REPORTS

ON

SANITARY ENGINEERING IN HOUSES,
HOSPITALS, AND PUBLIC
INSTITUTIONS.

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VII.—WATER-CLOSET DISINFECTANTS.

WITHIN the last few years considerable attention has been directed to the treatment of the excreta at the moment that they are being delivered to the drain, and it has resolved itself either into the distributing over the soil of a certain portion of smell-arresting powder, or the injecting into the closet basin a quantity of deodorising fluid. Unquestionably, by such means, the air of the closet room is rendered less offensive, but whether the *fæces* are disinfected and rendered innocuous or not, depends upon the material used. Of the relative value of these disinfectants I have nothing to say, but have merely to point out a contrivance or two which may be relied upon as affording a perfect mechanical delivery of a fluid. I purposely pass by those systems which have been devised for the liberation of a suitable powder, as I cannot think that these will be again preferred to fluid disinfectants. It would also be a waste of time to describe a disinfectant which is not automatic in its action; and I will, consequently, make no mention of those schemes in which a special manual attention is essential to a proper distribution.

Fig. 91 represents what is called a Baker's disinfectant; and in this case there is injected into the closet basin at the moment of closing the valve or fall of handle, a certain quantity of the chosen fluid, and as this mingles with the water whilst it is still in the state of agitation consequent upon its descent from the cistern or the waste preventor, the water, which is meant to lie in the basin and act as an hydraulic seal, becomes well charged with the disinfectant. The trapping water is thus in a better condition to arrest and fix any foul odour which may have arisen from the receiver or soil-pipe; and not only this, but it will, in some sort, preserve the closet room from smell during the moments of voidance.

In order not to appear invidious, I give, at fig. 92, a view of another

Fig. 91.

Fig. 92.

self-acting disinfectant, viz., Brown's patent; and in this case the disinfecting fluid is delivered to the basin at the same time as the descending flushing water. The vessel containing the deodorant is here fixed over the closet apparatus, and inside, a syphon is formed by a small tube, one end of which is led into the closet supply pipe. When the lever is lifted and the water rushes down, a vacuum is formed in the syphon which holds the measured-out disinfecting fluid, in other words, the quantity of chemical solution there is withdrawn with the cleansing water into the basin of the closet. A small orifice in the bottom of the coil or syphon pipe, which is in the disinfecting jar, permits this measurer to refill ready for the next operation. Both of the above contrivances serve the purpose for which they are intended; and, although

the former is vended only for the distribution of chloralum, and the latter for Condry's fluid, each can be trusted to administer either preparation equally well. Both the above descriptions of disinfectors are perfectly easy of erection, and, with the printed instructions sent out with them, an ordinary plumber can readily affix them to any kind of closet. As regards the cost, neither need exceed the sum of thirty shillings. The Baker pattern, holding a gallon, will serve to disinfect about a thousand discharges; and the Brown pattern, containing a pint, will supply about one hundred and forty different actions of the closet. For the rest, all will depend upon the relative values of the disinfectants used.

There can be no doubt whatever that such inventions possess a certain value in places where the soil-pipes of the closets are unventilated, or insufficiently so, and that if they were affixed to the 900,000 and odd water-closets in the metropolis, a great benefit would accrue; but I am inclined to think that in cases where the soil-pipe is properly ventilated by a continuation of the whole sectional area of the soil-pipe up to the roof, that their adoption may be considered quite supererogatory. They will, however, always prove useful to attach to the pipes which supply the water for cleansing out stables, kennels, shambles, and the like places; and they may also with advantage be fixed to the delivery pipes of liquid sewage when this manure is used close to the mansion.

If a disinfecting apparatus be adopted to a water-closet, it ought to be free from the following defects. The disinfecting fluid should not escape prematurely down the drain, and so leave none of the desired liquid in the pan; the apparatus should also be so contrived that a longer or shorter upheaval of the handle should not result in allowing the measure of the medicated fluid to flow through the trap of the closet, and thus leave water only in the basin or pan. It should also be so constructed that a syphon action should not ensue, which would rob the jar or reservoir of its whole contents, as I have often seen to be the case. As for the disinfecting fluid, one should certainly be chosen which cannot corrode the metal attachments; and if it were a coloured solution it would be all the better, inasmuch as if any lapse of the due release of the fluid occurred, it would be then immediately discovered: but any disinfectant can happily be made to fulfil this last condition.

Cesspools.

There is not much difference between the uses to which cesspools are put, but there are a few variations, nevertheless, in their mode of construction. Some are built up with dry brickwork inside, but carefully domed over, and the liquid contents allowed to drain into the surrounding soil. Others are steined with bricks in cement for the very purpose of preventing such infiltration; and cesspools of this class may be found further defended from any chance of leakage by clay puddling outside the walls, and cement rendering inside. Some cesspools are made of a certain depth, and the liquid overflow drains into a still deeper well, whence it is withdrawn by a pump. Cesspools of this class are now mostly made more compact—in shape a parallelogram—with an upright screen or fender halfway, so as to divide the liquids from the solids. If a cesspool must perforce be built for the use of a house, etc., this last kind will prove the best pattern to copy; but besides being made watertight by the use of clay and cement, and being carefully domed over by a brick arch, it should be ventilated by a 6 in. upright pipe, the solid portion made accessible by a manhole, and the liquid half fitted with a pump. Where there can be no overflow provided, an index can be fitted in the ventilating shaft, to give notice when pumping is necessary.

The cesspools to which I wish to refer more particularly, however, are not those situated outside the house, but those which long ago have been foolishly built inside. For the most part, these latter will be found of the watertight order; but it frequently occurs that they were purposely built with open joints, so as to economise the labour of emptying them. I will give a few examples.

In 1870, a house in Wimpole Street, London, was discovered to be in a very offensive condition, and, on opening up the basement, a chain of five cesspools was exposed, each about six feet in diameter and twelve feet in depth, connected together by a brick-drain. The oldest pit lay nearest to the main sinks, etc.; and it would appear that when that was full another was dug, and so on until the atmosphere of the house proved unbearable. There was no connection with any sewer, and the liquid wastes simply disappeared in the gravel. Next door, four similar cesspools were laid bare; and, in addition to these, a hole fourteen feet square and eight feet deep, full of putrid water and its silt, was discovered exactly in the middle of the kitchen. Likely enough this hole had been made for the use of the workmen who built the house originally, or it might possibly have been the ancient idea of a rain-water tank. Unlike the cesspools, it was deep enough to

reach the clay, which between High Street and the foot of Portland Place is close to the surface.

Here at Fig. 93 is another example of the basement-floor of a house in Harley Street, London, which I opened up during the past month. The dark lines represent the old brick drains, and the sewer lies in the middle of the street—the entrance to same beginning at A in the cellar B, which cellar is situated, with its fellows, under the foot-pavement.

The fall of the drain was from C to A, or rather ought to have been; but owing to the fact that the drain was for the most part *lower* than the sewer, and especially so about D, the effete matters for the last thirty years or more had mostly lodged in the cesspool E, close to the closet down-pipes S S, which cesspool was five feet in diameter, twelve feet in depth, and was found full to the overflow. The scullery wastes ran into the cesspool F, which was about four feet square and four feet deep, and the outlet was into the pit E—that is, when the ground was sufficiently soaked as to need it. The cesspool at G was tolerably empty, and free from deposit. The cesspool at H, on the contrary, which measured five feet square and eight feet deep, was, like that at E, as full as possible of black foul smelling deposit. That at J—a circular-shaped one, fourteen feet in depth and six feet in diameter—was, if possible, still worse, as an old servants' closet had stood immediately over it.

Nor was the nuisance altogether confined to the house. The stable buildings began at C; and as the ground-floor, or lowest floor, of these was some seven feet above the basement-floor of the servants' hall at K, and as the drains towards the mews were simply made of three bricks on edge at the sides, covered on the top with oak slabs, with nothing but the bare gravel for a bottom, it was not to be wondered at that the servants' hall was perfectly uninhabitable, owing to dampness, natural and artificial. To make matters worse, a closet-soil downpipe at L delivered—unattached to the drain—against the unprotected wall between C and K. In the house alone, forty cartloads of black sewage deposit and foul refuse had to be carted away, and a suitable shoot was not found nearer than the neighbourhood of Highgate.

When cesspools, either inside or outside a house, are hermetically sealed, there is some danger of an explosion if a lighted candle be brought too near the opened up place of escape. On one occasion which came under my notice, it was found necessary in a house which was drained into an unventilated cesspool, to raise the pavement-flags under the sink, in order to trace some rat-holes. The sink was especially well trapped with a patent syphon. The workman required a candle, and, as he lifted up the flag and laid bare the drain, the pent-up gases exploded and severely injured him. It is therefore necessary to give these places a wide berth, for more reasons than a zymotic one.

I have just alluded to rats, and might here add that these animals are the most reliable harbingers of sewer-gas eruptions. As a rule, wherever there is a bad drain smell, there exists an old brick barrel-drain or rat-run: very often these are also in conjunction with the modern sewer. I have before me a piece of cast-lead pipe, nearly a quarter of an inch in thickness, which had been gnawed by these vermin in order to admit them, by way of the sink-waste, into a house at Tulse Hill. They managed to make a hole through it, and on it are plainly discernible hundreds of their teeth marks. Once in the house, it was found almost impossible to extirpate them; and at the beginning of the crusade, when the boards and flags were pulled up, I am not exaggerating in the least when I say that over fifty nests were laid bare, besides a goodly collection of all kinds of bones, flanked by once shining articles, such as scissors, corkscrews, and one or two silver spoons. A favourite cat, and a good mouser, which I had sent there before I opened up the floors, died after a few days' experience of the place; it was said by some from the effects of nocturnal warfare, although it is just as likely that it was from grief, and because he had, unlike Alexander, too many worlds to conquer.

Speaking of rats, it does not invariably follow, because that a rat is seen about a house that it is a sewer-rat. For instance, on taking up the flags near D on fig. 93, some five nests were discovered and one

rat despatched: it proved to be, however, a house-rat, or, more strictly speaking, one of the barn-yard species. The latter have more or less pointed heads, whereas the head of the sewer-rat is fuller and rounder, and the neck thick and clumsy.

Old Brick-drains.

Occasionally a considerable amount of danger may arise from the presence of ancient brick-drains under the basement floors. These have been appropriately termed "elongated cesspools," and require removal quite as much as the cesspools proper, which they generally serve to connect.

On opening up an old brick-drain, the crown of the arch—if the drain be of the barrel pattern—will be found in tolerable preservation; but the bottom or invert will be generally discovered in a perished condition, the mortar gone, and the bricks rotten. In very bad cases, the floor of the drain will be here and there broken up, with a consequent soakage into the soil at such places. Pieces of the crown may also have fallen in, and the passage of the excreta partly obstructed. If the drain were formed with brick sides and flagstones at top and bottom, the stones forming the bed will be found very uneven and with open joints, and the subsoil around will be black and foul-smelling.

Nearly all the old houses in town and country possess such brick-drains, and not the least part of the evil lies in the fact, that one-third of the diameter would have sufficed to lead away all effete matters. Where brick-drains are found—and a search should be made for them—they should be taken up and glazed earthenware pipes laid in their place. No hesitation should be observed in this matter; for, where a brick-drain exists, there are many other things equally objectionable, which only the opening out of the drain will expose. When the old drain is laid bare, the whole of the brickwork should be taken up and carted away, and the earth around it also, if it should show any signs of filthiness. Some people are satisfied with removing the crown of the arch, laying the pipes over the old invert, and filling up around with the broken rubbish got out of the trench. Others have actually laid the new pipes alongside the brick barrel, and contented themselves with disconnecting the latter, thus converting the old drain into a gas retort, and really making matters worse. The only safe system, however, is to cart away all the old formation and provide new. No amount of lime or disinfecting powder will purify the old bricks and silt-sodden earth around. A concrete bed should also be prepared for the new pipes, and, when the latter are laid in, they should be covered with a few inches of concrete. If this be done, leaks will be impossible.

There is one precaution to take in bedding the joints of drain-pipes in mortar or cement, and that is, to see that, in pushing the pipe ends into the sockets, a ridge of the cement or mortar be not formed inside the drain. On taking up a long drain on an estate in Shropshire during the present year, I found that the stoppage had been entirely owing to the men's stupidity in this way.

It is necessary to take proper care to envelope the drain-pipes inside the house with concrete, and it is as necessary to concrete over the whole floor of basement, in order that no foul air should be sucked into the house by means of the fireplaces and heated flues. If the ground upon which a building stands be porous, it is also filled with air, and, if a leaky gas-pipe or faulty drain-pipe be laid in it, this poisoned ground-air, as it is now called, will assuredly be passed into the rooms for respiration. Dr. Pettenkofer instances a case where lighting gas traversed twenty feet of street, and penetrated the whole foundations and basement of a house, with fatal results. He has also discovered that the ground under all houses is charged with carbonic acid, and that in some cases there exists as much of this pulse-lowering gas a few feet below the surface as in the worst of unventilated houses. It is imperative, therefore, that the basement floors should be concreted over their whole area, and all drain-pipes laid in a water-tight trench of the same material. Strictly speaking, a pipe with concrete surrounding will not be air-tight, but it comes sufficiently near to that desirability. If there be no cellar, a well-ventilated air-space should be kept between the double flooring and the ground for the same general reason.

ANÆSTHETICS.

XXI.—DEATH FROM CHLOROFORM.

WE read in the *Ohio Clinic* of September 27th:—"Still another death from chloroform! The Cincinnati Hospital is peculiarly unfortunate in this regard. On Wednesday last, a German, aged 48, entered the hospital with a dislocated shoulder-joint. Anæsthesia was established, the luxation was reduced, but the patient was dead. Dr. N. P. Dundridge, who had charge of the case, made all the usual efforts, of course, at resuscitation.

Fig. 93.