

one of the dung manufactories. Now, these were the property of the Corporation, and they were in direct violation of the terms of the Public Health Act of 1864, which provided that no such things as these should be within the bounds of the community, or anywhere within fifty yards of any dwelling-house. The thing was intolerable to him to hear men lauded who he knew had systematically broken the law. There was another thing. On Saturday afternoon last he spent an hour or two in walking through the mews lanes in the immediate neighbourhood of where they were met, and if they wished to see modern Glasgow in its reality, and not in photograph, they should take a walk down those mews lanes. They would find that at every house, the rents of which would be from £100 to £150, there was a great, big, deep pit in the rear, where stuff was deposited and allowed to fester from six to twelve months. The commonest sense would show that that system should be immediately abolished. He should have liked to hear Dr. Carpenter explain how it was that while the death-rate in Cathcart parish, two miles from where they were met, and the death-rate in the burghs of Govanhill and Crosshill was 16 and 15 per thousand, the death-rate in the city was 25 per thousand. That would have been something like answering the attack. He was sorry to have to attack the officials of Glasgow. He knew them almost all personally, and he should like very well if he could speak favourably of them. Whenever he could, he did so.

On "Notes on House Sanitation in and round Glasgow," by
GILBERT THOMSON, M.A., C.E.

During the past year I have examined on behalf of the Glasgow Sanitary Protection Association close on three hundred houses. A number of these were country houses of various sizes, but the majority were in the city and suburbs of Glasgow, and varied from single flats to some of the largest and most expensively fitted houses in the district. As a rule, however, they were of the better class.

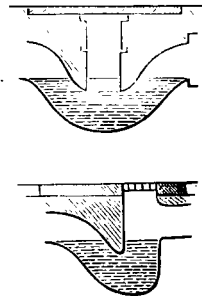
In the course of these examinations, a great amount of both good and bad work was seen, and the following notes have been selected as being likely to be of general interest. A first-class house in Glasgow contains a considerable amount of plumbers' work, and from what I have heard of other places, my impression is that the quality here is rather above the

average. The laying, and more especially the repairing of fire-clay drains, is to a considerable extent in the hands of the plumbers.

In considering the drainage system of a house, everything outside the main-trap or traps may, as a rule, be disregarded. There are many instances, however, in which that does not hold good, and where the state of the sewer outside the trap may affect the house almost as seriously as its own drain. It is no uncommon thing to find a terrace in which the common sewer runs under the front or back areas of the houses, sometimes so close that there is not room for a trap between the house wall and the sewer. The condition of the sewer is often very doubtful, and unfortunately, except by actual opening up, it is very difficult to discover if anything is wrong. In one such sewer, which was exposed recently, the joints of the pipe were perfectly open, and on three or four lengths of pipe there was a fall the wrong way of three or four inches. Naturally the foundations of the house were far from dry.

In the same connection may be mentioned the danger which may arise from the bad drainage of adjoining houses. The following case illustrates that very strikingly:—An outbreak of diphtheria took place in one of a row of self-contained houses, and the proprietor, suspecting his drains, employed a plumber to put his house in order. The drains were found to be very bad, but were thoroughly overhauled. Not very long after there was another outbreak, and our association was applied to. The house was examined and found to be very satisfactory. Permission was then obtained to test the two adjoining houses, and a quantity of paraffin was introduced into the drains of each. In a few minutes the smell of paraffin found its way from one of them into several parts of the house first tested, causing a strong suspicion that the disease germs had got access in the same way.

Coming to the house system itself, the main trap is the first thing to be noticed. The form most commonly met with is what is known as a common lying trap, that is, a syphon bend with a centre eye for cleaning. There are also a number of built cesspools, more or less tight, but both of these are gradually being superseded by ventilating traps, which are designed to admit fresh air into the drain. Of these Buchan's trap is the one that is generally used. The change is doubtless a great improvement, but it does not do to entrust the alteration to unskilled hands, for some men



have evidently no idea whatever of the use of a trap. The following case came to light recently:—

A proprietor was not very sure about his drains, but in order to make sure that no gas from the main sewer could enter the house, he had a Buchan's trap put on the outlet. Some time after a house two or three doors off was tested with paraffin, and in the basement of this carefully guarded house the smell was noticed very distinctly. An examination was then made of this house. The drain was found to be in bad condition, and the trap was arranged with great care, so as to be absolutely useless. It had two openings, one on each side of the waterseal. The one on the sewer side should have been plugged, and only opened if required for cleaning, while that on the house side should have had a grating at the surface for ventilation. In this case, however, both were left open, a brick box was built round all, and a close-fitting flagstone was set on the top. The passage thus formed over the trap was evidently taken advantage of both by sewer gas and by rats. In another house a Somerset trap, which is somewhat similar in construction, was set in a style not much better.

The following plan was still more efficacious for the admission of sewer gas. An old house had a built drain under it, which passed to the sewer through a built cesspool, trapped by means of a stone tongue. The drain, apparently, had not been tight, as a bad smell was complained of. Thereupon, men were set to open the drain and to lay a fireclay pipe through the house. This they did by taking off the covers of the drain, laying a fireclay pipe in the bottom, and replacing the covers. The end of the pipe merely projected into the cesspool. This arrangement, of course, left free connection between the cesspool and the old drain, *outside* the new pipe. To make a complete job, the tongue of the cesspool had been broken, either during these repairs or previously; and its trap being thus destroyed, the house was left in full communication with the sewer. Fortunately the atrocious smell led to an investigation before anything worse than occasional sickness had resulted.

With regard to the house drain, it would seem that the average Glasgow house, though very far from perfect, is considerably better than the average London house. The drains are often found to be leaky and dirty, but it is a rare thing to find a house in which the bulk of the sewage at least is not passing away. The great majority of the drains are fire-clay pipes, sometimes cement jointed, sometimes clay jointed, and sometimes not jointed at all. A large number of them are found to be defective when tested with paraffin or smoke. One case was very instructive as showing how a very bad state of

the drains might be quite unsuspected, even on a partial examination. The house was a comparatively new one, perhaps three or four years old. The drain was readily accessible at an open trap outside the house, and on running water from various baths and closets, it was seen that the water came freely and clean to this trap. On testing the drain with paraffin however, the smell appeared immediately throughout the basement, and it was found that a branch of the drain from the foot of a soil-pipe was for a length of six or eight feet smashed to pieces. This soil-pipe was only from one closet, which had not been tried at first, but it was sufficient to convert a space of several square yards into a dunghill. Curiously enough, no smell had ever been noticed, and no illness had ever taken place in the house. A common mistake here is the excessive size of the drain-pipes. I have seen a 12" pipe from a single soil-pipe, and 9" pipes are very frequent. Cast-iron pipes are beginning to be used here for the horizontal drains, but as yet to a very limited extent. They are generally coated with Dr. Smith's composition, and jointed with lead. The usual diameter has been six inches. Though there is no doubt that a fire-clay pipe may be made tight, there is I think as little that the iron pipe is superior.

Lead is now almost discarded here as a material for soil-pipes, iron having taken its place. The joints are made generally of red lead and hemp, staved into the faucet. When the pipe is heavy enough and when the jointing is well done, the job is a safer one than a lead pipe would make; but there is the danger that light pipes, which will not stand proper jointing, may be used. On the whole, however, I have found fewer defects in iron pipes than in even comparatively new lead ones.

In a great number of cases the same pipe does duty both as a soil-pipe and as a rain-pipe, the lower part being 4 or $4\frac{1}{2}$ in. diameter, and the upper part about 3 in. I have frequently found, in testing, that a smell of paraffin which was noticed in the house was distinctly traceable to the top of a rain-pipe, from which it was blowing in through a ventilator, a skylight or cupola, or even under the slates. The entrance of foul air in this way is therefore not merely a theoretical possibility, as it is often thought to be, but an actual fact. Offices, warehouses, and the like, with low-roofed wells surrounded by higher buildings, frequently receive foul air from the short rain-pipes.

There is one advantage, however, in the practice of using rain-pipes for soil-pipe ventilators, and that is that it ensures some sort of continuity in the pipe, and that it will end outside: otherwise, there is no saying where the air-pipe may go. This of course refers to existing houses more than to future ones. I

have found a house in which the air-pipe ended in the attics, and another where a pipe, which appeared outside the roof as a proper air-pipe, had a want of continuity, part of it having slipped down, with the result that the drainage system was largely ventilated into the nursery. Zinc pipes, more or less tight, are sometimes seen. On the other hand the arrangement is, in many cases, found to be very good, and the workmanship thorough, for a large number of plumbers in Glasgow are quite competent both to design and execute good work.

The practice of putting up separate pipes for closets, and for such fittings as baths and basins is extending greatly, and besides its other advantages, has the important one that the connection of the closet trap into the soil pipe has a much better chance of remaining tight when no hot water passes through it.

Of the water-closets in use here, the pan-closet is most frequently met with, even in the better class of houses. In them, however, it is steadily being displaced, the usual substitute being the Bramah. The writings of sanitarians have been effective so far that a considerable section of the public is quite aware that a pan closet is not a good thing, and this will, no doubt, come to be more and more considered by builders. In new houses pan closets are sometimes put in, which in their outside appearance and mountings have, when boxed in, some resemblance to Bramah closets. Bramah closets are largely manufactured in Glasgow by a number of makers. The frame and trunk are generally of iron, and the valves have India-rubber seats. They are made at prices ranging from about £2 10s. 0d. to about £4 10s. 0d. Many of them have ingenious lever arrangements to give a short lift, but I am not sure that the advantage is worth the extra cost. There are also a number of wash-out and hopper closets used, the prices of some of the latter being as low as 10s. or 12s.

When Bramah closets are used, syphonage of traps is a very decided danger. It is seldom safe to assume that any such closet is certain to leave both its own trap and the neighbouring traps full of water, and the test which I generally apply is to disconnect the water supply, fill the basin up to the overflow, and, when the water has come to rest, open the valve. The seal of the trap is then measured, and compared with the measurement after running water slowly in. A lookout is also kept at any fittings near for the sound of air gurgling through their traps. On referring to my notes, I find that about 250 Bramah closets have been thus tested, and of these about 60 affected distinctly either their own or neighbouring traps. The latter case is the most serious, because usually the closet trap in actual use will be filled again at once, but if a basin or bath

trap is syphoned it may remain empty for an indefinite time. One such case was a basin close at the side of a bed, the trap of which was invariably emptied by the use of a closet off the staircase. When a closet with what seems to be a sufficient air-pipe acts in this way it generally turns out that the air-pipe is choked or obstructed, as, for instance, by a bird's nest. It is a common practice to provide ventilating pipes from the trunks of closets, both Bramahs and pans. These pipes, in a number of instances, lead to a serious defect, as by them the trunk of the closet is sometimes directly connected with the soil-pipe, the assumption evidently being that the current of air will always be upward and sufficient to prevent any back draught. This, of course, is very far from the truth.

Basins and baths are occasionally found to syphon their own traps, more especially when the outlet-valve is closed, before all the water has passed out. The most common case is when a small pipe has been put up for one or two basins, and is not ventilated at the top. In one such case a ventilating pipe from the top of the trap was recommended. Shortly after we were informed that this had been done, but that the gurgling sound was as plain as ever. An examination showed that the ventilating pipe had certainly been put in, but that it was connected to the wrong side of the trap.

The water supply in Glasgow involves less danger than it does in many places, as the greater part of water for drinking and cooking is now drawn direct from the main. In most cases the scullery and pantry sinks, at least, are supplied in this way, and the general rule now is, that all baths, basins and sinks are supplied direct from the main. In addition to this, it is compulsory that in all new work, the cistern overflow pipes should end openly, and this removes one chance of pollution. The old place for the overflow pipes was into the bottom of the closet trap, and much more rarely they are found to be run direct into the soil-pipe, and in these cases they are generally trapped in some fashion. These traps are usually dry.

One very fruitful cause of danger is the thoughtless disuse of various fittings. The idea is very prevalent that when a closet or basin is little used the danger is correspondingly small, and I am frequently told that "this closet is hardly ever used;" the inference often being that it is hardly worth while looking at it. The very reverse is of course the case. One instance of this I saw lately. A large house had a closet off a bed-room, but it was thought not to be a good thing, and ordered to be taken out. The closet was taken out, but the cistern was allowed to remain. The overflow-pipe of the cistern went direct to the soil-pipe, and had a bell-trap on the top. The chances

were against this bell-trap being effective at any time, but the cutting off of the water made the matter quite certain, and left a good-sized opening for foul air to enter. Another house had a day and night nursery, each provided with a basin. This was thought not to be very safe in the night nursery, so the water supply was cut off. The trap before long was quite dry, but, fortunately, the danger was discovered soon after. Another instance of this was where a bed-room had been converted into a conservatory, and the basin into a flower-stand.

The examples I have given have all been found in and round Glasgow, except that the numbers of Bramah closets tried for syphonage include country houses as well. The country houses were, as a rule, less varied in their character, that is, more of them were either very good or very bad. The probability is that unless a country house is new, or has been recently overhauled, its drainage will be bad; and even if the work is recent it may not be above suspicion. In the older houses built drains of large size, and cesspools which are of course never cleaned, lie hidden in the most unlikely places, and very commonly the air from them can enter the house freely. It is, however, needless to generalise on such subjects with a view to showing that danger exists, as it must be evident now to everyone that bad drainage is extremely common and very dangerous.

PROFESSOR JAMES THOMSON said, with regard to Mr. Gilbert Thomson's paper, he very much approved of the efforts of the Glasgow Sanitary Protection Association for which Mr. Thomson was acting. He, Professor Thomson, was himself a member of that Association, and he thought it would do a great deal of good. He wished to ask for any information that Mr. Thomson could give as to the relative merits of the smoke test and the paraffin oil test. The smoke test, he considered, had the important advantage of giving very strikingly visible indications of leakage, and of helping, often very effectively by eyesight to the detection of the places from which the leakage proceeded. He would like to know whether the percolation of the paraffin oil into the ground under dwelling houses in case of the pipes being in fault, was ever found to produce any long continuing nuisance in the house where the test was applied, or in neighbouring houses. Of course he considered the smoke test was a little more difficult than the pouring in of paraffin oil.

Mr. E. C. ROBINS, London, was glad to hear that there was such an association carrying on operations in Glasgow. He was vice-president of a similar society which had lately been founded in London,

and it had wrought very successfully. They were enabled to give much assistance to householders who were anxious to improve the sanitary condition of their dwellings, but did not know how to set about it. He had never used the paraffin test, but had found oil of peppermint mixed with hot water to answer very well. If anything, the smoke test had the advantage over others, as it could be both seen and smelt.

Dr. A. CARPENTER said they should be careful whilst making all these arrangements to prevent the introduction of sewer gas, and also careful while fortifying the fortress, so to speak, of the individual house not to leave the drains and sewers in such a condition that gas might be generated with impunity. Wherever there was a development of that kind in any particular sewer, that sewer was defective, and it was to that defect that attention ought to be specially directed. Everything should be done to prevent the development of that which was certainly not a necessity of the sewer system. Any sewer system which gave out gas was defective, and on no condition ought to be allowed in connection with sanitary work which permitted putrefaction to take place in the sewers. These ought to be as clean as the kitchen sink should be kept by the cook, then no evils would arise from the drains. That was the great principle which ought to be at the bottom of all sanitary operations.

Mr. H. H. COLLINS, London, said he could not help recognising the difficulty of getting a sewer into the admirable condition which had been portrayed by Dr. Carpenter. To obtain a gradient to make the sewer a satisfactory one the ratepayers and Local Authorities would have to be appealed to. It would, however, be difficult to convince the ratepayers that it was necessary or desirable to spend money for such a purpose. If he found a sewer defective he would do his utmost to disconnect the house from it, and leave it to the Local Authorities to do the remainder. A large amount of good could be effected by flushing the drains regularly. Though he had not used paraffin oil, he had employed peppermint and ether, for the purpose of tracing the escape of sewer gas, but he had a preference for ether. In this way he had always been able to discover any escape of sewer air.

Mr. GILBERT THOMSON, in reply to Professor Thomson's question, said the smoke test had this advantage over the other, that it was visible, but on the other hand the paraffin test was easily and rapidly applied. He had experienced very little difficulty in getting at the exact spot where a defect existed when using paraffin, as the smell could not be mistaken. The mode of applying it was to pour it from the top into the soil pipe or conductor.