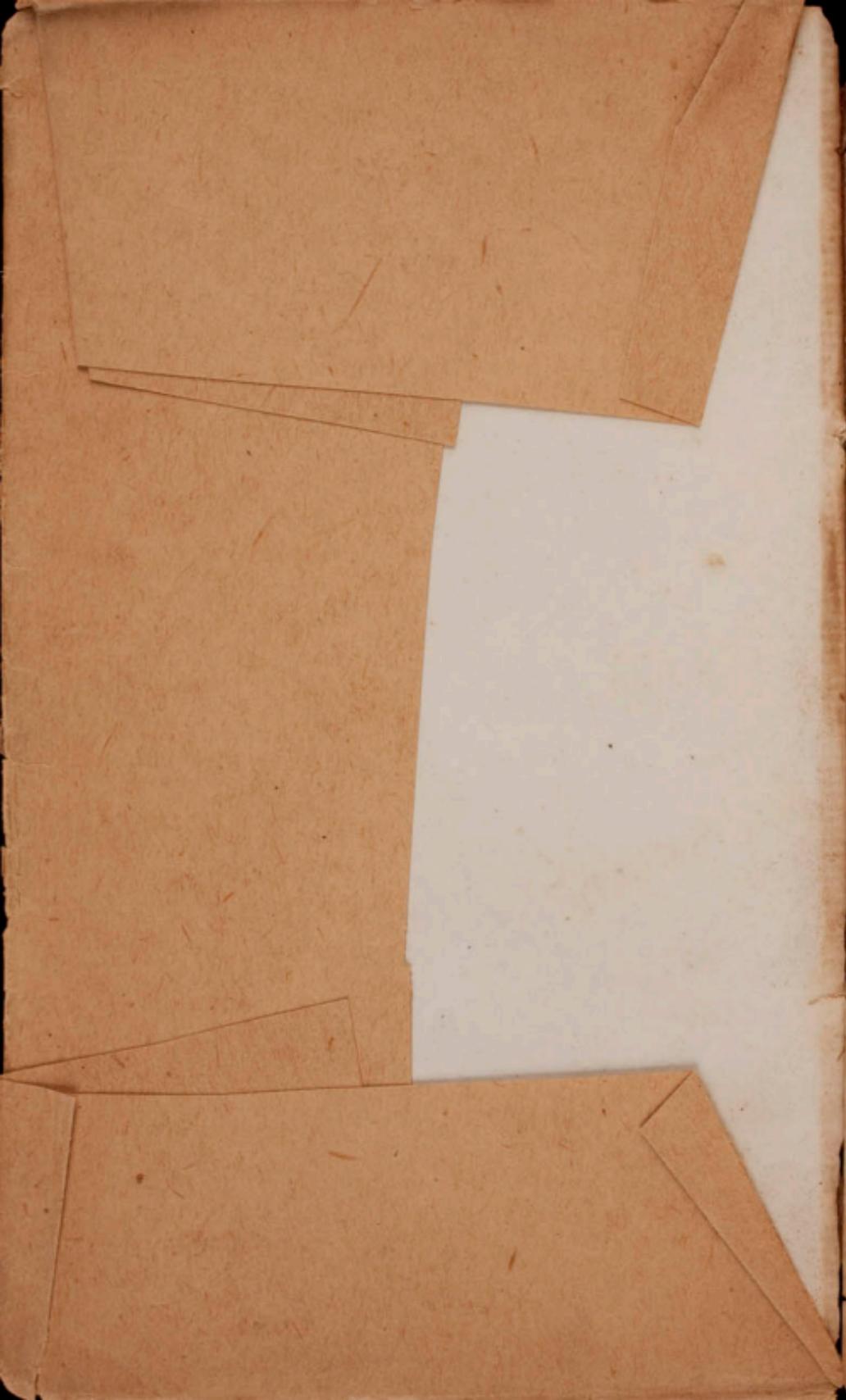


U.S.S. "Monitor"

Specifications



Waverly Hill

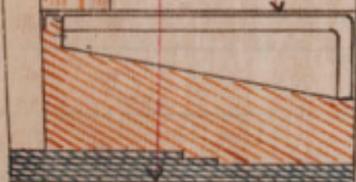
June 1<sup>st</sup> 1862.

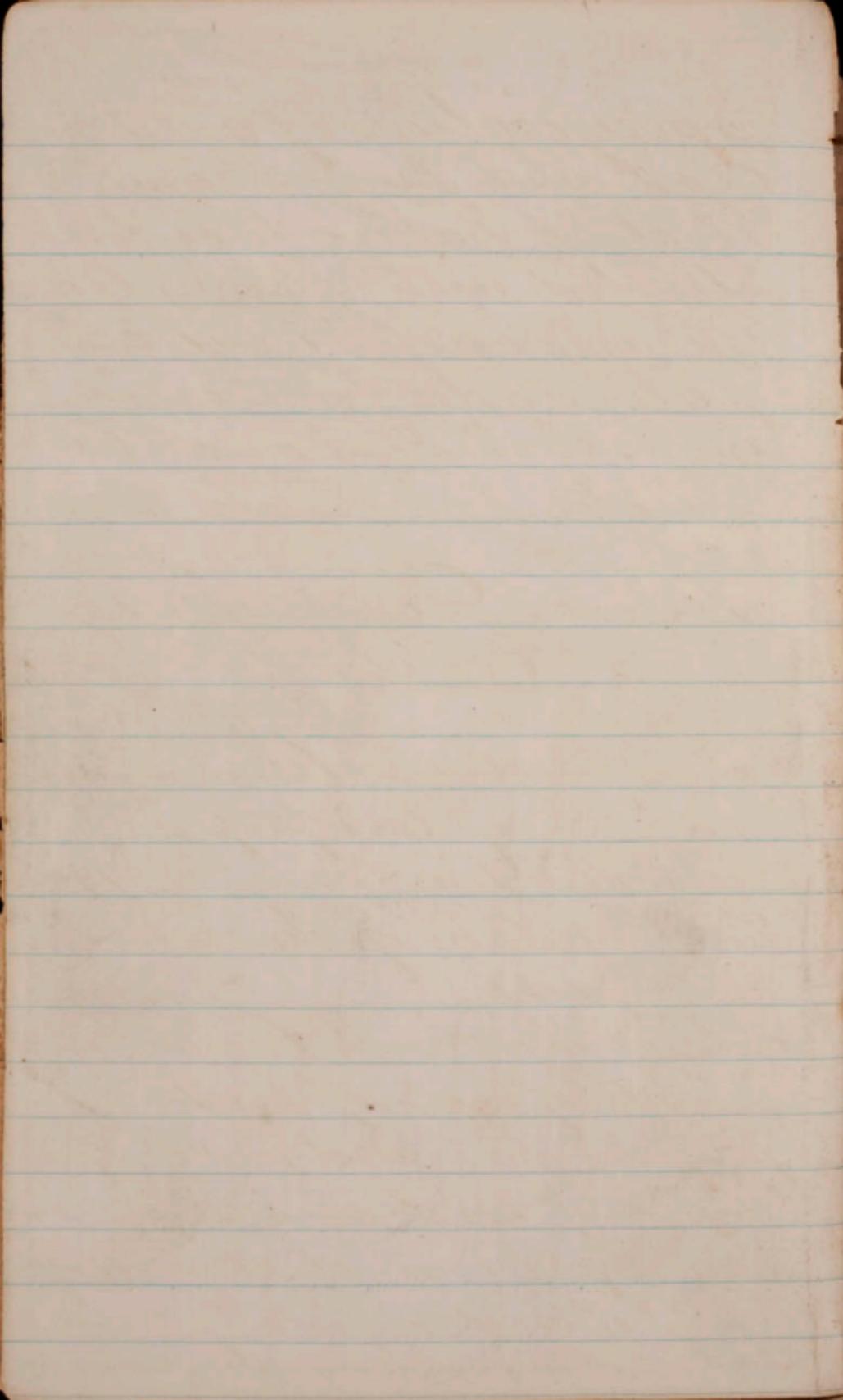
Continental Works New Print. or  
15 Cranberry Street  
Brooklyn.



2 1/2" 6"

18" 10"





Specification of an Iron  
Clad Shot Proof Steam  
Floating Battery to be con-  
structed with Steam Ma-  
chinery and Turret-com-  
plete ready for Service  
by S. Ericsson and As-  
sociates

General Dimensions of  
Vessel.

Extreme length over Armor	200 ft
" " of boat proper on water line	190 "
Length outside of Stem and Stern posts	159 "
Extreme beam over Armor	46 "
Breadth of beam of boat proper (moulded)	37-8 in
Depth of hold amidships from top of beams to skin	11-10 in
Crown of deck amidships	5 in

Shear of deck measured on ft.

Gunnwale —————	12 in
Distance from stern to extreme end of boat proper —————	10-9 in
Distance from stern to extreme end of armor forwards —————	16-
Distance from stern post to extreme end of boat aft —————	20-
Distance from stern post to extreme end of armor aft —————	25-

### Kick-

Of best quality flange iron  $\frac{3}{4}$  inch thick butted 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  $\frac{3}{4}$  inch thick, 8 in wide, thoroughly fastened with four rows of  $\frac{7}{8}$  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 thereto - 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  $3\frac{1}{2} \times 3\frac{1}{2}$ " angle iron - riveted and caulked to the stem and to the underside of the bottom of the hip plating

## Stem 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  $74\frac{1}{2}$  inches - The after side of the "eye" to be faced off at right angles to the bore - 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

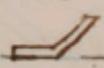
"stern post arm" for a distance of 3 feet forward and 1 aft (measured from the face of post) there are to be riveted two bars of 6x6" angle iron (the projecting legs to be flush with the bottom of post arm) forming a surface 16 inches wide 4 feet long to which is to be fastened the beam for carrying the rudder step. Said beam to be formed of two thicknesses of 1 inch plate 24 inches wide. These plates to be of suitable length to receive the rudder post step, 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"

" 24 inches for lateral strength"  
" and the requisite thickness 2 "  
" inches to carry the weight of "  
" the rudder 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  $4 \times 4 \frac{1}{2}$ "  
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  $1 \frac{1}{2}$   
inch holes drilled near the  
head for the purpose of re-  
ceiving the feet of two braces  
which are to be carried over  
to the sides of the boat to  
give strength to the pro-  
jecting lip

Frames Vertical Cross Floors &c.

Of angle iron  $4 \times 4 \times \frac{1}{2}$  inches spaced 18 inches from centre to centre - floor frames to be 20 ft long and to be butted to the futtocks equidistant from the centre of keel - All futtock frames forward of No 61 are to be pierced with  $\frac{9}{16}$  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  $3\frac{1}{2} \times 3\frac{1}{2} \times \frac{1}{2}$  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  $4 \times 4 \times \frac{1}{2}$  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 bevel standing, i.e. the iron is to be opened out, thus,  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 verticle floor plates are to have a bar of  $2\frac{1}{2} \times 2\frac{1}{2}$

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 forward part of the vessel from turret bulkhead, there will be 3 rows of stanchions of  $2\frac{3}{4}$  inch 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 beam - aft 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 + 93 will support the deck beams and thereby render the outer rows of stanchions unnecessary.

#### Fore + Aft Centre Kelsons

There is to be one fore and aft centre kelson extending from frames 57 to 3 said kelson to be formed of plates 32 inches wide  $\frac{1}{2}$  inch thick  $7\frac{1}{2}$  inches long let in between the 4 feet floors and resting upon the 16 inch floors - these plates are to be fastened to the 4 feet floors with a bar of  $3\frac{1}{2} \times 3\frac{1}{2}$ " angle.

iron at each end (the bar being reversed from right to left on every alternate plate) and to the 16 inch floors at the crossings with pieces of angle iron  $7\frac{1}{2}$  inches long - The end of the keelson at frame 51 is to be well tied by two bars of  $3\frac{1}{2} \times 3\frac{1}{2}$  each angle iron to the turret bulkhead - The top of the keelson to be bound with two bars of  $3\frac{1}{2} \times 3\frac{1}{2}$  inches angle iron - cut off - and tied to the topplings of the 4 ft floors at the crossings

Fore & Aft Floor Stringer  
Along the top of the 4 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 crossing. These stringers are to be formed of iron 4 inches wide  $\frac{3}{4}$  inch thick and are to run close to the feet of the deck stanchions for the purpose of holding said four feet floors in their vertical positions -

### Athwartship Bulkhead.

Upon frames No 1 there is to be an athwartship bulkhead  $\frac{1}{2}$  inch thick extending from underside of the deck down to the bottom of the projecting hip or over hanging portion of the hull (about 5 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  
vertical with bars of  $3\frac{1}{2} \times 3\frac{1}{2} \times \frac{1}{2}$   
inch angle iron placed 36  
inches from centre to centre.  
Upon frame No 9 there is to be  
a similar bulkhead ex-  
tending from keel to un-  
derside of deck fastened  
and stiffened as described  
and made water tight  
both these bulkheads are  
to be butt-jointed strap-  
ped and stiffened on  
the forward side and  
riveted flush on the af-  
ter side - A substantial  
iron door 2 feet wide  
4 feet high suspended  
on hinges will be applied  
in this bulkhead to open

towards the bow and made  
in such a manner as to be  
water-tight when closed -  
Upon frames 57 and 61 are  
the Turret bulkheads formed  
of  $\frac{1}{2}$  plate butt jointed, strap  
pied and riveted flush.

These bulkheads are to extend  
from keel to under side of  
deck and to be stiffened  
with bars of  $3 \times 6$  inch angle  
iron placed 24 inches from  
centre to centre the 6 inch  
leg projecting - these bulk-  
heads are to be bolted to the  
face of the deck beams  
with 1 inch screw bolts, through  
and through and to be fur-  
ther secured by a bar of  $3\frac{1}{2}$   
 $\times 3\frac{1}{2}$  inch angle iron bolted  
to the under side of beams  
and riveted to the bulkhead

plating - There are to be suitable 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 turret bulkheads by two bars of  $3\frac{1}{2} \times 3\frac{1}{2}$  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  $3\frac{1}{2} \times 3\frac{1}{2}$  inches angle iron (on each side of the plating) riveted to the plate and to the angle iron

toppings of floors, at the crossings  
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 crossings these  
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  
braces for carrying the turret  
gear will be introduced be-  
tween Nos 57 + 61 for which  
a drawing will be drawing  
Upon frames No 69 there will  
be an athwartship bulkhead  
formed of  $\frac{3}{8}$  inch plate ex-

tending from keel to underside  
of deck - this bulkhead is to be  
butted and strapped stiffened  
vertically by bars of  $3\frac{1}{2} \times 3\frac{1}{2}$  inches  
angle iron 36 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 + 9 - The space  
between bulkheads 61 + 69 to be  
used for coal bunkers com-  
munication being had through  
said bunker from compartments  
fore + aft by means of two alley  
ways formed of  $5\frac{1}{16}$  inch iron  
butted and strapped and  
riveted flush in the passage  
ways - These alleys are to  
have semicircular tops and  
flat bottoms agreeable to  
drawing to be furnished and

are to be fastened to athwartship  
bulkhead by a suitable ring  
formed of  $3\frac{1}{2} \times 3\frac{1}{2}$  angle iron  
There are to be two sliding doors  
in the bulkhead (Nos 69) for  
the purpose of trimming out  
the coal in Upon frames,  
No 100 there is to be an ath-  
wartship bulkhead  $\frac{1}{2}$  inch  
thick and of the same gen-  
eral description as those  
on frames Nos 9 & 69 to be  
made water-tight - care  
being taken not to allow  
a seam or butt to come  
within a radius of 15 inches  
round the propeller shaft -  
At a point say three feet  
above the centre of shaft  
there is to be a suitable man-  
hole in this bulkhead  
with water tight cover -

Between frames 69 + 93 there are to be two fore and aft bulkheads formed of  $\frac{5}{16}$  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 bars of  $3\frac{1}{2} \times 3\frac{1}{2}$  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 skin 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 angle iron 3 feet apart placed upon the outward side to have suitable sliding doors of iron for trimming out the coal.

### Engine Kelsons.

On frames 87 & 93 the cross floors are to be increased in depth to 60 inches and  $6\frac{1}{2}$ " respectively (measured from base line) to form the engine

Kulsons to have four fore  
and aft vertical plates  $\frac{1}{2}$   
inch thick tied between  
the kulsons, flush with the  
top and resting on the 16  
inch floors (located as  
per drawing) - the out-  
board plates to be braced  
vertically by increasing  
the depth of floors No 89  
& 91 (to 60 $\frac{1}{2}$  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 bars of 4 x 4 x  $\frac{1}{2}$  inch  
angle iron all the joints  
of engine kulsons are to  
be butted and strapped

and driven flush - No 87  
to be flush on the forward  
side No 93 on the afterside  
A detailed drawing of  
these keelsons will be furnished

Deck-beam Knees & Shelves  
On the head of every odd  
numbered frame, except-  
ing those occupied by  
bulkheads there is to be riv-  
eted a plate iron "gusset  
piece" or knee plate 53 inches  
long  $\frac{1}{2}$  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 berths  
to the wale streaks

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  
hip and riveting to the  
horizontal frame corres-  
ponding 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 gus-  
set plates all rivets must  
be driven flush -

### Plating of Hull

Courses to run fore and aft  
are to be put on in inside  
and outside streaks the

garboard streak to lap the  
keel plates 4 inches all other  
streaks to lap  $2\frac{3}{8}$  inches the  
ends of the plates are to be  
butted and strapped with  
pieces 8 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 Iron

The keel plates to be  $\frac{3}{4}$  inch thick  
the garboard streak to be  $\frac{5}{8}$  inch  
thick the two nearest plates  
to garboard streak at the  
central part of the vessel  
also to be  $\frac{5}{8}$  inches thick ~  
All other plates in the entire

metal to be  $\frac{1}{2}$  inch thick  
except the brackets which  
sustain the shelf fore & aft  
bulkheads on 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 46 inches  
wide amidship diminish-  
ing by a fair line to 32  
inches wide near the ends -  
said shelf to be formed of  
iron  $\frac{1}{2}$  inch thick and  
fastened to a hull by  
a bar of  $3\frac{1}{2} \times 3\frac{1}{2}$  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 one 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  $\frac{3}{8}$  inch plate  
and are to be riveted to a  
 $3\frac{1}{2} \times 3\frac{1}{2} \times \frac{1}{2}$  inch angle  
iron knee — which is to  
be rivited 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  $3\frac{1}{2} \times 3\frac{1}{2}$  inches angle iron the projecting leg facing to form a stopper to the heels of the armor backing timber - Around the top of the hull following the shear line there is to be carried a bar of  $4 \times 4 \times \frac{1}{2}$  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 this topping

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

There is to be a cylindrical well through the forward overhanging hip of the of the boat 69 inches inside diameter & formed of  $\frac{1}{2}$  inch plate butted and strapped and driven flush upon the inside this well to be secured to the bottom of hip by a ring of  $3\frac{1}{2} \times 3\frac{1}{2}$  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 6 inches  
or within 1 inch of the top  
(deck being 7 inches thick)  
and to be secured thereto  
with a suitable number  
of 3 inch blunt bolts 6 in  
long having counter sunk  
heads -

### Propeller Well

On the overhanging hip aft  
and directly over the propeller  
wheel there is to be a rectangu-  
lar well passing through  
the deck and bottom of  
overhanging hip to be formed  
of  $\frac{1}{2}$  inch plates riveted  
flush and secured to its  
position in the same gen-  
eral manner as described

for the anchor well - From the top of the propeller well and extending over to the feet of the deck beam knees diagonal braces will be introduced formed of angle iron 3 x 6 inches on frames Nos 111, 113 & 115 similar braces will be placed but fastened at the centre line of vessel to a vertical plate of iron  $\frac{1}{2}$  inch thick 12 inches wide - said plates to be bolted to the beams and riveted to the respective frames and stiffened vertically on each edge by bars of  $3\frac{1}{2} \times 3\frac{1}{2}$  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 Keel and garboard  
strake to be riveted with  
2 staggered rows of  $\frac{7}{8}$  inch  
rivets (the butts of garboard  
to be fastened with  $\frac{7}{8}$  in  
rivets) all other fore & aft  
seams to be riveted with a  
single row of  $\frac{3}{4}$  in rivets -  
the  $\frac{5}{16}$  in &  $\frac{3}{8}$  in bulkheads  
to be riveted with  $\frac{7}{8}$  in rivets  
all parts not otherwise speci-  
fied above to be riveted with  
 $\frac{3}{4}$  in 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 & aft seams are to be made fair & straight split & caulked the butts to be "fullered up" on the outside the straps are to be chipped and caulked at the ends and split & 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 17x12 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  
binds 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 run-  
ning from end to end of  
the vessel are firmly  
blunt bolted to the before  
mentioned vertical blocks  
these longitudinal timbers  
vary in thickness accord-  
ing to the varying thick-  
ness of bulwarks called

For by the general cur-  
vatures of the vessel  
According to the plan this  
curvature commences at  
the midships section and  
reduces rapidly the thick-  
ness of the bulwarks 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 com-  
mences viz - 29 inches inside  
of armor plate at the  
lower part - The exact  
thickness of bulwark op-  
posite each frame will be  
seen by the general plan  
of the vessel - The three  
lower longitudinal

timbers will be composed of pine and the two upper of oak - the plank 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 7 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 beam 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. 76. 80. and 100  
where it will be 16 (see  
general plan)

The deck beams secured to  
bulkheads under turret &  
to forward bulkhead will  
be 14 in. wide - The deck  
plank will be composed  
of pine wood 7 inches thick  
and 8 inches wide - Crown  
of deck between extreme  
points of bulwark 6 in.  
The seams to be thoroughly

caulked and pitched as there will be no means of recaulking 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 vessel 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 pro-  
vided with means for ef-  
fectually fastening the  
same from below if deemed  
requisite

### Deck Plating

To be composed of two thick  
ripes of best wrought iron  
plate each one  $\frac{1}{2}$  inch thick  
secured to the deck precisely  
as in the U. S. S. Gunboat  
Monitor with felling carefully  
spread between the deck and  
plating - Plates to be painted  
before laid down -

### Rope Stanchions and Ringbolts

Rope stanchions will be placed

all around the vessel at intervals of 10 feet to be made of wrought iron with an eye at the top for receiving the rope rail - appropriate sockets will be inserted in the deck for receiving the stanchions - A series of powerful ring-bolts will also be introduced all around the vessel - cavities lined with iron will be formed to receive the ring 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 in. 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 axle 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 vessel named. The brakes will so arranged as to admit of a greater number of hands being employed.

## Rudder & Stern Arrangement

The rudder will be equiptoise 28 inches wide forward of the axis and 56 in. aft 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 P.L. III. A wrought iron post 3 x 7 inches is firmly riveted 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 stuffing box terminating with a square to which the

tiller is applied as in the  
U. S. Gunboat Monitor.

### Motive Machinery

The engines will consist of 2  
cylinders 40 inches in diam-  
eter 22 inches stroke com-  
bined in one piece suppor-  
ted by a strong frame cast  
in one piece bolted to and  
supported by the wrought  
iron keelsons attached to  
the keel herein before de-  
scribed the entire arrange-  
ment of the motive engine  
condenser air-pump & other  
parts will be precisely as  
in the U. S. Gunboat  
Monitor. The blower en-  
gines and blowers will how-  
ever be of greater size and  
instead of being placed in

the engine room will be applied 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 conductors into the boiler rooms and other parts of the vessel -

### Vacuum Engine

In addition to the motive 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 + 100 this engine will  
consist of a capacious jet  
condenser to which are  
attached two air-pumps  
and 2 steam cylinders  
on Worthingtons 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, turret engines  
and Worthing Pumping En-  
gines - The power of the vac-  
uum engine will be suf-  
ficient 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  
Martin's 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 1  
felted and leaded as  
usual and provided  
with all approved appur-  
tenances —

## Smoke Pipe

An impregnable smoke pipe  
14 inches inside diameter at  
the top will be firmly se-  
cured to the deck in the  
centre line of the vessel above  
the exit of the common smoke  
box of the boilers — This im-  
pregnable smoke pipe will  
be composed of not less

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 plating  
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 a shell proof grating  
will be inserted. - A portable  
tube put together in sec-  
tions will be fitted to the  
upper end of the permanent

smoke pipe to be applied  
at sea in rough weather

### Turrets

To be 21 feet internal diam<sup>r</sup> 9 feet high  
Composed of 11 plates in thickness which are  
to measure together 11 ins through. These  
plates are applied in 20 sections and joined  
vertically in such a manner that there is  
only one joint at any one place. The two  
inside courses are riveted firmly together  
by  $1\frac{1}{4}$  in. rivets at intervals of 9 ins up &  
down. To these two inside courses the 9  
outer plates are bolted with  $1\frac{1}{4}$ " bolts with  
countersunk heads on the outside & nuts  
on the inside. The 20 joints formed by the  
plates on the inside are covered by up-  
right plates forming pillars  $1\frac{1}{4}$ " wide  
 $\frac{3}{4}$  ins thick. The before named rivets & bolts  
pass through these plates which thus form  
washers. The turret plates rest on a flat  
ring formed of Composition metal  $1\frac{1}{2}$ " thick  
12 ins wide provided with a beveled flange

on the inside  $2\frac{1}{2}$ " high  $1\frac{1}{2}$ " thick. The top face of the ring is turned the under side being accurately turned & polished. For the convenience of handling & transportation the ring is divided in 10 segments, united by flanges on the inside held together by bolts & nuts. At the top of the turret about 10" down a forged beam 8 ins. deep 4 ins. thick is inserted, well supported at the ends by plates riveted on the inside of the turret. On each side of this beam 4 short forged beams 3 ins. wide x 6 ins. deep, are morticed. The beam for that purpose being provided with hubs or projections in which said mortices are made. The opposite ends of the short beams are also firmly secured to the turret by plates riveted on the inside. A series of short rail way bars are placed 3 ins. apart on the top of the foregoing forged beam - supported partially on the beams and partly on plates - attached to the inside of the turret. On top of these rail way bars are placed cast iron plates  $\frac{1}{2}$ " thick neatly joined together

in such a manner that the joints come over the centres of the bars, certain portions of these plates are perforated with hole 1" diam. Two hatches are formed in these plates with knit 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 diam. over which a pilot house of equal dimensions is placed to be hereafter described - At right angles to the before described beam a similar beam is inserted close to the bottom of the turret. This beam is 8 in. thick & 5 in. deep and provides with a hub in the middle thro' which a vertical hole of 1 1/2" diam. is bored. The ends of this beam are made T thus, the projecting arms thus formed being accurately fitted to the inside of the turret and fastened with bolts & rivets. To resist upward strain plates are applied from above - bearing down upon the T ends of the beam, and firmly riveted & bolted to the inside of turret.

On the top of beams just described 4 other  
forged beams are placed at right angles,  
these beams 4" thick 9" deep from the  
sides upon which the gun carriage travel.  
They are firmly attached to the main beam  
and well secured at their ends to the inside  
of the turret. A floor made of oak planks,  
with several grated hatches formed in the  
same is laid on the outside of the gun slides.  
The turret ring before described which forms  
the base of the turret rests on another ring  
inserted in the deck composed of segments of  
thick plate iron accurately faced & secured  
to the deck with countersunk bolts in  
such a manner as to form a perfectly  
water tight joint. The cavity formed in  
deck round the circumference of turret will  
be covered by a loose thin broad ring of iron  
iron extending round the turret but free  
to slip up & down so as to bear on top  
of the deck plating at all times, thus  
effectually covering the cavity or channel  
below.

Above the turret roof on the inside of the turret 20 square sockets will be attached to receive an equal number of Stations made like those of the U. S. Gunboat "Monitor". The turret will revolve round a fixed central column of wrought iron 12" diam<sup>t</sup> resting on Keelsons placed at the bottom of the vessel, and braces fixing to the turret bulkhead heretofore described. A cast iron bracket fixing 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 turret beam. Said termination being provided with a broad deep transverse slot to act as a clutch. An upper central column of wrought iron 10" diam<sup>t</sup> is placed thro' a cylindrical hole in the upper main turret beam, 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 turret beam rests. A substantial

friction may of composition metal being introduced between the collar & the beam. For the support of the sides of the turret two diagonal braces 5" diamts are introduced connecting the two central gun slides with the upper main turret beam as near the centre of turret 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 turret ring by tightening up said braces. The upper central column will extend thro' the hole in the upper turret beam for the purpose of giving the central support to the Pilot house.

A cog wheel 10' feet diamts of very heavy pitch, say 6 ins, will be bolted under the lower turret beam & gun slides. Hubs will be forged on 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 firmly bolted. In order to prevent any derangements, lugs will be cast on the top of

The rim of the cog wheel to check firmly the  
hubs before described, a pinion of about 36"  
diam<sup>t</sup> will work into said cog, this pinion  
will be secured to the upper end of a vertical  
wrought iron shaft 9" diam<sup>t</sup> resting on the  
floor plates at the bottom of the vessel, and  
supported at the top by a pillow block bolted  
to the deck beams. To the lower end of this  
vertical axle a cog wheel of 6 ft 6 in diam<sup>t</sup>  
will be secured and actuated by a turret  
engine and gear precisely similar to that of  
the "Monitor." The turret engine will as in  
the Monitor be placed horizontally 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 turret engine will be of the same  
character as that of the Monitor, with  
the modification only that the gunner can  
control the rotation of the turret whilst  
he is looking over the gun. The contractor  
reserves to himself the right of introducing  
pendulums and oval post holes or dispensing

with the latter and keeping the guns stationary at the muzzle and depressing and elevating at the trunnions. 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 gear from below actuated by manual or steam power. The distance between the gun slides will be such as to admit of 15 inch Dahlgren guns being employed, but should the Department desire the employment of 12 or 11" guns the contractor will furnish suitable carriages and fit same to gun slides though made for the heavy ordnance before mentioned.

### Pilot House.

The Pilot House will be entirely of wrought iron 6 feet internal diameter 6 feet high 8 ins thick composed of 8 thicknesses of plate and put together in the same manner as the turret. The top will consist of two flat plates each 1" thick riveted together with perforations

for effecting ventilation. Near the top a number of peep 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 turret column, in such a manner as to secure the Pilot House against rotating with the turret. A strong iron ring accurately turned is secured to the outside of the turret. Another iron ring, either <sup>whole</sup> or in segments is bolted to beams on the turret roof. Its form being such as to guide and keep down the Pilot house at the same time. An appropriate hatch in the floor of the Pilot house will afford access to it when the turret is turned in a proper direction.

### Steering Wheel.

A steering wheel constructed as the one of the U. S. Gunboat "Monitor" will be applied in the forward part of the Pilot house with the steering ropes or chains, passing down through

grooves formed in the side of central column.  
From below deck said ropes or chains will  
communicate with the tiller in the usual  
manner. The compass will be adjusted on  
Morris' principle at the expense of the con-  
tractor.

### Side Armor.

Will be constructed & fastened to the  
wooden bulwarks of the vessel as in  
the Monitor. It will be composed of  
5 Courses of plates, measuring 3 ins  
in thickness. The 3 outer plates 5 feet deep  
extending from top of deck to the top of  
chelf. Inner plate from outside will  
be only 36 ins deep, and inner plate will  
be 30 ins deep. No plate will be less  
than 5 feet long. Each of the 4 inner  
plates will be fastened to the bulwarks with  
2 independent blunt bolts, of  $1\frac{1}{4}$ " diam-  
Counter sunk & flush. Outer plates are fastened  
each with 18.  $1\frac{1}{4}$ " Counter sunk head bolts  
passing thro' the entire depth of armor and  
driven thro' bulwark, all but 4 ins. The

beveled 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 a thousand gallons of fresh water every 24 hours, similar to the Monitor's, will be furnished and connected with the water tanks by appropriate pipes.

### Propeller & Stern Arrangements.

The propeller will be cast iron 12 feet in diameter 16 feet pitch, the mode of supporting the shaft, the construction of stuffing stem pipes & every other parts connected with the propeller on drawing as to require no description or specification.

### Spare Articles, Tools & Instruments.

One set of spare brass well fitted will be supplied for every part of the engine. Also spare spoke bars and other necessary parts, required in fully equipped war vessels oil tanks, oil cans, lamps, clock, indicator

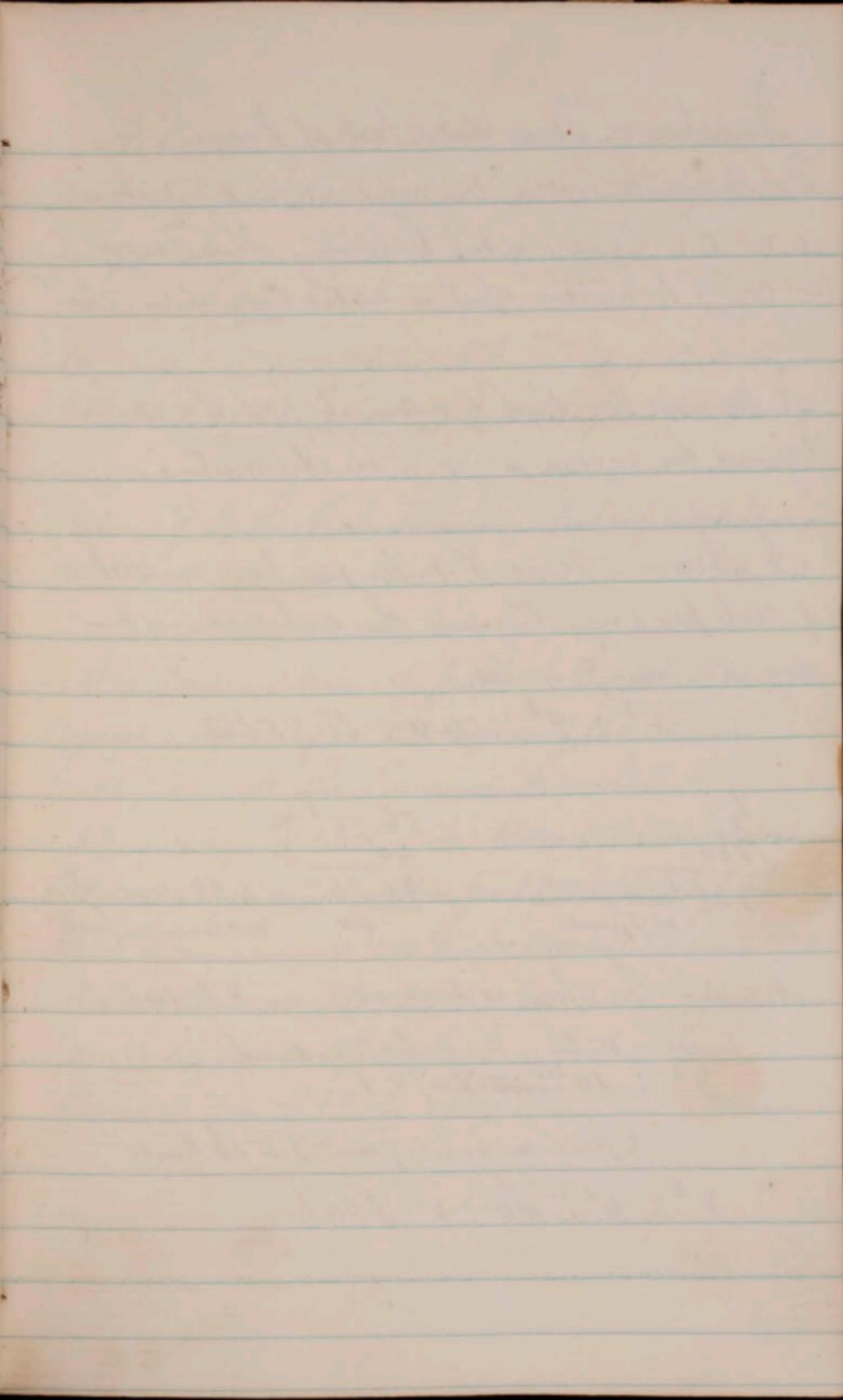
Gauges, wrenches, ash buckets, fire tools  
and all similar instruments to be furnished  
of the best material & workmanship.  
Also all tools necessary for keeping the  
the machinery in repair.

The intention 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  
coals & stores. It is understood that any  
omissions pointed out by the Navy Department  
will be corrected by the contractor etc.

New York March 28<sup>th</sup> 1862.

J. P. Mott, Mountbait, Hawkskile, Petapsee -  
W. C. Hawken -

Weight of Takapoa, Built in Wellington -  
 Hull. " " " " " " 695. 9 1/3 #  
 Side Armor " " " " " " 353. 6 3/4 #  
 Deck do " " " " " " 309. 6 1/2 #  
 Deck lights & coal hatch frames. 8. 130  
 Total weight 1,360. 352 #  
 Government price \$ 001. 000



## 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 speed is as the Cube of the Velocity.

If increase the speed of a vessel from 8 to 10 knots  
Requires the engine power to be doubled.

A Steamer runs 8 miles per hour on 40 tons of coal per day. Requires the coal consumed per day to run 9 miles.

$$8^3 : 9^3 :: 40 : 56.95 \text{ tons.}$$

$$\begin{array}{r} 9 \\ 8 \overline{)100} \\ \underline{72} \\ 28 \\ \underline{24} \\ 4 \end{array} \text{ } 12\frac{1}{2} \text{ per cent increase in speed}$$

$$\begin{array}{r} 56.95 \\ \underline{40} \\ 16.95 \\ \hline 40 \end{array} = 42\frac{1}{2} \text{ per cent increase in fuel}$$

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

Miles	Miles	Coal consumed
$8^3$	$10^3$	$40 \times X = 78.1$

Speed increased from 8 to 16 knots

$$8^3 : 16^3 :: 40 \text{ } ^{\text{Coal}} : X \text{ } 320 \text{ tons.}$$

A Vessel of 500 H.P. runs 12 knots on  
40 tons of coal per day. Required Speed if she  
go 9 knots -

$$40 : 30 :: 12^3$$

$$\text{or } 4 : 3 :: 1728 : V^3$$

$$\frac{3 \times 1728}{4} = \sqrt[3]{1296} = 10.902 \text{ knots.}$$

Saving  $\frac{1}{4}$  the fuel. Reducing Speed only about  $\frac{1}{12}$ .

— 11 —

The consumption of fuel on two or more  
voyages will 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.

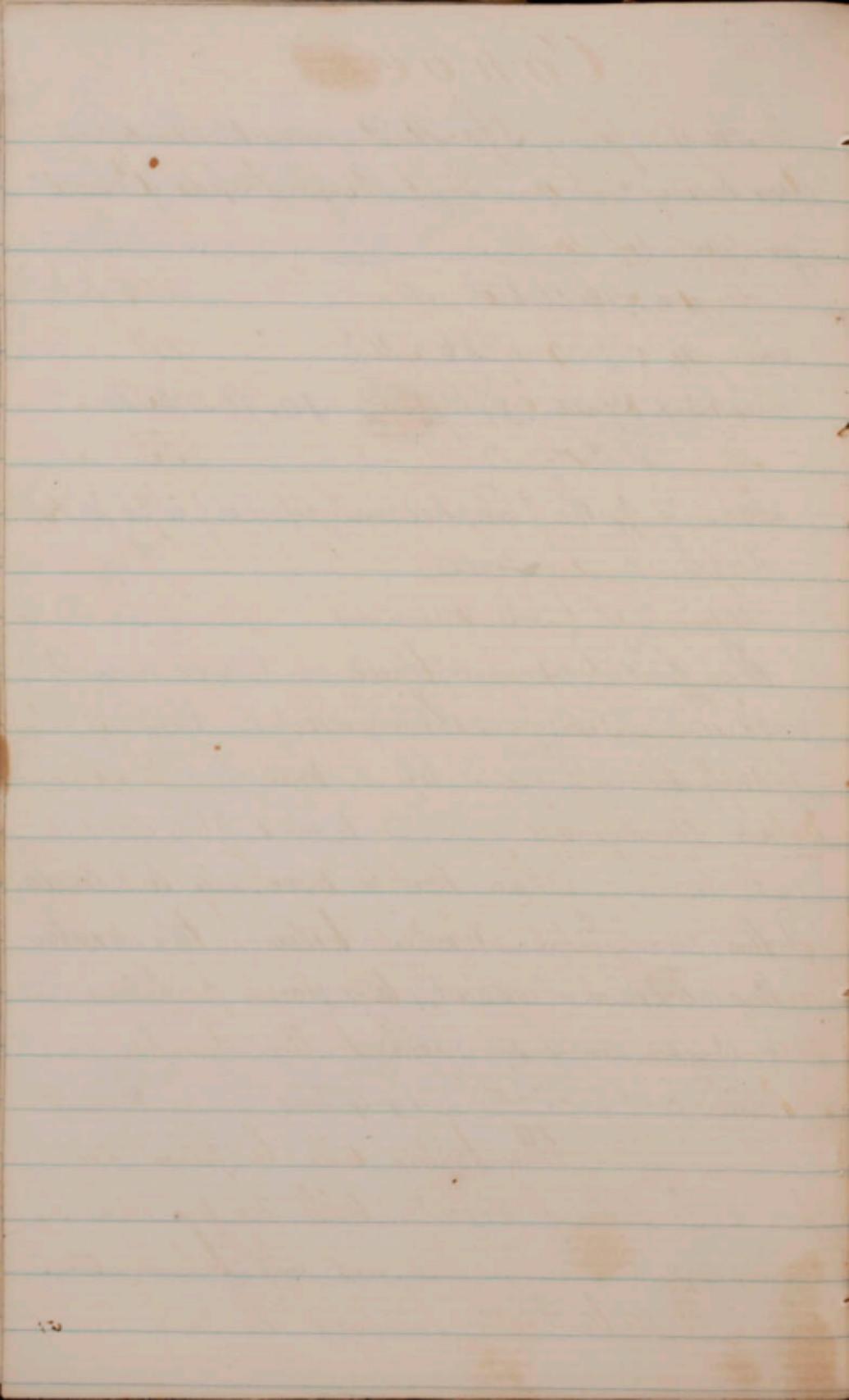
$$150 \text{ tons} : \text{Consumption required} :: 10^3 \text{ knots} \times 1200 \text{ miles} : 8^3 \text{ knots} \times 1800.$$

$$C \times 100 \times 1200 = 150 \times 64 \times 1800.$$

$$\text{or } C \times 120,000 = 17,280,000$$

$$\text{Reduced to } C = \frac{1728}{12} = 144 \text{ tons.}$$

Murray.



# Cohoes.

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

## Dimensions of Hull.

Length of Vessel over all-	225 feet
Length of Bow Hull.	188 "
Extreme Beam over Arms.	45 "
Beam of Bow Hull.	33 "
Actual Depth of Vessel amidships	9 " 1 inch
Depth of Bow Hull	7 "
Width of Deck Stanchions	23 in
Width of Deckal Traces.	2 in
Floor and Side frames Angle Iron	4 x 3 x $\frac{7}{16}$
Angle Iron all around top of Hull.	6 x $3\frac{1}{2}$ x $\frac{1}{2}$

## Motive Machinery

The motive machinery will consist of two horizontal tubular boilers, two direct acting inclined engines, two screw propellers, and one surface condenser without Air Pumps.

## Boilers

The boilers will be placed one upon each side of vessel, with one fire room in common, running fore and aft between them. There will be four furnaces in each, two of

show at the forward, and two at the after  
 ends with the tubes, through which the pro-  
 ducts of combustion will return between them  
 The coal will occupy the entire vessel be-  
 tween these boilers and the turret chamber  
 with the exception of a passage 30 ins wide  
 amidships, thro the upper part of which the  
 wind will be carried to the fire-room from the  
 jaw blowers.

Breadth of Boilers athwartships	9 feet
Length Fore and Aft	25 " 7 ins
Height	6 " 8 "
Length of Tubes.	7 " 6 "

Outside Diamt of Tubes.

Upper Row.	-	15/8"	Next Row.	-	2 1/8		
Next	"	-	1 3/4"	"	-	3"	
"	"	-	1 7/8	"	"	-	3 1/8.
"	"	-	2 ins				
"	"	-	2 1/8				
"	"	-	2 1/4				
"	"	-	2 3/8				
"	"	-	2 1/2				
"	"	-	2 3/4				

Tubes of each boiler to be disposed in two  
 Congeries, each Congerie to have 15 tubes in  
 breadth and twelve tubes in height.

Thickness of Sides and top of Shells =	$\frac{5}{16}$ "
" " Furnaces & Water bottoms	$\frac{5}{8}$ "
" " Ash Pans.	$\frac{4}{16}$ "
" " Tube Sheets	$\frac{1}{3}$ "
" " All other parts	$\frac{5}{16}$ "

All flat surfaces to be stayed every 8 ins  
 with Stay, 1 in diam. Wherever flat stays  
 are necessary the section must be equal to  
 1 8/32 inch for every point of surface stayed  
 T iron, of  $3\frac{1}{2} \times 4 \times \frac{3}{8}$  ins, to be riveted to  
 to top and sides of Shell every 4 ins (8 ins  
 apart on each side) as shown in the draw-  
 ing.

All parts, except those directly exposed  
 to the fire to be double riveted. The seams  
 of furnaces to run longitudinally, and to be  
 exactly as shown in the drawing.

# Engines.

The engines will be attached to 3 transverse iron Keelsons, and just sufficiently inclined to allow crosshead of one engine to work under the shaft of the other. The Starboard propeller to be worked by the Port cylinder. Engines to work entirely independent.

Circulating and Feed pumps to work independent of the main engines, to be upon the plan of Worthingtons Duplex pumps.

Two auxiliary steam pumps Worthingtons No 5.

Dia <sup>ts</sup> of cylinders. —————	22 inches
Length of Stroke —————	30 "
Dia <sup>ts</sup> of Piston rod —————	2 1/2 "
" " Connecting rods at neck —	2 1/2 "
" " Crank Pins —————	4 "
Length " do do —————	6 "
Dia <sup>ts</sup> of Main Journals of Shaft —	7 "
Length " do do do —————	15 "
Dia <sup>ts</sup> of Screw Shaft. —————	7 "

# Surface Condenser

Surface of tubes in condenser 2000 square feet  
 Outside diam<sup>r</sup> of tubes 5/8 inch  
 Thickness " do No 18. Wire gauge  
 Length " do 8 feet

## Screws.

Diameter of propellers 9 feet  
 Pitch " " 12 feet  
 Number of Blades 4.

## Plating

Keel Plates thickness ——— 1/2 and 9/16  
 Breadth ——— 24 ins

	{ 90 feet mid ships } { Ends }	
Thickness of Garboard Strake.	1/2 in	7/16 in
" " Bilge do	1/2 in	3/8 in
Other parts of Bottom	7/16 in	3/8
Thickness of Sides	5/16 in	5/16 in

## Size of Rivets

9/16	Plate rivets together or to thinner plate with 7/8 wide
1/2	" " " " " " " " 13/16 "
7/16	" " " " " " " " 3/4 "
5/16	" " " " " " " " 5/8 "

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 Keel with a lap of  $3\frac{3}{4}$  in to be increased after Seams are caulked.

All rivets in Angle iron and frames to be spaced 6 in centres.

