most interesting problem to study. The most effective depth of sewage under aeration to absorb the maximum of oxygen as the air passes through, as well as the effects of low temperature of the air on the efficiency of the process, are receiving attention, whilst the best method of applying the process according to the varying hourly flows of sewage and to the fluctuating strengths of the liquor will afford engineers and chemists ample scope for their ability and ingenuity. The advantages of continuous flow over intermittent flow methods do not appear to be very pronounced except as to the cost of construction and operation, where the continuous flow tanks are superior, although "with a wide variation in strength of sewage and rate of flow a more uniform standard of effluent can be obtained with the fill and draw method because it is susceptible of better control."

The question of how best to reduce the sludge to a fertilizer and extracting the grease is a most important one, because it is anticipated that sludge, which is now often an abomination to be got rid of by any means, will in future be saleable at profit, and if this is accomplished, then the ancient slogan of "back to the land" will be realized with advantage to the municipal authorities and to the farmers.

If space is available, fuller references will later on be made to the various engineering problems referred to, because the success of a sewage treatment plant depends largely on the careful development of details. A fifty-million-gallon plant is not constructed very often and, furthermore, what might answer admirably under scientific management which can be obtained for large works, may not be equally attainable at average installations.

Mr. Copeland's report is a comprehensive one and provides statistics which show what results were obtained, and these will now be discussed.

The sewage was screened through a ¾-in. bar screen to remove the coarse materials, passed through a grit chamber to settle out mineral substances and sampled every hour in a gallon measure. A representative portion of the sample—about 250 c.c.—was taken out each hour, chloroformed and put into a bottle which was packed in ice so as to suspend biological changes pending the time when a 24-hour collection of samples was available for analysis. Settleable solids were measured in tapering glass vessels; portions of sewage were filtered through filter paper, and these, as well as unfiltered sewage, were evaporated to dryness to determine the weights of the total and soluble solids—the difference being recorded as suspended matter. Free ammonia was determined by direct Nesslerization. The tests for numbers of bacteria contained by the sewage were made upon agar incubated at 20° C. for 48 hours, the sample being diluted with sterile distilled water.

From the results obtained at Manchester by the originator of the activated sludge process, Messrs. Adern and Lockett, it would appear that the time required for the maturing of sludge was in the first instance about six months, but this period has been reduced considerably. As already stated, the first experiments upon this process at Milwaukee were started in the laboratory about March 1st, 1915. The apparatus used consisted of two glass tubes 6 ft. long by 1¼ ins. diameter. At the bottom of one tube a filtros plate was placed to diffuse the air through the mixture. A small glass tube was placed inside the other tube to carry the air to and discharge it near the bottom of the tube in an open jet.

On March 6th these tubes were filled with raw, coarse screened sewage and some sludge from the final sedimentation tank of the 8-ft. sprinkling filter, air was turned on, of unknown quantity, but sufficient to keep the mixture in violent agitation. On March 10th, or at the end of four days' continuous aeration, the sewage was clarified, the sludge had a brown color and settled readily. The clear liquor was decanted off, raw sewage substituted and the mixture continuously aerated for another 24 hours, when the air was shut off.

Within one-half hour the sludge had settled, leaving a clear supernatant liquor, containing 20 parts per million of nitrates. Fresh sewage was again placed in the tubes; within 12 hours after aeration began nitrites and nitrates were present and at the end of 24 hours' continuous aeration the liquor contained but a trace of free ammonia, one-half part of nitrite and 20 parts of nitrates.

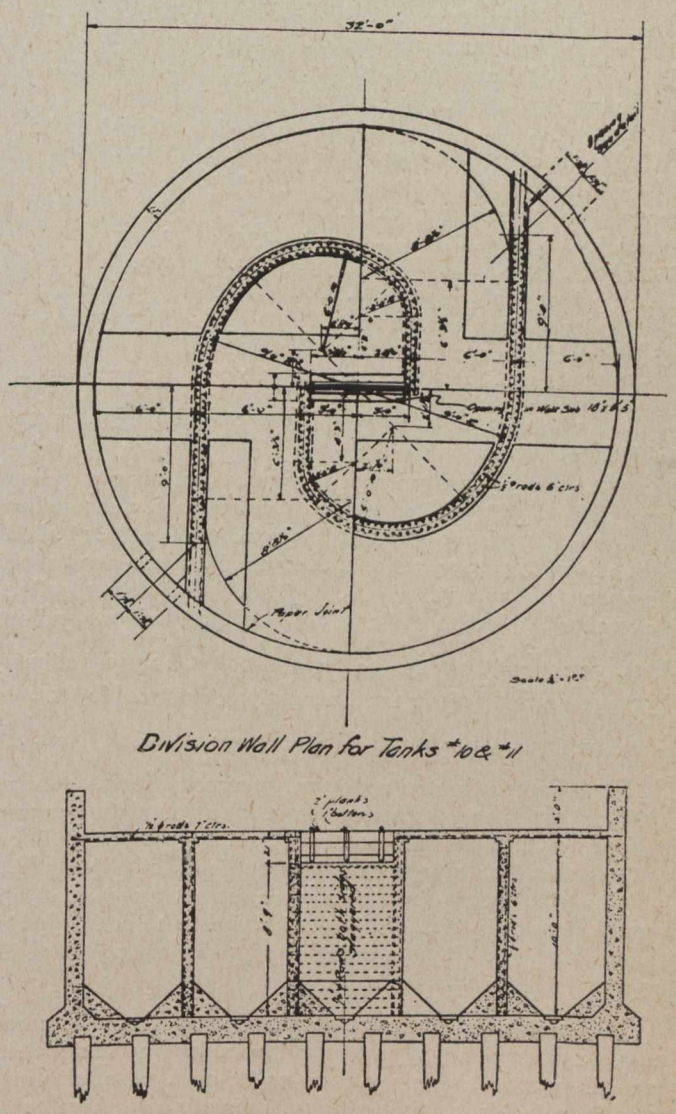

Fig. 3.—Section of Tank.

Dr. Edward Bartow, of Urbana, was also able to produce activated sludge in a few days.

The laboratory test showed that an open air jet gave about equal results as the filtros plate diffuser. The results gave such promise that a tank which had been used for chemical precipitation experiments was converted into a fill and draw tank for trying out the activated sludge process. This tank has a capacity of 22,200 (U.S.) gallons,