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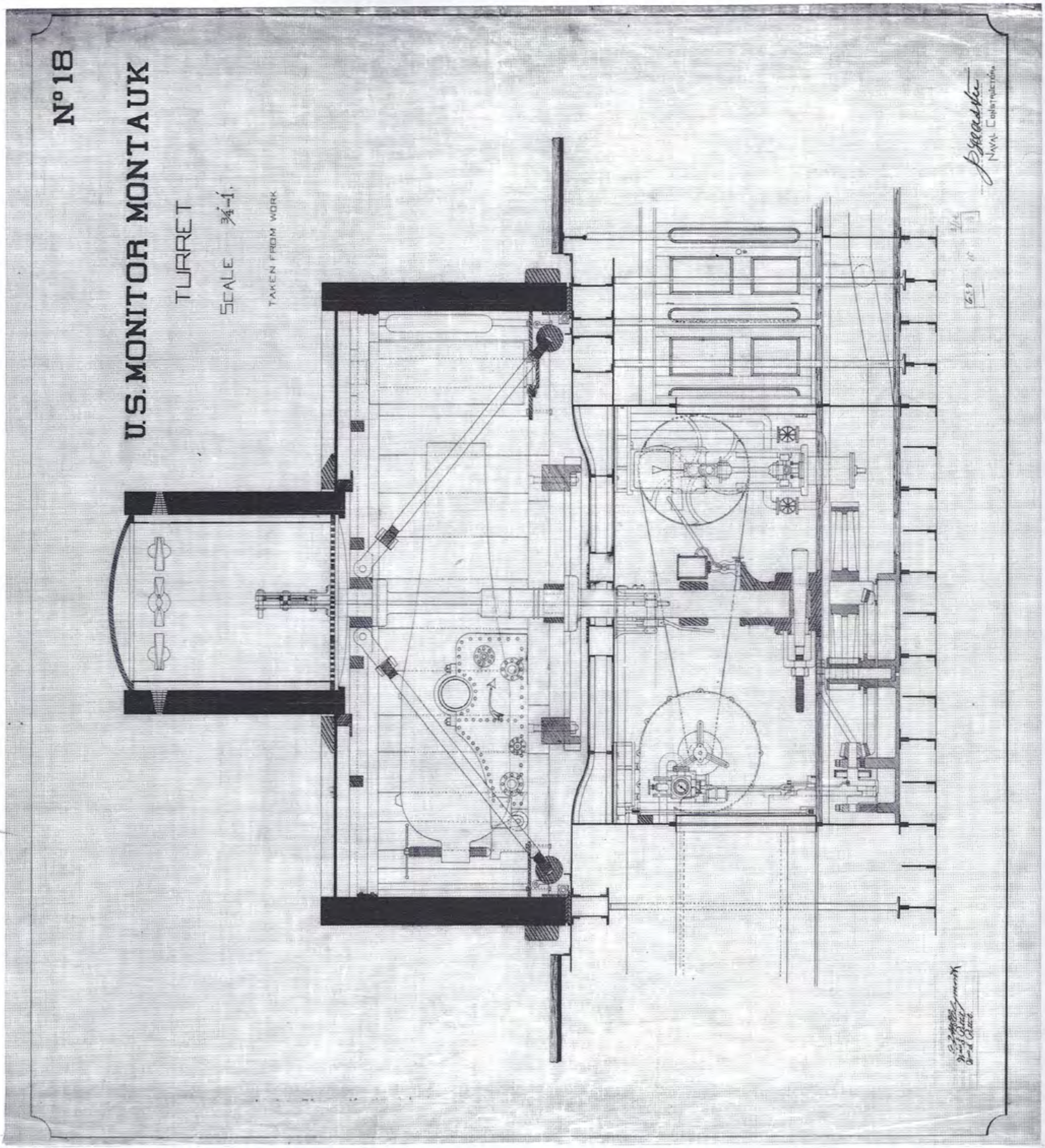
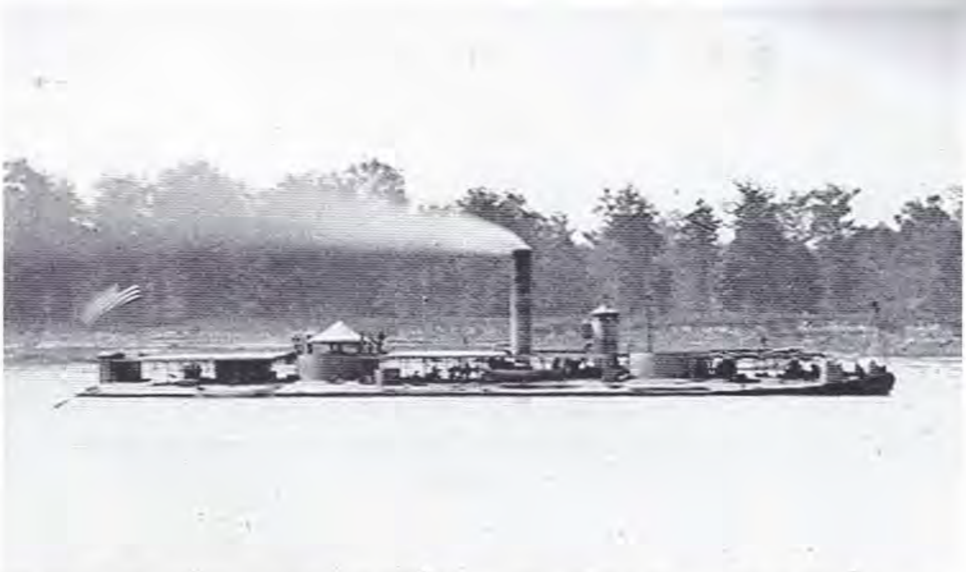


TURRET OF MONITOR MONTAUK
SCALE c. 1:66

FIGURE 1

C1765a



The Eads Steam-Powered Revolving Turret

ARNOLD A. PUTNAM

The American Civil War witnessed developments in both new and improved weapons technology applications. Among these were: the precursor of the machine gun; major advances in underwater mines; the military telegraph; breach-loading rifles; submarines; and the turreted ironclad warship. Several of these systems had been tried in earlier wars, notably the submarine and floating mines. The concept of the revolving, armored turret was not new. It had been suggested by a Scot named Gillespie in 1805,[1] Abraham Bloodgood of Albany, New York, in 1807,[2] and by Theodore R. Timby[3] of New York City in the early 1840s. However, the novel methods of construction and those applications to warship design received their first trial in combat by the United States Navy between 1862–1865.

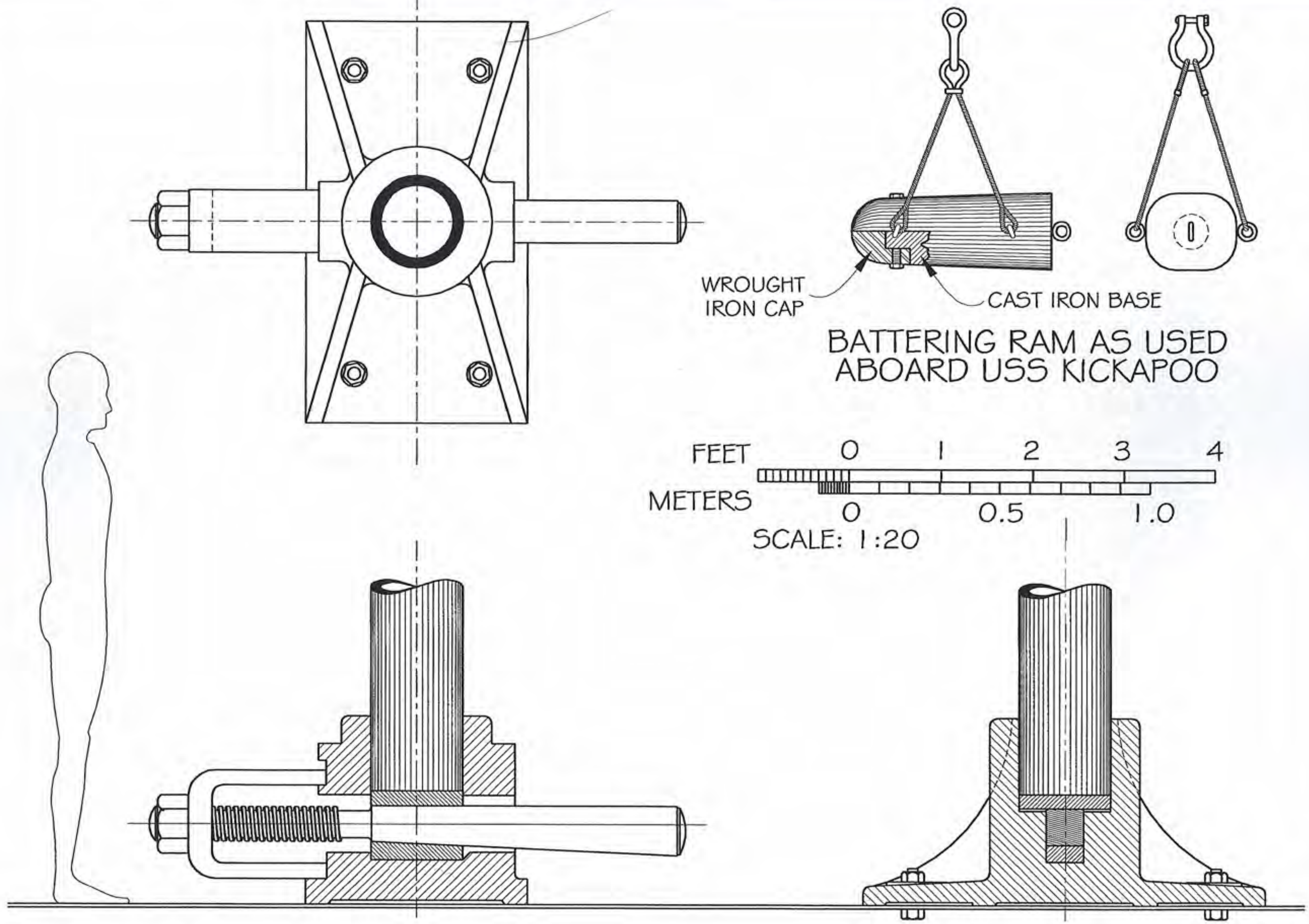
The naval aspect of this conflict was not primarily blue water, i.e., fought on the open ocean, but rather a coastal and riverine struggle. Union forces blockaded southern ports and carried out amphibious landings along the coasts and rivers of the Confederacy. The purpose of these operations was to close off the Confederacy from overseas commerce and to provide advanced bases for further Union offensive actions. At the same time, as part of a pincer movement, Federal troops were advancing up and down the Mississippi River and its tributaries. Most of these waters were confined, narrow areas affording few opportunities to bring the traditional broadside arrangement of guns to bear effectively on any one point. The coastal waterways and rivers of the South were also shallow, placing a limit on the draft of naval vessels.

Photo 1. (above) USS **Kickapoo** ***appears here in the Missisippi River Area prior to her transfer to Admiral Farragut's West Gulf Blockading Squadron in July 1864. An interesting point is that the Ead's turret forward is outwardly identical to the Ericsson turret aft.*** **Naval Historical Center Photo NH 64090.**

The Confederacy did not have the industrial resources necessary to construct a fleet capable of dealing with the Union Navy. Using the resourcefulness born of desperation, the South developed a series of shallow draft casemated ironclads for use in defense of its harbors and rivers. These ironclads, in conjunction with land fortifications, presented a formidable threat to wooden Federal warships.

These circumstances demanded Federal construction of naval vessels of unique design. The design would require a vessel of shallow draft, extremely low freeboard (to reduce the weight of hull armor required) and a means of traversing the guns without having to maneuver the ship. Two inventors, John Ericsson, of New York, and James B. Eads, of St. Louis, developed a series of ironclad warships to meet the Confederate challenge.

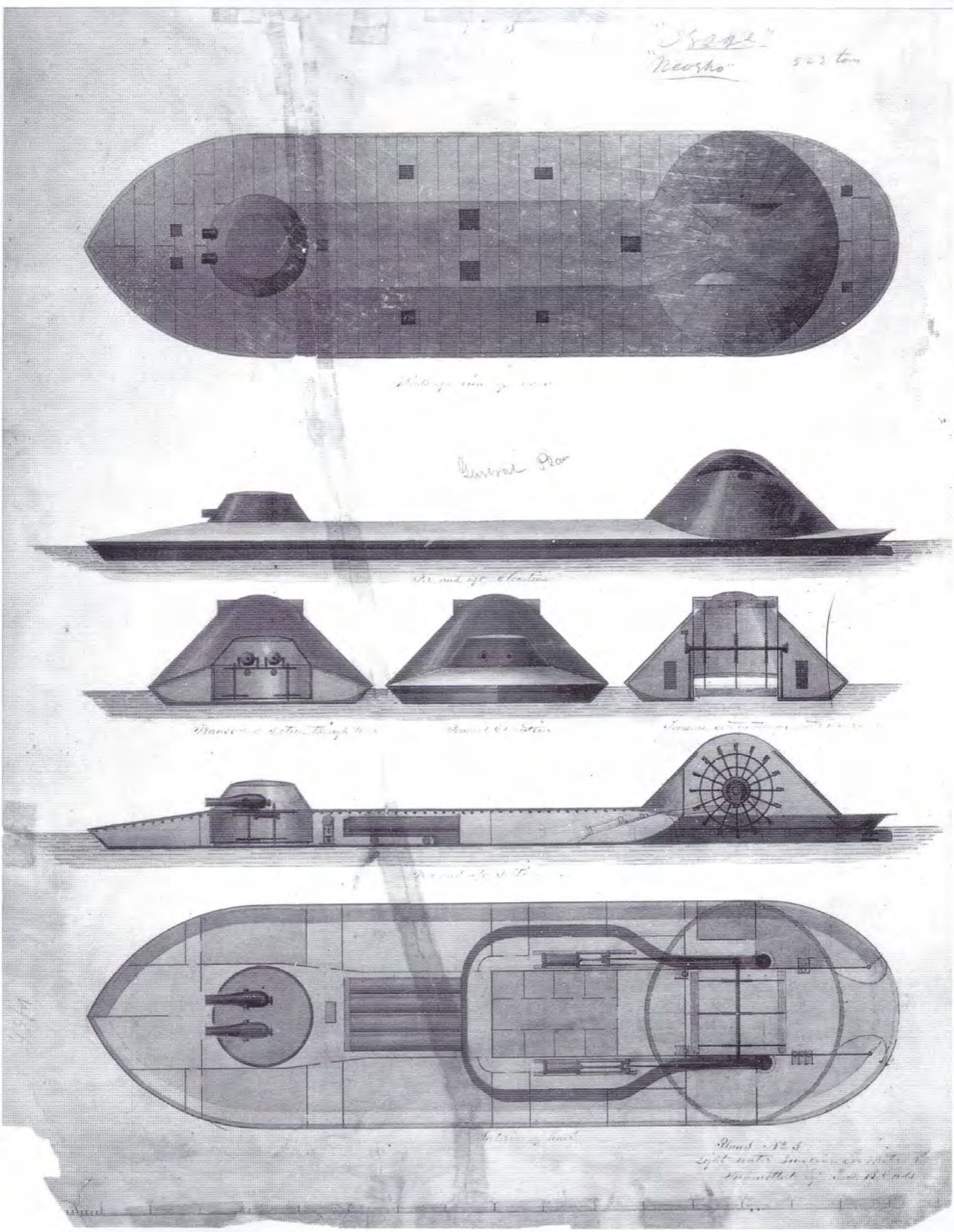
In 1861 Ericsson submitted a proposal to the



CASCO CLASS LIFTING WEDGE

FIGURE 2

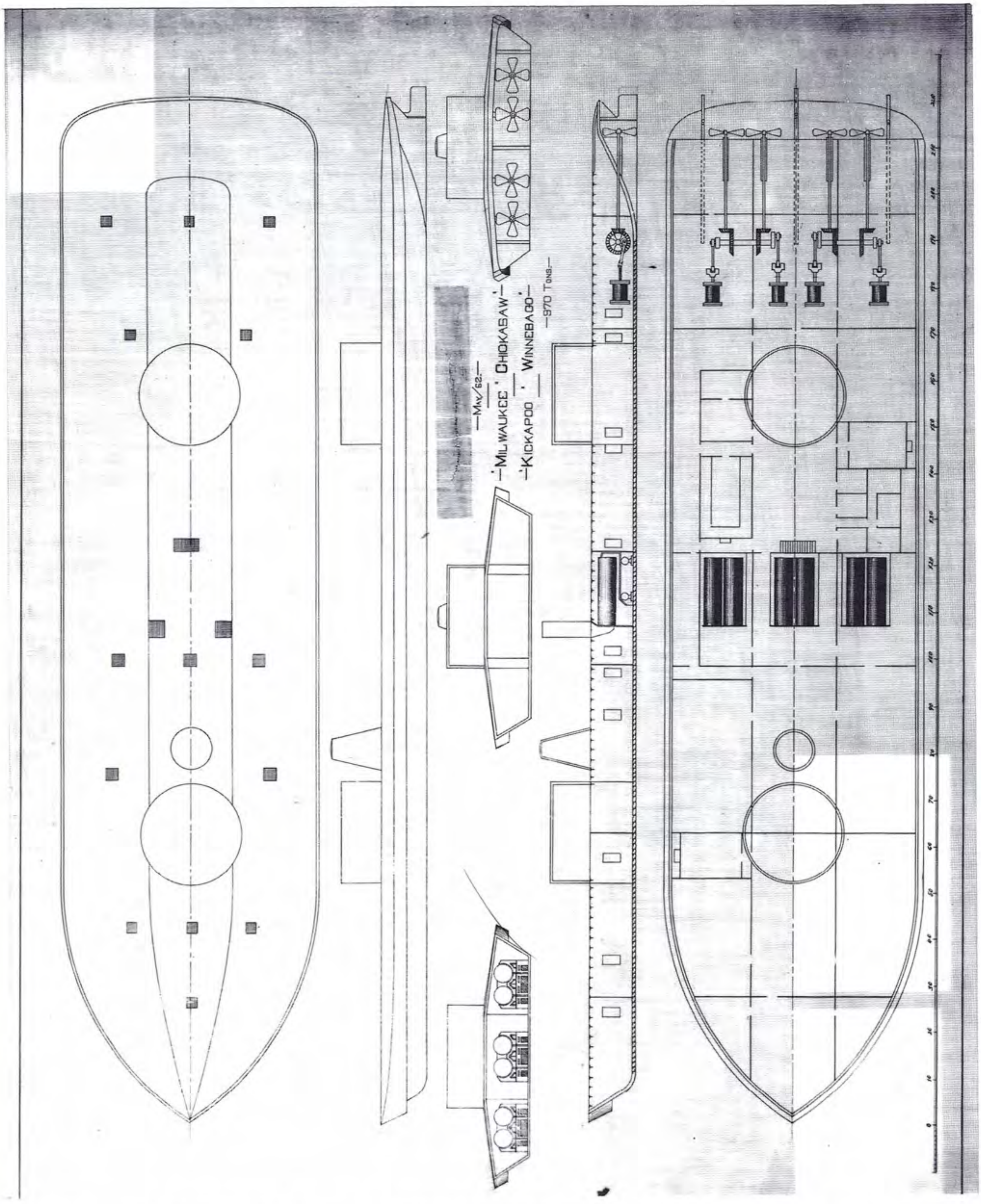
W. JURENS/INRO/C1766



MONITOR NEOSHO (@150'-0" O.A. LENGTH)

C1765c SCALE c. 1:350

FIGURE 3



MONITORS MILWAUKEE, CHICKASAW, KICKAPOO, & WINNEBAGO
SCALE c.1:386
FIGURE 4
C1765b

Navy Department that he claimed to have presented to the Emperor of France, Napoleon III, in 1854.[4] That design would evolve into USS *Monitor*. This ship would check the Confederate casemated ironclad CSS *Virginia* (formerly the wooden steam frigate USS *Merrimack*) on 9 March 1862, at Hampton Roads, Virginia. More than fifty vessels based on Ericsson's monitor design would be in service or under construction by the end of the War in 1865.

Ericsson's turret consisted of a hollow, layered iron cylinder, with internal cross-beams at bottom, to support the gun platform and carry the weight of the turret, and just below the top to support the turret roof. The two muzzle-loading cannon fired through two parallel ports cut in the side of the turret. The gun's recoil was taken up by friction clamps built into the gun-carriages and gun slides.

The weight of the 120-ton turret and its two 11-inch Dahlgren smoothbores was supported by a one-foot diameter wrought iron central column, which extended up through the gun platform to the roof of the turret. Ensuing designs would have the column extend through the top of the turret to support an armored pilot house, and would expand to carry 15-inch guns. The two bearings in the column, which supported the turret, also served as the pivot upon which the turret revolved.

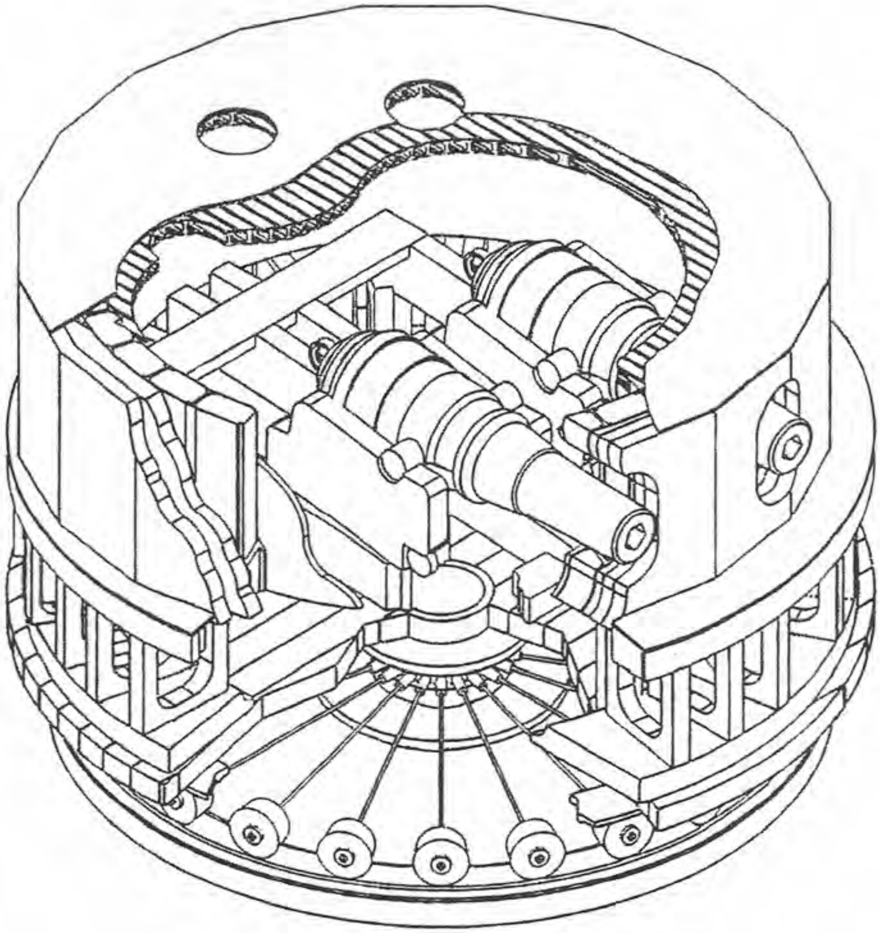
Coastal monitors moved between Federal ports and along the southern coast. Their decks, due to the their extremely low freeboard, were awash in all but the calmest waters. In order to allow the turret to turn, there had to be a space between the bottom of the turret and the monitor's deck. Such a space, however small, would allow seawater in under the turret and down into the hull below. The solution was to allow the turret to rest on the deck and to only be raised when in action. Accordingly, the central column and turret were raised by means of a tapered key or "turret step." This consisted of a wedge, pulled under the base of the column by tightening a nut attached to a bolt, which formed an extension to the sliding wedge. When going into action the nut was tightened, pulling the wedge under the column to raise it. A battering ram, held by two men, would be hammered against the large end of the key to force the key forward to reduce the amount of "elbow grease" needed for turning the nut. At the end of combat, the turret would be revolved to a pre-determined position, the nut loosened and the turret would drop back down on the deck, the weight of the turret forcing the wedge back out from under the column.[5]

Two steam engines, mounted at right angles to each other in the chamber below the turret, turned the turret. These drove a series of gears culminating in a huge cog wheel, which was bolted to the underside of the gun platform. The engines, which were controlled by the gun captain within the turret, could be reversed to allow the turret to turn clockwise or counter-clockwise for aiming purposes. It took one minute to make a complete revolution. The opening of the iron port stoppers and running out of the guns was accomplished by hand.

In the spring of 1862, after successful completion of the casemated City class ironclads, Eads was summoned to Washington to meet with the Secretary of the Navy, Gideon Welles. The Secretary, and his assistant, Gustavus V. Fox, asked Eads to design a turreted river ironclad, carrying a pair of 11-inch Dahlgrens, with a draft of less than six feet for operations on the Tennessee and Cumberland Rivers. After some preliminary discussion, Eads returned with plans for a single-turret, enclosed paddle-wheel, ironclad monitor. Eads had incorporated his own revolving turret design into the plans. Unfortunately, Eads presented his plans shortly after the success of Ericsson's *Monitor* at Hampton Roads. Welles, not wanting to change horses in midstream, rejected Eads' turret and required him to use the Ericsson design instead.[6] USS *Neosho* and USS *Osage*, for which the plans had been drawn, were commissioned in May and July of 1863 respectively.

During the Washington meeting, or shortly thereafter, the Navy ordered four more monitors with double-turrets, each to house a pair of 11-inch Dahlgrens, for use on the Mississippi River. The Navy Department consented to have one Eads turret on each.[7] However, they stipulated that if Eads's turret design was unsatisfactory, he would have to replace them with the Ericsson type at his own expense. Eads enthusiastically began construction of the River class monitors. *Milwaukee*, for which the class was named, and *Winnebago* were contracted to Eads at Carondelet, Missouri. G. B. Allen constructed *Kickapoo* at St. Louis, while *Chickasaw* was built at St. Louis by Thomas G. Gaylord.

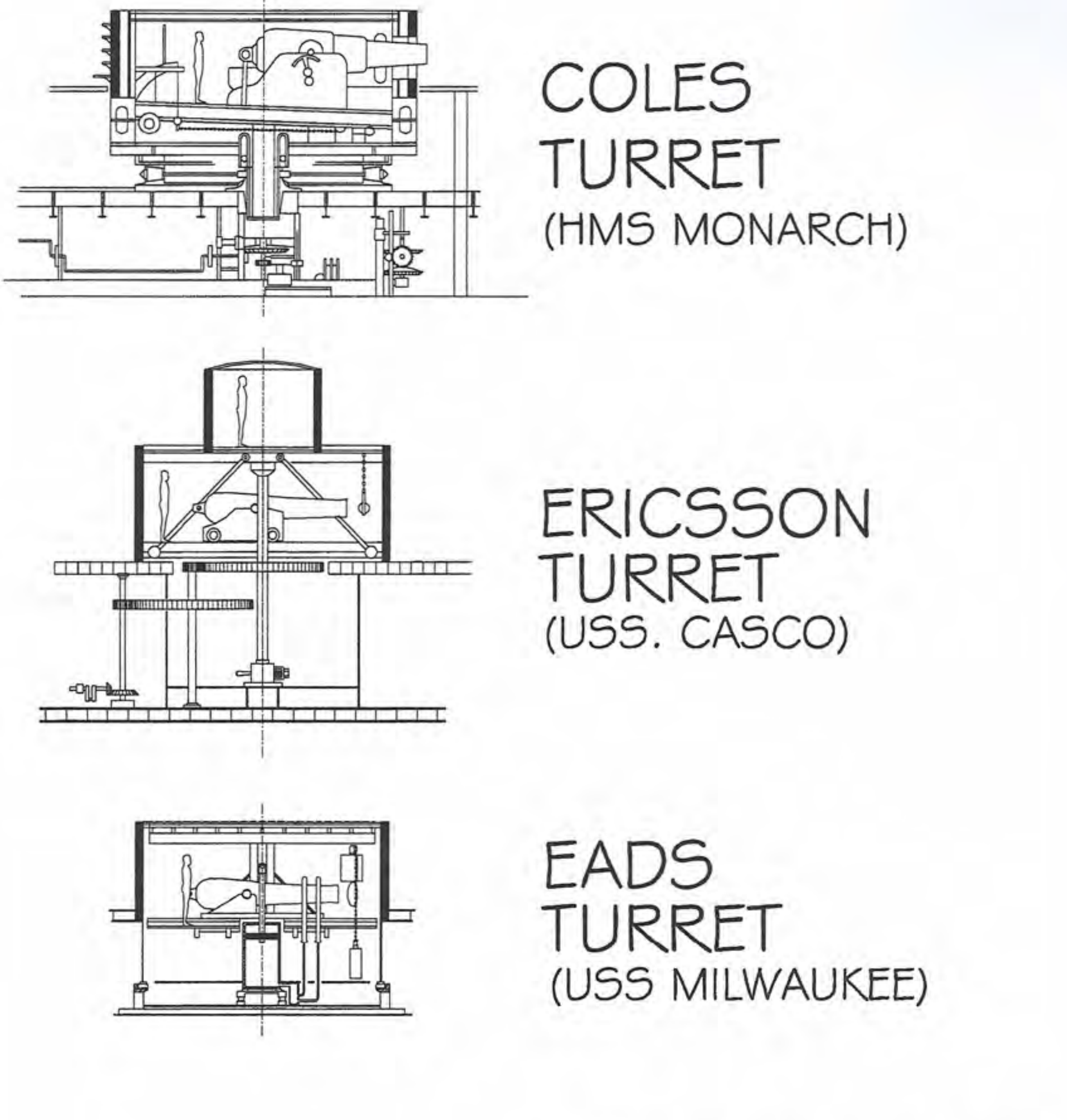
As was the case with Ericsson's turret, Eads' turret consisted of a hollow, layered iron cylinder that protected two guns and was turned by a steam engine. There the similarities ended. Instead



COLES TURRET
REPRODUCED FROM A DRAWING BY A. PUTNAM

C1765d

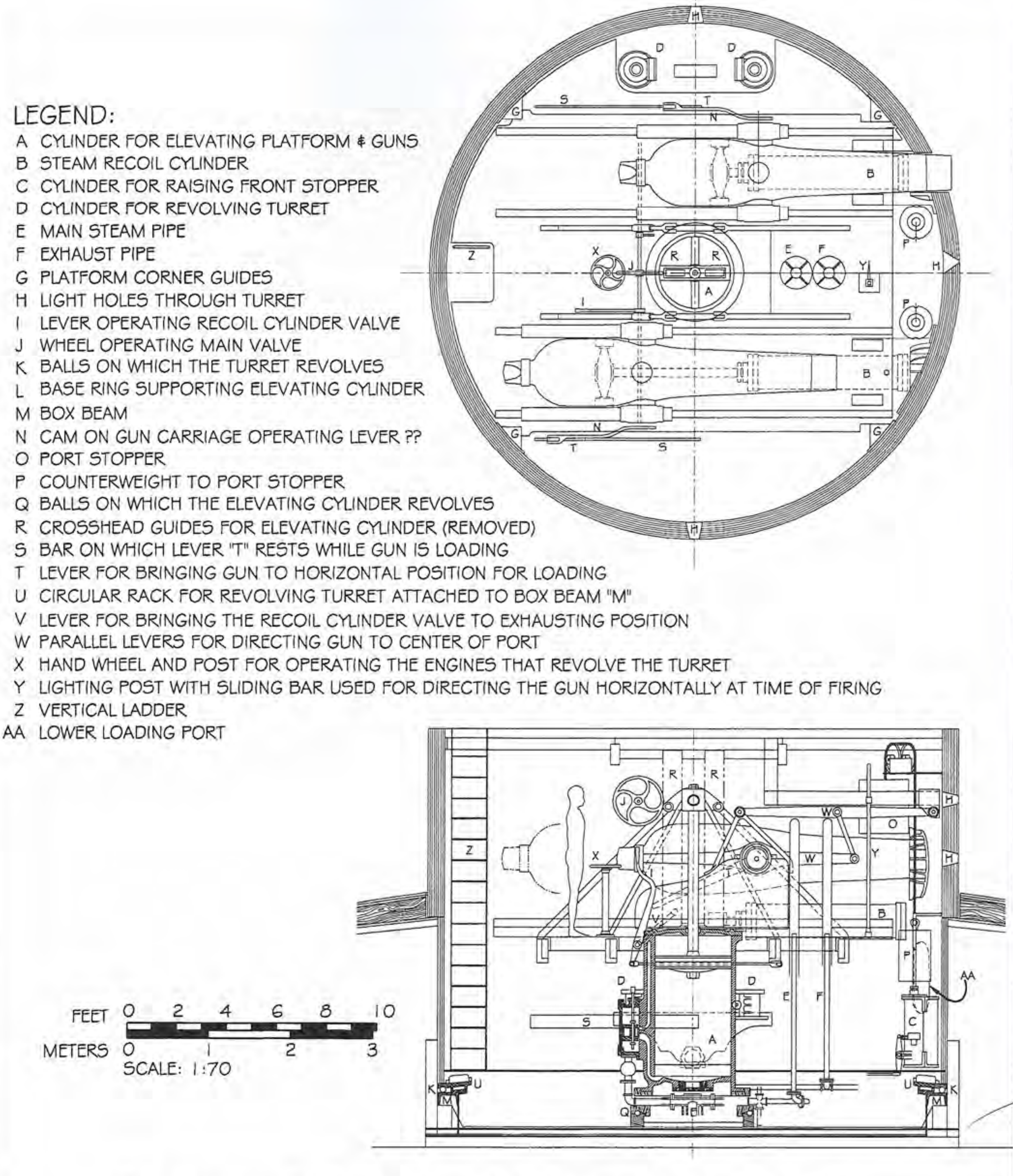
FIGURE 5



COMPARATIVE TURRET ARRANGEMENTS

W. JURENS/INRO/C1767

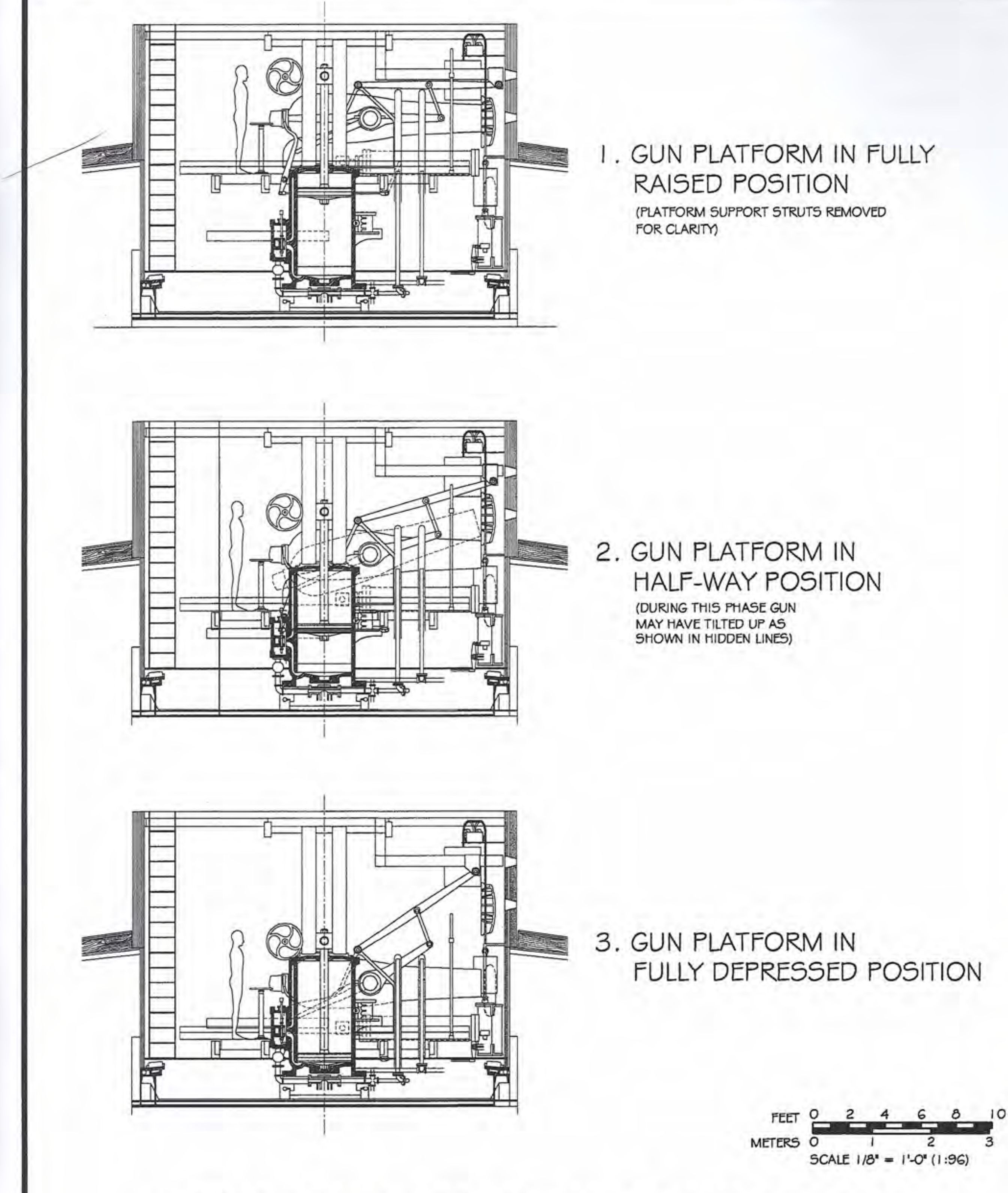
FIGURE 6



PLAN AND PROFILE OF EADS TURRET

W. JURENS/INRO/C1769

FIGURE 7



OPERATIONAL GEOMETRY OF EADS TURRET

FIGURE 8

W. JURENS/INRO/C1768

of resting on the main deck, with its weight on a central spindle like Ericsson's design, Eads's turret extended through the main deck to the lower deck, where the weight of the turret was borne on a circular ball bearing arrangement. Instead of running out the guns and opening the iron port stoppers by hand, Eads used steam power for all of the turret's operations. Eads received U.S. Patent 38,038 for his design on 31 March 1863. In many respects, Eads's turret drawings resembled a design developed by Capt. Cowper Phipps Coles in England in 1859. Eads did not claim to have invented the "revolving metallic gun-tower," or the concept of raising the guns "...up from the hold of a vessel to be fired, and lowered again by steam into the hold." His idea was two-fold; to ease and increase the speed of reloading the guns and to "bring the weight below decks and better trim the vessel for steaming or sailing."[8]

The external diameter of the Eads turret was 21 feet 4 inches, total height of the turret was 14 feet ¾ inches, of which 7 feet 6 inches rose above the main deck. The portion above the main deck was composed of eight layers of 1-inch thick rolled iron plates. Two elliptical gun port, 18½ x 17½ inches, were cut into the above-deck portion of the turret. The part below, not needing armor, was composed of a single layer of 1-inch plates. The base of the turret rested upon 253 3-inch diameter ball bearings set in a track around the circumference of the turret base. The roof of the turret was composed of two beams 4½ inches by 10 inches and 19 feet long. Across this were laid, evenly spaced, eleven iron cross members each 3 inches by 6 inches. Over this were placed railroad bars, which, in turn, were covered by ½-inch iron plates, perforated with 1-inch holes. The holes were for ventilation of the turret.[9]

The turret machinery performed four operations: turning the turret; raising and lowering the gun platform; running out the guns and taking up the recoil when they were fired; and opening and closing the port stoppers. All of the machinery was contained in and rotated with the turret. Steam for the various operations was supplied from the ship's boilers through a pipe, running under the turret, and connected through the axis of the turret with a steam fitting. This fitting allowed the pipe to turn with the turret without leakage. Around this pipe another pipe, also with a steam fitting, carried the exhaust steam from the turret machinery.

To turn the 134-ton turret, two steam engines, located at each side on the bottom of the inside of the turret, each drove a crank which turned a spur-gear. This gear fitted into a fixed cog wheel, which in turn was bolted to the deck at the base of the turret. A complete revolution of the turret took about 45 seconds.

The guns were arranged on a platform on either side of a yoke. The yoke was attached to the cross head slides of a piston rod. The whole, weighing in excess of twenty tons, was raised and lowered into the hull of the ship by a steam cylinder 36 inches in diameter with a five foot stroke. Dana Wegner aptly compared its operation to a hydraulic lift commonly found in automotive repair shops.[10] A crew of nine could load and fire the guns every five minutes, fifty-five seconds. The Ericsson turret required a crew of thirty-six to load and fire every ten minutes.[11]

As work on the double-turreted monitors progressed, Secretary Fox became more impressed with the Eads turret. In a letter to Rear Adm. David D. Porter in November of 1863 concerning the turret he wrote "if it succeeds, I propose to build an ocean steamer with one such turret, containing two 15 and two 20 inch guns." He felt that the success of the Eads turret would, "settle the question in favor of turrets as against casemates," for warship design.[12]

Milwaukee class monitors were commissioned during the spring and summer of 1864. Only USS *Chickasaw* did not have an Eads turret; the other three vessels' forward turrets were of his design. The new river monitors' careers on the Mississippi were short, as all would be sent to aid Union forces at Mobile Bay, on the Gulf Coast of Alabama.

During the Battle of Mobile Bay, on 4 August 1864, *Chickasaw* and *Winnebago* participated in the passing of Forts Morgan and Gaines and the engagement with the Confederate casemated ironclad CSS *Tennessee*. Though the Ericsson and Eads turrets aboard *Winnebago* were each struck by shellfire once, without damage, both jammed during the battle. The Ericsson turret was disabled due to mishandling, according to Acting Chief Eng. Simon Schultice. As a result "one tooth was broken and the other outer rim of the main spur wheel was cracked while engaging the enemy's steamer off Fort Gain[e]s."[13] W. F. Shankland, Acting Volunteer Lieutenant aboard *Winnebago*, wrote in the fall of 1864, "The machinery for hoisting, lowering, running in and out, and the recoil works splendidly." But, "the Eads turret would frequently jam," because "the revolving engine of the turret is too light for the work it has to perform," and that it "cannot be relied upon."[14] During the encounter with *Tennessee*, the commanding officer of *Winnebago*, T. H. Stevens, was forced "to turn his vessel every time to get a shot so that he could not fire very often, but he did the best under the circumstances."[15]

Despite the turret problems, all four monitors provided excellent close support for the army in their operations in the Mobile Bay area from the battle of August 1864, to the cessation of hostilities in April 1865. *Milwaukee* was sunk, without loss of life, by a floating mine in the Blakely River in March 1865. It was later raised and scrapped, the metal being used in the Mississippi River bridge that Eads designed and built at St. Louis in 1874.

With the end of the Civil War, American warship development came to a virtual halt, not to be renewed until the building of the New Navy in the 1880s. Congress, as was to be expected at the end of any war, hot or cold, cut military funding drastically. The result was a reduction of wooden shipbuilding and a termination of expensive ironclad warship construction by the middle of 1866. Assistant Secretary Fox's proposal would not be adopted because no turreted warships were built between the launching of the monitor USS *Umpqua* in December 1865 and the initiation of the nominal rebuilding of the ocean-going monitor USS *Miantonomoh* in December 1876. By that time, hydraulic power had replaced steam for turret operation. In addition, the breech-loading rifle had begun to replace the muzzle loading cannon, obviating the need for greater space to load the gun.

A tip of the hat to William H. Roberts.

Appendix A

From New-York Historical Society, Papers of Gustavus Vasa Fox, Box 5A, Letters Sent 1863, Fox to James B. Eads, 23 October 1863, Unofficial:

> If the turret on your plan proves a success in the '*Winnebago*,' of which I confess I see no obstacle, I should like to see an ocean steamer built in the West to carry one turret of eighteen inches in thickness, containing four guns as we talked over. [From Fox to Eads, October 14, 1863, the two interior guns were to be XX-inch and the two outer ones XV-inch]" Four feet freeboard at sides, deck crowned 3 feet, plus two feet from base of turret to ports => "nine feet height for the guns; the boasted height of the Warriors." "She must have masts to enable her to cross the ocean without using up her coal."... "I think it possible to produce an ocean turreted vessel that will give us the lead in maritime warfare, and he who leads on the ocean can bully every body else. But recollect that the greatest condition is four of the biggest guns possible to construct and eighteen knots speed.

Did anything come of this? Was Eads's turret followed up in any way?

Appendix B

From National Archives RG 19, Records of the Bureau of Ships, Entry 64, Letters Received from Superintendents Outside of Navy Yards, January 1862–May 1867, Box 7, "Volume 11" (January–June 1866) #63.

Gregory to Lenthall, 8, March 1866, w/enclosures:

> Gregory recommends approval of Wilmarth's patent hydraulic turret-raising device if the price for the rights can be reduced to "something more reasonable" [i.e. "by about one half"].
>
> B. F. Delano to Gregory, February 26, 1866, forwards the idea and observes "the plan is a capital one."
>
> Seth Wilmarth to B. F. Delano, February 1, 1866. Discusses "the old arrangement with the screw, wedge, and battering-ram" and notes that the new system would reduce time and labor at a cost "but a small amount over the cost of the old arrangement."
>
> Ericsson to Fox, March 14, 1866. Ericsson "carefully examined" Wilmarth's drawing. Notes that:
>
> ... a perfectly safe monitor turret should always have its base in contact with the deck ring. It is only because the turret engine cannot be made powerful enough to turn the turret when the entire weight rests on the base, that keying up is resorted to. It is hardly necessary to state that in order to relieve the turret engine the base of the turret need not actually be raised above the deck ring. And it is self-evident that more than nine tenths of the weight might rest on the shaft and yet the base and deck ring remain in perfect contact. In practice the turret will turn with the greatest steadiness and guns may be pointed with the greatest accuracy, when the key is driven in so far that three fourths of the entire weight is supported by the shaft and central bearing. To raise the turret con-

siderably above the base before going into action is a grave mistake, as the fragments which result from broken shot or torn deck plating, will be driven in between the deck ring and the turret and thus prevent the lowering of the turret to form a water tight joint after the action—if indeed such fragments do not cut the ring and check rotation altogether....In the original monitor, with four diagonal braces, the turret was readily lifted clear of the deck ring all round, and to this circumstance was owing the loss of that vessel, as it enabled her officers to lift the turret high enough to insert hemp under the entire base. Now the insertion of hemp of a uniform thickness is nearly impossible, and hence the turret will be kept up by thick lumps of hemp when the key is withdrawn previous to going to sea. In the case of the *Monitor* the introduction of hemp under the base was done in so careless a manner that after backing the key the turret was hung up on a few thick lumps, while the rest of the packing, not being held by the weight of the structure, was washed out at sea, admitting more water than the pumps, which happened to be in a wretched condition, could take away.

Much more might be said against the pernicious practice of raising the turret above the base ring, but what has already been stated fully established the impropriety of applying mechanism which, if successful in its operation, would inevitably lead to the destruction of the turret and probable loss of the vessel. I need not point out that if the turret is overstrained by undue elevation so as to take a permanent set, or if fragments enter under its base in action at sea, the consequences will be fatal.

In view of the peculiar conditions ... we may exhaust the entire resources of mechanic art without finding a substitute for the wedge. By simply regulating the blow on the wedge under the turret shaft, we can raise or lower the turret to an extent less than the thickness of a tissue paper. And what is far more important where we leave the wedge, there it will permanently retain the turret at a given altitude. Again, such is the simplicity of this ancient and remarkable devise for raising and lowering weights and for retaining the same at a permanent height, that it cannot get out of order, while the mechanism necessary to operate it consists only of a sledge or a ram.

The foregoing remarks will render it unnecessary to enter on an extended criticism of Mr. Wilmarth's hydraulic apparatus as it does not fulfil a single condition pointed out as necessary to insure the safety of the turret and vessel.

With regard to the accompanying drawing I have only to say, that it may be shown that an apparatus made from it, could not raise a turret at all. The entire detail is faulty, evincing utter want of practical knowledge on the part of the planner. ... the smallest leak in any one of the numerous packings, or the smallest particle of dirt under any one of the several valves, would render the turret stationary ...

... A few blows on the key before going into action to relieve the pressure on the base, is all that is needed—at other times the base of the turret and deck ring should be in contact. The trouble of backing the key in the *Passaic* class has been completely overcome by the reversing screw applied to the *Dictator* turret.

APPENDIX C

Ericsson to Fox, March 15, 1866, marked "private": "... a few remarks with reference to the favorable consideration which it appears that Mr. Wilmarth's useless and dangerous invention has met:

Of all the unreasonable and frivolous objections which have been raised against the several contrivances which I have resorted to in carrying out the monitor system, the objections to the wedge (key) which supports and regulates the height of the turret shaft, is pre-eminent for absurdity.... Surely it does not require an engineer to comprehend the danger of having no support for the turret shaft but the surface of a fluid subjected to a pressure of nearly 3000 pounds to the square inch! ...

As I understand it, the monstrous scheme of the inventor contemplates the removal of the turret keys from all the monitors and the substitution of the hydraulic apparatus. The practical effect of such a change would be to deprive the country of the use of the entire turret fleet for offensive or defensive purposes.

APPENDIX D

NARG 19, Records of the Bureau of Ships, Plan File, Plan 80-8-24, Jas. B. Eads to John Lenthall, February 1, 1864 [Proposal to Build 8000 ton Iron-clad Steamer]:

I have the honor of submitting the following proposal for building and equipping one of the large Iron Clad Iron Steamers recently designed by the Navy Department.

Extreme length of the vessel to be 475 feet. Extreme width 63½ feet over all; depth from bottom plates to deck plates exclusive of Crown of deck 23 feet.

You were pleased to remark that I could suggest any modifications of the designs and specifications which to my own judgement might, on reflection appear likely to insure a more perfect vessel without altering the power or size of the ship. Availing myself of this permission I have, on the plans here with submitted, discarded the recessed sides of the ship. This I have been impelled to by two reasons. The first and most important of which is because in my humble judgement they can only be placed on her at the expense of the strength of the vessel.

The most approved method we have of estimating the longitudinal strength of a ship is by considering her as a great beam, or girder, at one moment born upward by a force under its middle with the ends unsupported, and at the next, the whole weight resting alone upon its extremities. To resist these strains we must find the strength in the sides of the girder, and in such other longitudinal bulkheads as may be placed between the sides to aid in resisting flexure, and to stay the top and bottom and thus insure the best results from them in resisting the alternate tensile and crushing strains to which they are subject.

If the sides of the girder be brought up vertically and then deflected in, and then again brought up the remainder of the way vertically to the top, the two vertical portions are in two different planes and cease to stay the top and bottom as firmly to their places, — and really become only, or very little more than equivalent, in themselves to two separate girders, the united strength of which is far less than that of one girder whose depth is equal to the sum of the other two.

And this loss of strength consequent upon the longitudinal separation of the sides to form the recess can only be regained by the use of additional material and a consequent loss of buoyancy.

The second reason why I object to the proposed recess is from my thorough conviction that we will never obtain a perfectly armored ship until we incorporate the armor into and form with it a part and parcel of the ship herself, to which it should impart the strength due to the mass of iron employed. When this is done the armor ceases to be a helpless load, increasing the dangers of the seas, but inspires confidence and hope, and gives real safety in the greatest emergencies.

In my humble judgement this effect cannot be produced by uniting [iron] and wood together. Absolute rigidity in every joint of the ship should be aimed at, and every pound of her armor can and should be made to promote this end.

With a material so yielding as wood, I don't think this can be done. Before the strain can be imparted to it the iron joints have borne it all. They must give way before the resistance of the wood can be made available.

The introduction of this large body of wood upon the vessel will I think also ensure the necessity of repairs within a very brief period after her completion, which would not be the case if iron were alone used. In the modification proposed by me, I have endeavored to put the exact weight of the iron armor and wooden backing into solid iron armor. Not knowing the exact manner in which it is proposed to diminish the wooden backing at the extremities of the ship, I may have slightly exceeded the weight intended by the Department. I think, however, it will not be found to be 25 tons out of the way.

The whole weight estimate by me being 1200 tons nett, which I think will be found to be the weight of the wood and iron armor combined as designated by the Department.

I propose to put this armor on in three strakes 32 inches wide each. The two upper strakes on account of their great thickness are designed to be vertical from stem to stern, for 200 ft. amidships on each side of the vessel. The upper strake will be 10¼ inches in thickness, the middle strake 11¼ inches, and the lower strake 5¾ inches. The two upper strakes will diminish towards each end of the vessel to 5¾ inches, the middle strake diminishing 1½ inches every 26 feet until it is reduced to 5¾ inches. The upper strake will be similarly reduced. I propose to make the middle strake thicker than the upper one, because it protects the water line of the vessel, which line is more important to protect than the portion of the hull above it.

This armor will be in two thicknesses, the one next the hull being 1¼ inch thick in each strake. The outer plates will all be 26 ft. long. The lower strake 4½ inches thick, the middle one 10 inches thick, and the upper one 9 inches thick. The accompanying drawings will more clearly explain the manner of fastening the plates to the hull without any through bolts and by a system of broken joints, Cork and tabling and extra heavy tee iron bars and bolts whereby enormous strength is imparted to the hull whilst the whole will admit of being easily unfastened and taken off in case of injury. As a matter of greater security I place an iron bulkhead ⅜ in thickness 3 ft inside of the armor extending 400 feet of the length of the vessel on each side of the ship and made water tight so as to protect the vessel in case of the armor being broken or injured.

Another modification which I propose is to dispense with the Casemate and use a revolving turret of great strength, 32 ft in diameter. Containing within it two XX inch and two XV inch guns. The walls of the turret will be 18 inches in thickness composed of five thicknesses of 1 inch plates rivetted together to form a backing or arch for the support of four circles of iron plates placed one above the other in segments of about 20 feet in length. Each plate being of hammered iron of 12 inches thickness, and connected with each other by a system of tongue and grooving. The grooves being 4 inches wide and 3 inches deep, the two middle tiers of these plates through which the port holes will be

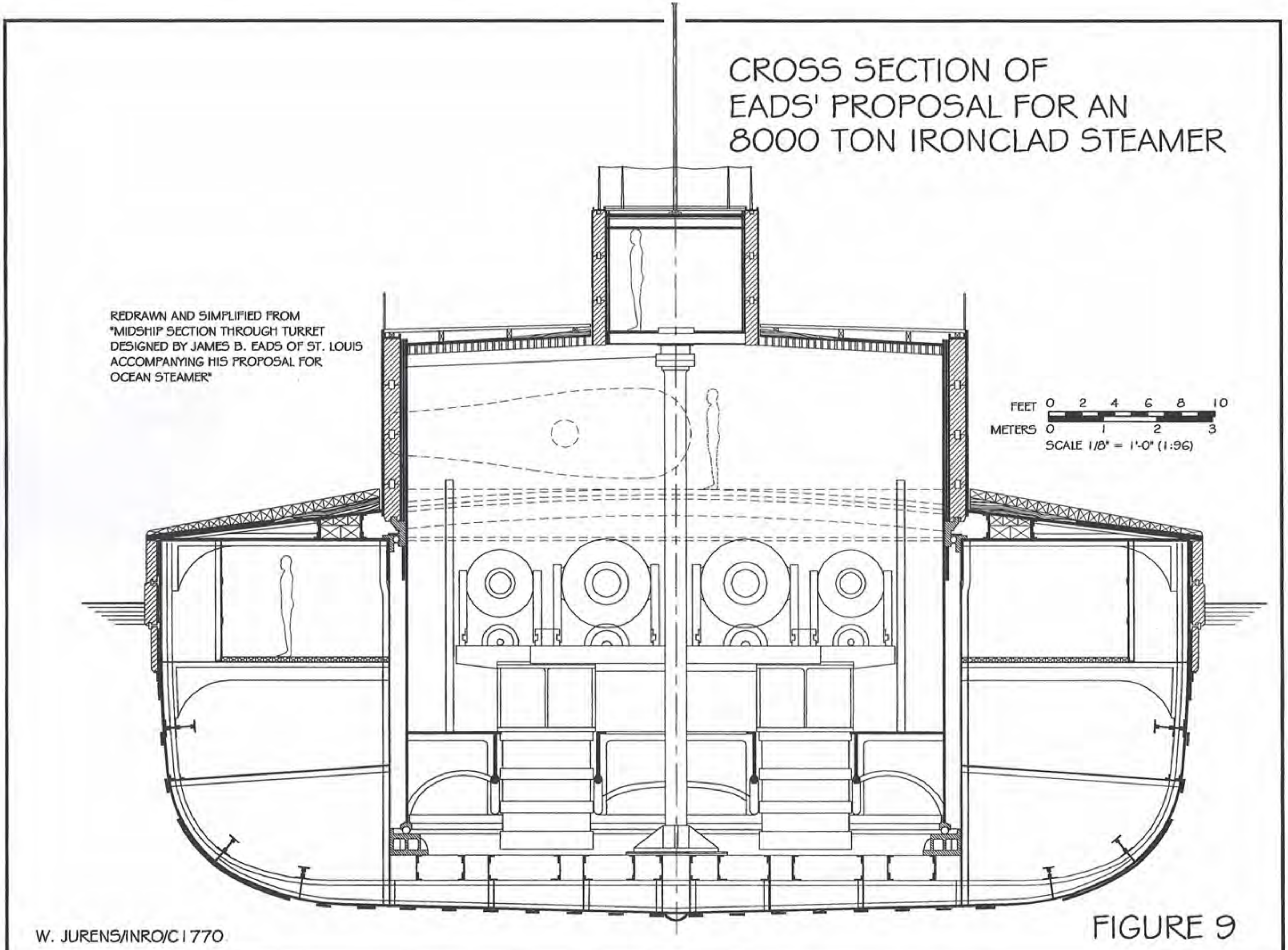

CROSS SECTION OF
EADS' PROPOSAL FOR AN
8000 TON IRONCLAD STEAMER
REDRAWN AND SIMPLIFIED FROM "MIDSHIP SECTION THROUGH TURRET DESIGNED BY JAMES B. EADS OF ST. LOUIS ACCOMPANYING HIS PROPOSAL FOR OCEAN STEAMER"
FEET 0 2 4 6 8 10
METERS 0 1 2 3
SCALE 1/8" = 1'-0" (1:96)
W. JURENS/INRO/C1770

FIGURE 9

formed will be 3 feet in height each, on the outside of these forged plates will be one course of upright plates 1 inch thickness, screwed on to the hammered plates with 1¼ inch bolts with countersunk flush heads, screwed 2½ inches deep into the hammered plates, in such manner as to secure the whole together without the use of any through bolts. All of which will be more clearly understood by reference to the drawing. The turret will be surmounted by a pilot house 8 ft in diameter inside and 12 inches thick, the walls of which will be similarly formed to those of the turret.

To compensate for the diminished strength of the deck where it is cut away for the accommodation of the turret, I introduce an extra deck immediately under the upper one 1½ inches thick, extending from side to side of the ship and for 60 feet of her length. I also place on the top of each fore and aft bulkhead, a stringer 2 ft wide 1½ inch thick, in three thicknesses vertically, extending 100 ft along each bulkhead by the sides of the turret.

As nearly as I can estimate the weight of the casemate, I believe the turret with the deck and stringers just described and the necessary kelsons and bulkheads required by the turret, including the machinery in the turret and its pilot house, will weight two or three hundred tons less than the casemate with its wooden deck, gratings and pilot houses. I think the invulnerability of the casemate will be far less than that of the turret.

The centres of the turret portholes will be 10 ft 3 inches above the water line.

The ship with these modifications I propose to complete and equip within three years for the sum of Sixty nine hundred and forty eight thousand ($6,948,000) Dollars. The modifications above proposed involve the use of between eight and ten hundred tons more iron and all of it of expensive workmanship, than what is required by the designs and specifications of the Department. I think you will agree with me however, that the ship as thus modified although much more costly will be more invulnerable, staunch and imperishable. Should these modifications be rejected by the Department, and an adherence to the original plans and specifications be required, the above price can be correspondingly reduced.

I have made no estimate for sheathing the vessel as it may be found to be unnecessary by the time the vessel is completed. I have not been able to inform my self whether I would be liable for the payment of the government tax on the cost of the ship or any portion of it and have made no estimate for anything of the kind. if so liable I shall be compelled to add the amount to the above figures.

In undertaking so large an amount of work running through a period of such length and in times of great Civil Commotion, it would seem but reasonable for me to claim of the government some protection against the danger of the depreciation of our Currency below its present standard. Such a depreciation as has already occurred within the last eighteen months, if occurring within a like period after making a contract of this magnitude, would utterly ruin almost any ship builder in our Country.

/s/ Jas. B. Eads

NOTES

1. John Ericsson, "The Monitors." *Century Illustrated Monthly Magazine*, 36 (December 1885): 286–287.
2. Abraham Bloodgood, "A Floating Battery on a New Construction," *Proceedings of the Society for the Promotion of Useful Arts in the State of New York*. (Albany, N.Y.: 1807): 230–231; Benson J. Lossing, The War of 1812 (Somersworth, N.H.: New Hampshire Publishing Co., 1976), 974–975.
3. Helen Woods, "Timby the Forgotten," *Harper's Weekly*, February 11, 1911, Vol. LV, 2825, 11 and 26.
4. Ericsson, "The Monitors."
5. U.S. Government. "Specifications of a Harbor and River Monitor;" Harrison Loring v. The United States, U.S. Court of Claims (No. 22892), National Archives Record Group 19. Entry 195. 208–210.
6. James Buchanan Eads, "Recollections of Foote and the Gun-boats," *Battles And Leaders Of The Civil War*, Robert Underwood Johnson, ed., Reprint; (New York: Thomas Ysloff, Inc., 1956), 1: 338–346.
7. Specifications for an Iron-clad Iron Propeller Gunboat. National Archives. Record Group 45. Navy Subject File AD. Civil War. USS *Winnebago*.
8. Improvement in Operating Guns and Gun-Towers, by James B. Eads, of St. Louis, Missouri. Patent No. 30,038 dated 31 March 1863, 1.
9. J. W. King, *Report and Letters Respecting the Steam Turret Patented by Jas B Eads of St. Louis, Missouri* (U.S. Government, Washington D.C.: 1864), 11.
10. Dana Wegner, "Mr. Eads's Turret," *Civil War Times Illustrated*, 12, no. 6 (October 1973): 28.
11. U.S. War Department, *Official Records of the Union and Confederate Navies in the War of the Rebellion* (Washington, D.C.: GPO, 1902. Series I, vol. 25: 529–530. (Cited hereafter as ORN). See also, *Ordnance Instructions for the United States Navy* (Washington, D.C.: GPO, 1866), 108–112.
12. Fox to Porter, 3 November 1863, *ORN* **25**: 529–530.
13. Schlutice to Cdr. Thos. H. Stevens, 6 August. 1864, *ORN*, 21: 497.
14. Shankland to Secretary of the Navy, 7 October 1864, *ORN*, 21: 498–500.
15. Adm. David D. Porter, "Admiral Farragut's Report," *Naval History of the Civil War*. Reprint (Secaucus, N.J.: Castle, Inc., 1984) 579.