It is not a theory, it is empiric. Yet opposition is offered on the ground that sewers are not strong enough, that low lying basements might be flooded, that the frosts of Canada are too severe, and that the tanks of water might be frozen.

In reply to these points I would say that these points are matters that have been overcome satisfactorily, a weak sewer has to be strengthened, although the expansive force is very slight; the low lying basements are gradually eliminated as contrary to by-laws, and the tanks are earth-sealed and frost resisting. The expense of these tanks is very trivial as compared with their importance. They average \$150 each, complete, and require no attention after adjustment.

The glass model illustrates the foregoing system. A. A. are little glass tanks that periodically discharge the flushing water into the sewer system B. B. B. The flow of sewage is derived from the tank C, and the normal and abnormal flows are controlled by tap D. The tank's water is supplied from reservoir E. The updraft in the sewer is created by the aspirator F, and bromine fumes are introduced from flask G to indicate passage of sewer gases towards the ventilators and P-trap H. The ventilator shafts are I and J, and the closing of these shafts results in sewer gas getting past P-trap H.

SEWAGE PURIFICATION vs. WATER FILTRATION.*

By George C. Whipple.

Water filtration and sewage purification are not antagonistic, as might be inferred from the title, any more than the hammer and the mallet of the carpenter's chest are antagonistic. Both of these tools are needed, and they are handled by the craftsman in a somewhat similar way, yet each has a particular use. The skilled workman always knows which tool to use; the apprentice and the amateur sometimes use the wrong tool. So it is with the two sanitary measures referred to. Water filtration is an agency for rendering a natural water or a polluted water clean and wholesome; the various methods of sewage purification are primarily agencies for helping to dispose of the faecal and industrial wastes of a community without nuisance. Both are alike in that they seek to remove objectionable or polluting substances from water; but in one case the pollution of the water to be treated is relatively small and can be easily and cheaply removed, while in the other case the polluting matters of sewage are large in amount and can be removed only at considerable expense. So obviously simple is this proposition that it seems strange that municipalities should ever attempt to use the wrong tool. Yet in the protection of public water supplies the attention of the public is sometimes distracted from water filtration by plausible arguments in favor of sewage purification. The attempt is made to use the mallet, when the hammer would be more effective.

Take, for example, the case of a certain city situated on one of cur large lakes. Like many other cities similarly situated, it discharged its raw sewage into the lake with little expense and with little or no nuisance to sight or smell; it also took its water supply from the same lake, and the natural consequence was a high death rate from typhoid fever. In the course of time the city awakened to the danger, and the question of filtering the water was agitated. All the official sanitary advisers and most of the citizens favored this; but others said "No; let us purify the sewage and the wholesomeness of the water will follow as a matter of course." This idea may have had its animus partly in political circles, but it was a plausible suggestion and was accepted by many. Water filtration ultimately triumphed, but its introduction was retarded by a discussion based on false premises.

Again, take the case of a large river with many communities along its shores, some using the waters of the stream for drinking purposes, and all, perhaps, using it as a place of depositing sewage. Suppose that all these communities

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had sewage purification plants of the ordinary type which discharged their effluents into the river, would the water supplies of the down-stream communities be safe? By no means. Ordinary sewage purification plants do not turn out drinking water, while the mere presence of a large community upon the shores of a stream, with all the necessarily involved opportunities for occasional or accidental contamination, is in itself a menace to a water supply taken from the stream below it.

In order adequately to safeguard the purity of public water supplies taken from rivers and lakes in populous regions there is only one course to pursue, and that is to filter the water. If the water is but slightly polluted filtration is sufficient; if the pollution is considerable, chemical treatment or double filtration should be used or the pollution should be reduced by means of proper sewage disposal plants. There are some cases now, and as the country grows these will become more numerous, where both sewage purification works and filter plants are necessary, but under most conditions water filtration logically should be put first, for it costs less and is more efficient. Of course, this statement, like all general statements, is not without exception, and some cases undoubtedly exist, as the speaker well knows, where to thoroughly purify a very small amount of sewage that is endangering a large water supply is cheaper than to filter the entire water supply.

Some may think that there is no occasion for calling attention to this question of the relative importance of water filtration, and sewage purification, but a study of the articles that are appearing in the popular magazines and papers of the day indicates that so far as the protection of water supplies is concerned there is a tendency to place the emphasis in the wrong place. In some States, as in New York, the State Department of Health has authority to compel a city or town to install sewage purification works, but has no authority to compel the filtration of water. Plans for sewer systems have to be examined and approved by the health department, but plans for waterworks systems do not have to be so approved. This condition is scientifically illogical and deserves correction.

The speaker has never forgotten the remark made to him a few years ago by a distinguished German sanitarian who was visiting this country for the purpose of studying the admirable sanitary work of the Massachusetts State Board of Health. He said, "It is all very fine, but very funny. You purify your sewage, but you drink your water raw." It was contrary to sanitary science, as he knew it.

What has brought about this condition? It is partly due to the natural feeling that is expressed in the saying that "innocence is better than repentance," and that "pure water is better than purified water." Taken literally, no one can question the soundness of this principle. The difficulty is where to find the water supply that is naturally pure, or that is not liable to pollution.

It is due partly to a natural feeling of repugnance at the idea of allowing the waters of streams to be contaminated and then spending money to purify them. To this it may be said that it is only a question of time and place when and where the contamination is removed; in one case the faecal matter is largely, but not wholly, removed from the sewer water before it reaches the river, while in the other case it is removed from the river water more effectively at a point nearer the consumer. The essential thing is that some purifying mechanism stand between the source of pollution and the water tap, and it is not a question of where this is, but how efficient it is.

Sewage disposal is attracting public attention for another reason. There have been recently some remarkable improvements in methods of sewage purification. These took their origin in England, from whence they have spread to other countries and to America. Unquestionably, these methods are interesting and deserve attention, but it ought not to be forgotten that they took their rise in a country where the water supplies are almost universally filtered. Water filtration in England was an old story a generation ago. England,