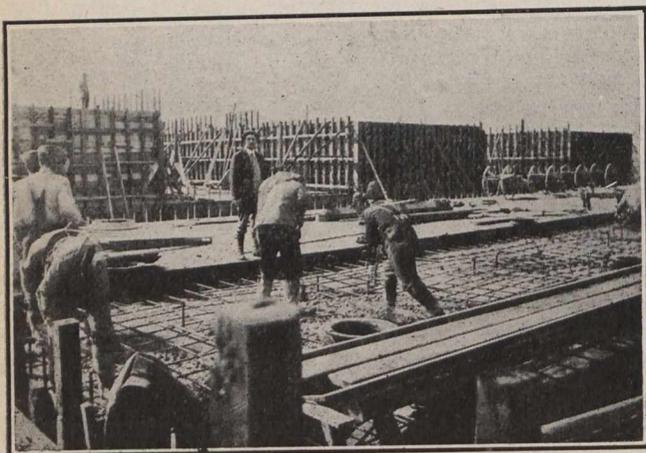


fever in Minneapolis among the users of the river water of the Mississippi goes to prove this. The fact that typhoid bacillus has been isolated from the waters of the Mississippi at Minneapolis, and the fact that above Minneapolis are situated several large towns contributing sewage directly into the river indicates the dangerous character of the raw Mississippi River water. It has been stated by engineers that typhoid fever germs will live in the same water for ten days. The Mississippi water passes several towns, such as Grand Rapids, Anoka, St. Cloud, Little Falls and Brainerd. The water that passes these towns reaches Minneapolis in less than eight days. The contamination of the Mississippi at Brainerd is sufficient to give colon bacilli in every cubic centimetre of the water throughout the course of the stream. The absolute numbers of bacteria in the



Reinforcement of Croin Arches North Filter Basin, and forms to South Series of Filter Built in Alternate Sections.

water at Minneapolis vary according to the season; the greatest in July and August was 3,000 per c.c., and lowest in January 150 per c.c.

The greatest percentage of reaction occurs in the reservoir also during July and August. These are the months of the maximum of plankton, when the range is from 400 to 1,200; in January 75 is an average.

Softening the Water.—The alkalinity of the Mississippi River water is due to the bi-carbonates of calcium and magnesium. This means the presence of carbon dioxide gas (Co_2). To reduce the alkalinity of the Mississippi water to about normal (66) after a treatment of 24 hours will be possible with lime treatment in about the quantities of 7.26% grains per gallon of raw water during November and December.

Color.—The color is due to vegetable substance which is slightly lessened by the lime treatment, and is further treated by alum as a bleaching medium. The slight precipitation soon settles with two grains per gallon, assisted with four grains of sulphate of aluminum. The Mississippi water will continue to bleach with longer storage.

Sterilization.—The water in the reservoirs: 90 million gallons was treated with copper sulphate (50 lbs. to the 90 million gallons three times a week, and as a result the plankton was decreased 80% in 30 days. Bacteria was reduced 40%, turbidity 20%. Also the color was slightly reduced. These experiments were conducted during July and August, the usual time for these organisms to be on the increase.

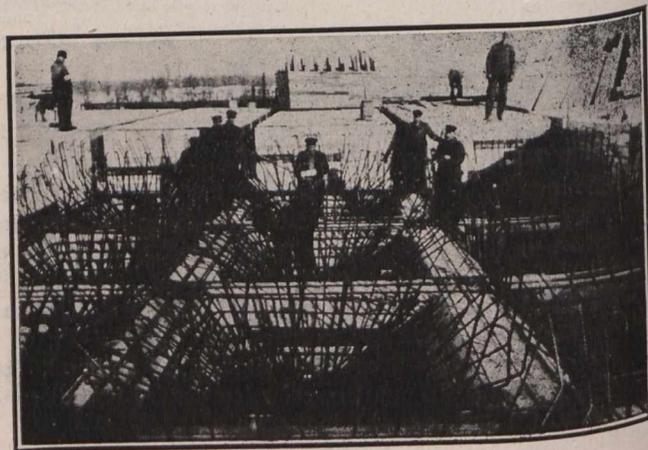
The purification of the Mississippi River water having been solved, and the amounts and kind of purifying mediums to be administered, the constructional part of the work was

started late in the fall of 1910, and has progressed very rapidly. The work was done on the day labor plan, the city of Minneapolis being the contractors.

The layout of the plant is as follows: The raw water or settling reservoir is of concrete and has a capacity of 75 million gallons. The water passes from this reservoir after sedimentation into a 60-inch intake pipe through a venturi meter into the chemical controlling chamber. There it receives the chemical treatment, measured by automatic devices according to the flow of the water. The water then passes into the mixing chamber, and is thoroughly mixed by flowing around a large number of wooden baffles. It then passes through controlling chamber No. 2 into a centre passage and is distributed into the two coagulating basins, again flowing against baffles, then passes over a skimming weir into the upper portion of the centre passage through a 60-inch influent pipe passing through the south side of the head house into the pipe gallery. The water is then passed into the filters ranging along each side of the pipe gallery through 24-inch branches off the influent pipe. The water passes through the filters into a network of pipes below, through a controlling meter into the clear water basins below, there to be turned into the large covered reservoir with a capacity of 47 million gallons, or into the city's distributing mains.

Head House.—The head house is of concrete and brick construction with several floors, and contains the mechanical devices for the operation of the plant. At grade 300 are located the two boilers for heating purposes, having a heating capacity of 15,000 square feet.

Alum Tanks.—These tanks are of concrete, reinforced with $\frac{3}{4}$ -inch rods, both vertical and longitudinal. They are 13 ft. by 12 ft. by 12 ft. high. The concrete in these tanks was a 1:2:4 mix, and was put in for \$7.00 per cubic yard. Above these tanks are located three 3-h.p. motors to drive the agitating devices. There are two pumps in connection with these alum tanks of the single section type, with a two-inch discharge having a pumping capacity of 40 gallons per minute against a 45-foot head including friction. They



Reinforcement of Concrete Storage Bins.

are operated by two single 2-h.p. motors. These pumps have bronze shells, runners, and diffusion vanes, and monal-metal shafts with especially designed packing to resist the action of the acid solutions. Switches for controlling these pumps are connected with the operating room at a point convenient to the pumps.

Hypo Tanks.—These tanks are similar to the alum tanks in construction, except that they have a concrete cover over them. The motive power, pumps and controlling devices are the same as in the alum arrangement.