

CATALOGUE "M"

Marine Iron Works

Chicago, U. S. A.

TO VISITORS.

WE have no down-town office or agency. Our shops, yard and office are all together at the foot of "C" Street, a few rods south of the corner of Clybourn and Southport Avenues—about twenty-five minutes' ride north from the City Hall on a Clybourn Avenue cable car.

We offer only our own product, and are pleased to receive callers.

Our exclusive specialty is the building of high-grade marine machinery and complete steam craft in small and medium sizes.

Having the best of modern shop equipment and an experienced working force, we respectfully invite the attention of all interested to our product and the critical examination of those most highly trained to pass judgment—the American engineer.

MARINE IRON WORKS,

H. G. House

Manager.

CHICAGO.

CATALOGUE M.

MARINE IRON WORKS.

(INCORPORATED.)

Capital Stock \$40,000, Fully Paid Up.

DIRECTORS:

ADLAI T. EWING, CHICAGO, ILL.

D. H. BURRELL, LITTLE FALLS, N. Y.

JAS. T. HALL, CHICAGO, ILL.

W. G. NOURSE, CHICAGO, ILL.

W. G. NOURSE, MANAGER.

BUILDERS OF

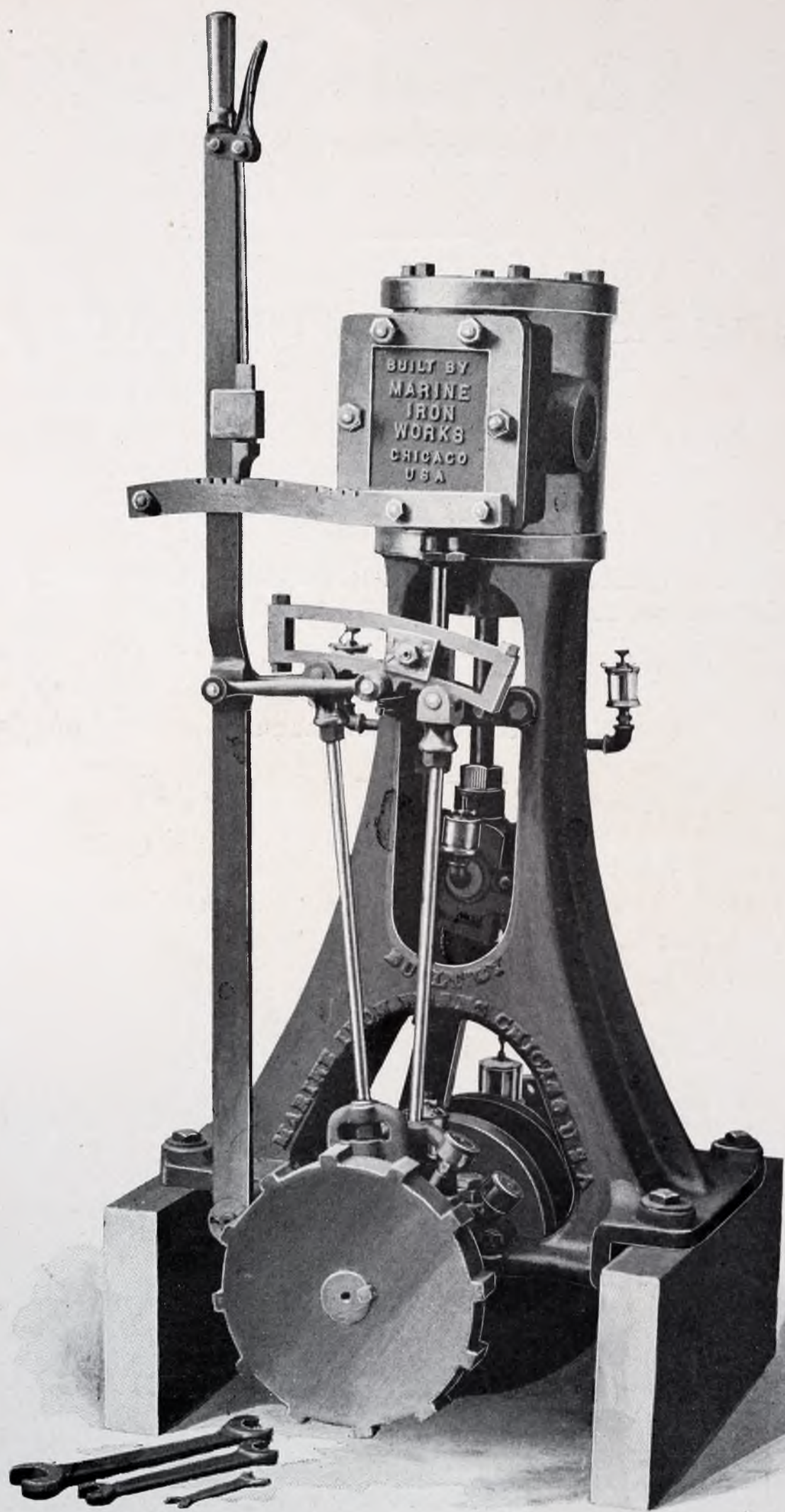
**MARINE ENGINES,
MARINE BOILERS,
MARINE MACHINERY.**

OFFICE AND WORKS:

**CLYBOURN AND SOUTHPORT AVENUES,
FOOT OF C STREET,
CHICAGO.**

CABLE ADDRESS, MARINEWORK, CHICAGO.

A. B. C. Code (4th Edition) used,
also Atlantic Cable Code.

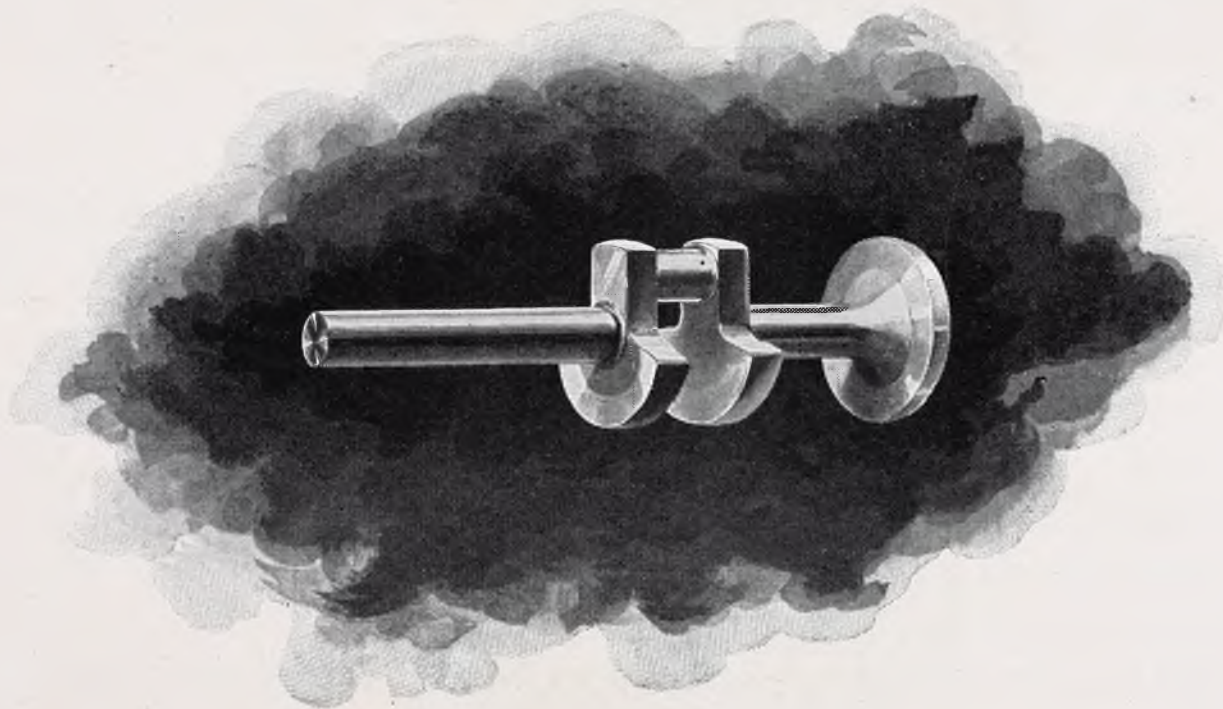


From photograph.

MARINE STEAM ENGINES.**5 TO 10 INCH CYLINDERS.**

The accompanying engravings of our engines from photographs of those recently built clearly indicate to the critical observer wherein their recognized superiority of design exists, and why the frequently severe conditions that any *Marine Engine* is sure to undergo are met successfully and easily. Note the position of crank shaft and form of bed plate, the liberal length of connections thus permitted without carrying the cylinder an inch too high, the easy access to all parts, the chance for firm foundation and accurate lining up, making a certainty of smooth, steady action under high steam pressure and resultant piston travel.

We are building seven sizes in this particular design, as specified in table of details.



CRANK SHAFT, FROM PHOTOGRAPH.

The crank shafts being steel forgings, are slotted out from the solid, and, including the counterbalance and coupling flange, are *one* continuous piece—no “building up” or bolting on of any part.

Connecting rods are also steel forgings and in proportion to the crank-shaft dimensions.

The crossheads have adjustable bronze slippers. All wear on reversing link, link block and link knuckles is adjustable.

The quadrant is double, and the reverse lever fitted with a *central* connection on *each side* of the link prevents lateral strain and adds years of good service to the engine.

Without unnecessary polish, there is enough finished work on each engine to harmonize with its general character. The cylinders are jacketed and covered with polished brass. The fittings are proper shipmates to an

"A" 1 Marine Engine, consisting of throttle valve, double connection sight-feed cylinder lubricator, compression grease cups, oil tubes with slide-top glass oil cups, cylinder drain valves and wrenches.

DETAILS.

Diameter of Cylinder. Inches.	Length of Stroke. Inches.	Height above Foundation Timbers. Inches.	Diameter of Crank Shaft. Inches.	Diameter of Crank Pin. Inches.	Steam Inlet. Inches.	Approximate Weight. Pounds.
5	5	34	1 $\frac{3}{4}$	1 $\frac{3}{4}$	1	375
6	7	40	2 $\frac{1}{4}$	2 $\frac{1}{4}$	1 $\frac{1}{4}$	660
7	7	42	2 $\frac{1}{4}$	2 $\frac{1}{4}$	1 $\frac{1}{2}$	715
8	8	48	2 $\frac{3}{4}$	2 $\frac{3}{4}$	2	925
8	10	62	2 $\frac{3}{4}$	2 $\frac{3}{4}$	2	1,400
9	10	63	3	3	2 $\frac{1}{2}$	1,775
10	10	64	3 $\frac{1}{4}$	3 $\frac{1}{4}$	2 $\frac{1}{2}$	1,900

Crank shafts in line with top of foundation timbers.

We always prefer making at least the engine end of the outfit *complete from throttle valve to propeller wheel, ready to install in position.* This, in addition to the engine, includes the following :

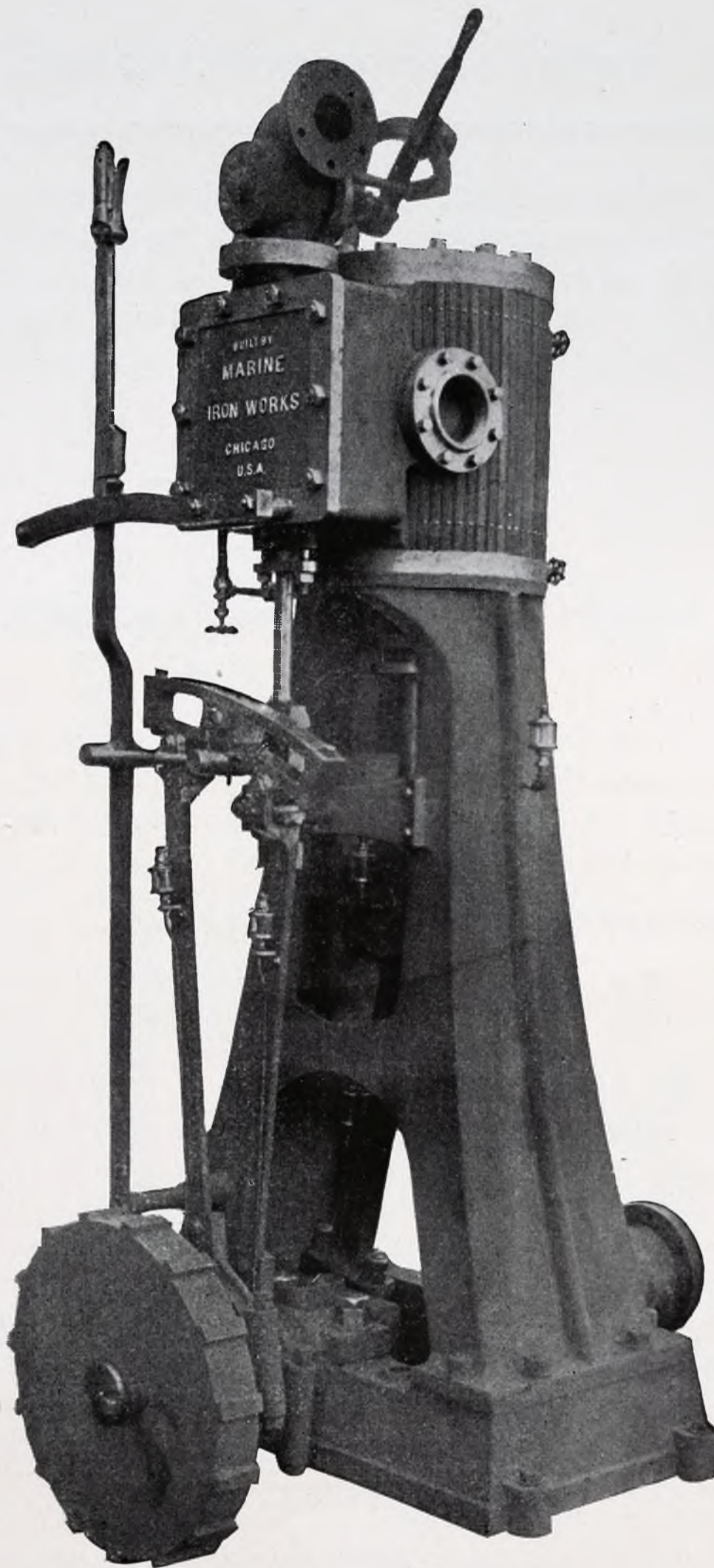
- Finished steel propeller shaft with keys and pin fitted.
- Flange couplings fitted on.
- Thrust bearing, with bronze rubbing collars fitted to shaft.
- Stern bearing fitted to shaft.
- Galvanized iron stern tube.
- Stuffing box fitted to shaft and to inboard end of stern tube.
- Propeller wheel fitted and keyed.

As we design and make each individual piece to fit its companion and the engine, as well as the work to be accomplished, it is an advantage to all concerned to have it designed and built under one supervision.

WHEN ORDERING THE ABOVE "OUTFIT"

Be particular to inform us as to the following :

- Character of service in which boat is engaged.
- Allowed steam pressure.
- Distance from center of engine to after end or face of stern post.
- Distance from forward end of deadwood to after end or face of stern post.
- Length and beam of boat on the load water line.
- Draft aft with ordinary load.



14 X 14 MARINE ENGINE.

FROM PHOTOGRAPH.

FOR DETAILS, SEE PAGE 6.

PISTON VALVE MARINE ENGINES.

SPECIAL FOR STEAM AT 200 TO 300 POUNDS PRESSURE.

Where a single cylinder engine is used in connection with very high pressures, especially where such pressure is in continued use or nearly so, a balanced piston valve is desirable. In these our line is complete up to and including engines with cylinders 10 inches in diameter by 10-inch stroke. Details, prices, etc., on request, accompanied by explanation as to requirements.

HEAVY SERVICE MARINE ENGINES.

ILLUSTRATED ON PAGE 5.

Within the limit of sizes named below no more substantial, strongly made single cylinder Marine Engines can be put up. They are intended for hard, steady service in business boats operating at long distances from repair shops and can be depended upon.

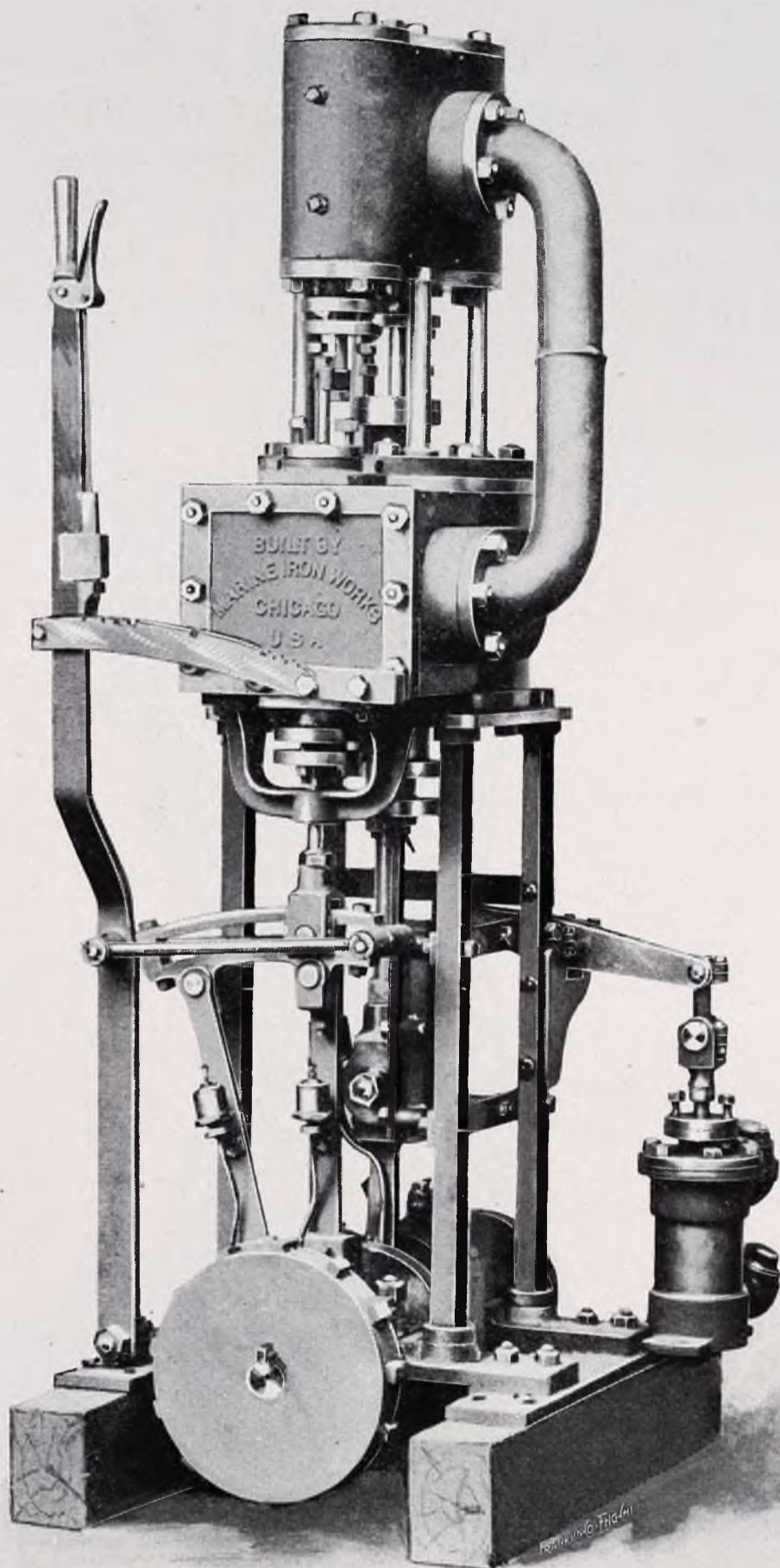
We enumerate principal proportions as follows:

Diameter of Cylinder.	Length of Stroke.	Diameter of Crank Shaft.	Height to Top of Cylinder.
12 inches.	12 inches.	4 inches.	6 feet 6 inches.
14 "	14 "	4½ "	7 " 9 "
14 "	16 "	4½ "	9 " 5 "
16 "	16 "	5 "	9 " 5 "

Every engine we build is given a thorough test under steam and is then fitted out complete with the best grade of marine trimmings, including throttle valve, slide-top glass oil cups, grease cups, drain valves all piped up, automatic sight feed, double connection cylinder lubricator, pinch wheel and half coupling ready to connect onto the shaft coupling.

It will be seen that in no instance are we offering "saw handle" or "D" handle single quadrant set screw reversing gear, which, though much cheaper to build, presents no other valid claim.

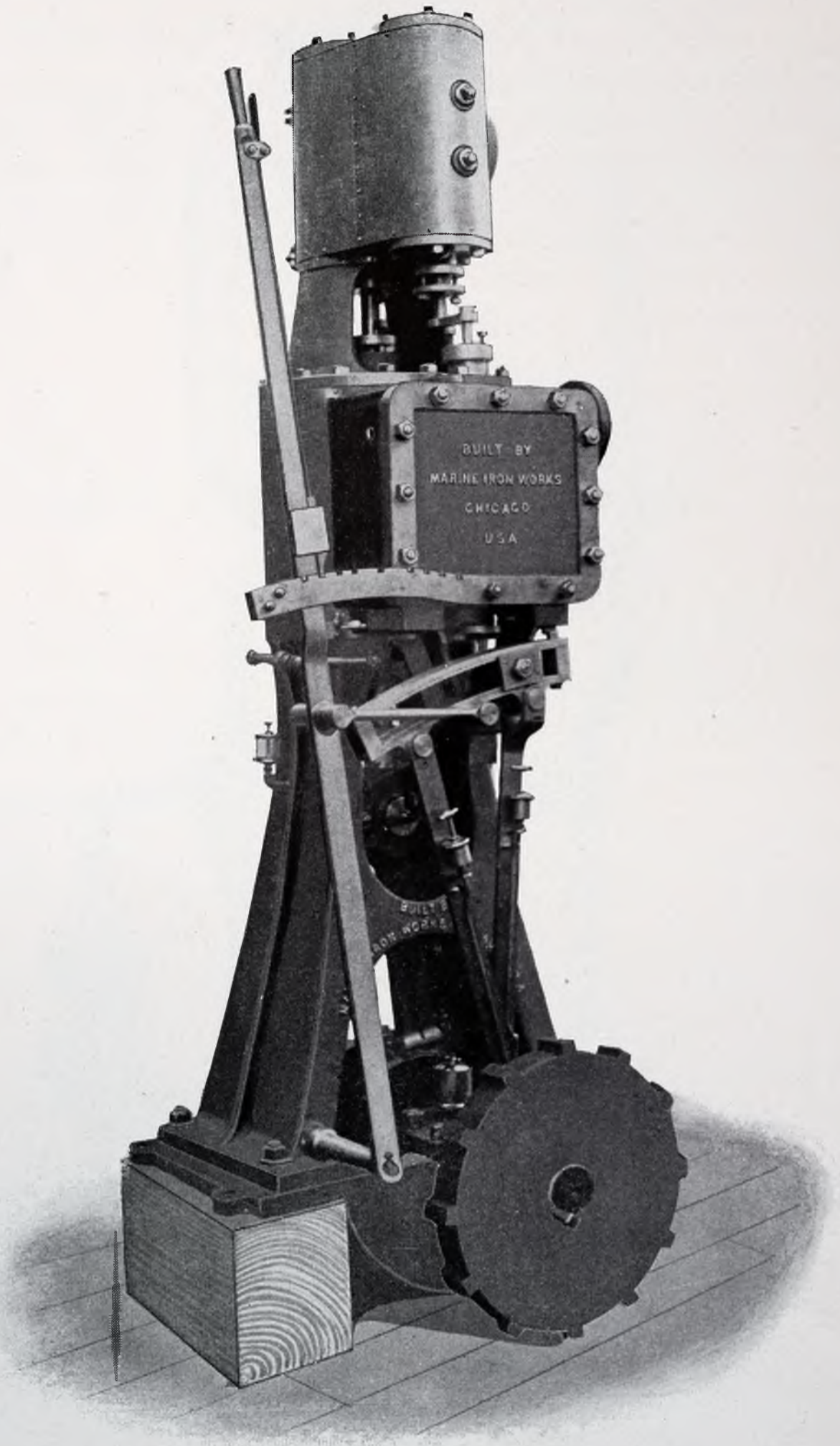
Consistent specifications and details pertaining to our engines, that are not given in this catalogue, will be cheerfully furnished to intending purchasers, together with blue print showing plan of the engine bed plates.



From photograph.

**COLUMN FRAME VERTICAL TANDEM COMPOUND MARINE ENGINE.
(WITH AIR PUMP ATTACHED.)**

BUILT IN TWO SIZES: 5½" — 10¼" X 6" AND 7" — 12" X 8".



$\frac{8'' - 14''}{10''}$

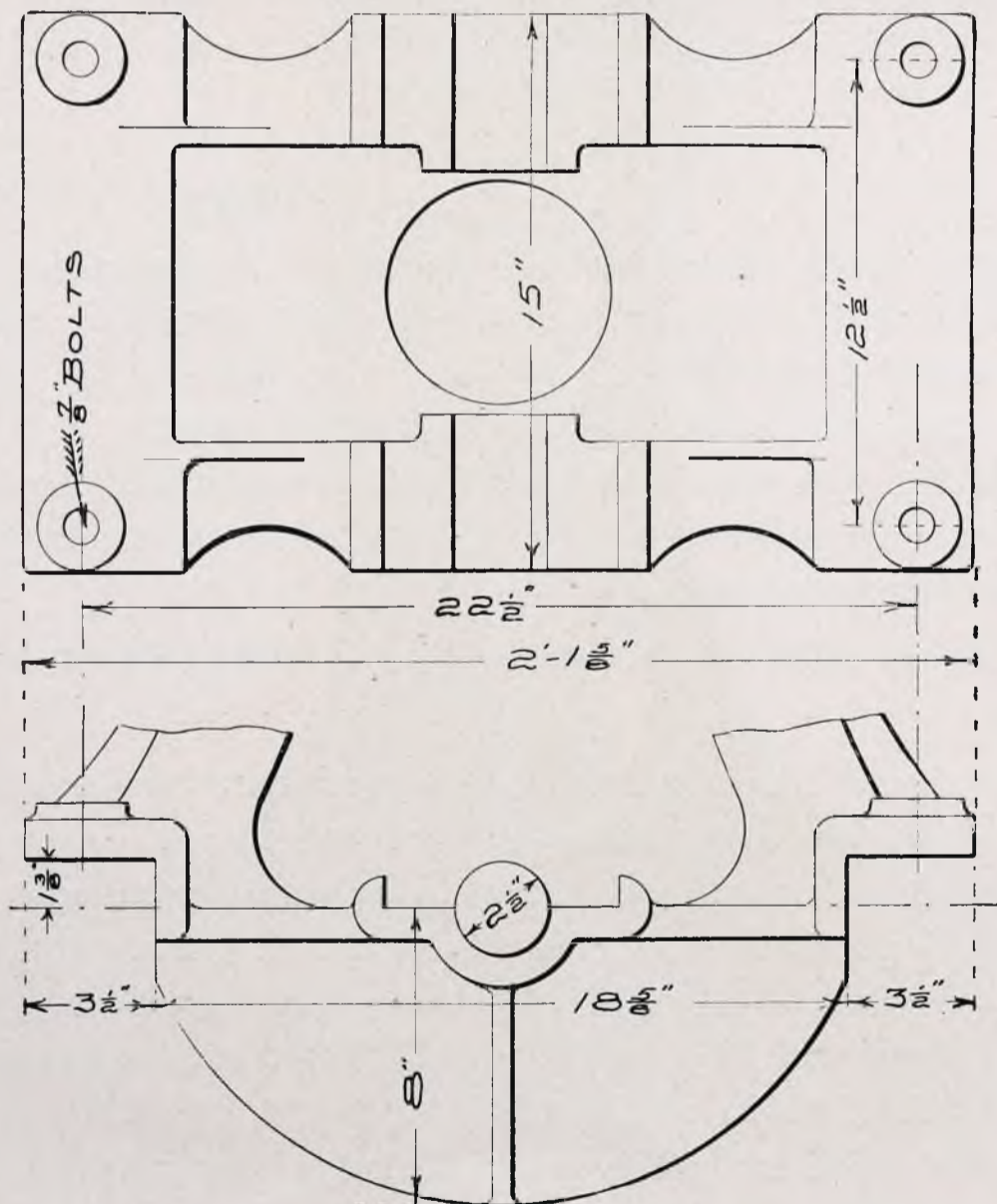
VERTICAL TANDEM MARINE ENGINE.

FROM PHOTOGRAPH.

VERTICAL TANDEM COMPOUND MARINE ENGINES.

For small and medium sized steam craft, especially for the hard-working cruising and business boats operating on salt water, or wherever economy of fuel and space is of extra value, a well-designed and reliably built vertical tandem compound engine presents valid claims for first choice, and it is for just such service that we are building (on orders only) the within described line.

No effort has been made to cheapen these engines at any point, the result being carefully constructed, accurately counterbalanced, smooth-running machinery that can be depended upon, and which, with only reasonable attention, will do splendid service for many years. They are adapted to the prevailing high steam pressures and resultant piston travel.



BED PLATE 5½ AND 10 BY 6 ENGINE.

The form and proportions of frame and bed plate not only give stability to the engine by placing the greatest weight low down in the boat, but also

provide for liberal length of connections, and yet carry the upper cylinder to only a moderate height.

It will also be seen that access to the stuffing boxes is fully provided for.

The high-pressure cylinder is fitted with balanced piston valve; the low-pressure cylinder with slide valve (balanced). The rods are made from steel forgings, with boxes and crosshead gibs of bronze. All wearing pins are casehardened, and the greatest exactitude of fit is guaranteed throughout.

A rigid test is made on every engine, of sufficient duration and under such conditions as render assurance doubly sure.

DIMENSIONS.

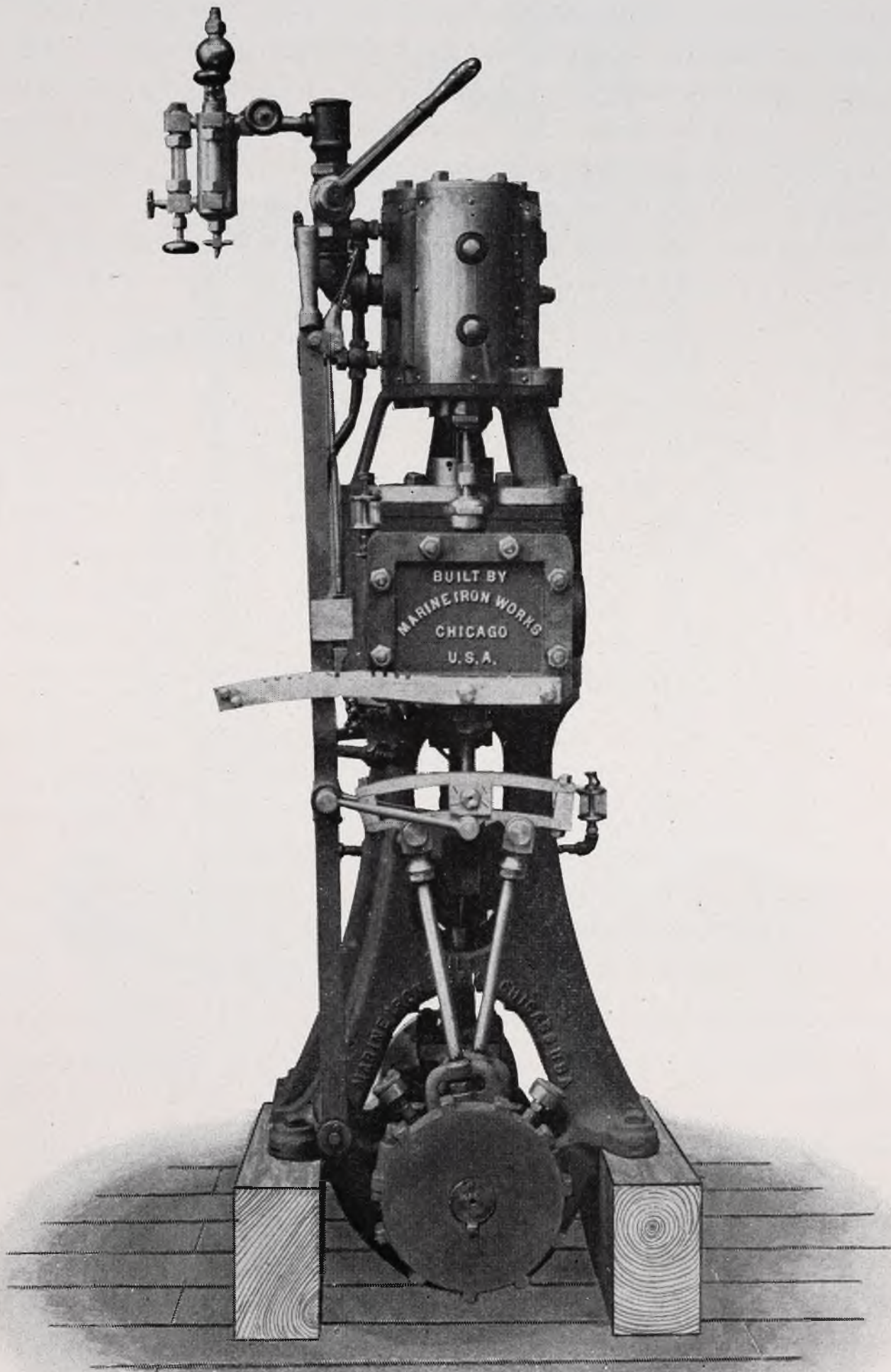
Diameter of Cylinders. Inches.	Length of Stroke. Inches.	Height above Timbers.	BED PLATE.		Diam. of Crank Shaft.	Approx. Weight. Lbs.
			Fore and Aft. Inches.	Width. Inches.		
5½—10¼	6	5 ft. 1 in.	15	25½	2½	950
7 —12	8	6 ft. 2 in.	21	29	3	1,600
8 —14	10	7 ft. 6 in.	24	38	4	2,800
10 —18	12	8 ft. 7 in.	28	40	5	4,200
12 —22	14	9 ft. 11 in.	34	46	6	5,400

Each engine, after being thoroughly tested in our shop, is fitted out very complete with A 1 Marine trimmings ready for high steam pressure, the oiling devices being arranged so that every part of the engine may be conveniently lubricated while it is running at full speed.

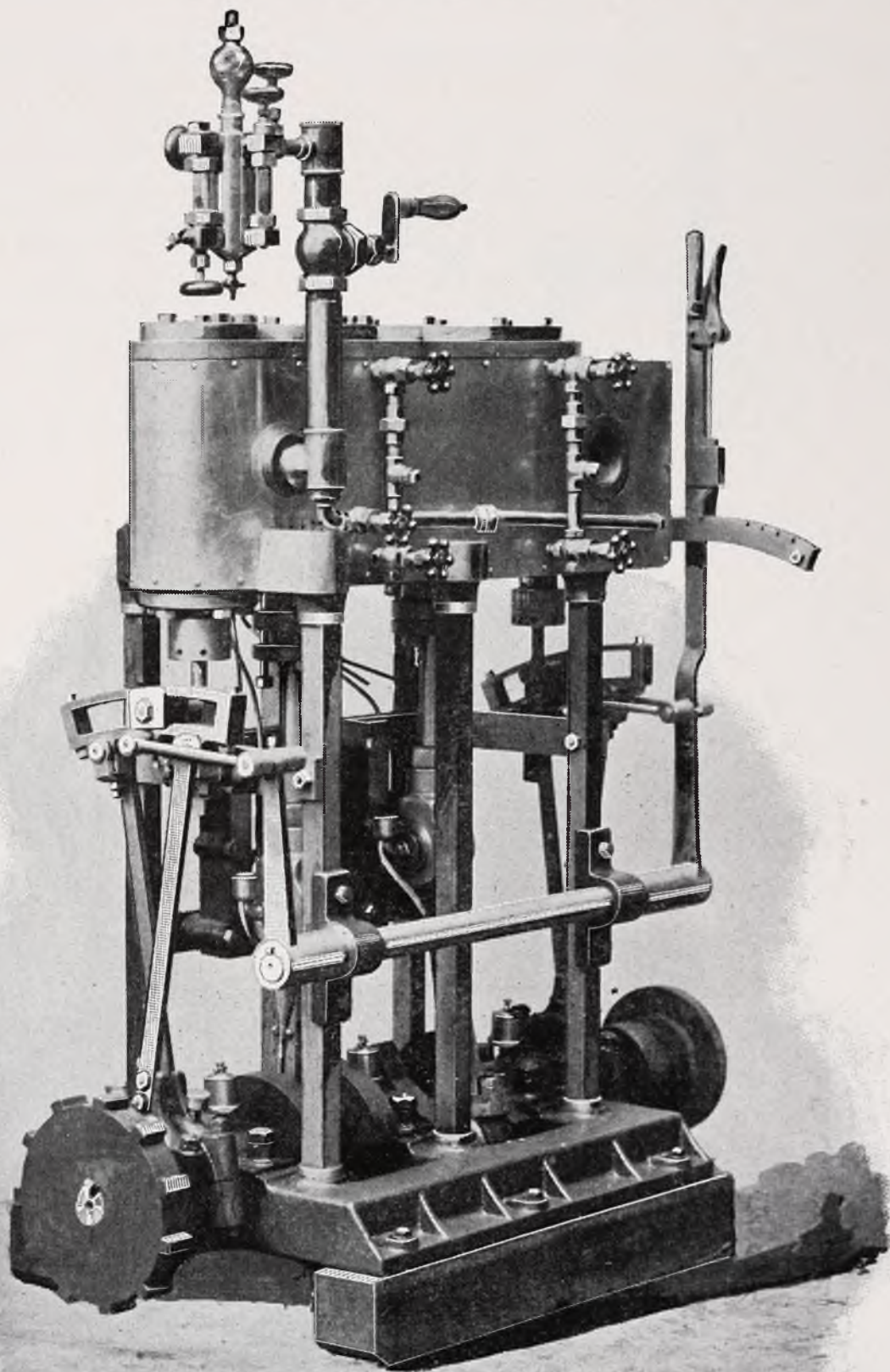
Thorough and yet simple arrangements are provided for taking up the wear, and even minor features receive the same careful attention that is given the most important parts.

N. B.—On the largest two sizes of engines named above, the open-frame design is used.

Strength, rigidity of frame, accuracy of counterbalancing and fine workmanship from the best metals place these engines on a par with our high-grade fore and aft compounds, and though less expensive, are for some purposes better, especially in the small sizes. For instance, in the cramped engine-room of a small pleasure yacht—and they too often are cramped—or substituted in place of a plain high-pressure engine where its boiler seems “rather small”; or as auxiliary power for sailing craft; and last, but by no means least, for business and cruising boats, plying on either salt or fresh water; bread-winners and reliables, whose power *must* be depended upon. These engines are designed, built and fitted out complete for just such service and no other. Numbers of them are now in constant use on both the Atlantic and Pacific oceans and the Gulf of Mexico, as well as on the inland fresh waters, in single and twin screw boats.



$\frac{5\frac{1}{2}'' - 10\frac{1}{4}''}{6''}$ VERTICAL TANDEM COMPOUND MARINE ENGINE.



BUILT BY MARINE IRON WORKS
CHICAGO

**FORE AND AFT COMPOUND MARINE ENGINES.
FOR HIGH SPEED DUTY.**

5½ AND 10¼ X 6 INCHES.	7 AND 12 X 8 INCHES.
6 AND 12 X 6 "	7 AND 14 X 9 "
6 AND 12 X 8 "	8 AND 16 X 10 "

For fast boats, and consistent with the design, we are building six sizes, as enumerated, of these light column type of high-speed Fore and Aft Compound Engines.

The illustration is from a photograph of one of these engines used in connection with a Roberts Safety Water-Tube Boiler, having an allowed steam pressure of 250 pounds; the quick travel of steam at this pressure justifying the slow opening throttle valve on a small engine.

INBOARD SURFACE CONDENSERS.

When a condenser of the inboard surface type is decided upon, it is the wisest plan to put in one of the comparatively few reliable makes, as their best points are so protected by patents that the cheaper types must avoid those features and as a consequence omit some good ones.

The Inboard Surface Condensers which we offer are made of selected material, under patents referred to. The shell, to combine lightness with strength, is cylindrical and is provided with necessary openings for exhaust steam and water connections, as well as having convenient access for cleaning. All air and water pockets are avoided. The brass tubes are made specially for the purpose and tinned inside and outside. The tube heads are brass, with brass glands. Baffle plates are arranged for the steam distribution and protection to the tubes. Necessary supports and lugs are provided to prevent sagging and "creeping."

One and a half to two square feet of cooling surface per horse-power of engine is required, depending upon the engine economy and temperature of circulating water.

In connection with this type of condenser, we recommend the combined air and circulating pumps, forming a self-contained apparatus complete in itself—the most convenient arrangement for a moderate size outfit being to fit the condenser on top of the pumps.

Price and details on application.

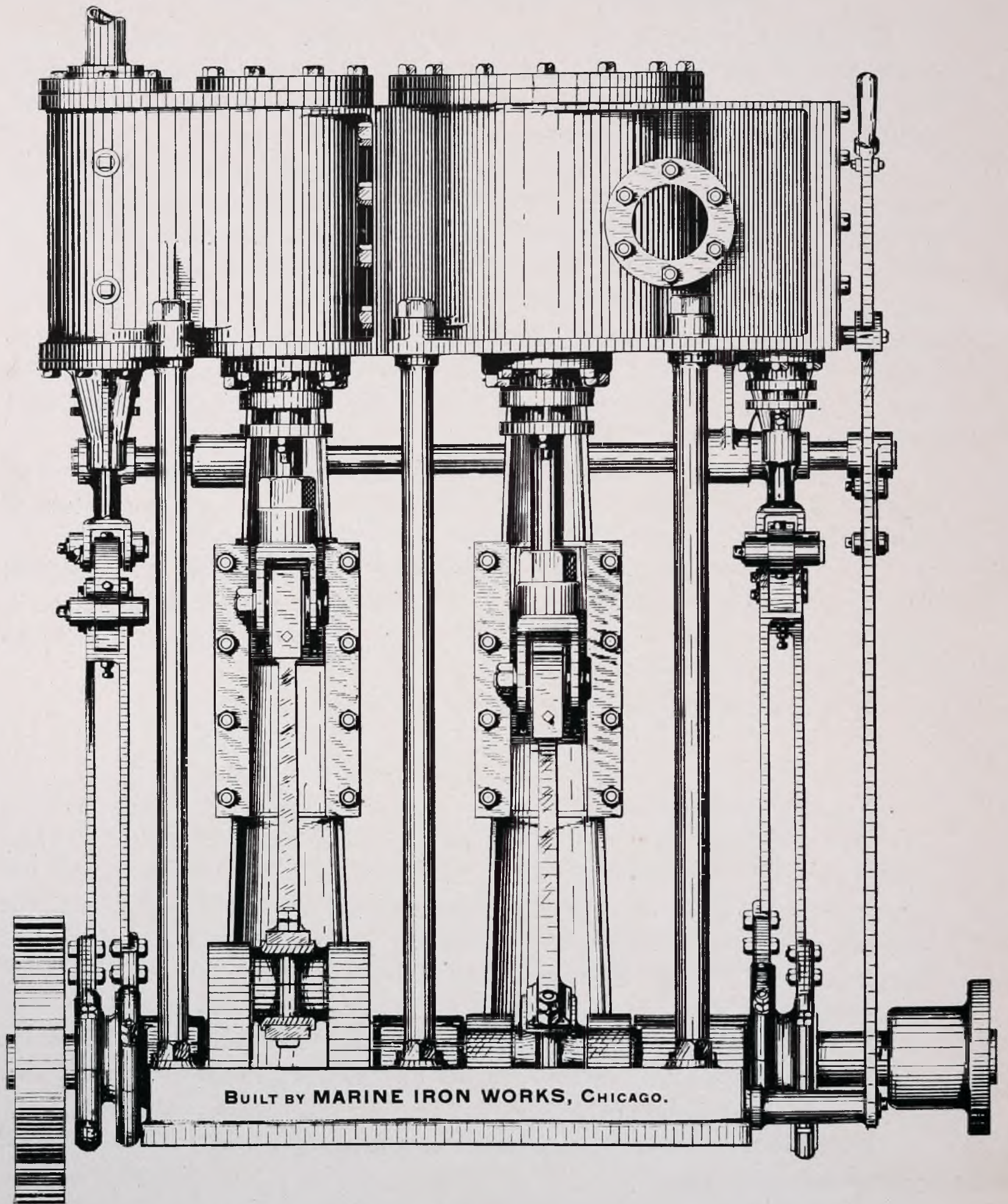
KEEL CONDENSERS.

For small and medium sized steam craft, we have a particularly satisfactory and very reasonable priced design of copper outboard surface (keel) condenser, and where desired make the complete apparatus, including not only the pump and the condenser, but also the connections between the engine and condenser, and also between the hot-well filter tank, as well as the tank itself. With this *keel* condenser, where we are building the engine or entire outfit of machinery, an air pump connected to and operated by the engine is very satisfactory and has the advantage of simplicity, also reduced weight and space occupied as compared to the independent air pump operated by steam.

We should be pleased to furnish estimates and other details for keel condensing apparatus.

JET CONDENSERS.

These are still used to some extent on fresh water, and we are occasionally called upon to make them, there being rare instances where it is justifiable to give them the choice over the surface condensers. There is, however, no such proportion of jet condensers giving satisfactory service as is the case with either type of surface condensers.



STARBOARD ENGINE OF TWIN SCREW OUTFIT.

Throttle Valve Handle Carried Close to Reverse Lever.

EITHER SCREW WHEEL OR LEVER REVERSING GEAR.

FORE AND AFT COMPOUND MARINE ENGINES.

SPECIAL FOR HARD SERVICE.

8 and 16 by 10 inches.
10 and 20 by 12 inches.
12 and 24 by 14 inches.

These Engines are of the reliable solid back, open front, slipper guide design, that permits rigidity of frame and a total of weight that is consistent with the engine efficiency. We build them with an exactitude of fit, to justify hard service under high steam pressure, and they will run cool and quiet at full speed.

The high pressure cylinders are fitted with double ported balanced piston valves, and the low pressure cylinders with double ported balanced slide valves. The piston valve takes steam at each end, and exhausts via the receiver into the low pressure cylinder.

All boxes are of the best bronze composition. The crank shafts are steel forgings *slotted out from the solid* and accurately counter-balanced. Fittings are very complete and include perfect ciling devices for lubricating the Engine while at full speed; also cylinder relief valves; drain valves; throttle valve with lever and quadrant; sight feed cylinder lubricator; grease cups, etc.

DIMENSIONS.

Diameter of Cylinders, Inches.	Stroke, Inches.	Height above Timbers, Feet.	Bed Plate Fore and Aft, Inches.	Bed Plate Width, Inches.	Diameter of Crank Shaft, Inches.	Dia. and Length of Crank Pins, Inches.
8—16	10	6 ft. 1¼ in.	46	35½	4	4 x 5
10—20	12	7 ft.	48	39½	5	5 x 6
12—24	14	8 ft. 4½ in.	57½	47½	6	6 x 7

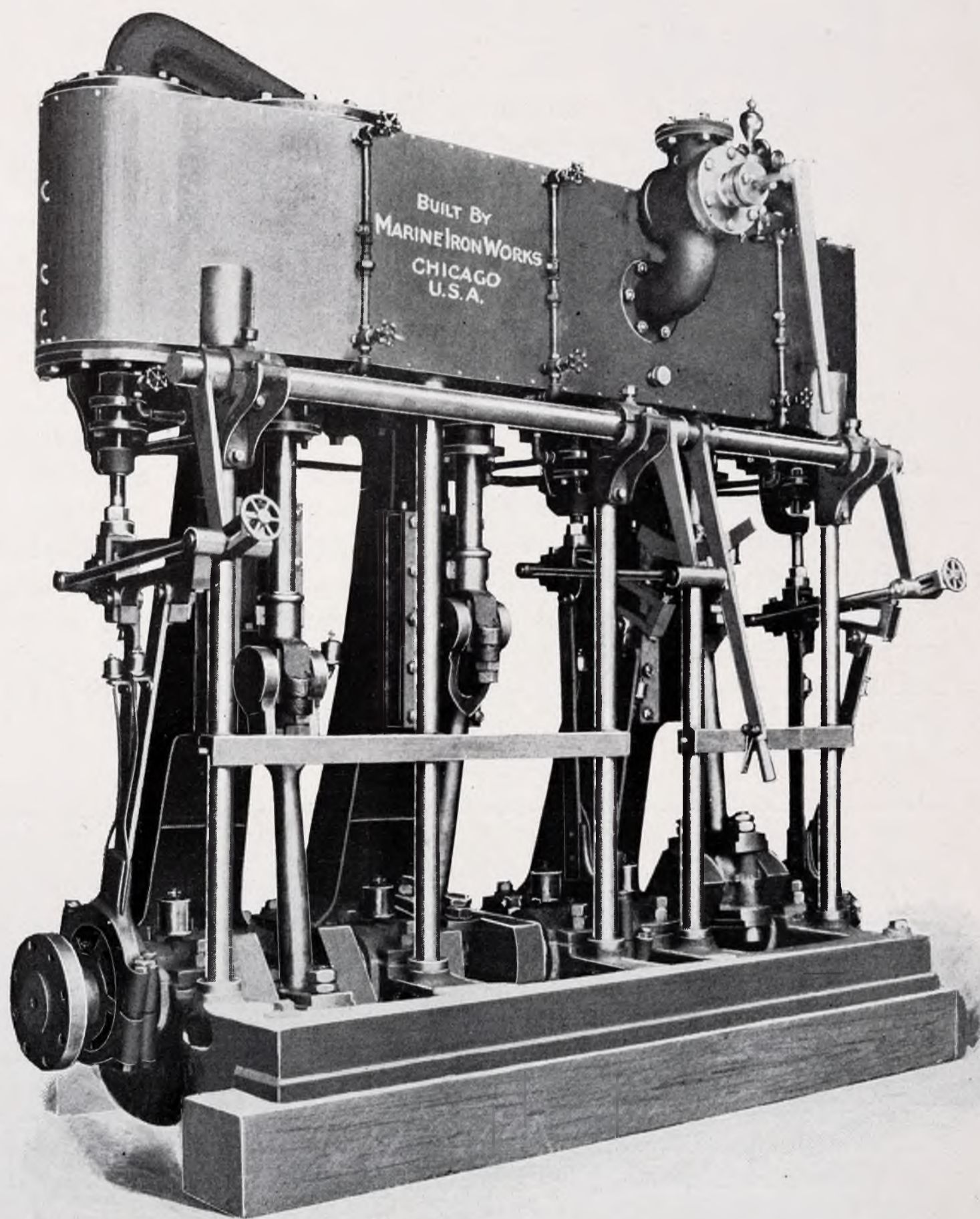
All rods, bearings and wearing surfaces are in proportion with crank shaft dimensions. Wearing pins are case-hardened. Cross-heads are steel.

Either screw-wheel or lever reversing gear as required.

Feed and Vacuum Pumps attached to Engine if desired.

Independent thrust bearings set close to Engine is our general practice, but they will be made of the collar type to form a part of the Engine if preferred. These as well as the stern and other bearings for the propeller shaft, are designed especially by us for these engines. Propeller wheels made to suit the boat and running conditions.

Estimates submitted on receipt of necessary details.



From photograph.

TRIPLE CYLINDER FORE AND AFT COMPOUND MARINE ENGINE.

SPECIAL.

The accompanying engraving, which is reproduced from a photograph of one of our three-cylinder Compound Engines that we have recently built, will, in itself, show to the critical engineer points of excellence sought for and secured.

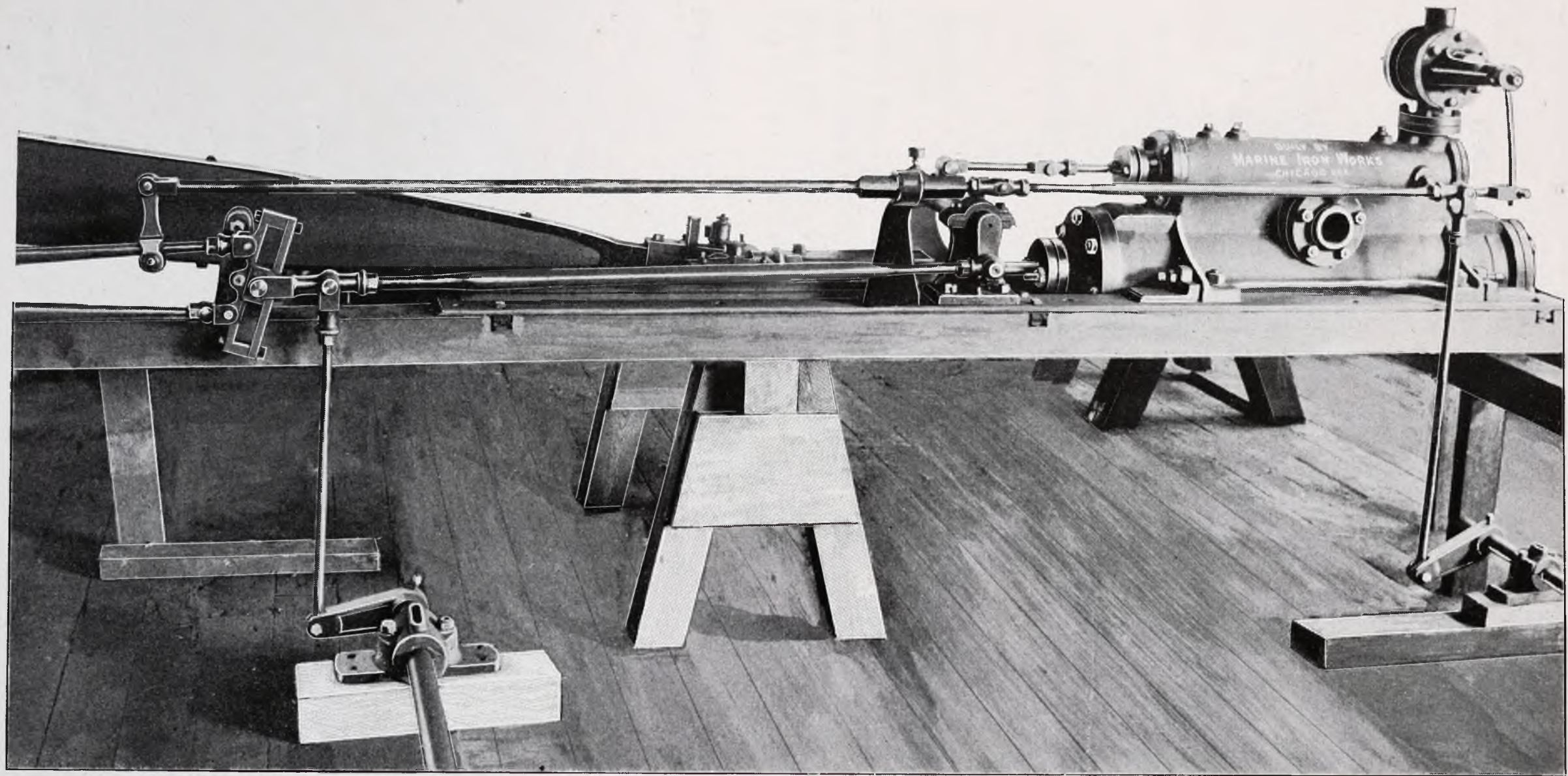
With the high-pressure cylinder in the center between the two low-pressure cylinders, and the cranks set at 120 degrees, not only is the counterbalancing of weights secured, but also a splendid distribution of the steam—the two low-pressure cylinders each being of the same area and proportioned according to the average steam pressure to be carried.

Although the frame design is of the most substantial form, the total weights are kept within a very moderate limit (power considered) through the use of semi-steel instead of cast iron, this material being used in the bed plate as well as in the frames, while a special composition is employed in the cylinder castings, of precisely the same character as that now used successfully in torpedo-boat engines where with highest steam pressures the most severe duty is exacted of them.

The following principal details of the engine illustrated may interest some of our readers :

Diameter of the high-pressure cylinder, . . .	12 inches.
Diameter of each low-pressure cylinder, . . .	18 inches.
Length of stroke,	14 inches.
Double-ported balanced piston valves on all three cylinders.	
Expansion rings on each valve.	
Crank shaft slotted out from a solid open-hearth steel forging and finished to 5½ inches diameter.	
Crank pins 5½ inches diameter by 6¾ inches long.	
Width of bed plate,	52 inches.
Length of bed plate,	7½ feet.
Height to top of cylinders,	7¼ feet.
Weight of engine,	9,000 pounds.
Steel crossheads. Adjustable bronze slippers.	
Wearing pins casehardened.	

The accessories and attachments are perfect and very complete. The finish, without being elaborate, is of the practical kind and consistent with an up-to-date high-grade Marine Engine.



7½ x 34 STERN PADDLE WHEEL MARINE ENGINE.

FITTED WITH DOUBLE-PORTED BALANCED PISTON VALVE AND INDEPENDENT ADJUSTABLE CUT-OFF VALVE.

FROM PHOTOGRAPH OF ONE OF A PAIR BUILT FOR 250 POUNDS WORKING STEAM PRESSURE.

MODERN STERN PADDLE-WHEEL MACHINERY.

The noticeable advancement that has taken place in the design and efficiency of small and medium size Stern Paddle-Wheel Machinery, during the past two or three years in particular, is clearly traceable to the greatly increased demand for the higher power and reduced weights, resulting in many successful steamboats now doing a profitable business on streams so shallow that a lead pencil would almost serve as a sounding pole and on waters so rapid that until recently they were abandoned as impossible to navigate on a paying basis.

The elements which enter into the design and construction of all successful steam craft are more numerous and conflicting, when the boat is to be used for general business purposes on shallow, rapid rivers, than is commonly understood. The machinery, equipment and power must be proportioned not only to the hull, the load and the runs to be made, but more especially to the shallow water and swift currents, requiring careful distribution of the weights; while the character of the feed water, as also the kind of fuel to be burned, demands consideration.

The high working steam pressures which it is now entirely safe and proper to carry on the better class of internally fired Marine Boilers have done more toward successfully meeting the obstacles of river navigation than any other one feature, for with engines designed, built and fitted out for steady service under such pressures, the total weight of the outfit of driving machinery is very considerably reduced, as is also the space occupied. Take, for instance, a 100-foot river boat, fitted with the old type of 10 x 48 slide-valve engines and cumbersome bricked-in boilers, that alone load the boat to nearly its maximum draft, while the actual *effective* power transmitted to the wheel seldom equals that which is now steadily supplied by 8 x 42 or 8 x 36 machinery, and yet the weight and space occupied by the heavy machinery is practically double that of the up-to-date outfit.

Buyers contemplating the purchase of such machinery, however, must not overlook the facts and base their calculations, arbitrarily, upon certain diameter of cylinders and length of stroke, as there is nothing gained through over-powering the hull and putting in more machinery than consistent proportions for the paddle wheel could take care of handily. Instead of a gain through such a proceeding, there would be a positive loss.

We are now building (on orders only) thirty-two different sizes of these Stern Paddle Wheel outfits, of which twenty-two are high pressure and range from double 16 x 72 inch engines down to double 4 x 16 inch, with ten sizes of Horizontal Tandem Compound. All strictly up-to-date. No old designs to work in. No cumbrous or complicated valve gear to cause trouble or require expert management. Even the smallest have the rocker shaft.

We enumerate our standard sizes of high-pressure stern paddle wheel engines, with kind of valve as follows :

- 4 x 16 Engines, slide valve.
- 5 $\frac{1}{2}$ x 20 Engines, slide valve.
- 7 x 28 Engines, slide valve.
- 8 x 42 Engines, slide valve.
- 8 x 48 Engines, slide valve.
- 10 x 48 Engines, slide valve.
- 6 x 24 Engines, double ported balanced piston valve.
- 6 x 30 Engines, double ported balanced piston valve.
- 7 $\frac{1}{2}$ x 28 Engines, double ported balanced piston valve.
- 7 $\frac{1}{2}$ x 34 Engines, double ported balanced piston valve.
- 8 x 36 Engines, double ported balanced piston valve.
- 8 x 42 Engines, double ported balanced piston valve.
- 10 x 40 Engines, double ported balanced piston valve and independent adjustable cut-off valves.
- 10 x 48 Engines, double ported balanced piston valve and independent adjustable cut-off valves.
- 12 x 48 Engines, double ported balanced piston valve and independent adjustable cut-off valves.
- 12 x 60 Engines, double ported balanced piston valve and independent adjustable cut-off valves.
- 14 x 56 Engines, double ported balanced piston valve and independent adjustable cut-off valves.
- 14 x 60 Engines, double ported balanced piston valve and independent adjustable cut-off valves.
- 14 x 66 Engines, double ported balanced piston valve and independent adjustable cut-off valves.
- 15 x 60 Engines, double ported balanced piston valve and independent adjustable cut-off valves.
- 15 x 72 Engines, double ported balanced piston valve and independent adjustable cut-off valves.
- 16 x 64 Engines, double ported balanced piston valve and independent adjustable cut-off valves.
- 16 x 72 Engines, double ported balanced piston valve and independent adjustable cut-off valves.

Lengths of connecting rods, diameter of wheel shafts, number of wheel flanges and the number of paddle arms they carry, with similar details, will be supplied, with quotation, on our learning the requirements as suggested on following page.

As to further details of construction, the cross-heads are regular marine type, with bronze gibs, adjustable at both top and bottom. The cross-head pins are steel and casehardened.

In the smaller sizes, up to and including 7 x 28 inch engines, the connecting rods are hollow iron. In all larger sizes the rods are forged steel, wood filled. The boxes ("brasses"), in all sizes, have the strap and key take-up.

Our engine cylinders, in every size, being absolutely rigid when in their fixed position, are adjustable in all directions on their bed-plates, thus insuring perfect alignment with the crank end, the bed-plates remaining fixed without being interfered with if, through warping of the wheel timbers, adjustment is necessary—a feature which every engineer familiar with stern wheelers understands the importance of, and asks that a method exists for him "to do it without taking the boat apart."

Several years ago we abandoned the cheaper plan of round-bottom "webbed" cast-iron beds for stern-wheel engines as decidedly objectionable, both on account of excessive weight, chance for serious breakage, and a lack of proper adjustment, the actual weight of the old-style cast-iron "webbed" plates for a pair of 7 x 28 inch engines being 620 pounds against 300 pounds for the wrought steel, as explained above.

For steel hulls, and also for boats shipped in sections—in fact, for any stern wheeler, as far as that is concerned—the wheel "timbers" may be made of steel, and well worth the increased cost, their weight closely approximating those made of wood. At this writing, we have several outfits in process of construction for Alaska (on orders) that have this addition, and we indorse the plan as a most excellent one. It also permits our testing the engines under steam, on these original steel beams ("timbers") that will carry them, in the boat itself. Though they do not form a part of the driving machinery, being really a portion of the hull, we have included them in the outfits named.

The extra cost for the steel wheel beams is but little more than the expense of ordinary wood timbers to the boat builder, and even this is offset by the decreased cost of installing the machinery in position. We drill the bolt holes through the steel beams for the wood panels, which are usually carried out aft to the end of the wheel and inboard through the transom of the boat, making a positively rigid bearing without a chance for its warping to even a slight degree.

We do not, however, include steel wheel beams unless arranged for at the time quotation is made and order placed.

WHEN ORDERING.

Orders for complete outfits of stern paddle-wheel Marine Machinery should contain the following information :

Name of proposed steamboat and its hailing port.

Length of transom.

Whether single or double deck.

Whether boiler will be fired from forward or from aft.

These details are necessary for the purpose of our calculating exact length of wheel shaft needed, proper height for smokestack, and, if desired, the best arrangement for intermediate connections between boiler and machinery.

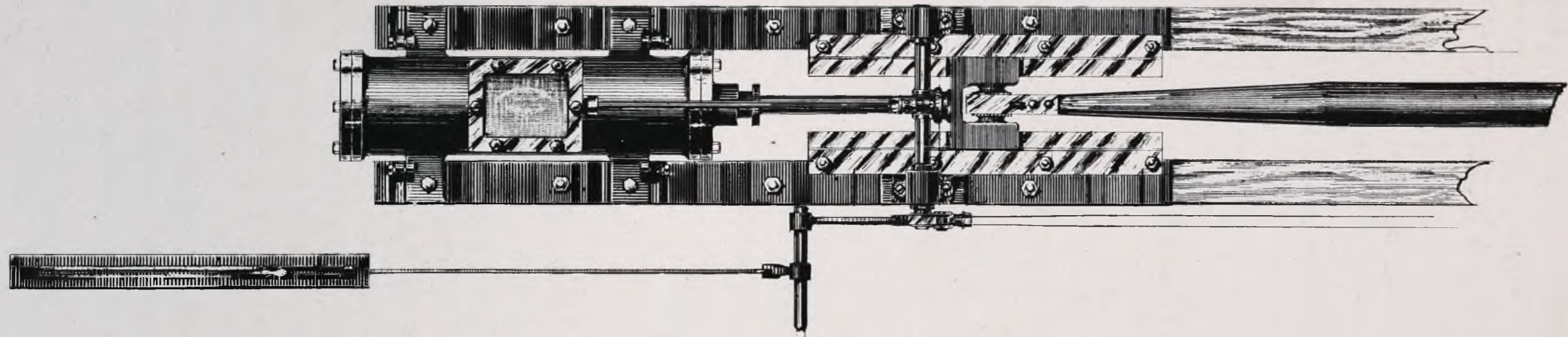
We will furnish, without charge, to those ordering complete outfits from us, a *general setting plan of the machinery*, showing all the piping, valves, fittings and connections, with an arrangement of those details that we have demonstrated in actual practice to be good. From these general plans it is only necessary to increase or decrease the lengths of the main piping to apply them to any modern stern paddle-wheel steamboat.

DEMAND, THAT

The *entire* outfit of driving machinery be complete, ready to install *and raise steam and built* by some *one* responsible concern who make a specialty of stern paddle-wheel work, are experienced in the construction and *operation* of such boats and understand the requirements for shallow waters. **INSIST** that the pair of engines be tested under steam pressure by the builders ; this will require the connecting and eccentric rods fully completed and engines lined up.

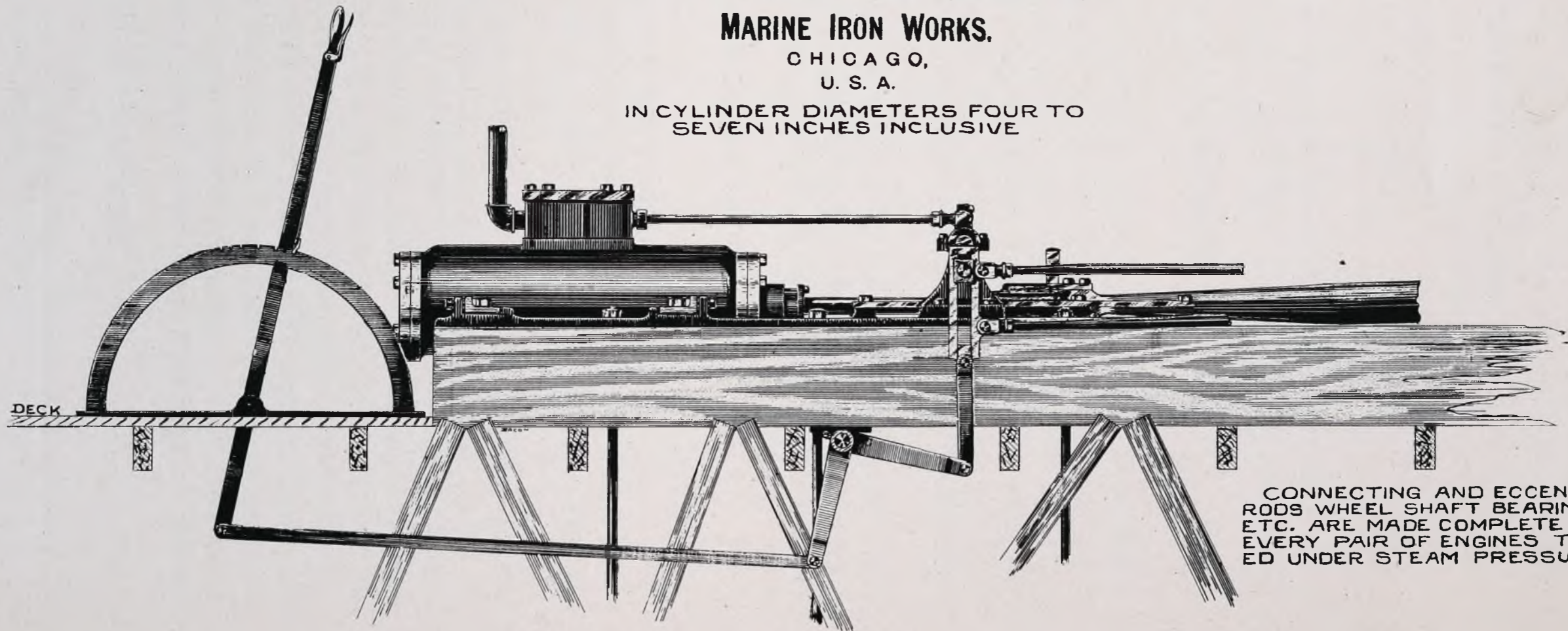
"A MERE SUGGESTION."

A thorough investigation of the real simon-pure kind, without prejudice or favor, will prove of more value *before* a contract is made than later on. If practicable visit the shops and *see* for yourself just how much (and how little) of "the complete outfit" is *built* there, the general *character* of work being done in the machine shop and boiler shop, and that it is marine *exclusively*.



STERN PADDLE WHEEL MARINE ENGINE
 SLIDE VALVE PATTERN AS BUILT BY
MARINE IRON WORKS.
 CHICAGO,
 U. S. A.

IN CYLINDER DIAMETERS FOUR TO SEVEN INCHES INCLUSIVE



CONNECTING AND ECCENTRIC
 RODS WHEEL SHAFT BEARINGS
 ETC. ARE MADE COMPLETE AND
 EVERY PAIR OF ENGINES TESTED
 UNDER STEAM PRESSURE.

MARINE BOILERS.

To comply with the United States Rules and Regulations, Marine Boilers must be built to order. The material is tested by the Inspection Department before work on the boiler can be commenced, and this cannot be done until the United States Inspector is informed by affidavit from the manufacturer of the name of vessel, etc., into which the boiler is to be placed. The test is rigidly complete, and with the provisions for construction is of great value to the purchaser, but it leaves no room for a countermand or any change in the order, and practically amounts to the boiler being the buyer's property even while it is in process of construction; hence our terms, as stated on page 40, are consistent and entirely without reference to the responsibility of the purchaser.

Although three to four weeks is ample time for us to build a boiler, it requires two to four weeks to procure the tested material; therefore, forty-five to sixty days should be allowed in which to make shipment.

HORSE-POWER OF BOILERS.

We do not place a "horse-power" rating on our boilers. The term, as applied to Marine Boilers in particular, leaves room for serious misunderstanding, for it is the design, size and details of engine that determine the power.

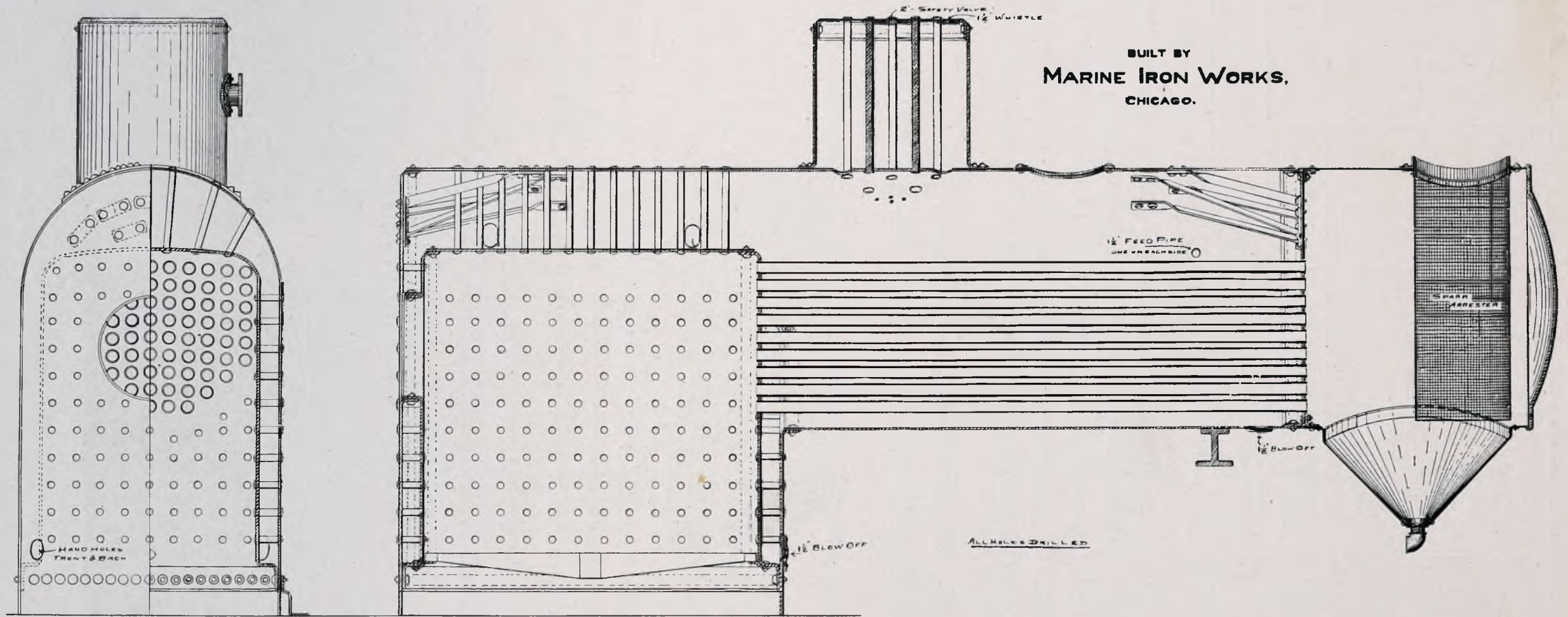
If correspondents when asking price on a Marine Boiler will inform us as to the kind of engine, diameter of cylinder, length of stroke, average working steam pressure required, revolutions per minute, kind of fuel to be used, and what assistance, if any, would be given to the draft, we can then calculate the proper size of boiler needed, with a safe margin of allowance, but without the chance of having too small a boiler, or of its being unnecessarily large.

WHEN ORDERING A MARINE BOILER.

Where possible, and to comply fully with United States Inspection requirements, it is desirable to furnish with an order for Marine Boiler all of the following information:

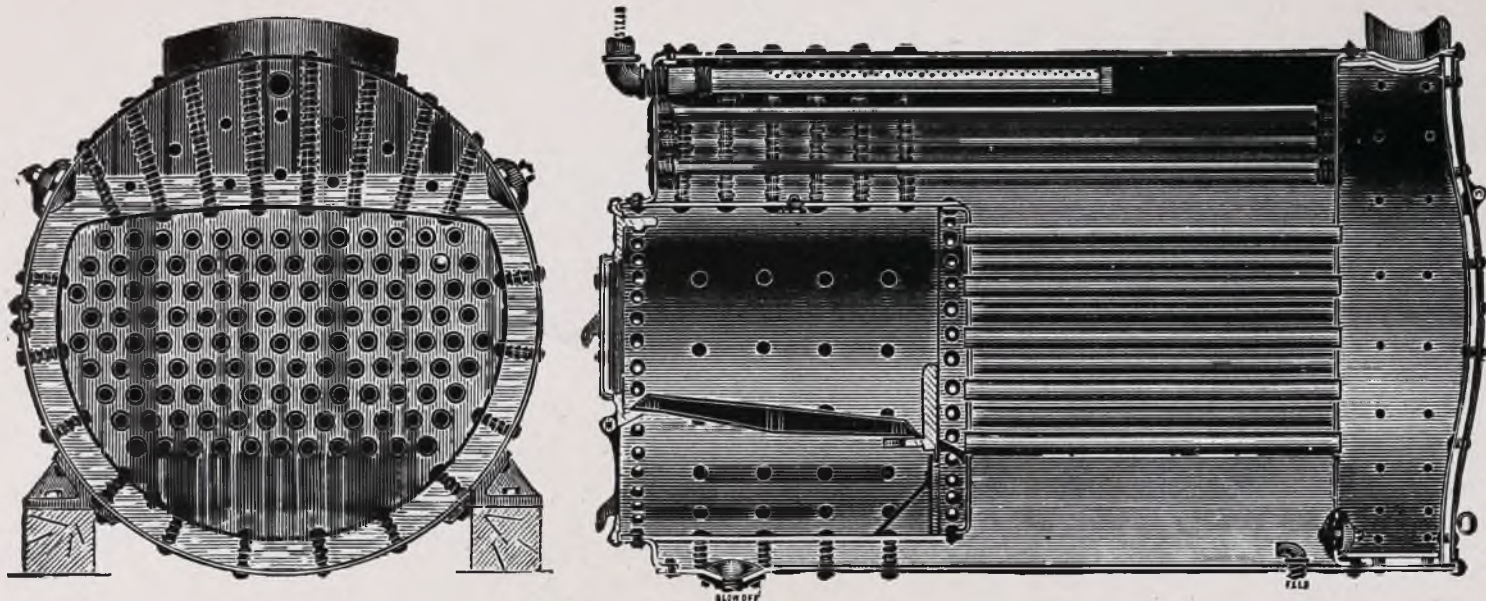
- Name of steamer and its hailing port.
- Waters on which boat will navigate.
- Where and when hull was built and by whom.
- Name and address of present owners of vessel.

Under no circumstances is it expected that salt feed water will be supplied to the boiler unless specifically arranged for at time quotation is made and order placed.



"COLUMBIA" MARINE BOILER. WOOD BURNER.

ESTIMATE ON APPLICATION EXPLAINING DETAILS AS TO REQUIREMENTS.



HORIZONTAL FIRE BOX MARINE BOILERS.

(BEST'S PATENT OF JUNE 6, 1893.)

These boilers are designed especially for marine duty where common soft coal or wood is used as fuel, hence the roomy fire box; where a low center of gravity is of importance, where high steam pressure is to be carried and where very ordinary attention in the way of firing is expected.

The conveniences for cleaning the tubes and combustion chamber, as well as the boiler itself, is apparent when it is understood that the back head (smokestack end) is hinged or bolted on and may be swung upward or easily unbolted and removed.

The ample storage capacity for steam renders a dome or steam drum unnecessary.

As with all our Marine Boilers, the holes are fairly drilled, and we guarantee the work and material to conform to the United States Marine Rules.

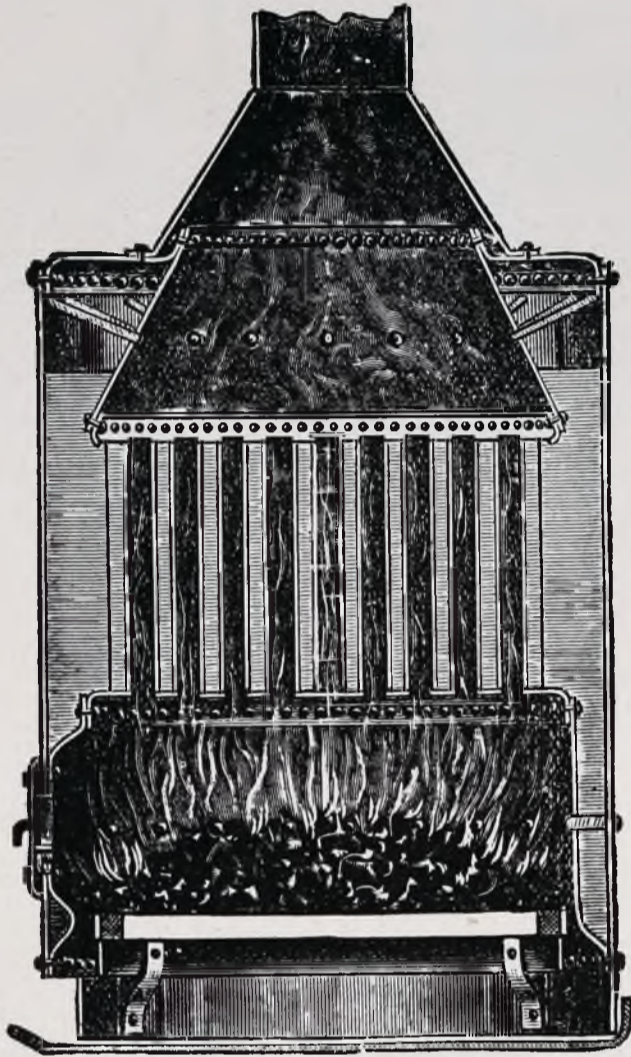
These boilers are mounted on skids and completely fitted out with first-class marine trimmings, which include smokestack, grates, steam and water gauges and gauge cocks, firing tools, steam whistle, pop safety valve and blow-off valve. Orders should specify whether coal or wood is to be burned.

We list a few standard sizes from the many different ones that we build in this very efficient type of boiler.

SHELL.		FIRE BOX.		Square Feet of Heating Surface.	Licensed Steam Pressure. U. S. Rules.	Approximate Weight, Complete. Pounds.
Diameter. Inches.	Length. Feet.	Width. Inches.	Length. Inches.			
24	5	20	24	35	150	1,000
30	5	25	28	60	150	1,600
36	6	30	40	95	165	2,600
42	6	37	40	140	140	3,300
48	8	42	52	215	155	5,000
54	9	48	52	300	165	7,000
60	10	54	52	425	150	9,000

SUBMERGED TUBE VERTICAL MARINE BOILERS.

NO RESTRICTIONS.



For small launches there is much in favor of a well-designed and suitably built Submerged Tube Vertical Marine Boiler.

They are quick and easy steamers, and with the right shape and proportion of "cone," have ample storage capacity for the steam.

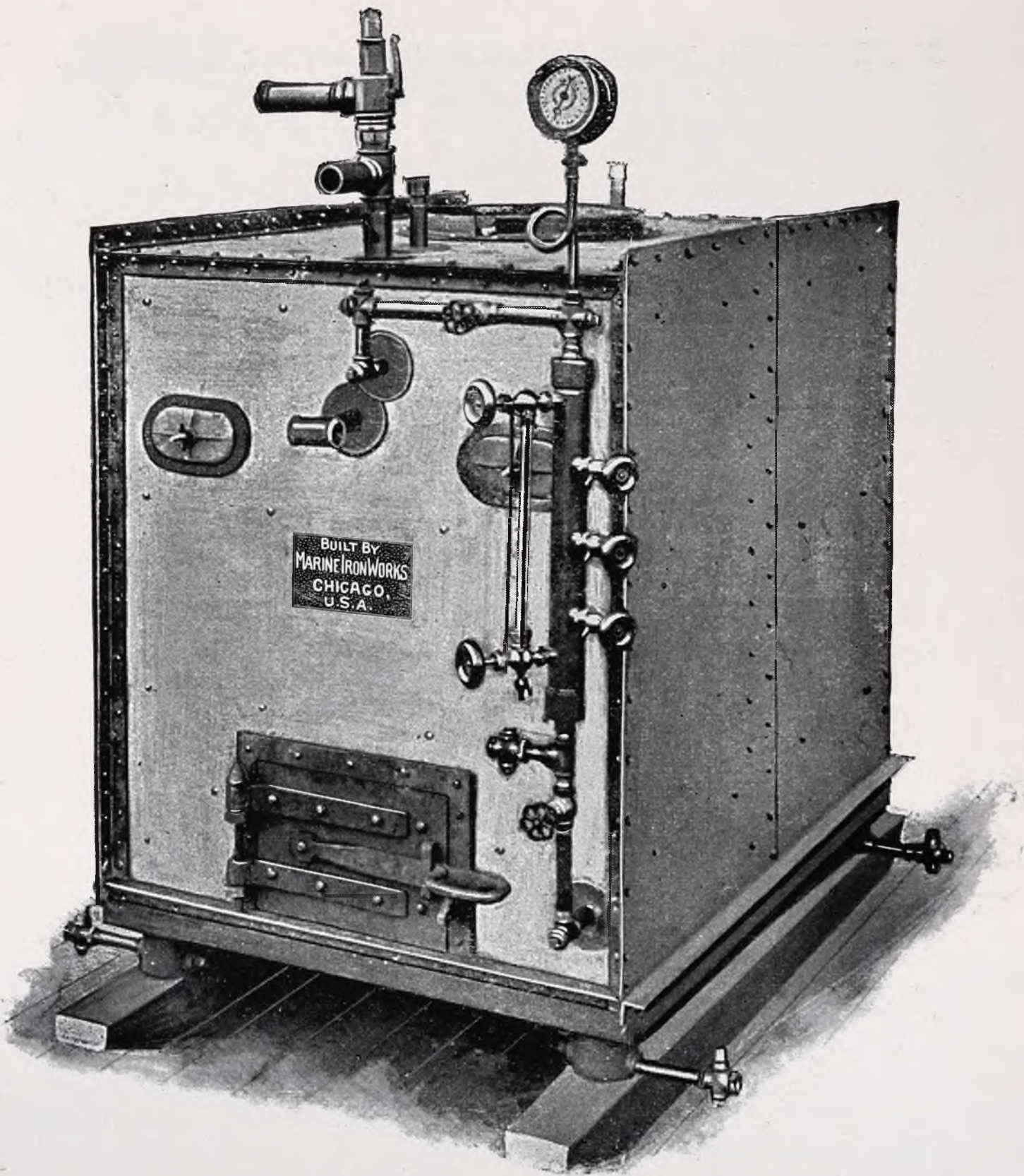
They occupy but little space and are not top-heavy. Ours are very easily cared for, are safe, and being built expressly for launch duty will stand rough usage without leaking. *All holes are fairly drilled.*

We build them to order according to the United States Marine Laws, and guarantee every boiler to pass inspection, for use on any waters under control of this Government.

Our standard sizes are as follows :

SHELL.		TUBES.		FIRE BOX.			Square Feet Heating Surface.	Licensed Steam Pressure.
Diameter.	Height over Ash Pan.	No.	Diameter.	Height.	Diameter.	Height of Ash Pit.		
26	50	36	2	18	22	4	38	180
30	52	64	2	18	26	4	62	165
36	60	91	2	20	32	5½	95	165
42	64	120	2	20	38	5½	130	140
48	72	160	2	22	42	8	183	155
54	78	186	2	24	48	8	230	165

Each boiler is fitted up complete, from smokestack to water-tight ash pan, inclusive.



THE ROBERTS SAFETY WATER-TUBE BOILER.

We are builders, under license from the patentees, of this well and favorably known boiler, which for an all around source of satisfaction to the boat's owner and crew, furnishes its full share.

The Roberts boiler, of which there are about 1,000 in successful operation, will work under abuse that would ruin a shell boiler in a short time and when repairs are finally necessary they can be quickly and comparatively inexpensively done.

Every one of the Roberts boilers which we build is tested to a Hydrostatic pressure of not less than 500 pounds and specially made and carefully tested materials are used throughout; all the work is done by skilled workmen in the most careful manner; men who are experienced in building these particular boilers and are liberally supplied with modern shop equipment for doing thorough work and who realize that it must be done properly. The result is a boiler which we can honestly guarantee and such as we *know* will prove satisfactory.

Unless otherwise specified in the contract, a licensed working steam pressure of 200 pounds is provided for and *guaranteed*, and the safety valve set to blow off at that pressure, but we build these boilers for even higher pressure if desired.

In the western and inland waters where these boilers are the least known and where it is often necessary to feed muddy water into the boilers, all of the water-tube type have met with more or less well meaning, but as far as the Roberts boiler is concerned, wrong opposition, for *the perfect and very rapid circulation of the water in this boiler*, taken in connection with the four mud pockets leaves no opportunity for that filling up of the tubes with mud or sediment that on first impressions would appear probable. It has been fully demonstrated by the experience of those operating these boilers on boats plying on the Upper Missouri, Mississippi, Ohio, Alleghany and other rivers, that they are peculiarly desirable for light draft steamers; their shape, compactness, and light weight together with their quick and steady steaming capabilities, places them in the foremost rank for such duty.

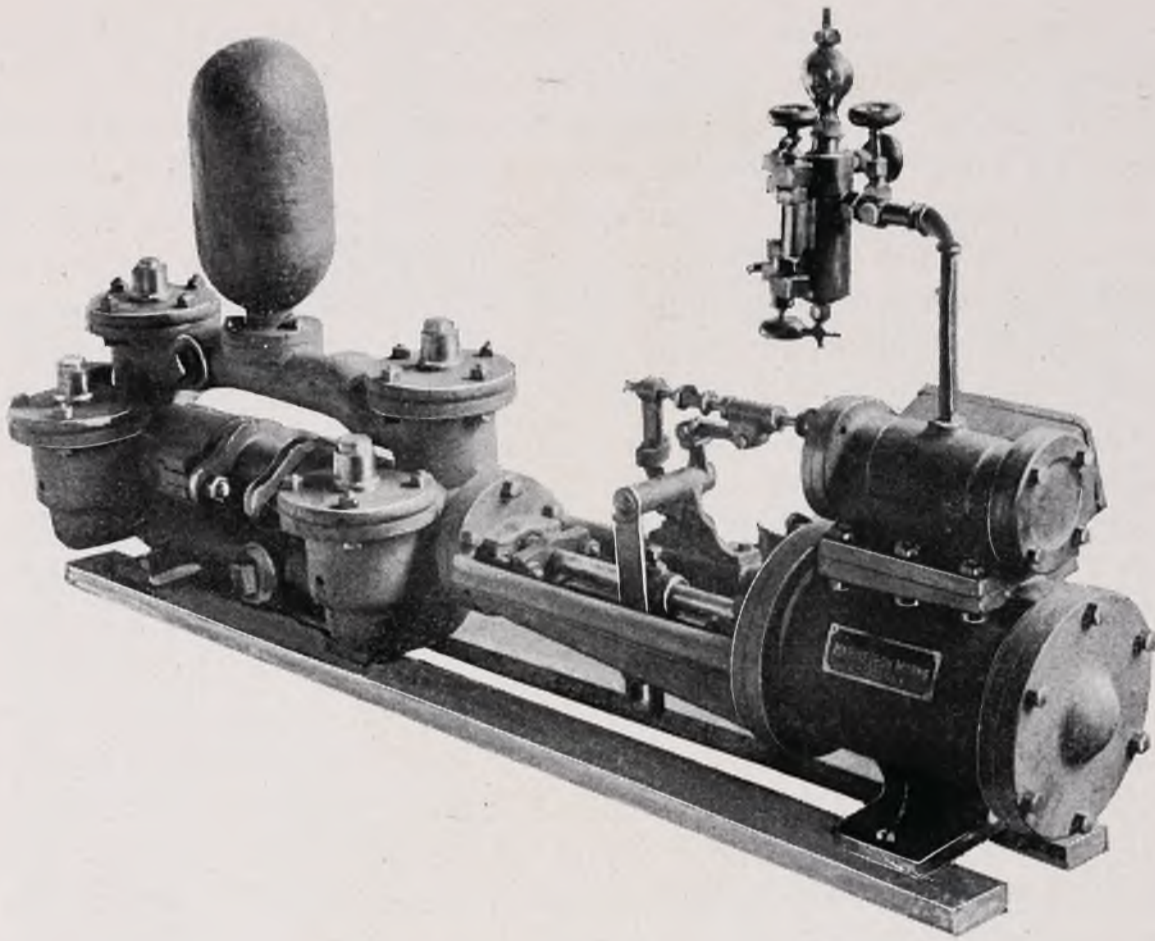
We build these boilers to meet the precise requirements of each particular case, not only as regards the form and space which is most convenient for them to occupy in the boat, but also as regards the kind of fuel to be used. For good soft coal or for hard coal the standard sizes as named below are practically alike, but where wood is to be used for fuel we change the proportions of the fire-box slightly, and also the grates, hence we would ask that our correspondents kindly advise us, along with other details, the kind, and average quality of fuel which they expect to use. There is no extra charge for building these boilers to fit the case, provided we are fully advised of the requirements along with the order.

With each boiler we furnish smoke stack, firing tools, steam whistle, combination body complete and connected to boiler as shown in the engraving, fitted with steam and water gauges, globe valves, compression gauge cocks and blow-off cocks; marine pop safety valve with connections as shown; also the connection for the boiler feed. All these fittings are of first grade and are suitable for the high steam pressure at which it is safe to operate these boilers.

The Roberts boilers are approved by the U. S. Marine authorities and we guarantee them to pass inspection on any waters in the United States. The standard sizes and proportions are as follows:

DIMENSIONS.

Size Number.	Width outside of Jacket.	Length outside of Jacket.	Height Inches.	Square feet Grate Surface.	Square feet Heating Surface.
0	1 $\frac{2}{3}$ feet.	2 feet	33	1.40	39
1	2 "	3 "	35	3.16	90
2	2 $\frac{1}{2}$ "	3 "	35	4.35	110
3	2 $\frac{1}{2}$ "	3 $\frac{1}{2}$ "	40	4.96	143
4	3 "	4 "	44	7.12	185
5	3 "	4 $\frac{1}{2}$ "	44	8.15	200
6	3 $\frac{1}{2}$ "	4 "	44	8.20	227
7	3 "	5 "	54	8.67	264
8	3 $\frac{1}{2}$ "	5 "	54	10.65	308
9	4 "	5 "	54	12.68	322
10	4 $\frac{1}{2}$ "	6 "	57	17.90	491
11	5 "	7 "	64	21.70	696
12	6 "	8 "	72	28.85	....
13	7 "	8 "	74	35.00	....
14	8 "	8 "	75	41.60	....
15	8 "	9 "	75	48.00	....
16	9 "	9 "	77	55.50	....



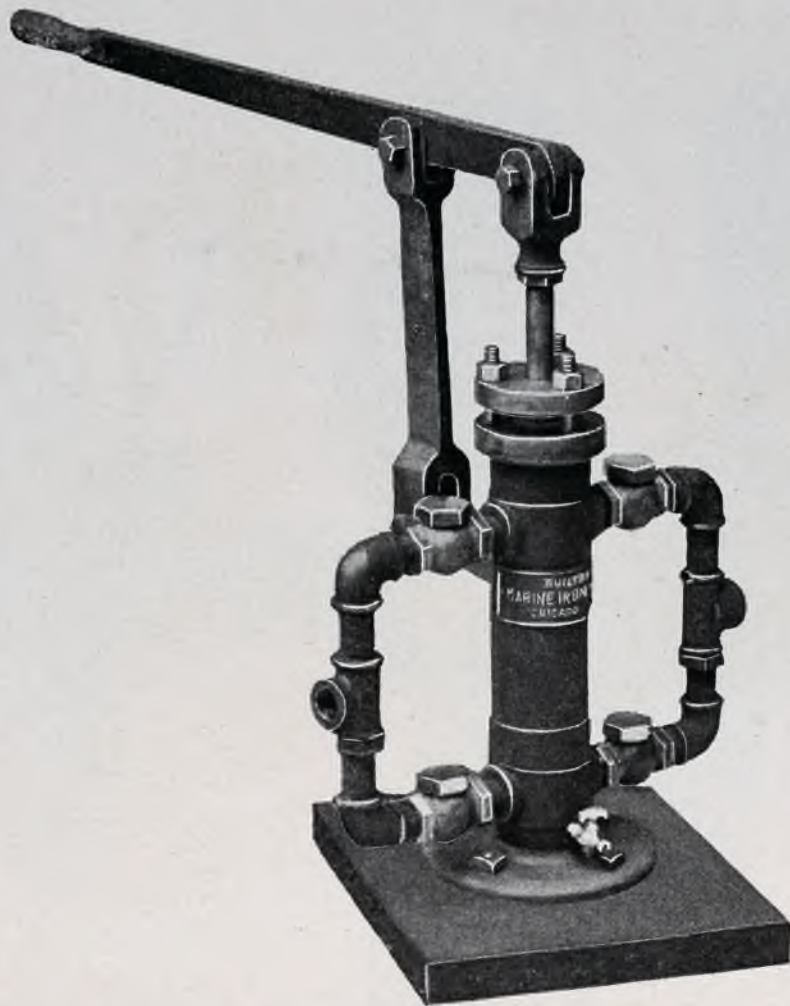
**“ MARINE ” OUTSIDE PACKED PLUNGER STEAM
BOILER FEED PUMPS.**

Where the feed water is absolutely clean and always free from sand or grit of any description, a well-made pump of the piston type will serve the purpose ; but for many light draft steam vessels that fortunate state of affairs does not exist, and for them the increased cost for one of our “ Marine ” *plunger* steam pumps is the best paying investment they can make about the driving machinery of their steamboat.

These pumps are adapted to highest steam pressures and are unquestionably efficient, while for reasons manifest to any engineer are wonderfully durable. No chance for hidden leaks and no cutting of the plungers, even when the water is impregnated with sand or other gritty matter.

Except in the smaller sizes the valves are as shown in the illustration, and seat loosely on a shoulder in the chamber, being held by screw in the cap pressing on the cage. This easy access to the valves presents good value.

Size Number.	At Moderate Speed will Deliver per Minute.	Diameter Steam Cylinder.	Diameter Water Cylinder.	Length of Stroke	Diameter of Discharge Pipe.	Width and Length, Inches.	Approximate Weight, Complete, Pounds.
0	9 galls.	3½	2	5	1	10 x 42	165
1	14 “	4¾	2½	5	1	10 x 42	285
2	16 “	4	2	6	1¼	10 x 48	285
3	35 “	6	3	8	1½	12 x 60	450
4	60 “	7	4	10	2	15 x 66	640
5	100 “	9	5	12	2½	24 x 84	1,100



COMBINATION DECK TEST AND HAND BOILER FEED PUMP.

(BRASS FITTED.)

This is a double-acting pump of special design and construction, capable of being worked by one man against 700 pounds pressure. It has brass piston (packed), brass piston rod and forged steel connections.

Diameter of piston, 2 inches.

Length of stroke, 5 inches.

Suction for 1-inch pipe.

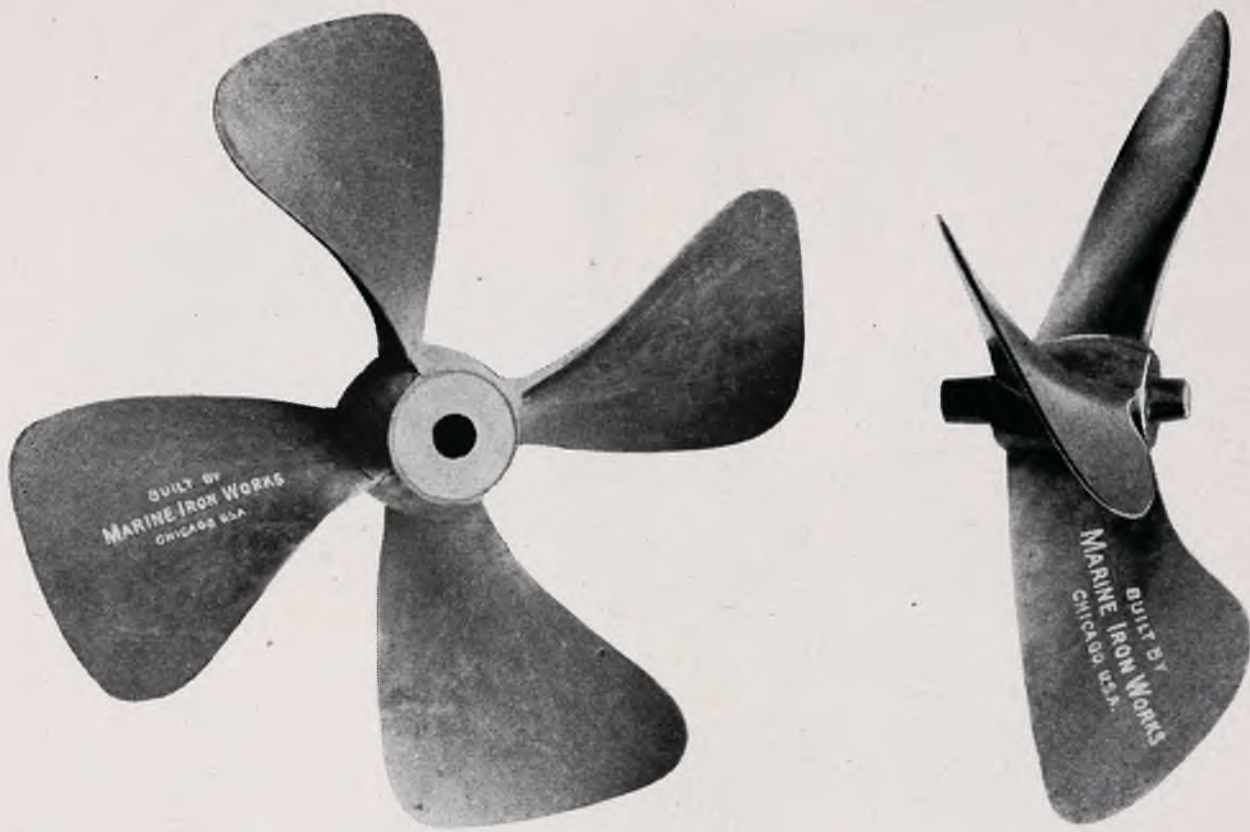
Discharge for $\frac{3}{4}$ -inch pipe.

Weight, including base plate, 60 pounds.

The illustration shows base for fastening down, but where the pump is intended for general purposes and to be moved from place to place (for inspectors or boiler-shop testing, etc.), we substitute a long base on which the operator may stand.

Repacking or cleaning out is conveniently done by simply unbolting and lifting the pump off from its base.

Where it is intended to use these pumps against pressures exceeding 350 or 400 pounds, that fact should be plainly stated in the order, that we may proportion the diameter of piston accordingly.



PROPELLER WHEELS.

We are often in receipt of letters congratulating us on the success of our propeller wheels, and not infrequently from those whose judgment on the subject is unquestioned. As a matter of fact, however, the success is, we think, largely attributable to our care in fitting the *conditions* in each case, rather than anything unique or very unusual about our patterns, none of which are patented or present startling conformations.

The too general use of some one certain pattern, no matter how good it may have proven in a few instances, is accountable in a very great degree for the rank failures of propeller wheels that are sometimes met with, and although we have many entirely separate and distinct patterns for each of our standard diameters of propeller wheels, we are constantly adding new patterns in the same sizes, in order to properly fit some unusual combination of machinery, hull, draft of water, revolutions per minute, service required, etc. It is an easy trick to take what has proved beyond a chance for an argument to be the very best possible wheel on some certain boat and transfer it over to a "somewhat similar vessel," where it would prove entirely unsatisfactory, the changed conditions accounting for the remarkable difference; hence, the number of patterns it is necessary to carry for each diameter and style of wheel and the care that we must exercise in making the selection.

If correspondents will be particular to state the duty required—whether for ordinary cruising, towing or speed purposes—we will guarantee a wheel to suit.



SECTIONAL PROPELLER WHEELS.

WITH STEEL OR SEMI-STEEL BLADES.

With extra blades for the one hub, the wheel may be changed from speed to towing without the delay or expense of docking the boat, while a broken blade may be replaced by a new one quickly and cheaply. The blades are not "adjustable" after being attached, and are therefore absolutely rigid.

Net Prices for four-blade wheels complete, ready for boring, F. O. B. Chicago :

DIAMETER.	With Semi-Steel Blades.	With Steel Blades.	DIAMETER.	With Semi-Steel Blades.	With Steel Blades.
38 inches	\$38.00	\$50.00	50 inches.....	\$50.00	\$70.00
40 "	40.00	53.00	52 "	55.00	75.00
42 "	42.00	57.00	54 "	57.00	80.00
44 "	44.00	60.00	56 "	60.00	85.00
46 "	46.00	62.00	60 "	65.00	95.00
48 "	48.00	65.00	66 "	75.00	125.00

Larger sizes quoted on receipt of details.

Extra blades will be made and fitted to hub at 15 per cent of the price

of the wheels if ordered with the wheel ; otherwise, each extra blade will be 20 per cent of the total cost.

Wheels with semi-steel blades made up on a few days' notice.

Steel blades are tough as a forging and the process has but one fault, viz : It requires two or three weeks' time to fill an order.

Net Prices for boring and key-seating, including key stock :

DIAMETER OF SHAFT.	Straight Bore.	Taper Bore.	DIAMETER OF SHAFT.	Straight Bore.	Taper Bore.
2½ inches.....	\$2.00	\$3.00	4 inches.....	\$3.50	\$5.50
2¾ "	2.25	3.75	4¼ "	3.75	5.75
3 "	2.50	4.00	4½ "	4.00	6.50
3¼ "	2.65	4.50	5 "	4.50	7.50
3½ "	2.75	4.75	5½ "	5.50	9.00

These prices are for boring sectional wheels at the time the wheel is made.

Our standard for tapered shaft is ¼ inch to the foot, and applies where the shaft, as well as the wheel, is made by us.

THRUST SHAFTS AND BEARINGS.

STERN BEARINGS.

STUFFING BOXES.

PROPELLER SHAFTS.

Thrust shafts, collars and bearings are with us *independent of the engine*, even on the smallest outfit we build. They are designed and proportioned according to the power of outfit and service in which boat is engaged. Are in all cases *adjustable*, and under no conditions form a part of the engine as is sometimes done on very small work.

Stern bearings in our medium and large size outfits are adjustable and fitted with "stirrup" for taking up wear from deck of vessel.

Stuffing boxes, propeller shafts, etc., receive the same attention and are in each case *made to fit the conditions*.

COMPLETE OUTFITS OF MACHINERY.

As a guide to those wishing to purchase marine machinery, where they furnish their own hull, we name below a few complete outfits; the proportions given being the result of experience in designing and building this class of work, with unusual opportunities for making thorough tests.

The dimensions for the hulls are not necessarily fixed for all cases, but are intended to be closely approximate.

You will have before you the fact that genuine *Marine* work is a specialty with us, and that as builders also of steam craft (complete from keel to smoke-stack), each article, fitting and bearing, in fact every piece included in the following "outfits" of Marine Machinery, is *guaranteed* suitable for the severe work it may be called upon to perform, and furthermore *the parts fit each other*, making the combination perfect and forming a successful whole.

While the steam connections between engine and boiler and pumps and boiler, etc., are not included, both boiler and engine are fitted out very complete with the best and most reliable fittings for marine service. The word "complete" as applied to engine or boiler invariably calls for all the fittings which our catalogue enumerates with such machinery.

IMPORTANT.

That we may know the exact lengths of propeller shafts required, advise us the distance between center of engine and the face of stern-post. We will add for bearings and wheel and deduct for engine crank.

For stern paddle-wheel outfits, state the distance between the inside faces of wheel timbers ("outriggers").

MACHINERY OUTFIT.

SUITABLE FOR 32-FOOT HULL.

5 x 5 High Speed Marine Engine, complete with best fittings. See pages 2 to 5.....	
Finished steel propeller shaft, 1 $\frac{3}{4}$ -inch diameter, with keys and pin.....	
Flange couplings, fitted to shaft, with keys and bolts.....	
Thrust bearing, with loose brass collars, fitted to shaft.....	
Stern bearing, fitted to shaft.....	
Two inch Galvanized stern tube.....	
Stuffing box, fitted to tube and shaft.....	
One 28-inch 3-blade speed propeller wheel, fitted and keyed.....	
Bilge pump syphon, size "A".....	
Sea-cock flange, with strainer and angle valve.....	
30 x 52 Submerged tube Marine boiler, all complete, with best fittings and stack....	
No. 1 Lever Injector.....	
Steam Boiler feed pump complete, including hand lever.....	
Exhaust steam feed water heater, ready to attach.....	

7 x 7 MACHINERY OUTFIT.

SUITABLE FOR 45 TO 48 FOOT HULL.

7 x 7 High Speed Marine Engine, complete with best fittings.....	.....
Finished steel propeller shaft, 2¼ inch diameter, with keys and pin.....	.....
Flanged couplings, fitted to shaft with keys and bolts.....	.....
Thrust bearing, with loose brass collars fitted to shaft.....	.....
Stern bearing fitted to shaft.....	.....
2½-inch Galvanized stern tube.....	.....
Stuffing box, fitted to tube and shaft.....	.....
One 36-inch 4-blade speed propeller wheel, fitted and keyed.....	.....
Bilge pump syphon, size "A".....	.....
Sea-cock flange, with strainer and angle valve.....	.....
42 x 72 Horizontal "Clyde" Marine Boiler, complete, with best fittings and stack...	.....
No. 2 lever injector.....	.....
Steam Boiler feed pump complete.....	.....
Hand Boiler feed pump complete.....	.....
Exhaust steam feed water heater, ready to attach.....	.....

9 x 10 MACHINERY OUTFIT.

SUITABLE FOR 60-FOOT HULL.

9 x 10 Marine Engine, complete with best fittings.....	.....
Finished steel propeller shaft, 3-inch, with keys and nut.....	.....
Thrust bearing, fitted to shaft, adjustable box pattern, with oil trough.....	.....
Flange couplings, fitted to shaft.....	.....
Stern bearing fitted to shaft.....	.....
3½-inch Galvanized stern tube.....	.....
Stuffing box, fitted to tube and shaft.....	.....
One 46-inch 4-blade propeller wheel, fitted and keyed.....	.....
Bilge pump syphon, size "B".....	.....
Sea-cock flange, with strainer and angle valve.....	.....
54 x 84 "Clyde" Marine Boiler, complete, with best fittings and stack.....	.....
No. 4 Lever Injector.....	.....
Steam Boiler feed pump complete.....	.....
Deck test and hand boiler feed pump.....	.....
Exhaust steam feed water heater, ready to attach.....	.....

6 x 7 TWIN SCREW OUTFIT.

SUITABLE FOR 55-FOOT HULL.

- Two 6 x 7 High speed (right and left) twin screw Marine Engines, each
all complete with bestfittings.....
- Two Finished steel propeller shafts, 2¼ inches diameter, with keys and pin.....
- Flanged couplings, fitted to shafts.....
- Two special thrust bearings, fitted to shafts.....
- Two combination flange stern bearings and tubes, special for twin screw
work, with stuffing boxes attached.....
- Two 32-inch four blade right and left speed propeller wheels, fitted.....
- One bilge pump syphon, size "A".....
- One sea-cock flange, with strainer and angle valve.....
- One 48 x 96 Horizontal fire-box Marine boiler complete, with best fittings and stack.
- One No. 3 Lever Injector.....
- One Steam boiler feed pump complete.....
- One Hand boiler feed pump complete.....
- One Exhaust steam feed water heater, ready to attach.....

DOUBLE 6 x 30 STERN PADDLE WHEEL MACHINERY.

SUITABLE FOR FAST 70-FOOT BOAT.

- Two 6 x 30 double-ported balanced piston valve, direct-acting stern wheel Marine
Engines, each with eccentric and connecting rods fitted up complete. Finished
steel wheel shaft, having wheel flanges fitted on. Engines lined up and *tested*
under steam. Both reversing links operated by rocker shaft and one locomotive
lever working in double quadrant with cut-off notches indicated. Each engine
fitted out with best grade of Marine trimmings, from throttle valve to wrenches,
ready for steam and suited to highest pressures. See page 21
- One No. 10 (4½ x 6) Roberts Safety Water Tube Marine Boiler, with water-tight ash pan,
smokestack, steamboat whistle, gauges and fittings complete. Boiler tested to
500 pounds, hydrostatic pressure. See page 31.....
- One Injector, special for high-working steam pressure
- One Marine outside packed plunger steam pump. See page 32.....
- One Combination deck test and hand boiler feed pump. See page 33
- One Bilge Syphon, complete
- One Sea-cock Flange, with strainer and angle valve
- One Exhaust steam feed water heater ready to attach.....

FACILITIES.

We have a particularly favorable location and equipment for building and delivering marine machinery and complete steam craft.

Our shops and yard are located on the Chicago River, (North Branch) just above Clybourn Place Bridge, where our ample water frontage affords convenient facilities for launching, fitting out and testing the finished boat. At our dock we have a depth of 15 feet of water, and can deliver by water to New Orleans or to New York or to intermediate or tributary points.

For rail shipments a private switch track runs into our yard and connects with the different Railroads that enter Chicago.

With Machine Shop, Boiler shop, Pipe and Fitting-up shops, as well as boat yard and offices all together and under one supervision, absolutely reliable work is produced with dispatch and on an as economical a basis as is possible to formulate.

PRICES.

Owing to the special character of our work and the fact that each outfit of machinery or complete boat, is built *to order* to meet the exact and oftentimes peculiar requirements of each particular case, it is impossible to make up a price list to fully cover our line; but if those wishing estimates, either on complete steam craft or on the outfit of Marine Machinery (without hull) will advise us of the following particulars as to their requirements, we will be pleased to submit quotations in detail.

Extreme length of hull on deck.

Beam outside of planking amidships.

Limit of draft when loaded.

Waters on which boat is to run (if a river, state velocity of current).

Whether snags or weeds, etc., are encountered to any extent.

Whether wood or coal is to be burned in boiler.

General character of work for which boat is required.

With this information before us, we will be in position to quote on either single or twin screw propeller, or on stern or side paddle wheel work; choosing that which is *most* suitable.

If it is expected to operate the boat on salt and on fresh water alternately, state the approximate length of run on salt water that we may include condensing apparatus if it be necessary, or advisable, to have it.

TERMS.

Twenty-five per cent of the amount to accompany order.

Twenty-five per cent additional when work is fully one-half completed. Balance when job is finished.

These terms are alike to all, irrespective of the responsibility of the purchaser; the machinery offered being Government test work, and built especially to order. The name of steamer and hailing port should accompany each order, that no delay ensues in our securing the official test, by the United States Inspectors, of material to be used in the boiler.

COMPLETE BOATS.

WE build the various successful types of complete boats in single screw, twin screw, side paddle and stern paddle wheel designs, within the limit of sizes that can be safely shipped, and will be pleased to submit estimates with drawings or blue prints on receipt of necessary data as to requirements, regarding which see page 40 of this catalogue.

MARINE IRON WORKS.

