



JOHN ERICSSON.

CHAPTER XIII.

THE VIRGINIA AND THE MONITOR.

Confederate Privateers.—Treatment of captured Privateersmen.—Necessity of Iron-clads.—Transformation of the Merrimac into the Virginia.—The Stevens Battery.—Iron-clads proposed to the Federal Government.—Approval of the Plan of the Monitor.—Its Inventor and Builder.—The Revolving Turret, and its Inventor.—Launch of the Monitor.—Hampton Roads.—Appearance of the Virginia.—Sinking of the Cumberland.—Destruction of the Congress.—The Minnesota, Roanoke, and St. Lawrence.—Wooden Vessels and Iron-clads.—Close of the first Day's Fight.—Appearance of the Monitor.—First Encounter of Iron-clads.—The Result.—The Monitor and Virginia watching each other.—Destruction of the Virginia.—Action at Drewry's Bluff.—Loss of the Monitor.—Perilous Voyage of the Passaic.—New Monitors built.—Obstacles to their Construction.—Forging Armor-plates.—Capacity of Turreted Vessels.—The Turrets as proposed by Timby.—Automatic Aiming and Discharge.—Advantages of the Turret System.

At the commencement of the war the Confederates were without any naval force. Of the fifty vessels which they had seized in their ports and rivers only a few were capable of service on the ocean. They had neither time nor means to construct vessels of war; but the Federal merchantmen offered a tempting prize which it was hoped might be secured by private armed vessels sailing under letters of marque. During the spring and early summer of 1861 several privateers were fitted out. Most of them came to grief; none were successful. The revenue schooner *Aikin* was seized at Charleston, and fitted out as a privateer under the name of the *Petrel*. She had hardly got to sea when she came in sight of the frigate *St. Lawrence*, to which she gave chase, supposing her to be an unarmed merchantman. Coming within range, the frigate discharged a single broadside, which sank the privateer. The *Echo*, a condemned slaver, was seized at Charleston, and equipped as a privateer under the name of the *Jeff Davis*. She made several prizes. Among these was the *S. J. Waring*, captured within less than two hundred miles from New York. The colored steward, William Tillman, and two seamen, were left on board, with a prize crew of five men, to take the vessel to Charleston. One night Tillman killed three of the captors, and, aided by one of the crew, compelled the others to take the *Waring* to New York, where salvage was awarded to him as the recaptor. The *Jeff Davis* was soon after wrecked on the Florida coast. The *Savannah*, a pilot schooner of only 54 tons, was fitted out as a privateer. After making a single prize, she was captured by the frigate *Perry*, and her captain and crew were put in irons as pirates. They were brought to trial as pirates, but the jury failing to agree, they were remanded. The Confederate government thereupon selected an equal number of Federal officers, among whom was Colonel Corcoran, captured at Bull Run, and placed them in close confinement, to be treated in the same manner as the crew of the *Savannah*. In consequence of this action, and of the prevailing sentiment at home and abroad, the Federal government receded from its position, and the rights of prisoners of war were tacitly conceded to captured privateersmen.

The blockade of the Southern coast soon became so strict that privateers had no chance of sending their prizes into their own ports, and those of foreign nations were closed by proclamations of neutrality. Privateers could only destroy their prizes without gaining any profit for themselves. The only practical advantage which the Confederates derived from the issue of letters of marque was the tacit acknowledgment by the Federal government that they were actual belligerents, and that prisoners made from them on the sea as well as on the land were to be considered as prisoners of war.

Though Confederate citizens could not wage war upon the ocean with

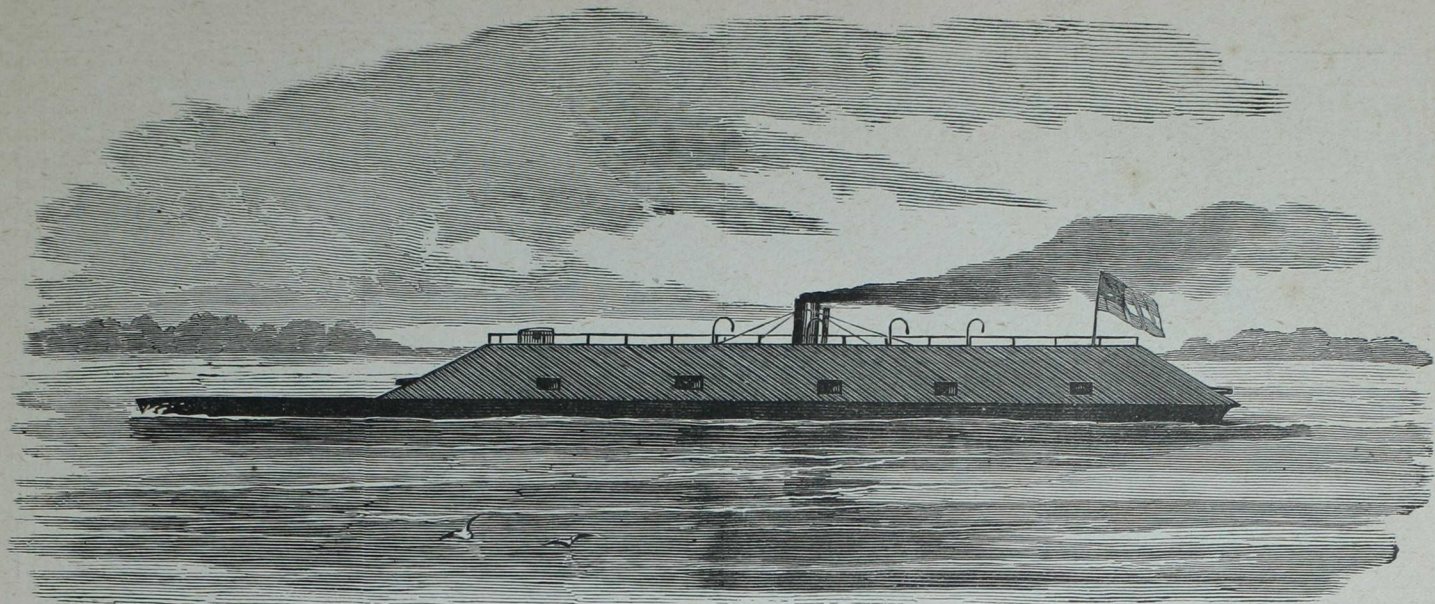
profit to themselves, government might greatly injure the enemy by preying upon its commerce. Armed vessels might be fitted out under the Confederate flag, bearing regular commissions as men-of-war. They had no ships built for this purpose, and no means for constructing them at home. Until they could buy or build them abroad, they could only arm and equip some of the merchant-steamers which had fallen into their hands. The *Nashville*, formerly plying as a packet between New York and Charleston, and the *Marques de la Habana*, a New Orleans and Havana trader, her name having been changed to the *Sumter*, were armed and sent to sea. The fate of these two vessels, which has already been described in this History, showed that steamers built for commerce were not adapted for cruisers. Steamers possessing great speed and sufficiently staunch to carry a heavy armament were demanded. In course of time several of these were procured in Great Britain. The career of two of these, the *Florida* and the *Alabama*, will be narrated hereafter. We now turn to a subject of greater importance, which comes up earlier in order of time.

The Confederate authorities early saw the necessity of floating batteries to defend their coasts, harbors, and inland waters. They could not hope to rival their enemy in the number of vessels. They must rely upon the superior offensive and defensive force of a few. The maritime powers of Europe had instituted experiments to test the practicability of rendering ships invulnerable by clothing them with iron. France had built *La Gloire*, and Great Britain the *Warrior*. These were ordinary men-of-war, covered wholly or in part with solid iron plates four or five inches thick, which was thought sufficient to withstand the heaviest shot possible in naval warfare. But to construct a vessel of this class, with all the appliances of European navy yards and foundries, required months. The Confederates needed such vessels in weeks. They had no means of building a hull or of making an engine. They had no iron which a European naval constructor would have thought fit for armor. But imbecility, treachery, and accident gave them a hull and engine ready for immediate use.

In 1855 the United States built at different navy yards three powerful steam frigates, the *Merrimac*, the *Roanoke*, and the *Minnesota*. They were all nearly alike, of about 3500 tons burden, carrying from forty to fifty heavy guns. In April, 1861, the *Merrimac* was at the Norfolk Navy Yard, undergoing repairs. When that place was abandoned, she was set on fire, scuttled, and sunk. She was soon after raised by the Confederates, and John M. Brooke, formerly a lieutenant in the United States Navy, John L. Porter, Confederate naval constructor, and William P. Williamson, chief engineer, were ordered to examine into her condition and the use to which she might be put. They reported that her upper works were so much damaged that she could not be rebuilt without great expense and delay; but the bottom part of the hull, the boilers, and heavy parts of the engine, were almost without injury, and that these could be adapted for a shot-proof steam battery more quickly and for one third of the sum which it would cost to construct such a vessel anew. The plan was furnished by Brooke and Porter. The central part of the hull, for something more than half of its length, was cut down to within three or four feet of the water-line to form the gun-deck, and the hull was plated with iron to a depth of about six feet below the water-line. A casemate of entirely novel construction was built upon the gun-deck. Pine beams, a foot square and fifteen feet long, were placed side by side, like rafters, at an inclination of about 45 degrees. These projected over the sides of the vessel like the eaves of a house, their ends dipping two feet below the water. Upon these beams were placed two layers of oak planks four inches thick, one layer horizontal, the other vertical. This was first overlaid with ordinary flat bars of iron four and a half inches thick. Experiments which were made under the care of Lieutenant Brooke showed that this thickness of iron was inadequate, and a layer of railroad iron was added. This casemate did not come to a point, like the roof of a house, but there was a flat space on the top, rendered bomb-proof by plates of wrought iron. From this roof projected a short smoke-stack. The armament consisted of eight 11-inch guns, four on each side, and a 100-pound rifled Armstrong gun at each end. The ends of the vessel were cut down still lower, so as to be two feet below water. A light bulwark, or false bow, of wood was built. This served the twofold purpose of preventing the water from banking up against the casemate when the vessel was in motion, and of a tank to diminish the draft. The inclined roof and submerged eaves and ends constituted the novel and distinctive features of this battery, to which was given the name of the *Virginia*. The draft of the *Merrimac* had been about twenty-three feet, and her speed was fourteen or fifteen miles an hour. The iron heaped upon her when she was converted into the *Virginia* brought her down about two feet more, and her speed was reduced quite one half.¹

The construction of the *Virginia* was commenced in June, 1861, and pushed forward as rapidly as possible. The fact that this battery was being built could not long be concealed from the Federal authorities, but every effort was made to mislead them by false information. Now it was reported that the *Virginia* was ready for action, and would soon come out; then some Southern paper would contain a paragraph affirming that she was a failure;

¹ The description of the *Virginia* is necessarily imperfect. The plans were carefully concealed in the archives of the Confederate naval department, which has never divulged them. No one except her builders and crew appears ever to have been on board of her. When she was blown up, so complete was the destruction that no fragment of her armor has been discovered. There is some doubt as to the character and thickness of the iron which covered the casemate. We have accepted, with some doubt, the statement of the double thickness, flat bars and railroad iron, making from seven to nine inches in all. This is confirmed by the effect of the shot which she withstood, which would certainly have penetrated four inches if struck perpendicularly.—The accompanying picture is the best ever taken. The submerged stern is not shown, as it was below water and invisible. The bow, which appears projecting before the casemate, was simply the light, false bow, built upon the real bow, which was below water. The sloping sides should have been represented as dipping below the water, instead of stopping at the edge of the hull, above the water-line.



THE VIRGINIA.

her armor had been found too thin to be of service; more had been piled upon her, until accurate calculation showed that she would never float. Again it was said that her back had been broken in attempting to launch her, and that she was abandoned. Several persons made their appearance in the Federal lines claiming to have been employed upon her, and furnished rude drawings of her construction. Whether they were treacherous or ignorant can not be known; but their descriptions were certainly far from accurate.

The Federal government was slow to perceive the necessity of iron-clad vessels. Before the rebellion it had made no direct experiments in this direction. Robert and Edwin Stevens, wealthy citizens of New Jersey, had indeed, for some years, been engaged in constructing an iron battery upon a plan of their own, and Congress had at different times made appropriations to the amount of half a million; the builders had also expended more than a quarter of a million dollars. In December, 1861, a commission was appointed to examine this vessel. They reported unfavorably. To complete her would cost more than \$550,000, making the whole expense nearly \$1,300,000, and it would be months before she could be made available. Meanwhile, when Congress met in extra session in July, 1861, the Naval Department asked for an appropriation of \$50,000 for the purpose of testing iron plates. This was refused; but the President ordered that plate should be prepared, without waiting for an appropriation. At length, on the 3d of August, just before the close of the session, an appropriation of \$1,500,000 was made for building one or more iron-clads. The next day an advertisement was issued for proposals, and a commission appointed to examine the plans suggested. Seventeen proposals were presented for vessels ranging from 83 to 400 feet in length, to cost from \$32,000 to \$1,500,000 each. The commission reported in favor of three different vessels. The Ironsides, by Merrick & Sons, of Philadelphia, was to be a regular man-of-war, covered with four and a half inch solid plates. She was to be 240 feet long, about 3500 tons burden, to carry 20 heavy guns in broadside. She would be completed in a year, at a cost of \$780,000. The Galena, by C. S. Bushnell, of New Haven, was to be a steamer of 700 tons, brigantine rigged, pierced for 18 guns. Her frame to be of solid timber 18 inches thick, covered from 2 to 4 inches with plates of thin rolled iron. Her armor was found in the end to be wholly inadequate to resist heavy guns. Her cost was \$235,000. Both these vessels were built upon general models which had been long in use.

Of an altogether different class was the Monitor proposed by John Ericsson, of New York.¹ Her design was so wholly new in every respect that the approval of the commission was cautiously guarded. They said: "This is novel, but seems to be based upon a plan which will render the battery shot and shell proof. We are somewhat apprehensive that her properties for sea are not such as a sea-going vessel should possess; but she may be moved from place to place on our coast in smooth water. We recommend that an experiment be made with one battery of this description on the terms proposed, with a guaranty and forfeiture in case of a failure in any of the points and properties of the vessel as proposed."

Novel as the plan was to others, it was no sudden conception of the inventor. It had been thought out to the minutest detail, and been constructed in drawings and models for years. So confident was Ericsson of the perfect success of his invention, that he proposed for it the name of the "Monitor," in order "to admonish the South of the fate of the rebellion, Great Britain of her fading naval supremacy, and the English government of the folly of spending millions in fixed fortifications for defense." These terms were accepted. The price was to be \$275,000. The contract was signed on the 5th of October. The construction of the vessel was undertaken by Thomas F. Rowland, who, starting in life as the driver of a railway engine, then becoming an engineer and ship-builder, had, at the age of twen-

ty-eight, become proprietor of the "Continental Works" at Greenpoint, in the city of Brooklyn. Ericsson superintended the whole work in person. In spite of his threescore years, he was every where skipping up and down ladders, and over planks and gangways, as though he were a boy of sixteen. It seemed as though a plate could not be fitted or a bolt driven without his being at the workman's side. So rapidly was the work pressed forward that the vessel was launched, with her engines on board, on the 30th of January, just a hundred days after the keel was laid.

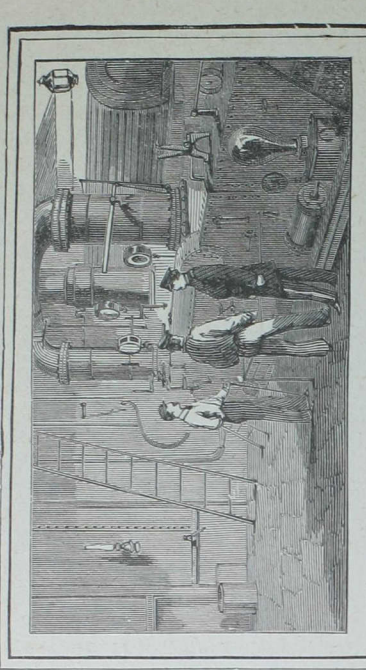
The hull of the Monitor was constructed of a double thickness of iron, three eighths of an inch thick, strengthened by iron ribs and knees. It was 140 feet long, 30 feet wide at the broadest part, and 12 feet deep. The shape and proportions were like those of the half of an egg-shell slightly flattened at the bottom. An Indian canoe is an almost perfect miniature of this hull, and is apparently hardly less frail, for a cannon ball would pierce the thin iron as easily as a pistol shot would the bark sides of the canoe. But this frail hull was so protected that when afloat no shot could reach it. Five feet below the top, an iron shelf, strongly braced, projected nearly four feet from the sides. This shelf was filled up with oaken blocks three and a half feet thick, over which were bolted five series of iron plates, each an inch thick. This armor-shelf or platform projected sixteen feet at the stern, in order to cover the rudder and propeller, and ten feet at the bow, to protect the anchor. The entire length on deck was 166 feet, the breadth 42. When afloat, the entire hull and three feet of the armor-platform were submerged. To the eye the vessel was merely a low raft, rising only two feet above water. No shot from a hostile vessel could reach the vulnerable hull without passing through the invulnerable armor. This defensive structure of the Monitor was solely the invention of Ericsson.

But a vessel of war must possess offensive as well as defensive power.

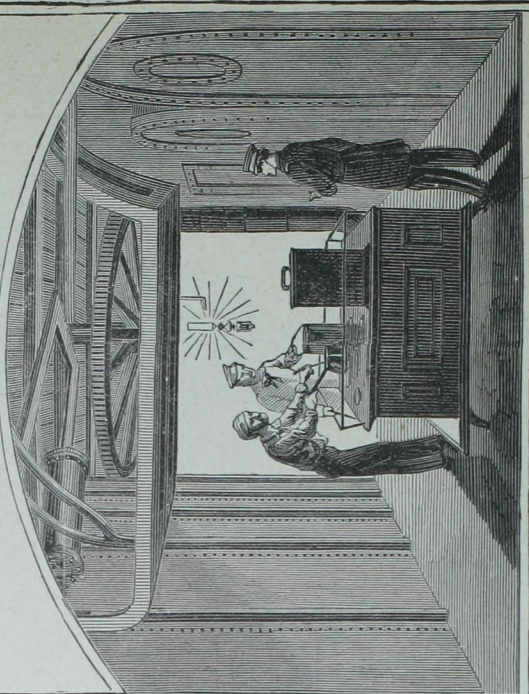


THOMAS F. ROWLAND.

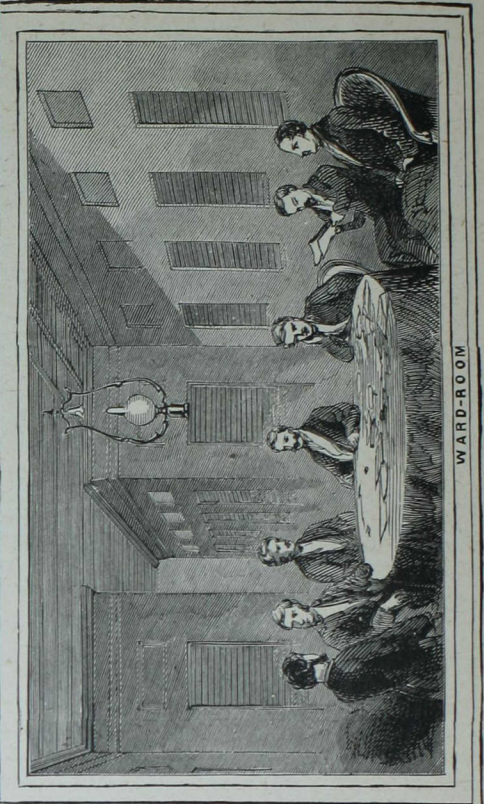
¹ John Ericsson was born in Sweden in 1803. From boyhood he manifested decided aptitude for mechanical invention. In 1823 he went to England, where he acquired the highest reputation as a constructive engineer. He came to America in 1839, assuming at once and maintaining a foremost place in his profession.



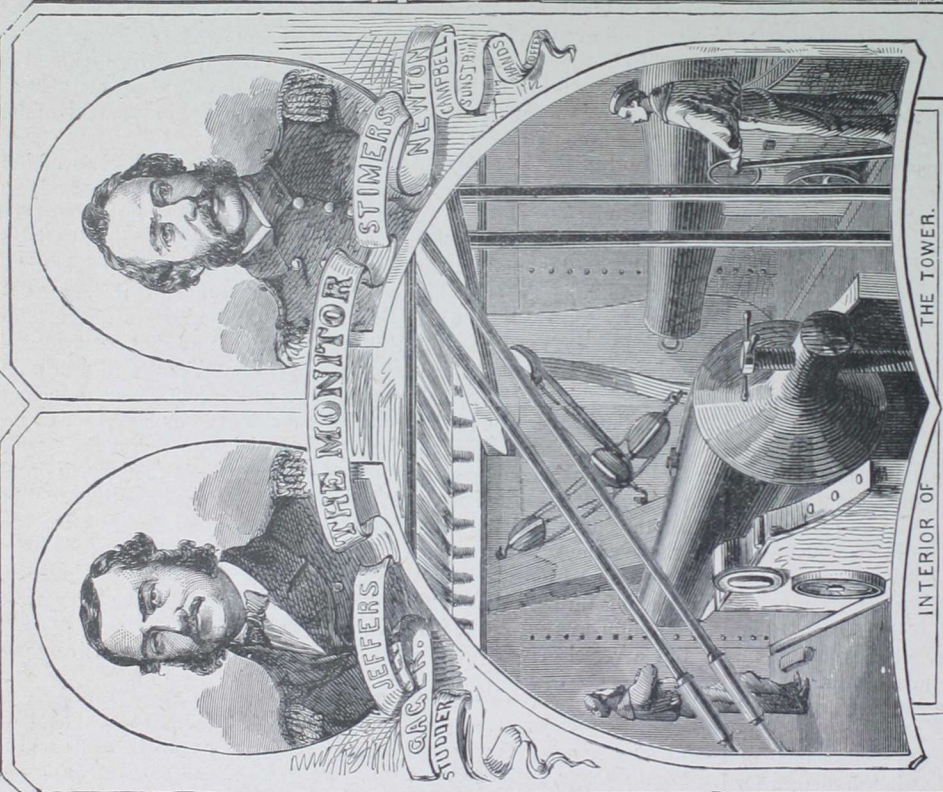
ENGINE-ROOM



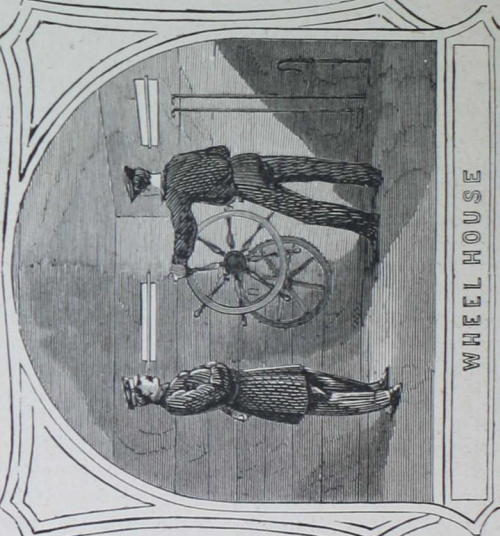
TURRET MACHINERY



WARD-ROOM



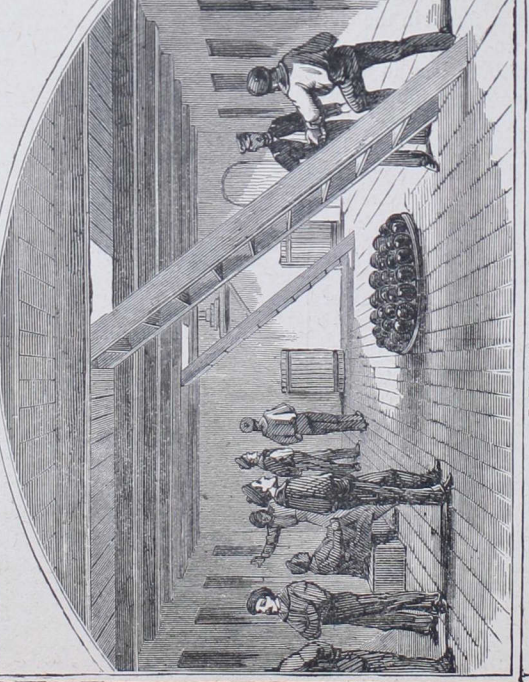
THE TOWER.



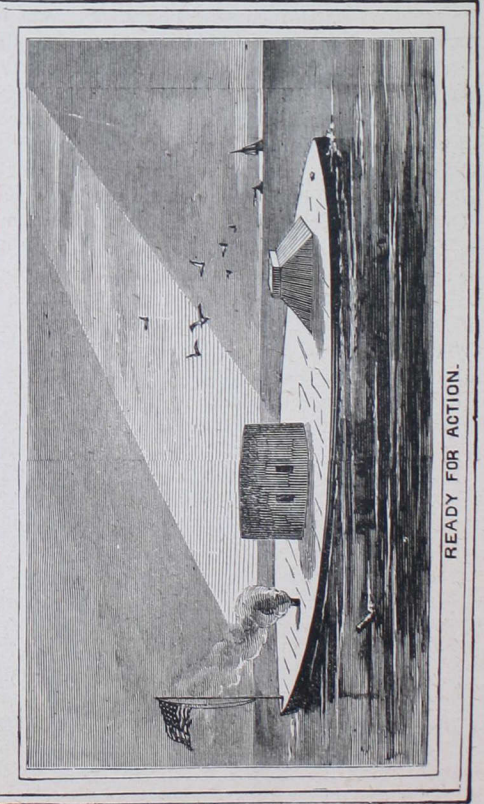
WHEEL HOUSE



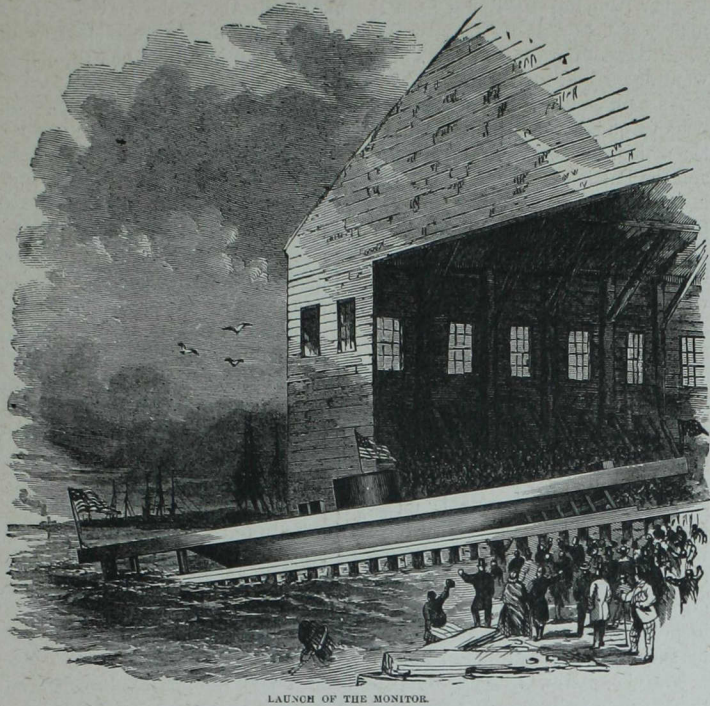
CAPTAIN'S CABIN.



BERTH DECK.



READY FOR ACTION.



LAUNCH OF THE MONITOR.

This in the Monitor was embodied in two 11-inch guns, a heavier ordnance than had ever before been placed on any vessel. Ericsson had struck upon a principle which all European engineers had strangely missed. In the field, the primary object in warfare is to slaughter the enemy's men; in naval warfare, to destroy his vessels. A rifle bullet will disable a man as effectually as a cannon ball; heavy shot only will destroy a ship. In the field, the combatant will succeed who can strike the more blows; on the water, the one who can strike the heavier. The guns of the Monitor could be placed only upon the deck; these, as well as the gunners, must be protected. For the means of doing this the Monitor was indebted to the revolving turret, the invention of another than Ericsson, though he displayed rare genius in first adapting it to practical use. Ten years before Ericsson had dreamed of the Monitor, a lad residing in an inland American village had thought of revolving turrets.

Theodore R. Timby was born in Dutchess County, New York, in 1822. He received the education usual among the sons of American farmers. Before he was twenty years old he was engaged in active business; but the bent of his mind was toward mechanical invention. At sixteen he constructed a model of a floating dry-dock, but it was pronounced to be practically useless by those to whom it was proposed, and he abandoned it. Years after it was re-invented by others; but these docks now in use contain nothing essential which was not embodied in the model of this young resident of a country town. Several other inventions were more profitable. His first model for a revolving turret was made in 1841. It was hardly six inches in height, but contains the germ of the whole invention. On the 18th of January, 1843, he filed his first caveat for this in the Patent Office. The specifications were for a "revolving metallic tower, and for a revolving tower for a floating battery, to be propelled by steam." In the mean while he was constructing a large iron model, which was finished in the spring of 1843, and was during that year publicly exhibited throughout the country. He urged his invention upon the attention of the American government, besides constructing several models, one of which was sent to the French government, and another to the Emperor of China. Our military authorities admitted the practicability of the invention, but assumed it to be wholly superfluous. The defenses of the country, it was said, were already more than could ever be required. A favorable report was indeed made, in 1848, to the Senate, one of the committee being Jefferson Davis. No farther action was taken on this report, although it was endorsed by the chief of the Ordnance Bureau. Timby, however, took out patents covering the broad claim "for a revolving tower for offensive and defensive warfare, whether used on land or water." The advantages of the revolving turret for naval warfare are apparent at a glance. It furnishes a shield for guns and gunners which can be made invulnerable without using a weight of iron greater than can be floated; and it enables the vessel, without altering its own position, to bring its whole ordnance to bear upon any point in the circle. When Ericsson bent himself to the invention of a floating battery, he found the one essential thing necessary to give it practical offensive power ready to his hands, though it is not probable that he then knew to whom he was indebted for it.

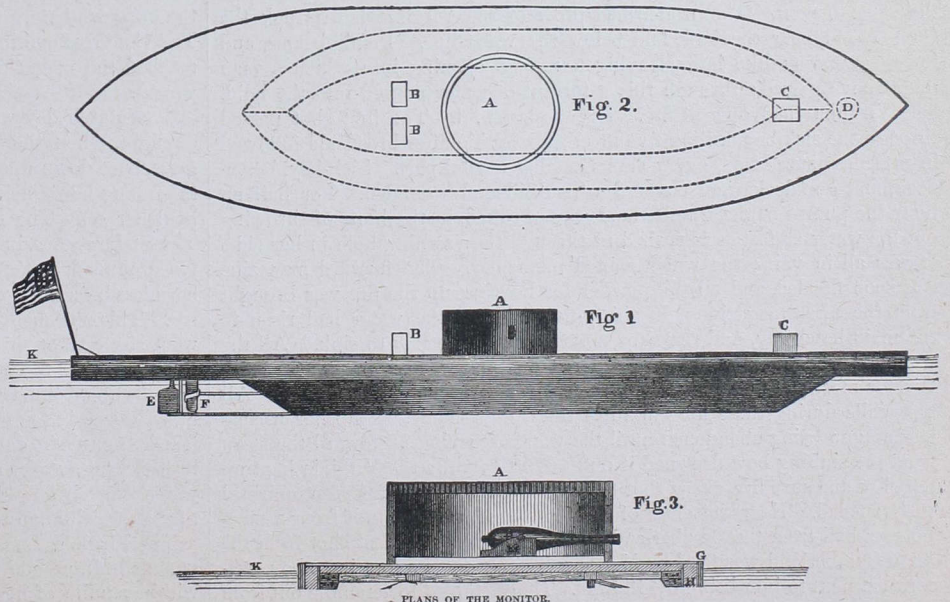
The turret of the Monitor was constructed of plates of iron an inch thick, about three feet wide,

and nine feet long. Eight of these plates constituted its thickness. It was thus nine feet high and eight inches thick, with a diameter of about twenty feet. The two port-holes, side by side, were oval, just large enough horizontally to allow the gun to be run out, with sufficient vertical height to give room for the elevation of the guns to secure the range for different distances. It was made to revolve upon a central shaft by means of a separate engine. When not in action, by driving back a wedge it rested firmly upon a metallic ring upon the deck. The guns were loaded within the turret, and only run out to be discharged. The deck was perfectly flat, without even a permanent railing. The smoke-pipe and draft-pipe for admitting air to the hull could be lowered below the deck. When the vessel was prepared for action the deck presented a smooth surface, broken only by the huge round turret, and a low square pilot-house near the bow. The vessel drew ten feet of water, and was rated at 776 tons.

The work of the constructors was completed early in January. Two full months were spent in fitting the armament and testing the apparatus. On the 5th of March, in obedience to a sudden order, she set out for Fortress Monroe. She reached her destination on the night of the 8th, just in time to avert an overwhelming catastrophe, but just too late to prevent a great disaster; for the Virginia had come out ten hours before, and won the first battle in Hampton Roads.

Hampton Roads is an indentation setting in westward from Chesapeake Bay. The narrow entrance is guarded by Fortress Monroe, built on a peninsula jutting out from the southern shore. It then spreads out into an oval harbor some five miles in diameter. Here and there is a shallow place; but almost every part is deep enough to float the largest vessel. The estuaries of two rivers enter the top of the harbor from opposite directions: the James from the northwest, and the Elizabeth from the southeast. At the head of the estuary of the Elizabeth, eight miles from its opening, are Norfolk on the east side, and Portsmouth, with Gosport, its suburb, on the west. The navy yard is at Gosport, which is about twenty miles from the entrance to the Roads. The harbor formed by the bay and estuary is one of the best on the continent. Hampton Roads was made the great naval rendezvous for the Federal fleet. The north shore was occupied by the Federals, who had a camp at Newport News, at the mouth of the James. The Confederates had intrenched camps at Sewall's Point and Craney Island, on each side of the mouth of the Elizabeth, covering the approach to Norfolk. During the spring and early summer of 1861, Norfolk had been so feebly held that it might have been taken. Butler, who had 11,000 men at Fortress Monroe, projected an expedition for this purpose; but the battle of Bull Run put a stop, for a time, to all active operations by the Federal armies. Every possible man was withdrawn to Washington. Only 5000 were left at Fortress Monroe, and for six months the enemy were left to construct the Virginia without hinderance.

Meantime Federal fleets had assembled in the Roads and had been dispatched upon various expeditions. In the first days of March the only vessels of war at that point were the steam frigates Minnesota and Roanoke, twins of the Merrimac, and the sailing frigates Cumberland, 24 guns, saved from the seizure at Norfolk, and Congress, 50 guns. The St. Lawrence, 50-gun ship, mounting 12 guns, came in on the 6th from a cruise. Besides these was a fleet of transports and tugs. The Minnesota and Roanoke lay down the Roads, near Fortress Monroe. The Roanoke, always unlucky, was disabled, having broken her shaft five months before. She bore the flag of Captain Marston, then the senior officer of the post, for Goldsborough, the flag-officer in command, was absent with the Albemarle expedition. The Cumberland and Congress lay off the mouth of the Elizabeth River. Goldsborough had given strict orders that no sailing vessel should be left without a tug at hand to manage it. This provision was neglected. The apprehensions excited by reports of the near completion of the Merrimac or Virginia had died away. Men had come to look upon her as a bugbear, or,



PLANS OF THE MONITOR.
These diagrams are accurately drawn to scale.—In Fig. 2 the exterior solid line represents the entire surface of the deck, including armor-plate and overhang at bow and stern. The exterior dotted line represents the top of the proper hull; the interior line shows the dimensions of the flat bottom.—Fig. 1 is a profile of the vessel; the portion visible when the vessel is afloat is shown by the place of the water-line.—Fig. 3 is a vertical section of the turret.—The reference letters are the same throughout: A, Revolving Turret.—B, R, Smoke-pipe.—C, Pilot-house.—D, Anchor-well.—E, Rudder.—F, Propeller.—G, Iron Armor.—H, Braces for Deck Beams.—K, K, Water-line.—L, Gun.—M, Gun-carriage.

at worst, an enemy that could easily be managed by the Minnesota. "We are tired of waiting for the Merrimac," wrote Captain Van Brunt, of the Minnesota, "and wish she would come out."

At noon on Saturday, the 8th of March, what appeared to be three small steamers were seen coming down the Elizabeth. One of these, merely from the large size of her smoke-pipe, was conjectured to be the Virginia. Cut down as she was, she looked in the distance no larger than a tug. Her appearance at that time was a surprise. The two frigates lay at anchor, with the wash-clothes of the crew hanging from the rigging. Radford, the commander of the Cumberland, was on the Roanoke, miles away, acting as a member of a court of inquiry. He took horse and rode for Newport News, where he arrived just in time to see his vessel go down. Marston ordered the Minnesota to get under way at once, and summoned two tugs to tow the broken-shafted Roanoke to the scene of action. The Minnesota was soon under full headway. Her speed being twice that of the enemy, she could choose her own ground. Van Brunt meant to run her into the iron-clad, whose armor would be no protection against such a blow, and the shock would have broken her in two. Passing near Sewall's Point, fire was opened upon the Minnesota from the rifle battery, one shot crippling her mainmast. She returned a broadside, and steamed on till she came within a couple of miles of the enemy. The tide was running ebb; the Minnesota drew twenty-three feet, and there was now less depth of water at a shoal part of the channel; but the bottom was soft, and it was vainly hoped she might be forced over. She stuck fast, out of range of the Virginia, and lay an idle spectator of the destruction of the Cumberland and Congress. The Roanoke was dragged slowly on by two tugs. She too ran aground at the stern, in twenty-one feet of water, and could go no farther. Her head was dragged around, and the helpless hulk was pointed down the bay. Going and returning, she was fired upon from the batteries at Sewall's Point. They aimed wildly; some shot passed through the rigging and fell far beyond. The fire was returned, but the balls fell short of the mark.

The Virginia left the navy yard at Gosport at 11 o'clock in the morning. Her commander, Franklin Buchanan, had entered the United States Navy thirty-five years before. He had attained the rank of captain, and stood high on the roll. When the war broke out he was commander of the navy yard at Washington. He then threw up his commission and entered the Confederate service. Born in Maryland, he had not even the pretext of following his state in taking up arms against his country. As the Virginia left her dock, the wharves on both sides of the river were crowded with spectators. Two barricades which closed the river were opened, and the iron-clad, accompanied by the Beaufort and the Raleigh, tugs, each mounting a single gun, steamed down the stream. It was the trial trip of the Virginia, and she was found to move slowly. At one o'clock she cleared the Elizabeth River, and stood straight across the Roads toward Newport News. The Congress lay at anchor in the channel, three hundred yards from the shore; the Cumberland was two hundred yards beyond. As the Virginia came within range, she opened upon the Congress from her 100-pound bow gun. Passing the Congress at three hundred yards, she received a harmless broadside. She returned it with effect, a single shot disabling every man but one at a gun, and kept straight on for the Cumberland, which had been swung across the channel, to bring her full broadside to bear upon the approaching enemy. The Cumberland opened fire from her two pivot guns, and soon after with her whole broadside of eleven 9-inch Dahlgrens. Broadside after broadside followed in rapid succession, but the balls glanced harmlessly from the iron armor of the Virginia, which kept straight on, without returning a shot or showing a single man. She seemed to wish to give her defensive power a fair test. Nothing could be more satisfactory. Six full broadsides had been received at nearer and nearer range, with no essential damage. The Virginia kept straight on for minutes, which seemed hours, her bow pointed square at the side of the Cumberland. It was now three in the afternoon. There was a sharp shot, and a dull, heavy blow at the same instant. The iron-armed prow of the Virginia had struck the Cumberland near the bow, and below the water-line. Plank, beams, and knees gave way like laths, leaving a ragged opening into which a man might have passed; through this a torrent of water poured into the hold. The Virginia then opened fire. Every shot told. The first shot passed through the sick-bay, killing five men. Broadside after broadside followed in merciless succession, every shot reaching a vital part. Sick-bay, berth-deck, and gun-deck were covered with dead and wounded. For half an hour the pumps of the Cumberland were worked, in the hope of throwing out the water as fast as it rushed in through the yawning hole in her side. It was all in vain; the water gained momentum. The forward magazine was soon flooded, and all the powder for keeping up the fire was brought from the after magazine. In thirty-five minutes the water had risen to the main hatchway, and the ship canted over, just ready to sink. All the wounded who could walk were ordered out of the cockpit. These were few, for most were unable to help themselves or be helped by others. All the while during these long minutes the Cumberland kept up her useless fire, no gun being abandoned until the waters creeping up toward the stern from the sinking bow drowned it out. All the while the Virginia kept up her slow and sure fire, every shot telling. Only one man was seen on board the iron-clad. Near the close of the fight he showed himself from a port-hole; a ball from the Cumberland cut him in two. The last shot from the fated Cumberland was fired by Matthew Tenney, from a gun just above water, that next to him being overflowed. He attempted to scramble out from the open port-hole, but the water rushing in swept him back, and he went down in the sinking vessel. In three quarters of an hour after the Virginia had given the fatal blow, the Cumberland went down in fifty-four foot wa-

ter, her pennant still flying from the mast-head above the waves. Not a man was captured. A few swam to land, and more were picked up by small boats from the shore. The Virginia ceased her fire when the frigate went down, and turned toward the Congress.

As soon as it was perceived that the Virginia had opened the fight, a number of Confederate steamers came out from the James River and joined in the action. These were the Teazer, of one gun, the Jamestown, of two guns, and the Patrick Henry, formerly known as the Yorktown, of six guns. The last two had formerly been packets, owned by New York merchants, and plying between New York and Richmond. They had been seized by the Confederates, and converted into armed vessels. Seeing the fate of the Cumberland, Lieutenant Smith, who commanded the Congress, hoisted sail, and, with the help of a tug-boat, ran the frigate ashore in water too shoal to permit the Virginia to run her down. All the small Confederate steamers assailed her with a sharp fire, which made terrible havoc among her crew. The Virginia, having finished the Cumberland, then turned upon the Congress. Taking up a position 150 yards astern, the iron-clad raked the frigate fore and aft with shell, every one, at that close range, telling with fatal precision. The fuses were cut short, and every shell burst inside the frigate. The first killed seventeen men at a single gun. During all the fire hardly a man was merely wounded; most who were hurt were killed outright, the head or shoulder being shorn off, or the body cut in twain. Surgical aid was useless. After the first fifteen or twenty minutes the surgeon of the Congress did not even pretend to amputate a limb. The most that he could do was to apply a tourniquet to stop the bleeding, and administer stimulants to prevent prostration. "The only insignificant wound which I dressed," he says, "was that of one of the crew who had his hand taken off."

The Congress was fast aground, and could meet the terrible broadsides of the Virginia only from her two stern guns. These were soon disabled; one was dismantled, the other had its muzzle shot off. Lieutenant Smith, the commander, was killed, and the command devolved upon Lieutenant Pendergrast. The frigate was disabled, and on fire in several places; not a gun could be brought to bear upon the enemy. If every gun had been brought to bear it would have been useless. A chance shot might enter a port-hole, but the armor of the Virginia was impenetrable. There was no hope of succor from the Minnesota, which lay three miles off fast aground. At four o'clock the colors of the Congress were hauled down. An officer of the Virginia took formal possession. The Congress prize was given in charge to Lieutenant Parker, who had brought the little gun-boat Beaufort alongside. He ordered that the frigate should be abandoned in a quarter of an hour, as he meant to burn her at once. The surgeon remonstrated. He said that it was impossible to remove the wounded in that time. A score or more of the crew of the Congress got on board the Beaufort. In the confusion it is said that they supposed her to be a Federal tug from the shore. The Congress lay within rifle-shot from the shore. A regiment or two had been hurried to the nearest point. They opened a sharp rifle and artillery fire upon the Beaufort. Several were wounded, among whom were Lieutenant Miner, of the Virginia. The gun-boat hauled off, and the Virginia again opened fire upon the ill-fated Congress, although she had a white flag flying to show that she was out of action. The Confederates reported, and doubtless believed, that they were fired upon from the Congress, after her colors had been hauled down and while the white flag was flying. They were certainly in error; but in the hurry and confusion they might well suppose that the shot which were fired from the shore came from the ship. They must stand fairly acquitted from the charge of having wantonly fired upon a defenseless enemy who had surrendered. The firing by the Federal forces from the shore can only be justified by presuming that the troops there did not see that the colors of the Congress had been hauled down, and were replaced by the white flag of truce. After firing a few shells the Virginia and her allies left the Congress and turned toward the Minnesota. The Congress was on fire in several places. Her boats were manned, and those of the crew who were unhurt, and a few of the wounded, were taken ashore. The Congress continued to burn for eight hours. At midnight the flames reached the magazine, and the frigate, blown up, disappeared beneath the waters.

The March day was wearing to a close, but there was still two hours of daylight, when the Virginia, having destroyed the Cumberland and Congress, bore down upon the Minnesota. This great steam frigate had lain all these long hours helplessly aground. Steam tugs had been vainly trying to haul her off. The Roanoke, after grounding, had gone down the Roads. The St. Lawrence, in tow of a steamer, had approached the Minnesota. She too grounded, and, after receiving a single shell, and throwing in return a harmless broadside, was dragged off, and steered down toward Fortress Monroe. This one shell, a chance shot, thrown from the distance of half a mile, went sheer through the side of the St. Lawrence just above the water-line, passed through the ward-room, the surgeon's state-room on the opposite side, demolishing a bulkhead; it then struck a heavy iron bar, and glanced back into the ward-room, where it rested, its force being expended. This shell failed to explode, and no person was injured; but the actual damage done by this one shot proved to the captain of the St. Lawrence that his vessel was no match for the Virginia. She was impervious to any shot from his fifty guns, while any shell from her might destroy the St. Lawrence.

The Virginia, Jamestown, and Patrick Henry had borne down upon the stranded Minnesota. The draft of the iron-clad prevented her from coming within a mile of her enemy. She took a position at this distance on the starboard bow, and opened fire. Only one shot hit its mark. The Minnesota returned from her 10-inch pivot, with no result. The Jamestown and Patrick Henry were more effective. They took a closer position on port-

bow and stern, firing from rifled guns, and killing and wounding several men. The return from the Minnesota was quite as effective. The Patrick Henry received a shot which passed through her boiler, killing and wounding seven men, and disabling her for the moment. She was towed off by her consorts. Two full hours had been spent in this indecisive combat. Night was closing in. The Virginia, essentially unharmed by the fiery ordeal through which she had passed, dared not lie out the night in the Roads. At seven o'clock, an hour after sunset, she hauled off, and with her consorts steamed to the sheltering batteries at the mouth of the Elizabeth. She might well do so. No vessel that ever floated had done so great a work in a single half day. She had destroyed two powerful vessels, carrying three times her number of men, and fully six times her weight of armament. She, with two feeble consorts, had engaged two other great vessels, greatly her superiors measured by any standard before known, inflicting far more damage than she received, and only prevented from destroying them because she could not come to close quarters with them. Her first day's work might fairly be claimed as the greatest ever achieved in naval warfare. Great victories had before been won upon the ocean, but never had there been such a disproportion between the losses of victors and vanquished.

The Cumberland went into action with 376 men. When the survivors were mustered there were only 255. She lost 121 in killed and drowned. The crew of the Congress were 434 officers and men; of these, 298 got to shore, 26 of them being wounded, 10 mortally; there were in all 120 killed and missing; about 20 of these were made prisoners, leaving a roll of killed and drowned of 100 men. Besides these, 3 were killed on the Minnesota, and 16 wounded; an absolute loss of fully 250 officers and men. On the Virginia there were but 2 killed and 8 wounded. On the other Confederate vessels 4 were killed and a few more wounded; an absolute loss of not more than 10 officers and men—fully twenty-five to one in favor of the Confederates. The disproportion in the loss of vessels and material was still greater. The Roanoke and St. Lawrence were driven away, glad of the accident of low water, which kept off the Virginia and enabled them to escape. The Minnesota had inflicted as much damage as she had received. The Cumberland and the Congress were utterly destroyed. They had expended their utmost fire upon the iron-clad. The result was that they had riddled her smoke-stack and steam-pipe, shot away her flag-staffs and anchor, knocked off the muzzles of two guns, which were easily replaced, and had started an armor-plate here and there. The Virginia herself, in dashing upon the Cumberland, had twisted her iron prow. All the harm which she had received was immaterial, and could be wholly remedied in a few hours. She withdrew from action only because the coming darkness intervened. On the morning of the next day she was as efficient as before.

The Virginia steamed off in the gathering darkness, leaving the Minnesota fast upon the mud-bank where she had lain for so many eventful hours. The recoil from her own heavy broadsides had forced her farther on, and she seemed to have made for herself a cradle. At ten o'clock the tide commenced to run flood, and for six hours all hands were at work, steam-tugs assisting, to haul her off the bank. Every effort was unavailing. She lay fast, and at four o'clock, the tide having fallen, the work was suspended, and the Minnesota lay immovable, awaiting a new onset from the Virginia.

Not wholly helpless, however, for a new actor had come upon the scene whose powers were yet to be tested. The Monitor had left New York three days before for Hampton Roads. The first part of the passage was stormy. The waves swept clear over her low deck, the turret often being the only thing above water. The draft-pipe for conveying air to the crew quartered in the hold was too low, and the water poured down it. It was lowered, and its opening in the deck tightly closed. Farther provision had been made for drawing air down the turret. The machinery became disarranged. The crew were almost suffocated. Water also leaked down at the junction of the turret and the deck. These deficiencies were remedied, and the battery outrode the storm, proving to be in the main an excellent sea-boat. On the evening of the 8th she came to Hampton Roads. She had for hours heard the heavy sound of the cannonading which announced that an action had been going on. At nine in the evening she reached the fortress and learned what had happened. Lieutenant Worden was ready to test his untried craft

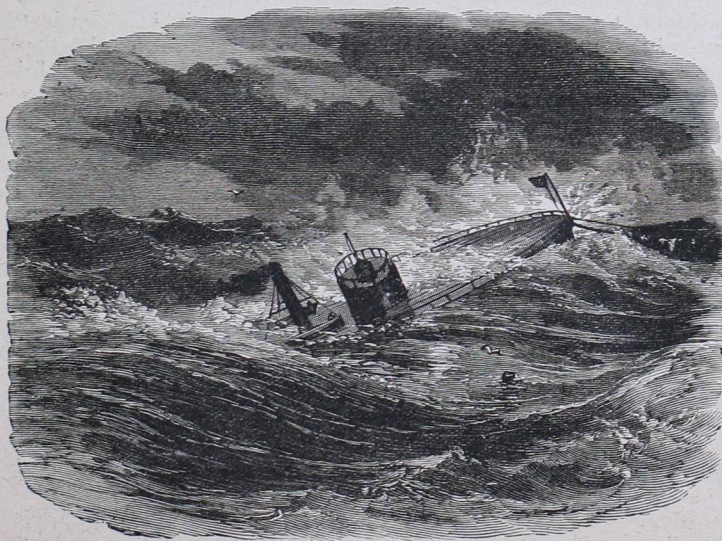


JOHN L. WORDEN.

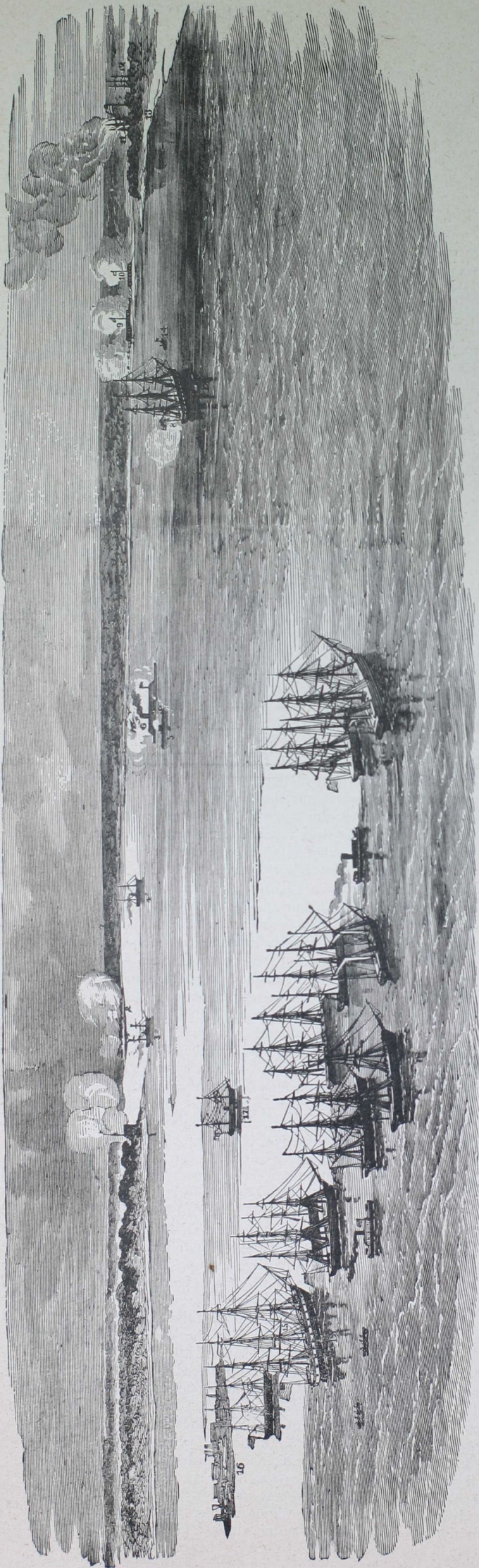
against the Virginia. In sixty minutes he was on his way to the Minnesota, by whose side the Monitor was anchored at an hour past midnight. The night passed, the morning broke, and the slow hours passed away until, at eight o'clock, the Virginia was seen bearing down upon the Minnesota.

The Christian day of rest has come to be the battle-day of Christendom. At sunrise the Virginia appeared coming down toward the Minnesota. All hands were beat to quarters; but the iron-clad ran directly past, almost within reach of the guns of Fortress Monroe, and then turning, stood straight up the channel through which the Minnesota had come the day before. Signal was made for the Monitor to engage. She ran down directly in the wake of the Minnesota, covering her as far as possible with her diminutive bulk, and laid herself directly alongside the Virginia. Never were antagonists apparently so unequally matched. The Monitor was only one fifth of the size of her antagonist, and appeared much smaller, for she presented to sight nothing but her flat deck just above the water, her low, square pilot-house, and round turret. The Virginia opened upon her with all her guns. Most of the shot flew over the low deck; a few struck the turret; but all except one glanced off, leaving hardly a mark. One rifled bolt, from the 100-pound Armstrong, struck fair and square, penetrating half through the nine inches of iron. The bolt broke off, leaving the head sticking in the wound. Soon the antagonists began to manoeuvre for position, keeping up a fire all the while. The speed of the two vessels was about equal, but the light draught of the Monitor gave her an advantage. Once the Virginia got aground, and the Monitor steamed round and round her, trying bow, stern, and sides in search of a vulnerable point. She fired cast-iron shot of 168 pounds, and so short was the distance and so fair the mark that hardly one missed; but they struck the sloping sides of the Virginia at so great an angle that they glanced harmlessly off; had they struck a perpendicular wall they would either have gone through or been shattered.

The Virginia soon got afloat again, and finding that she could make nothing of the invulnerable Monitor, turned her attention once more to the Minnesota, which had already received an 11-inch shot just above the water-line. The iron-clad came head on, and received the full broadside of the Minnesota. Fifty solid shot struck square. Any wooden vessel that ever floated would have gone down under such a fire. The Virginia was apparently unharmed. She fired shell in return from her rifled bow-gun. The first shell passed sheer through four rooms, tearing them all into one, and in exploding set the ship on fire. The second shell went through the boiler of the steam-tug Dragon, which lay alongside, blowing her up, killing and wounding seven men. But the third shell was hardly fired when the Monitor interposed, compelling the Virginia to shift her position. She grounded again, and lay exposed once more to the full broadside of the Minnesota. Afloat again, she steamed down the bay, closely followed by the Monitor. Reaching more open water, she turned sharp around, and ran at full speed square against the Monitor. Her iron prow, which had pierced the ribs of the Cumberland as though they had been of wicker-work, left hardly a mark upon the armed side of the Monitor, upon whose turret and pilot-house she now concentrated her whole fire. Soon after the anxious spectators on the Minnesota saw the Monitor standing down the bay, while the Virginia, with the Patrick Henry and Jamestown, which had been hovering around, headed apparently straight for the Minnesota, still fast aground, badly crippled, most of her shot expended, and her crew worn out with fatigue. Why the Monitor had withdrawn could not be known. Perhaps she had expended her ammunition; perhaps she had sustained some vital injury. All that Van Brunt could know was that the Virginia and her consorts were coming down upon him, and could take up a position to rake his stern with no possibility



FIRST VOYAGE OF THE MONITOR.



SCENE OF THE FIGHT OF THE IRON-CLAD.

1, Sewall's Point.—2, Craney Island.—3, The Patrick Henry.—4, The Jamestown.—5, The Monitor.—6, The Merrimack.—7, Confederate Camp.—8, The Minnesota.—9, 10, Batteries.—11, The Congress.—12, The Cumberland.—13, Newport News.—14, Steam Tug.—15, The Roanoke.—16, Rip-Rap.—17, French Man-of-War.

of an effective reply. He gave orders that preparations should be made for destroying his ship as soon as it was clear that all hope of saving her was gone; but, upon ascending to the deck, he saw that the Confederate vessels had no intention of continuing the fight. They had changed their course, and were heading with all speed for their refuge at Craney Island.

Such was the fight of the Monitor and the Virginia, as seen through the smoke from the deck of the Minnesota. From the Monitor itself it presented some different phases. At eight o'clock the Virginia was seen close at hand. Worden took his station in the pilot-house to direct the fight; Stimers controlled the movement of the turret, Greene had charge of the guns. The action began at a quarter before nine. At half past eleven a shot from the Virginia struck square against the pilot-house. One of the wrought-iron logs, 9 inches by 12, of which it was built, was shattered. Worden was looking from a narrow loop-hole just opposite the point where the shot struck. Fragments of cement were driven into his face, blinding him, and forcing him to give the command to Greene. The fight was kept up for three quarters of an hour longer, when the Virginia drew off, sagging down at the stern as though she was leaky; but her movements showed that her machinery was unharmed. The Monitor, which Van Brunt, in the excitement of the moment, thought to be heading for Fortress Monroe, soon came up to the Minnesota, but the Confederate vessels were close up to their refuge under the batteries at Craney Island. The Monitor did not pursue them. In the heat of the action it could not be ascertained how much damage had been sustained. It was certain that her pilot-house was seriously injured; another shot striking it fairly would have disabled her. Her heavy guns were an almost untried experiment; the explosion of one would probably have rendered her useless. In driving off the Virginia she had done her work. In attempting more all might have been lost. Even after the Virginia disappeared from view the safety of the Minnesota seemed by no means assured. She still lay fast, exposed to a new assault. Van Brunt determined to get her off at all hazards. Guns and provisions were thrown overboard, and water-tanks opened to lighten the steamer; more tugs were brought into use, and the great steamer was dragged half a mile from her mud bed; then the tide fell, and she was again fast. When the tide rose the next morning she was again afloat, and was brought back to Fortress Monroe.

If the importance of a battle were to be estimated solely by the actual loss inflicted or suffered, the first fight of iron-clads would be only a harmless duel. No man on the Virginia, it is affirmed, was harmed by the heavy shot of the Monitor or the great broadsides of the Minnesota. The firing had been going on for an hour and a half when a shot struck the Monitor turret fairly. One man happened to be standing so that his knee touched the wall just opposite; he was stunned, but soon recovered. Another man was partially stunned, but soon recovered. Besides Worden, no man was seriously harmed. On board the Minnesota three were killed and sixteen wounded, half of them only slightly. During the actions of the two days the Minnesota expended 247 solid shot, 282 shells, and more than two tons of powder, without any essential harm to her opponent. She was seriously damaged in hull and armament. At the close of the fight, what with guns disabled and thrown overboard, she had but eleven that could be equipped for service. During the three and a half hours of the engagement the Monitor fired 41 shot, few of which missed, but all except two or three were really harmless. She was fairly struck twenty-two times: nine times on the turret, eight times on the side armor, three times on the deck, and twice on the pilot-house. Of all these shot, delivered at close range from heavy guns, only one, which struck the pilot-house, did any perceptible damage.

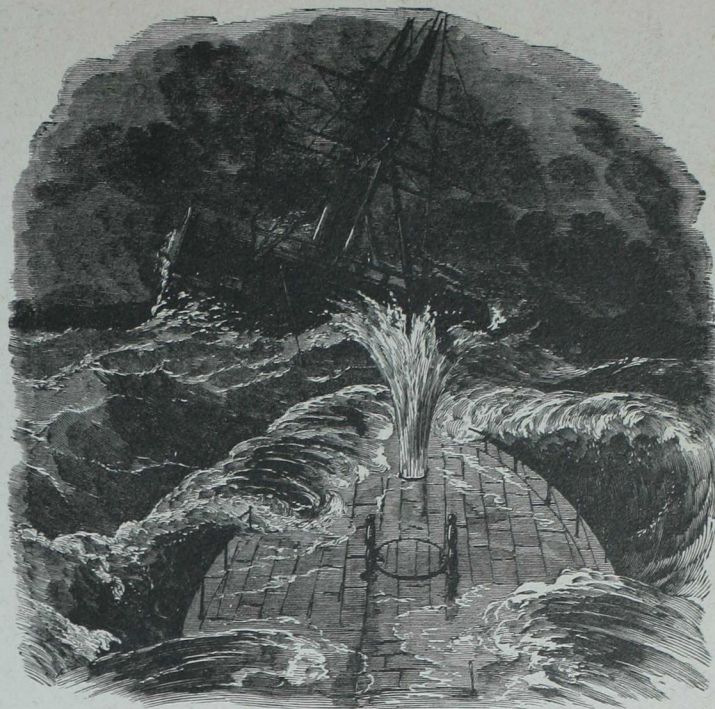
The Monitor and the Virginia, exposed to such a terrible ordeal, both proved themselves invulnerable against any fire which had ever before been brought to bear by one ship against another. The conclusion seemed inevitable that wooden ships were to be of no farther use in naval warfare, and that the great navies which France and Great Britain had built at such an immense cost were practically annihilated. When the tidings of this fight crossed the Atlantic, the London Times affirmed that England had on the day before 149 first class war-ships; now there were only two; beyond these there was not one that could, without madness, be pitted against the Monitor. Even these were not invulnerable; for, being iron-plated only amidships, they would be set in a blaze at either extremity in a few minutes by shells from their unassailable antagonists. The Illustrated London News, echoing the expressions of statesmen in Parliament, urged that Great Britain should cease to erect sea-board fortifications, but should spend the money wasted upon them in cutting down the useless line-of-battle ships, plating their hulls with iron, and fitting them with cupolas armed with guns at least as heavy as those of the Monitor. Like most hasty conclusions, this was too sweeping. In a few weeks Farragut showed at New Orleans, and again in a few months at Mobile, that wooden ships, boldly and skillfully handled, could yet play an important part even against iron-clads.

The Monitor and the Virginia never again tried their strength against each other. For a month they lay watching each other, the one in the lower Roads, the other at the mouth of the Elizabeth. On the 11th of April, the Virginia, with her old consorts, steamed out, as if bent on an action. By a rapid dash the fleet captured three Federal transports lying unguarded, and then returned. Twice after she showed herself in the Roads, as if to provoke a fight, and then steamed back. The Monitor now and then went up toward the mouth of the Elizabeth, but always drew back when her enemy appeared. It was clear that neither side wished to risk losing their main defense. If the Virginia was lost, the water approach to Richmond would be in the hands of the Federals; if the Monitor was disabled, Hampton Roads would be in the power of the Confederates. All the movements

of the rival iron-clads were mere feints, with no definite object. Meanwhile the Peninsular campaign had been inaugurated. McClellan had laid siege to Yorktown. The post was evacuated by the Confederates on the 3d of May. They resolved to withdraw all their force to the front of Richmond. Norfolk was abandoned, the work-shops and store-houses at the navy yard having been burned, and the great dry dock partially blown up. The troops by which this place had been garrisoned were ordered to Richmond. Norfolk was formally occupied by the Federal forces on the 10th of May. The withdrawal from Norfolk compelled the abandonment of the strong Confederate positions at Sewall's Point and Craney Island.

The Virginia had in the mean while been placed under the command of Josiah Tatnall, a veteran officer, who had spent a whole life in the naval service of the United States. Less than two years before he had commanded the fleet of the Union in the Chinese waters. In June, 1859, he rendered important aid to the French and English in their disastrous assault upon the Pei-ho forts. When recalled from the East by the approaching troubles at home, he threw up his commission, and joined the enemies of the nation which he had so long served. The Confederate government was then eagerly courting the support of foreign powers. Tatnall's opportune service had made his name popular in France and England. To this, rather than any ability which he had ever manifested, was owing his appointment to the command of the Virginia, the most important position in the Confederate navy. The abandonment of Norfolk shut the Virginia out from her refuge up the Elizabeth. She was liable at any moment to be assailed by a superior force. The James River was still open to her. If she could be taken up that stream she might be safe, and also aid in defending Richmond; but she drew quite twenty-five feet, and forty miles below Richmond was a shoal where there was only eighteen feet of water. If she could be brought to that draft the pilots said they could take her over. The work of lightening was begun. The commander went to bed; but he was awakened by an officer who told him that the vessel had been lifted just enough to render her unfit for action, yet more than two feet less than the pilots had declared necessary to take her over the shoal. Moreover, the westerly winds which had prevailed had driven the waters down the stream, so that there was less than the required eighteen feet. The poor old commander, awoke by these tidings, saw nothing to be done but to destroy his vessel; so he ran her ashore, landed her crew, and set her on fire fore and aft. She burned fiercely for an hour, and then, just before dawn on the 11th of May, blew up. So entire was the destruction, that no fragment was ever discovered of sufficient size to enable any one to describe the details of her construction. "The Virginia," reported Commander Tatnall, "no longer exists. I presume that a court of inquiry will be ordered to examine into all the circumstances, and I earnestly solicit it. Public opinion will never be put right without it." The court was ordered, and reported that the destruction of the Virginia was not necessary. She might have been taken up the James to a point of safety, where she could still have barred the ascent of the river. Then and there, if worst came to worst, was the time to decide upon the disposition to be made of the Virginia.

Four days after the destruction of the Virginia, the Monitor engaged in her second and last action. The James River was now open for operations, and Commander John Rogers was sent up the river with five vessels, among which were the Monitor and Galena. It was hoped that they could reach Richmond and compel the surrender of the city. The expedition met with no serious obstacles until it reached within eight miles of Richmond. The river here makes a sharp turn, with high banks on either side. On the western side is Drewry's Bluff, about 200 feet high, upon which the construction of a fort, since known as Fort Darling, had been hastily commenced. The river, here about 500 feet broad, was also obstructed by a double line of barriers, piles, and sunken vessels, and the banks were lined with sharpshooters. The three wooden vessels anchored 1300 yards below the fort. The Galena ran up to within 600 yards, swung across the river, and was at once exposed to the full fire from the fort. The Monitor went still nearer, but found that her guns could not be elevated sufficiently to reach the battery, and fell farther down to a point from which her guns could be brought to bear. The action was kept up for three hours. The Galena suffered se-



THE MONITOR IN THE STORM.

verely. Thirteen shot and shell penetrated her side; bulwarks were shattered and knees started; the deck was pierced by the plunging fire, the wheel injured, and armor started in several places. It was clearly shown that the light armor of this vessel was of no practical use when opposed to heavy guns. The Monitor was hit squarely three times, once on the turret and twice on the side armor, but received no damage beyond a slight bending of the armor-plates. The Naugatuck, which lay beyond the range of the fort, was disabled by the bursting of her 100-pound Parrott gun. Having expended nearly all her ammunition, the Galena withdrew, followed by the Monitor. The Galena lost thirteen killed and eleven wounded; three others, on the other vessels, were wounded by musketry from the shore. The Confederate loss was five killed and seven wounded. This action was at the time of far greater importance than is indicated by the loss suffered or inflicted. It was considered by both sides as proving that earth-works could not be reduced by gun-boats. "The action," said Lieutenant Jeffers, who now commanded the Monitor, "was most gallantly fought against great odds, and with the usual effect against earth-works. So long as our vessels kept up a rapid fire, the enemy rarely fired in return; but the moment our fire slackened, they remanned their guns. It was impossible to reduce such works except with the aid of a land force."

The Peninsular campaign had now been fairly commenced, and it was necessary to maintain a considerable fleet at Hampton Roads in order to convoy transports and protect the right flank of the army on its march along the York and Pamunkey Rivers. The Monitor remained here until nearly the close of the year. Then operations were contemplated against Charleston, and the Monitor, with the Passaic and Montauk, two vessels of the same general construction which had just been completed, was ordered to Beaufort, South Carolina. The Monitor set out on the 29th of December, in tow of the steamer Rhode Island. The second day out they approached the stormy point of Cape Hatteras. A gale sprung up, and the sea began to rise in heavy swells, breaking over the deck and pilot-house, and dashing against the base of the turret. The packing became loosened by the working of the turret, and the water began to leak in here and through the sight-holes in the pilot-house; but the pumps threw it out as fast as it entered until after dark. Then the gale increased, and the water began to dash into



THE PASSAIC AT SEA.



PUMPING AND BAILING.



LOSS OF THE MONITOR.

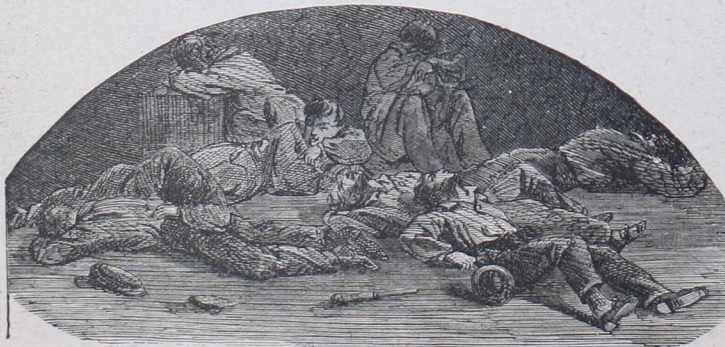
the turret and down the blower-pipes. A great wave would lift the vessel, and, when she descended to meet another, the flat under surface of her armor-shelf came down square with a heavy blow, which still farther loosened the packing of the turret, and caused other leaks. All the pumps were set to work; but the water gained, slowly at first, then rapidly. At half past ten it was above the ash-pits. A signal of distress was made, and the Rhode Island was requested to send boats to take off the crew. Two boats put off, which were filled to their utmost capacity. The sea dashed clear over the deck, sweeping off several men. By half past eleven the fires were all out, and the deck was on a level with the water. The men remaining on board were crowded into the turret. The boats from the Rhode Island had at length succeeded in getting alongside again. The men were ordered to try to get on board them. Some, stupefied by fear, would not make the attempt. Bankhead, the commander, was the last man to leave the sinking boat. The last that was seen of the Monitor was at midnight, when she drifted away, the red light gleaming from her turret. She must have gone down a few minutes after, carrying with her twelve of the sixty-five men on board. The Monitor was lost just eleven months from the day when she was launched.

The Passaic, in tow of the steamer Georgia, was a few miles behind the Monitor, and was nearly lost in the same gale. She began to leak first at the junction of the turret with the deck, and then toward the bows, and soon after near the stern. Ballast was thrown over, and then shot, in order to lighten the vessel. One after another the pumps gave out, and the men were set to bailing. Huge masses of water rolled over the deck, sometimes dashing clear over the top of the turret. There was no hope of relief, for not a boat could live. For three long hours the officers and men worked in the darkness. Then came a cry that the water was within three inches

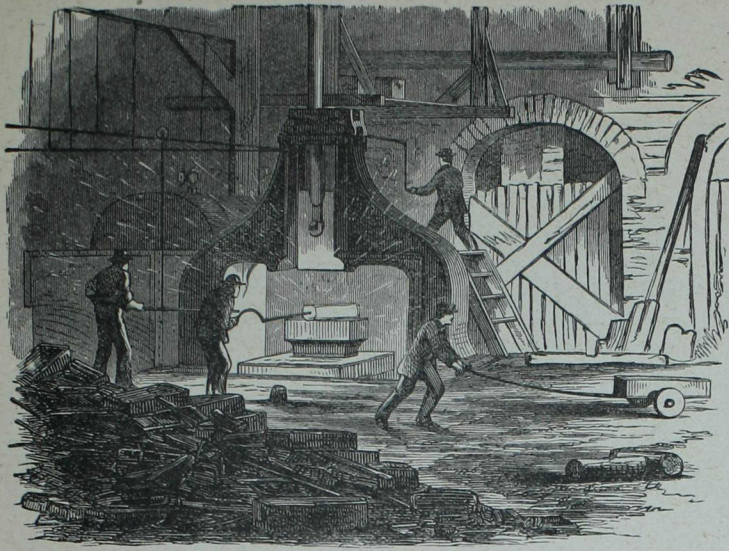
of the fires, and the last pump had given out. Then there was a fierce swash, and the water hissed over the glowing grates, for even the firemen and engineers had worked knee-deep in water. The men now gave up all hope. Some sat down and gazed silently at the rising water; some wept; some prayed; others rushed to the turret to be the last to go down. The officers urged the men to the pumps again. They were found to work, and hope again dawned. The head of the ship was turned straight toward the shore, forty miles away. This change of position saved her. The waves no longer lifted the vessel, but pitched her from side to side. As morning dawned the wind subsided. By bailing and pumping the crew gained upon the leak. The men flung themselves down upon the cold wet deck, and in a few moments were fast asleep. The next night the gale sprung up anew, and the leak began to gain a little; it was feared that new ones would be sprung. A brief account of what had happened was written, sealed up in a bottle, to which was attached a red flag, and thrown overboard. But the pumps worked well, and the storm was outdone. On the evening of the 2d of January the Passaic made Beaufort Harbor.

The battle in Hampton Roads gave each side unbounded confidence in the soundness of the principle upon which its iron-clads had been constructed. The Virginia and the Monitor furnished the models upon which other vessels were constructed. None of the Confederate iron-clads equaled the first. They had no more hulls and engines ready furnished to their hands, and had not the facilities for constructing them. The Federal government immediately commenced the construction of nearly a score of the monitor class, but larger, and embodying many improvements. At a later period other turreted iron-clads were built, of far greater size, and with such changes in construction as were thought necessary to fit them for sea-going vessels. Some of these carried also a few heavy stationary guns; but their essential offensive feature was the revolving turret. The construction of these vessels was attended with no small difficulty. The French and English iron-clads had been clothed only with solid armor-plates. Four and a half inches—just the width of this printed column—had been fixed upon as the standard thickness. In Europe there were founderies provided with the means of rolling such plates. Nothing of the kind existed in America. These plates could be produced here only by the slow process of forging.

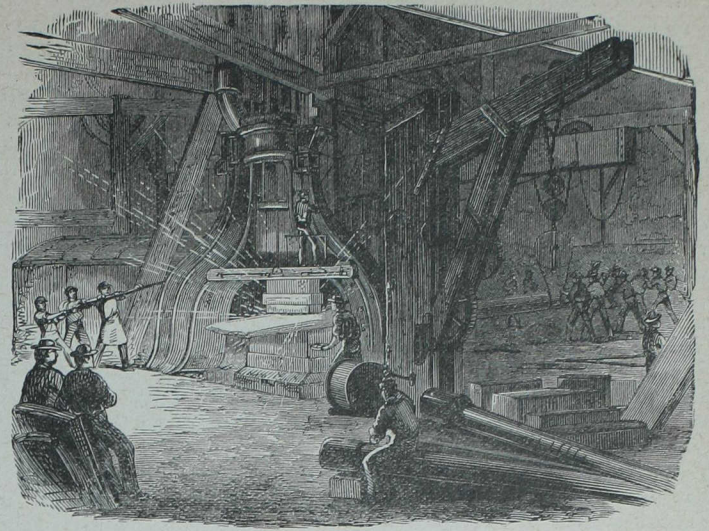
To produce a forged plate, a quantity of fragments of all sorts of iron is bound up into a fagot about two feet square. This is thrust into a furnace, heated to a bright red, when the mass becomes almost as plastic as wax. It is then placed under a heavy steam-hammer, a few blows from which reduce the fagot to a "bloom"—a homogeneous mass of iron, looking like a fragment of a wooden joist, about six inches square, and four feet long. To forge these blooms into plates, four or five layers are piled up on the end



ASLEEP ON DECK



FORGING A BLOOM.



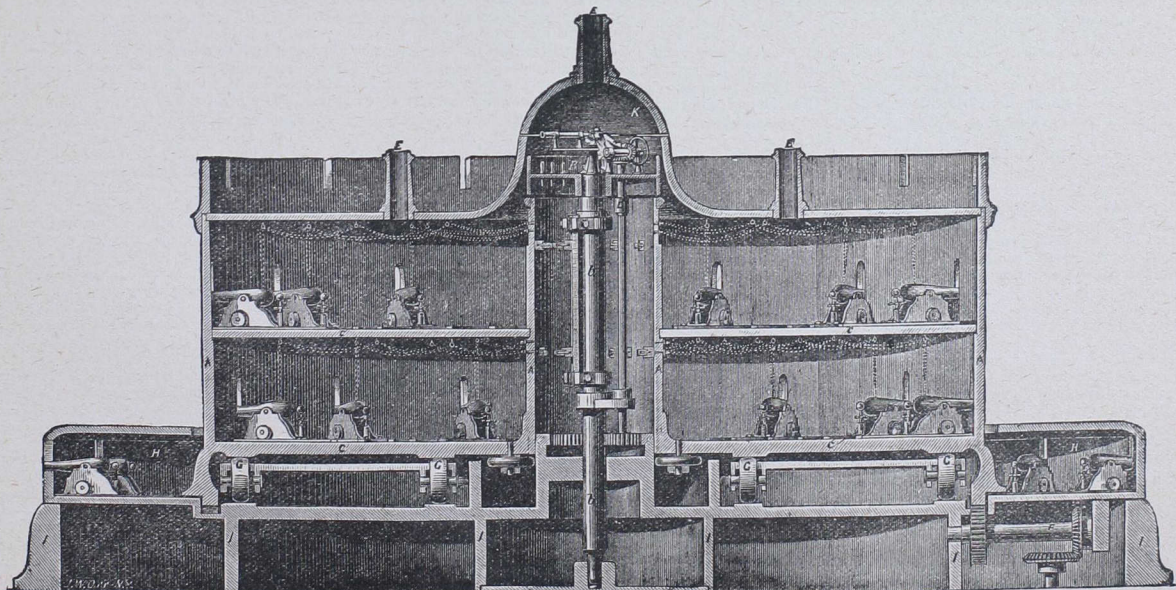
FORGING A PLATE.

of an iron bar, and thrust into a furnace. This bar answers the purpose of a handle to move the mass, and is suspended by chains so as to balance. The blooms, piled up on the flattened end of the bar, are thrust into a furnace, and heated for hours until they become plastic. They are then withdrawn from the furnace, swung around, and placed under a hammer still heavier than that which has reduced them from fagots, and beaten out flat, forming the commencement of a plate. Upon the end of this other blooms are piled, heated, and hammered out in like manner. This process is repeated until the plate has acquired the required length, when it is chiseled off from the bar. It is then simply a plank of solid iron, twelve or fifteen feet long, three broad, and four or five inches thick. This process is necessarily slow. There were no national founderies, and only two or three private ones capable of executing it. These could furnish only the plates for the Ironsides, and for the Roanoke; for this unlucky vessel being useless in its original shape, it had been resolved to cut her down, and convert her into an armored ship. The Ironsides proved in the end to be an effective vessel; the Roanoke was as useless as before. The turrets of the new monitors and their side armor must in the mean while be composed of layers of inch iron. The thickness of the turrets was increased from eight to eleven and even thirteen inches. This was found at Charleston in 1863, and at Wilmington in 1865, to be sufficient to resist the most powerful shot that could be brought to bear upon them. With some exceptions, which arose from causes nowise affecting the principle upon which they were constructed, no monitors have been seriously injured by the fire to which they have been subjected, even when put to service for which they were never designed—that of assailing fortifications.

Still, the revolving turrets hitherto constructed embody only a portion of the possible offensive power involved in the design of their inventor. Those built afford perfect protection to ordnance and gunners. They also give the vessel the power of throwing its whole offensive power upon any required point of the circle within the range of its guns. But the fire is given from a gun moving around the circumference of a circle, and the slightest interval between the aim and the discharge sends the ball in a line different from that intended. In the turret as designed by Timby provision was made against this grave defect. His turret was to revolve, not upon a central shaft, but upon rollers around its periphery. From its centre rose a plat-

form resting upon a central shaft, moving independent of the revolution of the turret itself. This platform was to be the post of the commander during action. A telescope is firmly fixed upon this platform; by his side is a wheel, by which he turns the shaft in any direction, so as to keep the telescope pointed directly at the object of attack. If it moves he follows it with the telescope, just as a rifleman moves his piece when taking aim at a bird in flight. As the turret revolves, each gun is for an instant brought in a line exactly parallel with the commander's telescope, always pointed upon the object of attack. If the gun be discharged at that instant, the ball must go straight to its mark. Provision is made to effect this with an instantaneousness unattainable by the motion of human nerves and muscles. A galvanic battery is provided, with a separate conducting wire running to each gun; this is so arranged that the connection is formed at the instant when the gun is brought by the revolution of the turret in a vertical line below the telescope. If the fuse attached to the conducting wire is placed in the vent of the piece, the discharge is instantaneous, and the telescope, and consequently the gun, being pointed directly at the object, the aim is perfect, and the ball must go straight to its mark. The accompanying diagram represents a vertical section of a large turret, designed for a stationary battery, mounting sixty guns in two tiers. It shows the interior of such a turret, with the automatic sighting and discharging apparatus. The principle and arrangement is the same whatever may be the number of the guns. The commander within the turret aims every gun of the battery with as much precision as a sharpshooter aims his telescopic rifle, discharging it by an electric current at the instant when the aim is secured. The gunners have nothing to do but to load the guns, run them to the port-hole, and insert the fuse.

The correctness of the principle on which the monitor turrets is based has been proved to be sound by the severest practical tests. Great improvements may doubtless be made in the actual construction of the turrets and hulls. Thus, instead of having the turret entirely above deck, it may be sunk for fully a third of its height below deck. Its liability to be struck would thus be diminished in that proportion, while its chief vulnerable point, the base upon which it revolves, would be effectually shielded by the side armor of the vessel. The seaworthiness of the vessel would be increased by bringing the centre of gravity nearer the keel. The protected part of the

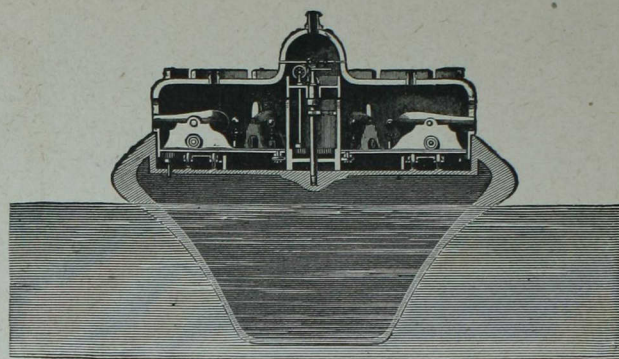


VERTICAL SECTION OF STATIONARY REVOLVING TURRET.

A, A, Exterior and interior Walls of the Turret, with dome-shaped Roof K, revolving by the Gearing F, upon friction Rollers G, G.—C, C, Artillery Platforms, the Gun-carriages radiating from the common Centre.—B, The Commander's Platform, revolving, independently of the Turret, upon the Shaft b, b, by means of the Rod and Gearing D.—On the left of the Shaft is the "Circuit Closer," forming the connection between the Galvanic Battery and Conductors passing to each Gun.—E, E, Ventilators.—H, H, Casemates, mounted with Guns, independent of Revolving Turrets.—I, I, Wall of subterranean foundation for Turret, inclosing Chambers for Stores and Munitions.

turret would require a much less thickness of armor, and its diameter might be increased without adding to its weight. With a diameter of thirty feet instead of twenty there would be space for an armament of four or six instead of two guns. A vessel with such a turret, and with hull and engines capable of a high rate of speed, could not fail to be superior in offensive and defensive power to any iron-clad that can be built upon the European plan of vessels little differing from the old men-of-war, with lofty sides and presenting a great extent of perpendicular surface to attack, or even the Confederate plan of a long casemate with sloping sides. No vessel can be constructed upon either of these plans capable of floating the thirteen inches of iron which constitute the best monitor turrets. A man-of-war with its guns mounted in broadside can use only half its armament upon any one point at a time, and that only by exposing its whole side to the enemy. A monitor can bring its whole armament to bear upon any point at each revolution of the turret, which occupies about a minute; and if the turret should be furnished with the automatic sighting apparatus, every shot is under the absolute control of one governing mind. A monitor, moreover, fights with equal force in any position. Its whole fire can be delivered at will from bow, stern, or either side. If it have speed to enable it to choose its own position, it never needs to present any portion of its hull except its sharp bow to the enemy. This offers a mark so small that it could be hit only by the merest chance. Practically, its low turret is the only assailable point, and this, as already constructed, is capable of resisting any shot to which, in the present state of naval artillery, it can ever be exposed. It is safe to say that the defensive power of the turret can be increased more rapidly than the offensive power of artillery.

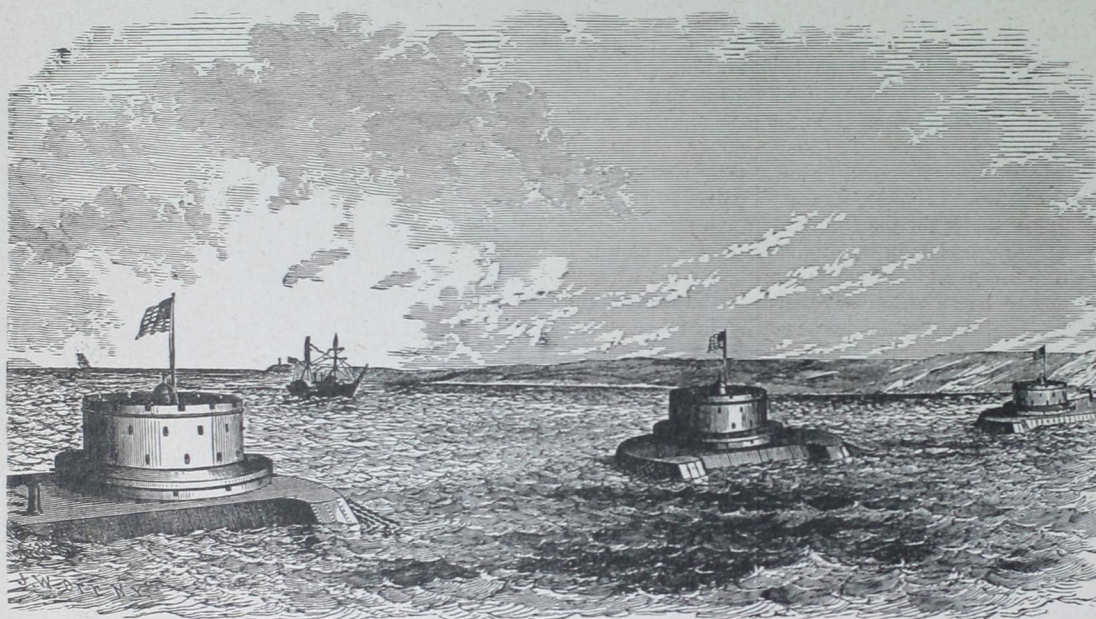
It was a part of the design of the inventor of the revolving turret to adapt



VERTICAL SECTION OF PROPOSED NAVAL TURRET AND HULL.

it to fortifications of large size for harbor defense. The following diagram represents a cordon of turrets for the protection of the Harbor of New York, the approach to which is through the "Narrows," about one third of a mile wide. This would be reduced to a quarter of a mile by docks built out from each shore. Upon the extremity of each dock would be erected a turret, and another upon an artificial foundation midway between them. Each of these turrets would be one hundred feet in diameter, mounting sixty guns in two tiers. The turrets are to revolve once a minute, equal to about three and a half miles an hour. As every gun may be discharged at every revolution, the possible effective fire from each turret would be sixty shot a minute. The three turrets could thus, in case of need, concentrate a fire of 180 guns upon any point in the circle. A series of chains is stretched from turret

to turret. When no attack is threatened these chains rest upon the bottom, leaving the passage unobstructed. They can be drawn up by a windlass, moved by the steam engine in the foundation of each turret. They are not to be drawn up "taut," but hang swaying in the water, at such a depth as to prevent the passage of a hostile fleet. They are furnished with buoys nearly sufficient to float the chains, so that only a small part of their tensile strength is expended in supporting them, leaving almost the whole strength to resist the passage of a hostile fleet. While detained here, any vessel would be exposed at point-blank distance to the whole fire of two turrets, which no ship ever built could sustain for a quarter of an hour. If thought necessary, movable torpedoes can be attached to chains in such a way as to be drawn directly below any vessel detained by the chains, and there exploded by a galvanic battery.



PROPOSED CORDON OF TURRETS FOR HARBOR DEFENSE.

NOTE ON THE MONITOR SYSTEM.

THE invention of the Revolving Turret has been attributed to Mr. Ericsson, and to Captain Cowper Coles, of the British Navy. The latter expressly claims it for himself upon the following grounds: "He says that in 1855 he sent to the British Admiralty drawings for an armored vessel of light draft, the guns protected by a stationary 'hemispherical tower.'" This suggestion was not acted upon. In March, 1859, he sent in drawings in which this tower, or shield, was placed upon a "turntable," thus constituting it a revolving turret. In Blackwood's Magazine for December, 1860, is an article on this subject, containing a drawing of such a turret, with the mechanism for turning it by hand. Now, in September, 1854, Ericsson had forwarded to the Emperor of France plans for a vessel provided with "a semi-globular turret of plate iron six inches thick, revolving on a column and pivot, by means of steam power and appropriate gear-work."¹ Coles says that his plans were "so exactly similar" to that of the Monitor "that I think it will be apparent that this invention is of English origin, and I claim it for this country"—that is, for himself. But the date of Ericsson's proposition to the French Emperor for a revolving turret antedates by almost four years that of Coles to the British Admiralty. But Timby, as has been shown, exhibited his invention publicly, and secured a right to a patent for it in 1843, eleven years before Ericsson proposed it to the French Emperor, and sixteen years before Coles claims to have thought of it. During all this time it was in many ways a matter of public record, and his claim was so clearly undeniable that the contractors for the monitors purchased his patent for a large sum.

Much discussion arose as to the capabilities of the monitors, of which Ericsson says "the revolving cupola forms so important a feature."² In April, 1864, the Secretary of the Navy presented to Congress an elaborate "Report in Relation to Armored Vessels," detailing all the facts which had at that time transpired, and giving the opinions of prominent naval officers upon the subject. These opinions differed greatly. Lieutenant Jeffers, who commanded the Monitor at Drewry's Bluff, says, "I am of opinion that protecting the guns and gunners does not, except in special cases, compensate for the greatly diminished quantity of artillery, slow speed, and inferior accuracy of fire; and that, for general purposes, wooden ships, shell guns, and forts, whether for offense or defense, have not yet been superseded."³ In the attack upon Fort Sumter, April 7, 1863, six monitors took part. The reports of Admiral Dupont and the commanders of these vessels was decidedly adverse to them. They were certainly considerably injured, but close examination shows that these injuries to the turrets in no wise affected the principle of their construction. Bolts were driven in, and some of the turrets were jammed at the base so as to prevent their revolution; but, although exposed to a heavier fire than any ships had ever endured, no turret was pierced. The Secretary of the Navy sums up the case thus: "Brief as was the conflict, the fire brought to bear upon the monitor vessels was such as could have been sustained by no ordinary boats, and demonstrates their power of resistance and their adaptation for harbor purposes. That the vessels in that engagement should have returned from the encounter with so few casualties, and the loss of but one life, is certainly remarkable."⁴ In the second attack upon the Charleston forts, July 11, three monitors participated. Admiral Dahlgren "was favorably impressed with the endurance of these iron-clads. The Catskill was struck 60 times, a large percentage of the hits being very severe. The pilot-house, turret, side-armor, and decks were all more or less damaged. Some of the shots were large; one, found on deck, where it fell after striking the turret, proved to be a 10-inch. . . . The test was very severe; yet, after firing 128 rounds, the vessel came out of action in good working order, as was proved by her going into action next day."⁵ For two months during the siege of Fort Wagner the monitors were in action almost every day. Lieutenant Simpson, of the Passaic, reports: "The strength of the turret has been most severely tried. At one place two round shot of very large calibre (estimated by some as 11-inch, by others as 15-inch) have struck close together on the same plate, the impression of the second shot overlapping a portion of that made by the first. The mass of iron has been pressed in so as to form an extensive bulging on the inside, and the outer plate is broken, but no serious effect was produced. . . . The turrets are as near impregnable as any thing can be made, and eleven inches of iron

seems to be enough for all purposes of defense. The only objection to them is the 'through bolts,' which allow the nut inside to fly when the head is struck. The new system of making turrets, now adopted by the Navy Department, obviates this difficulty. . . . I recommend that a system of turret should be devised by which it will have no connection with the spindle, but have a bearing all around its base, running on friction-rollers. I would also recommend that the base of the turret should be carried below the spar deck."⁶ This officer was probably not aware that these two features formed a part of the design of the inventor of the turret. Inspector Hughes reports: "The shot make an indentation on the iron, and break the bolts that fasten the plating together. The greatest indentations that have come to my knowledge were to the depth of 2½ and 2¾ inches. In my opinion, these indentations were made from 11-inch and 13-inch solid shot. A shot of this kind will generally break from one to five or six bolts. When the bolts break they can soon be replaced. I do not see that the turrets are injured practically."⁷ Admiral Goldsborough says: "A difference of opinion exists among naval minds, at home and abroad, as to whether the better expedient is to use the guns of an iron-clad turret-wise or in broadside ports. The turret I regard as decidedly preferable. It renders one gun of a class equivalent to at least two of the same disposed in opposite broadside ports, and this with a great reduction of crew. It admits also of much heavier guns. It does not necessarily involve a breadth of beam antagonistic to velocity. It affords a better protection to guns and men, and, withal, it secures the fighting of guns longer in a sea-way."⁸ Admiral Dahlgren, speaking of the whole of this two months' fighting, says: "The battering received by the monitors was without precedent. The Montauk had been struck 214 times, the Weehawken 187 times, and almost entirely by 10-inch shot. What vessels have ever been subject to such a test? It is not surprising that they should need considerable repair after sustaining such a severe pounding for so long a time, but only that they could be restored at all to serviceable condition. All the little defects of detail were marked by a searching process. Decks were cut through, cannon were worn out, side-armor shaken, tops of pilot-houses crushed, etc.; but all these were repairable, and no vital principle was seriously touched."⁹ Commodore Rodgers, after comparing at length the relative advantages and disadvantages of the Ironsides and Monitor class of vessels, says: "To sum up my conclusions, I think that the Monitor class and the Ironsides class are different weapons, each having its peculiar advantages, and both needed to an iron-clad navy; but that when the Monitor class measures its strength against the Ironside class, then, with vessels of an equal size, the Monitor class will overpower the Ironside class; and as vessels find their natural antagonists in vessels, and only their exceptional antagonists in forts, it must be considered, upon the whole, that the Monitor principle contains the most successful elements for plating vessels for war purposes."¹⁰ Admiral Porter says: "Any professional man who will lay aside his prejudices caused by the discomforts incident to monitors, must admit that as a harbor defense they are the best and only vessels to be built. If they have not been able to penetrate the harbor of Charleston, they have there done what no other vessels ever built could have accomplished. They held their own as no other vessels could have done, and under their shelter the army was enabled to perform its work successfully."¹¹ This favorable opinion, based upon the performances of the monitors at Charleston, was confirmed after Porter had occasion to test them at Fort Fisher, January, 1865, with the addition that the new ones which he had under his command proved themselves excellent sea-vessels, even upon the stormy coast of North Carolina. Captain Blakely, the celebrated English gun-maker, writing of the endurance of the monitors at the capture of Fort Fisher, says: "The fort contained not one gun powerful enough to sink an iron-clad ship. Most of these guns were more powerful than any gun mounted on any fort in England, or on any English ship except one, yet they failed to injure the Federal fleet. It follows that the fleet could attack Portsmouth or Plymouth with more impunity than Fort Fisher, so far as artillery fire is concerned."¹²

¹ Letter to the *London Times*, April 1, 1862. ² Report on Armored Vessels, p. 13. ³ *Ibid.*, p. 18. ⁴ *Ibid.*, p. 29. ⁵ *Ibid.*, p. 99. ⁶ *Ibid.*, p. 217. ⁷ *Ibid.*, p. 256-259. ⁸ *Ibid.*, p. 299. ⁹ *Ibid.*, p. 374. ¹⁰ *Ibid.*, p. 555. ¹¹ *Ibid.*, p. 694. ¹² *Ibid.*, p. 692.