

The earth closet and its varieties do not provide for liquid wastes, which exceed the solids by ten fold. This should be a convincing argument against its adoption unless there is a system of sewers to carry away the liquid filth, and then the question arises naturally, why not carry both solid and liquid filth together, using the liquid as a carrier for the solids?

The system of direct removal must always be an offensive and expensive method but it appears to be very well suited for a temporary arrangement for summer resorts, camp grounds, etc., where the value of the refuse as a manure on the surrounding farm lands may offset part of the cost of removal.

It is also admirably adapted for isolated houses of the better class with sufficient garden and grounds to utilize the wastes; but it is wholly unsuited to tenement houses in small towns, especially where surveillance of sanitary officers is known. It is found next to impossible to enforce the necessary rules for keeping closets and receptacles clean.

Sometimes we hear the statement made even by medical men that a water closet in a house is always a source of danger and that an earth closet is preferable. This objection to a water closet is generally based upon an acquaintance with some very imperfect system of house drainage and plumbing. With no rules and regulations governing such important matters, it is not to be expected that the best results will follow. Only last year did the great city of Toronto adopt a plumbing by-law.

*Pneumatic systems of removal.*—The principal pneumatic systems are those of Liernur and Berlier, which consist essentially of a net-work of air-tight pipes through which excrementitious matter is forced by air pressure to the outfall, a partial vacuum being maintained in the system by the air pump. The pipes being air-tight are generally made of iron. The Liernur system is in use in several cities in Holland, and to a limited extent in a few of the cities in Germany. The Berlier system is in a small district in Paris.

In any pneumatic system the pipes must be not only water-tight but air-tight. This condition it is difficult to maintain. These systems are especially adapted to those towns and cities where from the level nature of the country pumping of sewage must be resorted to in any case.

These systems are expensive in first cost, expensive in maintenance, and certainty of action at all times doubtful.

They would not be suitable for Canadian towns.

*Removal by water carriage.*—Sewage removal by water carriage has been in use for centuries.

When the sewers are designed to carry not only the sewage proper, but the rainfall as well, the system is known as the *combined system*; when the storm water is excluded, the *separate system*; when part of the rainfall is allowed to enter the sewer, the *restricted system*.

From a sanitary standpoint there is no doubt in the mind of the writer that the separate system is the one to be preferred. This opinion is based upon the following reasons:

1st. Except in the large cities the conduits can all be made of vitrified glazed pipe, which is impervious to liquids and gases under ordinary pressures and offers a smoother surface than any brick or cement surface.

Brick work is not impervious, and any brick or cement surface presents many small projections which collect matters in suspension, thus impeding the current. Fresh running dilute sewage is not dangerous nor even offensive. Not until it becomes stagnant and putrefaction commences is it dangerous. The pipe sewer therefore has a great advantage over any brick or cement sewer.

2nd. In the combined system the sewers are made large enough to carry the maximum rainfall, at which time they run full, while the flow of the sewage only is but a small fraction of the rainfall, so small indeed as to be wholly disregarded in designing the sizes of the sewers.

It therefore follows that these large sewers of the combined system cannot be fully flushed, except during a maximum rainfall, perhaps once or twice a year; consequently the sewer air must become foul, especially in the small branch sewers, during the dry seasons, the flow of sewage proper being but a small, putrid, thickening stream. Only when a sewer becomes offensive is it thought necessary to flush it from a hydrant or tank.

In the separate system the flow in the pipes is comparatively a constant one, the maximum flow being but a few times greater than the minimum flow. To flush the system a flush tank should be placed at the end of every sewer. These tanks work automatically, flushing the sewers copiously