THE MANAGEMENT OF SEWAGE DISPOSAL WORKS.

In a paper which he read last month before the Institute of Sanitary Engineers at Westminster, Eng., Mr. John E. Farmer, engineer-in-charge of the sewage disposal works of the town of Croydon, presents the following notes on the operation of disposal works:

The works manager should look at the disposal of sewage in the light of a manufacturing process—the sewage discharged on to the works being the raw material and the final effluent the finished product. With regard to the financial aspect, a manufacturer must part with his finished product at a price that is greater than the cost of his raw material plus expenses of manufacture. With sewage disposal the raw material may be taken as being delivered to the works free of cost, and, there not being, except in a few cases, any saleable product, there is only the cost of manufacture of the final effluent to be taken into account.

There are two things to consider in the improvement of sedimentation tanks, i.e., the reduction of the amount of suspended matter in the tank effluent of the present designs, or to increase the volume now treated by the same tank capacity without increasing the solids in suspension, as now obtained. The former would lessen the work to be done by the process which follows, and the latter would save tank construction.

By placing a fine screen, such as 3/32 in. perforated zinc, between the tanks and the filters, it will save about three-quarters of the labor in cleaning the holes of the sprinklers, where such are in use, and also save much treading on the surface of the filter.

During a portion of the year there is some of the irrigation area fallow. The efficiency of fallow land is about one-third that of grass-cropped land where broad irrigation is the method; but where land filtration is in vogue the effect of a fallow period is not so great.

With an up-to-date plant for the purification of the liquid portion there are the solids to be dealt with; these have been a source of much trouble ever since sewage disposal was first put into operation.

The solids screened out and that deposited in the grit chambers are easier to deal with than the sludge, as they contain less moisture, and thereby more easily disposed of.

At Croydon all the solids are disposed of on the land—the screenings and grit by cart or trucks, the sludge by pumping—all being spread and ploughed in as manure. Lime is added to the sludge before pumping to reduce the smell and to accelerate the decomposition of the organic matter. The addition of 0.5 per cent. of lime reduces the smell about 75 per cent. The ratio of screenings and grit to sludge is 1 to 11.75, both in their wet state, or 1 to 2.8 in the dry state.

In the management of a sewage disposal plant, irrespective of the method of disposal, there should be kept records of all the different items showing the work done, thereby not only giving the present position, but enabling comparison with the past and information for the future.

The most valuable method of keeping the records is by diagrams. The usefulness of this method far outweighs the time and labor required to plot them, as the information for comparative purposes, so essential in tracing the cause and effect, which many times arises in the disposal of sewage, can be seen at a glance.

The main items for recording are: Volume of sewage and amount of rainfall; quality of sewage and effluents; amount of screenings, grit, and sludge; number of units working of the different parts of the process of purification; also the cost in wages, say, of the sludge disposal; irrigation; pumping, etc.

In keeping records there is obtained information that is of value not only to the management, but to the engineer in designing new extension works.

Combining the record of the hourly flow and the oxygen absorbed in four hours of samples taken each hour, one is able to find between which hours the greatest amount of impurity, as indicated by the above test, has to be dealt with.

Last, but not the least, item in the management of sewage disposal is the finding by observation and research the means of improvement in the present methods of purification, and also for the cause of the effect obtained.

Some work in this respect which I have done may be of some interest.

It has been known for years that a filter of fine-grade material gives better results in purification than one of coarse grade. Also some materials give better results than others. But there has not been, to my knowledge, any work done to definitely settle the cause of these differences.

One difficulty has been the want of means to measure the physical properties of the different materials used as a nidus for the bacteria. If this could be overcome, the point could be settled as to whether the cause of the difference between two different materials, when used as a nidus was due to greater absorptive powers of one than the other, or to greater surface area. The former used to be given as the reason by many a few years ago, but I think the latter is generally recognized as the reason at the present time.

To find the purification given by clinker as a nidus in a filter, as compared with gravel, a filter was constructed in two halves, one-half filled with clinker and the other half with gravel, in 1904, at Croydon.

The grading being the same for both materials, i.e., drainage tiles and 3 in. gravel = 9 in.; ¾ in. to 1 in. = 1 ft.; ¼ in. to ¾ in. = 3 ft. 3 in.; total, 5 ft. Area, 200 square yards; rate of working, 200 gallons per square yard per 24 hours. Fed by revolving sprinkler.

The average results of 31 samples taken between October 13th, 1904, and June 19th, 1905, are:—

	Tanks' Effluent.	Clinker ½.	Gravel ½.
Free ammonia as nitrogen..	5.747	0.665	4.148*
Albuminoid as nitrogen	0.360	0.068	0.166*
Oxygen absorbed, 4 hours..	4.157	0.914	1.843*
Chlorine	9.43	9.14	9.71*
Nitrates as nitrogen	—	4.529	1.265*
Nitrites as nitrogen	—	0.165	0.294*
Dissolved oxygen	—	5,8	4.4†

*Parts per 100,000. †C.C.S. per litre.

The above results show that clinker gives much better results than gravel; but the question is, What is the cause of this?

To find the reason, I have carried out some experiments in the laboratory.

As regards the reduction of the impurity by passing over the surface, there must be taken into consideration that as the water passes downwards it gradually becomes less impure, so that after passing over one surface