

Company, of Regina; cement by Canadian Cement Company, Calgary; cast iron by the Canada Iron Corporation, and the concrete machinery by Mussels, Limited, Winnipeg.

**Some Itemized Costs.**—The following are some of the itemized costs: Cast iron pipes, class C,  $2\frac{1}{4}$  cents per lb.; special castings, 5 cents; cast iron covers and ventilators, 4 cents, all delivered Regina. Cement was \$2.85 per barrel; steel,  $\frac{1}{2}$  in. and  $\frac{3}{4}$  in. bars, 2.44 cents per lb.; 1 in. 2.80 cents;  $1\frac{3}{8}$  ins. 3.21 cents; 15-in. joists, 3.60 cents; 12-in. joists, 3.90 cents; standards, 3.90 cents, all delivered f.o.b. Regina.

Placing of steel in the columns, average cost of labor was 26 cents per 100 lbs.; in floor, 12 cents; in walls, 30 cents.

Cost of labor, team and coal for mixing and placing concrete in column footings averaged \$2; columns, \$10; floor, 82 cents; walls, \$1.10 per cubic yard.

**Generally.**—Tenders were invited for the construction of this reservoir, on the understanding that the city would supply all cement, gravel, steel and cast iron work, with the result that the lowest bid was \$63,176. The engineer's estimate was \$46,497, to which was added \$6,974 for contractors' profit, making a total of \$53,471. The offers were considered to be too high and it was decided to carry out the work by day labor, under the superintendence of Mr. Herbert Gibson. The total cost was about \$88,000, of which the items which the city would supply under the contract absorbed about \$58,000. The modifications in the design and specifications no doubt effected some reduction in the cost.

Mr. Theo. Brockman was resident engineer during the first season. Mr. L. A. Thornton, the city works commissioner, took an active part in the organization of the work, and Mr. J. McD. Patton, followed by his successor, Mr. J. Mackay, waterworks superintendent, attended to the matter of supply of materials. The reservoir was designed and supervised by the writer.

An important scheme has been put forward by the Egyptian Government for the Mahmoudieh Canal at Alexandria. It involves transforming the canal into a great fluvial harbor, seven miles in extent. At present the canal from the docks to Atfeh is under conflicting administrations. The importance of the canal to commerce and shipping is well borne out by statistics of vessels passing through it during 1910, when 6,512 lighters and sailing vessels and 165 steam tugs and steam barges passed down, and 6,507 and 179, respectively, up stream. These went through the tail locks of the canal at Alexandria, while for the Kafr Dawar lock 14,722 and 665 sailing and steam vessels, respectively, passed down and 13,323 and 680 up stream, and 19,713 boats passed through the Atfeh lock. The Government's scheme is to take away all control from the municipality and the other departments and transfer the canal to a single responsible body. From Hagar Nawatich to the Mahmoudieh locks (seven miles) a fluvial harbor will be built along the banks, which will enormously improve the discharge of merchandise and facilitate the discharge of cotton. At present boats have been jammed for three weeks owing to the block of traffic and lack of control. Lewa Gedge Pasha has sounded the canal, and it is to be dredged soon and convenient landing stages constructed of concrete, each fitted with a crane capable of lifting four tons. The whole seven miles will not be dealt with at once, but the new fluvial harbor will first be made up to the Farkha Canal.

## PIECE WORK SYSTEM APPLIED TO CITY FORCES.

MR. J. E. TUPPER, city engineer of Pomeroy, Wash., has an article in *Municipal Engineering* on the construction of municipal work by a new plan, some features of which, and the article describing them will be interesting to our municipal engineers, even although they, perhaps, cannot concur in all respects with the position taken by the author.

When the city of Pomeroy, Wash., was about to install its sewerage system the question of how it should be done, whether wholly by contract, partly by contract and partly by the city, or wholly by the city, was an important one and caused much discussion. We had no local contractors capable of handling the work and we were averse to letting the work to contractors from other places, even though there might be an apparent saving by doing so. The previous experience of the city in doing its work with city force had been so generally satisfactory that the council was strongly in favor of that method if some means could be devised of overcoming the one apparent defect in the system. While we had some men who would do as good work for the city as they would if working for a private individual, or even for themselves, a large number of the laboring men are inclined to take it easy when working for the public, and a by no means negligible element will "soldier" whenever and wherever possible. In all of the previous undertakings of the city the crews had been comparatively small, and it had been possible to eliminate the undesirable element, either by refusing them work when their traits were known, or by discharging them as soon as they began shirking.

In preparing for the installation of the sewers it was evident that a new factor entered the problem. The necessary force would be so much larger than any previously assembled by the city that we would need every available man, and would probably need to import some. Now, while the crew was small we could pick our men without causing much hard feeling, and even if a man was discharged for inefficiency, but little trouble was experienced, because his place was taken by another home man. When, however, it comes to replacing home labor with imported labor the matter becomes serious, and the offense would need to be flagrant to justify it.

It is well known to engineers and foremen that the efficiency of any crew is gauged very closely by the efficiency of the poorest man in the crew, and the example of one or two shirks will often have a disastrous effect on the discipline and efficiency of even the best of crews.

The problem that confronted us was that of employing all available home men, importing as few laborers as possible, and doing this without reducing the efficiency of the force below that of a picked crew.

The nature of our work was such that the employment of machinery to any considerable extent was impractical. Our water supply system, if system it could be called, is such a maze of pipes, the location of which is unknown, that the employment of a trenching machine would result in such utter demoralization of the water supply that the expense of repairing breaks in private pipes or cutting out and replacing them would more than offset the reduced cost of trenching. The water mains had been placed without any survey or record of location. In one case where the sewer location presumably paralleled a water main for 2,600 feet at a distance from the main of three feet, we found the water main in our trench for nearly one-third of the distance, and it crossed our trench eight times.