

THE SIZE OF GULLIES, TRAPS, AND DRAINS, IN RELATION TO THE OFFENSIVENESS OF SEWERS.*

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EVERY Medical Officer of Health is only too well acquainted with the frequent and constant complaints that are made, especially at certain seasons of the year, of the offensive odours emanating from sewer openings. The chief remedy for this state of things has been the application of various methods having for their object the better ventilation of sewers, and some of the methods which have been suggested and applied have involved a considerable outlay, both in construction and maintenance. I venture to suggest that the ventilation of sewers, as a general remedy for the above conditions, has signally failed, and even in those cases where special methods appear to have been successful, the cost incurred is frequently quite out of proportion to the benefit secured. It is a well-known axiom, which needs no proof, that a remedy, to be successful, must strike at the root of an objectionable condition, and remove its cause. It is because the various methods of ventilating sewers have failed to do this, that in my opinion their general non-success is due.

In this paper I intend to place before you for your consideration my views as to the chief cause of the presence of offensive air in sewers. In doing so, let me first deal with the size of drains as now usually constructed. In this connection I would point out that it is not in the main sewers that the largest volume of foul sewer air is present. Some years ago I made a calculation on this point, and found that the combined sectional area of the main branches of a certain sewer was seven times that of the sewer itself. This calculation did not take into account the smaller branches, which would be very much larger in number, nor the drains, much more numerous still, the combined sectional area of both of which it was impossible to ascertain, but which would necessarily be very much in excess of that of the main sewer; for instance, the sectional area of thirty-seven six-inch drains is greater than that of a three-foot sewer. This of course is a well known fact, and such being the case, what I have just stated is evident, viz., that sewer air is present in much larger

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quantities in the branch sewers and drains than in the main sewers.

Of course it is necessary to construct a main sewer of such a size that it may be adequate for all the future requirements of the particular area which it supplies. That is true also, no doubt, so far as the main branches are concerned, but with regard to the smaller branches I am inclined to think they are often made larger than is necessary, and I am decidedly of opinion that an ordinary house drain does not need to have a diameter of six inches. It is not necessary for me to remind you that a six-inch drain has two-and-a-half times the capacity of a four-inch one.

The amount of sewage from an ordinary house does not exceed 100 gallons per day, and a four-inch drain with a gradient of one in forty will discharge that amount in about forty seconds. There is, of course, the surface water to contend with, but a four-inch drain, laid as above, will discharge more water in one hour than would fall upon the surface of a quarter of an acre of ground if the rainfall during that period was equal to one and a half inches, and it would discharge in twenty-four hours a volume of water about equal to the average rainfall upon such an area during twelve months. That being the case, I cannot see the necessity for the construction of house drains of such capacity as are now usually provided.

If the peripheral branches of a sewer were made of smaller calibre than is at present the case, there would be a corresponding diminution in the amount of sewer air to be dealt with.

I now come to the consideration of the cause of the foulness of air in sewers.

A sewer laid with an uneven gradient, and which consequently allows sewage to become stagnant therein, must of necessity be foul through the decomposition of that sewage. The obvious remedy for that state of things is to relay the sewer with an even and proper gradient.

But sewers, however well laid, are at times filled with very foul air, and in order to illustrate to you my opinion as to the chief cause of this, I will take an imaginary town of, say, 100,000 inhabitants.

In such a town there would be about 10,000 street gullies connected with the sewers, each of which would hold at least, on an average, six gallons of sewage. There would be at least 20,000 gullies or traps which receive the sink waste from houses. These are, generally speaking, six-inch gullies, and hold eleven pints of sewage. There would also be a large number of gullies connected with stables, courts, yards, and the like, which receive quantities of putrescible organic

matter. The exact number of these it would be impossible to estimate, and they would vary much in size. Suppose we put them down at 2,000, with an average capacity of two-and-a-half gallons each, which I think would be under the mark. Then the total capacity of all the above gullies would be 92,000 gallons. This would mean then that the sewage of such a town, in gaining entrance to the sewers, would have to pass through a "septic tank," so to speak, having a capacity of 92,000 gallons. We know the character of the liquid which emanates from a septic tank. Can we be surprised then that the air in sewers is foul? The wonder would be if such were not the case.

In the above calculation I have not taken into account the intercepting or disconnecting trap, of which many more are now in use than formerly was the case. That being so, I think the above estimation would be considerably under, rather than over, the mark.

I might here mention that whatever may be the advantage of the disconnecting trap, and I admit the advantage is great, the disadvantage of such a trap, especially of the size that is now generally used, is that it holds up a considerable quantity of sewage for more or less prolonged periods, during which the sewage is undergoing decomposition. This objection could doubtless be partially remedied by utilizing a disconnecting trap for a block of houses instead of one house, in which case the amount of stagnant sewage would be correspondingly diminished, and the contents of the trap more frequently renewed.

During prolonged dry weather no sewage of course enters the majority of the street gullies, and the amount of putrescible matter which the sewage has to pass through in gaining admission to the sewers is diminished in proportion, though such is usually in a much more foul condition.

Suppose that more than half the houses of our imaginary town did not possess water-closets, then where these closets did not exist, the street gullies would be generally used for disposing of slops, etc. I should think at least 3,000 gullies would be so used in such a town. This is a very objectionable method of disposing of such refuse; some better means should be provided for this purpose. In water-closet towns this practice, I should say, will not obtain.

The total capacity of the above, and the gullies to the sink drains of houses, would be about 46,000 gallons, so that during dry weather the sewage of such a district would have to pass through a "septic tank," so to speak, of that capacity before it entered the sewers.

The amount of water supplied for domestic use to the houses connected with sewers would be about 1,000,000 gallons per day, or about twenty-one times the amount stored up in the gullies. Consequently, if this amount of water could be evenly distributed over all the gullies, it would only be sufficient to renew their contents twenty-one times in twenty-four hours. But this would not occur, and moreover, the construction of gullies is usually such that their contents could not be thoroughly renewed therewith.

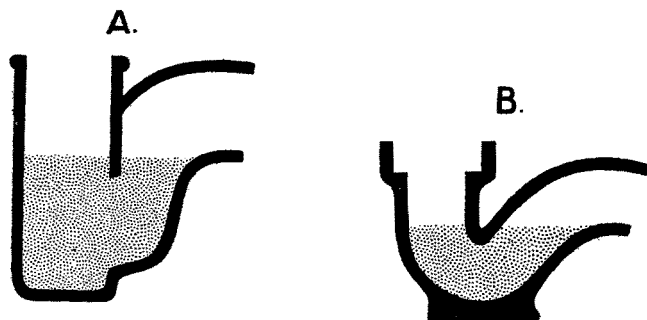
It seems to me, therefore, that in considering the remedy for offensive sewers, the above facts should be borne in mind, together with the size of the peripheral branches of a sewer previously referred to.

I suppose, at present at any rate, street gullies are indispensable, and traps to house drains a necessary evil. That being the case, this evil should be reduced to a minimum, by diminishing as far as possible the size of the gullies, and their number to the smallest limit.

The outlet of a street gully is usually six inches. Why, therefore, should the gully be twelve inches? Surely nine inches would be ample, and a nine-inch gully holds twenty-two pints, which is less than half the capacity of a twelve-inch gully.

If the 10,000 street gullies referred to above were nine inches instead of twelve inches, their total capacity would be about 27,000 gallons only, against 60,000, a difference of 33,000 gallons of decomposing sewage.

What we usually understand by the term gully, Diagram A should never be allowed in connection with house drains. My contention also is that such drains should be four inches only, then a P trap, as shown in Diagram B, could be used, which holds three pints only, as



against eleven pints, which is the capacity of the gully shown in Diagram A. If all the sink drain traps were of the pattern B, instead

of A, they would hold only 7,500, against 27,000 gallons. With drain traps of the above size, and street gullies of nine inches, the sewage of such a district as that referred to, under ordinary circumstances, would only have to pass through 40,500 gallons of putrescible matter in gaining entrance to the sewers, against 92,000 as under present conditions, and during prolonged dry weather, through only about 16,000 against 46,000 gallons as now obtains. Such a reduction in the combined capacity of gullies and traps could not but produce a corresponding improvement in the foulness of sewer air. Again, the ordinary domestic water supply would be sufficient during dry weather to renew this 16,000 gallons sixty-two times in twenty-four hours, against twenty-one under present conditions, thus reducing the length of time during which the contents of these gullies and traps would remain therein, and thereby minimizing the amount of putrefaction which could then take place. Moreover, the trap in Diagram B is self-cleansing, and its contents can be effectually renewed and changed, which is not the case with the gully depicted in Diagram A.

But why should not all street gullies be constructed on the principle of Diagram B, and be self-cleansing? This would obviate the storing up of such large quantities of decomposing urine and other equally objectionable organic matter in our street gullies. It would obviate the necessity of the regular emptying of the solid contents of these gullies upon the streets in the process of cleansing the same as is now usually done.

These gullies, in my opinion, and more especially those into which household slops are cast, offer a fitting nidus for the cultivation and growth of microbes noxious and injurious to the public health. It is impossible to thoroughly cleanse the surface of the street, and what is left, together with the germs therein, is dried into dust, and carried by air currents into houses, and no one knows whither.

It is well known that a wet summer is more healthy than a dry one, and this arises not only from the fact that the frequent rainfall cleanses the surfaces of the streets, yards, and ground generally, but also because the gullies, traps, and drains are repeatedly flushed out and cleansed therewith. Undoubtedly one objection would be raised against a change to this form of street gully, viz., that it would increase the amount of detritus to be dealt with at sewage works. If ample and suitable provision be made at sewage works for this purpose, I see no difficulty in dealing with this matter in that way. I cannot see why the carting and disposal of this refuse from sewage works should cost more than the present method of collecting it from the

streets. I think it would cost less. At any rate I am sure it would be a distinct and real advancement in sanitary administration, and one which would result in benefiting the health of the community.

When sewage leaves the house, it is practically fresh; it is not in a putrefactive condition; and could it be got into the sewers in that state, it would undergo very little decomposition in its passage to the outfall, even if it had to flow a long distance. But this, under present conditions, cannot be done. Sewage, in gaining access to the sewer, has to pass through a gully or trap, usually of much larger capacity than is necessary, and filled with decomposing sewage. The combined contents of these gullies and traps in a town afford an extensive medium for the growth and production of putrefactive organisms, so that each separate discharge of fresh sewage into the sewer not only carries with it a quantity of sewage in a state of decomposition, and charged with offensive odours, but also re-infects the sewers with a fresh strain of putrefactive bacteria. The consequence is that the sewage in its passage to the outfall undergoes greater decomposition than could possibly result if the sewage could be got into the sewers in a fresh condition. Under these circumstances is it surprising that sewers emit foul and offensive odours?

I am of opinion that no system of ventilation, however well arranged, however elaborately designed, however costly in application, can be a practical general remedy which will adequately and effectually remove the present unsatisfactory and unhealthy condition of matters.

STANDARDIZATION OF DISINFECTANTS.—Report of the Royal Sanitary Institute Committee. We understand that the following report has been approved and adopted by the Council of the Institute.

1. "The Committee are of opinion that no one method of testing disinfectants can indicate their relative values under every possible condition. These must be specially determined for the given case required, and where penetration is important, a "Thread Method" is indicated.

2. "For general purposes, on account of its simplicity of working, the Committee recommend the "Drop Method" as described in the *Journal of the Royal Sanitary Institute*, Vol. xxiv. (1903), page 424. The test to be carried out with pure broth cultures of the *B. typhosus*, using sterilized distilled water as the diluent of the disinfectant. All nutrient broth to have a constant reaction of + 15.

"Where special conditions exist, which may interfere with the activity of the disinfectant, the consumer should be advised to call for the same conditions to be embodied in the test."

In the *Journal of the Institute*, Vol. xxvii., No. 1, is published a report of experiments made on behalf of the Committee, and submitted to them by Col. Firth and Dr. Allan Macfadyen; and it is proposed to publish in No. 5 a contribution from Prof. Delépine on the "Thread Method."