On the size of house drains, and the use and misuse of traps / by John Honeyman.

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"*On the size of House Drains, and the use and misuse of Traps*," *by* JOHN HONEYMAN, F.R.I.B.A. *Read September 22nd*, 1887, *at the Congress of the Institute, held at* BOLTON.

RECENT investigations seem to prove that certain elements of ordinary atmospheric air—chiefly oxygen—acting upon aerobian microbes, destroy or attenuate their virulence, so that in either case the microbe, as a vehicle of specific disease, is annihilated.* The significance of this fact, in relation to the proper ventilation of sewers and house drains, has, I think, not been generally realized. The earlier advocates of such ventilation—among whom I venture to claim a place—aimed rather at the dilution and rapid removal of sewage emanations than at the destruction of associated microscopic organisms; but they were not without some apprehension of the truth, since demonstrated, that such organisms are practically destroyed by the action of atmospheric oxygen. It is exactly thirty years since I myself published a paper on sewer ventilation, in which I endeavoured to arouse the better class of my fellow citizens by pointing out the fact that while they in the most elevated and least crowded parts of the city had to submit to the frequent recurrence of epidemic disease, the people on the banks of the river (which seemed to them so pestiferous) were almost exempt from anything of the kind. And my explanation was this: I said that "the agents at work in both localities were identical, but they were *differently developed*." In the one case tainted air, undiluted and confined for miles in unventilated sewers, remained pestilential, whereas in the other, "mingling freely with the

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* I venture parenthetically to ask, if the protective effect of attenuated virus can only be obtained by inoculation? There seem to be grounds for inferring that it may also be obtained by inspiration or absorption.

atmosphere, it became harmless—as a homœopathic globule in a glass of water." I would be inclined to use very much the same language now—and I regret to say there is almost as much need to use it—but we have made an immense stride when we are able to plant our feet upon ascertained fact instead of reasonable but somewhat vague deduction.

We may indeed say that we have now a new and potent argument in favour of drain ventilation. We advise it not merely for the dilution of noxious gases, and their rapid removal, or for the relief of hydrostatic pressure, or the aeration of sewage, but also for the destruction of disease germs, or at least the attenuation of suspended virus; and it is evident that if we succeed in this we render our aerial drainage, if I may so call it, innocuous, so that even if it accidentally gained admission to our houses it would do no harm. To secure this, however, even partially, it is obvious that we must allow a much larger volume of fresh air to pass through our drains than has hitherto been customary—in short the more nearly we can make them approach in airiness to the condition of open drains the better. These remarks apply to drains of every size, but in this short paper I shall refer to house drains only.

One reason why I do so is that it seems almost a hopeless task to convince those who have control of the common sewers that anything in the shape of ventilation is called for. After nearly forty years of sanitarian effort, argument, entreaty, and painful and costly experiences, it is now almost as necessary as ever that those who connect their drains with common sewers should carefully protect themselves against the risks they run in doing so. In this and many other things, sanitarians have been very much like the "importunate widow," but after so many years' ineffectual reiteration of the same tale, they may almost be pardoned if they begin to despond. In the case of house drains, however, they are able to appeal to individuals, and individuals are more amenable to reason. Now, our house drains are under our own control, we can cut them off entirely from the common sewer and ventilate them as much as we like; and in view of the facts already referred to, this important question presents itself: do we in practice ventilate our house drains sufficiently to secure the best results? I think it is perfectly manifest that we do not, and that it is simply impossible to do so with drains of the size generally used.

Pipes of small diameter are recommended to facilitate rapid flow and scour; but we want rapid flow and scour of aerial as well as of liquid sewage, and we are met by this difficulty, that whereas small pipes are best for the one purpose, large pipes are absolutely necessary for the other. Now while we admit

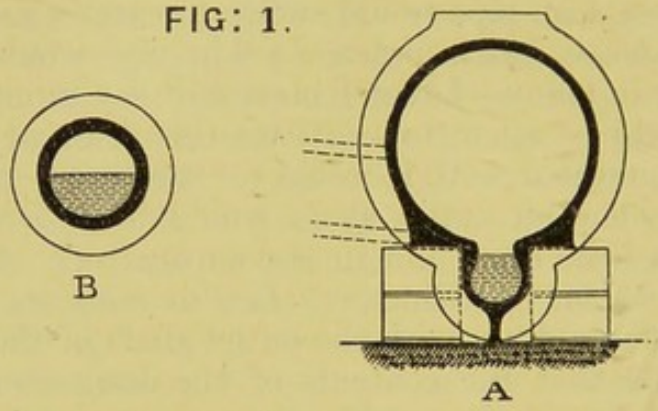
the importance of dealing with the aerial as well as the liquid contents of drains, we have hitherto made no adequate provision for doing so. We have, no doubt, several schemes of drain ventilation which are theoretically good, and which are useful so far as they go; but they stop a very long way short of that thorough flushing of the drains with fresh air which is desirable. In order to bring out clearly the difference between what is usually done and what I think ought to be done, let us suppose that we are dealing with a house of moderate size, having, say, two baths, three water-closets, three basins, and three sinks; a 4 in. pipe would suffice to carry away the sewage from such a house, but in practice a 6 in. pipe would probably be used. Now in many—I fear I must still say in most—cases no attempt would be made to ventilate this drain at all, although soil-pipes connected with it would for the most part be ventilated. In some an outlet shaft would be provided, 2 in. in diameter, in some 3 in., and in a comparatively small number shafts 4 or 4½ in. in diameter. Let us consider the state of matters in such a drain with the outlet shaft of the largest size. If we suppose that the contents of the drain would fill a 4 in. pipe, the 4½ in. shaft would give an area almost equal to that of the remaining empty segment of the 6 in. pipe, so that, roughly, what we have to do is to ventilate a tube, say 5 in. in diameter and 100 ft. long, the greater part of which is horizontal. Even assuming that there are no restricting cowls or gratings at either end, it is manifest that in such a tube there could hardly be any appreciable current without the application of great mechanical force, even if we suppose the tube to be smooth and empty. But the tube we have to deal with is neither. It is rough, and it has for the greater part of its course an exposed surface, greater than that of a 5 in. tube, part of which is in motion in an opposite direction to that which the aerial current would naturally take. In such circumstances it is evident that the current would not only be sluggish but variable, now in one direction, now in another, and often, when opposing forces were well balanced, stagnant. If such be the condition of a drain with a 5 in. air outlet, I need hardly pause to consider the condition of the great majority now in use, which have nothing like so much ventilation.

Of course everything depends on what we call ventilation. If we mean by that term such a change of air in the pipes as is possible under the conditions just described, we may admit that some of our house drains are ventilated; but if we mean by it constant flushing of our drains with fresh air having something like its normal proportion of oxygen, then I fear we must say that none of our house drains are ventilated—with such

restricted sectional area and consequent friction the thing is impossible.

The question then comes to be, can we provide the air space necessary for ventilation without either extending the exposed surface of the sewage or of the contaminated periphery with which the air must come in contact? I venture to think that it is quite possible, and indeed easy, to do so by means of a simple contrivance which I now submit to you (Fig. 1).

FIG: 1.



A. Proposed new form of Drain Pipe.
B. Ordinary Six-inch Drain Pipe.

The same quantity of liquid is shown in each.

A drain-pipe such as this may be made of any ordinary size, but assuming that one having the upper portion 12 in. in diameter would suffice, let us contrast it with the drain already described. In the first we had a sectional area for the transmission of air of (omitting fractions) 15 in., in the other you have 120 in.; in the first the surface of sewage exposed is 6 in., in the other $2\frac{3}{4}$ in., assuming that the maximum flow would fill a 4 in. pipe; so that in this new pipe there would be fully a half less exposed surface of sewage, and eight times the amount of air; besides which the flow of sewage would be more rapid being more confined. In such a drain 100 ft. long, open and unobstructed at both ends, the current would not be overpowered by friction, and would hardly be affected by the comparatively trifling area of moving surface; and we by no means advise that it should be open at the two ends only, but at as many points as practicable along its course. Dealing with comparatively pure air we would be at liberty to make intermediate openings without risk—the fresh air would thus have the upper hand and keep it. We can give air as well as water

too much to do, and in fact it is more dangerous to overcharge air than water with impurity.

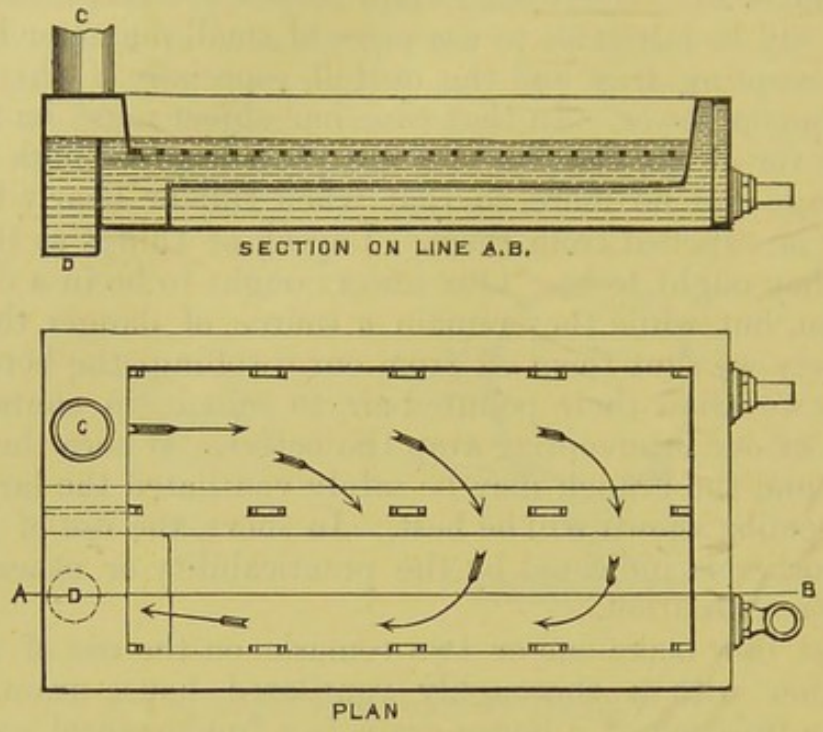
But while I recommend the use of large pipes immediately in connection with the house, that is to say on the inlet side of the manhole and intercepting trap, I must observe, that in most cases it will be advisable to use pipes of small diameter between the intercepting trap and the outfall, especially if that outfall be a common sewer. In that case our object must be to leave no room for air in the pipe—to use pipes large enough to hold the sewage and no more, so that when full or nearly full the air may be expelled from them. I speak of things as they are, not as they ought to be. Our sewers ought to be in a different condition, but while they remain a source of danger the more completely we shut them off from our dwellings the better, and the less we allow their polluted air to remain in contact with the seal of our intercepting trap the better. Where the outfall is good and the branch may be safely ventilated the large pipe of the section shown will be best. In short, the use of the one or the other is indicated by the practicability or otherwise of thorough ventilation.

I must now make one or two remarks on the use of traps in connection with a thoroughly ventilated house-drain. The complete isolation of a house-drain is a fundamental condition. It must not be connected aerially either with a common drain or with the drain of any other house. Having secured that condition by means familiar to you all, and having also secured the thorough flushing of the drain with fresh air and water, it follows that trapping, as a protection against foul air, is unnecessary.

We are practically safe, and the fewer traps we have either outside or inside the better. We do not require to trap soil-pipes, rain-water pipes, or gullies; and by leaving them trapless we only the better insure the purity of the air in the drain. The truth is that by a multiplicity of traps we create a multiplicity of obstructions and deposits, and to that extent interfere with the rapid cleansing and efficient ventilation of the drain. The only excuse for using traps inside at sinks, baths, and the like, is to protect the inmates from cold draughts. For this purpose some obstruction is no doubt necessary, but it need not take the form of a syphon trap. If it does it is most desirable that every trap of the kind should be accessible and and cleansable from the vessel with which it is connected. Scullery sinks should be provided with a grease box, which would also serve as a trap; but it ought to be inside, easily got at, and regularly cleaned by the servant who works at the sink. By appliances at present in use it is impossible to catch the

grease in close proximity to the sink, especially where much hot water is used, but I think the difficulty may be got over by a contrivance which I shall now describe (Fig. 2).

FIG. 2.



C. Pipe from Sink. D. Pipe to Drain.

This consists of a shallow box encased with cold water, and covered with a movable grating resting about half-an-inch or more, according to circumstances, below the level to which the waste water will rise. The casing or jacket is really an expansion of the cold water supply to the sink, and the water in it would therefore be frequently replaced. The contents of the sink entering this box would at once spread over the cold bottom and impinge against the cold sides and raised central division. Much of the grease would rise through the grating and congeal above it, and thence be easily removed, but a good deal would no doubt adhere to the bottom and sides of the box. A depression is made at the end of the box to catch sand or other solids; the size would be in proportion to the amount of work to be done in the sink. It is evident that such a box would be quite easily cleaned, and that the cleaning of it could not be neglected without interfering with the use of the sink; moreover, as it would not be enclosed in any way it would not be out of sight and therefore out of mind.

I shall conclude with a word or two about the trapping of water-closets. The ordinary wash-out closets have necessarily traps which prevent the inconvenient or otherwise objectionable

ingress of external air, but I have no doubt that a good valve closet without any trap is hygienically a greatly superior apparatus. The external air is effectually excluded in this case by the water held in the basin; but it would be *sufficiently* excluded by the valve itself if we assume that the air in the house drain is innocuous; there is therefore no use of a trap in addition to the valve, and without that obstruction the contents of the closet are at once discharged into the drain and carried clear of the house in a few seconds. In this way you not only with certainty get quit of excrementitious matter, but also of water which has been in contact with it; whereas in trapped closets you may get rid of the former but not of the latter, and in many varieties you get rid of neither. It is about twelve years since I first ventured to use trapless closets, and I have recently had an opportunity of comparing some of these, which have been in use for more than ten years, with trapped closets of about the same age, with the following result: in no case was I able to detect the slightest smell from a trapless closet, however long I held the valve open, and in every case where the closet was trapped a most offensive smell was perceptible, if the valve were kept open for a few seconds. All my experience indeed points to this: that our best chance of safety lies in so contriving our house-drains and plumber-work that there shall not be one single receptacle where stagnation is possible throughout our entire system, and that the pure air of heaven shall constantly permeate every nook and cranny of it.

Besides plenty of air and a good scour, and periodical flushing, one thing more is desirable, if not essential, if the contents of our house-drains are to be harmless, and that is that they should be regularly cleaned. I may not enter upon this subject now, but venture to say that I see no difficulty whatever in having this cleaning done periodically at less expense, and with very much less trouble to the occupants of the house, than a somewhat analogous operation to which we are quite accustomed—the sweeping of chimneys. There is indeed no reason why we should not have drain-sweeps as well as chimney-sweeps.

[*This discussion also applies to a paper by* Mr. R. E. Middleton.]

Mr. Daniel Emptage (Margate) opened the discussion, and remarked that he agreed with Mr. Middleton that the best way to ventilate a sewer was by carrying a pipe from it to the top of every house, though he thought the pipe should be taken as close to the seal of the disconnecting trap as possible. He also considered that

the disconnecting trap should be self-cleansing; but he could not agree with Mr. Middleton that a plain syphon trap was as good as a cascade action. His experience taught him that with the former it was difficult for paper, &c., to pass through unless before a heavy flush of water. He had experimented with them, side by side, with equal quantities of water, and under equal conditions, and found that while the cascade action forced water at once through the trap, in the other the water frequently slipped underneath the paper without carrying it through. With regard to the waste from sinks discharging over instead of under a grating, he might say that he had tried them both ways, and his experience showed him that it was best for the waste to be so fixed; that it would deliver the discharge straight on to the seal of the trap, but that the outlet of the waste should be so fixed and tapered off that bad smells from the surface trap could not readily pass up it. The advantage of this arrangement was that there was no accumulation of filth upon the grating. Speaking with respect to Mr. Honeyman's paper, he pointed out that that gentleman said, the only excuse for traps inside under a sink was to keep out a cold draught. To his mind there was a much more important reason, viz., to keep out impure air. They all knew that waste-pipes became quickly more or less fouled, and to have air constantly passing through such channels, was, to say the least, very undesirable. He was sorry to hear the author so strongly advocate those, so-called, trapless closets. He had hoped that, by sanitarians at least, this system had been condemned. If they could ensure such apparatus always being fixed under the conditions insisted upon by the gentleman who introduced them, viz., complete trapping and ventilation of the drain and soil-pipe, and a good flush, they might be tolerably wholesome, but this they could not do. If the closets were made, they would be fixed, either ignorantly or wilfully, regardless of conditions. He had recently removed one which was fixed to an untrapped drain in connection with a cesspool; and upon one occasion he was shown over some large houses at the West End of London in which this system was carried out (the builder being a strong advocate of the arrangement). In connection with the first closet which he attempted to flush there was a defective flushing apparatus, as no water came into the basin, which he found dry and in an unclean state.

Mr. Rogers Field, M.Inst.C.E. (London), expressed his general concurrence with Mr. Middleton's excellent paper. Regarding the ventilation of sewers by pipes carried up the house, he quite agreed with Mr. Middleten, assuming his meaning to be that if pipes were adopted they should not close the openings in the streets, as was often done, which was a great mistake. He also agreed with what the author of the paper said about the use of cast-iron pipes in house drainage. One of the best methods of using these was the one adopted in the United States, where the cast-iron pipes were invariably made to pass under the house and hang along the side of the wall. This was an admirable plan, as the pipe was always visible,

and any defect could at once be detected. He did not quite understand Mr. Middleton when he said, "if there be more than one outlet ventilating pipe connected with the house-drain, then each such portion of drain and outlet ventilating pipe shall be provided with a suitable syphon trap and an inlet air-pipe or disconnecting man-hole." There were cases no doubt in which this might be desirable, but the great thing to be aimed at should be simplicity. To have a multiplicity of traps and pipes would be a mistake. Again, it was perfectly impossible to lay down hard and fast rules: the matter should be left for consideration in each individual case by competent men. As to the question of cascade action with disconnecting traps there were differences of opinion, and he had himself tried a long series of experiments on the subject. The conclusion he arrived at was, that a certain amount of cascade action was desirable, as they could not clear away the paper without it, but that too much was objectionable, as it caused the sewage to splash against the opposite side of the trap. They must judge cases by the peculiar circumstances that arose. Mr. Middleton said that the height of the flushing cistern above any closet, urinal, or slop-sink, should not be less than four feet. This was quite right if they could get it, but there were many cases where they could not, and he consequently did not consider a hard and fast rule desirable in this instance. There were, moreover, many flushing cisterns that would flush the closet effectually at less than four feet. Mr. Middleton remarked that "though there are many bad sanitary appliances in the market, the selection of good ones is a simple matter, requiring little more than common sense knowledge." He could not agree with this, for his experience, which was considerable, taught him that the question of whether appliances of this character are good or bad could only be told by actual test. As one of the judges of the Exhibition of the Institute since the commencement, he had had much experience in testing closets; but notwithstanding this, he never drew a conclusion as to any new form of closet without practically trying it. Anyone who formed an opinion from merely looking at a closet might find himself very much deceived. Turning his attention to Mr. Honeyman's paper, Mr. Field said the author appeared to start with the idea that they could not get sufficient ventilation in drains to make them satisfactory as they were ordinarily laid. If the author meant by this drains inefficiently laid, as was unfortunately too often the case, Mr. Field quite agreed with the idea; but on the other hand, he was sure they would never find any difficulty in getting a cylindrical six-inch drain thoroughly ventilated, so as to have no smell at all emanating from it if only it were well laid and made perfectly water-tight. This being so he could not see the necessity for the very complicated arrangement Mr. Honeyman proposed, or that there was any corresponding benefit to be derived from it. The author proceeded to say that "having secured that condition by means familiar to you all, and having also secured the thorough flushing of the drain with fresh air, it follows that trapping as a protection against foul air is unnecessary." He agreed with Mr. Honeyman that a mulitplicity of traps was objec-

tionable and should be avoided as far as possible; but could not coincide with him that trapping should be done away with altogether. On the subject of grease traps as ordinarily understood, his experience was, that that contrivance was nothing but an unmitigated nuisance. Each discharge which took place from the sink passed through the grease trap and carried some of the filthy matter from it along the drain, thus causing everything in connection with it to smell abominably. The operation of cleaning a grease trap would never be forgotten by anyone who had assisted at it. The contrivance was, moreover, generally quite unnecessary, its supposed necessity arising from defects in the drains. He had removed grease traps from many large institutions and mansions, and had always found things work satisfactorily without them, as long as the drainage generally was in thorough good order. The next question he had to refer to was trapless closets. He had used them himself many years ago, and they were still working satisfactorily, so that he could not altogether condemn them; at the same time he should certainly not recommend them for general use, as their satisfactory action depended on several conditions which would not be attended to in general practice; in fact, he did not now use them himself except in very special cases. In his last paragraph Mr. Honeyman made a good suggestion about the cleaning of house drains. He did not think there was any reason why they should not be cleaned periodically, just as chimneys were swept, and an arrangement might be made for the workmen who came to clean the drains also to clean the cisterns and look over the whole of the sanitary appliances.

Mr. J. Corbett (Manchester) also remarked upon the ventilation of drains, and intimated that by considerable observation he had come to the conclusion that whatever course they might lay out on paper for the current to pass, it would certainly at times go the opposite way. If they depended upon heat, they must at the same time be prepared for cold, which of course reversed the current arranged by heat. He thought this was a matter sanitary engineers were apt to overlook. He believed a perfectly satisfactory arrangement could be made by a syphon trap without an access manhole, so long as the drain remained in good order; but it seemed to him they ought always to provide for the drain getting into bad order. It should be the custom never to bury any traps without access, either by a direct manhole or at least by tools down an eye. He could quite corroborate Mr. Field's remarks as to the difficulty of selecting sanitary apparatus. He must say that every sanitary exhibition he went to had a depressing effect upon him, because it was usually an insanitary exhibition: and, without excepting even the latest one now open at Bolton, he did think that a great work still remained for the Sanitary Institute in the matter of sanitary exhibitions. So far, at nearly every exhibition he had been to—he thought he had been to nearly all—there was a preponderance of things that ought to be in a chamber of horrors. He suggested that in future a select committee of the association should be appointed to supervise the exhibits, and

be armed with power to let no apparatus be admitted into the exhibition that did not meet with their approval. This done, they would have the great result that, instead of being sneered at as having a small shop show, they would have the thanks of the public, who would then be led to think that the Sanitary Institute could do something for them, and was not merely a tool in the hands of shopkeepers and manufacturers.

Mr. E. C. Robins, F.R.I.B.A. (London), said he wished it to be particularly understood that the papers just read started from two different points of view: one was a repetition of what had been done in sanitary science for the benefit of householders up to the present time, and the other was an original paper which aimed at the introduction of something novel. The author of the latter deserved more commendation than he had received; but at the same time he knew Mr. Field did not discredit original work, and would be happy to see and recognise success when it came. Mr. Honeyman's paper showed a great amount of ingenuity, and if worked out a deal of good might come from the suggestions.

Mr. W. Wilkinson (Bury) drew attention to the paragraph in Mr. Middleton's paper in which he said: "The main soil pipe shall be similarly ventilated, and if there be more than one soil pipe, then each such soil pipe which shall be longer between the basin of the closet and the main drain than eight feet shall be similarly ventilated." He should maintain, in a case of that kind, that every soil pipe should be ventilated irrespective of the length of it, whether it be eight feet or eighty feet. He contended from his experience that traps were a necessity, and also maintained that Mr. Honeyman had himself demonstrated the necessity of traps in his observation that, besides plenty of air and a good scour, one thing more was desirable, if not essential, if the contents of their house drains were to be harmless: and this was that they should be regularly cleaned. That to his mind gave the deathblow to the "no trap" theory, because if there was a necessity for drains to be cleaned, so also was there a necessity for traps to prevent foul air from entering the house. His experience had also been that to allow a slopstone pipe, even if only a yard long, to act as a fresh-air inlet for a house, was certainly a suicidal policy; because if they had such a pipe only a yard long, through which continually passed greasy water, it was impossible to use that pipe even for a week without it being offensive.

Mr. R. E. Middleton, M.Inst.C.E. (London), in replying, said he should not think of having the openings in the street closed, as to do so was most objectionable. Four-inch pipes were no doubt very small for sewer ventilators, but he considered that this form of ventilation was the only one practicable for the purpose. He did not say it was the best, and he should be glad to hear of something better. With regard to using different systems of ventilation in the same set of house drains, if two ventilating pipes were put in the same drain with one inlet ventilator, he found they counteracted each other, and

were equal only to one system where one inlet pipe and one outlet pipe were used, and the inlet pipe would, under these conditions, frequently become the outlet one. In his opinion if more than one inlet ventilating pipe were used it was necessary to have a separate inlet pipe for each, and that each system of ventilation should be separate and distinct. In making the remarks he had done it was of course open to every sanitarian to make objection, and if these objections led to the whole question being sufficiently ventilated, some system which would be generally accepted might be advantageously drawn up. With regard to what he said as to the selection of sanitary appliances, he could quite understand his remarks being misunderstood. He did not mean to say that those things should not be tested carefully, for they should be, but it was easy to find a moderately safe appliance by the simple rules of common sense. If they were able to test them of course it was all the better.

Mr. Harry R. Newton (Weybridge) said: I fear, Mr. Chairman, the time at disposal will only suffice to enable me to make a few remarks, though I had wished to have spoken *in extenso* on this particular question connected with sewering; viz., that air should in all possible ways be excluded from fouled waters: for which purpose I hold that every drain and sewer throughout the kingdom, instead of being nearly empty, and therefore full of air, as they now are (except at storm periods), should be always charged with liquid, always full, always slowly overflowing; in fact, that an absolutely enclosed and arrested rivulet should be created, running over and away in every locality at a higher level than ordinary; so that, besides storing reserved force for the most powerful removal of the contents of any drain, by the usual drain outlet, at any moment desired or required; other beneficial opportunities would arise to take advantage of and to suit any circumstances by which the contents of any drain, or sewer, must in all ways then be under entire control; instead of, as now, the contents of such drains and sewers be left to the chapter of accidents, and remain without control, restraint or check to the unpleasant, destructive and deleterious properties that fouled waters contain. With reference to animal and vegetable refuse, solid or liquid, the actions of three of the elements on them are definite and distinct in all ways. 1st. *Earth*, by absolutely enclosing organic refuse from the external air, can compel all organism to resume its original condition, its elementary innocuous condition. 2nd. *Water* is, under any circumstances, but a temporary holder of organic refuse, and if then kept from air, retains organic refuse in its then condition without power, *per se*, to reduce that organic refuse to a wholesome condition; but refuse water, in direct connection with air, has enormous powers of making the organic refuse of contagion infinitely more baneful than when in its initiatory state, producing an unhealthiness hitherto next to impossible to get rid of, accumulating as refuse does day by day. 3rd. *Air* has no action on refuse, but what is primarily intensely bad for the health of human nature; for air attacks vigorously everything with moisture in it; so that everything

created by nature may ultimately be evaporated, diffused and given up to it, for its own atmospheric purposes, to be subsequently returned according to the natural and unfathomable laws that control the universe. This natural process of distribution, or action of atmospherical conditions, it is the absolute duty of humanity not to aid or inconsiderately feed with any impurities whatsoever, but where it can and as it can, stamp such unhealthy actions out. Hence, if water is used for getting rid of animal impurities—and which I see no avoidance of for reasons I have given elsewhere—it should *only* and *solely* be used under the following condition, viz.: to be held up at pleasure, and overflow so as to obtain increased power for removal, and to obtain at the same time the actually most favourable conditions and powers for the deodorization, the sterilizing and the destruction of all impurities within its grasp. With the short time at my command, the house drain less requires explanation as to how it can hold liquid and exclude air; but for sewer requirements I can best convey what I desire to do to the meeting, if our friend Mr. Honeyman, who read a paper here this morning, will kindly allow me to explain my views by a reference to the model he has favoured us with and brought here to explain his system for the better ventilation of drains: a condition I am taking the opposite view on. Mr. Honeyman's model shows a quasi sub-drain; that is, a drain with a smaller drain in it at the bottom, not joined in the middle, as the two divisions have a free communication with each other by a horizontal and longitudinal opening throughout: the object being, I understand, to contract a circular space for sewage at the bottom, and provide a permanent air circular reservoir at the top for ventilation. My view is, that it would be better that the semi-division between this dual form of drain should be entirely closed up, so that the two parts be without any connection one with the other; that the lower (the sewage) drain should be always full and running over and away, as before described by me; and that the upper one should be of the size for a man to pass through it easily, and otherwise should be only used for surface and storm waters: the lower drain would then, equally with the house drain, be in precisely the condition required for the artificial correction or sterilizing of all fouled liquids entering therein, and so that, by absence of emission of any deleterious vapour, a source of nuisance and ill-health to humanity may be removed. Though I should like to say a great deal more as to the considerations foreshadowed and as to many details; still I have, Mr. Chairman, in essence, expressed the views I have formed on the sewage question, holding firmly to the definite standpoint, that liquids must

[Note by the Editor.—It is presumed that, in Mr. Newton's case, the pipes would be kept full by the syphon being above instead of below the general level of the pipes. It is to be hoped that both Mr. Honeyman and Mr. Newton will hereafter prepare further details, showing the application of their respective principles to an ordinary London residence of the first class.]

be kept absolutely from all contact with air, so long as they retain, in the smallest degree, any foulness or constituents for fermentation; and which fermentation can only arise from the conjuncture of the two elements—Air and Water. On these grounds I maintain that any ventilation whatsoever of fouled liquids or of refuse waters is a fatal error of the most profound character.

Mr. J. Honeyman, F.R.I.B.A. (Glasgow), said he must admit having spoken rather rashly with regard to the absence of traps altogether. Protection from smell was quite as good a reason for using traps as protection from cold draughts. He would not like it to be supposed that he advised the omission of all traps between waste pipes, &c., and the house, although he said that as a protection against air from the house drain they would be unnecessary. He was sorry he could not agree with Mr. Field regarding the necessity of more air in the drain; he thought it could be shown to be physically impossible to ventilate a drain only six inches in diameter sufficiently without mechanical force. Mr. Field said he got a six-inch pipe perfectly without smell; but even if he did he must be aware that a smell was not necessarily a test of the purity or harmlessness of the air. This was a point often forgotten. He would like it borne in mind that his remarks with regard to the doing away of traps were based upon the idea that the house drains were entirely disconnected from the common sewer, and that they were formed and ventilated and kept clean as he had suggested.

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