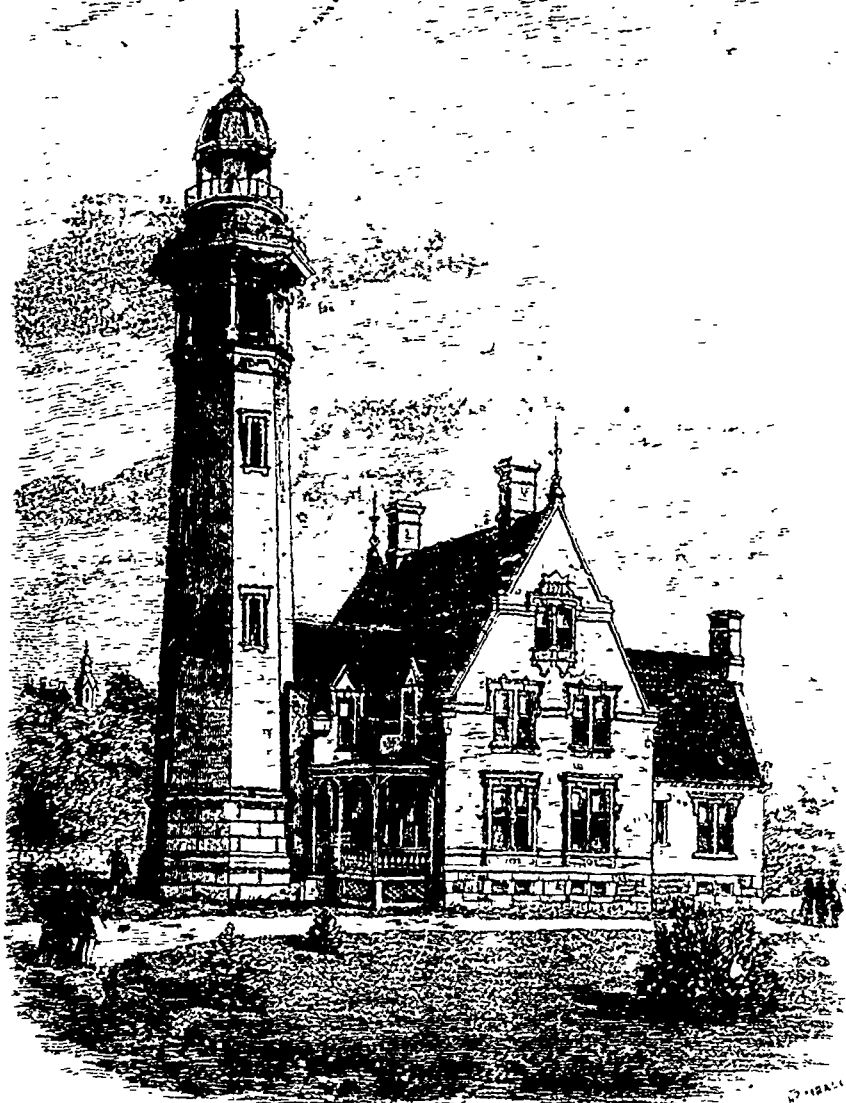


night. This mortar was composed of equal parts of Portland cement and screened siliceous sand. Specimens of it obtained the following spring, after being in place under water for seven months, were quite as hard or harder than either the bed rock or the stone used in building the tower.

The weather having now become very boisterous, with frequent snow squalls, often interrupting the work, and the settling of any additional stone requiring the removal of a portion of the most important of the interior braces of the cofferdam, it was deemed prudent to close the work for the season. This, too, would give ample time for the hardening of the mortar used in bedding the stone, and in the concrete used for filling cavities in the bed rock, as well as the space between the outside of the first course and the cofferdam (which was solidly filled with concrete to the top of the first course). Therefore the cofferdam was allowed to fill with water, the process being hastened by boring holes through it to admit the water, and it was secured to prevent its being lifted by the ice during the winter. The machinery was laid up, and on the last of October all the working force, except two men, were removed. These two men were left to attend to the fourth order light, which had been established on top of the men's quarters, and the fog signal, consisting of a whistle attached to one of the steam boilers. At the close of navigation they were taken off the pier by the lighthouse tender Haze.

The degree of success of this novel cofferdam may be inferred from the fact that although prepared with pumps of an aggregate capacity of 5000 gallons per minute, not more than a capacity of 700 gallons was used, except when emptying the cofferdam, and then only to expedite the work. Once emptied, a small proportion of this capacity was ample to keep the cofferdam free from water, and this at a depth of 12 ft. of water, on rock, at a distance of nearly 11 miles from the nearest land. Every person connected with the work may well feel a just pride in its success. All the stone which had been delivered at the harbour, consisting of the first five courses (each course 2 ft. thick), having been cut by this time, the work there was also closed.

The season opened a month later in 1872 than in 1871, consequently work was not resumed at the harbour until the 3rd of May, and upon the reef on the 28th of the same month. On the 13th of May the ice in the cofferdam was still a compact mass, of some feet in thickness. Masses of ice still lay on top of the pier itself. As soon as anything could be done, the ice still remaining was cleared out of the cofferdam, the machinery put in order, the braces removed from the interior of the cofferdam, and the work of setting additional courses begun. This has continued without interruption to the present time, when the masonry is well above the water, and going on at such a rate that one entire course is set, drilled, and bolted complete every three days. If this continues, the tower will



LIGHTHOUSE AT CLEVELAND, OHIO, LAKE ERIE.

have reached a height of at least 40 ft. above the lake level before the close of the season.

It is greatly to be regretted that in a work of such difficulty and importance it was not found practicable to use granite. The first contractor to furnish stone agreed to supply granite from a quarry at Duluth, Minnesota. After a trifling effort to quarry the stone, he utterly failed, and he abandoned the contract. It was then so late in the season that the engineer was compelled either to stop operations or to go into the open market and purchase such stone as he could get. The best available was the Marblehead limestone from the vicinity of Sandusky, Ohio, and this was used. In February, 1872, proposals for the remaining stone were received, and of these the