corners. The caisson was leaking to a certain extent, but could be readily kept dry by means of two pumps. At this time, however, an accident happened to the boiler equipment and before it could be repaired the caisson had been filled with water to such an extent that it grounded on an uneven bottom. The result was that the caisson was seriously strained and the seams opened up to such an extent that it was found impossible to keep air in the working chamber. It was decided to remove the concrete from the caisson and tow it to St. Joseph de Levis and have permanent repairs made there during the coming winter.

In view of this accident a re-consideration of the masonry design was made by the board, with the result that it was decided, in consequence of the difficult sinking on the north side, to use two caissons for the north main pier and to use the reconstructed larger caisson for the south side, where the sinking operations would be much simpler and the material to be penetrated would be, as shown by the borings, composed mostly of sand. This entailed the abandonment of the enlargement of the south main pier and meant the sinking of a caisson south of the old pier and entirely distinct from it. It was, therefore, decided to sink this new large caisson, or caisson No. 1 as it has been designated, 65 ft. nearer the shore, or south of the existing main pier, and to sink the caissons for the north main pier the same distance towards the river, or south of the existing north main pier, thus making the span 1,800 ft.—the same as that of the original bridge. This change in the plans allowed the board to keep the centre line of the bridge coincident with that of the old structure which was a very important item, as it would avoid the large expense of changing the location of the railroads approaching both ends of the bridge.

It was found that caisson No. 1 could be satisfactorily repaired in dry-dock, and on May 28, 1911, it was floated out and towed up the river about nine miles to the site on the south side which, being exposed at low water, had been carefully levelled off. At extreme high water there is about 15 ft. of water over this prepared bed. As the caisson from its construction had a pretty deep draught, a false bottom was constructed with a view to decreasing this draught before floating into position. The result was that the caisson floated with a draught of 11 ft. and was placed in its exact position for sinking without serious difficulty.

The openings in the various shafts were then left unobstructed in order that the rise and fall of the tide would not lift the caisson from its permanent bed. This caisson was left in this position throughout the season of 1910, the work of the contractor being directed towards the sinking of the caissons on the north side of the river.

Caissons Nos. 2 and 3, for the north main pier, were constructed at Sillery on the same location as caisson No. 1, the same details of construction being followed throughout. Each of these caissons were 85 ft. long by 60 ft. wide. No. 2 was started June 15, and No. 3 on June 29th, 1911. Both these caissons reached their permanent location at El. 20.0 about October 20th, 1911.

The average rate of progress of sinking the westerly caisson (No. 2) was 0.37 ft. per day, and that of the easterly caisson (No. 3) 0.47 ft. per day. It was the original intention to sink these caissons to rock, but as the work progressed the sinking became more difficult, and finally, when the caissons had reached El. 20.0, it was considered that the foundations at this point were quite satisfactory for many times the load that the piers would be called upon to carry.

Bearing tests were made at this point to determine the supporting value of the foundation. A cube of granite 2 ft. square was placed on an average section of the bottom and over this was placed a lever composed of 2 I-beams supported on pin bearings. The short end of the I-beams was supported against the roof of the caisson. A hydraulic jack was placed to exercise a definite load at the end of the longer lever arm. A load of 59 tons per sq. ft. showed a settlement of only ⅛ in., practically no settlement at all being noticed at 20 to 30 tons. As the average working load at the foot of this pier was only 8 tons per sq. ft., it was considered that the board would not be justified in carrying the foundations to a lower level.

In the operation of sinking these caissons, the contractor met with considerable difficulty owing to large bounders fouling the cutting edge, and in several places this cutting edge was forced inward from 6 to 10 in., and, as it was feared that if the sinking was continued in the same manner this cutting edge would be further distorted and sinking operations endangered, the method of sinking was then changed so as to avoid any such contingency.

Timber blocking was placed beneath the bulkheads and at the centre of the chambers. A trench was then excavated all around and below the cutting edge and for several inches outside the exterior surface of the caisson. This trench was excavated to a depth of about 2 ft., after which it was filled with blue clay in bags and when all was ready the blocking was under-scoured with water jets and the caisson lowered on a cushion of clay. The clay tended to act as a lubricant and also prevented considerable air leakage, and as all boulders were removed from beneath the cutting edge before the caisson was lowered, all further damage to the cutting edge was prevented, and it was found that the sinking was carried on even more rapidly.

After the caisson had reached its final location the working chamber was filled with concrete composed of one part of cement, two parts of sand, and four parts of small crushed stone. This concrete was made much drier than the concrete used in the main caisson, it being found that concrete deposited under compressed air gave better results when very dry than in a more or less liquid state.

Concrete was deposited in terraces, the men working towards the centre from the sides and ends. Great care was taken to ram the concrete thoroughly round the roof timbers so that a bearing would be assured under the roof of the working chamber. After the working chamber was filled as carefully as possible by hand the shafts were filled with concrete. As a still further precaution, a rich grout was forced in through 4-in. blow pipes by compressed air under a pressure of 100 pounds per sq. in. One hundred and fifty-four bags of cement were used in grouting caisson No. 2, and 274 for caisson No. 3.

Caissons Nos. 2 and 3 were sunk with 10 ft. space between the two ends, thus making the overall length of the two caissons 180 ft., the same as No. 1. After they had been filled with concrete, the space between them was dredged by a clam-shell bucket to a depth of 25 ft. below high water, the boulders and hard sand being excavated with considerable difficulty. Shutters 40 ft. high, made of 12 x 12-in. timbers, were placed vertically against the outside walls of the adjacent caissons so as to close each end of the space between the caissons and overlap about 12 in. on their sides. The bottoms of the caissons were banked up on the outside with clay dumped in the river and covered with heavy rip-rap. The shutters were securely bolted to the caisson walls down to low-water level, and thus formed coffer dam walls enclosing this space between the caissons. This space was then filled with concrete deposited under water up to an elevation of 7 ft. below low-water mark. After the concrete was de-