will ring and advise the filter operator. At this time the filter must be washed.

Washing the filter is done by closing the gate valve which admits the water from the coagulating basin, filtering or draining off the water left in the shell to a point 5 ins. below the lip of the gutter, closing the effluent valve and opening the sewer valve. The bed is then agitated with air by starting the air blower and opening the air valve. After the sand is sufficiently agitated to free it of the dirt accumulated on the particles, the air is shut off and the wash-water pump started and the wash-water valve opened, the wash water passing through the wash-water main, the header section and laterals of the strainer system, upward through the gravel and sand, the dirty water passing off by the wash-water gutters and sewer. The operation of washing a filter requires ordinarily from five to six minutes.

A new and interesting feature in connection with the Aylmer plant is the composition of the filtering medium. The beds, as before stated, consist of two-thirds silica sand and one-third crushed marble, both with an effective size of .45 mm. and a uniformity coefficient of 1.65. The function of the crushed marble is to prevent by chemical action the presence of free alum in the filtered water and to correct any excess of carbon dioxide. While crushed marble has been used for several years in pressure filter installations, it is a comparatively new development to use it in a gravity plant, and it is my understanding that this is the first time that it has been done, at least in Canada.

The normal rate used for filtering, and the one for which the plant was designed, is 2 U.S. gallons per square foot per minute of filter area, or 125,000,000 gallons per acre per day, or from forty to fifty times the rate of slow sand filtration. The wash-water pump, wash-water mains and strainer system and gutters are designed to care for wash water at the maximum rate of 9 U.S. gallons per square foot of filter area per minute. The air blower, air mains, etc., are designed to provide for the

(Concluded on page 388.)

LAKE OF THE WOODS REPORT

The Federal Printing Office at Washington has now issued for the International Joint Commission, the final four volumes of the commission's report on the Lake of the Woods levels. These volumes include text, tables, plates and a watershed map. Accompanying these four volumes is an atlas which was reviewed on page 281 of our September 27th issue.

The volumes are 6¾ ins. x 10 ins., the one containing text having 314 pages; the one containing plates having 144 plates of various size, most of them being folded in; and the volume containing the tables having 82 tables, occupying 330 pages. The water-shed map is lithographed in several colors and mounted on canvas; it is approximately 3½ ft. wide by 3 ft. deep, and is arranged so as to fold neatly into the stiff covers of the volume. All four volumes are bound in blue cloth.

Besides the four volumes and atlas above mentioned, the work of the International Joint Commission and its engineers in regard to these Lake of the Woods levels has required publication of eleven other volumes, six of which deal with the public hearings in the investigation, the other five being advance reports by the consulting engineers.

CEMENT JOINTS FOR CAST-IRON WATER MAINS

IN *The Canadian Engineer* of May 24th, 1917, there appeared a paper read before the American Society of Civil Engineers by Clark H. Shaw in which were brought out some of the results obtained by the use of cement joints for cast-iron water mains.

The following discussion of this subject is taken from the August, 1917, Proceedings of the American Society of Civil Engineers:—

H. B. Lynch: This method of caulking joints in cast-iron pipe deserves a wider use, not only on account of its low cost, but because it makes a better joint, at least where no considerable movement of the pipe is expected after it is laid.

Cement joints have been adopted as standard at Glendale, Cal., and have been used on 10 miles of cast-iron pipe laid in the past two years. This joint was not adopted until after investigation had shown that it is being used with perfect satisfaction in various Southern California localities, and tests had been made to show its effectiveness. The results obtained at Glendale have been similar to those described in the paper. No joint yet placed has shown permanent leakage, and, in only four, has the presence of dampness been detected after the pressure was turned on. No joint has required recaulking.

The strength of this joint has been shown at Glendale by several incidents of various kinds. As a matter of fact, it is customary for the pipe crew to take the greatest liberty with the pipe after the joints are completed, as experience has shown that a joint properly made will not be started by quite severe treatment. A 3-mile pumping main of 20-in. cast-iron pipe recently completed was entirely laid up with cement, at an estimated saving of more than $3,000. On this line, when a nipple was to be caulked into a cross, it was customary for the men to stand the cross on end on the surface of the ground and set the nipple into the top bell, and caulk up on the surface. The nipple and cross, weighing 3,000 lbs., were then picked up with the chain blocks and lowered into the trench, without waiting for the set to occur. No joint treated in this way showed the slightest leakage or dampness under a pressure of 90 lbs. On one occasion, a 20-in. cross had caulked into it a plug, a reducer, and a 20-in. nipple, 10 ft. long. This whole assembly, weighing about 4,000 lbs., was lowered into place as soon as caulked, and is at present operating under a pressure of 90 lbs. per square inch without seepage.

This 20-in. line was connected to a 16-in. riveted steel line. For this purpose the 16-in. line was taken out of service at 8 p.m., and put back at 4.30 a.m. Joints were given 4½ hours to set. Out of eight joints thus treated, one remained damp for one day. One joint, where the 16-in. riveted line was caulked into a cast-iron bell, dripped for two days and then took up tight. This joint showed a face of about 1¼ ins. between the pipe and the bell. No other joint on this job showed any initial seepage, and all are tight now.

The method of making a joint in Glendale is much the same as that described in the paper. After yarning, the joint is rammed full of slightly damp cement. Great care is taken to caulk this first ring of cement thoroughly, as this is the greatest factor in a successful joint. No bead is now used, as no difference in results is noted when this is omitted. After caulking, the joints are covered with earth for protection against the sun.