

sunk by the additional expense of repairing leaks, and by the loss of time in extra pumping.

The concrete was mixed on a decked scow anchored alongside the caisson. In the centre of the scow was a pile of broken stone, and at each end a number of barrels of cement and a pile of sand, leaving a clear space on each side of the pile of broken stone. A barrel of cement being broken open, the contents were spread out in a layer five or six inches thick; an equal quantity of sand was then added, and the whole intimately mixed in the dry state with shovels and hoes. A sufficient quantity of water was then poured into the centre of the mass, which was immediately worked into a moderately thin mortar. The broken stone was then thrown in from the heap, the quantity being so regulated that each fragment of stone was completely covered with and imbedded in the mortar. The whole heap, after it was thoroughly incorporated by being turned over two or three times with shovels, was then thrown into the box which it just filled. While at one end of the scow the concrete was being mixed, at the other end it was being thrown into the box and deposited in the caisson; two gangs were thus kept constantly going and no time lost. The contractors for the whole sub-structure of these bridges were Messrs. Wm. Davis & Sons of Ottawa.

The temporary staging for the erection of the super-structure of these bridges was of the ordinary character of trestle-work, consisting for the most part of four post bents at spans of about 14 ft.; with the exception of that for the fourth span (324 ft.) of the St. Ann's bridge, it was all erected in the winter, and calls for no special description.

Owing to unforeseen delay in the shipment of the 324 ft. span from Glasgow, where it was made, the false work for it could not be erected during the time of low water in the winter. When at length the iron did arrive, further delay was caused by having to wait till all the ice had broken up and gone down the stream. In consequence the false work for this span, commenced May 5th, 1887, had to be erected when the river was at its highest and the current at its swiftest; the depth of water at the deepest point of the channel being 37 ft., and the current from 7 to 8 miles per hour at a considerable skew. Preparatory to framing the bents, accurate soundings were taken at the position of each post by means of lengths of gas-pipe steadied by lines to bow and stern of a scow, which was held in place by wire cables to the cribs described further on.

The bents were 13 ft. apart; those under panel points, i.e., every alternate bent, had five posts each; the intermediates three each. They were framed on a large scow lying alongside the upper canal pier. Before sending any of them down to their place, two small but heavy cribs, about twelve feet square in plan and six or eight feet high, were framed, loaded with stone, and sunk in the stream some four or five hundred feet above the bridge. In addition to these anchor cribs, two tugs were employed during the greater part of the time that this span of false work was in course of erection. As each bent was framed, the scow carrying it was lowered down stream into position, escorted by a tug, and steadied by wire cables to the anchor cribs. On reaching the site the lines to the cribs were made fast and the scow firmly held. The bent was then raised with suitable tackle by two small engines, one on top of each of piers 3 and 4, wire cables having first been made fast to the feet of the posts and carried up to the anchor cribs. As the posts in the channel bents were from 65 to 70 ft. long, the current from 7 to 8 miles per hour and the water 30 ft. deep, as has been said, it will readily be seen that the difficulties to be overcome in the construction of this temporary staging were of no ordinary character. In one or two instances the posts, upon feeling the force of the current, began to swing, the bracing gave way, and the whole bent had to be dropped into the stream to save the scow from being broken to pieces by the lashing backwards and forwards of the posts as the motion increased. A tug was then despatched to pick up the posts and tow them up the canal to be re-framed.

Immediately upon each bent reaching a vertical position, it was promptly steadied from the water line to the tops of the posts, a height of about 30 ft., by braces and waling pieces of 6 ins. x 10 ins. stuff bolted and spiked to the last preceding bent. Owing to the utter impossibility of ascertaining to a few inches the exact depth of water in which each post would stand, the braces and caps were all double, and attached to the bent by bolts passing through them but not through the posts, thus leaving the latter free to move up and down to a small extent