THE MONITORS.*

THE introduction of General Paixhans's brilliant invention, the shell-gun, in 1824, followed, in 1858, by the successful application of armor-plating to the steam-frigate *La Gloire*, under Napoleon III., compelled an immediate change in naval construction which startled the maritime countries of Europe, especially England, whose boasted security behind her "wooden walls" was shown to be a complete delusion. The English naval architects, however, did not overlook the fact that their French rivals, while producing a gun which rendered wooden navies almost useless, had also by their armor-plating provided an efficient protection against the destructive Paixhans shell.

Accordingly, the Admiralty without loss of time laid the keel of the *Warrior*, an armored iron steam-frigate 380 feet long, 58 feet beam, 26 feet draught, and 9200 tons displacement. The work being pushed with extraordinary vigor, this iron-clad ship was speedily launched and equipped, the admiration of the naval world.

Shortly after the adoption of armor-plating as an essential feature in the construction of vessels of war, the Southern States seceded from the Union, some of the most efficient of the United States naval officers resigning their commissions. Their loss was severely felt by the Navy Department at Washington; nor was it long before the presence of great professional skill among the officers of the naval administration of the Confederate States became manifest. Indeed, the utility of the armor-plating adopted by France and England proved to be better understood at Richmond than at Washington. While the Secretary of the Navy, Mr. Welles, and his advisers were discussing the question of armor, news reached Washington that the partly burnt and scuttled steam-frigate *Merrimac*, at the Norfolk Navy Yard, had been raised and cut down to her berth-deck, and that a very substantial structure of timber, resembling a citadel with inclined sides, was being erected on that deck.

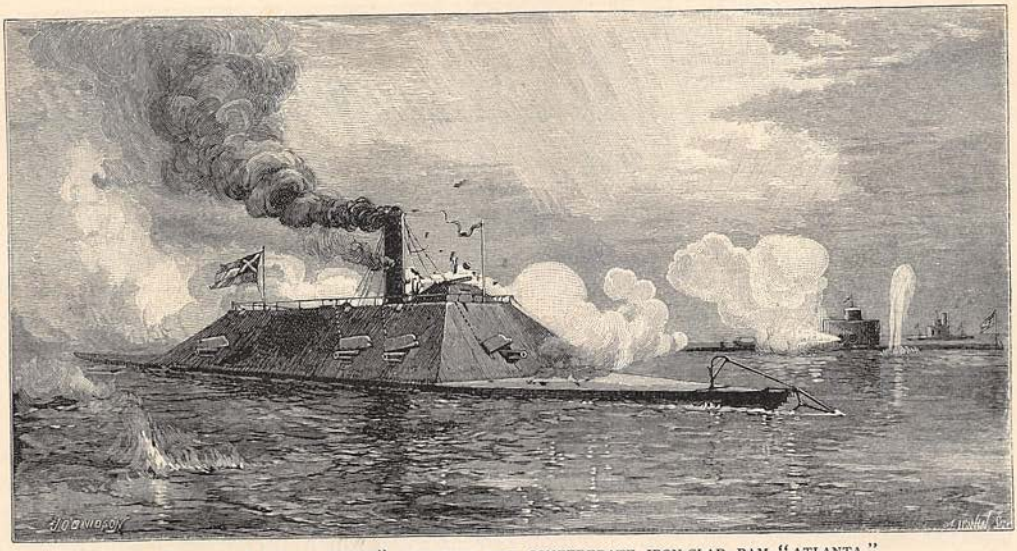
The Navy Department at Washington had previously advertised for plans and offers for iron-clad steam-batteries to be built within a stipulated time. My attention having been thus called to a subject which I had thoroughly considered during a series of years, I was fully prepared to present plans of an impregnable steam-battery of light draught, suitable to navigate the shallow rivers and harbors of the Confederate States. Availing myself of the services of a friend who chanced to be in Washington at the time, proposals were at once submitted to a board of naval officers appointed by the President; but the plans presented by my friend being rejected by the board, I immediately set out for Washington and laid the matter personally before its members, all of whom proved to be well-informed and experienced naval experts. Contrary to anticipation, the board permitted me to present a theoretical demonstration concerning the stability of the new structure, doubt of which was the principal consideration which had caused the rejection of the plan presented. In less than an hour I succeeded in demonstrating to the entire satisfaction of the board appointed by President Lincoln that the design was thoroughly practical, and based on sound theory. The Secretary of the Navy accordingly accepted my proposal to build an iron-clad steam-battery, and instructed me verbally to commence the construction forthwith. Returning immediately to New York, I divided the work among three leading mechanical establishments, furnishing each with detailed drawings of every part of the structure; the understanding being that the most skillful men and the best tools should be employed; also that work should be continued during night-time whenever practicable. The construction of nearly every part of the battery accordingly commenced simultaneously, all hands working with the utmost diligence, apparently confident that their exertions would result in something of great benefit to the national cause. Fortunately no trouble or delay was met at any point; all progressed satisfactorily; every part sent on board from the workshops fitted exactly the place for which it was intended. As a consequence of these favorable circumstances, the battery, with steam-machinery complete, was launched in one hundred days from the laying of the keel-plate. It should be mentioned that at the moment of starting on the inclined ways toward its destined element, the novel fighting-machine was named *Monitor*.

Before entering on a description of this *fighting-machine* I propose to answer the question frequently asked: What circumstances dictated its size and peculiar construction?

1. The work on the *Merrimac* had progressed so far that no structure of large dimensions could possibly be completed in time to meet her.

2. The well-matured plan of erecting a citadel of considerable dimensions on the am-

* See also articles on the fight between the *Monitor* and the *Merrimac*, in THE CENTURY for March, 1885.—EDITOR.



THE MONITOR "WEEHAWKEN" CAPTURING THE CONFEDERATE IRON-CLAD RAM "ATLANTA," WARSAW SOUND, GEORGIA, JUNE 17, 1863.

ple deck of the razeed *Merrimac* admitted of a battery of heavy ordnance so formidable that no vessel of the ordinary type, of small dimensions, could withstand its fire.

3. The battery designed by the naval constructor of the Confederate States, in addition to the advantage of ample room and numerous guns, presented a formidable front to an opponent's fire by being inclined to such a degree that shot would be readily deflected. Again, the inclined sides, composed of heavy timbers well braced, were covered with two thicknesses of bar iron, ingeniously combined, well calculated to resist the spherical shot peculiar to the Dahlgren and Rodman system of naval ordnance adopted by the United States Navy.

4. The shallow waters on the coast of the Southern States called for very light draught; hence the upper circumference of the propeller of the battery would be exposed to the enemy's fire unless thoroughly protected against shot of heavy caliber. A difficulty was thus presented which apparently could not be met by any device which would not seriously impair the efficiency of the propeller.

5. The limited width of the navigable parts of the Southern rivers and inlets presented an obstacle rendering manœuvring impossible; hence it would not be practicable at all times to turn the battery so as to present a broadside to the points to be attacked.

6. The accurate knowledge possessed by the adversary of the distance between the forts on the river banks within range of his guns, would enable him to point the latter with such accuracy that unless every part of the sides of the battery could be made absolutely shot-proof, destruction would be certain. It may be observed that the accurate knowledge of range was an advantage in favor of the Southern forts which placed the attacking steam-batteries at great disadvantage.

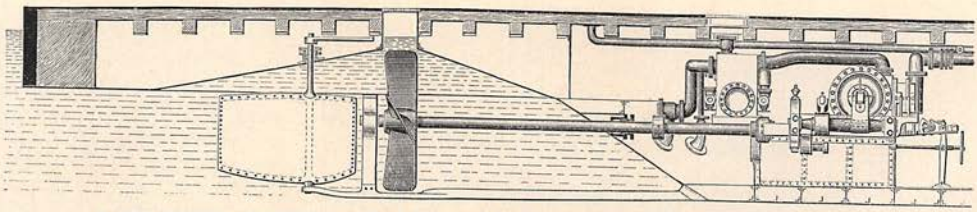
7. The difficulty of manipulating the anchor within range of powerful fixed batteries presented difficulties which called for better protection to the crew of the batteries than any previously known.

Several minor points familiar to the naval artillerist and naval architect presented considerations which could not be neglected by the constructor of the new battery; but these must be omitted in our brief statement, while the foregoing, being of vital importance, have demanded special notice.

The plans on pages 282–3 represent a longitudinal section through the center line of the battery, which, for want of space on the page, has been divided into three sections, viz., the forward, central, and aft sections, which for ready reference will be called *forward*, *central*, and *aft*.

Referring particularly to the upper and lower sections, it will be seen that the hull consists of an upper and lower body joined together in the horizontal plane not far below the water-line. The length of the upper part of the hull is 172 feet, beam 41 feet; the length of the lower hull being 122 feet, beam 34 feet. The depth from the underside of deck to the keel-plate is eleven feet two inches, draught of water at load-line ten feet.

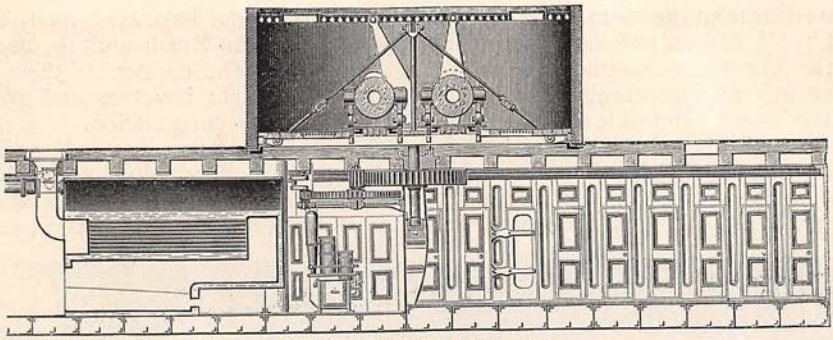
Let us now examine separately the three sectional representations.



1. AFT SECTION. LONGITUDINAL PLAN THROUGH THE CENTER LINE OF THE ORIGINAL MONITOR.

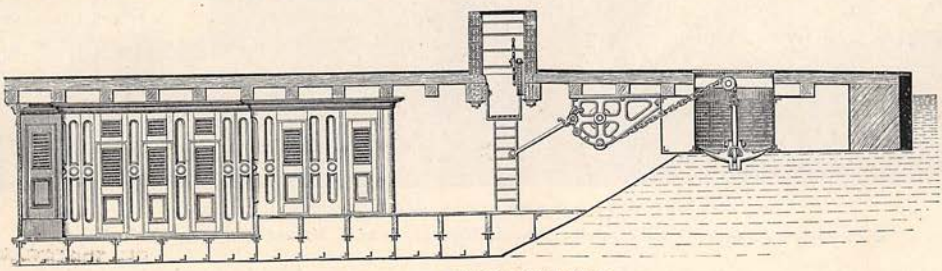
Forward Section. The anchor-well, a cylindrical perforation of the overhanging deck, near the bow, first claims our attention. The object of this well being to protect the anchor when raised, it is lined with plate iron backed by heavy timbers, besides being protected by the armor-plating bolted to the outside of the overhang. It should be noticed that this method proved so efficient that in no instance did the anchor-gear receive any injury during the several engagements with the Confederate batteries, although nearly all of the monitors of the *Passaic* class were subjected to rapid fire at short range in upwards of twenty actions. It will be remembered that the unprotected anchor of the *Merrimac* was shot away during the short battle with the *Congress* and the *Cumberland.* Having described the method of protecting the anchors, the mechanism adopted for manipulating the same remains to be explained. Referring to the illustration, it will be seen that a windlass is secured under the deck-beams near the anchor-well. The men working the handles of this mechanism were stationed on the bottom of the vessel, and hence were most effectually protected against the enemy's shot, besides being completely out of sight. The Confederate artillerists were at first much surprised at witnessing the novel spectacle of vessels approaching their batteries, then stopping and remaining stationary for an indefinite time while firing, and then again departing, apparently without any intervention of anchor-gear. Our examination of this gear and the anchor-well affords a favorable opportunity of explaining the cause of Lieutenant Greene's alarm, mentioned in a statement recently published by a military journal, concerning a mysterious sound emanating from the said well during the passage of the *Monitor* from New York to Fortress Monroe. Lieutenant Greene says that the sound from the anchor-well "resembled the death-groans of twenty men, and was the most dismal, awful sound [he] ever heard." Let us endeavor to trace to some physical cause this portentous sound. The reader will find, on close examination, that the chain cable which suspends the anchor passes through an aperture ("hawse-pipe") on the aft side of the well, and that this pipe is very near the water-line; hence the slightest vertical depression of the bow will occasion a flow of water into the vessel. Obviously, any downward motion of the overhang will cause the air confined in the upper part of the well, when covered, to be blown through the hawse-pipe along with the admitted water, thereby producing a very discordant sound, repeated at every rise and fall of the bow during pitching. Lieutenant Greene also states that apart from the reported fearful sound, the battery was flooded by the water which entered through the hawse-pipe; a statement suggesting that this flooding was the result of faulty construction, whereas it resulted from gross oversight on the part of the executive officer,—namely, in going to sea without stopping the opening round the chain-cable at the point where it passes through the side of the anchor-well.

The pilot-house is the next important object represented in the forward section of the illustration now under consideration. This structure is situated ten feet from the anchor-well, its internal dimensions being three feet six inches long, two feet eight inches wide, three feet ten inches high above the plating of the deck, the sides consisting of solid blocks of wrought iron, twelve inches deep and nine inches thick, firmly held down at the corners by three-inch bolts passing through the iron-plated deck and deck-beams. The wheel, which by means of ordinary tiller-ropes operates the rudder, is placed within the pilot-house, its axle being supported by a bracket secured to the iron blocks as shown by the illustration. An ordinary ladder resting on the bottom of the battery leads to the grated floor of the pilot-house. In order to afford the commanding officer and the pilot a clear view of objects before and on the sides of the battery, the first and second iron blocks from the top are kept apart by packing pieces at the corners; long and narrow sight-holes being thereby formed extending round the pilot-house, and giving a clear view which sweeps round the entire horizon, all but that part which is hidden by the turret, hardly twelve degrees on each side of the line of keel. Regarding the adequacy of the elongated sight-hole formed between the iron blocks in the manner described, it should be borne in mind



2. CENTRAL SECTION, SAME PLAN.

that an opening of five-eighths of an inch affords a vertical view eighty feet high at a distance of only two hundred yards. More is not needed, a fact established during trials instituted by experts before the constructor delivered the battery to the Government. Unfortunately the sight-holes were subsequently altered, the iron blocks being raised and the opening between them increased to such an extent that at sea, to quote Lieutenant Greene's report, the water entered "with such force as to knock the helmsman completely round from the wheel." It may be shown that but for the injudicious increase of the sight-holes, the commander of the *Monitor* would not have been temporarily blinded during the conflict at Hampton Roads, although he placed his vessel in such an extraordinary position that, according to Lieutenant Greene's report, "a shell from the enemy's gun, the muzzle not ten yards distant, struck the forward side of the pilot-house." The size of the sight-hole, after the injudicious increase, may be inferred from the reported fact that the blast caused by the explosion of the Confederate shell on striking the outside of the pilot-house had the power of "partly lifting the top." This "top," it should be observed, consisted of an iron plate two inches thick, let down into an appropriate groove, but not bolted down—a circumstance which called forth Lieutenant Greene's disapprobation. The object of the constructor in leaving the top plate of the pilot-house loose, so as to be readily pushed up from below, was that of affording egress to the crew in case of accident. Had the monitor *Tecumseh*, commanded by Captain T. A. T. Craven, when struck by a torpedo during the conflict in Mobile Bay, August 5, 1864, been provided with a similar loose plate over the main hatch, the fearful calamity of drowning officers and crew would have been prevented. In referring to this untoward event it should be observed that means had been provided in all the sea-going monitors to afford egress in case of injury to the hull: an opening in the turret floor, when placed above a corresponding opening in the deck, formed a free passage to the turret, the top of which was provided with sliding hatches. Apparently the officer in charge of the turret-gear of Captain Craven's vessel was not at his post, as he ought to have been during action, or else he had not been taught the imperative duty of placing the turret in such a position that these openings would admit of a free passage from below.



3. FORWARD SECTION, SAME PLAN.

Lieutenant Greene's report with reference to the position of the pilot-house calls for particular notice, his assertion being that he "could not fire ahead within several points of the bow." The distance between the center of the turret and the pilot-house being fifty-five feet, while the extreme breadth of the latter is only five feet, it will be found that by turning the turret through an angle of only *six degrees* from the center line of the vessel, the shot will clear the pilot-house, a structure too sub-

stantial to suffer from the mere aërial current produced by the flight of the shot. Considering that the *Monitor*, as reported by Lieutenant Greene, was a "quick-turning vessel," the disadvantage of not being able to fire over the bow within *six degrees* of the line of keel is insignificant. Captain Coles claimed for his famous iron-clad turret-ship the advantage of an all-round fire, although the axis of his turret guns had many times greater deviation from the line of keel than that of the *Monitor*.

The statement published by Lieutenant Greene, that the chief engineer of the battery immediately after the engagement in Hampton Roads "suggested the clever plan of putting the pilot-house on top of the turret," is incorrect and calls for notice. The obvious device of placing the pilot-house in the center and above the turret was carefully considered before the *Monitor* turret was constructed, but could not be carried out for these reasons:

1. The turret of the battery was too light to support a structure large enough to accommodate the commanding officer, the pilot, and the steering-gear, under the severe condition of absolute impregnability against solid shot from guns of ten-inch caliber employed by the Confederates.

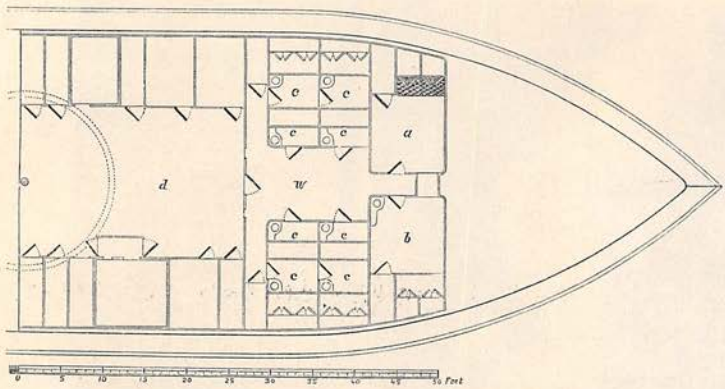
2. A central stationary pilot-house connected with the turret involved so much complication and additional work (see description of turret and pilot-houses further on), that had its adoption not been abandoned the *Monitor* would not have been ready to proceed to Hampton Roads until the beginning of April, 1862. The damage to the national cause which might have resulted from that delay is beyond computation.

The next important part of the battery delineated on the forward section of the illustration, namely, the quarters of the officers and crew, will now be considered; but before entering on a description it should be mentioned that in a small turret-vessel built for fighting, only one-half of the crew need be accommodated at a time, as the other half should be in and on the turret, the latter being always covered with a water-proof awning. Referring again to the forward and to part of the central section, it will be seen that the quarters extend from the transverse bulkhead under the turret to within five feet of the pilot-house, a distance of fifty feet; the forward portion, twenty-four feet in length, being occupied by the officers' quarters and extending across the battery from side to side. The height of the aft part of these quarters is eight feet six inches under the deck-beams; while the height of the whole of the quarters of the crew is eight feet six inches. A mere glance at the illustrations showing a side elevation [page 283] and top view of internal arrangement [page 286] gives a correct idea of the nature of the accommodations prepared for the officers and crew of the battery which Lieutenant Greene

BOMBARDMENT OF FORT SUMTER AND ADJACENT FORTS, APRIL 7, 1863.

The monitors engaged were the *Weehawken*, *Passaic*, *Montauk*, *Catskill*, *Nahant*, *Patapsco*, and *Nantucket*.

CAPTURE OF FORT FISHER, JANUARY 15, 1864. (DRAWN BY J. O. DAVIDSON, FROM LITHOGRAPHS BY ENDICOTT & CO.)



PLAN OF THE BERTH-DECK OF THE ORIGINAL MONITOR, DRAWN TO SCALE.

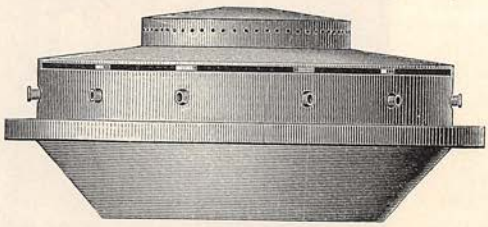
a, captain's cabin; *b*, his state-room; *c*, state-rooms of the officers; *w*, ward-room; *d*, quarters of the crew, with store-rooms on the sides.

regards as a "crude" structure, and of which he says: "Probably no ship was ever devised which was so uncomfortable for the crew." If this opinion were well founded, it would prove that submerged vessels like the monitors are unfit to live in.

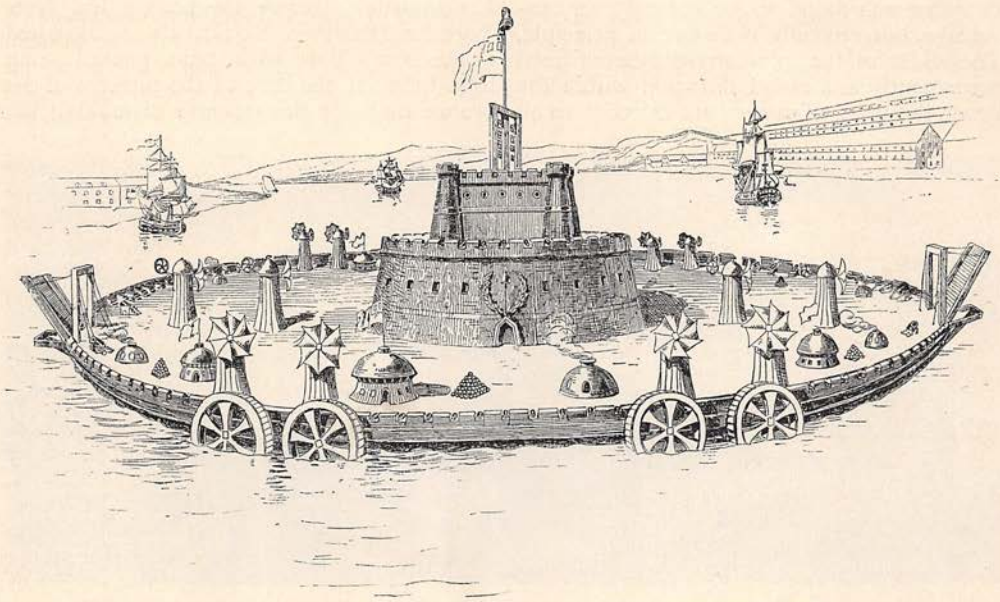
Fortunately, the important question whether crews can live permanently below water-line has been set at rest by the report of the chief of the Bureau of Medicine and Surgery to the Secretary of the Navy, 1864. This minute and carefully considered report enabled the naval administration, organized by President Lincoln, to prove the healthfulness of the monitors, by the following clear presentation of the subject: "The monitor class of vessels, it is well known, have but a few inches of their hulls above the water-line, and in a heavy sea are entirely submerged. It has been doubted whether under such circumstances it would be possible long to preserve the health of the men on board, and consequently maintain the fighting material in a condition for effective service. It is gratifying, therefore, to know that an examination of the sick-reports, covering a period of over thirty months, shows that, so far from being unhealthy, there was less sickness on board the monitors than on the same number of wooden ships with an equal number of men and in similar exposed positions. The exemption from sickness upon the iron-clads in some instances is remarkable. There were on board the *Saugus*, from November 25th, 1864, to April 1st, 1865, a period of over four months, but four cases of sickness (excluding accidental injuries), and of these two were diseases with which the patients had suffered for years. On the *Montauk*, for a period of one hundred and sixty-five days prior to the 29th of May, 1865, there was but one case of disease on board. Other vessels of the class exhibit equally remarkable results, and the conclusion is reached that no wooden vessels in any squadron throughout the world can show an equal immunity from disease."

Apart from the ample size of the quarters on board the battery, shown by the illustration, it should be mentioned that the system adopted for ventilating those quarters furnishes an abundant supply of fresh air by the following means. Two centrifugal blowers, driven by separate steam-engines, furnished seven thousand cubic feet of atmospheric air per minute by the process of suction through standing pipes on deck. Part of the air thus drawn in supported the combustion of the boiler furnaces, the remainder entering the lower part of the hull, gradually expelling the heated and vitiated air within the vessel. It has been imagined that the fresh air supplied by the blowers ought to have been conveyed to the quarters at the forward end of the vessel, by a system of conducting pipes. The laws of static balance, however, render the adoption of such a method unnecessary, since agreeably to those laws the fresh cold air, unless it be stopped by closed doors in the bulkheads, will find its way to every part of the bottom of the hull, gradually rising and expelling the upper heated strata through the hatches, and lastly through the grated top of the turret. Naval constructors who speculate on the cause of the extraordinary healthfulness of the monitors need not extend their researches beyond a thorough investigation of the system of ventilation just described.

Turret Department. The most important object delineated on the *central* section of the illustration, namely, the rotating turret, will now be considered; but before describing this essential part of the monitor system, it will be well to observe that the general belief is quite



SIDE ELEVATION OF A FLOATING REVOLVING CIRCULAR TOWER, PUBLISHED BY ABRAHAM BLOODGOOD IN 1807.



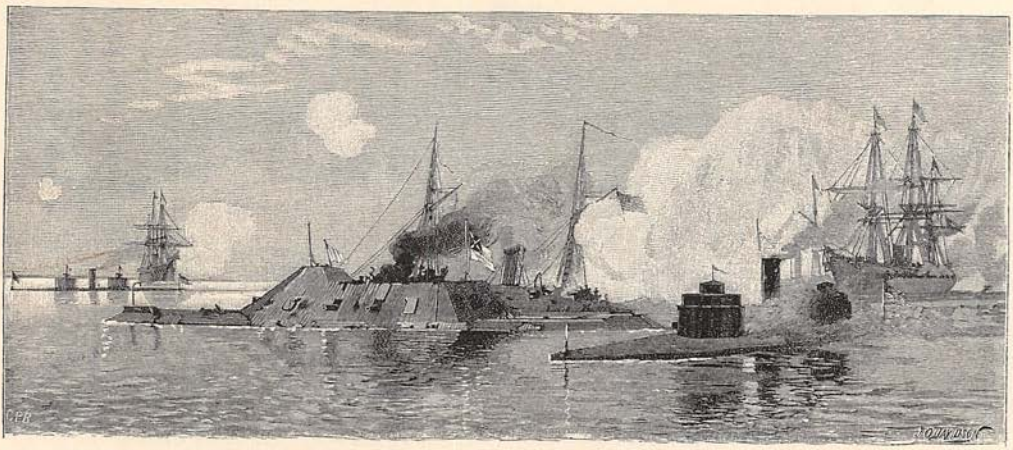
FLOATING CIRCULAR CITADEL, SUBMITTED TO THE FRENCH DIRECTORY IN 1798.

erroneous that a revolving platform, open or covered, is a novel design. So far from that being the case, this obvious device dates back to the first introduction of artillery. Sixty-four years ago the writer was taught by an instructor in fortification and gunnery that under certain conditions a position assailable from all sides should be defended by placing the guns on a turn-table. Long before building the *Monitor* I regarded the employment of a revolving structure to operate guns on board ships as a device familiar to all well-informed naval artillerists. But although constructors of revolving circular gun-platforms for naval purposes, open or covered, have a right to employ this ancient device, it will be demonstrated further on that the turret of the monitors is a distinct mechanical combination differing from previous inventions. The correctness of the assumption that revolving batteries for manipulating guns on board floating structures had been constructed nearly a century ago will be seen by the following reference to printed publications.

The "Nautical Chronicle" for 1805 contains an account of a "movable turning impregnable battery, invented by a Mr. Gillespie, a native of Scotland, who completed the model of a movable impregnable castle or battery, impervious to shot or bombs, provided with a cannon and carriage calculated to take a sure aim at any object." It is further stated that "the invention proposed will be found equally serviceable in floating batteries. Its machinery is adapted to turn the most ponderous mortars with the greatest ease, according to the position of the enemy." Again, the Transactions of the Society for the Promotion of Useful Arts in the State of New York, 1807, contains an illustration representing a side elevation of a circular revolving floating battery constructed by Abraham Bloodgood (see cut on page 286). The guns of this battery, as the inventor points out, "would be more easily worked than is common, as they would not require any lateral movement." It is also stated, as a peculiar feature of this floating battery, that "its rotary motion would bring all its cannon to bear successively, as fast as they could be loaded, on objects in any direction"; and that "its circular form would cause every shot that might strike it, not near the center, to glance." Thirty-five years after the publication of the illustration and description of the circular floating revolving tower of Abraham Bloodgood, Theodore R. Timby proposed to build a tower on land for coast defense, to be composed of iron, with several floors and tiers of guns, the tower to turn on a series of friction-rollers under its base. The principal feature of Timby's "invention" was that of arranging the guns radially within the tower, and firing each gun at the instant of its coming in line with the object aimed at during the rotary motion of the tower, precisely as invented by Bloodgood. About twenty years ago certain influential citizens presented drawings of Timby's revolving tower to the authorities at Washington, with a view of obtaining orders to build such towers for coast defense; but

the plan was found to be not only very expensive, but radically defective in principle. The slides of the gun-carriages being fixed permanently in a radial direction within the tower, the guns, of course, are directed to all points of the compass. Hence, during an attack by a hostile fleet, with many ships abreast, only one assailant can be fired at, its companions being scot-free in the dead angle formed between the effective gun and the guns on either side. In the mean time the numerous guns, distributed round the tower on the several floors, cannot be fired until their time comes during the revolution of the tower. The enemy's fleet continuing its advance, of course, calls for a change of elevation of the pieces, which, considering the constant revolution of the tower and the different altitudes above the sea of the several tiers, presents perplexing difficulties. Nothing further need be said to explain why the Government did not accept the plans for Timby's revolving towers.

The origin of rotating circular gun-platforms being disposed of, the consideration of the central section of the illustration will now be resumed. It will be seen that the turret which protects the guns and gunners of the *Monitor* consists simply of a short cylinder resting on the deck, covered with a grated iron roof provided with sliding hatches. This cylinder is composed of eight thicknesses of wrought-iron plates, each one inch thick, firmly riveted together, the inside course, which extends below the rest, being accurately faced underneath. A flat, broad ring of bronze is let into the deck, its upper face being very smooth in order to form a water-tight joint with the base of the turret without the employment of any elastic packing, a peculiar feature of the turrets of the monitors, as will be seen further on. Unfortunately, before the battery left New York for Hampton Roads, it was suggested at the Navy Yard to insert a plaited hemp rope between the base of the turret and the bronze ring, for the purpose of making the joint perfectly water-tight. As might have been supposed, the rough and uneven hemp rope did not form a perfect joint; hence during the passage a great leak was observed at intervals as the sea washed over the decks. "The water came down under the turret like a waterfall," says Lieutenant Greene in his report. It will be proper to observe in this place that the "foundering" of the *Monitor* on its way to Charleston was not caused by the "separation of the upper and lower part of the hull," as was imagined by persons who possessed no knowledge of the method adopted by the builders in joining the upper and lower hulls. Again, those who asserted that the plates had been torn asunder at the junction of the hulls did not consider that severe strain cannot take place in a structure nearly submerged. The easy motion at sea, peculiar to the monitors, was pointed out by several of their commanders. Lieutenant Greene in his report to the Secretary of the Navy, dated on board the *Monitor*, March 27, 1862, says with reference to sea-going qualities:



BATTLE OF MOBILE BAY, AUGUST 5, 1864. THE MONITORS CAPTURING THE IRON-CLAD RAM "TENNESSEE."

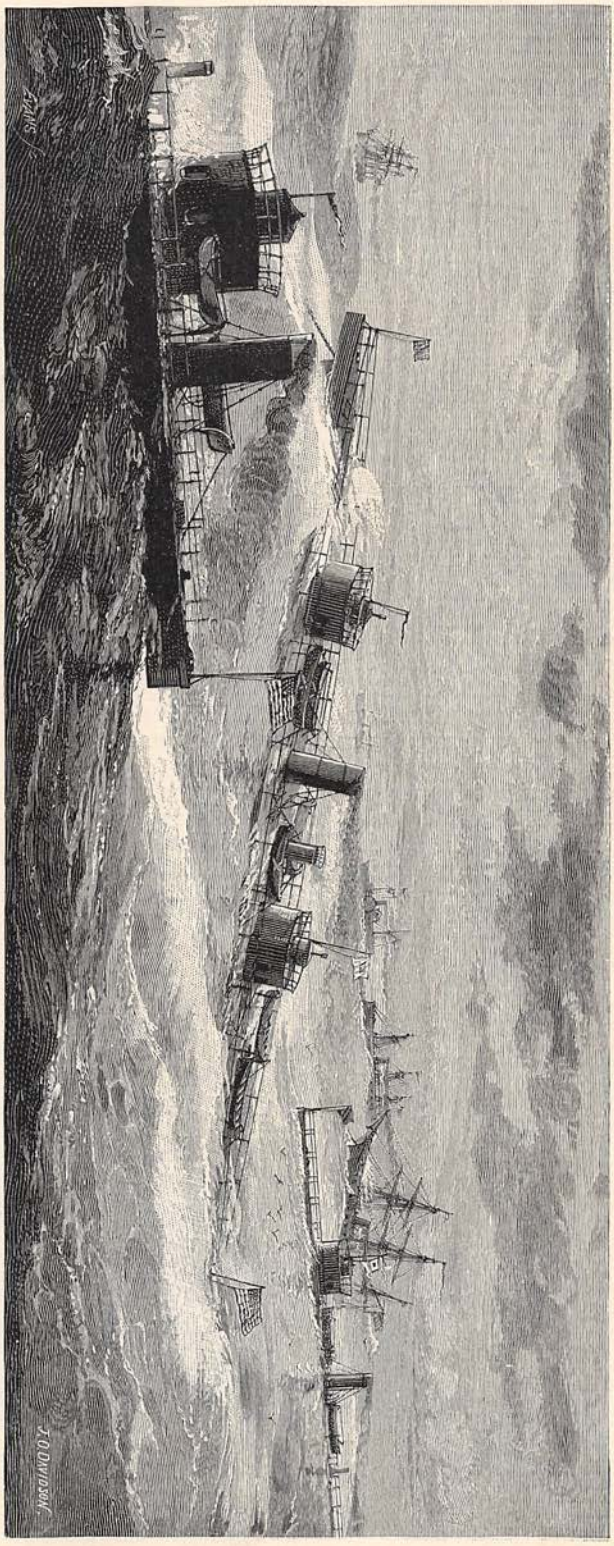
"During her passage from New York her roll was very easy and slow and not at all deep. She pitched very little and with no strain whatever."

Captain John Rodgers's report to the Secretary of the Navy, dated on board the monitor *Weehawken*, January 22, 1863, refers specially to the easy motion of his vessel:

"On Tuesday night, when off Chincoteague shoals, we had a very heavy gale from the E. N. E. with a very heavy sea, made confused and dangerous by the

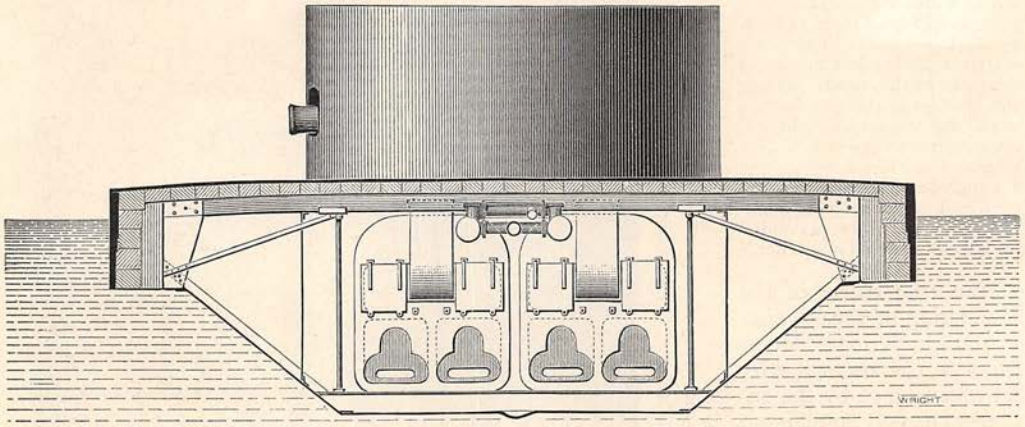
proximity of the land. The waves I measured after the sea abated; I found them twenty-three feet high. They were certainly seven feet higher in the midst of the storm. During the heaviest of the gale I stood upon the turret and admired the behavior of the vessel. She rose and fell to the waves, and I concluded that the monitor form had great sea-going qualities. If leaks were prevented no hurricane could injure her."

The true cause of the foundering of the *Monitor* was minutely explained to the writer some time after the occurrence by the engineer, a very intelligent person, who operated the centrifugal pumping-engine of the battery at the time. According to his statement, oakum was packed under the base of the turret before going to sea, in order to make sure of a water-tight joint; but this expedient failed altogether, the sea gradually washing out the oakum in those places where it had been loosely packed, thereby permitting so large a quantity of water to enter under the turret, fully sixty-three feet in circumference, that the centrifugal pumping-engine had not sufficient power to expel it. The hull consequently filled gradually and settled, until at the expiration of about four hours the battery went to the bottom. It will be asked, in view of the preceding explanation of the construction of the monitor turrets, namely, that the smooth base of the turret forms a water-tight joint with the ring on the deck, why was oakum packed under the turret before going to Charleston? The commander of the battery, Captain Bankhead, in his report of the foundering, adverts to the admission of water under the turret, but does not duly consider the serious character of



THE MONITORS "MONADNOCK," "CANONICUS," "MAHOPAC," AND "SAUGUS" AT ANCHOR NEAR FORT FISHER DURING A GALE. (AFTER LITHOGRAPH BY ENDICOTT & CO.)

Their commanders were surprised to find that not one of the turret vessels dragged its anchor, while the remainder of the fleet was in great danger owing to the inability of the ground tackle to hold out against the pressure of the wind on the top hampers, from which the monitors were free.

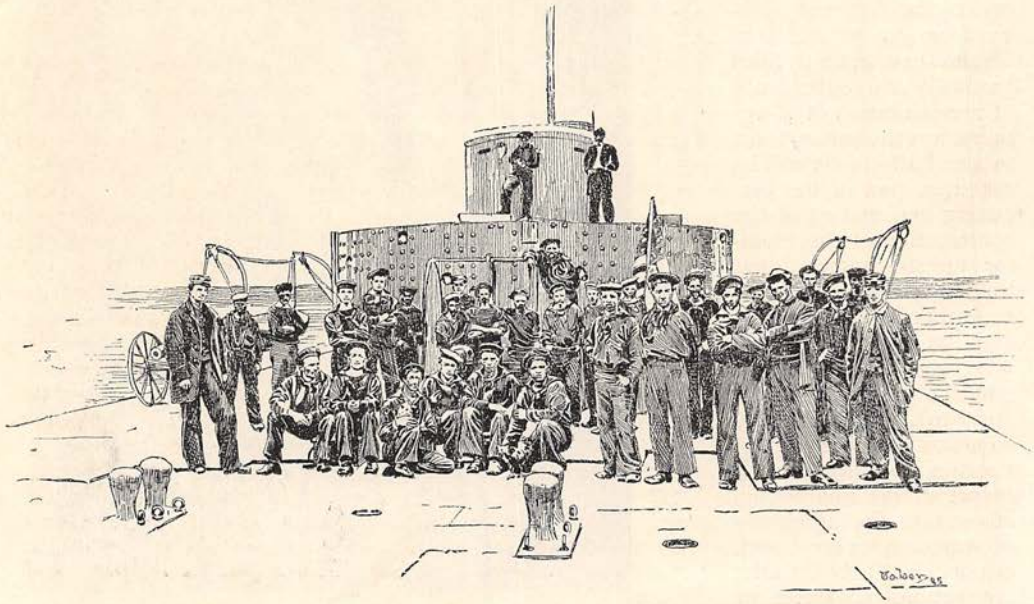


TRANSVERSE SECTION OF THE HULL OF THE ORIGINAL MONITOR.

The diagram gives a front view of the boilers and furnaces; also a side elevation of the rotating cylindrical turret which proved impregnable against ten-inch solid shot fired with battering charges at very short range.

the leak, sixty-three feet in length. Captain Bankhead evidently had not carefully investigated the matter when he attributed the accident to an imaginary separation of the upper and lower hull. It should be observed, in justice to this officer, that having commanded the *Monitor* only during a brief period he possessed but an imperfect knowledge of his vessel, and probably knew nothing regarding the consequence of employing packing,— namely, that it might cause "water to come down under the turret like a waterfall," as previously reported by the second officer in command. Having explained that Captain Bankhead had not commanded the battery long enough to become fully acquainted with its construction, it will be proper to mention as a mitigating circumstance in favor of the second officer, Lieutenant Greene, that previous to the battle in Hampton Roads he had "never performed any but midshipman duty." The important question, therefore, must remain unanswered, whether the *Monitor*, like the other vessels of her type, might not in the hands of an older and more experienced executive officer have reached Charleston in safety.

Referring again to the central part of the



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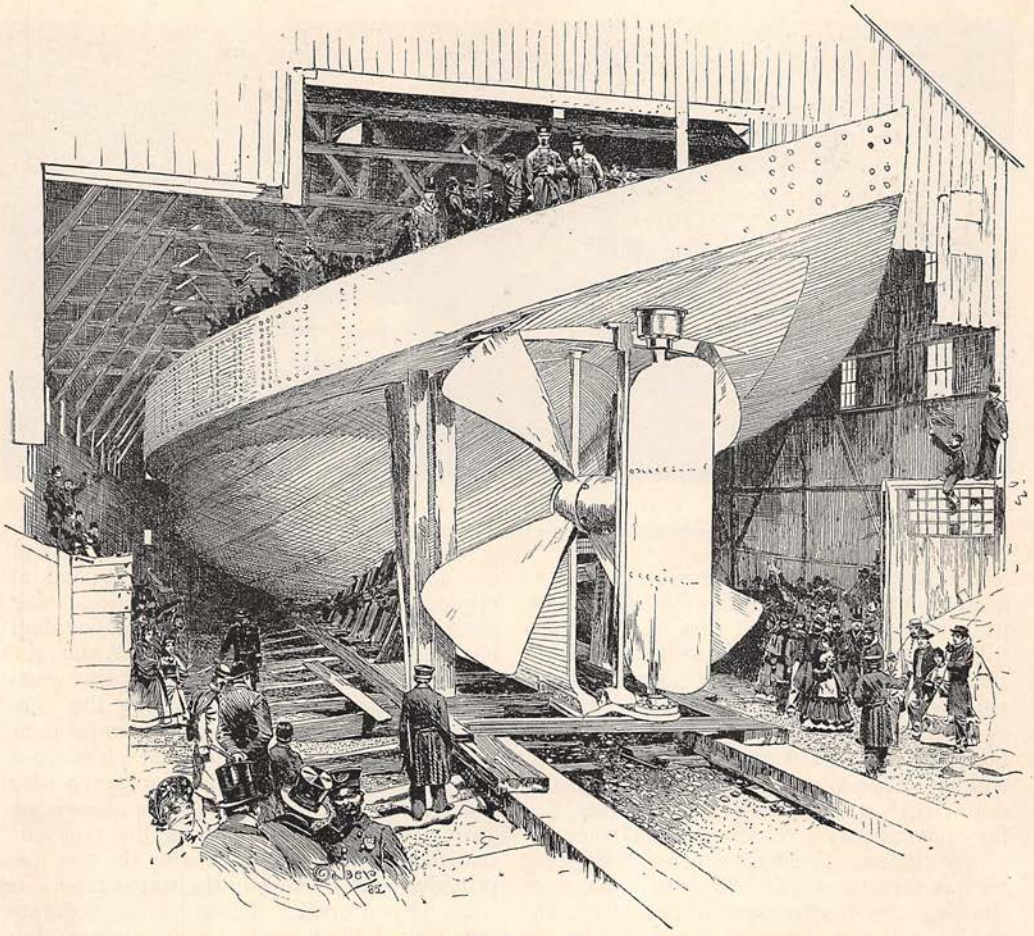
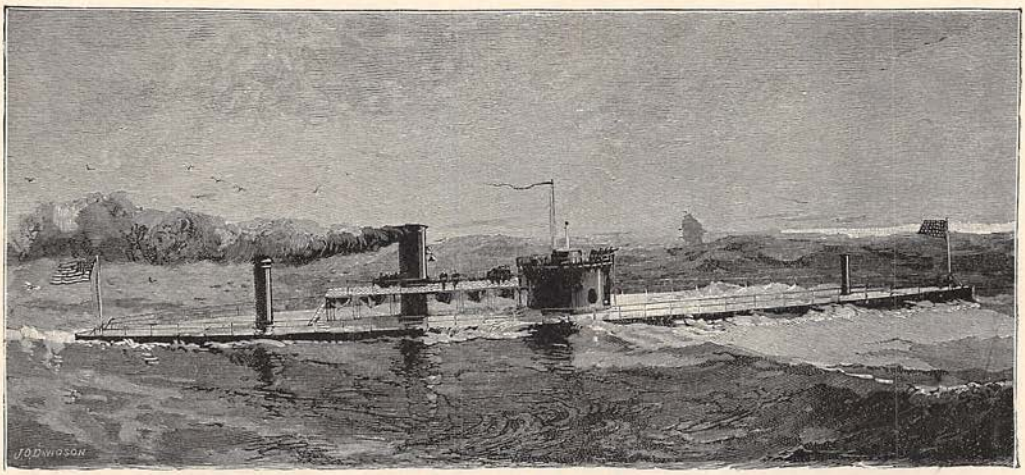


LAUNCH OF THE "DICTATOR" FROM THE DELAMATER IRON WORKS, DECEMBER 27, 1863.

illustration, page 283, and the sectional representation of the turret, it will be found that the guns are placed across the vessel, consequently only the end of the breech and upper part of the port-hole are seen. The object of the pendulum port-stoppers suspended under the roof is to afford protection to the turret crew while loading the guns. Generally, however, the turret should be moved, and the port-holes thereby turned away from the enemy. Much time was lost during the conflict with the *Merrimac* by closing the port-stoppers in place of merely moving the turret, the latter operation being performed by a small steam-engine controlled by a single hand; while opening and closing the port-stoppers, as reported by Lieutenant Greene, required the entire gun-crew. The slow fire of the *Monitor* during the action, complained of by critics, was no doubt occasioned by an injudicious manipulation of the port-stoppers. There are occasions, however, when the turret should not be turned, in which case the port-stoppers are indispensable. The method adopted for turning the turret will be readily understood. The small steam-engine controlled by one man, before referred to, drives a double train of cog-wheels connected with the vertical axle of the turret, this axle being stepped in a bronze bearing secured to the central bulkhead of the battery. The mechanism thus described was carefully tested before the *Monitor* left New York for Hampton Roads, and was found to move very freely, the turret being turned and the guns accurately pointed by the sailing-master without aid. The trouble reported by Lieutenant Greene regarding the manipulation of the turret was caused by inattention during the passage from New York; the working-gear having been permitted to rust for want of proper cleaning and oiling while exposed to the action of salt water entering under the turret, from causes already explained.



THE "DICTATOR" AT SEA.

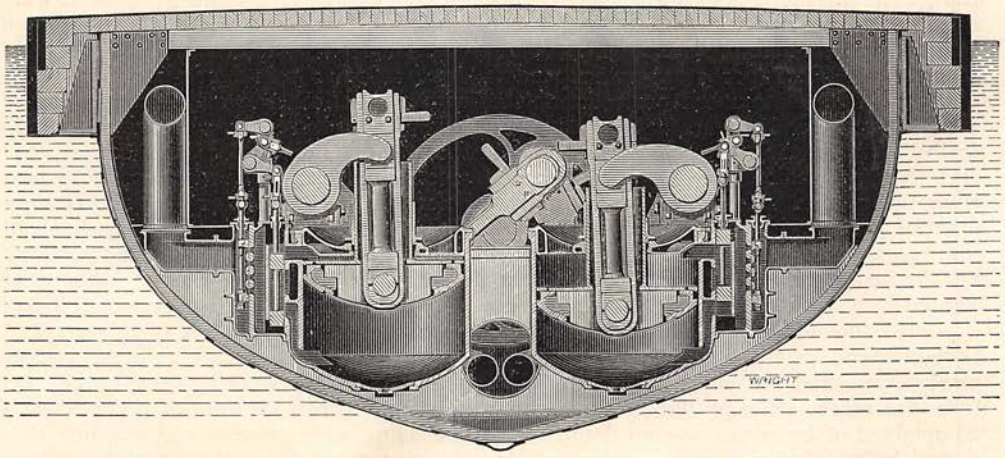
Amidships is seen the elevated promenade deck to which the ship's company resort when driven from the main deck by the seas.

Having thus briefly described the turret and its mechanism, our investigation of the central part of the sectional view of the battery will be completed by a mere reference to the steam-boilers placed aft of the turret. There are two of these boilers placed side by side, as shown in the cut on page 290. Two views being thus presented, the nature of the boilers will be understood without further explanation. It should be mentioned, however, that they proved very economical and efficient.

Aft Section. The following brief reference to this section of the sectional illustration, showing the motive engine, propeller, and rudder, will complete our description of the battery:

1. The motive engine, the construction of which is somewhat peculiar, consists of only one steam-cylinder with pistons applied at opposite ends, a steam-tight partition being introduced in the middle. The propeller-shaft has only one crank and one crank-pin, the difficulty of "passing the centers" being overcome by the expedient of placing the connecting-rods, actuated by the steam-pistons, at right angles to each other. Much space is saved within the vessel by employing only one steam-cylinder, an advantage of such importance in the short hulls of the monitors that the entire fleet built during the war was provided with engines of the stated type.

2. The propeller, being of the ordinary four-bladed type, needs no description; but the mode of protecting the same against shot demands full explanation. Referring to the illustration, it will be seen that the under side



TRANSVERSE SECTION OF THE MONITOR "DICTATOR" THROUGH THE CENTER LINE OF THE STEAM CYLINDERS.

The diagram shows the application of rock-shafts and vibrating levers by which the problem of placing engines with vertical cylinders below the water-line has been solved.

of the overhang near the stern is cut out in the middle, forming a cavity needed to give free sweep to the propeller-blades; the slope of the said cavity on either side of the propeller being considerably inclined in order to favor a free passage of the water to and from the propeller-blades.

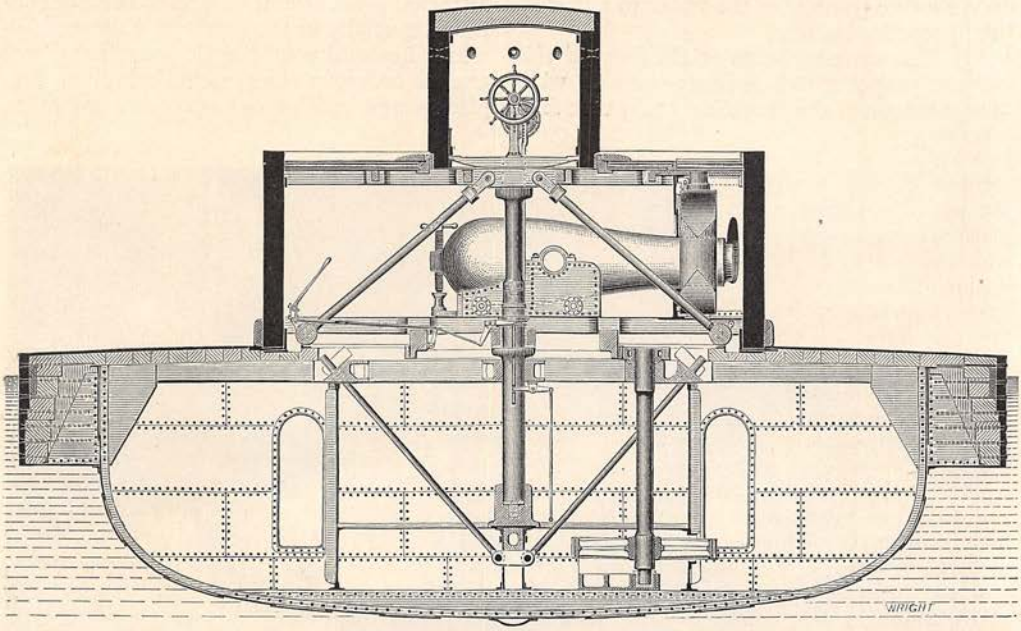
3. The extreme beam at the forward side of the propeller-well is thirty-one feet, while the diameter of the propeller is only nine feet; it will therefore be seen that the deck and side armor projects eleven feet on each side, thus protecting most effectually the propelling instrument as well as the equipoise rudder applied aft of the same. It will be readily admitted that no other vessel constructed here or elsewhere has such thorough protection to rudder and propeller as that just described.

THE MONITOR "MONTAUK" DESTROYING THE CONFEDERATE PRIVATEER "NASHVILLE," OGEECHEE RIVER, GEORGIA.

THE foregoing description of the hastily constructed steam-battery proves that, so far from being, as generally supposed, a rude specimen of naval construction, the *Monitor* displayed careful planning, besides workmanship of superior quality. Experts who examined the vessel and machinery after completion pronounced the entire structure a fine specimen of naval engineering.

The conflict in Hampton Roads, and the immediate building of a fleet of sea-going monitors by the United States Government, attracted great attention in all maritime countries, especially in the north of Europe. Admiral Lessoffsky of the Russian navy was at once ordered to be present during the completion and trial of our sea-going monitors. The report of this talented officer to his government being favorable, the Emperor immediately ordered a fleet of twelve vessels on the new system, to be constructed according to copies of the working drawings from which the American sea-going monitors had been built. Sweden and Norway also forthwith laid the keels of a fleet of seven vessels of the new type, Turkey rapidly following the example of the northern European nations. It will be remembered that during the naval contest on the Danube the Russian batteries and torpedo boats subjected the Turkish monitors to severe tests. England, in due course, adopted our turret system, discarding the turn-table and cupola.

Many prominent naval architects in the European maritime countries warmly advocated our system of war-vessels with turrets and low freeboard. In England the subject was critically investigated by ship-constructors



TRANSVERSE SECTION OF THE HULL OF A SEA-GOING MONITOR THROUGH THE CENTER LINE OF THE TURRET AND PILOT-HOUSE.

of the highest standing; the following epitome presents their views of the monitor system:

"1. It is a creation altogether original, peculiarly American, admirably adapted to the special purpose which gave it birth. Like most American inventions, use has been allowed to dictate terms of construction, and purpose not prejudice has been allowed to rule invention. The ruling conditions of construction for the inventor of the American fleet were these: the vessels must be perfectly shot-proof; they must fight in shallow water; they must be able to endure a heavy sea, and pass through it, if not fight in it. The American iron-clad navy is a child of these conditions. Minimum draught of water means minimum extent of surface; perfect protection means thickness to resist the heaviest shot, and protection for the whole length of the ship; it also means perfect protection to guns and gunners. Had they added, what English legislators exact, that the ports shall lie in the ship's side, nine feet above the water, the problem might at once have become impossible and absurd; but they wanted the work done as it could be done, and allowed the conditions of success to rule the methods of construction.

"2. The conditions of success in the given circumstances were these: that you should not require the sides of the ship to rise much above the water's edge; that you should not require more protection to the guns than would contain the guns and gunners; that you should be content with as many guns as the ship could carry, and no more. To do the work, therefore, the full thickness of armor required to keep out the enemy's shot was taken, but the ship was made to rise a few inches above water, and no more; and so a narrow strip of thick armor, all along the upper edge of the ship's side, gave her complete protection. Thus the least quantity of thickest armor did most work in protecting the ship, engines, boilers, and magazine. Next, to protect the guns, a small circular fortress, shield, or tower encircled a couple of guns, and, if four guns were to be carried, two such turrets carried the armament and contained the gunners. Thus, again, weight of armor was spared to the utmost, and so both ship and armament were completely protected. But the consequences of these conditions are such as England, at least for sea-going ships, would reluctantly accept. The low ship's side, in a seaway, allows the sea to sweep over the ship, and the waves, not the sailors, will have possession of the deck. The American accepts the conditions, removes the sailors from the deck, allows the sea to have its way, and drives his vessel through, not over, the sea to her fighting destination by steam, abandoning sails. The American also cheerfully accepts the small round turret as protection for guns

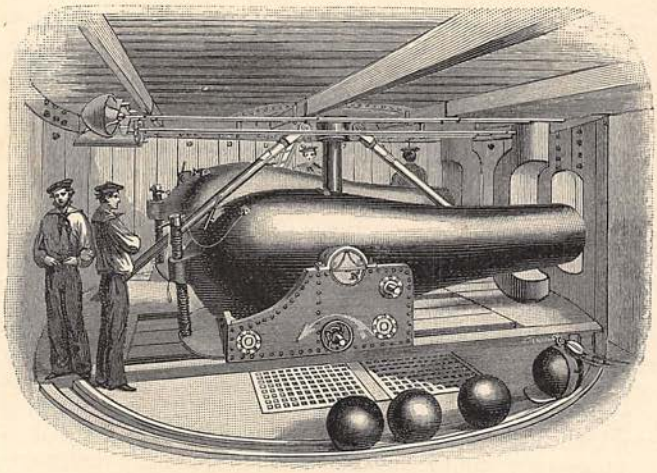
and men, and pivots them on a central turntable in the middle of his ship, raising his port high enough to be out of the water, and then fighting his guns through an aperture little larger than its muzzle. By thus frankly accepting the conditions he could not control, the American did his work and built his fleet. It is beyond doubt that the American *Monitor* class, with two turrets in each ship, and two guns in each turret, is a kind of vessel that can be made fast, shot-proof, and sea-going. It may be uncomfortable, but it can be made secure. The sea may possess its deck, but in the air, above the sea, the American raises a platform on the level of the top of his turrets, which he calls his hurricane-deck [see illustration of the *Dictator* at sea, page 292], whence he can look down with indifference at the waves furiously foaming and breaking themselves on the abandoned deck below. His vessel, too, has the advantage, as he thinks it, of not rolling with the waves; so that he can take his aim steadily and throw his shot surely. Thus, if he abandons much that we value, he secures what he values more. It may be shown that the American turret ships, of the larger class, with two turrets and four guns, are successful vessels — successful beyond the measure of English estimate of their success. Like so many American inventions, they are severely subject to the conditions of use, and successful by the rigidity and precision with which they fit the end and fulfill the purpose which was their aim. The design of these vessels has about it all the characteristics of American audacity. Every conventionality has been despised and discarded; in the sailor's sense of the word, there is nothing 'ship-shape' about this original *Monitor;* everything is unusual. She has neither keel, nor bilges, nor bulwarks. She is covered by a great horizontal platform of timber, projecting beyond her deck and descending below the water-line. This great upper platform in no way conforms to the shape of the under-ship which carries it; it is obviously meant to shelter the rudder and the stern from every attempt to damage them by shot or collision. At the bow the entire hull is equally protected by the overhanging platform of the deck."

The correctness of the views entertained by the English naval constructors was practically demonstrated by the performance of the monitors during the civil war. Impregnability proved by capability to keep out Confederate shot, being demanded by President Lincoln and promised by the constructor of the fleet which was built during the early part of 1862, it will be proper to inquire how far the performance accorded with anticipation. Admiral Dahlgren, the distinguished naval artillerist, commanding the blockading fleet at Charleston, reported to the Navy Department that from July 18 to September 8, 1863, a period of fifty-two days, the monitors *Weehawken*, *Patapsco*, *Montauk*, *Nahant*, *Catskill*, and *Passaic* engaged Forts Sumter, Moultrie, Wagner, Gregg, and the batteries on Morris and Sullivan's islands, on an average ten times each, the *Montauk* going before the muzzles of the enemy's guns fifteen times during the stated period, while the *Patapsco* was engaged thirteen times and the *Weehawken* twelve times. The number of hits received by the six vessels mentioned amounted to 629; yet not a single penetration of side armor, turret, or pilot-house took place. Admiral Dahlgren observes that the *Montauk* was struck 154 times during the engagements referred to, "almost entirely," he states, "by ten-inch shot." Considering that the hull of the *Montauk* was nearly submerged, hence presenting a very small target, the recorded number of hits marked splendid practice on the part of the Confederate gunners. The report of the experienced commander concludes thus: "What vessels have ever been subjected to such a test?" It merits special notice that the same monitors which Admiral Dahlgren thus found to possess such remarkable power of endurance had led the unsuccessful attack at Charleston three months previously,— a circumstance which shows that difficulties presented themselves during that attack which had not been foreseen, or the magnitude of which had not been properly estimated. The attack referred to being one of the leading incidents of the civil war, the following facts connected with the same cannot properly be withheld in this place, more particularly since these facts rebut the allegation that injudicious advice to certain officers induced the Navy Department to adopt hazardous expedients in connection with the attack on Charleston. A letter from the Assistant-Secretary of the Navy in reference to the contemplated attack, written before the news of its failure had been received, contained the following sentence:

"Though everybody is despondent about Charleston, and even the President thinks we shall be defeated, I must say that I have never had a shadow of a doubt as to our success, and this confidence arises from careful study of your marvelous vessels."

To this letter the following reply was forwarded the next day:

"I confess that I cannot share in your confidence relative to the capture of Charleston. I am so much in the habit of estimating force and resistance that I cannot feel sanguine of success. If you succeed, it will not be a mechanical consequence of your 'marvelous' vessels, but because you are marvelously fortunate. The most *I* dare hope is, that the contest will end without

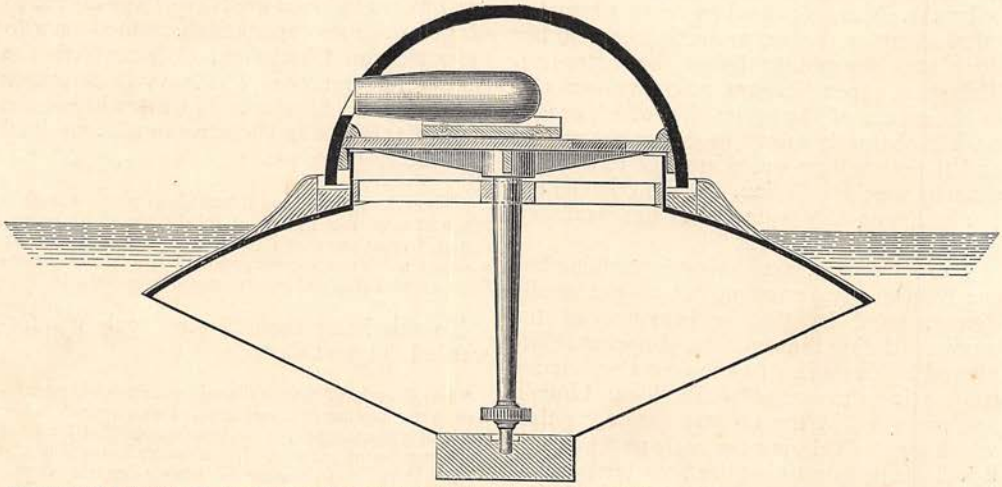


INTERIOR VIEW OF THE TURRET OF A SEA-GOING MONITOR.

The compact form of the gun-carriages, the simplicity of the massive port-stoppers, and the enormous size of the spherical projectiles (15-inch diameter) surprised naval experts.

the loss of that prestige which your iron-clads have conferred on the nation abroad. A single shot may sink a ship, while a hundred rounds cannot silence a fort, as you have proved on the Ogeechee. The immutable laws of force and resistance do not favor your enterprise. Chance, therefore, can alone save you."

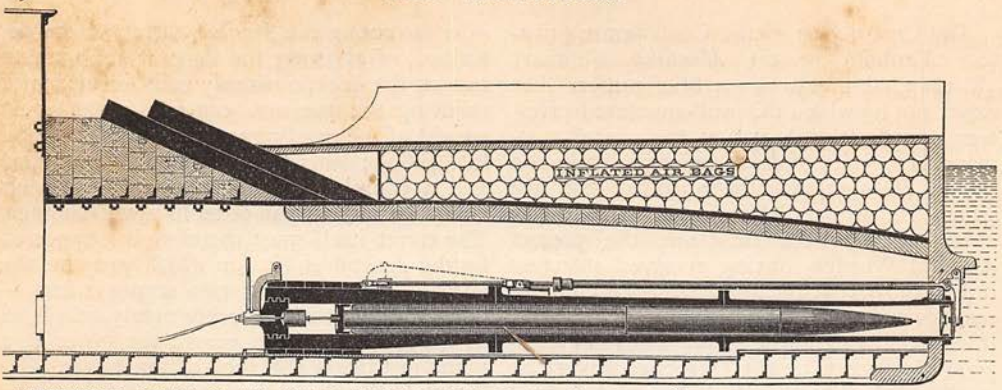
The discomfiture of the "marvelous" vessels before Charleston, however, did not impair their fitness to fight other battles. It will be recollected that the *Weehawken*, commanded by the late Admiral John Rodgers, defeated and captured the Confederate ram *Atlanta*, in Warsaw Sound, June 17, 1863, ten weeks *after* the battle of Charleston; consequently, *previous* to the engagements in which this monitor participated, as reported by Admiral Dahlgren. The splendid victory in Warsaw Sound did not attract much attention in the United States, while in the European maritime countries it was looked upon as an event of the highest importance, since it established the fact, practically, that armor-plating of the same thickness as that of *La Gloire* and the *Warrior* could be readily pierced, even when placed at an inclination of only twenty-nine degrees to the horizon. Moreover, the shot from the *Weehawken* struck at an angle of fifty degrees to the line of keel, thereby generating a compound angle, causing the line of the shot to approach the face of the armor-plate within twenty-two degrees. The great amount of iron and wood dislodged by the fifteen-inch spherical shot entering the citadel, protected by four-inch armor-plating and eighteen-inch wood backing, was shown by the fact that forty men on the *Atlanta's* gun-deck were prostrated by the concussion, fifteen being wounded, principally by splinters; a circumstance readily explained, since penetration at an angle of twenty-two degrees means that, independent of deflection, the shot must pass through nearly five feet of obstruction, — namely, eleven inches of iron and four feet of wood. Rodgers's victory in Warsaw Sound, therefore, proved that the four-and-a-half-inch vertical plating of the magnificent *Warrior* of nine thousand tons — the pride of the British Admiralty — would present a mere pasteboard protection against the fifteen-inch monitor guns.



TRANSVERSE SECTION OF AN IRON-CLAD STEAM-BATTERY THROUGH THE CENTER LINE OF ITS REVOLVING SEMI-SPHERICAL TURRET — SUBMITTED TO NAPOLEON III. IN THE LATTER PART OF 1854.

The destruction of the Confederate privateer *Nashville* by the *Montauk*, February 28, 1863, also calls for a brief notice. The expedient by which this well-appointed privateer was destroyed, just on the eve of commencing a series of depredations in imitation of the *Alabama*, must be regarded as a feat which has no parallel in naval annals. The commander of the *Montauk*, the present Admiral Worden, having received stringent orders to prevent the *Nashville* from going to sea, devised a plan for destroying the privateer (then occupying a safe position beyond a torpedo obstruction on the Ogeechee River), by means of the fifteen-inch shells which formed part of his equipment; but in order to get near enough for effective shelling, he was compelled to take up a position under the guns of Fort McAllister, then commanded by a Confederate officer of distinguished ability. Obviously, the success of the daring plan of not returning the concentrated flanking fire from the fort while shelling the privateer depended on the power of endurance of the *Montauk*, then for the first time subjected to such a crucial test. The result proved that Worden had not overestimated the resisting power of his vessel. The fifth shell had scarcely reached its destination when signs of serious damage on board the privateer were observed; a few additional shells being dispatched, a volume of black smoke was seen rising above the doomed *Nashville*. The shelling was continued for a short time, with the result that the entire hull of the intended depredator was enveloped in flames. The magazine ultimately exploded with terrific violence, tearing part of the structure into fragments. The gunners in the Confederate fort, McAllister, had in the mean time continued to practice against the *Montauk;* but no serious damage having been inflicted, the anchor was raised and the victor dropped down the river, cheered by the crews of the blockading fleet.

The cut on page 294 represents a transverse section through the turret and pilot-house of the *Montauk* and other sea-going vessels of the monitor type. It will be noticed that the pilot-house is placed above the turret, an arrangement which for lack of time could not be adopted in the original *Monitor*, as before particularly referred to. Evidently the pilot-house must remain stationary while the turret is being turned for the purpose of directing the guns; consequently it can derive no support from the turret; a stationary central shaft of wrought iron resting on the bottom of the vessel has therefore been introduced to carry the weight of the pilot-house, the substantial wrought-iron floor of which rests on the top of the shaft. The method adopted in constructing the *Monitor* turret, before described, of allowing the base of the same to rest on the deck, obviously calls for means of relieving the pressure caused by the great weight of the revolving structure before going into action; otherwise a very powerful engine and a complex arrangement of cog-wheels would be necessary in order to point the guns. The turret itself must therefore be supported by the central shaft, for which purpose the latter is provided with two strong collars,—one under the turret flooring nearly on a level with the deck of the vessel, the other at a point just below the roof of the turret. Referring to the illustration (page 294), it will be seen that diagonal braces connect the central part of the turret roof with the ends of the gun-slides, which latter consist of heavy girders of wrought iron stretching across the turret, to which they are firmly bolted. Corresponding diagonal braces applied below connect the ends of the gun-slides with the bearings into which the vertical shaft is stepped. The turret, the base of which is accurately faced underneath, rests on a smooth ring composed of bronze let into the deck, the base and this ring forming a water-tight joint at all times, even when the weight of the turret is partially relieved by keying up the central shaft. The port-stopper consists simply of a massive crank of wrought iron placed vertically, turning on a central pivot, readily operated by two men, and requiring only a few seconds in opening and closing. When turned in a line with the axis of the gun it closes the port, and when turned at right angles, as shown in the illustration, permits the gun to be run out. By means of a small steam-engine and a train of cog-wheels, the turret is turned and the guns pointed, as previously explained. The turret and pilot-house are perfectly cylindrical, each being composed of eleven plates of wrought iron, one inch thick, riveted together by "lapping" the same in a very peculiar manner insuring great strength. The pilot-house, provided with numerous sight-holes, generally elongated, is sufficiently large to accommodate the commanding officer, pilot, and helmsman. The mechanism for transmitting the power from the wheel to the tiller-ropes which control the rudder is quite novel. The success of this apparently complex mechanism has called forth favorable comments among European naval engineers, who all admit that a closed rotating gun-platform is not complete unless it is provided with an impregnable stationary protection for the commanding officer, pilot, and helmsman. A device which allows the commander to watch in perfect safety the movements of his opponent, instruct his helmsman, and direct the



LONGITUDINAL SECTION OF THE BOW OF AN IRON VESSEL OF THE "DESTROYER" TYPE, SHOWING ITS SUBMARINE GUN, EXPLOSIVE PROJECTILE, AND SEA-VALVES.

gunners under his feet, without changing his position, may well be deemed a mechanical triumph.

Regarding the plan of the *Monitor* and its origin, it should be stated that during the month of September, 1854, I presented a drawing and description of an iron-clad steam-battery to the Emperor Napoleon III.* This battery, like the *Monitor*, carried in its center a rotating circular gun-platform protected by a semi-spherical cupola composed of wrought iron six inches thick, the rotary platform and cupola being supported by a vertical axle resting on the bottom of the battery and operated by a steam-engine and a train of cog-wheels geared to the axle, as in the *Monitor*. The deck of this original battery was composed of plate iron three inches thick, curved upwards, the sides being entirely submerged, as shown by the illustration representing a transverse section of the hull through the center of the gun-platform and cupola. The peculiar form of this transverse section calls for an explanation,— namely, the keel consists of a square hollow box filled with cast iron, the weight of which is necessary to give stability to the structure. The illustration (page 296), it should be mentioned, is a facsimile of the drawing presented to the French Emperor. Regarding the internal arrangement of the battery, the fact calls for special notice that it was provided with a cylindrical tube for expelling submarine projectiles charged with explosives for destroying ships. The original battery submitted to Napoleon III. may, therefore, be regarded as a duplex fighting-machine, capable of attacking an enemy by an improved method of firing above water, together with the application of *submarine artillery* for expelling projectiles under water, capable of piercing the lower part of the hull of iron-clads, thereby rendering the employment of armor-plating as a means of protection practically useless.

The nautical community is aware that I have recently built a vessel, the *Destroyer* (now lying at the wharf in the United States Navy Yard at Brooklyn), provided with a submarine gun. The *Destroyer* is an iron vessel one hundred and thirty feet long, seventeen feet wide, eleven feet deep, protected by a wrought-iron breastwork of great strength applied near the bow. The submarine gun, a formidable piece of ordnance of sixteen-inch caliber and thirty feet length, is placed on the bottom of the vessel, the muzzle projecting through an opening in the stem, as shown by the illustration representing a longitudinal section of the bow of the *Destroyer*. The projectile expelled by the submarine gun is twenty-five feet long, its weight being fifteen hundred pounds, including an explosive charge of three hundred pounds of gun-cotton, its form being shown by the above illustration. It is hardly necessary to point out that the carrier of the submarine gun is intended to supersede the costly ships called steam-rams, admitted to be the most powerful offensive weapons for naval purposes hitherto constructed. The *Destroyer* attacks bows on, and discharges the projectile at a distance of three hundred feet from the ship attacked. Experts need not be told that the explosion of three hundred pounds of gun-cotton against the lower part of a ship's hull will shatter it so completely that the expedient of employing water-tight compartments will be of no avail. Naval experts who have been present during the trials of the submarine gun of the *Destroyer* can give good reasons for not taking a warm interest in the present contest between armor-plates two feet thick and one-

* The Emperor promptly acknowledged the receipt of the plans, through General Favé, who said in his letter: "L'Empereur a examiné lui-même avec le plus grand soin le nouveau système d'attaque navale que vous lui avez communiqué. S. M. me charge d'avoir l'honneur de vous informer qu'elle a trouvé vos idées trés ingénieuses et dignes du nom célèbre de leur auteur."

hundred-ton guns. Considering the defenseless condition of New York and other important seaports, it may be urged that the United States should no longer lose time by watching the contest between the plate manufacturers of Sheffield and Essen; nor should time be lost by investigations intended to decide the merits of Krupp and Armstrong guns.

The Committee of Naval Affairs of the Senate, during the last session of Congress, in view of the fact that this country possesses no plant for producing either thick armor-plates or big guns, reported a bill (passed by the Senate February 27, 1885) for purchasing the *Destroyer*, in order to enable the Navy Department to test experimentally the efficacy of submarine artillery. The defense of the seaports of the United States by the new method of piercing iron-clads in spite of their thick armor-belt will in due time demonstrate that a conflict between an *Inflexible* and a *Destroyer* will be shorter and more decisive than that between the *Merrimac* and the *Monitor*.

John Ericsson.

THE LOSS OF THE MONITOR.*

BY A SURVIVOR.

AT daybreak on the 29th of December, 1862, at Fort Monroe, the *Monitor* hove short her anchor, and by ten o'clock in the forenoon she was under way for Charleston, South Carolina, in charge of Commander J. B. Bankhead. The *Rhode Island*, a powerful side-wheeled steamer, was to be our convoy, and to hasten our speed she took us in tow with two long twelve-inch hawsers. The weather was heavy with dark, stormy-looking clouds and a westerly wind. We passed out of the Roads and rounded Cape Henry, proceeding on our course with but little change in the weather up to the next day at noon, when the wind shifted to the south-south-west and increased to a gale. At twelve o'clock it was my trick at the lee wheel, and being a good hand I was kept there. At dark we were about seventy miles at sea, and directly off Cape Hatteras. The sea rolled high and pitched together in the peculiar manner only seen at Hatteras. The *Rhode Island* steamed slowly and steadily ahead. The sea rolled over us as if our vessel were a rock in the ocean only a few inches above the water, and men who stood abaft on the deck of the *Rhode Island* have told me that several times we were thought to have gone down. It seemed that for minutes we were out of sight, as the heavy seas entirely submerged the vessel. The wheel had been temporarily rigged on top of the turret, where all the officers, except those on duty in the engine-room, now were. I heard their remarks, and watched closely the movements of the vessel, so that I exactly understood our condition. The vessel was making very heavy weather, riding one huge wave, plunging through the next as if shooting straight for the bottom of the ocean, and splashing down upon another with such force that her hull would tremble, and with a shock that would sometimes take us off our feet, while a fourth would leap upon us and break far above the turret, so that if we had not been protected by a rifle-armor that was securely fastened and rose to the height of a man's chest, we should have been washed away. I had volunteered for service on the *Monitor* while she lay at the Washington Navy Yard in November. This going to sea in an iron-clad I began to think was the dearest part of my bargain. I thought of what I had been taught in the service, that a man always gets into trouble if he volunteers.

About eight o'clock, while I was taking a message from the captain to the engineer, I saw the water pouring in through the coal-bunkers in sudden volumes as it swept over the deck. About that time the engineer reported that the coal was too wet to keep up steam, which had run down from its usual pressure of eighty pounds to twenty. The water in the vessel was gaining rapidly over the small pumps, and I heard the captain order the chief engineer to start the main pump, a very powerful one of new invention. This was done, and I saw a stream of water eight inches in diameter spouting up from beneath the waves.

About half-past eight the first signals of distress to the *Rhode Island* were burned. She lay to, and we rode the sea more comfortably than when we were being towed. The *Rhode Island* was obliged to turn slowly ahead to keep from drifting upon us and to prevent the tow-lines

* By the courtesy of the Rhode Island Historical Society we are permitted to print the following interesting paper condensed from one of its pamphlets, of which only a very small edition has been published. —[EDITOR.