means of two 1¼-inch glass tubes 6 ft. long, and next in a tank 32 ft. 0 in. x 10 ft. 6 in. and 9 ft. average depth, on the fill and draw method which was put into operation on March 26th, 1915. The continuous flow tank was put into commission on June 28th, and had the capacity of 22,600 U.S. gallons (18,830 Imperial gallons).

The foregoing experiments produced such promising results that the commission decided to install a plant capable of treating two million (U.S.) gallons per day, with the view to ascertaining the results under normal working conditions. This plant consists of eleven reinforced circular concrete tanks 30 ft. internal diameter by 13 ft. deep, eight of which are used as aerating tanks, one as a final sedimentation tank and two as sludge aerating tanks. The layout is shown in Figs. 1 and 2. The total capacity of the eight aerating tanks is 360,000 U.S. gallons, two sludge tanks 88,200 U.S. gallons, and the sedimentation tank 33,000 U.S. gallons. The daily working capacity of the plant with 25 per cent. activated sludge in the aerating tanks and four-hour tank passage is 1,620,000 U.S. gallons, and by reducing the tank passage period to three hours the working capacity is increased to 2,160,000 U.S. gallons.

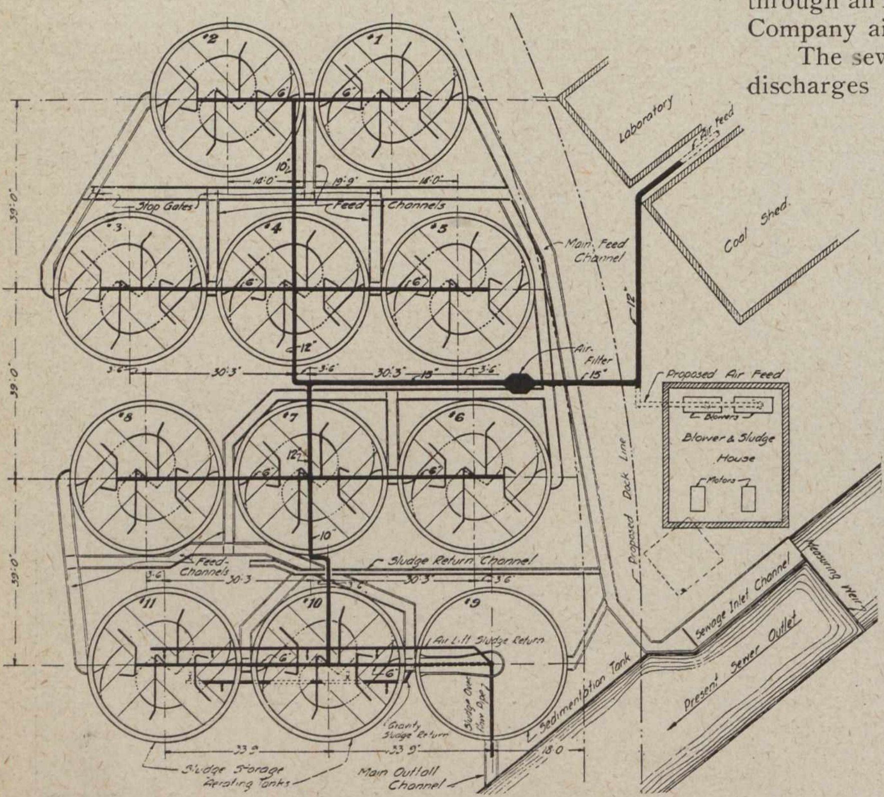

Fig. 2.—Plan of Tanks.

Each of the aerating and sludge tanks is divided by a baffle wall which makes a spiral running through chamber about 6 ft. wide and 114 ft. long. Each chamber has a sloping bottom in the apex of which 12-in. x 12-in. filtros plates are set in castings built in units containing from five to seven plates. These castings have an air duct cast in them which discharges the air through a brass orifice to the under side of the plate. This orifice is designed to pass 2 cu. ft. of air per minute under 5 pounds pressure per square inch. This capacity being based upon our experiments showing maximum air required to be .25 cu. ft. per minute per square foot of tank surface.

The baffle walls separating the running through chambers of the eight aerating tanks are 2 ins. thick, built of Hyrib plastered with cement mortar. Those in the two sludge tanks are 6 ins. thick, built of the same material. The extra thickness is here necessary because each of the sludge tanks is divided into two distinct compartments permitting one compartment to be emptied while the other is being filled and aerated.

The sedimentation tank is built with a hopper bottom terminating in a 4-ft. diameter cast iron pipe 24 ft. below bottom of tank, from near the bottom of which a 12-in. pipe extends to the top of the tank. Inside of this 12-in. pipe is a 1-in. pipe for delivering air to the sludge by which it is lifted from the bottom of the 4-ft. pipe and delivered to the sludge tanks, or to the sludge presses.

The compressed air for the two-million-gallon plant is furnished by means of a Connorsville blower having a capacity of 2,400 cu. ft. of free air per minute to five pounds per square inch pressure. This is operated by a 75 h.p., a.c., variable speed motor. The air, after passing through an Excelsior filter, is measured by General Electric Company air meters.

The sewage is taken from an intercepting sewer which discharges about 12,000,000 gallons of sewage per day and some of this originates seven miles above the outlet and is quite septic on reaching the works.

As this plant was not completed until the end of 1915, not much information is available as to the results obtained.

Without in any way minimizing the excellent work done at Milwaukee, and before discussing some of the results obtained there it will be instructive to refer to a few of the engineering considerations, which require to be further and more fully developed. These are referred to in the report and go to prove that to obtain the maximum efficiency at the least cost it involves many studies and experiments.

"Activated sludge accomplishes four principal functions: The clarification of the liquor, removal of the putrescible organic matter, reduction of bacteria, and finally, if the process be continued a sufficient period, oxidizes the ammoniacal compounds into nitrates."

William R. Copeland, the chief chemist, defines the process as follows:—

"The sludge embodied in sewage, and consisting of suspended organic solids, including those of a colloidal nature, when agitated with air for a sufficient period, assumes a flocculent appearance very similar to small pieces of sponge. Aerobic and focultative aerobic bacteria gather in these flocculi in immense numbers, from 12 to 14 million per c.c.; some having been strained from the sewage, and others developed by natural growth. Among the latter are species which possess the power to decompose organic matter, especially of an albuminoid or nitrogenous nature, setting the nitrogen free; and others, absorbing this nitrogen, convert it into nitrites and nitrates. These biological processes require time, air and favorable environments, such as suitable temperature, food supply and sufficient agitation to distribute them throughout all parts of the sewage."

As the supply of air under suitable conditions is a primordial requirement, experiments were made with air jets, filtros plates, monel metal cloth, and Kisselghur, to ascertain the best practicable method of diffusing the air and the relative area of the diffusers to that of the tank was investigated. Whether superactivated sludge will lead to an economy in the supply of air in the tanks is a