# COMMENTS ON CONSTRUCTION OF LOCK AND DAM AT TROY, NEW YORK*

By Maj. Gen. W. M. Black
Chief of Engineers

IT is rare that any extensive work of engineering construction does not afford opportunity for the exercise of originality either in adapting conventional methods to the local conditions or in actually improving on common practice. The Troy lock and dam was no exception to this rule and departures from ordinary practice were made in all stages of its construction. Some were necessitated to meet conditions while others were deemed improvements.

Upon tearing out the old crib dam built in 1823, tests were made of the spruce timbers therein which had been submerged nearly a century. Under test they developed a tensile strength of from 7,000 pounds to 12,000 pounds per square inch. This compares very favorably with a normal tensile strength of 10,000 pounds per square inch as noted in Trautwine.

## Modified "Maine" Cofferdam

One style of cofferdam used consisted of a row of flattened cylindrical chambers, or shells of steel piling, the cylinders being placed side by side with the piles of one locking into those adjacent. The cylinders were driven in water from 12 to 24 feet deep and the largest one was about 40 feet across and 40 feet in height. They were filled with sand and gravel dredged from the river, this material being used to provide stability and water tightness. Although high in first cost, the same piles were used for other cofferdams thereby greatly reducing the cost, especially as the piles were sold for a considerable sum on completion of the construction. The sand and gravel filling of one cofferdam was used to a great extent for the next cofferdam, much of the surplus being used in making concrete. This style of cofferdam was quite similar to the cofferdam of the Black Rock lock at Buffalo, N.Y. In its use care must be taken to place the filling materials progressively in adjacent cylinder pockets. If one cylinder be filled too much in advance of its adjacent cylinder distortion of the partition walls will result. Later it was found that the type could be modified and its cost reduced, by using cylinders of the kind used in the Maine cofferdam at Havanna combined with straight lines of interlocking steel sheet piling. Instead of the cylinders being placed closely together as at Havana, they were spaced a considerable distance apart with a single line of interlocking steel sheet piling between them. This piling was reinforced by both an exterior and interior sand and gravel fill. The cylinders acted as anchors for the lines of piling at corners and along the sides. The piling prevented any cutting out of the earth fills by overflow as well as increasing the tightness of the dam. Sluice ways closed by sliding gates were placed in each cofferdam to admit of flooding the coffer when desirable without interior wash, as happens when the water is allowed to flood over the top of the dam.

For construction of the lock, two small derricks of special pattern were devised. They were made narrow so as to pass each other but had a long reach, so as to cover the wide foundations and the considerable height of walls. This reach was obtained by using an overhanging arm built up of channel irons. The width of the derrick frame is 10 feet and its length 24 feet; the mast is 24 feet high, the boom is 40 feet and the outward overhanging arm has a reach of 16 feet. Owing to the narrow base of the derrick, ampler counter weights of sand and gravel had to be used, and in lifting weights on a low boom a portable guy was strung from the top of the mast.

## Emergency Dam

The emergency dam to shut out the river in case of accidents happening or repairs becoming necessary was of rather unusual size, the depth from the top of the walls to the sill being 26 feet. This dam is of the Boulé gate type consisting of three large steel trestles which, when not in use, are turned down on hinges, the tops extending into recesses in walls. The trestles are spaced over 11 feet apart, and a series of steel gates, each about 5 feet high and with small wheels on the back, are placed in front of them and roll down or up as the dam is closed or opened, being handled by means of chains.

To prevent wall scarring by the boats, vertical strips or fenders of cast iron with rounded fronts projecting two inches from the concrete, were used with success. These strips were placed in short lengths and bolted to the walls, the bolt heads being countersunk. The top edges of the lock faces of the walls were also provided with quarter round cast iron strips or nosings to prevent mooring lines from cutting into the concrete.

Between the vertical fenders there are occasional line hooks to be used by boats for mooring when locking through. These have proved very useful at the Troy lock, as the boatmen can attend to their own lines without the help of lock tenders. These hooks are so designed that they hold the bight of a rope against a downward or horizontal pull but instantly release it when the pull is upward. The hooks are in recess to engage rope easily.

Another convenience in the locks are ladders placed in recesses at intervals along the wall. The tops of the ladders are placed so that a man can pass easily and safely from the top of wall to the ladder, and the reverse, yet the top of wall presents a smooth, unbroken surface for the movement of the lock attendants and for handling lines. All the accessory iron work of the lock is so designed and set that the broken parts can be renewed without disturbing the concrete.

## Wall Construction

Mention might be made of the fact that the tops of the walls were brought to grade and surfaced with wooden floats giving a safe footing. The use of steel floats for surfacing concrete was forbidden since such floats bring an access of cement to the surface which, after a short time, develop a net of unsightly hair cracks.

The upper guide wall is used to protect boats from the effect of cross currents. As a cofferdam would have been very expensive for the 18-foot depth of water and the small amount of masonry involved, the wall was made in a series of isolated piers 10 feet wide with spaces of 10 feet between and with a continuous top above the water line. For laying the piers bottomless reinforced concrete cribs built in the dry were lowered in place after the river bed had been dredged and levelled with bags of concrete. Vertical reinforcing rods were placed through the interiors of these cribs which were then filled with concrete delivered through a tremie. This construction insured a hard and compact surface for the guide wall. The imperfections of the interior concrete fill placed in tht water are thus made of no moment.

*From Professional Memoirs, Corps of Engineers, United States Army, and Engineer Department At Large. See also *The Canadian Engineer*, December 14th, 1916, "Laying Concrete in Freezing Weather; Troy Lock and Dam."