

**On the drainage of Glasgow : with special reference to the disinfection of sewage, the ventilation of sewers, and the trapping of house drains / by John Honeyman.**

**Contributors**

Honeyman, John, 1831-1914.  
Glasgow Architectural Society.  
University of Glasgow. Library

**Publication/Creation**

Glasgow : Printed by J. MacNab, 1873.

**Persistent URL**

<https://wellcomecollection.org/works/d5b46ngv>

**Provider**

University of Glasgow

**License and attribution**

This material has been provided by This material has been provided by The University of Glasgow Library. The original may be consulted at The University of Glasgow Library. where the originals may be consulted. This work has been identified as being free of known restrictions under copyright law, including all related and neighbouring rights and is being made available under the Creative Commons, Public Domain Mark.

You can copy, modify, distribute and perform the work, even for commercial purposes, without asking permission.



Wellcome Collection  
183 Euston Road  
London NW1 2BE UK  
T +44 (0)20 7611 8722  
E [library@wellcomecollection.org](mailto:library@wellcomecollection.org)  
<https://wellcomecollection.org>

ON  
THE DRAINAGE OF GLASGOW

WITH SPECIAL REFERENCE TO

THE DISINFECTION OF SEWAGE,  
THE VENTILATION OF SEWERS,  
AND  
THE TRAPPING OF HOUSE DRAINS:

BY  
JOHN HONEYMAN,  
ARCHITECT.

---

GLASGOW:  
PRINTED BY JAMES MACNAB, 11 MILLER STREET.

MDCCCLXXIII.

# THE DRAINAGE OF GLASGOW

## THE DISINFECTION OF SEWAGE

## THE VENTILATION OF SEWERAGE

## THE TRAPPING OF HOUSE DRAINS

JOHN BOSTON

GLASGOW  
PRINTED BY JAMES WATSON & CO. LTD.



## P R E F A C E.

---

THE following Paper was read at a meeting of the Glasgow Architectural Society in December, 1858, and I have been induced to reprint it now by a desire to bring prominently into notice certain aspects of the sewage question which throughout recent prolonged discussions have not received due consideration. To all intents and purposes the paper is as good as new; for it is a fact that during the long period which has intervened since it was written, absolutely *nothing has been done* to remove the palpable and admitted defects of our present system of sewerage.

What I have consistently advanced, and wish now to reiterate, is this, that the only part of sewage which acts injuriously on the health being the gaseous or volatile part, we can protect ourselves from that effectually, with ease and without great cost, and by doing so we get quit of the whole sewage difficulty, *so far as it is a sanitary difficulty*. This being so, it is evident that the importance of the more or less purely economical question—how are we to intercept or dispose of the sewage?—although actually great, is relatively insignificant.

JOHN HONEYMAN.

61 WEST REGENT STREET,

GLASGOW, December, 1873.





## ON THE DRAINAGE OF GLASGOW.

---

THERE is, I think, a peculiar fitness in the Glasgow Architectural Society considering and discussing this subject. It is in many ways forced upon the attention of architects and builders, and they especially are bound to give it their most serious consideration; indeed, they cannot neglect to do so without an obvious and culpable neglect of duty. Moreover, I think that, to use the words of Mr. Bright at Edinburgh, when alluding to another important question of reform,—“at a time like this every man who has studied this question with care, and who thinks he at all comprehends it, is bound to give the result of his study and examination to his countrymen; if, perchance, it may be of use to them in the deliberations which are now being carried on;” and I am tempted to hope that a consideration of a different aspect of the subject from that which was so ably illustrated at our last meeting may not be unproductive of some benefit to the cause of sanitary reform.

Looking at the extent and the accuracy of the information which is now within our reach regarding the various component parts and properties of sewage and of sewer gases and their effects, with which, no doubt, most of you are conversant, it would seem that what is now most required is a practical application of the knowledge we possess. In other words, I believe we have been furnished, through the investigations of the most eminent chemists and engineers, with a sufficiency of reliable data on which to construct a practicable method of overcoming the evils of our present system of drainage. For,



of course, I take it for granted, in the meantime, that it is the present system—that is, the sewer system—with which we have still to deal. I take it for granted that you have not been induced to adopt the views of those radical reformers who, content with nothing short of revolutionising our domestic arrangements, would shut up the sewers altogether, and so make an end of all necessity for their improvement. The very fact, however, that there are those who advocate the adoption of such a course as this, renders it all the more expedient that we should start upon our present inquiry—as indeed we should on every other—with a clear and definite conception of what we really aim at, without, in the first instance, permitting our attention to be distracted by ingenious schemes for the attainment of what otherwise must remain an unknown object. In the case of the drainage question this preliminary consideration has, I think, been very much overlooked. Within the past year we have seen scheme after scheme propounded for the drainage of Glasgow, each vying with the other in the elaboration of its details or the costliness of its application, and yet nothing has been done and hardly any progress has been made towards the solution of this great social problem; and I cannot help thinking that the reason why so little has been done is just this, that we have too much neglected the primary question—What is wanted? There is a continual cry that “something must be done,” and it is a fortunate circumstance that the necessity for action is so generally recognised, but surely the very first thing to be done is to get a clear conception of what is required; it will be time enough to set about devising means for the attainment of the object we desiderate when we have determined what that object is. Let us then, first of all, without referring to the comparative merits of cesspools or sewers, or any other mechanical appliances, endeavour to come to a distinct understanding on this point.

Obliged to live in close proximity to others, or, it may be, occupying the very identical area of ground on which two or three other families reside, it is I think obvious that the true



desideratum in regard to domestic drainage is, the removal of refuse as conveniently and as rapidly as possible, without interfering in any way with the comfort of our neighbours. In other words, the sewage must be removed from our dwellings, without being permitted in any way to affect the health of ourselves or others, that is the main point; and, of course, I should consider that system most perfect which would effect this in the most convenient manner. This is evidently the legitimate result of any efficient system of drainage, and we should be content with nothing less. Now, although there is nothing new in this view of the subject, and although the truth of this definition will hardly be denied, it is a very remarkable fact that not one of the schemes for improving the sewerage of Glasgow which have as yet been published—except such as that proposed by Mr. Salmon—seems to have aimed at the realisation of this result. We have, for instance, several gigantic schemes for the purification of the Clyde. We have schemes for the irrigation of the surrounding country with the sewage in a liquid state. We have schemes for the deodorisation of the sewage and the manufacture of the solid parts into a kind of British guano, besides several other schemes for intercepting the solid sewage and making it available for agricultural purposes; but none of these comprehend the whole requirements of the case. These might, indeed, effect a partial or local alleviation of existing evils, but they do not necessarily embrace the object which we consider essential, and the most extensive and costly of them all might leave our domestic drainage exactly as it is. If you examine these schemes you will perceive that, for the most part, they only provide for one-half of what is required. The subject necessarily assumes a twofold aspect. For if the true object be to free our habitations from filthy refuse without interfering with health, it is obvious that we have not simply to study our own individual convenience, but the comfort and health of others—of the community at large; it being, of course, quite possible to conceive a system which would effectually remove noxious matters from our dwellings which would nevertheless be highly objectionable



from the mode in which it disposed of them, or otherwise; and, on the other hand, we can easily imagine a system whereby the whole sewage of a town would be effectually got rid of, while the evils we deprecate in our domestic drainage would remain still unmitigated. It is this latter half of the subject which seems to have obtained by far the greatest share of attention during the last twelve months, both in Glasgow and elsewhere; and it is the other—in reality the most important of the two—which has been almost completely neglected, and which seems to have been entirely overlooked in most of the schemes to which I have referred. Now I may, I think, safely assert that no system can be considered perfect which does not provide for both. It will not suit me, when half suffocated with the stench from a common sewer, or from the river, to know that the system of water-closets and other sanitary contrivances in the houses is most efficient; and just as little, or rather still less, when my house is filled with disagreeable smells, to be told that the Clyde is as clear as crystal, or that the Public Manure Company is paying a respectable dividend. Let us purify the Clyde by all means, if it be practicable, but first of all let us set to work to purify our houses. This must be done in any case; it is absolutely essential, do what we may with the sewage, and the sooner it is done the better.

Before proceeding to point out more particularly a method whereby I believe our present system of sewers can be made available for this all-important end, it is right that I should refer for a moment to a question which has been somewhat prominently brought forward of late. It is asked, "Why attempt to cobble up a system which is radically defective; why not rather cast it entirely aside and adopt a totally different and superior method of dealing with our sewage? Instead of exhausting ingenuity in devising schemes for the removal of the evils resulting from the use of sewers, would it not be infinitely better to remove the cause of these evils, by removing the excreta from our habitations by some other means?" Most certainly it would, if this were practicable, and if the sewer



system were indeed essentially defective, as the advocates for this course rather unreasonably assume. But most certainly not, if sewers can be made perfectly efficient for freeing us from sewage, both solid and gaseous, without the slightest inconvenience, whilst the other method would perform the same duty in a very inferior way with a world of inconvenience and discomfort, and, after all, fail to relieve us of sewers of some sort. I must not here stop to particularise objections to such a scheme as that proposed by my friend Mr. Salmon, as I fear that, with my utmost efforts to condense, the length of this paper will sufficiently tax your patience; but as my main object is to show that the sewer system, far from being *necessarily* defective, is perfectly sufficient for the requirements of the case, if only properly worked, these objections will naturally be referred to in my subsequent remarks; and, at all events, may be disposed of by implication, for if I succeed in proving the practicability of rendering the sewers efficient, it will be hardly necessary to allude to the defects of other schemes, as in that case the only tolerable pretext for introducing any other method will be removed; for no one, I think, will deny that water-closets, if properly constructed, and free from evil influences from the sewers, are superior in convenience and cleanliness to any description of mongrel apparatus which would be tolerable only with assiduous and unceasing attention.

We may, I believe, proceed on the assumption that, in any case, sewers of some sort are indispensable. This is, indeed, admitted on all hands; and if so, you will, I am sure, easily see that if these sewers are perfectly suited for the purpose for which they are required, it is not of the slightest consequence, in a sanitary point of view, whether the excrementitious matters are added to the other sewage or not. It would certainly be of considerable importance were the present condition of the sewers irremediable, but nothing of the sort can be asserted. There is no reason whatever why we should continue to put up with the obvious defects of the present system; nay, on the contrary, it is absolutely necessary that a change should be



made, whatever becomes of the sewage, and in whatever manner it may be treated. Our present arrangements, indeed, are altogether incomplete. They are only suited to perform one part of what is required, and even that in a very imperfect manner; and because they fail to do that for which there is not the slightest provision made either in their construction or management, they are set down as nuisances—very properly, and as essentially so—just as improperly and absurdly. You are aware that sewage, strictly speaking, is something more than sewage as commonly understood. The term should comprehend not merely the solid and liquid portions of refuse, but also the gaseous. This latter part of the sewage does not obtrude itself so offensively as the other upon our observation, and we are therefore very apt to under-estimate its true importance, if not to despise it altogether. But after all that has been said and written upon this subject, I can add nothing, and I am sure I do not require to add anything in order to convince you that it is absolutely indispensable to secure the efficient drainage of our houses that the drains themselves should be drained of sewer gases. There is then, obviously, a double duty to be performed by an efficient sewer, in order that the object we desiderate may be attained. It must free us from sewage, whether solid, liquid, or gaseous—in other words, from sewage as it is commonly understood, and from sewer gases. Now, gentlemen, if you admit, as I have no doubt you will, that this is really so, you will at once perceive how utterly unfit our sewers in their present condition are to effect the efficient drainage of Glasgow, and therefore how unreasonable it is to expect them to do so. You will also easily see that if these sewers are allowed to remain in their present defective state, the sanitary condition of the city will not be materially altered by the purification of the Clyde, by whatever means accomplished; for, of course, the effluvium from the river—*when there is any*—can only affect the health of a mere fraction of the population, whereas, the influence of the defective sewers is constant and universal. And if you have followed me thus far, you cannot fail to share with me in a feeling of astonishment



that this part of the subject, so evidently of primary importance, has received so little attention, and that the professional advisers of our Sanitary Committee seem to be as far as ever from recognising the fact that something else is required for the efficient drainage of a city than a vast engineering scheme for the final disposal of the sewage.

I must now ask you to consider more particularly the adaptation of sewers to the twofold operation essential for our comfort. And first, as to the removal of the solid and liquid portions. It may be, I believe, regarded as "a fundamental" in this discussion, that the *sooner* these are removed the better for the health of those who would otherwise be exposed to their noxious exhalations. Our first object, then, should be to make provision for the speedy removal of the sewage. Do with it what you will, and especially utilise it, if possible; but by all means away with it and at once. Nothing will justify the retention of it in or near our habitations for an hour, if it is not physically impossible to get rid of it. Of course, in the case of Glasgow, there is no such physical obstacle to prevent the drainage of the city from being both rapid and uninterrupted. There is no such thing as streets or districts under the level of high water; on the contrary, the natural levels and inclinations of the ground are such as to render any engineering scheme for this purpose remarkably simple; and, indeed, so far as I am aware, the present sewers, with a few exceptions, might be rendered perfectly efficient. Where existing sewers are defective, and not adapted for the rapid transmission of the sewage, they would necessarily require, at whatever cost, to be reconstructed; but observe, this repairing of our system of sewers would be equally necessary in whatever way the sewage may be ultimately disposed of, and whether the outfall be the river or main intercepting sewers. The sewers then being sufficiently large, and sufficiently inclined, and sufficiently constructed in every way, it is obvious there is nothing to prevent the rapid removal of the sewage, provided we make sure of its being sufficiently liquid. The transmission of the solid sewage along the sewers is not, it is true, such a difficult matter even



in ordinary circumstances as some would seem to regard it, as must be evident if we remember how slightly its specific gravity, exceeds that of water; but there can be no difference of opinion on this point, that the greater the volume of water in which it is suspended the more rapidly will it be carried away. It is, therefore, I submit, only necessary to insure the rapid removal of sewage from our dwellings that it should be conveyed in well-constructed sewers, and that it should be largely diluted with water. But it has doubtless already occurred to some of you that this mode of dealing with the sewage would prove fatal to any scheme for the utilisation of the solid portions; that its effect in short would be to *waste* the whole of the sewage. I cannot admit that it would, with the evidence of Mr. Laurence Hill and other distinguished agriculturists and chemists to the contrary; but even supposing that this would be the result, what then? I take it for granted that, if your solicitude for the improvement of our sanitary condition be sincere, you are not prepared to sacrifice an efficient system of drainage for a possible, or at best paltry, pecuniary consideration. The importance of utilising the sewage cannot be denied, but we must carefully discriminate between the relative importance of securing efficient drainage, and of making the sewage available for agricultural purposes. This latter, I submit, is only a secondary consideration, and must, therefore, in no way be permitted to interfere with what is of infinitely greater consequence. In other words, if we really desire to improve the sanitary condition of our city, we must not begin by devising a scheme which shall yield a good return for the money invested in it, and then endeavour to make it subserve, as far as possible, the improvement of our system of sewerage; we must first of all set our ingenuity to work, to devise the best possible scheme for freeing us from sewage in its widest signification; and then, gladly and carefully avail ourselves of every expedient for making such a scheme, if not remunerative, at least self-supporting, always provided that such expedient in no way interferes with the object we principally desiderate. This latter and subordinate



branch of the subject, however, I must leave out of consideration in the meantime.

The arrangement which I have already suggested would no doubt secure the rapid transmission of the sewage from our houses to the outfall. This is one most important step towards the attainment of our object; but the next which claims our attention is scarcely inferior to it, I mean the disinfection, or deodorisation, or oxidation of the sewage, as it is variously termed. If this operation is to have any influence upon the condition of the sewers—and so upon the sanitary condition of the city, it is evident that it must be effected upon their contents *in transitu*; and, therefore, so far as our present inquiry is concerned, it is not of the slightest consequence whether any of those schemes which have been proposed for deodorising the sewage, *after it has left the sewers*, may be effectual or not. Such schemes as that of Mr. Manning, for instance, if carried out on a sufficiently gigantic scale, might effect the purification of the river or the utilisation of the solid sewage, but they would in no degree subserve the most important object of disinfecting sewage, which is simply to prevent the generation of poisonous gases in the sewers. Supposing the river to be retained as the outfall, its condition would necessarily be materially improved by the thorough disinfection of the sewage *in transitu*. But this, by the way, you will remember that we are not at present considering the ultimate disposal of the sewage, but only the primary step of removing it from our houses. We must, therefore, in the meantime confine our attention to the importance of disinfection as a means of disposing of the gaseous portion of the sewage. It is, of course, a better method of disposing of it than any system of ventilation, however perfect, by so much as prevention is better than cure; and it, therefore, next to the removal of the solid portions which we have already considered, merits our most serious consideration. The expediency, though not, I think, the true importance of disinfecting the sewage *in transitu*, is recognised by Professor Anderson and Mr. Bateman in their joint report to the Sanitary Committee of the Town Council. They seem, indeed, to have



been led to this conclusion more by economic than sanitary considerations, if we may judge from the *modus operandi* which they propose. It is evident that the purification of the Clyde is the main object of their solicitude, and the disinfection of the sewage is merely regarded as a means to that end. They infer that a smaller quantity of the disinfectant will be necessary, if it is applied before the sewage has reached an advanced stage of decomposition, and, therefore, very properly recommend that the disinfectant should be applied as near the source of the sewers as possible. As the nearest practicable approach to this, they propose that the city should be divided into certain districts, "in each of which the minor sewers should be made to converge to some central point, where a station should be erected for throwing a deodoriser into the main sewer." Now, not to mention the enormous expense of altering the sewers to suit such an arrangement, it is obvious that its effect would be entirely to neutralise the advantages which would result from the sewage being disinfected in the sewers themselves, and in every part of them. In fact, although Messrs. Anderson and Bateman, in the report to which I refer, most distinctly recognise the importance of preventing the evolution of noxious gases in the sewers, it is evident that for this purpose their deodorising scheme is hardly, if at all, superior to those which aim at deodorisation at the outfall, while, in some respects, it is inferior; for, while by it the solid portions would still be precipitated into the river, by the others they would be intercepted, and made available, it is said, for manure. This scheme, then, although a step in the right direction, is, I conceive, independently of the difficulty of procuring a suitable deodoriser at a reasonable cost, altogether inadequate to meet the requirements of the case. It must be admitted that this subject is hedged in with many, though not, I trust, with insuperable difficulties; and I am very far from agreeing with those who characterise all attempts at deodorisation as foolish, if not impious! The allusion to Scripture on this point, is, of course, a joke, though not a very *good* joke, I submit. The truth is, that, practi-



cally, nothing is more common in chemistry than bringing a clean substance out of what is apparently a very foul one: and the fact is undeniable that sewage of the filthiest description can be, and has been deodorised so effectually that the liquid portion has been thrown off pure and colourless, and without any perceptible smell or even taste. This result, however, can only be obtained by the use of those chemical substances which cause a precipitation of the solid parts of the sewage, such as the alkalies, the refuse of bleaching works, alum sludge, lime, &c., and which, therefore, are altogether inapplicable for the deodorisation of sewage *in transitu*. There are, indeed, comparatively few substances which can be applied in the sewers for this purpose without precipitating the solid portions, and so causing obstructions; and I believe there is only one efficient disinfectant which can be used with facility in the sewers, wherever it may be considered advisable to apply it, not merely without the chance of causing accumulations and obstructions, but with the positive certainty of producing the very opposite effect—namely, preventing precipitation, and scouring the sewers. That agent is water, the same which I have already recommended for facilitating the rapid removal of the sewage. Water is a disinfectant which expedites the decomposition of organic matters diffused in it by bringing them into chemical contact with the oxygen which it contains. The result of this combination is a species of slow combustion, which has the effect of completely oxidising the sewage without evolving any offensive gases. (See Mr. Hawksley's evidence before Committee on the River Thames, Report p. 187, sec. 3012, &c.) If—as is at present the case—the organic matter should be out of all proportion to the quantity of water in which it is suspended, this combustion must necessarily cease for want of oxygen, and the whole mass of the sewage will, in that case, decompose by putrefaction, evolving the most offensive and dangerous compounds. The remedy, then, for this great defect in our present system is obviously simple enough. It is admitted on all hands that no danger need be apprehended from the decomposition of the solid sewage,



if only it be *sufficiently diluted with water* to enable this process of *eremacausis*, as it is termed, to go on uninterruptedly. For farther evidence on this point, I may just refer you to the various Reports which have been recently published, and probably to every scientific treatise on the drainage question. We have a good practical illustration of the powerful disinfecting properties of water, and one which should come home with peculiar force to the conviction of the inhabitants of Glasgow, on the north side of the river at least, in the circumstance that their whole supply of water for culinary and domestic purposes is taken from the Clyde within a distance of three miles from Glasgow Bridge, although, above that point, the river receives the drainage of a very large population, besides the refuse of many extensive works. Now, you will not allow that the water you daily use is perceptibly affected by this admixture. You say that the water is filtered before it is sent through the pipes, and no doubt so it is in a kind of way; still, I believe you would not use it with much pleasure if you were aware that, before entering these filters, it was largely impregnated with sewage matter. In reality it is not. Before it reaches Dalmarnock the sewage from the towns and villages of Lanarkshire has become completely decomposed and recomposed; in fact, it no longer exists as such; it has been completely deodorised *in transitu* by the action of the water itself. This is even more strikingly illustrated by the case of the Thames, which, "immediately above London, contains no perceptible quantity of sewage matter at all," although at that point it has received the sewage of 700,000 people. There can, indeed, be no doubt about the efficiency of water as a disinfectant; besides, as I have already said, nothing can be better for cleansing the sewers, and nothing can be more easily applied to them. It is in these respects very greatly superior to any other disinfectant which has as yet been proposed. Nor are these all its good qualities. I believe it would have a most important effect upon the condition of the sewers by its action in merely reducing the temperature of their contents, and thereby retarding the putrefaction of organic matters. You are aware that at present, in many cases,



the sewage is always at a much higher temperature than the atmosphere, from the liquid part being thrown in from public works, little if at all under the boiling point. Indeed, in many parts of the town you may, from one point of observation, see the steam rising from as many as five or six street gullies at once. This, I need hardly say, is a most serious evil, but it is one which might evidently be materially mitigated by flushing the sewers with a copious supply of cold water. I will only mention another beneficial result of such an application of water, and that is the purification of the river. On this point, however, I cannot venture upon any very positive assertions. I merely submit one or two suggestions for your consideration.

The purification of the river by this means would certainly not be perfect; it would be only partial. The same amount of sewage would still flow into the river, but it would not be the same kind of sewage, and its effect would therefore be different. At present the whole mass of the sewage is thrown into the river in a state of putrid fermentation, and, therefore, in the best possible condition for creating a stench, and for defiling the water with which it is mixed; and in summer when the freshet is small, and putrefaction is powerfully accelerated by a high temperature, the small body of water is scarcely sufficient to disinfect the concentrated filth which is thrown into it. It has, as it were, to act on the defensive; and putrefaction proceeds to a very considerable extent in the river as well as in the sewers. Hence the natural consequence of this state of things—the abominable smells which rise from the water. But if this putrefaction be prevented from commencing in the sewers by the method I have proposed—a copious supply of water—the case would be entirely altered. The fresh water in the river would not then require to struggle with the energy of a large mass of putrifying matter, it would merely require to carry on a process of decomposition by *eremacausis* already commenced in the sewers, for which purpose I believe there is always a sufficient freshet. We might, therefore, by the adoption of such a system reasonably expect a material improvement in the state of the river, and *perfect freedom from injurious effluvia*, though not perhaps from occa-



sional whiffs of disagreeable smell after a long continuance of dry and hot weather.

If, then, all these important results of continual flushing be taken into consideration, I believe the conclusion is inevitable that this mode of dealing with sewage is all that is necessary to render sewers perfectly efficient for the speedy removal of refuse from our dwellings in such a condition as to be inoffensive to health; while, at the same time, it would make the ventilation of the sewers a comparatively simple matter, by striking at the root of the evil, and preventing the generation of noxious gases.

Now, as to the practicability of such a system, you will readily see that there can be no difficulty whatever in the way of its application, if only a sufficient supply of water can be obtained. For this, I fear, we must look somewhere else than to Loch Katrine. Mr. Bateman, indeed, seems to regard with apprehension even the probable extension of the water closet system; and in his report published in October last, very properly reminds the Corporation that Loch Katrine is not inexhaustible, and very clearly shows the cost and the consequences of waste; and although water used for cleansing the sewers can hardly be regarded as wasted; and waterworks which cannot spare a considerable supply for this purpose must certainly be regarded as insufficient, there can be no doubt that the Water Commissioners either could not, or would not, devote upwards of, say ten millions of gallons per diem to this purpose. Nor is it necessary that Loch Katrine water should be used; an inferior article will answer the purpose quite as well, and may be much more easily obtained. An abundant supply may still be drawn from the Clyde, and distributed to the various districts of the city, by means of the pipes of the old company.\* I observe that it is intended to use a consider-

---

\* The chance of carrying out any such arrangement has, of course, been lost, and the cost of the necessary appliances for flushing the sewers as here suggested would now be great—probably twice as much as it would have been in 1858; it does not, however, by any means follow that therefore the idea of flushing the sewers should be abandoned, if it is, as I believe it to be, the *best* method of keeping them clean. If excreta, in all cases where practicable, and the foul liquids from manufactories, were excluded from the sewers their contents could easily be raised by flushing to the standard of purity which would admit of their being discharged harmlessly into the river.



able portion of the old pipes for the new water, but if it were deemed advisable to adopt some such method of cleansing the sewers as I have proposed, this arrangement might probably be modified, and the principal mains of the old company be allowed to remain. Of course, the smaller distributing pipes would not be required for the flushing of the sewers. The question still remains, how is the water to be drawn from the river? This would be very easily managed if the gigantic scheme proposed by Mr. Laurence Hill for storing up the "waste waters of the Clyde"—the storm waters of Clydesdale—were carried into execution. In that case the highest sewers could easily be scoured with abundance of fresh water from their very source. But although this great project would be productive of this and many other desirable results, I fear there is little probability of its ever being carried into execution—at all events, not for many years; and our sewers require cleansing *now*. As the next best thing, I would suggest that the water should be taken from the river at a point so far up as to allow it to flow constantly down by gravitation, so as to admit of its being applied to all the sewers at a level say of 60 feet above high water at Glasgow Bridge. By this means all the principal sewers might be uninterruptedly flushed, without the slightest trouble, at as many different points along their course as may be deemed advisable; and I think we might reasonably expect to get as much of the Loch Katrine water as would suffice to flush the smaller sewers in the high districts of the city, which, from their small capacity and steep inclinations, would require a comparatively trifling supply of water. By these means, I believe, our object might be attained at a very moderate cost. Another practicable method of obtaining the necessary supply would be by pumping it from the position of the present waterworks to the level I have just suggested; but this, of course, would be very much inferior to the other method, which would insure a constant, and, for all practical purposes, an unlimited supply without the operation of any complicated mechanical contrivances.

Although I have thus endeavoured to indicate a practicable



method of accomplishing the scouring of the common sewers, I have purposely refrained from entering deeply into this part of the subject, as I am well aware that the professional advisers of the Town Council, and many gentlemen now before me, are much better able to do so—if only the expediency of the operation were admitted. I have therefore endeavoured to show the very important influence it would have upon the sanitary condition of the city, by facilitating the speedy removal of the solid and liquid portions of sewage, and by preventing the generation of noxious gases.

But even if this system of flushing were constantly in operation, and the sewers as good in every respect as we could wish, it would still be necessary to provide for their thorough ventilation; for it seems unquestionable that many gases almost imperceptible to smell are highly injurious to health, and the properties of many of the products of decomposition in sewers are comparatively unknown. In considering this division of our subject, therefore, we shall proceed upon the assumption that, notwithstanding our disinfecting operations, there still exist noxious gases in the sewers determined to effect their escape by some means, and in fact constantly doing so by the street gullies or by the soil pipes of sinks, baths, and water closets; and if it be necessary, in such circumstances, to provide for the removal of these gases, I would just ask you, in passing, to consider how much more necessary it must be to provide for the ventilation of the sewers in their present filthy condition. There is doubtless some excuse for our civic authorities deferring the *cleansing* of the sewers. Common prudence demands for that subject the most careful and deliberate consideration. I cannot see any excuse, however, for delaying the *ventilation* of the sewers, which is a simple and comparatively inexpensive undertaking, which will, moreover, be absolutely essential in any case—even in the event of water-closets being entirely abolished—and its immediate adoption would counteract, almost perfectly, the evils arising from the present condition of the sewers. Because, the gaseous sewage being the proximate cause of disease, it is, of course,



obvious that, that being removed, the filthiest sewer becomes innoxious. To effect the ventilation of sewers two things are required—abundant means for a free and uninterrupted egress of the gaseous sewage, and a suitable outfall for it. Although in many cases mechanical appliances, such as furnaces, fanners, the steam-jet, and such like, for drawing or driving the foul air out of sewers, may be necessary, or at all events advantageous, I have no doubt that in the case of Glasgow nothing of the kind is needed; and, as a general rule, it is best to let the sewers ventilate themselves, which they will do without difficulty, if they are just allowed the means, and as all that is required for this is simply a large number of openings, it is evident that an abundant and free egress may very easily be obtained, since it would not be impracticable to make an opening every yard along the whole course of the sewer. Such openings, however, might not be very suitable outfalls for noxious gases. This is a most important consideration. I think we may safely lay it down as an inviolable rule that the outfall of these gas drains must, at least, be *outside* our dwellings. This rule at present is systematically violated. This arises partly from the use of defective traps, partly from traps being carelessly laid, and so rendered completely useless, and in some instances from no other outlet being provided, and the most effective trapping being in consequence forced. In all such cases the outfall for the gaseous sewage (the part which is really injurious, be it remembered) is necessarily our dwellings; and so common is this state of things that it has come to be considered a kind of necessary evil. I was told lately of a gentleman in one of the new houses in the West-end, who was very much troubled by exhalations from the drains constantly polluting his kitchen and lobby. He applied to a person who considered himself qualified to give advice in such circumstances, and who had little difficulty in arranging the matter to his satisfaction. And how do you suppose he did it?—by the very excellent expedient of thoroughly ventilating the staircase. This is an example of the usual mode of dealing with escapes of foul air into our houses; though evidently it



requires but a moment's reflection to perceive that the proper and common-sense course to adopt in all such cases is, *to prevent the foul air from getting into the house at all*, and not merely to provide means for its escape. It must not, and it need not be tolerated within our doors. The street gullies are scarcely less objectionable as outlets. It is, indeed, difficult to estimate the amount of mischief done by the escape of foul vapours and gases from these during close still weather, especially in the more densely populated districts; and even in the most favourable circumstances they give rise to a most disagreeable nuisance, compared with which, to my mind, the stench from the river is quite insignificant. I would have little hesitation in saying, that one inhalation of the filthy and abominable vapours issuing from the gully in front of the Western Club would do more serious injury to health than inhaling the atmosphere at the harbour for a month, when the river is at its worst. The consequences of allowing the concentrated exhalations of the sewers to escape at the street gullies, however, seem to be totally disregarded, and hence we find the most costly expedients proposed and favourably entertained for the purification of the river—which at worst is only a nuisance for a few weeks annually—while nothing whatever is attempted to mitigate or abolish the constant escape of effluvia from the street gullies. The first step then towards the proper ventilation of the sewers must be the efficient trapping of the house drains and the street gullies. This I conceive to be absolutely indispensable if the drainage of our houses is to be inoffensively effected by common sewers; but this need not prevent abundant provision being made for ventilation. Wherever there is a trap I would also propose that there should be an opening for the escape of foul air, and you will easily see that if there were a full opening at every trap along the course of a sewer it would be almost impossible for the sewer gases to accumulate. To facilitate this double purpose of trapping and ventilating, I recently designed a trap, the working of which you will easily understand by referring to the drawing exhibited.\* The opening for ventilation being at

---

\* See Appendix.



the side of the trap next the sewer, it is evident that the trap cannot be forced, as any pressure would at once find easy relief; and if the number of these openings be as great as I recommend they should be (*viz.*, one for every trap), I can hardly imagine that there would be any pressure even if a gale were blowing up the sewer. The use of this trap then would, I conceive, effectually prevent the escape of sewage gases into houses, or at gullies, and it would insure abundant means of ventilating the sewers. The important point still remains to be considered. Where are the gases to be allowed to escape into the atmosphere? The best plan, where it is practicable, would be to lead them up to the roofs of the houses, which could be easily effected by connecting fire-clay pipes with the trap at the opening. These could be led up the gables of new houses, if close to kitchen flues, all the better, and in the case of old houses cast-iron pipes or conductors might be used in the same manner. But in some circumstances a different course might be preferable. The ventilation openings of the traps might be connected together by a line of fire-clay pipes laid under the surface parallel with the houses, the ventilators of the gully traps would also join this foul air drain, which should not, in my opinion, extend to more than sixty yards in any case, and should then terminate either in a flue carried up a gable, or in the stalk of any public work where that is practicable, or in chimneys erected for the special purpose, which, however, need not be of very formidable dimensions; indeed an extra thick lamp-post here and there would be all that would be required. Having conducted our foul gas to the gable top, or to the top of the lamp-post ventilating shaft, it is not necessary that we should there allow it to escape, without, like the solid sewage, undergoing a process of disinfection. We would, in fact, consume it, and not allow it to escape at all. This can be easily done by means of common charcoal, as has been proved by the experiments of Professor Graham, Dr. Stenhouse, Dr. Letheby, and other distinguished chemists. On this subject, Dr. Letheby, in his valuable report on the disinfection of sewage and sewer ventila-



tion, says:—"Let the gases go out of the sewers how they will and where they will, you have but to place a small box containing a few pennyworth of charcoal in the course of the draught, and the purification of the air will be complete. As far as we know the strength and the endurance of this power is almost unlimited; so that when once the air-filter has been set up it will last continuously for years." So that, in fact, having provided a sufficient number of outlets, all we have to do to insure perfect safety from the effects of the sewer gases is to provide each of these outlets with an "air-filter" of charcoal; and by this simple contrivance—which, you will observe, like the system of flushing and disinfecting, would be perfectly self-acting—we would be entirely freed from the injurious effects of the sewer gases, and from the disgusting smells which assail us at almost every corner; and this, even supposing the present system of drainage to remain unaltered in all other respects.

I have thus endeavoured to show what, in my opinion, is necessary for the efficient drainage of Glasgow, or, I may add, any other town—namely, first of all, well constructed sewers, both as to form, size, and gradient; secondly, clean sewers and the disinfection of the sewage by means of a continual system of flushing, so that putrefaction and the consequent evolution of noxious gases in the sewers may be prevented; and thirdly, well ventilated sewers, so that in the event of injurious exhalations rising from the sewage they may be disposed of in such a way as not to be obnoxious to health; and I submit that if such a system were in operation it would practically be of no consequence what manner of filth the sewers contained. It would all be speedily got rid of, and without being permitted to affect our comfort in any degree whatever. There can, therefore, be no excuse for abandoning our water closet system, except the introduction of some apparatus superior in cleanliness and convenience.

And now, gentlemen, you may perhaps be surprised that I have not alluded more particularly to the purification of the river and the utilisation of the sewage. I intended to do so when I commenced this essay, but find that I have already exceeded my proper limits. But the sum and substance of



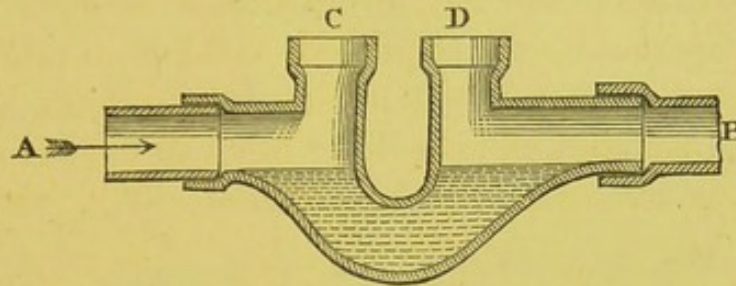
what I intended to say on this subject is simply this—that I believe it has received a great deal more attention than it deserves, and that it is of very secondary importance compared with the efficient drainage of the city. I do not for a moment deny that if the sewage were intercepted and conveyed to the Ayrshire coast, or distributed over the adjacent pastures, a very great improvement would be effected upon the condition of the river, and one which no citizen of Glasgow would fail to appreciate; but I certainly do deny that this would of itself affect the sanitary condition of the city in any perceptible degree. I cannot help thinking that those who have devoted so much attention to this part of the subject proceed on a totally erroneous opinion of its importance. They speak, for instance, of the river “endangering the health of about half a million of human beings;” whereas it must be obvious that the injurious influence of the river can only extend to one or two thousands of the inhabitants; and, in fact, it remains still to be proved that such evil influence exists at all. Probably nothing of the sort can be proved; and I have no doubt that, if putrefaction could be prevented in the sewers by the method I have indicated, or otherwise, the river would be a perfectly suitable outfall for the sewage of Glasgow for many years to come. No one would be better pleased than I to see such a scheme as that proposed by Mr. Hill, for instance, carried into execution; and, if any body of men consider that by such an undertaking they might “turn the penny,” I suppose no one will prevent them from doing so, provided they do not interfere with the pockets of the ratepayers; but any such scheme must be judged of by its value as a commercial enterprise, and not as a sanitary measure at all. I must place Mr. Manning’s method of deodorising sewage in the same category, for it is evident that the only way in which its operation would affect the health of the inhabitants of Glasgow would be by the purification of the river. And it will surely not be affirmed that such a result would warrant the expenditure by our municipal authorities of the enormous sum necessary for its attainment. I leave commercial men to judge of its merits as a speculation.



You will not understand me to imply that it is a matter of no consequence whether the river is purified or not. I am merely anxious that its importance should not be exaggerated, and our attention thereby diverted from what is really of primary importance—the solution of the difficult problem how a city such as this, with all its streets, and sinks, and water closets, and factories, is to be freed from all its refuse without allowing the atmosphere to be contaminated by the noxious gases and vapours of the sewers. That the filthy condition of the river and its consequent influence on the health of those living in its neighbourhood have been greatly exaggerated, I do not hesitate to affirm. Nor can I be satisfied with mere vague and general assertions regarding the effects of the “pestilential effluvia,” unless these are found to be supported by something like intelligible facts. If the river be indeed the most fruitful source of pestilence, how comes it that those who live in its immediate vicinity are comparatively free from epidemic disease, while fever and cholera gather in their heavy harvest on the distant and airy slopes of Blythwood or Garnethill? May not this, think you, be the true explanation of the phenomenon, that the exhalations from this source, though more palpable to our senses, are far less injurious to health than the poisonous gases which are evolved in the vast unseen ramifications of the common sewers? Let us, then, turn our attention first of all to these; and, when we have succeeded in getting them into a satisfactory state, if we still feel inclined to spend a million or two in the purification of the Clyde, by all means let it be done.



## APPENDIX.



## THE SOMERSET TRAP.

*(Referred to at page 22.)*

## DESCRIPTION.

A, drain from house. B, continuation of drain to common sewer, or outfall. C, opening for cleaning trap. This, when the drain is deep, is continued to the surface by 4-inch pipes, and the cleaning is effectually done by stirring the contents of the trap and pouring down a bucket of water. D, opening for ventilation, continued to ventilation flue in wall of house or other conductor by 4-inch pipes. In some cases, where the trap is used at a distance from the house, to prevent a blow-up from the outfall, the opening D would be merely carried to the surface and covered with an open grating.



## APPENDIX



## THE SOMMERSET TRAP.

A drain from house. B, continuation of drain to common sewer or cesspit. C, opening for cleaning trap. This, when the drain is deep, is continued to the surface by a lead pipe, and the opening is effectively done by entering the contents of the trap and pouring down a bucket of water. D, opening for ventilation, continued in ventilation flue in wall of house or other pipe for 4 inch pipe. In some cases, where the trap is fixed at a distance from the house, to prevent a blow-up from the cesspit, the opening D would be merely vented to the surface and covered with an open pipe.