy to wear for any length of time India-rubber outer coats during a wet and cold day, and even for any length of time on a wet and warm day, it is still more unsound to wear a macintosh material next the skin. It is, therefore, a mistake to paint or varnish walls, or to line them with wall-tiles, mirror-attachments, or cement-bedded veneers. Stencilling or water-colour painting upon merely distempered walls can be made to yield as much flat ornamentation as need be desired. The most sensible walls I have seen are those in the passages of the ducal residence at Chatsworth, which were merely built up of rubbed masonry, and neither plastered nor painted. Ordinary plastering will not destroy the porosity of a wall, but houses which already have their walls painted and varnished should be especially well ventilated. We might take many more lessons from our forefathers: if they wished to hide their walls they hung tapestry before them; and if they did paint them, it was not in oils, but in frescoes.

I must not be understood as saying that the more porous the materials of a wall are the healthier the house will always be; for, as any one may imagine, a wall may be built of too porous a material—as, for instance, of mud or road-drift; but rather as recommending a certain perviousness of walling materials; and as, with my betters, condemning all walls whose exterior stopped-up pores prevent the evaporation of water outside, or whose interior unporous surface serves merely to precipitate on the inner walls the water derived from the air inside the house. The thing to avoid is a wall-material which will admit water too easily; the thing to adopt is a substance which will just fairly admit the air. With Pettenkofer's apparatus air can be driven through mortar, sandstone, and even some limestones; water will also pass through, but far less readily.

In a country like ours, where the majority of houses are built with whatever comes first to hand, it is satisfactory to think that everything positively necessary is reached by the adoption of hollow exterior walls. Walls, like garments, interpose between the outer air and the inmates. Hollow walls are doubly agreeable, for in cold weather the air passing into the house is well heated during its passage through the inner wall; the hollow space also impedes the radiation of heat outwards. In hot weather they impart a sense of coolness, because the more interrupted the shade which acts as a cover, the greater is the current through the walls to the outer air. It does not follow that because there is a hollow space the ventilation is impeded, for there is a constant interchange of air between the two walls, just as between coat and vest. Hollow walls are also very readily cleared of drifting wet.

There are several methods of erecting these hollow walls. Sometimes ramped bricks are used, as at *a*, fig. 96; or straight bricks may be inserted, resembling that seen at *b*, and both may have glazed or enamelled surfaces. They are generally laid twenty-seven inches apart, and alternately spaced. There are, moreover, many patterns of iron ties—some made with a depending piece in the middle, and thus forming a water-drip, as at *c*; others are per-

fectly straight, like that at *d*. These are also variously fashioned at the ends—some bent up at one extremity and turned down at the other; but the kind most commonly used now are those made with clawed ends. As for the space usually left between walls, some architects prefer three, some two, inches. In the house mentioned by me at the beginning of this article, the walls had a two-inch space between, and the contents of this hollow space exceeds 3,000 cubic feet.

There are some precautions to be taken when building hollow walls—for instance, providing for some means of draining the base of the intermediary space. The best plan is to leave a few small openings there, to the exterior of house; and, as the hollow walling begins, or should begin, from the damp-course, any water, whether generated inside or outside, will thus readily find exit without soaking into the foundations. There should also be a few air-bricks inserted along the walls, just where the hollow space is left off. The nature of the cornice or the weight of the roof will sometimes necessitate a few solid courses at the top of the building, and the ventilating bricks are best put immediately under these. The hollow space need not be continued round the corners of a structure unless the wall is sufficiently thick to withstand this abstraction of strength where often most wanted. If the walls, too, be kept hollow up to the extreme top, the tie-beams of roof should sit upon stone templates which cross the space and rest on both walls. As for the window and other sills spanning the hollow, it is a mere matter of strength of outer walling.

Hollow walls are easiest built in brickwork, but they can of course be erected in stone, concrete, or other material. As regards thickness, walls of this description may be built which measure only nine inches across both walls and hollow space as well: for instance, the house and farm-offices of the residence I have previously alluded to are built of two half-brick ($4\frac{1}{2}$ in.) walls, with an air space of two inches. This thinness of wall is, however, only suitable for one-storey erections, or for top storeys of higher buildings. Where the height or weight of superstructure calls for thick walls, the hollow should be begun at such a distance from the face of outer wall as will preserve the whole space truly perpendicular. The only other caution I can bring to mind is to see that iron ties are so shaped as really to tie the walls together, and that they have been either galvanised or dipped in boiled oil, etc. The mortar-droppings should also be well cleaned from the top of the stretching media, and as well from the foot of the hollow spacing.

Damp Pavements, etc.—Very many old houses, and not a few modern ones, are rendered unhealthy by the damp condition of their pavements, particularly in the basement-floors—the reason being that the flags were bedded in mortar laid directly upon the cold earth, instead of being laid upon a bed of concrete. A wise system is to cover the whole floor superficies with proper concrete, six inches in depth, and then to bed the stones upon a layer of cement upon this concrete. The best plan is to put in the concrete at such a level as will allow of piers or walls being built upon its surface, such piers, etc., being about a foot or so in height, and prepared to carry the stone-flagging. Whichever plan be adopted, it is imperative that the subsoil be drained as much as possible, and to take care that the walls are guarded by external areas, or the water may find its way through the walls and cover the concrete.

I have seen cellars which were duly protected by areas from the wetness of the environing soil, and yet, from the absence of drains, the piers which supported the flags were found mostly surrounded with water. The only cure for damp flags is to take them up, excavate underneath, put in a bed of concrete, and lay them in cement upon that or upon piers or sleeper walls. If the houses have been built, or is being erected, upon *made ground*—i.e., shot rubbish of all kinds—it will be necessary to interpose a layer of charcoal.

The Drying of Buildings.—The dampness which results from basement-walls that are surrounded by damp earth, or from underground paving which had been simply laid upon the cold clay or moist earth, can never be removed by any amount of firing, because the evil is a persistent one. It often occurs, however, that it is necessary to occupy as quickly as possible a new house; and here fires may be made of service, provided that the dwelling has been properly erected. If we institute fires in a room newly built, we render the air in it capable of taking up more than its natural quantity of water; and if we continually replace this fully saturated air by fresh air, the room will speedily become dry. Heat and ventilation combined are the only means by which one can force on a suitable dryness. And yet this is not universally known, for it is not long since I found a builder attempting to dry the walls and ceiling of a newly erected billiard-room by burning coke in two grates placed in the centre of the room, and insisting upon keeping the windows closed for fear of letting in the cold outside air. One thing I might add here, and that is, that the fires should be as much as possible kept up in the proper fireplaces, because the ventilation is

Fig. 96.

thus rendered more perfect. A ventilating grate possessing a chamber behind it, which is duly fed with air from the outside, and that sends this air heated into the room, is also of more service than the common form of grate.

ADDENDUM TO THE BRITISH PHARMACOPEIA OF 1867.

*Published under the direction of the General Council of Medical Education and Registration of the United Kingdom.**

WE mentioned some time since that the Medical Council have taken the opportunity afforded by the necessity for a reprint of the *British Pharmacopœia* of 1867 to add to it an Addendum, which will be published at the end of the volume in the forthcoming reprint, and which will also be published separately for the convenience of those who already possess that volume.

The Addendum is in the hands of the binder, and will be forthcoming for the use of the profession, we anticipate, at the close of the year. It will be found to include many new medicines and new preparations, and a few slight numerical corrections of the text of the old *Pharmacopœia*. That they are not very bulky, will be gathered from the fact that the Addendum will not exceed twenty-four pages altogether. Yet it will be found to include most articles of interest and approved use which have come into notice lately. Among them are the following: *Tinctura ipecacuanhæ*; a new *Tinctura aurantii recentis* (from fresh bitter orange-peel); a syrup of chloral; suppositories of tannic acid, morphia, and carbolic acid, with soap; *Succus hyoscyami*, made of the fresh leaves and young branches of *hyoscyamus* (now well recognised as a most efficient preparation), and a *Succus belladonnæ* similarly prepared; the hypophosphite of soda; a compound of elaterium powder, made by rubbing ten parts of elaterium with ninety parts of sugar of milk; a compound jalap pill made with resin of jalap and of scammony, and soap, strong tincture of ginger, and rectified spirit; a formula for pepsin; a formula for making phosphorated oil, by dissolving phosphorus in oil of almonds; a solution of citrate of magnesia (*Limonade purgatif*); an excellent solution for the hypodermic injection of morphia, the acetate being formed by the process in the proportion of one-twelfth of a grain to each minim; yellow oxide of mercury; a fluid extract of liquorice; mustard papers, to supersede the ancient mustard plaster; oxide of bismuth; and nitrite of amyl. It will be seen that the list is comprehensive, although eclectic. Besides the *Pharmacopœia* Committee, which has deserved well of the profession by its patriotic and successful labours, the Council have had the services of Professor Redwood, the Professor of Pharmacology of the Pharmaceutical Society, who has for the last few years undertaken the duty of watching and reporting on pharmacological progress to the Committee, and has assisted in seeing these pages through the press. Pharmacology and therapeutics are not yet sciences so exact or so complete, but that we may expect to see reproaches of two kinds addressed to any committee or to any individuals who undertake to prepare an addendum to an official *Pharmacopœia*: the one that they have done too much, and the other that they have done too little. It would, however, be premature to discuss the Addendum to the *Pharmacopœia* from either point of view at present. Very shortly it will be in everybody's hands: we feel sure that the principal feeling will be one of obligation to the *Pharmacopœia* Committee for their important and successful labours, and the care and zeal which they have shown in making the *Pharmacopœia* a really valuable standard guide and book of reference for the most modern therapeutic purposes. Whether the book be perfection, or on which side of the line its errors are to be found, will be a matter for further consideration. We may as well announce, however, that it is our intention to be as critical as possible when the time for criticism comes.

* London: Printed for the General Medical Council by Spottiswoode and Co., New Street Square, F.C. 1873.

REPORT ON DRINKING-WATER IN THE EASTERN COUNTIES.

I HAVE recently had an opportunity of examining the drinking-water of certain well known places in the Eastern Counties. The results are as follows.

Date. 1873.	Name and Description of the Samples of Water.	Grains per Gallon. Solids. Chlorine.	Parts per Million. Free Ammonia. Albumin.
December.	Norwich Water Company...	24.0 1.7	0.00 0.05
16th Nov.	Yarmouth Water Company.	22.0 4.2	0.00 0.18
	Well (North) ...	15.2	0.04 0.18
	Well (South) ...	10.2	0.00 0.15
	Naval Asylum...	19.2 4.2	0.01 0.30
December.	Cromer; Town Pump	118.0 20.0	0.02 0.26
	“Happy Jack” Pump.	36.0 5.0	0.12 0.23
December.	Beccles.....	36.0 3.7	0.00 0.12
December.	Lowestoft (from Lound Water Works).....	20.0 3.5	0.05 0.14

For comparison, the analyses of London waters are appended.

London Water Supply (Thames).....	18.5	1.2	0.01 0.06
“ “ (New River)	17.7	—	0.00 0.06
“ “ (Kent Company)	26.5	—	0.01 0.02

From the foregoing it will be seen that of all these specimens of Eastern Counties water, only one—viz., the water of the Norwich Water Works—comes up to the standard of purity. The city of Norwich is to be congratulated on the improvement of its water-supply. In 1868, when I examined Norwich water, the result was very unfavourable, far different from what it is now. The water of Yarmouth is in a disgraceful condition; and, as is apparent from the above, the water supplied by the Water Works Company is as bad as that from the wells in the place. The mortality in Yarmouth is notoriously high—far too high for a town which, in other respects, enjoys great sanitary advantages.

Cromer—the snug little watering-place which boasts that it is still uncorrupted by the stream of modern civilisation, and which no railroad has hitherto dared to approach—is quite mediæval in the matter of water-supply. Its town-pump yields a fluid comparable with the contents of the Fleet Ditch-sewer in London. Fortunately, Cromer is a small place at the sea-side, otherwise it might every now and then contribute a mediæval plague to modern England.

Of Beccles and Lowestoft the remark may be made that, although they do not drink water of average purity, yet they do drink drinking-water, and they may be encouraged to attempt a further improvement of their water-supply.

J. A. WANKLYN.

SPECIAL CORRESPONDENCE.

PARIS.

[FROM OUR OWN CORRESPONDENT.]

M. Béhier.—Dr. Galezowski on Ophthalmology.—The “Two-headed Nightingale.”

PROFESSOR BÉHIER is decidedly the leading physician in Paris. As a professor, he is unexcelled, and his lectures bear the impression of a superior and a practical mind. His powers of diagnosis are simply marvellous, and his therapeutics are rational, savouring nothing of the scepticism prevalent amongst French physicians. He, at least, believes in drugs; and, while he abhors polypharmacy, he has a certain amount of faith in pharmaceutical preparations. His *clinique* is always well attended, not only by students, but by practitioners from all parts of the world. M. Béhier opened his winter course in the midst of a great number of practitioners and students, several representatives of the medical press of all countries being present. The Professor began by declaring that he was not tied down to any particular doctrine; that he was neither a humoralist, solidist, nor vitalist, but believed that, in most cases, the powers of nature alone were sufficient to cure disease—that is to say, without the intervention of drugs, properly so-called. He dwelt upon the utility of personal observation and the importance of taking cases at the bedside, for which, I must say, he affords every aid and facility. Whenever a patient is admitted into his wards, he