IMHOFF TANKS.*

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The Imhoff tank is said to throw down 95 per cent. of the "capable-of-settling" suspended solids, and the advocates of the tank explain that the term "capable-of-settling" refers to that proportion of suspended matters in the sewage which will settle out in a measuring glass when allowed to stand quiescent for two hours. If Mr. Fuller's estimate of the amount of colloidal matter in sewage not capable of settling is 30 per cent., then the remainder, 70 per cent., is that which remains as precipitable after the use of chemicals; and if the Imhoff tank will throw down 95 per cent. of this it means that, of the total suspended solids, it will remove 66.5 per cent. This should be compared with the 50 to 55 per cent. which is obtained from strictly domestic sewage, and it is probably correct to say that the increased efficiency of the Imhoff tank due to the separation of the rising gas increases the deposit of solids from 10 to 15 per cent.

The second principle of the Imhoff tank is its remarkable performance in taking care of the sludge. Three reasons are assigned for this. In the first place, below the settling tank proper there is provided a large compartment in which the sludge is allowed to remain three to six months, during which time decomposition proceeds and effectively destroys the organic matter so that when finally the sludge is removed it is odorless and much reduced in quantity.

Perhaps no single element has worked more against a greater use of the septic tank than the fact that during the septic process offensive gases are given off. It is to the elimination of these odors that the energies of the inventor of the Imhoff tank were directed, and for this purpose he provides a separate tank for disintegration of solids, but he carries on that disintegration without producing odors. His second point, therefore, was that there must be through the sludge compartment no moving or renewed fresh sewage. The construction of the tank seems to solve this problem.

In the septic tanks the liquid sewage and the deposited sludge undergo decomposition together, while in the Imhoff tank all supernatant liquid passes through the tank so rapidly that no septic action is obtained, although in the sludge underneath a very high degree of septicization may be going on. It is said, therefore, that the organic matter in solution, either true or colloidal, is that part of any decomposition that is responsible for offensive gases, and that the deposited solids not subjected to renewed application of fresh sewage do not in their decomposition become offensive. This may explain why the Travis^{*} tank smells and the Imhoff tank does not.

The third point which seems to be fundamental in the design is that the deposited solids shall be overlaid with 25 or 30 ft. of liquid. Shallow tanks do not seem to be as effective as deep ones and the reason assigned for this is that the gases of decomposition which are produced in the lower strata must, on account of the high pressure, accumulate in greater volume and in their escape produce a greater separation of the sludge particles than in shallow tanks. It is to this action of the gases in the lower layers of the sludge deposits that Dr. Imhoff ascribes the marked porous condition of the sludge which gives it its rapid drying properties after being taken from the tank. The decomposition

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which goes on at the bottom of the Imhoff tank also gasifies and liquefies a large proportion of the solids originally deposited.

Based on experiments of Dr. Spilner and Mr. Blunk, chemist and engineer respectively for the Emscher Association, the fresh sludge deposited in the lower compartment contains, on an average, 95 per cent. of water. After remaining several weeks or months in the septic chamber it will contain only 75 per cent. of water, and about one-third of the original organic matter will have been either gasified or liquefied. Through these two agencies an original volume of 100 cu. yd. of fresh sludge will be reduced, according to their experiments and figures, to a volume of 16 cu. yd., a shrinkage in volume of about 84 per cent. They assert that through septic action only an original 5 cu. yd. of dry sludge matter will be reduced to 3.92 cu. yd., a reduction of 22 per cent. The largest part, therefore, of the reduced volume is gained by the loss in water, this being pressed out on account of the great depth of tank, or indirectly by the greater pressure of entrained gas.

Instead of being compact, non-porous and in texture much like asphalt or rubber, the Imhoff sludge is so porous that the contained water disappears readily, drying out so that it can be spaded in about five days and is thereby still further reduced in volume so that its volume is about 40 per cent. less than when emptied from the tank.

Since sewage disposal plants are generally built on the lowest ground where foundation soil is the poorest and where the ground saturation is most complete, it is inevitable that the cost of tanks 30 ft. down will be high. Wisner estimates the Imhoff tank to cost twice that of shallow tanks for the same volume of sewage, although the actual volume of the Imhoff tank is perhaps only one-fourth that of ordinary tanks in volume, but the storage compartment for sludge underneath is so great that the total volume of the tank is nearly that of an ordinary settling tank. Apparently the practice of Dr. Imhoff is to make the upper compartment large enough to hold about two hours' flow and to make the lower one twice this size. This makes the Imhoff tank large enough to hold about six hours' sewage flow, which is about the capacity of the more recently built septic tank.

The cost of the Imhoff tanks is higher even with smaller capacity because of higher unit prices in both excavation and masonry linings. The question, therefore, resolves itself into this: Is the greater sedimentation, the freedom from odor at the plant and the vastly reduced labor of disposing of the sludge sufficient justification for an increased cost of construction of the tank and for the patent fee which the inventor very properly claims? It has been said that there is no opportunity for equalizing the variable flow in so small a tank and that for best results a large sedimentation tank ought to precede the Imhoff tank action. But with every criticism considered, and with full appreciation of the difficulties of the deep tank construction, the boon of an odorless sewage disposal plant is so great and the elimination of the sludge problem so gratefully appreciated, that its rapid installation in this country cannot but follow its European successes.

STREET RAILWAY FOR PRINCE ALBERT.

An estimate of the probable cost of a street railway at Prince Albert, Saskatchewan, consisting of eight miles of track and eight or ten cars to start, has been submitted to the civic authorities by Mr. J. S. Townsend, of the Messrs. Stone and Webster Engineering Company of Boston, placing the figure at \$275,000.