# SCIENTIFIC AMERICAN

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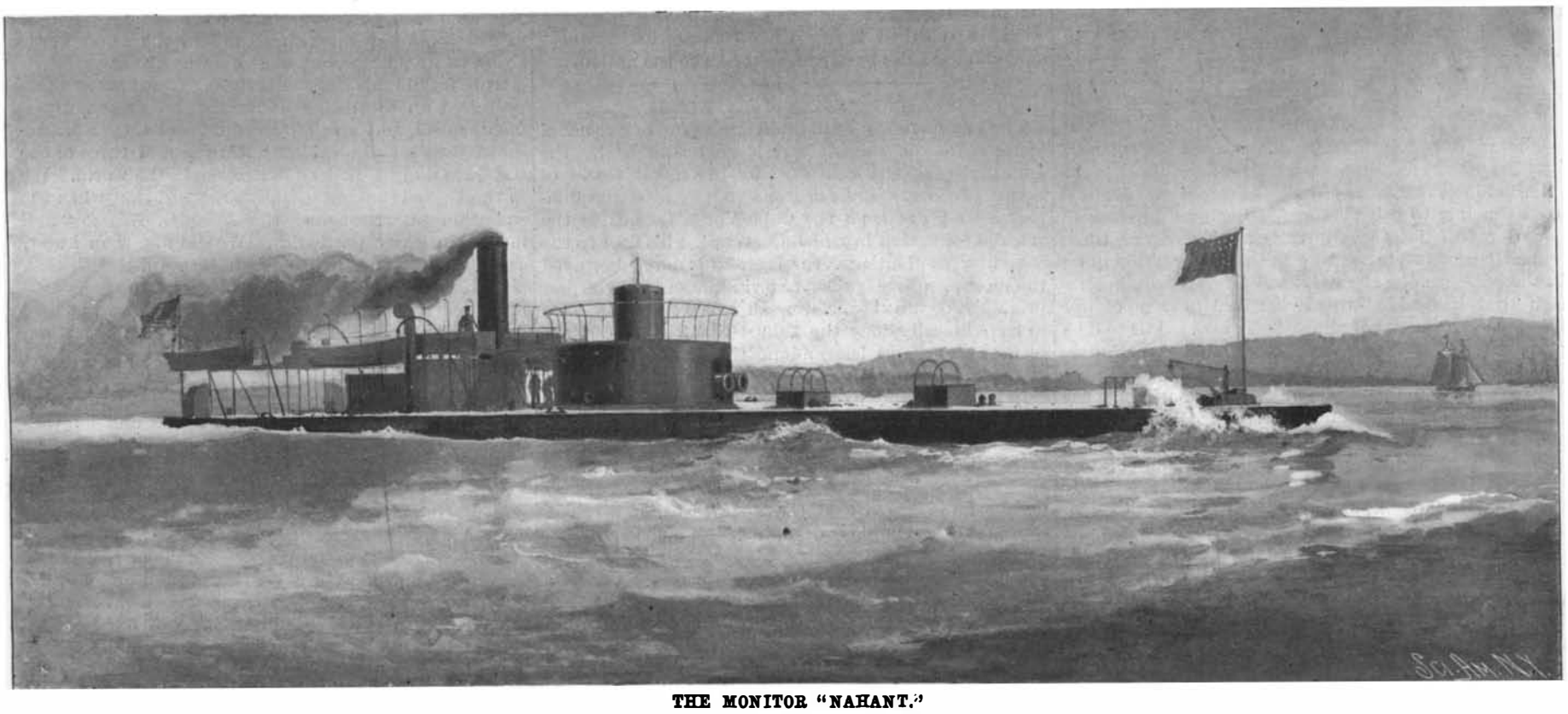
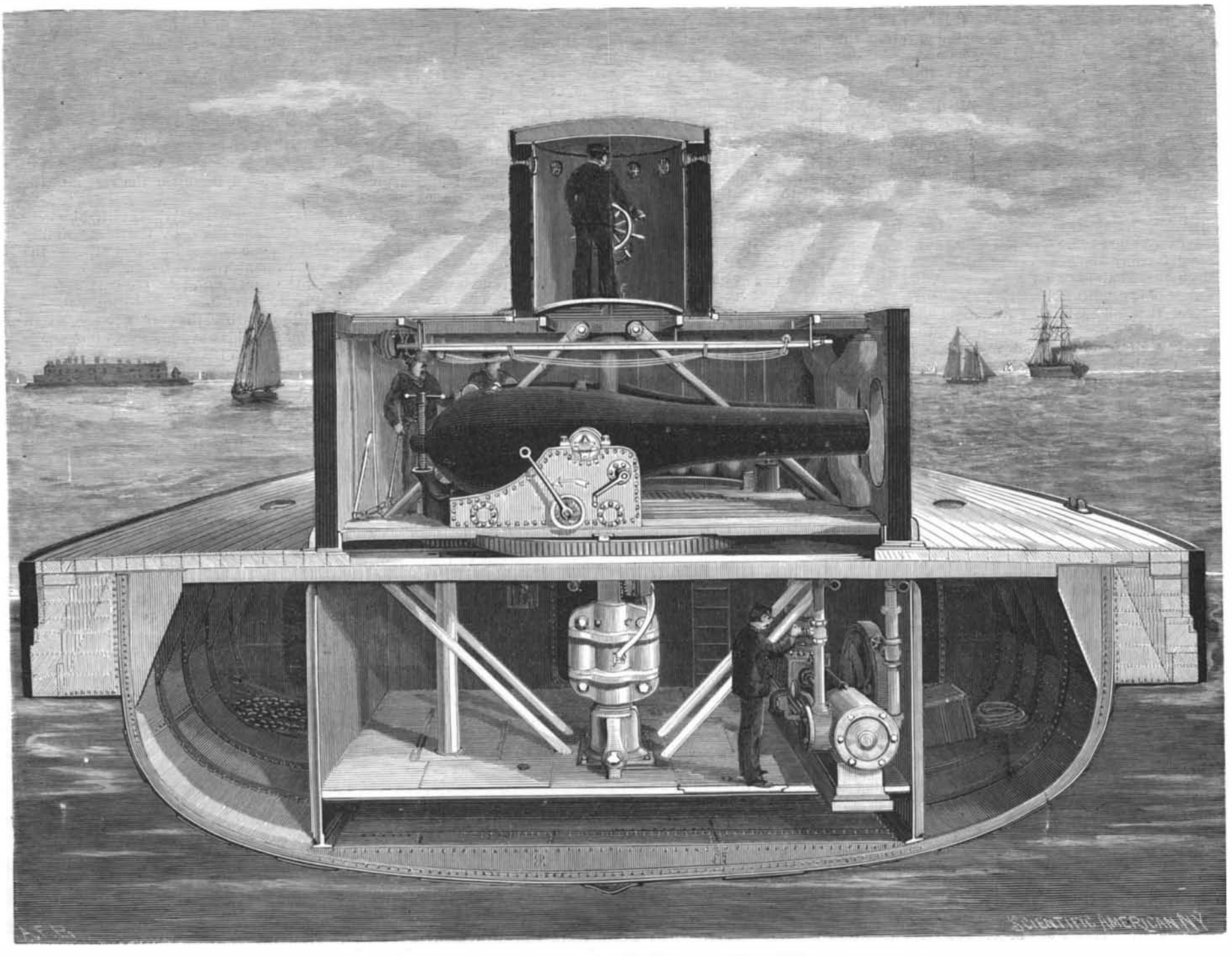


**THE MONITOR "NAHANT."**

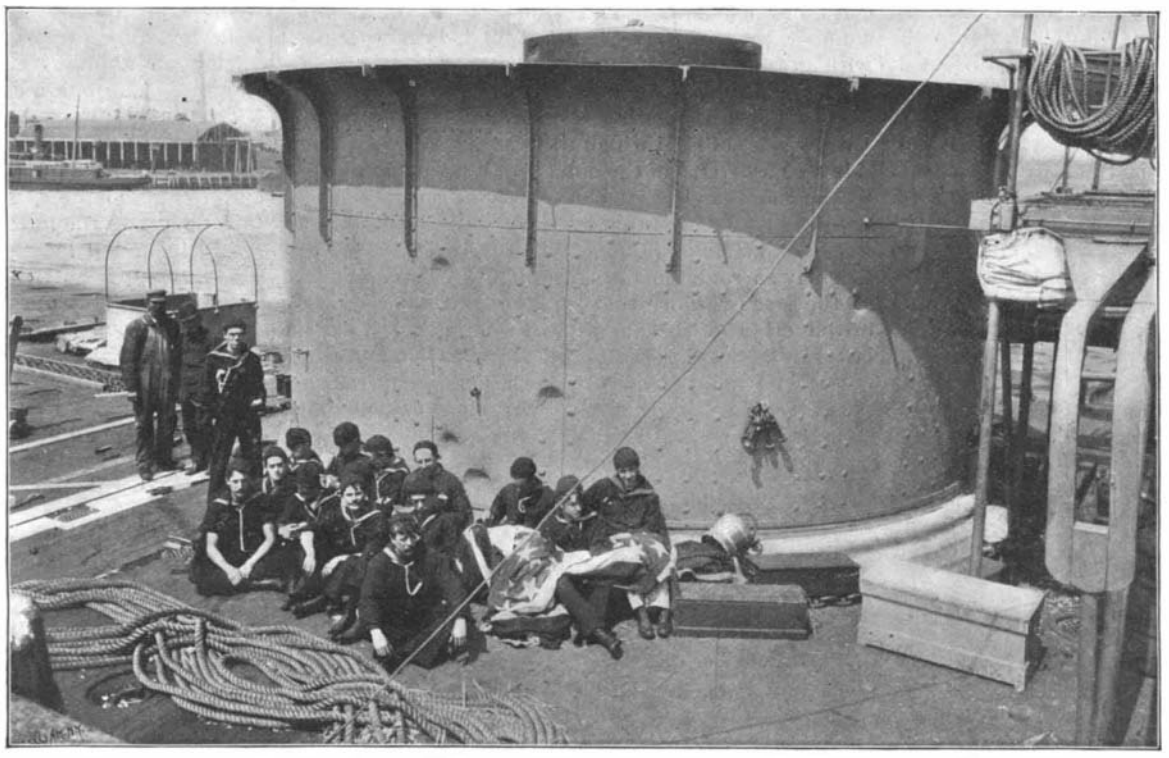
DISPLACEMENT, 1,875 tons. SPEED, 5½ knots. ARMOR: Sides, 5 inches iron; turret, 11 inches iron. ARMAMENT: Two 15-inch smooth-bores, two small rapid-fire guns. AUTHORIZED April 16, 1862.



**TRANSVERSE SECTION THROUGH MONITOR "NAHANT" AT THE TURRET.**—[See page 104.]

## ERICSSON'S COAST-DEFENSE MONITOR "NAHANT."

The old coast-defense monitor "Nahant," which has been doing duty during the war as one of the guardians of New York Harbor, is one of the most interesting legacies of the civil war. Her shot-indented turrets alone entitle her to "honorable mention," and it is no small tribute to the merit of her design and the excellent work that was put into the vessel by her constructors that now, after being afloat for nearly forty years, she should be capable of making the deep sea voyage from the Delaware to New York and taking an active part in the defense of the harbor. Historically, it would be impossible to find a vessel, much less a whole group of vessels, which, in this present age of warship construction, is entitled to more profound respect than the "Nahant" and the other twelve ships of the class to which she belongs.

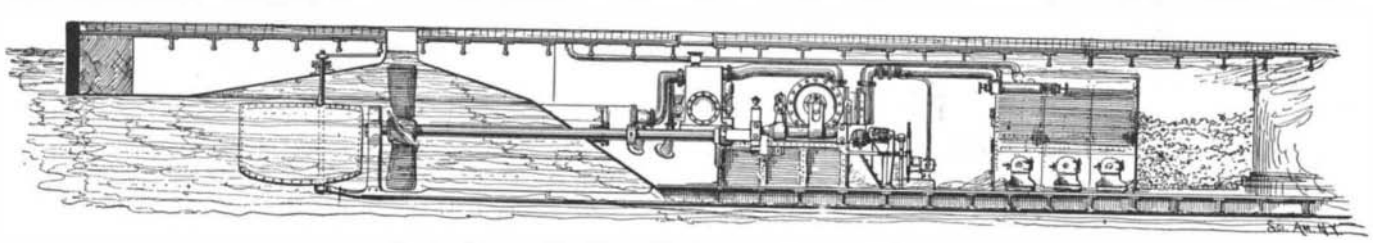


TURRET OF THE "NAHANT," SHOWING SHOT HOLES RECEIVED DURING BOMBARDMENTS OF THE CIVIL WAR.

The story of the "Merrimac" and the "Monitor" is too familiar to bear repetition here; it must suffice to say that to oppose the formidable powers of the Confederate ship "Merrimac" demanded something entirely different from the wooden frigates that were then doing duty in the South. To Ericsson was intrusted the task of building a war vessel that could oppose armor to armor, heavy gun to heavy gun, and overmatch the novel and greatly dreaded craft in a square stand-up fight upon the sea. The "Monitor" was built, hurried to Hampton Roads, and met and checked the "Merrimac" while the latter was in the very act of sinking the unarmored Northern vessels. The "Monitor" marked the decisive turning point in the construction of modern warships. We say this with full knowledge that armored vessels had been already used in the Crimean war, and that Capt. Cowles, of the English navy, had already written a treatise explaining his device for "mounting heavy guns in a revolving, armored, circular turret." Full credit is to be given both to the French and English in this respect, and even greater credit to our own Mr. Stevens, who, at an even earlier date, as far back as 1841 and 1853, had recommended and commenced the construction of an armored floating battery at New York. These earlier designs foreshadowed the coming change, and "La Gloire," of the French navy, was already afloat with a full suit of armor upon her sides; but to Ericsson's "Monitor" is due the credit of being the first war vessel in commission to combine side armor, the armored revolving turret, the armored conning tower, and engines below the water line.

Within a month after the eventful duel in Hampton Roads Congress had authorized the construction of thirteen single turret monitors. The keels were at once laid and the whole fleet was rushed to completion in time to take a very active part in the subsequent operations of the war. Eight of the monitors, including the "Nahant," were of 1,875 tons displacement and the other five were given larger dimensions, being 25 feet longer, of 2 feet 4 inches less beam, 2 feet greater draught, and half a knot more speed, with a displacement of 2,100 tons.

The leading dimensions of the "Nahant" and her class are as follows: Length, 200 feet; beam, 46 feet; draught, 11 feet 6 inches; indicated horse power, 340; speed, 5½ knots. The battery consisted originally of two 15-inch smooth-bores, but for her duties in the present war a pair of 6-pounder rapid-fire guns were added on the bridge deck, astern of the turret. The total cost of the hull and machinery was $413,575, and she was constructed by Harrison Loring, at Boston, Mass. In her general design she is very similar to the original "Monitor," and the description, "a cheese-box on a raft," fairly well describes her appearance when stripped for action. By referring to the transverse section through the turret and the longitudinal section, it will be seen that the vessel consists of a shallow hull within an inclosing raft-like structure of solid timber. The "raft" projects several feet from the hull proper along the sides, and has a great overhang fore and aft. It is formed of solid timber closely packed and securely bolted to the hull. The sides of the raft are protected for its whole depth with five 1-inch iron plates, three of the plates extending the full depth (6 feet) of the raft and the others extending to various depths, so as to present a tapering thickness of protection. The raft performs the duty of protecting the hull from shot and from the ram of the enemy.

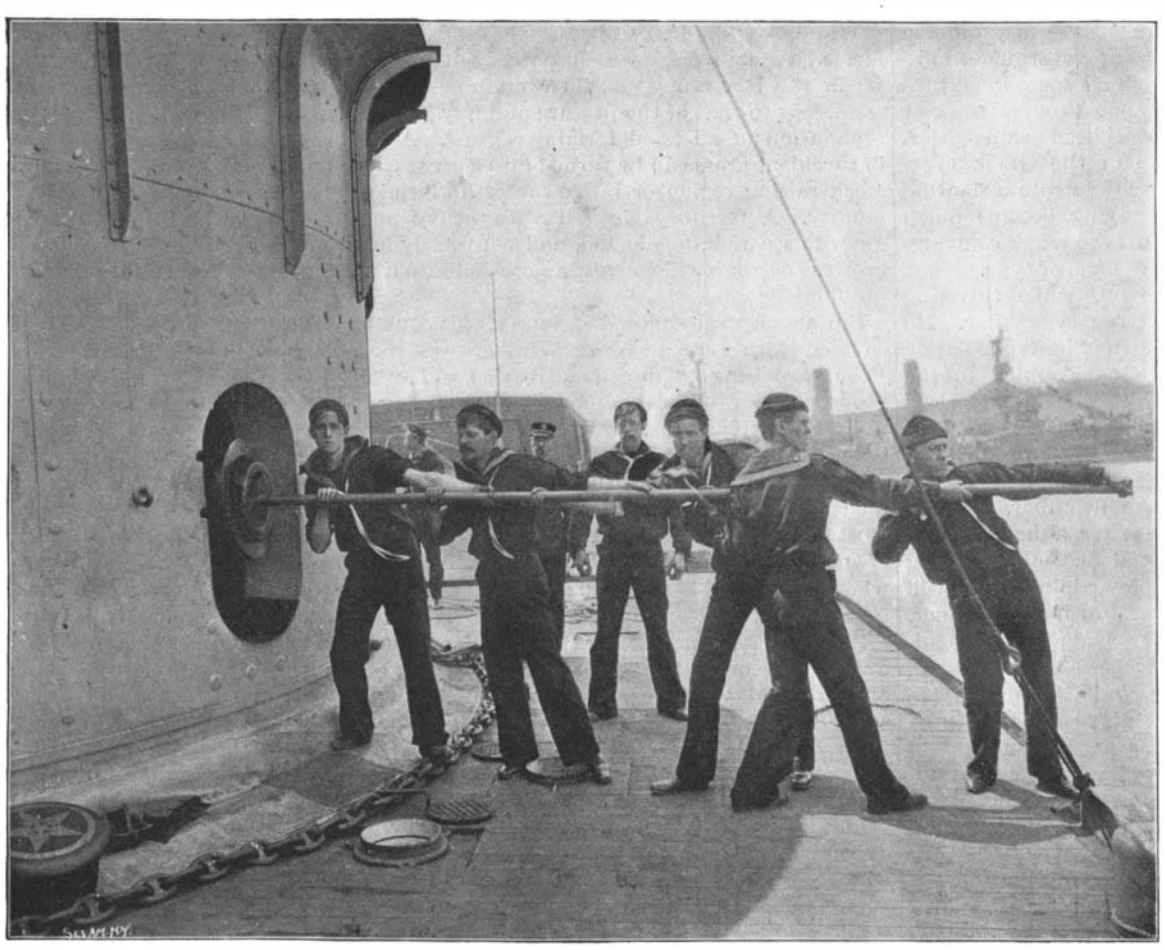


LONGITUDINAL SECTION THROUGH MONITOR "NAHANT."

The subdivision of the hull is as follows: Forward in the bows are the chain locker and the anchor engine. Then come the wardroom, the berthing space for the crew, the turret chamber, the boiler room, and the engine room. The frames are spaced 18 inches apart, and they are 18 inches deep at the keel, decreasing in depth toward the bilges. The deck consists of one thickness of 1-inch iron plating, above which is laid a deck of wood. A curious feature is the method of hoisting and stowing the anchor. It is not hauled up on the outside of the bow in the usual manner, but is drawn up into a well, formed between the overhanging bow and the hull proper. The anchor chain passes over a sheave at the top of the well and down to the hoisting engine in the chain locker. It is thus protected at all times from shell fire. The same device was used on Ericsson's first "Monitor," and the Confederate sailors were puzzled to explain how she could move up to a position and remain there stationary, apparently without casting anchor. In a similar well at the stern, protected by the overhang, are the propeller and the rudder, the latter being of the balanced type.

The most interesting feature of the "Nahant" is, of course, the turret, with its two 15-inch Rodman smooth-bores. It stands a little forward of amidships and has an arc of fire of about 190°, the forward deck included within this arc being entirely free from structures that would interfere with the fire. It was made of sufficient diameter to allow the guns to be loaded in the inboard position.

The gun crew, during an action, are chiefly located on the deck, behind the shelter of the turret. After a shell is fired the turret is turned around for loading, as shown in the accompanying engraving. The construction and general arrangements are shown in the transverse section on our front page. When the turret is not in use, it rests upon a path on the main deck; but when it is in action, it is carried and turns upon a solid vertical column of wrought iron, which extends through the axis of the turret and terminates in a hydraulic ram on the deck below. The turret is raised from the deck by a few strokes of the pump, and as soon as it is sufficiently clear to admit of its turning freely, a large iron wedge is driven in beneath the foot of the column and held in place by a nut. Rotation is effected by a spur wheel and pinion beneath the floor of the turret, driven by two steam engines. The roof is built of railroad iron laid upon a stout framing of 5 × 6 and 5 × 9 bar iron, and it is stiffened at the center over the carrying column by four 4-inch tie-rods, which run down to the lower edge of the turret, as shown



NAVAL RESERVE CREW OF "NAHANT" AT GUN DRILL.

in the engraving. Similarly the load on the column is transferred by four 4-inch rods to two box-girders, whose ends rest upon the framing of the vessel.

The pilot house which is plated with 11 inches of laminated armor is carried above the turret. It is pierced with a number of observation slits, and within it are the steering wheel and means of communication with the turret and engine room. The railing which is shown above the turret is utilized in peace times for stretching a canvas awning.

Back of the turret is a light bridge deck on which are mounted a couple of light rapid-fire guns for repelling torpedo attack. These are modern additions made when the "Nahant" was being overhauled at the opening of the war. It should be mentioned that the base of the smokestack is protected by 8 inches of armor.

The two 15-inch smooth-bores in the turret constitute the main battery of the "Nahant. They were the most formidable weapons in use during the civil war, and comparatively few of this size were carried, the largest weapons being of 11 inches caliber. They fired a spherical projectile, 35 pounds of black powder being used for firing a 250-pound shell against the unarmored portions of a ship, and a battering charge of 70 pounds with a 350-pound solid shot was used for attack on armor. They are sighted up to 2,700 yards, but the ordinary fighting range varied from a mile to 2,000 yards. Most of the fighting, indeed, was done at 1,200 yards. The shell was fired with a time fuse graduated from 3½ to 7 seconds, the time being determined by the length of fuse cut off. The destructive effects of the old spherical shot were very different from those of the modern type, the latter penetrating the armor, whereas the spherical shot racked and loosened it.

That it was not always very effective may be judged from the shot indentations on the turret and conning tower of the "Nahant," several of which are shown in our illustrations. Fifteen of these battle scars may be counted, all of which were received in the various bombardments of the war, yet the monitor appears to be none the worse for its punishment.

The recoil is controlled by a wedge supplemented by rope tackles; the guns are traversed by the rotation of the turret, and the screw shown at the breech of the guns serves to give the proper elevation. The complete operations of loading and firing one round are as follows:

1. Stop the vent with a pad carried on the hand.
2. Swab out gun with a wet sheepskin swab.
3. Insert powder charge, done up in canvas bag to fit bore of gun.
4. Ram home powder.
5. Insert projectile.
6. Ram home.
7. Insert primer at breech.
8. Swing aside the port shutters.
9. Return gun to battery.
10. Rotate gun to face the enemy.
11. Elevate gun for range.
12. Fire!

It can readily be believed that the rate of fire is slow, and, as a matter of fact, there is an interval of ten minutes between rounds.

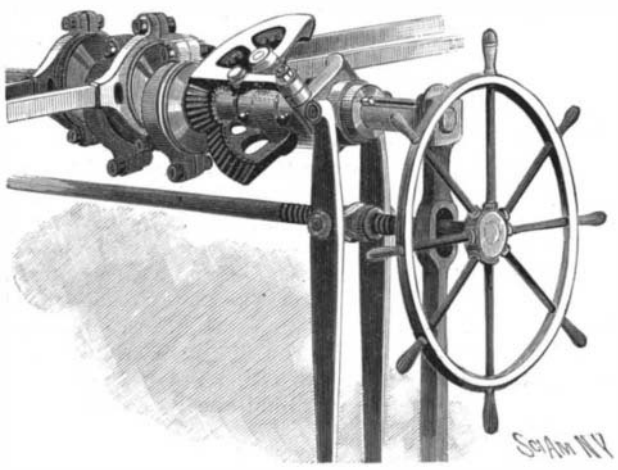
Compare this with the modern rapid-fire gun of equal or greater destructiveness which can fire ten rounds in one minute.

The port shutters above mentioned are heavy masses of wrought iron, which are swung in front of the ports after the gun was fired, to keep out the enemy's shot and shell. They are pivoted vertically, as shown in the engraving. The shutters are 9 inches thick by 2 feet wide, and completely close the gun ports.

The vessel is driven at a speed of 5½ knots an hour by an Ericsson 340 horse power two-cylinder, trunk, grasshopper engine of extremely curious construction. The two cylinders are placed back to back on a common axis, the whole being made in one casting. The diameter is 48 inches and the stroke 38 inches. Each piston connects through a trunk piston rod to a way or rocking shaft, and connecting rods transfer the motion from rocking arms at the forward ends of these rocking shafts to a common crank on the crankshaft, which is located on the axis of the vessel, the "Nahant," like all of her class, being driven by a single screw. The connecting rods consist of a cast iron center inclosed in a wrought iron strap, a gib and key serving to tighten both brasses.

Another arm on the rocking shaft serves to operate the jet condenser, as shown in the engraving.

Steam is supplied by two rectangular boilers, which represent the best practice of that day. They were built in 1862, in Boston, from designs by Ericsson. They are 11 feet wide by 11 feet high and 8 feet deep. The main shell is ⅝ inch thick. There are three furnace flues, which lead to a common combustion chamber, from which the gases return through 2-inch copper tubes to the front of the boiler, where they pass through a superheater at the base of the uptake. The original boiler pressure was 45 to 50 pounds, but only 30 pounds was used on the trip up from the Delaware to New York.



REVERSING GEAR—ENGINES OF "NAHANT."

We give an illustration of the curious reversing gear, which is carried at the forward end of the engine. The four eccentrics and the bevel wheel on the foremost eccentric are loose upon the eccentric shaft. The bevel wheel is engaged by two quadrants, one above the shaft, the other below, which turn upon pins that are carried by a collar keyed to the eccentric shaft. The effect is that the eccentrics are kept in any desired position on the shaft through the intermediary of the bevel wheel and quadrants. The quadrants are moved by means of short connecting levers which are attached to a sleeve, which is keyed loosely upon the shaft. This sleeve is attached by a loose collar to the upper end of a pair of rocking levers, which are moved by means of the reversing wheel and screw, clearly shown in the engraving. To reverse the engine, the levers with the attached sleeve would be drawn forward. The centers on which the quadrants rotate being in a fixed position relative to the shaft, the pull on the short connecting links causes the quadrants to swing across the shaft in opposite directions and turn the bevel gear and eccentrics on the shaft. It will be understood that when the engine is running, the eccentrics, quadrants, links, etc., continuously turn with the shaft.

The "Nahant" carries a full complement of 62, including the captain, executive officer, navigator, and four watch officers.

As soon as she arrived at New York, she went to the navy yard for the completion of her refitting, and then steamed to her station off Tompkinsville, her guardian duties being confined to the lower bay. Fortunately, the storm center of the war never moved so far north as New York, and the reputed speed and prowess of Admiral Cervera's ships failed to materialize. Had the Cape Verde fleet found its way to New York, the "Nahant" would have assisted the batteries and mines in repelling an attempt to rush by Sandy Hook and through the Narrows. For this work the "Nahant" could have rendered good service by firing 15-inch shells against the unprotected sides of the cruisers, supposing, of course, she was not put out of action by the Spaniards at long range—an event which their execrable gunnery would render very unlikely.

We are indebted to Capt. Richman for courtesies extended during the preparation of this article.

### Discovery of a Volcanic Bomb.

In Darwin's geological observations on the volcanic islands visited during the voyage of H. M. S. "Beagle," reference is made to a "volcanic bomb" found in the interior of Australia. The specimen was composed of green obsidian, and was found on a great sandy plain between the rivers Darling and Murray, at a distance of several hundred miles from any known volcanic region. Many similar specimens of obsidian "buttons" have since been found in Australia, and The Proceedings of the Royal Society of Tasmania (1897) contains two short descriptive papers on their occurrence in Tasmania.

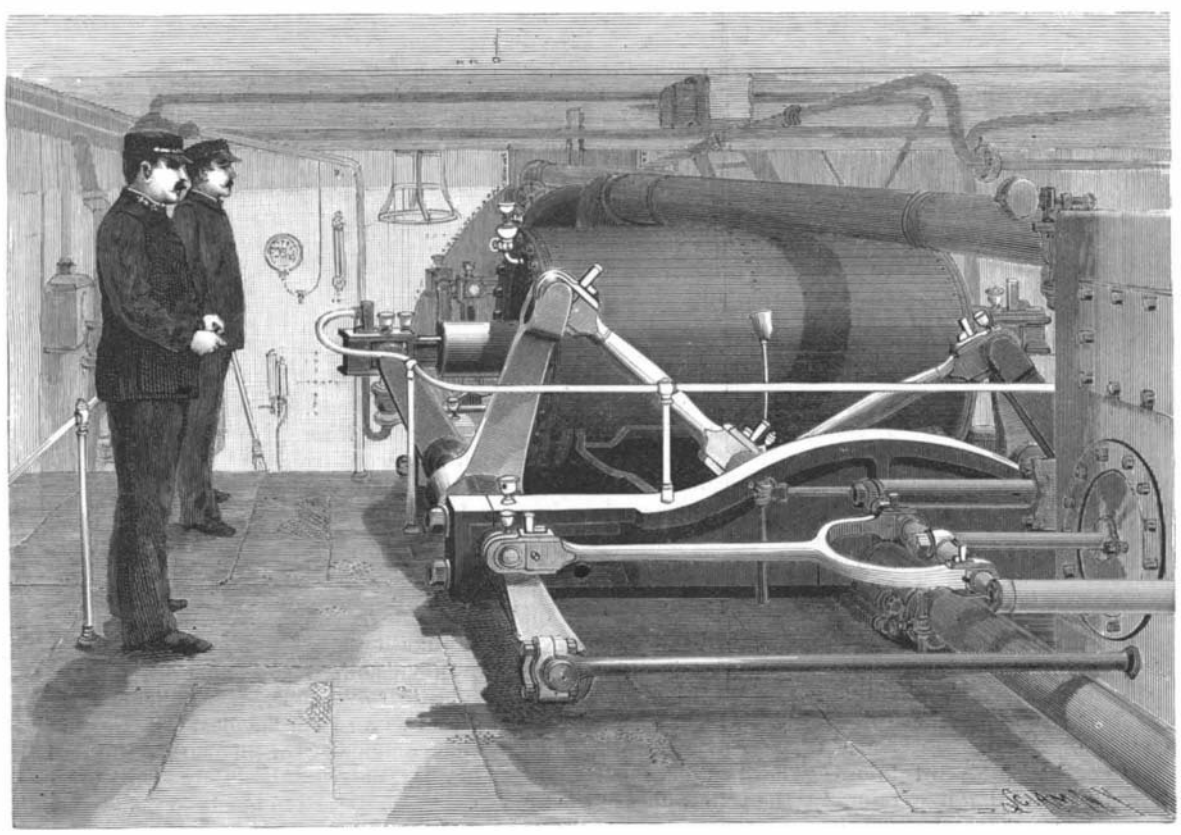
How these singular objects found their way to some of the localities in Tasmania, where their occurrence in undisturbed quartz drift far away from any known volcanic source has been reported, is unexplained. That they are volcanic products is unquestionable; and their spheroidal or discoid form points to rotation while in a fluid state. It has been suggested that the objects came from lunar volcanoes, but it is highly improbable (even if they were ejected from the moon) that they would reach our globe, and if they did, they could not penetrate the atmosphere.

Mr. T. Stephens, the author of one of the papers referred to, thinks the aborigines of Australia are probably largely responsible for the distribution of the obsidian buttons over the mud plains of Victoria and Riverina, but no such explanation can be given in reference to most of the places where they have been found in Tasmania.

In a paper by Messrs. W. H. Twelvetrees and W. F. Petterd in The Proceedings mentioned above, the suggestion is made that the objects are products of terrestrial volcanoes of an acid or sub-acid type, formerly in eruption in the southern hemisphere. The nearest known source of tertiary obsidian is New Zealand, but whether the objects have been transported through the air from that island, or from the Antarctic continent or elsewhere, it is impossible at present to decide.

### A Mine Exploded by Accident.

The value of the precautions taken by the army engineers in unloading mines was amply demonstrated on August 3, at Fort Wadsworth, where a mine was accidentally exploded. In unscrewing the cap there is danger of the charge being ignited either by a spark or by heat caused by friction, for the parts are apt to be heavily rusted. To avoid casualties in case an explosion should occur, the engineers constructed a raft on which the mine was placed. A machine for unscrewing the cap was then attached and the raft floated out to a distance from shore. The machine was operated by electricity, the current being supplied from the shore. After the cap was removed, the raft was to be hauled in and the explosives taken out. Usually the device works well, but on the day named while the cap was being removed the mine exploded. It was one of the large mines which guarded the entrance to the Narrows, and when it was taken up it was found to have been badly damaged, so that extra care was taken in handling it.



THE DOUBLE-TRUNK ENGINES OF THE "NAHANT."

Diameter of cylinders, 48 inches; stroke, 38 inches; steam pressure, 45 pounds; horse power, 340.