U.S.S. "Monitor"

Specifications
Wander E. Hill
June 1st 1865.

Continental Works, Beech Print., or
135 Cranberry Street
Brooklyn.
Specification of an Iron Clad Ship Proof Steam Floating Battery to be constructed with Steam Machinery and Tie-re-fort complete ready for Service by J. Ericsson and Associates.

General Dimensions of

Extrm. length over Armor  200 ft
"  " of boat proper on water line  190 "
Length outside of Skin and Stern posts  159 "
Extrm. beam over Armor  46 "
Breadth of beam of boat proper (moulded)  37-3/4"
Depth of hold amidships from top of beams to stern  11-10"
Crown of deck amidships  - 5"
Shear of deck measured on pt. (Yarmouth) 12 in.

Distance from stern to extreme end of boat forward 10.9 in.
Distance from stern to extreme end of armor forward 16.
Distance from stern post to extreme end of boat aft 20.
Distance from stern post to extreme end of armor aft 25.

Keeb

Of best quality flange iron 3/4 in. thick buttled and strapped every six feet and hollowed out 4 inches deep 18 inches wide to form a "water limber" fore and aft vessel — see drawing —. Straps to be 3/4 inch thick 8 in. wide, thoroughly fastened with four rows of 3/8 inch rivets 3 inches from centre to centre (Staggered).
Stem—

Of hammered iron 3 inches thick 6 inches deep, the lower end to run 5 ft 6 inches into the keel (measured from the forward face of stem) and to be securely riveted there to. The upper end is to be flush with the overhanging portion or hip of the boat (forward) and to be fastened to said hip and made water tight by a boxing of 3⅛ x 3⅛ "angle iron riveted and caulked to the stem and to the underside of the bottom of the hip plating.

Stern Post—

Of hammered iron forged in the form of a knee, the arm to extend 6 feet into the keel—
(measured from the after face of post). The post to be 4 inches thick 9 inches deep, to have a "shaft eye" forged in and bored 16 in diameter – the external diameter to be 22 inch. The axis of this "eye" is not to be at right angles to the post but is to have an inclination towards the keel (forward) of 1 inch in 7 1/2 inches. The after side of the "eye" to be faced off at right angles to the bow. The arm post is to be made to conform to the shape of the after length of keel and to be securely riveted thereto. A portion of this arm is 13 inches deep diminishing by an ogive curve to 4 inches deep at the ends along the bottom of the
"stem post arm" for a distance of 3 feet forwards and 1 foot (measured from the face of post) there are to be riveted two bars of 6 x 6" angle iron (the projecting legs to be flush with the bottom of post arm) forming a surface 16 inches wide 7 1/2 feet long to which is to be fastened the beam for carrying the rudder stop. Said beam to be formed of two thicknesses of 1 inch plate 2 1/4 inches wide. These plates to be of suitable length to receive the rudder post stop, and to be well riveted together. Note—"the object of using two thicknesses of 1 inch plate is to get the necessary width of the beam."
"2 1/2" inches for lateral strength" and the requisite thickness 2" inches to carry the weight of the midden in a practical way. 2 inch plates not being easily obtained. The upper end of stern post to extend to the under side of deck and to be fastened to the deck beam by two vertical bars of 4 x 4 1/2" angle iron 12 inches long riveted on the sides of the post and bolted through and through the beam. This post is to have two 1/2 inch holes drilled near the head for the purpose of receiving the feet of two braces which are to be carried over to the sides of the boat to give strength to the projecting...
Frame Vertical Cross Floors etc.

Of angle iron 4 x 4 x \( \frac{3}{8} \) inches spaced 18 inches from centre to centre - floor frames to be 20 ft long and to be butted to the futtocks equal distance from the centre of keel - All futtock frames forward of No 61 are to be spliced with 9\( \frac{1}{2} \) inch holes apart (on the projecting leg) for the purpose of holding the ceiling of hold - Every alternate frame is to be stiffened with a vertical "floor plate" half inch thick topped with two bars of 3\( \frac{1}{2} \) x 3\( \frac{1}{2} \) x \( \frac{1}{2} \) inch angle iron ending upon the futtock frames - The vertical floor plates on frames Nos 3, 7, 11, 15, 19, 23, 27, 31, 35, 39 & 43.
(see drawing of shear plan) are 48 inches deep. The balance of floor plates are 16 inches deep. 

Frames Nos. 57 + 61 are to be doubled, that is, formed with two bars of 4 x 4 x ½ inch angle iron placed back to back leaving a half inch space between the projecting legs for the purpose of receiving the "turret bulkhead." All the frames are to be bevel standing, i.e., the iron is to be opened out, thus, \( \square \) to accomplish which all numbers forward of 75 have the projecting leg of the iron facing forward - all frames aft of 75 have the projecting leg facing aft. The 4 feet vertical floor plates are to have a bar of 2½ x 2½.
inch angle iron riveted the whole length, the top of said angle iron being placed on a level with the top of the vertical 16 in floor plates.

**Stanchions**

Under each deck beam of the forecastle part of the vessel from turret bulkhead, there will be 3 rows of stanchions of 2 3/4 in. iron round iron of T form at the bottom and bolted to the angle irons of floor plates by 1 inch bolts and nuts. At the upper ends the stanchions will be made square and flat and bolted by 1 inch bolts to a casting secured under the deck beams of the turret bulkhead there.
will be only one central row of stanchions of the form and dimensions described. The fore and aft bulkheads between frames 59 and 93 will support the deck beams and thereby under the outer rows of stanchions necessary.

Fore & Aft Centre Tulsons—There is to be one fore and aft centre tulson extending from frames 57 to 3 paid tulson to be formed of plates 8 2
inch wide 7/2 inch thick 7 1/2 inches long let in between the 14 feet floors and resting upon the 16 inch floors—these plates are to be fastened to the 14 feet floors with a bar of 3 1/2 x 3 1/2" angle
Iron at each end (the bar being reversed from right to left or every alternate plate) and at the 16 inch floors at the crossbeams with pieces of angle iron 7 1/2 inches long. The end of the keelson at frame 51 is to be well tied by two bars of 3 1/2 x 3 1/2 each angle iron to the turret bulkhead. The top of the keelson to be bound with two bars of 3 1/2 x 3 1/2 inches angle iron - cut off and tied to the top spigots of the 4 1/2 feet floors at the crossbeams.

Fore + Aft Floor Stringer along the top of the 14 feet floors and at a distance of about 10 feet 2 inches from each side of the fore and aft
centre line, there is to be a fore and aft stringer to be securely riveted to the angle iron toppings, at every spacing. These stringers are to be formed of iron 14 inches wide ¾ inch thick and are to run close to the feet of the deck stand shores for the purpose of holding said four feet floor in their vertical positions.

**Athwartship Bulkhead**

Upon Frames No. 1 there is to be an athwartship bulkhead ½ inch thick extending from underside of the deck down to the bottom of the projecting hip or over hanging portion of the hull (about 3 feet deep); this bulkhead to be riveted to the frame on the sides.
Fastened to the deck beam with 1 inch screw bolts 12 inches apart and stiffened vertically with bars of 3/2 x 3/2 x 3/16 inch angle iron placed 36 inches from centre to centre. Upon frame No. 9 there is to be a similar bulkhead extending from keel to underside of deck fastened and stiffened as described and made water tight both these bulkheads are to be butt-joined, strap-ped and stiffened on the forward side and riveted flush on the after side. A substantial iron door 2 feet wide 4 feet high suspended on hinges will be applied on this bulkhead to open
towards the bow and made in such a manner as to be water-tight when closed. Upon frames 51 and 61 are the Turret bulkheads formed of plate butt jointed, strap ped and riveted flush. These bulkheads are to extend from keel to under side of deck and to be stiffened with bars of 3 x 6 inch angle iron placed 24 inches from centre to centre the 6 inch leg projecting - these bulkheads are to be bolted to the face of the deck beams with 1 inch screw bolts, through and through and to be further secured by a bar of 3\(\frac{1}{2}\) x 3\(\frac{1}{2}\) inch angle iron bolted to the under side of beams and riveted to the bulkhead.
plating. There are to be puttable door ways through these bulkheads communicating with the various compartments, for which a drawing will be furnished. There are to be two fore and aft bulkheads placed 15 feet apart running from frame 57 to 61, fastened to the tunnel bulkheads by two bars of 3 1/2 x 3 1/2 inches angle iron at each connection and extending from the tops of the 16 inch floors to the undersides of the deck beams. These bulkheads are to be secured to the cross floors with a bar of 3 1/2 x 3 1/2 inches angle iron (on each side of the plating) riveted to the plate and to the angle iron.
tappings of floors, at the casings the tops of bulkheads to be secured
to the deck beams in a similar manner, but bolted with 1
inch screw bolts through the beams at the casings. The
fore and aft bulkheads are to be bolted, strapped and
riveted flush (the rivets being driven on the outboard sides
and stiffened vertically with
bars of 3 x 6 inches angle iron
placed 24 inches apart the 6
inch leg projecting. Strong
bulkheads and diagonal
trusses for carrying the turret
gear will be introduced
between Nos 57 and 61 for which
a drawing will be drawning
Upon frames No 69 there will
be an alternate step bulkhead
formed of 3/8 inch plate ex-
Louding from keel to underside of deck - this bulkhead is to be butted and strapped stiffened vertically by bars of 3½ x 3½ inches angle iron 5½ inches apart placed upon the forward side all rivets to be driven flush on the after side. To be secured to the deck beam in the manner described for bulkheads Nos. 1 and 9. The space between bulkheads 61 and 69 to be used for coal bunkers communication being had through paid bulk and front compartments fore and aft by means of two alley ways formed of §¾ inch iron butted and strapped and riveted flush in the passage ways. These alley's are to have semicircular tops and flat bottoms arranged to drawing to be furnished and
are to be fastened to the aftership bulkhead by a suitable ring formed of 3/4 x 3/4 angle iron. There are to be two sliding doors in the bulkhead (Nos 69) for the purpose of trimming out the coal on frames Nos 90. There is to be an aftership bulkhead 6 inch thick and of the same general description as those on frames Nos 90 & 69. To be made water-tight care being taken not to allow a flaw or butt to come within a radius of 15 inches round the propeller shaft. At a point say three feet above the centre of the shaft, there is to be a suitable manhole in this bulkhead with water tight cover.
Between frames 69 + 93 there are to be two fore and aft bulkheads formed of 5/16 inch plates and located (one on each side) 12 ft 3 inches from the fore and aft centre line of boat. These bulkheads to extend from the bottom of the vessel to the underside of deck beams and to be secured to the deck beams with bolts of 3½ x 3½ inches angle iron in the manner described for the fore and aft "turret bulkhead". At the bottom these fore and aft bulkheads will be attached to the stern of the vessel with 3 inch angle iron in the usual manner. The plating of these fore and aft bulk
heads can be applied in vertical courses of iron placed in and out (sheets long enough to run from floors to deck beams) and riveted flush upon the inboard sides, said bulkheads to be stiffened vertically with bars of $3\frac{1}{2} \times 3\frac{1}{2}$ inches on all iron 3 feet apart placed upon the outboard side to have suitable sliding doors of iron for thinning out the coal.

[Signature]

On frames 87 and 93 the craft floors are to be increased in depth to 60 inches and 61\frac{1}{2}'' respectively (measured from base line) to form the engine.
Kulsons to have four fore and after vertical plates 1/2 inch thick tied between the kulsons, flush with the top and resting on the 16 inch floor (located as per drawing) - the outboard plates to be braced vertically by increasing the depth of floors No. 89 & 91 (to 60 1/2 inches & 61 inches respectively) from the said outboard fore & aft plates to the skin of the boat - the kulson on frame 87 and the fore and aft plates between 87 & 93 are to be topped with two bails of 4 1/2 inch angle iron. All the joints of the wings the kulsons are to be nutted and strapped.
and driven flush. No. 87 to be flush on the forward side. No. 93 on the after side. A detailed drawing of these keelsons will be furnished.

Deck-beams, Knees & Shelves

On the head of every odd numbered frame excepting those occupied by bulkheads there is to be inserted a plate iron "gusset piece" or knee plate 63 inches long, 1/2 inch thick (see drawing) and bolted to the wooden deck beams with 5 one inch screw bolts. The deck beams are to rest upon an angle iron shelf 4 x 4 inches 14 inches long riveted in the proper depth to the wall stanch.
Forward and aft where the hips or overhanging portion of the hull secure these knees in place of being gusset shaped or triangular are to be rectangular plates extending from the deck beams to the bottom of the hips and resting on the horizontal frame corresponding to the beam which it supports. At all places where the ends of the beams come in contact with the sides of the hull or the gusset plates all rivets must be driven flush.

**Plating of Hull**

Courses to be ran fore and aft and to be put on in inside and outside streaks.
Garboard strake to lap the keel plates 4 inches all other strakes to lap 2 3/8 inches the ends of the plates are to be butt and strapped with pieces 9 inches wide of a thickness corresponding to the plates which they join the interstices between the frames and the outside courses are to be filled with suitable pieces as wide as the face of the frames

Thickness of Strakes

The keel plates to be 3/4 inch thick the garboard strake to be 5/8 inch thick the two nearest plates to garboard strake at the central part of the vessel also to be 7/8 inches thick all other plates in the entire
refel to be ½ inch thick except the brackets which sustain the shelf fore and aft bulkheads or frame No. 69. The thickness of these parts will be specified in their appropriate places.

**Armor Shelf.**

Around the outside of the boat and in plane with the hip or overhanging portions of the hull proper there is to be a horizontal shelf 4½ inches wide amidship diminishing by a fair line to 32 inches wide near the ends. Said shelf to be formed of iron ½ inch thick and fastened to a hull to a bar of 3 ½ x 3 ½ inches angle iron riveted to the
underside (except on the over-
hanging part forward &
aft where plate iron will have
to be substituted) and to be
secured by a series of outside
knees or brackets the oppo-
site every odd numbered,
frame, said knees to be

gusset shaped 22 inches
wide at the bottom for
those placed amidship,
gradually diminishing
to a width of 17 inches
for those placed near the
ends of the hull.

These gusset pieces are to be
formed of 3/8 inch plate
and are to be riveted to a
3 1/2 x 3 1/2 x 1/2 inch angle
iron knee — which is to
be riveted to the side of
hull and of armor shelf.
Around the shelf and bearing against the ends of the hanging knees there is to be riveted a bar of \(\frac{3}{4} \times \frac{3}{4}\) inches angle iron, the projecting leg facing to form a slipper to the heels of the armor backing timber. Around the top of the hull following the sheer line, there is to be carried a bar of \(4 \times \frac{4}{4}\) inches angle iron, the leg projecting outboard. All the butts of this topping iron are to be strapped on the top side by a bar of iron half-inch thick 4 inches wide and 36 inches long. The hanging knees are to reach from the shelf to the underside of the topping iron.
angle iron and are all to be set at right angles to the side of the boat. "There is to be a cylindrical well"

**Anchor Well**

This is to be a cylindrical well through the forward overhanging lip of the keel 6 9 inches in diameter. Formed of 1/2 inch plate bolted and strapped and driven flush upon the inside. This well to be secured to the bottom of ship by a ring of 3 1/2 x 3 1/2 inches angle iron caulked water tight and to the deck beams by a similar bar riveted to the well and bolted to the underside.
of the beams - this well is to be long enough to pass into the deck plank bitts or within 1 inch of the top (deck being 7 inches thick) and to be secured thence with a suitable number of 3 inch blunt bolts 6 in. long having countersunk heads.

Propeller Well

On the overhanging hip aft and directly over the propeller wheel that is to be a rectangular well passing through the deck and bottom of the deck, and bottom of overhanging hip to be formed of pitch plates riveted flush and secured to its position in the same general manner as described.
for the anchor well—From the top of the propeller well and running over to the feet of the deck beam. The diagonal traces will be introduced formed of angle iron 3 x 6 inches on frames Nos. 111, 113, and 115. Similar traces will be placed but fastened at the center line of vessel to a vertical plate of iron 1/2 inch thick, 12 inches wide—paid plates to be bolted to the beams and riveted to the respective frames and stiffened vertically on each edge by bars of 3 1/2 x 3 1/2 inches angle iron.

**Riveting**

All the butts are to be strap.
ped and riveted with 4 staggered rows of rivets (two each side of butt) the join-
ing of heel and garboard strake to be riveted with 2 staggered rows of 7/8 inch rivets (the butts of garboard to be fastened with 7/8 inch rivets) all other fore and aft seams to be riveted with a single row of 3/4 inch rivets — the 7/16 inch 3/8 inch bulkheads to be riveted with 7/16 inch rivets all parts not otherwise specified above to be riveted with 3/4 inch rivets

Laps to be put together with red-lead paint

All the laps and straps are to be well painted.
with a good and sufficient coat of the best red paint when they are being put together.

Caulking

All the fore and aft seams are to be made fair and straight split and caulked the butts to be fullered up on the outside the straps are to be chipped and caulked at the ends and split and caulked along the sides the whole to be made perfectly water tight.

Bulwarks or Armor Timbers

To be composed of a series of vertical blocks of oak 17 x 12 in. held in place at the bottom by a 3 1/2 in. angle iron riveted to the shelf.
as herein before described.
At the top the blocks are
fastened by bolts 1 inch
diameter passing through
the 4 in angle iron which
brides the top of the vessel.
In addition to this fastening
these vertical blocks will
be secured by 4 blunt bolts
of 1 inch diameter driven
horizontally through each
of the side brackets which
support the shelf.

Longitudinal timbers running from end to end of
the vessel are firmly
blunt bolted to the before
mentioned 6 vertical blocks.
These longitudinal timbers
vary in thickness according
to the varying thick-
ness of bulwarks called
for by the general curvatures of the vessel. According to the plan this curvature commences at the midship section and reduces rapidly towards both ends of the vessel. At a distance of 57 feet from the stern (at frame No. 89) and at frame No. 21 which is situated 47 feet from the bow the minimum thickness of bulwark commences viz. 29 inches inside of armor plate at the lower part. The exact thickness of bulwark opposite each frame will be seen by the general plan of the vessel. The three closed longitudinal
Timbers will be composed of pine and the two upper of oak—the planks shear which forms part of the bulwarks will be made of oak 18 inches wide measured from the side of the vessel; it will be 5 inches thick and secured by blunt bolts to the deck beams and to the vertical blocks composing the bulwarks.

**Deck.**

The deck beams will be made of oak 12 x 12 inches in the middle and 10 in. deep by 12 inches wide towards the ends. Each deck beam will be bolted to the plate iron side.
bracket by 5 bolts of 1 inch diameter in each bracket as before described. The deck beams bolted to the aft water tight bulkhead will be 18 inches wide as also the deck beams on each side of the smoke pipe. The space between the deck beams will be 24 inches excepting at frames 1, 50, 60, 70, 80, and 100 where it will be 30 (see general plan). The deck beams secured to bulkheads under turret and forward bulkhead will be 14 in. wide - The deck planks will be composed of pine wood 7 inches thick and 8 inches wide - Width of deck between extreme points of bulwark 16 in. The realms to be thoroughly
walked and pitched so there will be no means of recutting the deck owing to the plate covering thereon. Adequate provisions will be made for carrying off any water that may pass through the deck so that no inconvenience to officers and crew or injury to stores may be experienced.

**Deck Hatches**

All deck hatches for entering the hold taking in coal or for ventilating purposes or for obtaining light will be composed of wrought iron frames inserted in the deck so as to form water-tight joints. These frames to be accurately faced and provided with appropriate covers made of...
wrought iron 2 inches thick accurately faced and provided with means for effectually fastening the same from below if deemed requisite.

**Deck Plating**

To be composed of two thick pieces of best wrought iron plate, each one 1/2 inch thick, secured to the deck precisely as in the U. S. Monitor with lettings carefully espaced between the deck and plating. Plates to be painted before laid down.

Rope Stanchions and Ringbolts

Rope stanchions will be placed.
all around the rebel at intervals of 10 feet to be made of wrought iron with an eye at the top for receiving the rope. A "apparate box" will be inserted in the deck for receiving the stanchions. A series of powerful spring bolts will also be introduced all around the rebel. Cavities lined with iron will be formed to receive the spring bolts in order that they may be flush with the deck when not in use. A telescopic pipe of plate iron 5 feet diameter swelled out at the bottom trumpet form to 5 feet 9" will be inserted into the anchor well and so arranged that it may be brought
that it may be brought on deck when requisite. This telescopic pipe will contain a strong cross-piece which supports the yoke of a cast iron sheave over which the cable passes. By this arrangement the anchor when suspended in the well may readily be brought on deck. A circular wrought iron cover 2 inches thick is made to cover the anchor well provided with eye-bolts and other appropriate means for being lifted up. It may be stated here that a similar cover though of rectangular form will be put over the propeller well at the stern of the vessel.
Anchor & Capstan

The anchor will be made with four flukes similar to that of the U.S. gunboat Monitor the form being somewhat modified to take a better hold of the ground. A spare anchor will be supplied as the navy department may direct and cables furnished of required size and length. The capstan will likewise resemble the one on board the Monitor but differently geared in order to raise the anchor about 5 times faster than in the rebel named. The brakes will be arranged as to admit of a greater number of hands being employed.
Rudder & Stern Arrangement

The rudder will be equidistant 28 inches wide forward of the axis and 36 in. aft. In height 8 feet made of wrought iron, the centre piece of rudder will have arms forged at the top & bottom for supporting the plating forms and dimensions are all clearly shown on the annexed Pl. III. A wrought iron post 8 x 7 inches is firmly nailed under the curved overhanging part of the vessel for supporting the plates on which the lower step of the axis of the rudder rests. The upper end of the axis passing through a stiffening bar terminating with a square to which the
Litter is applied as in the U.S. Gunboat Monitor.

**Motive Machinery**

The engines will consist of 2 cylinders 40 inches in diameter, 12 inches stroke combined in one piece supported by a strong frame cast in one piece bolted to and supported by the wrought iron keelsons attached to the vessel herein before described. The entire arrangement of the motive engine, condenser, air-pump, and other parts, will be precisely as in the U.S. Gunboat Monitor. The blower engines and blowers will however be of greater size and instead of being placed in
the engine room will be ap-
plied under the turret—
in the square chamber
formed by the turret bulk
heads. — The object of
this change of location
being that of drawing the
cold air down through
the turret roof into said
chamber and forcing it
directly or through conduits
into the boiler rooms and
other parts of the vessel —

Vacuum Engine

In addition to theotive
engine a vacuum engine
will be furnished to be
placed on the port side of
the vessel after the main
engine to be supported
on plate iron keelsons
extending between frames 93 and 100. This engine will consist of a capacious jet condenser to which are attached two air pumps and 2 steam cylinders on Worthington's improved system. By means of these air pumps a constant vacuum will be kept up in the said condensers for the purpose of condensing all the steam from the blower engines, turbin engines and Worthington Pumping Engines. The power of this vacuum engine will be sufficient to condense all the steam from a boiler the evaporating power of which is 100 cubic feet per hour.
Boilers

There will be two boilers on Martins plan 10 feet face 9 ft 3 in. 12 feet 6 in long with 3 furnaces in each. These boilers will rest on the 16 in. floor plates to be felted and headed as usual and provided with all approved appurtenances.

Smoke Pipe

An impregnable smoke pipe 14 inches inside diameter at the top will be firmly secured to the deck in the centre line of the vessel above the exit of the common smoke box of the boilers. This impregnable smoke pipe will be composed of mottled lea...
than 6 plates of iron 1 inch thick riveted in such a manner as not to break joints - the base will be formed of plates of iron 1 inch thick extending under the deck plate and bolted to those deck beams which are attached to frames 76, 77, 79, 60 & 61. Forged solid rings will be riveted to the said 1 inch plates and to the plates forming the smoke pipe. The height of the pipe will be 8 feet tapering off in thickness towards the top where an all-steel proof grating will be inserted. A portable tube put together in sections will be fitted to the upper end of the permanent
Safes
To be 20 feet internal diameter 9 feet high
composed of 11 plates in thickness which are
to measure together 11 feet through. These
plates are applied in 90 degrees and joined
vertically in such a manner that there is
only one joint at any one place. The two
inside courses are driven point together
by 14 rivets at intervals of 7 inches
there. To these two inside courses the 9
inner plates are bolted with 14" bolts with
countersunk heads on the outside trucks
on the inside. The 20 joints formed by the
plates on the inside are covered by up-
right plates forming pilasters 14" wide
by 7 feet high. The before named rivet bolts
pass through these plate which thus join
wackers. The trunk plates rest on a flat
ring formed of composition metal 1½" thick
12½" wide provided with a vertical flange.
on the inside 3\(\frac{3}{4}\)" high 1\(\frac{3}{4}\)" in thick. The top face of the ring is turned the under side being accurately turned and polished. For the convenience of handling and transportation the ring is divided into 12 segments, united by hinges on the inside held together by bolts and nuts. At the top of the tunnel about 10" down a forged beam 8" in deep, 4\(\frac{3}{4}\)" in thick is inserted, well supported at the ends, plates riveted on the inside of the tunnel. By each side of this beam 4 short forged beams 3\(\frac{3}{4}\)" wide \& 1\(\frac{1}{2}\)" in deep are riveted. The beam for that purpose being provided with hubs or projections in which said notches are made. The opposite ends of the short beams are also firmly secured to the tunnel by plates riveted on the inside. A series of short rail way bars are placed 3\(\frac{3}{4}\)" apart on the top of the foregoing forged beam and fastened partially on the beams and partly on plates. Attached to the inside of the tunnel, on the top of these rail way bars are placed two 1\(\frac{1}{2}\)" plates to which密切ly joined together
in such a manner that the joints come over the centre of the bars. Certain portions of these plates are perforated with holes 1" dia. Two hatchets are formed in these plates with flat iron frames & sliding covers, guided by appropriate guide pieces. In the centre of the top plating just described a circular aperture is made 6 feet in diameter over which a pilot house of equal dimensions is placed to be hereafter described. At right angles to the before described beam is similar beam as inserted close to the bottom of the turret. This beam is 8' in thick 5' in deep and provided with a hub in the middle thru which a vertical hole of 13" diameter is bored. The ends of this beam are made T shaped, the projecting arms thus formed being accurately fitted to the inside of the turret and fastened with bolts & rivets. To resist upward thrust, plates are applied from above leaving down where the T ends of the beam, and thinly riveted & bolted to the inside of turret.
On the top of beams just described 4 other forge beams are placed at right angles. These beams 4" thick 4" deep form the sides upon which the gun carriages travel. They are being attached to the main beams and well secured at their ends to the inside of the tunnel. A floor made of oak plank, with several grating hatches formed in the same is laid on the outside of the gun sides. The tunnel may be described to that from the base of the tunnel rests on another ring inserted in the deck composed of segments of sheet plate thus accurately faced and secured in the deck with countersunk bolts in such a manner as to form a perfectly water tight joint. The cavity formed in this bend the circumference of tunnel will be covered by a loose sheet lead may be lined extending round the tunnel but free to slip up and down so as to bear on top of the deck plastering at all times, thus effectively rendering the cavity or channel.
Above the turret roof on the inside of the turret 20 square pockets will be attached to receive an equal number of Starshells made like those of the U.S. Gunboat "Monitor." The turret will revolve around a fixed central column of cast iron 12" diam., resting on Keelsons placed at the bottom of the breastwork, and traced firmly to the turret bulkhead here-mentioned. A cast iron bracket firmly secured to the deck beams will support the upper end of the column. A cylindrical hole in the bracket being made for that purpose. The central column will terminate 8' above the top of the lower main turrett beam. Said termination being bridged with a broad deep transverse disk to act as a clutch.

An upper central column of cast iron 16" diam. is placed thru a cylindrical hole in the upper turrett beams, which beam is provided with a hub in the middle similar to that of the beam below. The upper column is provided with a deep broad collar upon which the upper turrett beam rests. To substantial
frictionary of composition metal being introduced between the collet of the beam. For the support of the sides of the tunnel, two diagonal braces 5" diam. are introduced connecting the two central gun slides with the upper main tunnel beam as near the centre of tunnel as the said hole will allow. The diagonal braces are provided with right & left handed screws for the purpose of relieving the pressure on the tunnel by tightening up said braces. The upper central column will extend thru the hole in the upper tunnel beam for the purpose of giving the central support to the Pilothouse.

At one wheel 10 feet diameter of very heavy pitch, say 6 tons, hole be bolted under the lower tunnel beam 2 gun slides. Hubs will be forged in the sides of said beams, as well as on sides of gun slides. At the places where they intersect the rim of the cog wheel this latter will at those intersections be forging bolted. In order to prevent any de-rangements, legs will be cast on the top of
The time of the cog wheel to which the hubs before described, a pinion of about 90°
which will work into said cog, this pinion
will be secured to the upper end of a vertical
arm, which will be made of a solid block of iron or
iron plates at the bottom of the vessel and
depth of the top by a pillow block bolted
to the deck beams. By the current of this
vertical axle a cog wheel of left-hand direction
will be secured and actuated by a turner
cramp and gear precisely similar to that of
the "Monitor." The turner cramp will on
the monitor be placed horizontal but
attached to the bottom of the vessel instead
of to the deck as in the vessel named.
The mechanism for regulating the action
of the turner cramp will be of the same
character as that of the Monitor, with
the modification only that the turner can
control the rotation of the turner whilst
he is looking over the gun. The contractor
reserves to himself the right of introducing
pendulums and other pieces to adjust.
with the latter and keeping the guns stationary at the muzzle and depressing and elevating at the trunions. In either case he will furnish the gun carriage or its equivalent at his own cost. He also reserves to himself the right of running the guns by a screw from below actuated by manual or steam power. The distance between the gun slides will be such as to admit of 15 inch 18 pounder guns being employed, but should the Department desire the employment of 12 or 11 inch guns the contractor will furnish suitable carriages and far time to gun slides thought made for the heavy ordnance here mentioned.

Pilot House.

The Pilot House will be entirely of wrought iron 6 feet internal diameter 5 feet height 8 ins thick composed of 3 thicknesses of plate and put together in the same manner as the barrel. The top will consist of two flat plates each 1 ins thick riveted together with perforations
for effecting Ventilation. Near the top a number of small holes will be introduced for obtaining a clear view in all directions. The bottom of the Pilot House will consist of a grating of sufficient strength to support the weight of the structure. Into the centre of this grating is inserted the upper end of the upper central transverse column, in such a manner as to secure the Pilot House against rotating with the turret. A strong wire may be accurately turned is attached to the outside of the turret. Another wire may also, either to its segments is bolted to become as the turret roof. By this being such as to guide and keep down the Pilot house at the same time. An appropriate latch in the floor of the Pilot house will afford access to it when the turret is turned in a proper direction.

Steering Wheel.

The steering wheel constructed as the one of the U.S. Gunboat "Monitor" will be applied to the forward part of the pilot house with the steering wheel or chains passing down through
goods frames on the side of central columns. From below deck, said ropes or chains will communicate with the tilts in the usual manner. The compass will be adjusted in the main. The principle of the invention is the experience of the two

**Side Armor.**

Will be constructed fastened to the wooden bulwarks of the vessel as in the Monitor. It will be composed of 2 courses of planks measuring 5 in. in thickness. The Female planks 5 ft. deep extending from top of deck to the top of bulk. Female planks from outside will be only 3 mds. deep, and minor planks will be 26 in. deep. The planks will be laid from 6 feet long. Each of the 4 minor planks will be fastened to the bulwarks with 3 independent blind bolts, of 1/2" diameter. Countersunk flush. Other planks are fastened each with 18 1/4" countersunk head bolts passing thru the entire depth of armor and through the bulwarks all but 4 in. The
vertical edges of the outer armor plates to be planed and accurately fitted, the edges of the inner plates to be well fitted, but not necessarily planed.

**Fresh Water Condenser.**

A fresh water condenser capable of furnishing 10,000 gallons of fresh water every 24 hours similar to the Monitor. Will be furnished and connected with the water tanks by appropriate pipes.

**Wheel and Stern Arrangements.**

The pilot wheel will be cast iron 12 feet in diameter. 10 feet pitch. The mode of supporting the shaft, the construction of stuffing stem pipes, every other parts connected with the pilot wheel on drawing as to require no description or specification.

Space Above, into that amount.

All set of hose brass bends fitted will be supplied for every part of the engine. Also hose grove hose and other necessary parts required to fully equip the war vessels. Oil tanks, oil cans, lamps, clock, indicator,
gauges, wrenches, ash buckets, fire trucks and all similar instruments be furnished of the best material and workmanship. Also all tools necessary for keeping the machinery in repair.

The intent and spirit of the contract being that the Contractor shall deliver the vessel finished in a complete manner and fully equipped for active sea service in all respects excepting guns, ammunition, tools &c. &c. It is understood that any omission pointed out by the Navy Captain will be corrected by the Contractor etc.

New York March 28th 1862.

J. A. B. Montague, Secretary, Etchebee.

William Howes.
Weight of Splahsac, Built at Wilmington

Hull: 695.913
Side Armor: 353.631
Deck: 303.612
Deck lights & Coal hald frames: 8.130
Total weight: 1.380.352

Wreck price: $0.01.00
Resistance, Power and Speed of Vessels.
Resistance to bodies moving through the water is as the square of the velocity. The power (or coal) to produce this is as the cube of the velocity.

To increase the speed of a vessel from 8 to 10 knots requires the engine's power to be doubled.

A steamer runs 8 miles per hour on 4 tons of coal per day. Requires the coal consumed per day to run 9 miles.

\[8^3 : 9^3 :: 40 : 56.95\text{ bns.}\]

\[\frac{\frac{2}{3}}{\frac{1}{100}} = 12\frac{1}{2}\text{ per cent} \text{ per speed.}\]

\[\frac{56.95}{40} = 42\frac{1}{2}\text{ per cent increase in fuel.}\]

Again - the speed is increased from 8 to 10 knots.

Miles | Miles | Coal consumed
--- | --- | ---
8 \(^3\) | 10 \(^3\) | 40 \(\times\) 78.1

Speed increased from 8 to 16 knots.

\[8^3 : 16^3 :: 40 : 320\text{ bns.}\]
A vessel of 500 H.P. runs 12 knots on 40 tons of coal per day. Required speed of the ship 9 knots.

\[
\frac{40 \times 30}{12^3} = 4 \times \frac{31}{28} \approx 1.28 = 10.90 \text{ knots}
\]

Saving on the fuel. Requiring coal of about 12.

The consumption of fuel on two or more voyages with vary as the square of the velocity multiplied into the distance travelled.

A voyage of 1200 miles takes 150 tons of coal at 10 knots. Required consumption for 1800 miles at 8 knots.

\[
150 \times 10^2 \text{ tons} \times 1200 \text{ miles} = 10^2 \times 1200 \text{ tons} \times 1800.
\]

\[
C \times 100 \times 1200 = 150 \times 64 \times 1800.
\]

or \[
C \times 120,000 = 150 \times 64 \times 1800.
\]

Reduced to \( C = \frac{1.28}{12} = 14.4 \text{ tons}. \]
Cohoes.

Extracts from Specifications, and Principal Dimensions of the Light-draft Monitor "Cohoes."

Dimensions of Hull:

Length of Vessel overall: 235 feet
Length of Bow 188
Extreme Beam over Amor: 45
Beam of Bow Hull: 35
Max Depth of Vessel amidships: 9
Depth of Bow Hull:

Waterline of Deck Machinery:

Waterline of Diagonal Braces: 2
Floor and Side Frames Angle 4 3 x 3 9
Angle from all around top of Hull: 6 x 3 5 x 3

Machinery:

The Machinery will consist of two Horizontal Tubular Boilers, two Acting Vertical, with a Surface Condenser without Air pumps.

The Boilers will be placed one upon each side of Vessel, with one fire room in common running free and off between them. There will be four furnaces to each, two of
Three at the forward, under two at the after ends write the tubes, through which the products of combustion will return between them. The coal will occupy the entire vessel between these boilers and the turbot chamber with the exception of a passage 5 feet wide amidships, thus the upper part of which the wind will be carried to the fire-room from the saw blower.

<table>
<thead>
<tr>
<th>Breadth of Boats amidships</th>
<th>9 feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length, Fore and Aft</td>
<td>25 ft</td>
</tr>
<tr>
<td>Height</td>
<td>6 ft 8&quot;</td>
</tr>
<tr>
<td>Outside Diameter of Tubos</td>
<td>1 ft 6&quot;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Upper Row.</th>
<th>1 3/8&quot;</th>
<th>Next Row.</th>
<th>2 1/8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Next</td>
<td>1 3/4&quot;</td>
<td>Next</td>
<td>1 3/8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5/8</td>
</tr>
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<td>3/8</td>
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<td>2 1/8</td>
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<td>2 1/4</td>
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<td></td>
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<td>2 1/4</td>
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<td></td>
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<td>2 1/4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2 1/4</td>
</tr>
</tbody>
</table>
Tubes of each boiler to be disposed in two categories, each category to have 15 tubes in breadth and twelve tubes in height.

Thickness of sides and top of shells = 5/8"  
Hernaez Water bottoms  
Ash Pan  
Tube Sheets  
All other parts  

All flat surfaces to be stayed every 8 ins. with stay. 1 in. drain. Whenever flat stays are necessary, the section must be equal to 1 sq. inch for every foot of surface stayed.

Tone, of 3/8 x 4 x 9/32 in., to be riveted to to top and sides of shells every 4 in. (8 in. apart on each side) as shown in the drawing.

All parts, except those directly exposed to the fire to be double riveted. The seams of furnace to run longitudinally, and be sealed as shown in the drawing.
Engines.
The engines will be attached to 5 steam
mills. Steam, and just sufficient inclined
to allow crookhead of one engine to work upon
the shaft of the other. The Starboard propeller
to be worked by the Port cylinder. Engines to
work entire independent.

Circulating and feed pumps to work
independently. Of the Main engines to be
upon the plan of Worthington duplex
pumps.

No auxiliary steam pumps Worthington
No. 5.

<table>
<thead>
<tr>
<th>Diameter of Cylinder</th>
<th>32 inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of Stroke</td>
<td>30</td>
</tr>
<tr>
<td>Diameter of Piston Rod</td>
<td>2 1/2</td>
</tr>
<tr>
<td>Connecting rod at neck</td>
<td>2 1/2</td>
</tr>
<tr>
<td>Crank Pins</td>
<td>14</td>
</tr>
<tr>
<td>Length do</td>
<td>6</td>
</tr>
<tr>
<td>Diameter of Main Journals of shaft</td>
<td>7</td>
</tr>
<tr>
<td>Length do</td>
<td>15</td>
</tr>
<tr>
<td>Diameter of Screw shaft</td>
<td>7</td>
</tr>
</tbody>
</table>
Surface Condensed

Surface of tubes in condenser: 300 square feet.
Outside diameter of tubes: 1/2 inch.
Thickness: do.
Length: do.
Screws: 8 feet.

Diameter of propellers: 9 feet.
Pitch: 13 feet.
Number of blades: 4.

Keel Plates Thickness — 1/2 and 3/8.
Breadth — 24 feet.

Width of Garboard Strake: 1/2 in.
Belge: do. 3/8 in.
Other parts of Bottom: 11/16 in.
Thickness of Sides: 5/16.

Size of Rivets:
1/16 Plate rivets together or to thinner plate with 7/16 rivets.
1/2 " " " " " " 1/2 " " " " " " 1/16 " " " " " " 1/8 " " " " " " 5/32 " " " " " " 7/32 " " " " " "
Bottom to be butt jointed and strapped
with Straps equal to the thickness of the
plates joined. Straps to be 8 in. wide and
double riveted to the steel with a lap of
3\(\frac{3}{4}\) in. to be increased after seams are
completed.

All webs 8 in. Angle 1 in. and frames
10 to be spaced 6 in. centres.