

bars, with a gang of thirty or forty men hauling at the ropes. All this force was frequently found ineffective. The strain required being usually from two to three times the weight of the stone. The cause of this lay in the air pressure which amounted not only to the fifteen pounds of atmospheric pressure but the caisson pressure in addition, the whole being effective by reason of the water tight clay in which the stone was embedded. As soon as the boulder was loosened in its bed to a slight extent, it soon followed. These hauling arrangements were replaced after a time by three of Dudgeon's Hydraulic pulling jacks, two of ten tons and one of fifteen tons capacity. This proved to be a very effective instrument. They were usually attached to heavy screw bolts let into the roof of the caisson and formed part of a chain leading to the stone. Many boulders, however, resisted the united efforts of all three jacks.

The removal of the hard earth could be effected at the beginning only by the use of steel-pointed crow-bars driven in with sledge hammers. Under water the blow of a pick has but little effect. The long handled, round pointed shovel answered best for lifting the material out of water into wheelbarrows.

After the caisson had been lowered about two feet it became possible to build dams around the trenches under the frames and bail out the water. This enabled us to see the work at hand, and materially lightened the labor attending it. These dams were shifted from trench to trench, care being taken always to leave an open trench leading to the water shaft.

The removal of the water from the trenches was accomplished partly by hand-bailing, then by air syphon pumps and steam syphon pumps, and finally by the compressed air itself, throwing it entirely outside of the caisson through pipes introduced through the timber and masonry.

To work the air syphon a complete system of one and a-half inch pipes was placed in the caisson with suitable connection. Through this pipe air was introduced under a pressure of sixty pounds, one of the main air pumps being set apart for that purpose. The pump was constructed on the principle of a Giffard injector, and as the duty required