THE VENTILATION OF SEWERS.

BY JOHN G. WINTON.

The furnace system for the ventilation of coal mines has now become obsolete. The plan was a sluggish one, depending on the rarefaction of the air in the furnace or upcast shaft, which was so arranged with those intricate passages in the depths of the earth, that, as the rarefied air ascended, another or downcast shaft supplied fresh air to the workings. The suction fan now takes the place of the furnace system. In some instances air is discharged and supplied by these fans at the rate of 100,000 cubic feet and upward per minute.

Suction fans have been condemned by some authorities as inapplicable for the ventilation of our main drainage systems. I think differently, that the main drainage systems of Great Britain have been constructed in ignorance as regards ventilation. Our forefathers, no doubt, did not experience the want of proper ventilation and dilution of sewer gas which now exists in densely-populated cities. Modern works have been constructed, ventilating shafts have been adopted, forming upcast and downcast, according to the locality; nature has been coaxed to abate these foul receptacles, the sluggish gases have been purified by the charcoal process, and the noxious vapors have been trapped from our dwellings; yet, with all these precautions, very little has been done to create an in-draught into our main sewers, dispersing the vapors from the subways far overhead.

In the first instance, I consider that the sewerage works of towns should be so planned that the low-lying districts are kept separate, as far as practicable, from those of the higher districts; that each district should have a separate sewer, carrying away the sewage and rainfall from that district alone; they should debouch into a main common to all, and should be arranged with large siphon bends, so that the sewer gas of one district may not flow into that of another district; thus I may be able to deal most effectually with the sewer gas. With such an arrangement, I propose drawing the gases out of each district, discharging them into the main common to all, and which eventually would be discharged at the outfall, or made to pass up a chimney, and be dispersed far overhead.

Secondly, that all the existing water-carriage plans for the removal of refuse are defective, in the absence of an abundant supply of flushing water directly applied to the main drainage system. I have advocated pumping up sea water for this purpose for sea-coast towns, and, indeed, for all towns where it could be cheaply and conveniently applied. I consider that, by the application of sea water, the refuse would be pickled, and would find its way seaward before decomposition took place and noxious gases were evolved. In all other towns the fresh-water supply should be sufficient to meet ordinary requirements, as likewise for periodical or continuous flushing. In the application I have simply considered it necessary to flush the house pipes; and when these tributaries are promptly flushed, the mains will likewise be so.

If it is once ceded that continuous flushing is needed for the present system, I consider that a separate system, independent of rainfall, is preferable for the removal of refuse and the effluent water from our dwellings. We should be able to dispense with gullies, and, as there would not be so many air-holes, the gases would be more effectually dealt with. However, there can be no objection to carry away the rainfall, discharging it into the large main already mentioned, which finally terminates at the outfall.

The small jets of water for flushing the pipes leading from the houses need not be more than half an inch in diameter; the water should be made to spread, striking against the side of the pipe, thus tending to prevent in draught, and placed in such a position as not to be affected with refuse. For the sake of illustration, 4,000 of these jets would represent an area of 784 square inches, or a diameter of nearly 31½ inches; so, with the water delivered under a moderate pressure, as from ordinary cisterns, these small tributaries would eventually create a great rush of flushing water in the mains, the delivery being carefully calculated to suit the requirements.

In some recent examples for the ventilation of sewers open gratings have been fitted in the middle of the roadways, in connection with shafts leading from the top of the main sewers. Many towns have such an arrangement. These, no doubt, allow the gases to flow out of the mains, more especially when the sewer gases are compressed by a sudden flow of water. In warm weather, with a minimum flow of water through the sewers, the gases rise very sluggishly, and we know the exhalations are very offensive. The "sun" is the furnace, as it were (as in the plan adopted by the early miner); and the sewers being of lower temperature than the atmosphere, the cold air in the sewers rises through the open gratings; hence the various systems for deodorizing the gases by the charcoal process. In the winter months our houses act as the furnaces, and as we try to make them as snug as possible, by reducing all in-draft through window fittings and doorways to the minimum, the open gratings, fitted to the main sewers, then act as feeders, sweeping a cold current of air through the sewers, which carries the foul gases along, and eventually rushes through faulty fittings into our comparatively warm dwellings. This must take place at all seasons of the year, and more especially during the night, when we cannot open our windows for ventilation, and when our rooms are at a higher temperature than the atmosphere. However, the more the sewers are properly aerated, reducing the in-drafts into out dwellings, from these noxious receptacles at all seasons of the year, the more healthful will our habitations become. So I am forced to condemn the plain "Roman" system, and advocate the suction fan method adopted by the modern miner.

The furnace system, for promoting ventilation, we all know to be a very expensive plan, unless we can utilize, as in large manufacturing districts, the numerous furnaces under steam boilers. This plan has, no doubt, certain advantages in being able to deodorize the gases, by passing them through the furnace, and then up tall chimneys, where purified vapors would be wafted away into infinite space.

Next comes the suction fan, driven by the steam engine. Now we have a furnace, and at the same time we create a powerful current of air passing into and drawn out of the sewers, and then through the furnace and up the chimney to the clouds.

When fans propelled by wind we have a power uncertain and capricious. However, I consider Archimedean screw ventilators could be applied with a measure of success in many small villages where economy may be a desideratum. They are very sensitive; the least wind will cause them to revolve, and with such an apparatus placed on the top of a high chimney, the revolving wheel being 6 feet in diameter, we should have an engine of considerable power. These machines are fitted with spiral screw blades for creating an upward current. At times the action is feeble; the gases, however, would be kept in motion. In high winds the revolutions are considerable, and the gases would be screwed out of the sewers more rapidly, and instantly dispersed. Gas engines may be used for driving the fan, as some authorities may object to steam engines and smoke chimneys studded over large and fashionable localities; but when we consider that science has rendered these shafts smokeless, the engine becomes a matter of convenience, and a good gas engine of moderate power requires less skill on the part of the attendant.

Lastly, we have to consider the turbine or water engine for driving the fan. I have shown that, for the removal of refuse, more flushing water becomes imperative, and I propose to take advantage of the effluent water flowing from the turbine to effect a thorough cleansing of our underground netways. And, to satisfy the most fastidious, I propose drawing the gases through an enclosed bed of charcoal of sufficient capacity to suit the requirements.

I will now draw attention to these suction fans. A fan driven by an engine of 20-horse-power discharges 25,000 cubic feet per minute; the suction pipe being 30 inches in diameter, one mile of such pipe contains 25,872 cubic feet, or a little more than the above fan delivers per minute. The mileage per hour drawn through this 30-inch pipe will be 58, in round numbers, and in the 24 hours 1,392 miles of air are drawn through this pipe of 30 inches in diameter, while the total quantity of air expelled by the machine is 36,000,000 cubic feet in the 24 hours, or, in other words, 36,000,000 of cubic feet would be drawn out of a certain sewerage area, the pure air would instantly fill up the void, pouring into the sewers through existing apertures, or properly constructed inlets. To place these fans in immediate connection with the sewers is impracticable. As the numerous gully holes would act as feeders, and the exhaustive power, at a short distance, would become inoperative, we must lay down a system of piping, so that the sewers may be attacked, and the gases gently drawn over a large area. Were we to create a sudden rush of air at one part of the sewerage system, even although with no gully holes, we consider the water traps in the house arrangements would be unsealed, and, as we have already stated, the exhaustive power would be limited.

For the sake of illustration, I will take a straight length of piping commencing with 30 inches diameter at the fan. This line of piping should be graduated to a small diameter at the extreme end of say, one sixth of the area, or 12¼ inches diameter, the