

**THE FIFTH REPORT OF THE ROYAL COMMISSION ON SEWAGE DISPOSAL, 1908.**

**A Review By T. Aird Murray.**

(Continued.)

**Percolating Filters.**

As might be expected a large amount of space is given to the various points arising in connection with percolating filters. Seventeen pages are occupied with observations and conclusions on the most suitable depths of filtering media, while 50 pages in all are devoted to the subject.

With reference to the depth of the filtering media par. 153 states:

(1) "That the deeper the filters the better the effluent. This holds both for fine and coarse material, assuming good distribution and aeration."

(2) "For practical purposes and assuming good distribution, the same purification will be obtained from a given quantity of coarse material, whether it is arranged in the form of a deep or of a shallow percolating filter, if the volume of sewage liquid treated per cube yard be the same in each case.

Thus a filter, 3 feet deep, worked at the rate of x gallons per square yard per day would give similar results to a filter 6 feet deep, worked at the rate of 2 x gallons per square yard.

In the absence of clogging, the balance would be slightly in favor of the deep filter, because the greater the depth the more the errors of distribution would be neutralized."

A limit to shallowness is fixed at 3 feet. The Commissioners do not recommend the use of fine material for percolating filters." But when a liquor may be so free from suspended matter, that fine material may be used, they recommended shallow filters rather than deep ones.

No mention is made by the Commissioners of the maximum efficient depth, but there is probably an economical limit which may be found between 6 and 9 feet.

Par. 133.—Comparative tests made on 3 percolating filters respectively 8 feet, 6 feet and 3 feet deep of the same super area medium sized clinker receiving liquor at the same rate per square yard.

**Grains Per Gallon.**

	Shallow filter 3 feet deep.	Medium filter 6 ft. deep.	Deep filter. 8 feet deep.
Free ammonia. ....	2.6	2.4	2.2
Alb. ammonia. ....	.20	.18	.14
Oxygen absorbed by permanganate in 4 hours.....	1.1	.8	.50
Nitrogen as nitrates.....	.84	1.10	1.30
Total solids.....	65.0	66.0	65.0
Koch's gelatine and incubation test. ....	Fairly satisfactory.	Satisfactory.	Very satisfactory.

The Commissioners prove by further experiments that if in the case of the deep filter the same cubic quantity of material was arranged to cover a large surface so that there was only a depth of 3.0 instead of 8 feet, similar satisfactory results would be obtained.

The importance of this point is obvious to engineers. So often is it impossible to obtain sufficient fall without resource to pumping, that shallow filters are often a necessity. The point to be observed is that the shallow filter shall contain cubic contents equal to the deeper. In fact the size of the filters in proportion to the amount of sewage to be treated is a question of gallons to the cubic yard of filtering material within certain limits of depth, from 3 feet 0 inches to 9 feet 0 inches.

**Filtering Material.**

Par. 139, with reference to the nature of the filtering material and purification effected, experiments were carried out at York with different materials. These are of considerable interest. A percolating filter 100 feet diameter was used with a revolving distributor feeding the sewage liquor. The filter was divided into four segments each, independent of each other. Each segment was respectively filled with clinker, broken

bricks, blast furnace slag, gas coke, all of 1 1-2 to 3 1-2 inches diameter.

Result of analysis of the average of 24 samples from each segment.

Parts in 100,000.	Clinker.	Coke.	Slag.	Broken brick.
Ammoniacal nitrogen ...	0.01	0.06	0.05	0.21
Albuminoid nitrogen .....	0.10	0.10	0.12	0.15
Oxidized nitrogen .....	2.90	2.47	2.32	2.48
Total nitrogen .....	3.18	2.95	2.72	2.88
Oxygen absorbed at 27° C. at once. ....	0.38	0.49	0.63	0.63
Oxygen absorbed at 27°C. in 4 hours. ....	1.46	1.27	1.48	2.23
Dissolved oxygen taken up in 24 hours at 18°C. ....	0.09	0.19	0.24	0.37
Dissolved oxygen in C.C. per litre .....	0.65	1.32	1.72	2.57
Solids in suspension. ....	2.15	1.22	1.73	2.00
Solids by centrifuge (vols.).	33.5	24.4	20.5	37.00
Ratio of solids in suspension to centrifuge solids. ....	1:15.6	1:20.4	1:17.3	1:15.0
	all	all	all	all
Incubator test (scudder)	passed	passed	passed	passed
	all	all	all	all
Incubator test (by smell)	passed	passed	passed	passed
Smell when analyzed.	all good	all good	all good	all good

It will be seen if we differentiate between the above, the following order of merits is the case.

- (1) Clinker.
- (2) Coke.
- (3) Slag.
- (4) Broken brick.

These results go to prove that as in the case of contact beds good hard burnt furnace clinker cannot be beaten as filtering material for sewage.

The Commissioners further point out that better results are obtained by filtration through clinker than through pebbles. The rate of filtration in the latter being too rapid.

Par. 141.—Defines filtering materials thus:—

- Coarse, 2 1-2 inch to 3 inch diameter.
- Medium, 1-2 inch to 1 inch diameter.
- Very fine, under 1-4-1-2 inch diameter.

The Commissioners, however, do not lay down any hard and fast rules as to size of filtering media, but only give general suggestions such as "the size of the filtering material should depend very largely, upon the amount and character of the suspended matter in the liquid to be filtered." This is all that could be expected and the decision as to the most suitable size of material must be left to the judgment of those entrusted with the works. The Commissioners are, however, in favor of medium sized material as producing the best effluents, with ordinary sewage.

Pars. 156-157.—Deal with the various methods of feeding percolating filters. The main point of any distributor being that "it distributes the liquid uniformly over the whole filtering area." Many of the various types are discussed, but no recommendations are made as to the best form of distributor to adopt. We are treated to an elaborate list of defects of each system, and may conclude to avoid all the systems in use and yet be in the position to have to chose one or the other.

However, there are many improvements which have been made in distributors, especially on the revolving type, since the Commissioners obtained their evidence, and engineers will have little difficulty on this score in making a choice after careful study and examination of the types in use. For example, the improved open trough arm sprinkler is not referred to, which entirely gets over the difficulty in the older type in which the perforations in the pipe arm were liable to choke. With reference to the Stoddart dripping trays and tipping troughs, the Commissioners have to say that "the distribution is seldom perfect and that they are more suitable for small plants than for large installations."

Par. 95.—With reference to the amount of sewage which may be safely passed through percolating filters, there is a