Submarine Torpedo Boats.

On this subject Mr. Nordenfelt lately read an interesting paper before the Royal Service Institution, London, from which we take the following points relating to his new submarine boat, illustrated in the SCIENTIFIC AMERICAN of November 7, 1885.

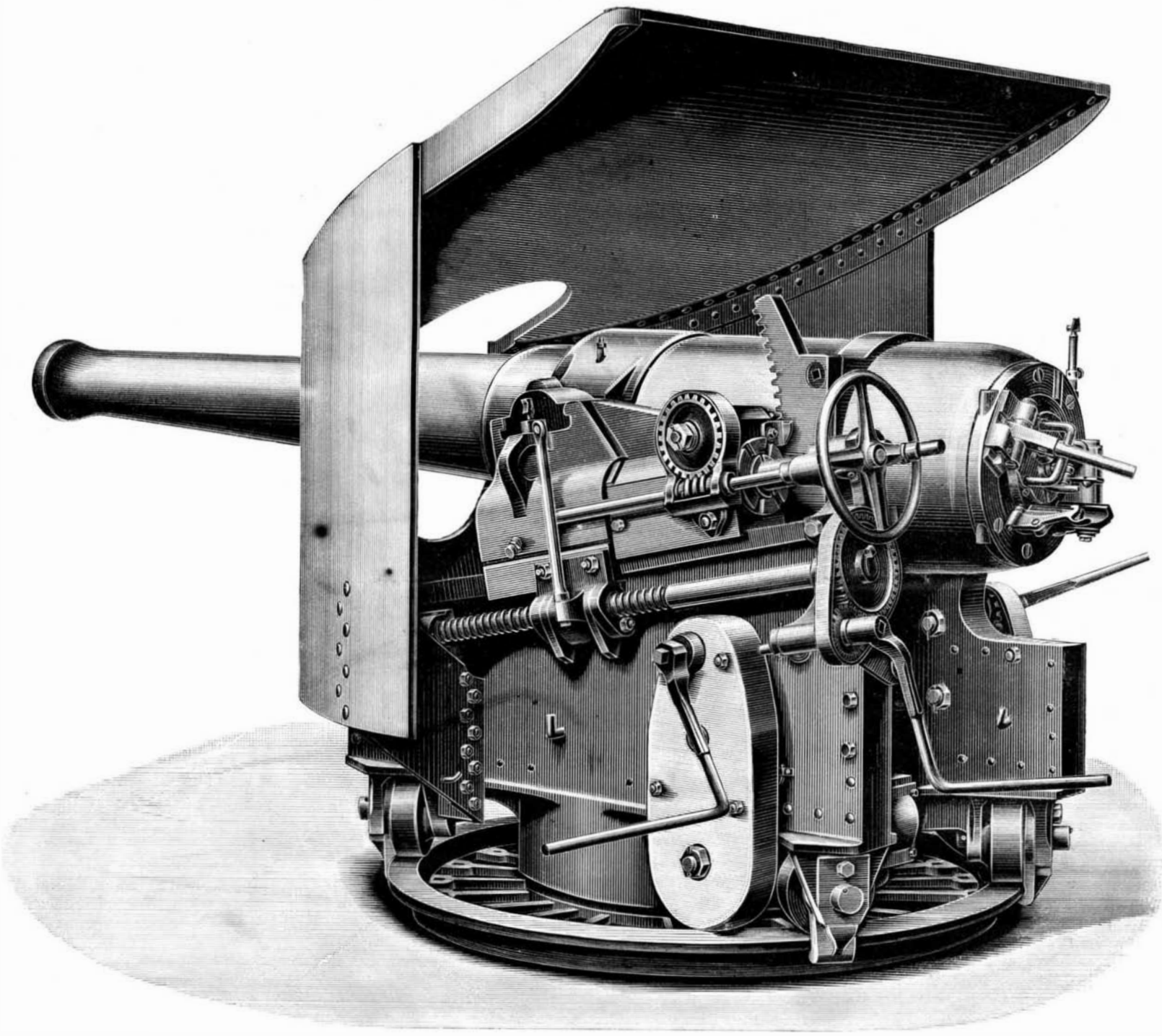
This fast boat was 64 feet long, 9 feet beam, over sponson 12 feet, with 60 tons displacement, and 100 horse power engines. Speed, 9 knots, capable of going 150 miles without recoaling. It carried a fish torpedo outside, to be discharged mechanically. It is intended to run on the surface, but blowing its smoke out under water, till it nears an enemy, when it descends and moves "awash," with a cupola alone above water. When this is liable to be seen, she descends altogether under water by means of propellers. The vessel is kept in the horizontal position longitudinally by means of rudders in the bow, which by the action of a plumb weight bring the boat back to this position should anything suddenly make her leave it.

Three features are specially emphasized by Nordenfelt: (1) The employment of heated water to give off steam as an unfailing reservoir of energy. (2) The submersion of the boat by mechanical means, which is much safer than depending on specific gravity, because practically the density of water alters so slowly with the depth that a vessel that descends below the surface may descend to a great depth. The horizontal position protects the boat from dangerous impetus downward, and the mere cessation of working the special propellers causes the boat to rise. (3) The use of rudders to keep the vessel always horizontal. There is no difficulty as to sufficiency of air and heat. After fourteen miles run, when the crew had been inclosed for three hours, the temperature was only 32° C., or 90° F., and a tallow candle even on the floor burnt without visible diminution. The turtle back of the boat can be protected against machine or quick-firing guns by an inch steel plate, but it is so oblique to the direction of fire that it would, Mr. Nordenfelt believes, resist it without. When "awash," the water would protect the vessel. Two Whitehead fish torpedoes are carried, but more is expected from an electrical controlled torpedo, which would push in any protecting netting, and would fire 300 pounds of dynamite. There is a quick-firing 2-pounder for use against torpedo boats if necessary. Finally, Mr. Nordenfelt prognosticated the employment of such boats in the defense of channels all over the world, declaring them to be most sober, business-like affairs, although they might be suggestive of the conceptions of Jules Verne.

It may be well for our naval people and Congressmen to consider the points here given before they waste millions of dollars upon great hulks for a new navy.

TEN INCH BREECH LOADING NAVAL GUN.

Our illustration, which is from *Engineering*, shows a ten inch breech loader with Vavasseur carriage, complete with all the latest appliances for rapid firing and quick change in the direction of the cannon. When we compare one of these guns, with all their attachments of levers, cog wheels, screw gears, etc., with the simple great guns of twenty-five years ago, it will be seen that mechanical ingenuity has greatly advanced; probably the efficiency of the gun itself has been correspondingly improved. In a future number we intend to refer to the subject again.



TEN INCH BREECH LOADER GUN WITH VAVASSEUR CARRIAGE.

Sinking Tubular Foundations with Dynamite.

Le Genie Civil, in describing the construction of the Palma bridge over the Guadalquivir River in Spain, notes the use of explosives in sinking several of the tubular piers.

Work was commenced in the spring of 1884 upon the foundations, and compressed air was employed on the first pier, which was made up of two cast iron columns, each 8 feet in diameter. But progress was interfered with by frequent rises in the river to the extent of 16 to 18 feet, and by the fact that the depth to hard bottom was only about 34 feet below the water surface, and the heavy counterweight thus required to overcome the lifting effect of the compressed air was awkward to handle under the controlling conditions.

M. Jardin, the engineer in charge, finding it impracticable to increase the weight, conceived the idea of employing dynamite as an aid in sinking his piers. His method was as follows: The cylinder being cleaned out and all made ready for a "sink," holes were bored horizontally out under the cutting edge, and cartridges of dynamite inserted. Wanting electrical apparatus, the firing was done by fuse cut to a length sufficient to permit the men to escape from the cylinder, which was filled with water before firing. The simultaneous explosion of the cartridges produced the intended effect, and the process was repeated until the desired point was reached.

M. Jardin claims that this method may be applied without danger, provided that the cartridges are placed as far as possible away from the cylinder, which would otherwise be broken. The effect upon the soil was comparable to a light earthquake shock, at times accompanied by jets of water thrown up around the pier; but more frequently, with depths of 27 to 30 feet of earth, the gases of explosion escaped into the interior of the tube without making any outside demonstrations.

THE CATHEDRAL OF GRANADA.

A good idea of the architectural beauties presented by some of the old Spanish churches may be gathered from an examination of the picture of the Perdon entrance or doorway of the Cathedral of Granada, herewith presented, and for which we are indebted to *La Ilustracion Espanola*. The first stone of this great edifice was laid March 15, 1529, with solemn ceremonies. The architect was Diego de Syloe; he died long before the completion of his great work. Over a hundred years elapsed before it was finished.

We have in this design the variety and profusion of adornments which are so characteristic of the Renaissance. The elegant arches adorned with the richest mouldings; the figures of Justice and Faith, which sustain a Latin inscription, written by the confessor of Queen Isabella; the airy columns that rise at the sides, girdled with floral wreaths and crowned with capitals at whose corners appear little faces from between thistle leaves; the magnificent frieze and the shaded cornice of its entablature; the grand shield of arms carved on the two salient pillars; the delicate proportions of the second division, which give character to the figures of Moses, of David, and the Eternal Father—all that Syloe left complete—contribute to render this work one of the most faultless creations of ornamental architecture.