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A STEAM SUPPLY FROM COMBINED LOCOMOTIVES.

Some time ago the Ohio Steel Company, of Youngstown, O., not being able to generate sufficient steam with the boilers already constructed, and not wishing to wait for the completion of those in course of erection, obtained six locomotives from the N. Y., L. E. & W. RR. Co.'s round house, and, placing them side by side at the rear of the enginehouse, connected them up as shown in our illustrations.

Each locomotive supplies steam to the extent of 100 horse power, the aggregate being 600 horse power.

Our engravings are from photographs specially taken for the SCIENTIFIC AMERICAN by Mr. James J. Dalzell, of Youngstown. In our SUPPLEMENT of this week we give a number of illustrations of the works of the Ohio Steel Company, which, we believe, is now the second largest establishment of the kind in this country.

Recent Tests of Position Finders.

An interesting series of tests of the position finders of Lieutenant Bradley A. Fiske, U. S. N., and Lieutenant I. N. Lewis, Second Artillery, occurred at Fort Hamilton on Tuesday, June 25, 1895, before members of the board appointed by the Ordnance Department. Broadly speaking, the work of the position finder is to plot upon a chart the position of objects both at rest and in motion, and the test undertaken by the board consisted in making estimates by the use of these instruments of the range and direction of various objects and comparing them with a known standard. The modern fort does not consist of a single inclosure, but is rather a series of isolated small forts and batteries. Many of the guns which are mounted in these forts and batteries are disappearing and are only raised at the moment of firing; and in the mortar batteries, as at Sandy Hook, the mortars are entirely concealed, being below the level of the ground, yet with the aid of position finders, which may be a mile away, it is possible for both the guns and mortars to put 45 per cent. of hits on the deck of an imaginary iron-clad, at ranges of from 3,000 yards to several miles. The object of the position finder is not only to assist in aiming one gun or a set of guns, but is intended to place within the power of the commanding officer of the fort the control of all of the variously disposed batteries in the fort. With his own position finder he ascertains the location of a certain group of ships and sees what batteries may be trained upon it. He then telegraphs to the batteries the position and distance he has determined, and they direct their fire accordingly, following the ships with their own posi-

tion finders. If the guns were not of the disappearing type, they would need only a range finder, as non-disappearing guns can point directly at the target, using the ordinary gun sight. We have described the Fiske range and position finders in detail in the SCIENTIFIC AMERICAN SUPPLEMENTS, 788, 769 and 805. In brief, the new position finder may be said to be a

the circuit is balanced; the pointer arm moves over a chart representing the area, which includes the position of the distant object on a reduced scale. On this chart there is a simple pivoted arm which can be trained directly on the object; the arm may be mechanically controlled by a telescope directed upon the object, so that it will make with the other arm an

angle equal to that made by the lines of sight drawn from the two telescopes to the object. The position of the object is then shown by the intersection of the electrically directed pointer and the mechanically directed arm upon the chart. The horizontal base line is used in Lieutenant Fiske's instrument and a vertical base line in that of Lieutenant Lewis; the test was in no sense a competitive one, as the conditions under which the two systems are expected to work are very different. The Lewis instrument is available for high elevations and is simpler than the Fiske apparatus. One of the great advantages of the Lewis instrument is that it can be used with a vertical as well as a horizontal base, and in that case a 50 foot base would be sufficient.

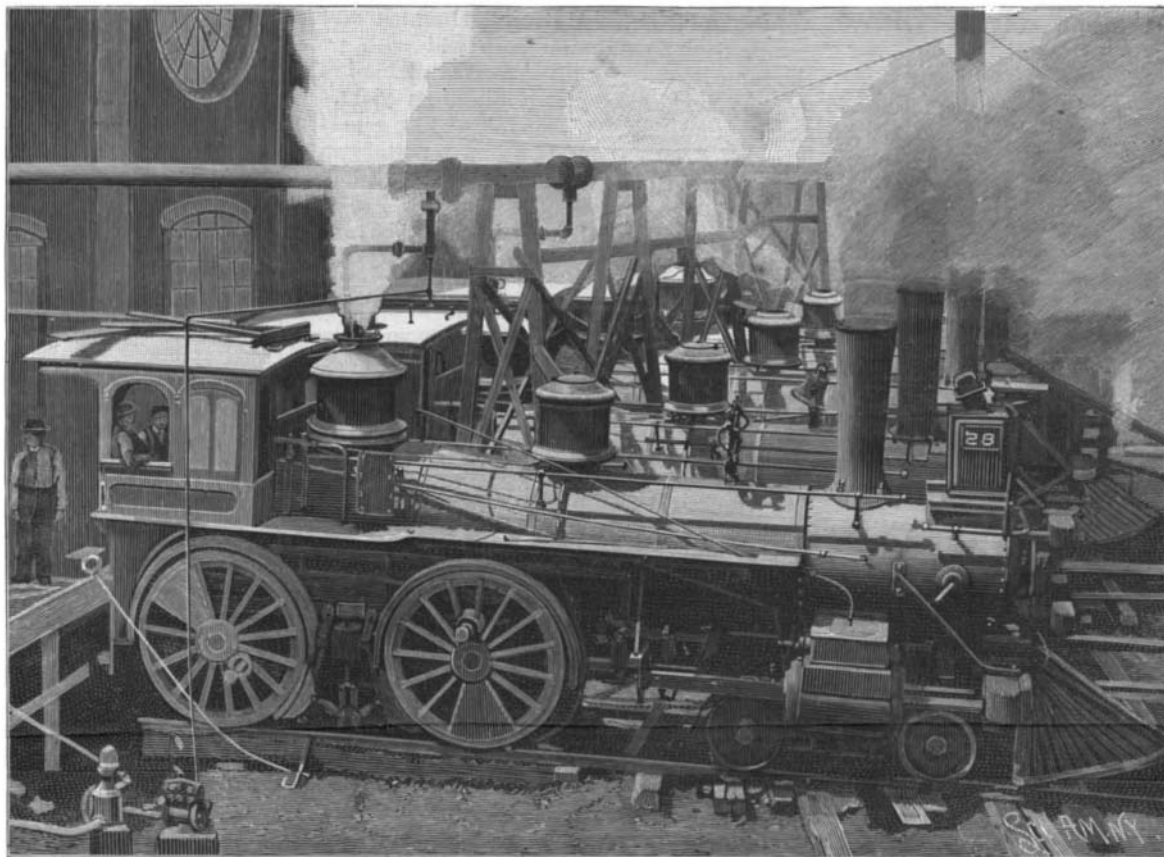
Two temporary conning towers were erected on the north and south parapets of the fort, from which they commanded the whole lower bay, and in these the Board met for the tests.

In each tower one of the telescopes of the position finder had been set up. The standard adopted for the purpose of comparison was furnished by a set of triangulating instruments, one of which was at Fort Wadsworth, on the Staten Island side of the Narrows, and the other at Fort Hamilton, the operators being connected by telephone.

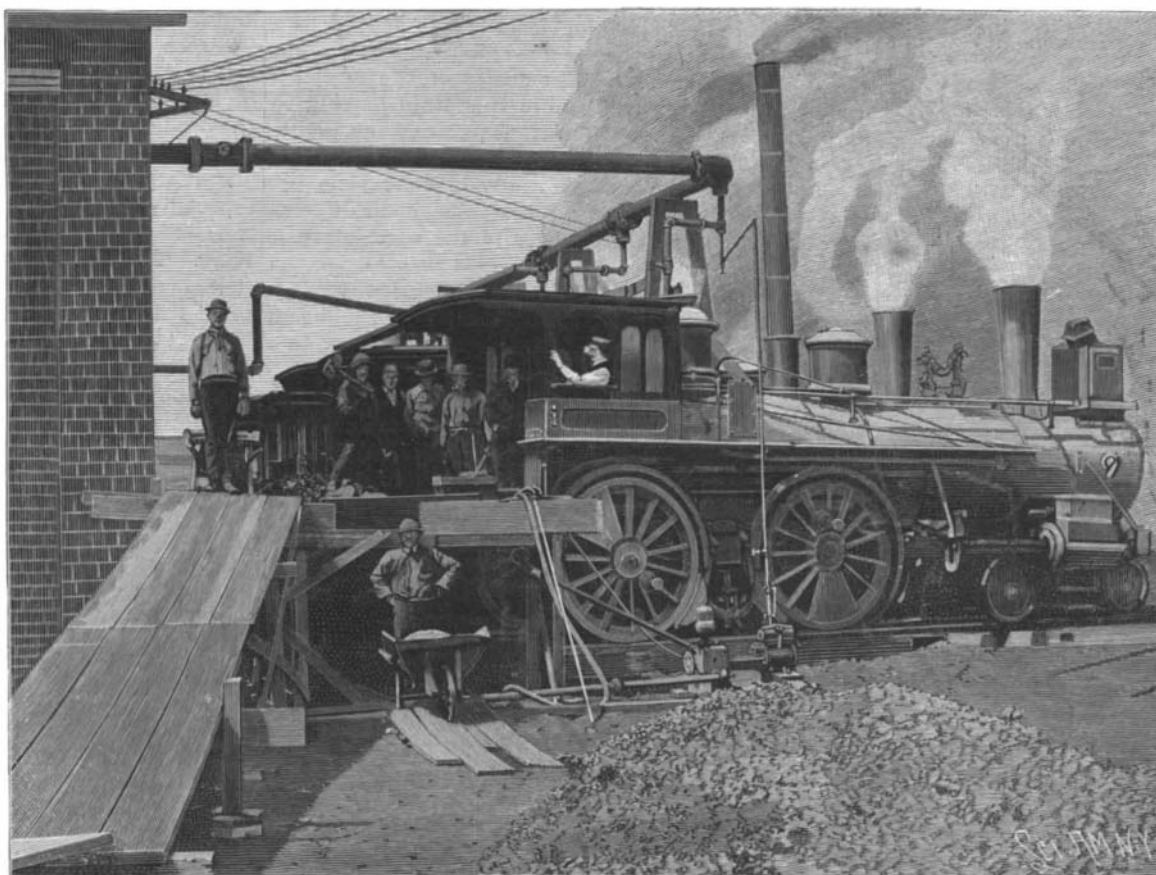
Observations were made upon a stationary point, the Coney Island lighthouse being used. Other observations were taken on Hoffman and Swinburne Islands and other points of known distance with excellent results. Then a series of observations were taken on schooners and other passing craft, and afterward compared with ranges taken with a transit. In every case the Fiske position finder showed an error of much less than one per cent. for each thousand yards of range, which is the standard required by both the United States and English governments. A series of tests of the Lewis depression position finder was also made with very satisfactory results.

The Electrical Industry.

The electrical industry, according to the Electrical Review, is about 17 years old and employs over \$1,000,000,000 of invested capital. The greater part of this immense investment has been made since 1888, when the electric motor was proved to be a success.



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