bodies of water will be available, and the cuttings will be short.

A private corporation holds a charter allowing them to construct the canal, but it is very doubtful if the Government will allow such an undertaking to be controlled by private capital. The Government have spent $500,000 on surveys and investigation, and it is just probable that now they are considering the advisability of appointing a Commission to report on the whole question.

* * * *

Who was the knocker that commenced this hard-time cry? Canada is just as rich in natural resources in 1908 as she was in 1907. They must be developed to be valuable. They will give as good returns in 1908 as ever before. The cheerful, optimistic engineer can do much to allay the present condition, which is neither a panic nor a calamity, but just an uneasiness.

FOUNDATION WORK FOR SIX LIFT BRIDGES.

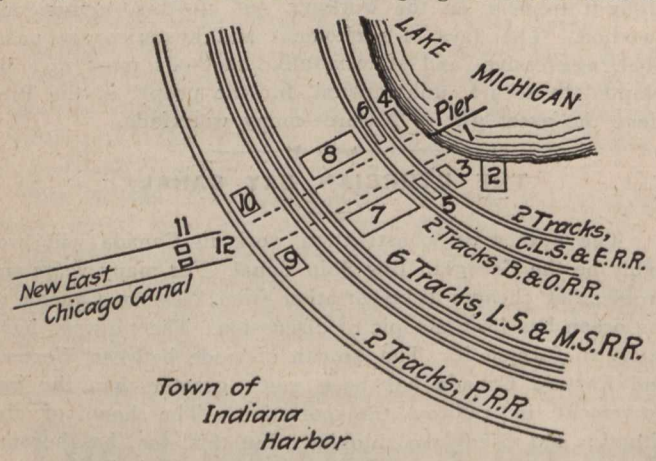
By C. M. Ripley, New York City.

A Description of the Excavation Work.

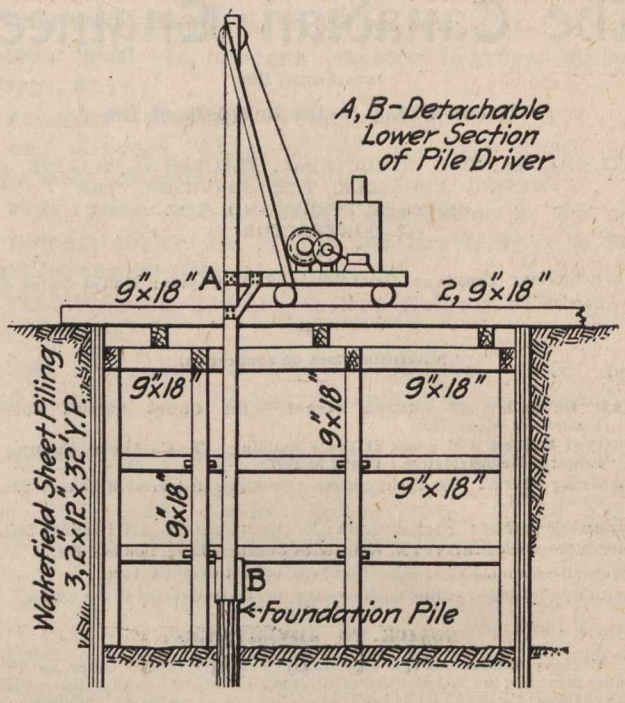
The running of the new East Chicago Canal from the inland to its junction with the Lake Michigan at Indiana Harbor, Ind., where it connects with the ore unloading slip of the Inland Steel Company's plant, makes necessary lift bridges in the tracks of all those railroads which skirt the southern lake shore on their way east. The P.R.R. is farthest from the shore of the lake with two tracks, the L.S. and M.S. with six tracks is next, the B. and O.R.R. is next with two tracks, and the C.L.S. and E.R.R. with two tracks is the one closest to Lake Michigan.

The average amount of excavation for the piers of these lift bridges is about 5,000 cubic yards for each two-track lift bridge. The work on the Lake Shore and Michigan Southern is three times as large as that of any of the other roads here, and will be considered more in detail than the other three jobs. Since three double-track bridges are to be built side by side on this job, the excavation work is obviously less in amount per double track than is the case with the other three separate jobs, which have only one double-track bridge each.

At the beginning of the work the Lake Shore people drove and jetted Wakefield sheet piling of 2 x 12 yellow pine 32 ft. long. These were so overlapped as to make three feet of piling measured horizontally for every foot of periphery around the cofferdam, which is 42 x 105 feet. One 2,000 pound drop hammer with a gang of twelve men at



an average of $2.45 per day, drove fifteen peripheral feet of the sheet piling on an average each day. Since jetting was employed the piling generally sank under the weight of the hammer, and very little driving was needed in this portion of the work. From about the middle of September until the first week in November the excavation work had been carried down 26 ft. and foundation pile-driving started. Ten men at $1.60 per day, one hoisting engineer at $3 per day, and two men at the gondola car, dumping the one-yard cylindrical buckets, constituted the gang for this work. As the work progressed onward through eight feet of dry sand, 9 x 18 in. walling pieces, with the flat sides against the sheet piles, were run at a depth of six feet below the top of the sheet piling all the way round the cofferdam. Cross bracings of 9 x 18 timbers longest dimension vertical were then strung across the cofferdam at intervals of every fifteen feet, measuring along the longest dimension and every fourteen feet along its shortest dimension. Two different lengths of these cross pieces were used, namely, 14 and 28 ft., approximately, and, as shown in the accompanying diagram, they were employed alternately or staggered. Vertical posts were set in at the junction of the longitudinal and transverse bracing as shown, and a one-half by four-inch forged angle, each leg five inches long and containing two



holes, were used in connection with eight-inch log screws to join a longitudinal or the transverse bracing, as the case may be, to the vertical uprights.

As the excavation was carried down new walling pieces were added at intervals of approximately five feet each until the full depth of 28 feet was reached. These lower walling pieces, however, were composed of two 9 x 18 in. timbers, lagged together and placed with their narrowest dimension against the sheet piling in order to gain additional strength, since the earth pressure increases at the lower depths. Beneath those points where the walling pieces and the cross bracing intercepted, vertical 8 x 16 in. timbers were lagged on, with the flat side against the sheet piling, as shown.

At a depth of about eight feet below the surface the excavation became wet, and two type B Emerson Junior pumps, 180 G.P.M., each with 4-in. suction and 3-in. discharge pipes, were hung from the upper timbers. These sufficed for unwatering the excavation down to its lowest level, 25 ft. below the water line, and during the time the foundation piles were being driven. Two other Emerson pumps were used also in the cofferdam for the smaller pier. These only weighed 250 pounds each, the superintendent said. A total of 1,200 piles were driven in the main and minor excavations, and twenty-four men, averaging $2.45 per day, with one 2,800-pound and one $2,000-pound drop hammers in 65-foot leads, drove an average of 30 piles per day, each pile approximately 45 feet long.

Mounting of the Pile Driver.

The method of mounting the pile drivers is shown in the sketch attached herewith. Two chords, 9 x 18 in. each, were lagged together, with joints staggered, and in lengths of approximately 30 feet, so as to make an 18 x 18 in. girder 60 feet long. Two of these girders spaced about 10 feet apart rested upon the transverse and vertical cross bracing of the upper tier. Across these two girders were laid two 10 in. wrought iron pipes, extra heavy, which served as rollers for the D.C.D.D. hoisting engine, which operated the drop.

Since the piles were not driven until the excavation had reached its lowest level there were, therefore, four different

(Continued on Page 40.)