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DEPARTMENT OF COMMERCE

LIGHTHOUSE SERVICE

SPECIFICATIONS

FOR THE

THIRD-CLASS STEEL STEAM LIGHT VESSELS

Nos. 103 and 104

1917

WASHINGTON : GOVERNMENT PRINTING OFFICE : 1917

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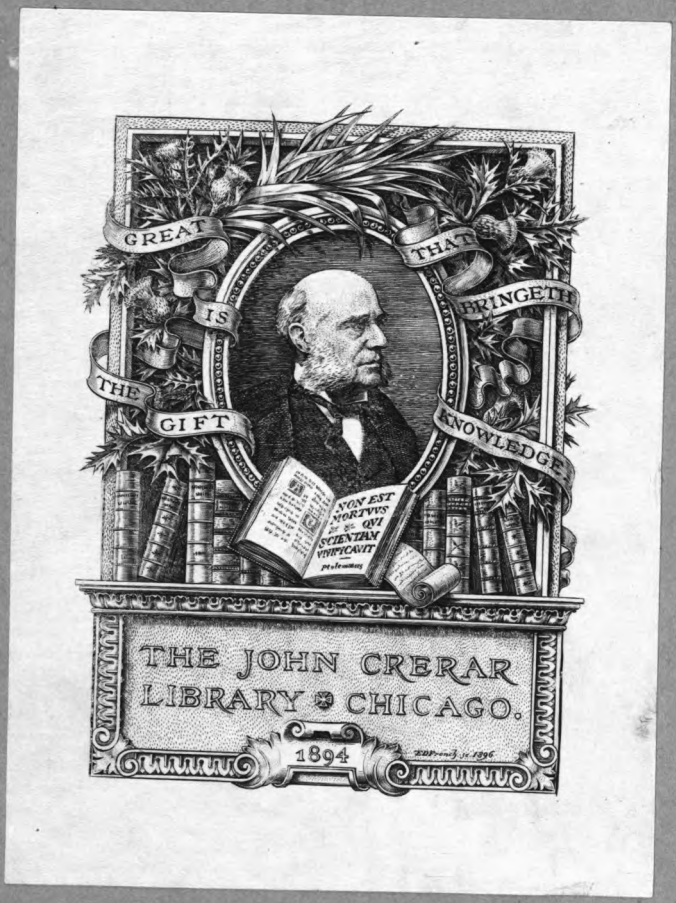

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SPECIFICATIONS

FOR THE

THIRD-CLASS STEEL STEAM LIGHT VESSELS

Nos. 103 and 104.

DIMENSIONS AND DESCRIPTION.

1. Principal Dimensions.—

	Ft.	in.
Length over all	96	5
Length on designed water line, from after side of stem to forward side of propeller post	80	8
Beam molded	24	0
Minimum depth of hold at center line from top of main deck beam to top of keel	11	9

Displacement molded at 9 feet, mean draft, fresh water, approximately 310 tons.

Draft: Aft, 9 feet 6 inches; forward, 8 feet 6 inches.

2. General Description.—The vessel shall be constructed of steel, and, where practicable, other fireproof materials. It shall have a continuous sheer line, raised continuous wooden upper deck, an overhanging stern, bilge keels, a steel pilot house, and acetylene gas tank storage room, steel skylights and companionway, a tubular steel lantern mast for the support of the characteristic light, etc., a wooden jigger mast with boom and leg-of-mutton sail and range light, a smokestack with a mechanically operated fog whistle and a running whistle, a steam hoisting engine, a fog bell located on the forward deck, and such other features as are hereinafter specified.

The hull proper shall consist of a steel framing and shell, a continuous steel main deck; water-tight flats forward and aft and three water-tight transverse bulkheads, and also transverse and longitudinal water-tight coal-bunker bulkheads; the coal-bunker openings shall be fitted with cast-iron, vertical, water-tight sliding doors; the forward and after trimming tanks shall be fitted with air vents, and all appliances for effectively filling, emptying, and sounding.

The hold below the main deck shall be subdivided to form a forward water-tight trimming tank and compartment; a general storage hold with a galley coal bunker; chain lockers, storerooms, etc., the coal bunkers, boiler and machinery space and the after trimming tank with illuminating-oil storage space above.

The main deck shall be arranged with a breakwater bulkhead forward; the windlass compartment fitted with a steam windlass; chain stoppers, scuttles, etc., the crew's water-closet and a lamp room; the crew's quarters, hatch, the galley; the boiler and engine-room casing;

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the officers' quarters and mess room; and the cook's room, the transom seat, the rudder quadrant aft, close under the upper deck beams.

The upper deck shall be wood with calked seams arranged with ventilators, a boat hoister, a fog bell, a combined steel pilot house with bridge, and gas-tank storage room, hatches, companionway, steel skylights for the galley, the engine room, and the officers' mess room, the smokestack with casing and umbrella, scuttles, boat and cargo davits, boats, etc., and miscellaneous fittings necessary for the handling of the vessel and its equipment.

The steam generating plant shall consist of one Scotch-type boiler with two furnaces using bituminous coal. The main propelling engine shall consist of a two-cylinder, vertical, direct-acting, noncondensing marine engine with cranks standing at 90° to each other, driving a right-handed four-bladed propeller.

The principal auxiliary machinery shall include one steam anchor windlass, one steam hoisting engine for the boats, one automatically operated fog-signal apparatus, one main feed pump, one injector, one feed-water heater, a fire, deck, and bilge pump, a water-service pump, a bilge siphon, all operated by steam, and such smaller pumps, mechanisms, and devices as are hereinafter specified.

The vessel shall be fitted with a hand steering gear of an approved standard design, cleats, fairleads, chocks, and rigging. The outfit and equipment shall include two Navy standard compensating binnacles and compasses, blocks, stream and kedge anchors, anchor and chain-handling gear, boats, boat and cargo davits, fog-signal and running whistles, ship lights, running lights, speaking tubes, ventilators, fire and drainage system and scuppers, hot and cold water plumbing with sinks, basins, showers, and water-closets; air ports, deck and fixed lights, doors, hatches, scuttles; ladders, gratings, handrails, stanchions, grab rods, eyebolts and pads, ring life buoys, shelves, lockers, built-in furniture with drawers and accessories to adapt each compartment and space to its intended purpose; and such other fittings as are hereinafter specified and necessary for the safe and prompt handling of the vessel, its equipment, stores, provisions, coal, water, and for cleaning decks, holds, or other work pertaining to the duties of a light vessel.

The various articles to be furnished by the Government, but installed by the contractor, ready for service, are listed on page 71. and —.

GENERAL CLAUSES.

3. Plans and Specifications.—The following blue prints are issued to prospective bidders with and form a part of these specifications:

Drawing No. 14293. Outboard profile.
14294. General arrangement of decks and hold.
14295. Type section.

The successful bidder will be furnished with all the necessary copies of the above plans and specifications, and in addition thereto will also be furnished the necessary copies of the following plans:

Drawing No. 14296. Line draft.
14297. Mold-loft table.

It is the intent and purpose of the plans and specifications to show and require the construction and entire completion, except items

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listed under "Articles furnished by the Government," of a vessel of first-class commercial materials and workmanship in all parts.

If requirements shown on the plans are not mentioned in the specifications, or if mentioned in the specifications are not shown on the plans, they shall be executed by the contractor as though shown and mentioned in both, and also if a description of any parts or details necessary to complete the vessel shall have been omitted from the specifications, or objects or parts shall have been omitted from the drawings, such parts or details shall be deemed part of the contract and shall be furnished by the contractor. And further, should it be found that these specifications do not mention, or fail to give a comprehensive description of any details, materials, or workmanship, approved standard rules for the construction of vessels and the rules of the Board of Supervising Inspectors of Steam Vessels shall, under the cognizance of the Bureau of Lighthouses, govern the construction and completion of such details, whether concerning the metal work, woodwork, painting, machinery, piping, draining, or any other work whatsoever. Discrepancies existing between the plans and specifications shall be referred to the superintendent of construction. Suitable instructions will be given upon notification of the discovery of omissions or discrepancies.

In these specifications the words "furnish," "fitted," "installed," and similar expressions mean that materials, articles, and details of work shall be supplied by the contractor; and the words "will be," or "shall be," and similar expressions shall be binding upon the contractor and not upon the Bureau of Lighthouses.

The words "either ——— or" mean that the matter referred to shall be decided by the Bureau or its superintendent of construction.

The word "steel" means wrought steel, unless otherwise specified.

The figures given for all plates and for shapes are the actual thickness required.

The contractor will be furnished with all necessary copies of the specifications and blue prints issued therewith.

Measurement shall not be taken from these blue prints in laying down the lines of the vessel, but the work shall be governed entirely by the table of offsets.

4. Changes.—Changes from the requirements of the specifications and plans after the award and acceptance of the contract shall be made only upon the written directions of the Commissioner of Lighthouses.

Changes may be proposed by the Bureau or the contractor, in writing, and shall be accompanied by drawings, calculations, etc., as may be necessary for their full understanding. Changes found necessary and required by the Bureau in the arrangements or details of the hull, machinery, joiner, or other work, wherein the general style and character of the vessel are maintained, shall be made by the contractor without extra compensation. Changes involving differences in cost shall be done only after consideration as to the amount and an agreement in writing relative thereto before the work is commenced.

The contractor shall be responsible for all departures from these plans and specifications without proper authority, and the Bureau may at any time direct the removal and reconstruction of such

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changes, together with all parts affected thereby, by and at the expense of the contractor.

5. Materials.[1]—All material (plates, shapes, rivets, etc.) for the hull shall be open-hearth mild steel of uniform quality, and the chemical and physical properties shall conform to the Manufacturers' Standard Specifications for Steel for Ships, Class "A," and a mill-test report with an affidavit thereon shall be furnished, certifying that the material conforms to the above specifications.

Plates and shapes used for interior partitions, the smokestacks and casing, umbrella, etc., where no structural strength is required, are subject to surface inspection only when entering into the construction of the vessel.

Boss plates, stapling, etc., requiring extensive working, shall be of soft or flange steel.

Forgings of steel and iron shall be made from the very best materials.

Boiler materials.—Plates must be of marine steel; all materials entering the construction of the boiler must meet the requirements of the United States Steamboat-Inspection Service and shall be subject to their inspection.

Castings of steel, iron, bronze or composition, and brass, for the machinery and elsewhere, shall be of the very best quality of ingredients, free from all defects. The brass shall be of uniform color, and the compositions shall be of standard mixture.

Steel castings, without exception, shall be thoroughly annealed.

All other metals and materials used in the construction of the hull, machinery, joiner work, or any parts thereof, including the glass, paints, oils, varnishes, red and white lead, canvas, rope, oakum, felt, cement, putty, and similar articles, shall be of the best quality.

Woods of all kinds used in the construction of the vessel and its fittings shall be naturally and thoroughly seasoned; the wood shall not be "bled"; all timber and lumber shall be stored in the building yard under cover in ample time and in such a manner as to facilitate its seasoning; wood showing injurious sun checks, pitch pockets, splits, sap, knots, or other defects will not be accepted.

For the purpose of securing uniformity in practice in castings of the alloys of copper, tin, and zinc for incorporation into vessels, the Bureau establishes the following standard mixtures:

Name.	Mark.	Per cent.				Parts.			
		Copper.	Tin.	Zinc.	Lead.	Copper.	Tin.	Zinc.	Lead.
Bearing bronze	H	82½	14	3½	.....	6	1	¼	.....
Gun metal	G	88	10	2	.....	44	5	1	.....
Steam metal	M	89	3	7	1	89	3	7	1
Flange brass	F	85	.....	15	.....	85	.....	15	.....
Yellow or scrap brass	S	67	.....	33	.....	2	.....	1	.....
Naval brass	N	62	1	37	.....	62	1	37	.....

[1] The attention of intending bidders is invited to Treasury decision 34150, of Feb. 5, 1914, containing regulations in accordance with subsections 5 and 6, par. J, sec. 4, tariff act of Oct. 3, 1913, with reference to the free entry of materials for construction of vessels and their machinery and the free entry of articles for their outfit and for repairs of certain vessels. Information as to any changes that may be made in these regulations can be obtained from the Treasury Department.

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Contractors in submitting plans or schedules involving such castings shall designate by name or by mark the alloy which is proposed for the purpose.

If defects in materials already passed should develop or be discovered during the construction of the vessel, such materials shall be rejected, and the fact that the materials may have been previously accepted shall not prevent such subsequent rejection.

6. Workmanship.—All workmanship entering into the construction of the hull, equipment, outfit, machinery, piping, auxiliary machinery, pumps, and all other work as herein provided, shall be strictly first class and subject to the approval of the Bureau's superintendent of construction.

All plating shall be fair and smoothly fitted. The edges of the outside shell plating must run fair and be properly beveled for calking. Calking edges on angles, bulkheads, decks, and elsewhere shall be beveled, squared, and properly dressed as will be directed.

All plates for decks, bulkheads, flats, and similar structures shall be freed from buckles. Plates showing buckles after being fitted and riveted in place will not be accepted.

All metal work shall be tightly fitted and drawn up metal to metal before riveting, angles shall be jogged where necessary or directed, and the use of packing and liners will be allowed only at such places as required by other causes than bad fitting and as may be designated by the superintendent of construction. The exposed ends of plates in hatches and other openings shall be dressed and show flush, smooth edges.

The butts of all deck stringer plates shall be planed and closely fitted, and the butt straps shall be fitted on the underside and double chain riveted.

The sloping edges or the edges of flanges of beam brackets shall be finished smooth. The arrangement and punching of rivet holes in beams and brackets shall be carefully done, and holes in or near the edges will not be accepted.

All lines shall be laid down in the mold loft. All frames shall be faired on a scrieve board or by templates, all bevels carefully taken, and the shape worked to show fair and true when in place.

Keelsons, stringers, and similar structural members shall be carried continuously through water-tight bulkheads, unless otherwise specified, and the scores shall be covered on each side of the bulkheads with staple collars strongly riveted and calked on both sides. They shall extend as far forward and aft as practicable and terminate in breasthooks or deep bracket plates. The angles shall be in the longest lengths practicable, and the butts shall be properly shifted in reference to all adjacent butts. Butts of continuous angles in keelsons, deck, hold, and side stringers, waterways, etc., shall be secured by bosom angles of the same scantling, with neatly fitted heel and flanges, and secured with at least three rivets in each flange on each side of the butt. Clips shall be fitted where necessary for the attachment of keelsons, etc.

All angles for whatever purpose shall be well formed, fair, carefully curved and beveled, and free from hollows at the back of both flanges. In all work the rivets in flanges of an angle shall not be opposite. The corners of the outstanding flanges of all frames, stiffeners, clips, and similar angles and the corners of the other

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flanges where directed shall be clipped off before they are worked in place.

Lightening holes shall be worked in floors, brackets, etc., in general where shown and where directed by the superintendent of construction. Care shall be exercised to prevent undue weakening of the structure by improperly located or excessively large holes. Sharp edges shall be removed by filing.

Limber and drain holes shall be worked where necessary in floors, brackets, etc., to assure perfect drainage and prevent water pockets. The holes shall be punched or drilled, as may be best suited to the conditions, and shall be of such size and so located as to avoid weakening the structure.

Holes for pipe leads, etc., in a strength member shall be located in the line of the neutral axis.

All riveting, laps, butts, etc., shall be under the cognizance of the Bureau, as specified in detail, and in general accordance with approved standard rules for the construction of vessels.

All holes shall be carefully laid out and the edges of all holes shall be at least the diameter of the rivet inside the edge of the plate or shape. All unfair holes shall be reamed fair before riveting and rivets used of a size suitable for the enlarged hole. If the unfairness is such that it can not be properly corrected by reaming, new material will be required. All rivets shall be properly heated, fill their holes completely, and be well driven. The driven heads shall be generally finished slightly convex or flush in the shell, deck plating, exposed surfaces of hatch coamings, casings, etc., as will be directed. All riveting shall be tested, and loose, burned, or broken rivets shall be cut out and replaced.

All seams, butts, staples, clips, etc., shall be carefully calked, and where necessary to prevent corrosion between structural members.

All forgings shall be smooth, strong, neatly formed, and such of them galvanized as directed.

Instruments, gauges, name plates, and similar visible parts shall be finished as will be directed.

The bedplates of all auxiliaries, etc., shall be provided with means to retain oil drip.

The boiler with its fittings, instruments, safety appliances, piping, etc., shall be constructed and connected in accordance with the rules and regulations of the Board of Supervising Inspectors of Steam Vessels.

All pipes shall be supported on steel hangers and stiffened to prevent all vibration. The hangers for copper and brass piping shall be lead lined.

All woodwork shall be kept away from ironwork of the hull, as far as possible and practicable, for accessibility in scaling and painting. It shall be connected to the steel structure of vessel by angle or plate clips bolted to the frames, beams, etc.

The carpenter work shall be properly fastened, and neatly and smoothly finished, as indicated by the superintendent of construction.

The joiner work shall be sandpapered and made perfectly smooth before finishing. All seams, dovetails, corners, and connections shall be tightly and perfectly fitted and finished; no cracks in panels, doors, corners, or elsewhere shall be visible when the reserved per cent of the contract price is to be paid.

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The maximum practical headroom is desired in all quarters, staterooms, passages, doors, etc., and this feature should be given full consideration in the arrangement of piping, etc.

7. Superintendent of Construction.—The Bureau will authorize a representative to inspect the vessel during the progress of its construction. The work shall be open at all times to the superintendent while work is being performed under this contract, and every facility and assistance shall be extended to him in the prosecution of his duties. He will approve or reject the materials and workmanship in detail or upon completion, as they may be satisfactory or may fail to meet with the requirements of the specifications. He will decide questions relative to the intent of the plans and specifications, subject to the Bureau's approval as to important matters. He will transmit plans and correspondence from the contractors to the Bureau. If the decisions of the superintendent are questioned by the contractors, the matter in dispute shall be referred in writing to the Commissioner of Lighthouses, through the superintendent, and the commissioner's decision shall be final.

8. Contractor's Plant.—All bidders, if required, shall present satisfactory evidence that they have been regularly engaged in such work as they propose to execute, and that they are fully prepared, with necessary capital, machinery, and material, to commence the construction of the hull, machinery, and all other work immediately upon notice of award of the contract. The plant and its equipment shall be sufficient to insure first-class work throughout as required by the specifications.

Office facilities shall be furnished for the superintendent of construction.

9. Duties of Contractor.—It shall be expressly understood and agreed that the metal and woodwork and materials of every kind, except as otherwise stated, in and about the vessel, shall be furnished by the contractor complete in all its various parts and details. The workmanship as provided in the foregoing paragraphs necessary to complete the hull, machinery, equipment, and outfit with its fittings and fastenings, calking, water-tight work, and all other work thereon or therein ready for actual service, shall be executed in accordance with the plans and specifications.

The contractor shall furnish *detailed working drawings, lists, schedules, etc., of the vessel* as may be required and in accordance with the following. Three blue prints or copies thereof, with a letter of transmittal, in triplicate, shall be submitted to the Bureau for its approval.

Stern frame with rudder, rudder bearing, and rudder quadrant.
The stern tube with bearing and stuffing box.
The stem with hawse-pipe boss, showing scarphs, drilling, and plate landings.
Transverse and longitudinal framing.
Shell-expansion plan, showing plating with doublings, openings, bilge keels, riveting, etc.
Inboard profile showing the interior arrangement of the vessel.
Water-tight bulkheads.
Nonwater-tight bulkheads, partitions, galley coal bunker, and chain lockers, etc.
Plans showing arrangement and details of boat and anchor handling gear, rigging, location of chocks, cleats, etc., rail, bulwark, and awning stanchions.
Foundations for boiler, engine, thrust bearing, pumps, etc.
Boiler, smokestack with whistle platform, umbrella casing, etc.
Details of air ports, hatches, scuppers, scuttles, swivel fair-leads, and the skylights and hawse pipes.

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General arrangement of fire, deck, and bilge system.
General arrangement of heating system.
Details of sea chests and connections.
Arrangement of main-deck plating.
Arrangement of spar-deck plating.
Arrangement of windlass, chain stoppers, breakwaters, chain rollers, and hawse pipes.
Arrangement of pilot house.
Arrangement of stanchions in hold and main deck.
Arrangement and construction of ventilators.
Arrangement of lantern mast and details.
Arrangement of illuminating apparatus.
Arrangement of fog whistle, operating gear, and details.
Arrangement of sanitary, hot and cold water systems.
Arrangement of steering gear and leads and details.
Arrangement of fog bell and support.
General arrangement of machinery.
Design of boiler with all fittings in complete detail.
Arrangement and details of steam and exhaust piping, the throttle and shifter valves, etc.
General arrangement and important details of the propelling engine.
Arrangement and details of the shafting with couplings, the thrust, and the spring bearings, etc.
The type and design of the feed-water heater.
The type of the injector and all pumps giving complete catalogue numbers, sizes, and setting plans.

The action of the Bureau will be indicated upon these copies and letters and one of each returned to the contractor approved or with the corrections and changes deemed necessary thereon, and the original tracing, before the blue prints are issued to the shops, shall be modified accordingly *before the work is begun.* One print of the corrected plan shall be forwarded to the Bureau for its files, as soon thereafter as practicable.

If departures from these specifications or the contract plans are shown upon plans submitted for approval, and attention not clearly drawn in writing to such departures, the contractor becomes responsible for work covered, even though approval of the plan is given by the Bureau or superintendent.

Any portion of the work found defective, whether partially or entirely completed, shall be removed and satisfactorily replaced by the contractor at once and without extra charge.

Articles of every kind used shall be of the best quality, of first-class workmanship, and perfectly suited for their several purposes, secured in their places, and, upon the delivery of the vessel, be in as good condition as when purchased, or replaced with new if injured.

If any article, device, or arrangement used about the machinery, hull, or elsewhere in the vessel, or in the construction of any part thereof, is subject to a patent right, the royalty for its use shall be paid by the contractor.

All parts of the vessel for which payment has been made under the provisions of the contract shall be under the care of the contractor. The work shall be kept clear of dirt, chips, etc., and water shall not be allowed to stand in the vessel. Finished work shall be protected during the execution of adjacent work. Any damage caused by launching, collision, grounding, docking, corrosion, or other cause shall be made good by the contractor.

The contractor for the vessel shall be responsible for all materials, machinery, or parts thereof, fittings, appliances, etc., furnished by

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him under subcontracts, which must fully comply with the requirements of these specifications, and their final acceptance by the Bureau is subject to a successful trial trip of the vessel and their satisfactory performance during the contractor's guaranty time as hereinafter specified and as set forth in the contract.

All materials to be used in the construction of the vessel shall be properly cared for at all times and kept under cover so far as practicable. All articles delivered to the contractor, as listed under "Articles furnished by Government," shall be properly stored under lock and key, and the contractor shall be responsible for their safekeeping and their installation on the vessel.

10. Finished Plans, Model, Photographs, and Data.—Upon the completion of the vessel, the contractor shall furnish two blue prints each on cloth of the dimensioned working drawings of the following parts as actually constructed, assembled, and completed on the vessel:

Docking plan.
General arrangement of machinery.
General arrangement of piping.
Arrangement of stern frame and rudder.
Stern tube, with stern and inboard bearings and stuffing box.
Propelling engine design.
Boiler design with fittings.

A half model of the hull shall be furnished. It shall be of white pine, 3/8-inch scale, with all deck lines, frames, bulkheads, seams of plating, butts, openings, etc., shown in black ink, and varnished and mounted upon a natural finished mahogany board, in accordance with the Bureau's standard, a blue print of which will be furnished upon request.

The contractor shall furnish two mounted photographs, in size 14 by 17 inches, of the vessel. The pictures shall be taken upon completion and prior to delivery, at such time and from such points as may be designated by the superintendent of construction; one of the pictures to be framed.

Before completion and at such time as the superintendent of construction may select, the vessel shall be inclined in an approved manner and the metacentric height determined. The detail calculations relating thereto shall be furnished.

The weights of the main engine, shafting, propeller, bearings, boiler, pumps, feed water heater, windlass and chain stoppers, deck hoister, auxiliary machinery, boats, deck fittings, etc., as far as they possibly can be ascertained, shall be tabulated and furnished.

All blue prints, the model, inventories, photographs, and similar data shall be delivered when the vessel is completed and in readiness for delivery.

HULL, EQUIPMENT, AND OUTFIT.

11. Bar Keel.—The keel shall be of rolled steel, 6½ by 1¼ inches, and shall be in as long lengths as practicable. The scarfs between sections of the keel and to the stem and stern posts shall be 20 inches in length, planed, fitted to a faced joint, secured with countersunk tack rivets clear of the regular keel rivets, calked, and fitted with screw stopwaters before the garboard is fitted. The keel shall be drilled for double zigzag riveting for the lap of the shell plating.

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The rivet holes in scarfs for securing the garboards shall be drilled after the scarfs are fitted and tack riveted.

12. Stem.—The stem proper shall be 6½ by 1¼ inch steel bar carefully shaped to the profile shown, and extended above the upper deck as shown for the attachment of an eyebolt. The part forming the hawse-pipe boss shall be cast steel of suitable size to take the hawse pipe stowing the mushroom anchor, and the angle of the pipe shall be subject to the Bureau's approval. The sections of the stem shall be scarfed and fitted same as required under "Bar keel," and all rivet holes shall be drilled. The stem shall be drilled for double zigzag riveting for the lap of the shell plating.

13. Stern Frame.—The propeller and rudderpost, with transom and keel connections, including boss for the stern tube, shall be a one-piece steel casting. The rudderpost shall be 6 by 2 inches, with bosses for gudgeons, and a boss with a hole 5½ inches in diameter to permit the removal of the propeller shaft through the rudderpost. The propeller post and keel connections shall be 6 by 2½ inches. The shoe shall be widened, shaped, and molded as shown. The lower end of the stern frame shall extend forward about 5 feet and be scarfed to the keel. The gudgeons for the pintles shall be bushed with white metal and the bottom of the heel gudgeons shall be drilled vertically with a ¾-inch hole. The frame shall be drilled for double zigzag riveting for the lap of the shell plating.

14. Rudder and Quadrant.—The rudder shall be of the single-plate type. The frame shall be cast steel, thoroughly annealed, and in one piece, with an arm of approved section at each pintle and one on the opposite side between pintles. The plate shall be ½ inch thick. The pintles shall be of steel, 2 inches in diameter, designed to be easily removable and properly secured. The top of the rudder frame shall be formed into a palm or flange, be machined, fitted with a feather key, all to suit the half coupling on the rudder stock, and bolted together with 6 fitted steel bolts. A lifting stop shall be bolted to the frame at the upper gudgeon. A heavy lifting shackle shall be attached at the top of the rudder frame.

The stock shall be forged steel, 3½ inches least diameter, have a forged-on coupling, and worked with shoulders at the bearing collar and quadrant. The head of the stock shall be square to fit the tiller and fitted with an eyebolt for lifting.

The weight of the rudder shall be carried by a two-part bearing collar bolted about the stock and resting in a steel casting at the main deck; the bearing surface shall be conical in form and fitted with a brass bushing and gland, divided in halves by a diagonal cut, and forming a water-tight stuffing box with a two-part brass bushing in the lower part of the deck casting. Two grease cups shall be fitted.

A cast-steel quadrant, with integral lugs for turnbuckle shackles, stops, and centering pin, shall be secured to the stock; the hub shall be split and fitted with a cap connected with four bolts and two feather keys. Stops shall be fitted under the upper deck beams to limit the rudder angle to 45 degrees each side. A locking device, consisting of double clips and tapered centering pins, shall be fitted at the quadrant to secure the rudder amidships.

A tiller of cast steel shall be fitted to the rudderhead and furnished with the necessary blocks, relieving tackle, eyebolts, cleats, etc., complete; it shall be stowed and secured as directed on steel racks.

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A composition deck plate with a bearing for the rudderstock and a water-tight screw cover shall be fitted at the upper deck for shipping the tiller.

A trunk of 3/8-inch plate shall be secured to the transom floor and inclose the rudderstock; it shall be calked water-tight throughout. A cover plate shall be fitted about the rudderstock at the lower opening of the trunk and secured to the adjacent shell plating by composition tap bolts.

A steam pipe shall be led from the heating system to the rudder trunk to prevent freezing.

A pad eye shall be riveted in the center and at the sides of the counter for handling the rudder and propeller.

15. Stern Tube.—The stern tube shall be made of 6-inch extra-strong wrought iron or steel pipe screwed into the boss on the propeller post; the forward end shall be fitted with a cast-iron stuffing box with a flange bolted to the bulkhead and having a composition gland in halves and a gun-metal neck ring; the sternpost shall be bushed with a gun-metal liner not less than 5/8 inch thick and 12 inches long and provided with a flange securely bolted to the after-side of the boss with bronze studs and composition nuts. A suitable fairwater made of steel plate shall be securely bolted to the boss on the sternpost.

16. Frames.—The frames are numbered on the plans consecutively from stern to stem and shall be spaced 20 inches apart; they shall be 3 by 2½ by 5/16 inch angle bar. The frames shall extend in one length from the keel to the main deck and in general alternately to the spar-deck stringer plate, as shown. All rivet holes shall be punched from the faying side; holes at the turn of the bilge, or in places where the curvature of the frames is great, shall not be punched until the frames are bent; holes for the laps of the plating must be drilled after the plating is fitted on the vessel. There shall be double 3 by 3 by 5/16 inch angle frames at all bulkheads, extending to the main-deck stringer plates.

There shall be double lugs for keelsons, etc. Scarf pieces 3 by 2½ by 5/16 inch angle, 3 feet in length, shall be fitted across the line of the keel and riveted back to back at every frame. At the stern of the vessel the scarf pieces shall be omitted and the ends of the frames lapped and riveted to each other. The frames when in place shall be secured by heavy rib bands, and the whole system of framing shall be carefully faired and adjusted before fitting the plating.

17. Intermediate Frames.—Intermediate frames 3 by 2½ by 5/16 inch shall be fitted between the regular frames forward of bulkhead No. 42 and carried up to the main deck and securely riveted to the shell plating.

18. Cant Frames.—The cant frames shall be 3 by 2½ by 5/16 inch, spaced not more than 15 inches apart at the transom plate on the stern frame and be riveted to it through flanged plate brackets. These frames shall run to the underside of the upper deck. Bracket knees shall be fitted at the main and upper decks and riveted to the deck beams. The cant frames shall be laid down on the mold-loft floor, their bevels carefully taken, and the outer flange must show no hollowness when finished.

19. Reverse Frames.—The reverse frames shall be 2½ by 2½ by ¼ inch, extending to the lower edges of the main-deck beam brackets

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and well above the upper turn of the bilges past the stringer angles alternately. Under the chain lockers, coal bunker, and in the machinery and boiler spaces all the reverse frames shall be doubled, and clips shall be fitted under the keelsons and wherever required for proper riveting. The reverse frames shall be riveted to the floors and frames before being placed in the vessel. The butts shall be on alternate sides of the center line of the vessel, and the butt straps must be long enough for three rivets on each side of the butt; the shorter reverse frames shall be put in in one length where practicable.

20. Center Keelson.—The center keelson shall be built up with a vertical 15-pound plate, 9 inches wide; double top and bottom angles, 3 by 3 by $\frac{5}{16}$ inch; a rider plate of 15-pound plate, 6½ inches wide; and a foundation plate of 15-pound plate, 11 inches wide. The foundation plate and bottom angles shall be continuous from bulkhead No. 7 to bulkhead No. 42.

The vertical plate, top angles, and rider plate shall be continuous from frame No. 12 to bulkhead No. 42, and securely connected to the intercostal members extending forward and aft of same.

The plates and angle bars shall be worked in the greatest length procurable and to have their butts shifted well clear of each other. The butts of the vertical plate shall be secured with double butt straps, treble riveted; the thickness of each butt strap must not be less than three-fourths the thickness of the plates to which they are riveted. The butts of the rider plate and the horizontal foundation plate shall be secured with treble-riveted butt straps. The butt straps of the rider plate shall be fitted on the upper side and those of the horizontal foundation plate shall be fitted on the under side of the plates. The butts of the continuous angle bars shall be secured with angle-bar straps of equal thickness to the bars to which they are riveted and are to have not less than three rivets in each flange on each side of the butt. The angle-bar butt straps shall have rounded heels to properly fit in the throat of the continuous angle bars which they connect.

From bulkhead No. 7 to frame No. 12 the keelson shall be built up of 15-pound plates secured between the continuous bottom angles, fitted intercostally between the floors and secured to them with 3 by 3 by $\frac{5}{16}$ inch double angle clips. Similar clips shall also be fitted to the tops of these intercostal plates, to which will be secured the engine, thrust, and spring bearing foundation plates.

Forward of bulkhead No. 42 there shall be fitted deep intercostals of 10-pound plate and angle clips, forming an extension and suitable end for the center keelson.

21. Keelsons and Stringers.—The side keelson shall extend from bulkhead No. 42 aft through the deep engine-room floors as far as practicable. The longitudinal bulkheads of the chain locker and the boiler foundations shall form a part of this keelson.

The bilge keelson shall extend from bulkhead No. 7 to bulkhead No. 42. The longitudinal coal-bunker bulkheads shall form a part of this keelson.

The side and bilge stringers shall extend from bulkhead No. 7 to bulkhead No. 42.

All of the above keelsons and stringers shall be double 3 by 2½ by $\frac{5}{16}$ inch angle bars in the longest lengths procurable. They shall be run continuously through all water-tight bulkheads, except where they

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end at bulkheads No. 7 and No. 42 large brackets of 12½-pound plate shall be fitted. They shall be fitted to run fair from end to end without liners, and shall be secured to each frame with four rivets through the double reverse angles, or, in lieu of reverse angles, clips 2½ by 2½ by ¼ inch by 9 inches long, shall be fitted. The butts shall be widely spaced and fitted with bosom piece butt straps securely riveted.

The between-decks stringer, of 3 by 2½ by $\frac{5}{16}$ inch angles, shall run continuously around the vessel and terminate in a breast hook forward. It shall be attached to the frames by 2½ by 2½ by ¼ inch angle clips 6 inches long.

22. Floors.—The floors shall be in one length from bilge to bilge. The ordinary floors shall be 13 inches deep at the center line, tapered at the ends, and curved well up the bilges, their outer ends to be not less above the level of top of keel than twice the center depth. At the lower turn of the bilge the plates shall be at least 6½ inches deep.

Those in the forward and after trimming tanks and under the engine, thrust, and spring bearing foundations shall be of increased depth and straight across the tops, except in way of the engine, where they shall be shaped to suit.

The transom floor and the floors in the machinery space under engine, boilers, etc., shall be of 14-pound plate, the deep floors in the trimming tanks shall be of 10.2-pound plate, the ordinary floors shall be of 12-pound plate.

Smooth limber holes 2½ inches diameter and drain holes ⅞ by 1½ inches shall be cut as directed.

23. Trimming Tanks.—Trimming tanks shall be constructed at both ends of the vessel, as shown on the plans; the top plating shall weigh 10 pounds per square foot. The seams shall be lapped and single riveted.

The frames shall be cut at the trimming-tank top and be strongly connected thereto by means of plate brackets, as will be directed. The tank top shall be supported by angles 4½ by 3 by $\frac{5}{16}$ inch.

The tank shall be fitted with a manhole and reinforcing frame, a water-tight cover of plate steel, with studs, nuts, and fittings, steps or ladder, and all other fittings, including air vents, sounding tubes, pipes, and valves for filling and emptying by the fire deck and bilge pump and for its proper care. The tank must be absolutely water-tight under a pressure corresponding to a head of 16 feet above its top. Suitable holes shall be drilled in the tank-top angles to prevent air pockets.

24. Engine, Boiler, and Other Foundations.—The engine foundations shall be formed of deep floor plates and intercostals, as shown on the plans. The foundation top plates for the engine beds shall be 20 pounds per square foot and of the dimensions and form to suit the shape of the engine bedplates. The angle connections shall be 2½ by 2½ by $\frac{5}{16}$ inch; the angles taking the holding-down bolts of the bedplates shall be 4 by 3 by ½ inch. Strong and rigid seatings for spring bearings, pumps, and other auxiliaries shall be constructed on the top of the floors. The foundations for the thrust blocks shall be formed by extensions of the engine foundations.

Fore-and-aft continuous lightened girders shall be fitted under each side of the boiler. These girders shall be fitted with double 3½ by 3½ by ⅜ inch top angles, and rider plates 7½ by ½ inch,

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and shall be supported by transverse flanged lightened 12.5-pound brackets at each end, secured by double 2½ by 2½ by $\frac{5}{16}$ inch angles. The entire space around and under the boiler must be accessible for cleaning and painting.

The drinking-water tank in the hold shall be supported and secured on a suitable steel foundation and properly fastened to the bulkheads or elsewhere as may be directed.

The lantern mast will be stepped on a 15-pound foundation plate on top of the main deck and supported by the bulkhead on frame No. 31, fitted with a 3 by 3 by ⅜ inch connecting angle ring securely riveted to the deck and mast.

The jigger mast will be stepped on the spar deck in a square cast-iron socket secured to the deck; the underside of the deck to be reinforced by a beam and stanchion.

The steel deck plating under the windlass shall be reinforced as specified. A wooden bed of yellow pine not less than 4½ inches thick, tapered to suit the sheer, shall be fitted, using canvas soaked in thick red lead between the wood and the steel deck and all seams calked. A bounding angle 4 by 3 by ⅜ inches securely riveted and calked to the deck shall be fitted. Sheet lead ⅛ inch thick shall be worked over the wooden bed and a raised molding 1 inch high to form a drip pan. All seams to be soldered and drains from the bed to be led overboard.

A 15-pound reinforced plate shall be riveted to the spar-deck beams under the boat-hoisting engine, and a wooden foundation, lead lined, as described above, constructed on top of the spar-deck planking.

25. Main-Deck Beams.—The main-deck beams shall be 4 by 3 by ⅜ inch angles fitted on every frame; 4 by 3 by $\frac{7}{16}$ inch angles shall be used under the windlass, at hatches, and in such places as the Bureau's superintendent of construction will designate. Flanges shall be turned forward or aft at hatches and other openings in the deck to suit conditions. The crown of the beams will be ¼ inch to the foot amidship. The ends of the beams shall have plate knees or brackets not less than 15 inches deep and weighing 15 pounds per square foot, carefully and strongly riveted to the frames and beams. For lifting out the machinery and boiler, the deck beams shall be cut and fastened by double clips to fore-and-aft plate girders as may be required, and the deck framing shall be arranged to suit all openings. Extra beams shall be fitted where required.

26. Lower-Deck Beams.—The beams supporting the lower deck, where laid, shall be 3 by 2½ by $\frac{5}{16}$ inch angles without crown, properly bracketed with plates 12 inches deep and 15 pounds per square foot and riveted to the frames. They shall be located on alternate frames, properly supported, as will be directed.

These beams are to be arranged bosom up and fitted with yellow pine bosom beams bolted thereto, with thick iron washers between to provide air spaces and to prevent corrosion.

27. Spar-Deck Beams.—The spar-deck beams shall be 4 by 3 by ⅜ inch angles, fitted on alternate frames. The crown of the beams will be the same as for the main-deck beams. The general directions under the heading "Main-deck beams" apply also to the spar-deck beams.

Bracket plates to be 15 inches deep and 15 pounds per square foot.

The spacing and punching of the holes for the deck-plank bolts

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must be carefully done. Holes in or near the edges of the planks will cause the rejection of such planks and new planks furnished and new holes properly spaced and drilled. Fore and aft partner beams will be framed at each side of the lantern mast for the mast partner and as may be necessary.

28. Mast Partner.—The welded wedge ring shall be made of a 4 by 3 by 3/8 inch angle, the vertical plate ring shall extend 4 inches under the mast partner plate and 8 inches above same; on top it shall be fitted with a welded half-round, such as used for the sheer molding. All to be properly coned for the wedges, riveted, and calked.

29. Main-Deck Stringers.—The main-deck stringers shall be of 12½-pound plating 24 inches wide and shall extend all around the sides of the deck. They shall be made to fit closely against the shell plating, notched in way of the butt straps of the sheer strake, and connected to it by angle clips 2½ by 2½ by ¼ inch; in the way of the forward breakwater 3 by 3 by $\frac{5}{16}$ inch angles shall be worked as staples against the sheer strake and frames, and turning, form lugs for riveting together inside the frame flanges; these angles must be carefully calked water-tight. Where there are no staples, the frames shall have double clips for the stringer angle and space cemented water-tight.

The stringer angle shall be 3 by 3 by $\frac{5}{16}$ inch; it shall extend around the stern and at each side stop at the breakwater forward where stapling is fitted. The lower edge of the angle shall be planed and calked water-tight. Suitable angle-bar scarf pieces shall be fitted and riveted in the throat of the stringer angles to properly secure the butts; angle clips to the frames to be 2½ by 2½ by ¼ inch. The riveting in the stringer angles shall be countersunk, and all the work must be perfectly water-tight.

The butts of the stringer plates shall be planed and closely fitted together; the butt straps shall be on the underside and double chain riveted; all seams shall be calked water-tight.

30. Spar-Deck Stringer.—The spar-deck stringer plate shall be 21 inches wide by 12½ pounds per square foot amidship, reduced toward the ends to 10 pounds. The stringer plate butt straps will be double-chain riveted to the underside of the plates. All edges of the plates shall have a close fit, and the rivets shall be countersunk on top of the plate and inside of both angles.

The angle connecting the stringer plate to the shell plating will be 2½ by 2½ by $\frac{5}{16}$ inch. The inboard angle forming the waterway which extends from stem to stern will be 2¼ by 2¼ by ¼ inch. The butts of the angle bars must be secured with angle straps properly fitted in the throat of said angle bars. Both edges of the outboard angle and the lower edge of the inboard one shall be planed and calked water-tight.

31. Main-Deck Plating.—The main-deck plating shall be 10 pounds throughout and so arranged that the removal of the boiler will be as easy as practicable. The butts shall be carefully shifted. The seams shall be lapped and single-riveted, and butts strapped on the underside and double-riveted. Rivets shall be countersunk on the deck. All calking edges shall be planed and calked water-tight. Tapered liners shall be used throughout, and all riveting shall be flush on top.

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32. Spar-Deck Tie Plates.—These tie plates will be 10 inches wide and weigh 10 pounds per square foot; diagonals will be 10 inches wide. Tie plates to lie parallel with the center line of the vessel, and connect with stringers forward and aft, and be arranged to suit the skylights, pilot-house base, hatches, etc. The strake of tie plate, when broken by hatches or openings, shall extend a proper distance beyond each other to form a continuous longitudinal tie from end to end. Butt straps shall be located on the underside of the plates, and rivets shall be countersunk on top. Lodger plates shall be fitted where required.

33. Reinforce Plates under Cleats, Windlass, Lantern, and Jigger Mast, etc.—At the lantern mast and under bitts, cleats, fairleads, ventilators, fog-bell standard, windlass, hoisting engine, chain stoppers, etc., extra heavy plates, or plates of proper dimensions and thickness shall be fitted upon, and strongly riveted to, the deck beams; the whole to be in accordance with the best practice of ship construction.

All parts of the vessel subject to extra strain by shrouds, stays, etc., must be stiffened and reinforced in an efficient manner.

34. Bulkheads.—Water-tight bulkheads will be built on frames Nos. 7, 31, and 42. From bulkheads Nos. 7 and 42 there shall be built water-tight flats extending to the ends of the vessel. Water-tight partial bulkheads shall be built on frames Nos. 17 and 27, together with water-tight longitudinal bulkheads between them, forming the coal bunkers.

The bulkhead plates shall run horizontally and weigh 10.2 pounds per square foot. The lowest strake shall not be lighter than the heaviest adjacent floor.

Losenge-shaped lining plates must be fitted and riveted to all outside strakes of the shell plating in way of bulkheads. These plates must be calked water-tight all around.

The plates of the bulkheads must be stiffened on one side vertically and on the other side horizontally by 3 by 2½ by $\frac{5}{16}$ inch angle bars; the vertical bars to be spaced 24 inches apart from center to center and joggled over and rivet to the angles on the shell plating. The horizontal bars will be not more than 4 feet apart from center to center and be secured to the vessel's side with bracket plates. The bulkhead plates shall be calked water-tight on one side. Angle-bar staples and patch plates will be fitted around all stringers, beams, and keelsons passing through the bulkheads and made water-tight by calking. They shall be tested as required under "Water test of hull."

35. Sluice Valve.—Composition 3-inch flanged gate valves shall be fitted to water-tight bulkheads Nos. 27 and 31. The rods shall be boxed in or otherwise protected between decks. The valve and the gear must work freely and without jamming. The upper end of the valve rod shall be fitted with and work in a suitable composition socket, plate, and plug in the main deck, with an indicator to show when the valve is open or shut.

36. Coal-Bunker Bulkheads.—The coal bunkers shall be water-tight constructed as shown on the plan. The lower coaming plates shall be 12.5 pounds and the remaining plates 10.2 pounds per square foot. The stiffeners shall be 3 by 2½ by $\frac{5}{16}$ inch angle bars spaced about 30 inches centers. Braces of the same material and ¼-inch bracket plates shall be fitted between the stiffeners and side stringers or

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frames of the vessel. There shall be two bunker openings in the fire-room, one on each side as shown, fitted with sliding water-tight doors on the outside of the bunkers.

To prevent the shifting of the coal in the cross bunker forward of the boilers there shall be fitted a removable fore and aft partition, about 8 feet high, formed of rough planks 2 inches thick, loosely held in place between double angle bars riveted to transverse bulkheads 27 and 31.

The transverse coal-bunker floor shall consist of 12.5-pound plates fitted dust tight and secured to the reverse frame angles by ½-inch countersunk composition tap bolts.

37. Water-Tight Doors.—Water-tight doors shall be fitted in the coal-bunker bulkheads. They shall be 24 inches by 38 inches in the clear, and shall be of cast iron of the vertical sliding type, with finished contact surfaces. Each door shall be fitted with coarse-threaded screw steel hoisting rod, 1¾ inches in diameter, working in gun-metal nuts, with suitable plate shields on the doors to cover the screws.

The doors shall be operated by beveled gears and chain wheels from below the main deck, and by a hand wrench through suitable water-tight composition deck plate on the main deck. A wrench with a square socket to fit the head of the hoisting rod and a cross handle about 30 inches above the deck when in position shall be furnished and fitted for each door.

A water-tight door, with rounded corners, hinged vertically, shall be fitted in bulkhead No. 7 just above the top of the after trimming tank, to give access to the illuminating oil storage room. The door shall have a clear opening of 24 by 30 inches, as shown on the plan; be fitted with frames, dogs, rubber gaskets, etc., and shall, when closed, be perfectly water-tight. A positive locking device shall be fitted to hold the door when open.

38. Galley Coal Bunker.—This bunker shall be located in the forward hold as shown on the plan, formed of nonwater-tight bulkheads extending from the top of the floors to the main deck, of scantling similar to the adjacent water-tight bulkhead. The bottom shall consist of 12.5-pound plates and supported on the level of the top of the center keelson by bracket plates and angles riveted to the reverse bars. It shall have two vertical nonwater-tight sliding doors fitted with shovel plates, and a loose wooden fore and aft partition similar as specified under the heading "Coal bunker bulkheads." The bunker will be filled through a main-deck scuttle of the same design as specified under "Coal scuttles."

39. Shell Plating.—The shell plating shall be of inside and outside strakes. The sheer strake will be 33 inches wide and weigh 14 pounds per square foot amidship and forward, and be reduced at the after end to 12 pounds. The garboard strake will be 30 inches by 14 pounds per square foot throughout. The remainder of the plating will be as indicated on drawing No. 14295 (type section), carefully arranged. The plating between the main and the spar decks shall be 10 pounds per square foot. The fore and aft seams of the shell plating shall be lapped and double-chain riveted in the sheer and garboard strakes and in all lapped butts; the sheer-strake butts shall be treble chain riveted for one-half of the length of the vessel. The keel, stem, and sternpost must be double riveted, rivets to be ⅞ inch

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diameter. The lap butts in the adjoining strakes must be three frame spaces apart, and there shall be four passing strakes between the butts in the same frame space; all calking edges must be bevel planed or sheared, and butts shall be planed for close fitting and calking. The inside strakes must be worked close to the frames.

Liners will be allowed only for the outside strakes and in such places where required by other causes than bad fitting. All work must be tightly drawn up, metal to metal, before riveting. The edges of the plates shall be fair and their surface must show no buckling. Plate laps shall be arranged to clear butts on stem. The plates must not be less than six frame spaces in length except for the forward and after hoods, which, if shorter than five frame spaces, must be secured to the shell plates abaft or before them with treble chain-riveted lapped butts. Butts of the garboard strakes must be kept clear of the keel scarfs by a shift of two frame spaces from each other on opposite sides. Butts of the sheer strake to be shifted not less than two frame spaces clear of the butts of the adjoining main-deck stringer plates. Strakes through which openings are cut for sea chests or sea valves must be properly reinforced. Plates around the propeller boss and hawse-pipe opening in the stem, the tuck plates aft, shall be increased ⅛ inch in thickness. A plating plan showing all seams, butts, stringers, keelsons, deck lines, bulkheads, and the weight per square foot of the plates shall be prepared by the contractor, and be subject to the approval of the Bureau.

All plates shall be thoroughly cleaned from rust, etc., before they are fitted, the cleaning to be done with wire brushes. Ice plates of suitable thickness will be fitted from the stem aft, and riveted to the strakes inside and outside on each side of the bow at and below the load water line down to the keel; the inside plates will end in the frame space aft of the collision bulkhead on frame No. 42, and the outside plates will stop in the second frame space aft of that bulkhead. The after ends of the outside ice plates will be semicircular.

40. Bilge or Rolling Keels.—The bilge keels will be constructed as shown on the plan. They will extend from frame No. 15 to frame No. 36 on each side of the vessel; they are to run in a line conforming as nearly as practicable to the flow of the water when the vessel is going ahead, but kept clear of the laps in the shell plating.

They will consist of 15-pound plates, 12 inches wide, stiffened on the lower edge with a 2-inch half-round bar of iron or steel and connected to the shell plating by a 5 by 3 inch by 13.4 pound T bar. This bar must be properly calked all around on both edges. It may be notched over butt laps on shell.

41. Fender.—A fender shall be fitted as shown between frames 10 and 40. It shall consist of a 15-pound plate, shaped as shown, with a radius of 3½ inches, and with 2½-inch flanges for single riveting at the top and bottom. Butt straps shall be fitted on the inside and the fender shall be calked throughout and filled with pitch.

42. Stanchions in Hold and Between Decks.—Stanchions shall in general be fitted under alternate beams, and under every beam where deemed necessary. The stanchions below the main deck shall be of extra strong pipe 3 inches in diameter, with neatly forged or cast steel solid feet and heads, formed so that the beams rest on the stanchions and not on the rivets. The feet shall be flat or shaped to

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suit; heads and feet to have two ¾-inch rivets each. Extra stanchions shall be placed under the windlass and elsewhere, as will be directed by the Bureau.

Stanchions under the spar deck shall be 2½-inch extra strong pipes, with solid-forged or cast-steel welded heads and feet shaped and riveted as specified for hold stanchions. They shall be straight, made from accurate measurements, and driven into place. Their feet shall be turned diagonally where required to obtain satisfactory riveting. Two rivet holes shall not be drilled through a beam in a vertical line at the head of any stanchion. The beams must be supported as soon as they are put in place, and no heavyweight shall be placed on any deck until the stanchions are in place and the beams are properly supported.

The heads and feet shall be properly cross pinned and welded into the pipes.

43. Sheer Moldings.—The sheer molding at the spar deck shall be a 2 by 1 inch half-round solid bar, riveted at the top edge of the spar-deck sheer strake, following the top curvature from one side of the stem around the stern to the other side.

The molding at the top edge of the main-deck sheer strake shall be of the same dimensions run around the stern and stop with a neatly designed ornament at each side of the vessel, as shown on the plan. The moldings must show perfectly fair when finished, and be calked water-tight to the plating; the rivets shall be flush and smooth with the curved surface.

44. Ash Hopper and Buckets.—An ash and garbage hopper shall be constructed, where shown, of ¼-inch steel plates and angles riveted to the hull and calked water-tight. The outboard wall may be formed by the shell plating. The top opening shall be 16 inches square and fitted with a water-tight cover with steel hinges and composition pins. There shall be six ¾-inch tumble bolts of steel, with pins and lever handle nuts of composition. Hooks and eyes shall be fitted to hold the cover open; the outboard opening shall be 9 by 16 inches, reinforced inside, and have an angle-iron lip outboard at the bottom and sides. The hopper shall be water-tight and shall be tested from outboard by a stream from a fire hose.

Three No. 16 B. W. G. galvanized-iron ash buckets, 14 inches in diameter, 16 inches deep, fitted with handle and eye, and reinforced by 1 by $\frac{3}{16}$ inch flat rings at top and bottom, shall be furnished and stowed in the machinery space.

45. Bulwark and Stanchions, Spar Deck Forward.—The bulwarks forward shall be of the heights shown, fitted on the outside top edge with the half-round sheer molding and on the inside with a 5-inch by 10-pound bulb rail angle, joined together at the stem with a neatly shaped 15-pound plate forming a breasthook and a support for the bow chocks; the rail angle shall extend from the stem as far aft as frame No. 41. The bulwarks and rail angle shall be supported by wrought or cast steel stanchions riveted to the horizontal flange of the inboard waterway angle, to the plating and the bulb rail angle.

46. Handrail on Spar Deck, Deck House and Bridge, Stairs, etc.—The spar-deck rail and the rails on the upper deck house and bridge shall run all around, as shown on the plans; loose stanchions and chains shall be fitted in way of the boats and ladders at each side.

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Stanchions shall be solid drop forgings or steel castings, 3 feet in height from the top of the spar-deck sheer strake. Fore and aft rail pipes shall be 1 inch inside diameter for the top rail and ¾ inch inside diameter for the lower rail. The distance between the stanchions will be about 3 feet 6 inches, and the stanchions shall be riveted to the top of the spar-deck sheer strake. The entire rail stanchions and rail pipes shall be galvanized in a first-class manner. Braces shall be fitted at gangways and openings as necessary.

Handrails and grab rods shall also be fitted about the hatches, to stairs and steps, to ladders, and wherever required.

In the gangways on the main deck, in the crew's space, windlass room, upper and lower engine and boiler room, on storerooms under the main deck, and wherever else deemed necessary, there shall be fitted handrails of 1-inch galzanized-iron pipe with globe sockets.

47. Awning Stanchions.—Awning stanchions shall be fitted at every other rail stanchion. They shall be of standard 1½-inch wrought-iron pipe with cast-steel open fingers at the top and foot pieces securely welded and cross-pinned; all necessary deck sockets, clamps, etc., shall be furnished; the castings shall be annealed and the whole shall be galvanized and securely set in place with awning ropes of galvanized steel, spreaders, jack rods, stays, turnbuckles, and stowage gear.

Hardwood ridgepoles shall be fitted, forward, complete with all stanchions and braces.

The boom for the sail shall be arranged to serve as a ridgepole for the after awning.

48. Cleats, Fair-Leads, Scuppers, etc.—Six galvanized cast-iron 30-inch cleats shall be located as shown on the upper deck. These cleats shall be strongly fastened and suitable for towing. Chocks of galvanized cast iron and approved design shall be located where shown; suitable fair-leads shall be fitted at the stem on the upper deck and through the bulwarks.

All the necessary ring bolts, snatch blocks, fair-leads, cleats, etc., for hoisting the boats with the steam hoister shall be furnished and properly installed; the arrangement must be in perfect working order.

Four galvanized cast-iron scuppers of approved design shall be fitted on each side of the main deck; the forward pair shall be 8 by 5 inches and the others 4 by 3 inches; all shall have removable composition gratings. The scuppers shall retain full area to the ship's side, and shall be fitted with hinged cast-iron flap valves and 1¼-inch brass plugs for cleaning.

Three galvanized cast-iron scuppers 2 inches in diameter shall be fitted on each side of the upper deck, discharging through a 2-inch standard galvanized wrought-iron pipe and galvanized cast-iron outlet overboard just above the main deck. Iron lips shall be fitted outside the scuppers, flat on the plating, and riveted thereto; they shall not extend beyond the surface of the plating more than ¾ inch and be designed so that corners will not be caught by vessels alongside or damaged from any cause; all hinge bolts to be of composition.

Brass scuppers, 1½ inches in diameter, with galvanized-iron pipe and fittings discharging through a gate valve at the shell or into the nearest main deck scupper pipes, shall be fitted in the after end of the

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windlass room, the officers' and crew's shower-bath spaces, and the galley.

Two scuppers shall be fitted at the after outboard corners of both the pilot and deck house, and connected to discharge where directed on the upper deck through galvanized piping.

All necessary eyebolts, ringbolts, cleats, etc., for handling anchors, chains, lamps, rigging, coal, provisions, etc., shall be provided and secured in their proper places; their location will be determined by the superintendent of construction.

49. Cargo Ports.—A cargo port shall be fitted on each side as shown. The doors shall be made in three parts, the two lower parts to open inboard, and the upper part to open upward and inboard. All three parts shall close against rubber gaskets laid in beveled grooves all around the ports; they shall be fitted with all necessary bolts, dogs, strongbacks, hooks, and rings for securing them open or shut, and the shell and door plates shall be strongly framed and braced. When closed they shall be fair with the shell and fit closely, neatly, and be perfectly water-tight.

50 Coal Scuttles.—Coal scuttles with 18-inch diameter clear opening shall be located in the main and spar decks as shown. They shall be made of galvanized cast iron; each shall have a solid cover and a grating; the covers shall be securely fastened with a locking device and made perfectly water-tight upon a rubber gasket. The frames and gratings shall be so arranged that when the covers are removed, the grating may be firmly supported within the opening with its upper surface flush with the deck. All necessary crossbars or lugs, eyebolts, hooks, etc., for securing the covers in place and stowing them, shall be furnished and fitted; also removable folding baffle plates to protect the deck when coaling. A drawing of the scuttles will be loaned upon request.

Similar scuttles shall be fitted for access from the upper deck to the windlass room, and one to give access to the space over the trimming tank forward.

51. Air Ports and Fixed Lights.—Air ports shall be located as shown and as will be directed. The frames and fastenings shall be of composition; they shall have hinged blank storm covers of cast steel or composition, and four hinged bolts and ring nuts for securing them water-tight; the hinged bolts for the storm covers shall have a long thread so that all bolts may be set up on the glass frame. The diameter of the glass in the clear sight shall be 10 inches, and it shall be ¾ inch thick; both the frames for the glass and the storm cover shall have rubber gaskets. Screw eyes, chains, and hooks of brass shall be provided for holding them open.

Air ports located in the shell shall be 10 inches diameter in the clear glass. They shall be hinged up and shall be fitted with storm covers. Screens shall be furnished for those in the living quarters.

Air ports of similar design, 15 inches in diameter in the clear glass, but without covers, shall be fitted in the deck and pilot house, in the companion way and machinery casing, etc., all as shown on the plans or as will be directed.

Fixed lights, 15 inches diameter clear glass, shall be fitted in the after pilot house bulkhead, the pilot and deck house and doors where shown.

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Rectangular flush-deck lights in brass frames shall be fitted in the spar deck where necessary and directed; the glass shall be 4 by 12 inches, ribbed.

52. Hawse Pipes and Plugs.—There shall be one hawse pipe, 15 inches inside diameter in the center of the stem, constructed as shown on the plans. The tube and its flanges shall be of cast steel, free from all imperfections; the inboard flange shall be provided with a planed lip about 4 inches long, to fit in a groove in the pipe, and it shall also have a sliding cover; the whole shall be strongly bolted or riveted together and to the hull and be perfectly water-tight.

The outboard flange shall be securely riveted and calked to the boss of the stem; at its lower lip and at the bending point of the chain cable there shall be a local recess 6 inches wide and not more than 2 inches deep, to guide the chain and prevent its side movement in the pipe. The thickness of the pipe shall be 1½ inches at the top and 3 inches at the bottom side. The interior of the hawse pipe shall be bored to the specified diameter, and be entirely clear of any and all obstructions to the free movement of the anchor stock or chain. A cast-iron plug, in halves, shall be supplied to fit about the chain and ride in the hawse pipe; this plug shall be turned to the proper diameter, and its upper and lower faces rounded to prevent catching on the flanges of the hawse pipe. Four grooves shall be cut about the casting to retain the grease and make the plug more effective in preventing water from driving up through the pipe. Two plugs shall be provided.

A cast-steel hawse pipe shall be fitted on the starboard side of the vessel, arranged for housing the shank and shackle of a 1,200-pound anchor of the stockless pattern, as shown. The hull shall be properly reinforced by extra frames and plates at this place, the top flange of this pipe shall be riveted to the deck, and all must be fitted and calked water-tight.

53. Water Test of Hull.—When the hull is completed, and before being launched, all compartments shall be flooded to test the water-tightness at rivets, seams, trimming tanks, bulkheads, breakwaters, water-tight flats, and elsewhere. The tests shall be conducted in the presence of and as required by the superintendent of construction, and water levels carried to about the upper turn of the bilges. All parts of the hull and water-tight bulkheads above the bilges, also the main deck, shall be thoroughly tested by means of a fire hose; the water pressure at the nozzle shall be at least 50 pounds. The trimming tanks shall show no leaks under a water pressure corresponding to a head of 16 feet, measured above the top of the compartment tested. All sea connections, the rudder-stock casing, breakwaters, hawse pipes, etc., shall be carefully tested.

All leaks shall be effectually stopped, leaking rivets shall be calked or cut out and new rivets driven in their places, and all other defects shall be remedied. The work shall be tested until satisfactory. All such work shall be done effectually by the contractor without delay or extra charge.

The contractors shall furnish everything required for the tests, shore up the vessel safely before water is let into any compartment, and shall make good any injury that may be caused by the tests.

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Should any leaks be discovered below the water line after launching, the vessel shall be docked immediately and all defects shall be made good.

54. Cementing.—A cement mixture shall be used where specified and where directed by the superintendent of construction. It shall consist of one part of the best quality Portland cement, two parts of clean, sharp-grained, fresh-water sand, and clean fresh water. Three parts of coke shall be added where directed. In all cases the surfaces to which the cement is applied shall be perfectly clean and bare.

The inside of the bottom plating below the lower turn of the bilges shall be sparingly and smoothly coated with cement mixture to cover the rivet heads and permit a free flow of water to the limbers. The cement shall not be applied until such time after launching as the superintendent of construction will direct; it shall not be used to obtain water-tightness and no more cement shall be used than necessary.

The space between the frames and the stringer angle on the main deck shall be filled with cement carried up on the shell to form a watershed. The main deck in way of the hawse-pipes inclosure shall be covered with cement as necessary to drain all water through the scuppers. The space between and under the chain stoppers shall be cemented to give proper drainage.

The inside of the trimming tanks, the fore peak, and the space aft of transom plate shall be filled with cement and coke as necessary to insure perfect drainage.

The floor in the officers' shower-bath inclosure and the crew's shower and toilet room shall be cemented and the surface shaped to give proper drainage to the scuppers.

55. Covering.—The entire main deck, as far forward as the steel breakwater, including all rooms, galley, etc., excepting the space under the windlass foundation and places where cement is specified, shall be covered with a composition having similar properties and weight per square foot as the covering manufactured by the American Monolith Co., of Milwaukee, Wis. The covering when finished on the decks shall not be more than 1 inch in thickness, the top coating of which shall be finished in a color similar to metallic brown. The material shall be worked well up in fillets against the angles at the ship's sides, bulkheads, partitions, etc., to prevent water from standing against the steel parts of the vessel. Before the material is applied the decks must be fitted with retaining clips, spaced about 1 foot apart, bolted or electric spot-welded to the steel deck. Scuttles, etc., must be flush with the surface of the covering and their flanges tapered at their edges to allow the material to flow under to assure a good contact.

The hull plating in the way of the officers' and crew's staterooms and the officers' mess room shall be covered on the inside of these spaces with cork board about 1 inch in thickness, as will be directed. The steel construction between the main and the under side of the upper decks shall be cleaned and protected against corrosion by a coat of bitumastic solution or enamel. The cork board shall be nicely fitted between frame angles, steel partitions, and over rivet heads, butt straps, etc., to give an even appearance, and fastened to the steel with a bitumastic or other approved cement. At the air ports the cork shall closely work up to the flange and beveled to permit the

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full opening of the hinged glass frame and the cover. Working samples demonstrating the perfect binding of the cork board to the steel plating must be prepared and submitted to the Bureau for approval before the work is commenced.

56. Spar Deck.—The spar-deck planks shall be clear and thoroughly seasoned wood, equal to the best Oregon pine; after having been laid and planed on both sides they shall be not less than 2½ inches thick and not more than 4 inches wide. The wood shall be of the quality specified under the head of "Materials." They shall be laid in the decks with the grain vertical and be fastened with ½-inch galvanized-iron screw bolts and nuts having their heads sunk into the planks with grommets and thick white lead under them. The deck shall be tightly calked in the very best manner with three threads, two of oakum and one of cotton, the cotton to be driven first, and finely payed with marine glue. The deck planks shall be worked into margin pieces, with nibs not less than 1¼ inches wide. No deck planks or woodwork of other parts of the vessel shall be laid or fastened until a fresh coat of red-lead paint shall have been applied to the metal surfaces to be covered. The deck planks shall be carefully fitted over the edges of plates. No irregular edges of planks will be allowed. Deck plugs shall be of pine of the best quality, driven with the grain parallel to the grain of the planks, well covered with thick white lead before being driven. They must fill the holes tightly and fit squarely on the boltheads and be thoroughly water-tight. The butts of the planking must fit neatly, leaving a proper end space for calking. The underside of this deck shall be planed and sandpapered before being painted, and protected in the uptake room and in the galley by galvanized-iron plates with fire-felt filling between.

57. Lower Deck.—The lower deck, as shown on the plans, will be without crown and of Oregon or Michigan pine, tongued and grooved 1¾ inches thick after being laid and planed; the widths of the planks will be not more than 4 inches. The deck plank shall be blind spiked to the wooden strips bolted in the bosoms of the angle beams. The deck must be planed and painted. Hatches and scuttles and their covers shall be framed and fitted as will be directed to give access to all parts of the bilges.

58. Chain Locker.—The chain locker shall be located as shown and formed of nonwater-tight bulkheads, extending from the top of the floors to the main deck, of scantling similar to the adjacent water-tight bulkhead. The bottom shall consist of 12.5-pound plates removable, perforated to drain directly into the bilge, and supported on the level of the top of the keelson by bracket plates secured to the floors. A fore-and-aft partition of 2-inch loose planking shall be fitted between vertical 2½ by 2½ inch by 5-pound angles. The chains shall pass through heavy eyes at the keelson and be secured by strong shackles connected to heavy pad eyes riveted to the underside of the main deck and the after bulkhead; the deck and bulkhead shall be reinforced in way of the pad eyes.

Ladder rounds and hinged steel doors shall be fitted for access to each of the lockers from the hold, and all necessary fittings, hinges, bolts, latches, etc., for the operation of the doors shall be fitted complete, as will be directed.

59. Drinking-Water Tank in Hold.—There shall be furnished and securely fastened on a suitable steel foundation in the forward hold

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one fresh-water tank of steel 36 inches in diameter by 6 feet 6 inches high in the shell; the shell to be of ¼-inch steel, the heads of ⅜-inch steel and bumped. The tank shall be fitted with a 10 by 16 inch manhole and cover in the lower part of the shell complete with crab, bolts, gasket, etc.; a ¾ by 14 inch glass water gauge, and all the necessary tapped steel flanges for the pipe connections, drain, and air vent. The tank shall be filled from the main deck through a suitable composition deck plate with screw plug and valves, when the vessel is in port and by gravity from the sea and water service pump when on the station. The pump suction pipe for the galley force pump shall be near the base, the pump shall have a faucet over the sink, and a connection in the discharge line to the hot-water boiler. When completed, the tanks shall have two coats of cement wash applied to the inside.

60. Deck House and Bridge.—A steel deck house shall be built on the upper deck as shown. The coaming shall be 10 pounds, 12 inches deep, and connected to the deck tie and lodger plating by 3½ by 2½ inch by 5.6-pound angles. The side plating shall be 8 pounds, arranged in panels with single riveted seam straps on the outside and connected to the top plating by 2¼ by 2¼ inch by 3.7-pound angles. The stiffeners shall be 2½ by 2½ inches by 5 pounds, spaced 30 inches, or to suit conditions. The beams and floor angles shall be 3 by 2½ inches by 5.6 pounds, fitted on every stiffener and connected thereto by 10-pound brackets. The top of the house shall be 10.2-pound plate worked flush, and extend over the outer angle. A 2½ by 2½ inch by 5-pound boundary angle shall be fitted about the top of the house and calked. The whole shall be calked and made thoroughly watertight. The doors shall be of steel plates, 2 pounds lighter in weight than the adjacent structure, reinforced with frames of flat steel bars having welded corners. The doorway frames may be formed by the stiffeners and top and bottom angles. The door giving entrance to the crew space shall be of the Dutch type. Fixed 15-inch deadlights shall be fitted in the doors for the pilot house and the acetylene gas storage room. The latter shall also be fitted with a sliding register vent at its base to accelerate the ventilation in that room.

All fittings, hinges, locks, hooks, door bolts, and stoppers, etc., shall be of brass, extra heavy in design.

The outer wings of the bridge shall be 40 inches wide, neatly formed by angles and plates, secured to the bounding angles at the top of the house by bracket plates and supported on the outer ends by 3 by 3 inches by 6.1-pound angles securely bracketed at the top and bottom as shown.

A substantial ash grating resting in the bosom of the angles shall form the floor; similar removable ash gratings of the same width reaching from side to side shall be fitted on top of the deck house just aft of the steering stand; all to be held in place by clips and buttons as will be directed.

The top of the deck house forming a part of the bridge shall be fitted with a steering stand and wheel, the compass, bell pulls for the engine room (one set at each side), speaking tubes, pull cords for the running whistle, etc., as hereinafter specified.

The after lower part of the deck house shall contain the companionway leading to the crew space on the main deck and a storage room for the acetylene gas tanks; the latter shall be securely stowed

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in racks, and connected with the signal lighting system as will be directed. Mushroom ventilators of an approved design shall be fitted on the top of the roof as shown.

The mast opening shall be covered with ⅛-inch sheet lead, which shall extend on the mast 10 inches above the top of the house. Brass rings, with suitable rabbet for securing the lead, shall be secured by tap screws to the deck and the mast. All seams shall be soldered and perfectly water-tight. The mast shall not be wedged at the house top.

Air ports and fixed lights, etc., shall be arranged as shown and as hereinbefore specified; the after steel bulkhead of the pilot house shall be fitted with two 15-inch fixed lights arranged as high as practicable, to give an unobstructed view aft.

Vertical iron ladders with handrails shall be fitted on both sides of the deck house as shown, to give access to the bridge; and iron steps with rail shall lead from the top of the pilot house to the roof of the after part of the deck house.

The pilot house shall be fitted with a steering stand and wheel, a compass and stand, two sets of bell pulls for the bells in the engine room, one set at each side with annunciators from the engine room gong, whistle pulls, speaking tubes, etc.; a built-in permanent seat with lockers and removable leather covered cushions, a folding chart table made of ash, with hinged top 4 feet 6 inches long by 3 feet wide with a chart retainer 2½ inches deep, a locker with pigeon holes for the two ensigns, two lighthouse pennants and a complete set of code flags, signal boxes or racks, hooks, etc., complete in detail and in actual working order.

A flush scuttle shall be fitted in the floor of the pilot house to give access to the space under.

61. Main Deck Hatch, Skylights, and Companions.—The main deck hatch, the skylights, and companionway shall be located as shown, strongly and neatly built of steel.

The hatch coamings on the main deck shall be 40 inches square in the deck opening, have rounded corners, and shall be of steel, 8 inches high, the plates to be 12.5 pounds per square foot, the base angles 3 by 2½ inches by 5.6 pounds, all to be calked water-tight, the top moldings 2 by 1 inch half round, the supporting moldings for the wooden covers 1 by 1½ inches. The hatch shall be fitted with yellow pine covers and ash or oak grating, 2½ inches thick, made in halves; the covers to have suitable ringbolts for lifting, worked flush with the wood.

The hatch must be guarded by removable solid iron stanchions in sockets and hand ropes. A suitable strongback, with shackle, blocks and fall for hoisting provisions, etc., shall be fitted over the hatch, just under the upper deck and secured to the deck beam on frame No. 35, and bulkhead No. 37.

The skylights on the spar deck shall be located as shown, constructed as will be directed of 10.2 pound plates and 2½ by 2½ by $\frac{5}{16}$-inch angles, connected to the tie and lodger plates by 3 by 2½ by $\frac{5}{16}$-inch angles, with the 3-inch leg vertical; the lowest part of the casing plates must be 18 inches high above the wooden deck. The upper edges shall be fitted with angles, channels, and moldings as suitable, and the edges of all plates and angles shall be planed and calked water-tight, all neatly finished, trued, and faired.

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The skylight tops shall be steel with a weatherproof rubber joint at the trunk, fitted with substantial hinges, screw lifts, and brackets made of steel, gun metal, and brass as will be necessary and directed. Each section of the covers shall be fitted with fixed circular deck lights in brass frames, in diameter as large as practicable to suit the conditions; the glass shall be ¾ inch in thickness, and shall be flush with the top surface.

The skylight over the officers' mess room shall have 3 feet 4 inches by 4 feet clear opening at the deck, and have an additional fixed deck light at each side.

The engine-room skylight shall be 5 by 6 feet 3 inches, the after-end shall connect with the companionway partition, and its entire top shall be fitted detachable to permit the removal of the machinery below.

The galley skylight shall be 2 by 3 feet 4 inches at the deck, arranged as shown, with an adjoining water-tight casing to form a fireproof outlet for the galley smoke pipe.

The companionway leading from the spar deck to the officers' quarters shall, between decks, be a part of the machinery room casing, with steel partitions on frames Nos. 10 and 12, and a steel door opening into the starboard gangway. A vertical partition, sloped to suit the rake of the stairs, shall be fitted and all made water-tight. The space inclosing the ladder shall be fitted with a drain leading into the engine-room bilges, and a suitable ash grating as shown. The entrance casing at the spar deck shall be of suitable height, built of steel throughout, with a two-part door; the top shall be crowned and shall slide on composition guides. A 15-inch air port shall be fitted at the after end of the casing.

The skylights and the companionway must be perfectly weather-tight when closed. The space under the sloping staircase partition shall be arranged with steel shelves to serve as an engineer's store-room and locker, with a steel door opening into the upper engine room.

All hardware, such as locks, hinges, bolts, hooks, etc., must be of brass or bronze extra strong in design.

62. Main-Deck Casings.—The machinery room and upper boiler-room casings shall be located as shown and constructed of 7.6-pound plates with 10-pound coamings, and stiffened inside by angles 2¼ by 2¼ by ¼ inch, spaced about 24 inches apart. The plates shall be fitted with single-riveted planed butt straps, placed outside, forming pilasters. The angles at the main deck shall be 2½ by 2½ by $\frac{5}{16}$ inch, all riveted and calked.

Steel plate doors shall be fitted in the casings as shown and such openings made as will be directed. The doorway frames may be formed by the stiffeners and top and bottom angles, or the plating otherwise reinforced. All doors shall be fitted all around with frames of flat steel with welded corners. All doors shall be fitted with locks, keys, hinges, bumpers, hooks, hook rests, etc., of composition, strongly and neatly made.

63. Breakwater.—A breakwater shall be located on the main deck forward of the chain stoppers, and built about 4 feet in height at the center of steel plates weighing 7.6 pounds per square foot; the bottom angles shall be 2½ by 2½ by $\frac{5}{16}$ inch; and all shall be calked

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water-tight. The breakwater shall be efficiently stiffened as will be directed. A 2¼ by 2¼ by ¼ inch angle shall be fitted all around the upper edge of the plate with a 2½ by 1 inch half-round steel molding riveted to its top flange. The breakwater shall be thoroughly tested for water-tightness by filling the space forward of it with water.

The openings for the chains shall be reinforced on the forward side by 2-inch diameter half-round, and fitted on the afterside with adjustable sliding plate steel covers in sections, cut to the shape of the chain and provided with galvanized hooks, composition butterfly nuts, etc., to hold them in position.

64. Officers' Quarters.—The arrangement of the quarters shall be as shown. All bulkheads, partitions, divisions, etc., within the quarters shall be built of No. 12 B. W. G. steel plates stiffened by 2½ by $\frac{3}{16}$ inch bevel-edge flats extending between the coaming and top angle, fitted on each side of the doors, and equally spaced about 30 inches to cover the seams of bulkhead plating. Additional stiffening shall be fitted if required.

A deck coaming of 7.6-pound plate, 6 inches deep, and 2¼ by 2¼ by ¼ inch angle, shall be fitted throughout, and the plating shall attach to a 2¼ by 2¼ by ¼ inch angle under the beams. The partitions forming the cook's room and the officers' toilet room shall be carried to the upper deck and finished to correspond with the adjacent casing.

The doors shall be of wood and hinged as shown; the doorway frames shall be formed of wood and the sills neatly covered with $\frac{1}{32}$-inch thick sheet brass. The stateroom, officers' toilet room, oil-skin locker, and pantry doors shall be fitted with ventilating blinds in the upper panel.

The mess room shall be fitted with a polished oak sideboard and a polished oak mess table secured to the deck, shelves, racks, etc., as will be directed.

The transon seat shall be built of ⅛-inch steel plates and 1½ by 1½ by $\frac{3}{16}$ inch angles. Cushions shall be in removable sections 4 inches thick, filled with horsehair and covered with dark bottle-green natural leather. The back of the transom seat shall be of a light steel construction or of wood, fitted removable; the cushions for the back shall be upholstered on removable frames, securely held in place, the materials to be the same as specified for the seats. Lockers accessible from the top shall be fitted in the seats.

Locks, hinges, fittings, door hooks, bumpers, etc., on all doors and in quarters generally shall be of composition. (See "Hardware.") Each stateroom shall be fitted complete with one built-in wardrobe with oak front with drawers as will be directed, one lavatory. (See "Plumbing.") All wardrobes, lockers, desks, and drawers shall be of pine, with oak fronts, shelves, etc. Each stateroom shall have 12 strong brass clothes hooks secured in the wardrobe and on the bulkheads as directed. The iron beds and bed springs for the officers' quarters shall be furnished by the contractor and must be of a substantial, sanitary, and approved type.

The master's and chief engineer's rooms shall be fitted, in addition, with an oak built-in desk with a top drawer, side and under drawers, as the space will allow, and 12 letter pigeonholes.

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The china and linen closet shall be fitted with a locker and a dresser having an oak front and ash top and drawers, shelves, brass hooks, etc., and hinged doors underneath. A sufficient number of racks, shelves, and hooks for china and glassware, drawers for knives and forks, hooks, etc., shall be fitted as will be directed.

The bath and toilet shall be located as shown and fitted as described under "Plumbing." The bath space shall be fitted with a water-proof curtain; four clothes hooks shall be fitted in this room.

65. Crew's Quarters and Galley.—The quarters shall be located and arranged as shown; the bulkheads on frames Nos. 30 and 37 shall be constructed of 7.6-pound plates with 10-pound coaming plates 6 inches high; the steel-plate doors shall be 30 inches and 24 inches in the clear, as shown; the galley door shall be of the Dutch type, with a 15-inch dead light in the upper half; otherwise the bulkheads and doors shall be in design as specified for the main-deck casing. The fore and after galley partition, the partitions for the crew's toilet, and the lamp room shall be built of No. 12 B. W. G. steel plates and as specified under the heading "Officers' quarters."

The quarters shall be fitted with two double galvanized-iron-pipe berths, 30 inches wide, 6 foot 4 inches long, center to center of pipe, strongly and neatly constructed, fitted with national fabric spring mattresses in a steel frame, and two galvanized-iron flat-wire-netting drawers underneath with stops and locks.

All fastenings and locks shall be of composition, with duplicate keys.

Four ventilated steel lockers, fitted with doors, shelves, brass clothes hooks, locks, keys, hinges, etc., shall be furnished and secured in place as shown. Eight strong brass clothes hooks and racks for smaller toilet articles for each man shall be placed conveniently about the room.

The doors for the crew's toilet and the lamp room shall be of steel and fitted with ventilating blinds in the upper half.

A substantial oak mess table, as shown, shall be furnished and secured, removable, to the deck.

The bathroom and water-closet shall be located as shown and be divided by a steel-plate partial bulkhead. The plumbing fixtures shall be as described under "Plumbing." The bath space shall be fitted with four clothes hooks, a towel hook, and soap tray, and the closet space with one toilet-paper holder and two clothes hooks.

The galley floor shall be covered with the same composition as specified for the main deck and drained to the nearest deck scupper at after outboard corner, as shown. The galley shall be fitted with hot and cold water service, a hand force pump, ash-top dresser with drawers, drain board with a grooved top, a sink as specified under plumbing inclosed below with lockers containing shelves and hooks all mounted on steel framing, having steel fronts and doors; also with a kitchen cabinet, steel dish rack, shelves, and a folding serving table. The fore and after bulkhead shall have a suitable opening fitted with a vertical sliding cover operated from the galley for the purpose of passing the food into the crew's space.

There shall be furnished, complete for operation, properly mounted and secured, an iron or steel range of approved make, with guards, cross rails, etc., fitted with a hot-water back or extra heavy pipe

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coil for heating water, a 12-inch by 4½-foot extra-heavy galvanized iron circulating boiler with all connections and fittings. There shall also be furnished one spare set of fire tools, two sets of fire bricks, and two grates.

The coal bin shall be constructed of No. 12 sheet steel and fitted with a vertical sliding door in front and a hinged cover on top.

The skylight shall be built of steel plates, as specified under "Hatches, skylights, etc."

The underside of the deck over the range will be protected by galvanized-iron plates, with asbestos fire-felt filling between.

The galley smokepipe shall be made of $\frac{1}{16}$-inch sheet steel, provided with a damper, an attachment to clean out the soot, and fitted on top with a "Liverpool" hood. Above the skylight casing it shall be galvanized, and shall consist of an inner and outer pipe having an air space of 1 inch between, and be of such a height that the bottom of the hood will be 7 feet above the bridge; the pipe must be securely stayed to the deck house and be water-tight where it passes through the casing.

66. Workbench.—A workbench shall be constructed and secured where shown. The top of the bench shall be 2-inch yellow pine, supported by steel angles; two suitable tool drawers with brass locks, etc., shall be fitted. A cabinet shall be fitted and a tool and store locker with shelves, hooks, etc., constructed and located as will be directed.

67. Lamp Room.—The lamp room shall be provided with a metal table, drawers, lockers, shelves, and lamp stalls to fit the running and anchor lights, and six hand lanterns.

68. Windlass Space.—Forward of the breakwater shall be fitted a shelf, as shown. There shall also be additional steel shelves, racks, etc., for stowing miscellaneous articles, as will be directed.

69. Storerooms Below Main Deck.—The partitions in these spaces shall be built of No. 12 B. W. G. steel plating similar as specified for the quarters on the main deck, properly stiffened by angles, arranged as shown. All doors shall be wood and of the type shown. For locks, hinges, bolts, etc., see "Hardware." The rooms shall be fitted with metal shelves, lockers, bins, and properly ventilated, as will be directed.

The space over the after trimming tank shall be fitted with metal racks, etc., for securing the oil cases, as will be directed, for use as an illuminating-oil storage room, and be accessible through a water-tight hinged door from the engine room. The oil cases are rectangular, made of wood, 21 inches long by 10½ inches wide by 15¼ inches high, each containing two 5-gallon cans.

Two mushroom ventilators for this room shall be located on the spar deck.

70. Wooden Stairs, Steps, Gratings, and Ladders.—Substantial stairs, made of ash, shall be fitted in the companionways leading from the spar deck to the officers' quarters, the crew's space, and for the main deck hatch leading to the lower deck.

Galvanized pipe handrails and grab rods must be provided; the ladder in the main hatch may be fitted with stanchions and hand ropes.

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The stairs shall be held in position at the top by extra strong composition hooks and eyes; their feet must be secured by chocks fastened down with brass screws. All steps shall be covered with universal treads securely fastened. A suitable portable ladder of wood for use in the fireroom and engine room shall be furnished.

There shall also be furnished and fitted for each side of the vessel, as indicated on the plans, two flexible removable ladders, made of hardwood steps and rope. They shall reach from the water line to the spar deck; man ropes shall be provided and fastened with eyebolts to the bridge stanchions.

Ash gratings of suitable length and width must be fitted in front of the steering wheel in the pilot house, for the wings of the bridge and in sections across the top of the upper deck house in line with the bridge; also in the officers' companionway where shown. All must be removable, but securely held in place. The gratings must be substantial in design, properly framed and have brass screw fastenings throughout.

71. Iron Ladders and Steps.—Iron ladders constructed of side bars and single or double rungs, as will be directed, shall be fitted to the lantern mast, the smokestack and casing, in the forward fireroom, in the engine room to give access to the illuminating-oil storage room, and under the scuttle giving access to the paint locker. Cast-iron or flanged steel steps between side bars shall be fitted in the ladders to the lower engine room and on top of the deck house, with the necessary handrails. The ladders leading from the spar deck to the top of the pilot house may be constructed of galvanized iron pipes and fittings or as described above, fitted with handrails as shown. Climb irons shall be fitted at the chain lockers and where directed.

72. Machinery-Room Gratings, Floors, etc.—The upper machinery and drum room shall be fitted with strong steel gratings, in sections of convenient size, of $\frac{5}{8}$-inch square rods spaced $2\frac{1}{2}$ inches center, riveted to $2\frac{1}{2}$ by $\frac{3}{8}$-inch side bars.

Floors in the lower machinery room shall consist of 11.2-pound diamond-pattern steel plates; from the after end of the wing coal bunkers to the furnace end of the boiler cast-iron floor plates $\frac{5}{8}$-inch in thickness of raised design shall be fitted and neatly matched. The plates shall be of a convenient size and easily removable for cleaning or for access to the bilge. The floor plates shall be supported by a framing of angle bars. All fastenings for floor plates shall be countersunk composition tap bolts.

Guards of suitable material and form shall be fitted around the machinery and where directed by the superintendent of construction.

Suitable steel protection plates and bounding angles at sides and lap straps under the joints where necessary, shall be fitted, as will be directed, to prevent ashes or dirt from falling into the bilges; handholes with covers to be provided to give access to valves below the flooring.

The handrails in the engine and upper boiler room shall be arranged as shown and as will be directed.

73. Painting, Lettering, and Ornamenting.—All surfaces of contact of wood or metal work shall be painted before being put together, and every part of the hull, steel, or other materials inside and out-

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side, unless otherwise specified, shall be thoroughly painted with three coats of pure lead or other approved paint. All woodwork shall be thoroughly sandpapered and perfectly smooth when finished, and, except where otherwise specified, shall have three coats of white-lead paint.

The entire underwater body, sea connections, and appendages from about 12 inches above the load water line shall be painted with two coats of red lead, one coat of approved antifouling composition, and a water-line belt 3 feet in depth of boot-topping composition. The topsides and exterior upper parts of the vessel shall be painted in such characteristic colors as will be directed. The name of the vessel's station shall be painted in letters about 6 feet high on each side as will be directed. Such parts of the masts and fittings, and such fittings of the rigging as will be directed, shall be painted with three coats of approved paint. Draft figures, 6 inches in height, from the 4-foot water line up to the 10-foot water line, both inclusive, shall be center punched or chisel marked and durably painted white on each side of the stem and the rudderpost.

The main-deck quarters shall be generally finished white; also the galley and upper engine room shall be white with a wainscoting 42 inches high of light straw color. The woodwork in the quarters and the hardwood furniture and fittings in the various staterooms and quarters throughout the vessel shall be of natural finish. The wood shall be properly "filled," shellacked, sandpapered, and varnished, the last coat to be of the best grade of marine varnish; the varnish to be "rubbed" to give a dull finish. The flooring in the holds, quarters, and storerooms shall have two coats of lead-and-oil paint on the bottom before being laid and two coats on top after being fastened.

The boiler, uptake, and smokestack, the engine and pumps, the engine-room appointments and attachments, and all work not finished bright about the machinery shall have three coats and all insulation or its canvas covering two coats of approved paint; the final coats in all cases shall comply with the regulations for the United States Lighthouse Service. The water tank and all similar accessories and fittings shall be painted three coats outside.

The letters "U. S. L. H. S., L. V.," and number of the vessel shall be neatly painted (not stenciled) on all movable articles as may be directed. The figures "103" or "104," as may be the case, shall be cut in the main deck beam at the entrance to the machinery room.

The galvanized-iron handrails, stanchions, etc., shall be painted white unless otherwise required. Radiators shall be finished with the best bronze paint.

74. Hardware.—All hardware shall be of brass or composition and of extra strong approved design.

There shall be furnished throughout the vessel suitable and substantial locks with duplicate keys, also hinges, hooks, handles, eyes, bolts, rubber-tipped doorstops or catches, knobs, ringbolts, etc., wherever required, of approved pattern and make, all of brass, fitted in place on doors, ports, and drawers in the staterooms, toilet rooms, lockers, and elsewhere as directed. The wardrobes shall be provided with at least six substantial brass clothes hooks. Each door hook shall rest in an eye to prevent rattling.

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75. Glazing.—The glass in the fixed lights, all air ports, and elsewhere throughout shall be of the best quality, of an approved thickness, white, clear, and polished, free from all defects, and shall be approved by the superintendent of construction.

76. Steering Gear.—A compound geared rack and pinion steering gear with two steering stands and hand wheels shall be furnished and located where shown; the gear on the pilot house shall be arranged to disengage. It shall be similar to the Bureau's standard design. A guidance plan will be furnished upon request. The stands shall be composition castings, the hand wheels of composition 3½ feet rim diameter with handles covered with rosewood, the shafting of Tobin bronze, and bevel gears of phosphor bronze with cut teeth. The rack and pinions shall be of steel with cut teeth fitted in a bronze frame secured to the upper deck beams. Shackles shall be fitted at each end of the rack for securing the leads to the quadrant. A sheet steel drip pan shall be fitted to support the ends of the rack and catch the oil drip.

The leads to the quadrant shall be $\frac{9}{16}$-inch diameter extra flexible galvanized crucible cast steel wire rope having 8 strands and one hemp center, each strand having 19 wires, properly spliced, and fitted with thimbles, turnbuckles, etc. The leads shall be carried on cast-iron rollers and sheaves, with graphite bronze bushings and steel pins, secured to the deck beams and spaced as will be directed. The quarter blocks shall be of cast iron, 12 inches in diameter, with deep groove, bushed, as above, and suspended from the deck by wrought-plate or cast-steel frame. Thimbles of composition "S" shall be fitted at all bulkheads.

All leads, nuts, lock nuts, fair-leads, turnbuckles, etc., necessary for the completion and successful operation of the gear shall be furnished and fitted complete.

77. Interior Communication.—*Speaking tubes.*—There shall be fitted between the engine and windlass room and two stations on the bridge and in the pilot house a complete system of galvanized-iron speaking tubes, 1½ inches in diameter, with nickel-plated mouthpieces of the heavy whistle pattern. There shall also be a speaking tube from the bridge to the pilot house below. All tubing in the pilot house shall be of polished brass. The mouthpieces on the bridge shall have weather-tight composition covers.

Bells and pulls.—The engine-room gong shall be 14 inches in diameter and the jingle bell 4 inches in diameter, all properly wired from two stations inside of the pilot house, the bridge, and upper deck aft. The bell wires shall be of hard-drawn composition of No. 13 B. W. G., properly led and supported. Bends, where unavoidable, shall have brass pulleys, chains, brackets, and fair leads as may be required; bell cranks will not be accepted. Brass springs and turnbuckles shall be fitted on all the wires for taking up their slack, and the wires shall be so connected as to render adjustment convenient. Open and closed drop-bell pulls of brass for the gong and jingle bell of approved form and finish shall be properly attached and located at a convenient height. There shall be six stations in all—two in the pilot house, two on the bridge, and two on the upper deck aft.

Galvanized-iron tubes shall be fitted from the engine room with a polished brass hood over the gong to convey the sound through

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suitably shaped trumpet opening in the pilot house and the bridge. All tubing in the pilot house shall be polished brass.

78. Fog Bell and Belfry.—There will be furnished by the contractor one clear-sounding bell of 700 pounds weight, to be located as shown on the plans, and to be hung in a steel frame strongly and neatly constructed and braced. The bell will be arranged so as to swing or not at will. The clapper will be of suitable size, provided with springs, and well and carefully hung. The bearings for the bell trunnions shall be not less than 2 inches in diameter, fitted with brass bushings. The letters "U. S. L. H. S." and the year in which the vessel is completed shall be neatly engraved on the bell and black enameled in the very best manner. A manila rope of suitable length and size shall be secured to the clapper.

79. Steam Windlass.—A steam windlass with cylinders 6 inches in diameter and 6 inches stroke, reversible by handwheel-controlled eccentrics, shall be furnished and installed. The windlass shall be fitted with two wildcats for 1⅜-inch stud link chain cables, two gypsy heads. The wildcats shall have a positive handwheel screw-locking device and friction-band brakes of ample strength to ride by.

The pump-brake arrangement shall be attached to the bedplate.

A large 1½-inch shackle shall be fitted to each of the outer main bearing supports for handling the chains. The bedplate shall be provided with four steel pads to take the fork end of the chain-stopper back stays.

The main bearing supports, the pump-brake arrangement, and the bedplate shall be of cast steel. All steam piping leading to the windlass shall be of copper; the exhaust piping shall be of galvanized iron and lead directly overboard. All valves, connections, fastenings, and fittings shall be furnished and all complete for actual service. The windlass shall be mounted on a wooden foundation, as specified under "Engine, boiler, and other foundations."

80. Chain Stoppers.—The chain stoppers and pawls with locking device shall be made of cast steel of extra strong design, arranged as shown and mounted on plate and angle foundations. The springs for the chain stoppers shall be 3 feet long, carefully tempered. Four heavy backstays shall extend from the stoppers to and be secured to the windlass bedplate, and they shall be fitted with turnbuckles and lock nuts. The rollers shall be designed to suit the 1⅜-inch stud-link chain cables.

The bearings for the rollers shall be babbitted and provided with large compression grease cups.

The chain stopper and roller foundations shall be carefully centered to suit the lead of the chains through the hawse pipes to the specified position of the windlass.

The bottom angles will be 3 by 3 by ⅜ inch, the top, sides, and stiffening angles 3 by 3 by ⅜ inch; the top plates to be 20 pounds and the side plates 15 pounds per foot; the inner stiffening plates to be 10 pounds per foot.

The plates must have lightening holes so arranged as not to interfere with the structural strength of the foundation.

81. Anchors and Chains.—The contractor shall furnish one cast-steel harbor anchor of the stockless pattern weighing 1,200 pounds, and to stow in the hawse pipe, and one kedge anchor of wrought iron or steel of the "Cape Cod" type, weighing 225 pounds, the

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latter to be stowed in front of the pilot house, mounted on chocks and securely held in place; also six hand chain hooks and three devil's claws with rings and fitted for 1⅜-inch stud-link chain cables.

The mooring chains and the 5,000-pound mushroom mooring anchor will be furnished by the Bureau, but all chocks, ringbolts, beddings, etc., necessary for the stowing, working, handling, and securing of all chains and anchors shall be furnished and fitted by the contractor, to the satisfaction of the Bureau's superintendent of construction.

82. Boat and Cargo Davits.—The boat davits shall be of the screw type, supported and swinging outboard from the heel, or of the quadrant type, similar to that manufactured by the Welin Marine Equipment Co., or other approved type having the characteristics specified. They must be of such strength that the boat can be easily lowered with their full complement of persons and equipment, the vessel being assumed to have a list of 15°. The davits must be fitted with a gear of sufficient power to insure that the boats can be turned out against the maximum list of the vessel under which the lowering is possible. The davits shall handle a working load of 4,900 pounds, they shall weigh not more than 1,450 pounds each, and swing the center of the boats to a position outboard about 4 feet from the sides of the vessel. The davits shall be properly mounted and the underside of the spar deck reinforced; the surfaces of contact between the base flange of the davits and their foundations must be rough planed.

The cargo davits, shown over the cargo ports at each side of the vessel, shall be of wrought steel 3 inches in diameter at the bearing and properly shaped. The tubular bearing shall be of cast iron, have a large rectangular base flange strongly ribbed, drilled for a ½-inch drain, and secured to the spar deck.

All davits must be furnished and fitted with blocks, ropes, hooks, cleats, fair leads, etc., to hoist the boats and cargo by means of the gypsy heads on the steam hoisting engine on the spar deck.

83. Boat Chocks.—Chocks of a suitable size shall be fitted for stowing the boats on deck. They shall be of a modified Navy type, consisting of a deck casting notched for the keel of the boat and two cradle arms extending from same and curved to the shape of the boat. The deck casting shall be of sufficient width to permit strong connections of the arms and through bolting to the deck.

The outboard arm shall be hinged to fold down on the deck, and shall be made of T-bar or other suitable shape. The upper surfaces shall be covered with tufted leather sewed in place. The inboard arms shall be rigidly and permanently supported, and the outboard arms supported by means of a threaded bar and turnbuckle hinged to a pad eye on deck and to a lug near the extremity of the arm.

Modification in detail of the arrangement may be proposed by the contractor.

Two ringbolts shall be fitted on each side of each boat. Leather-covered iron grips reaching over the gunwales in one piece with rings at their lower ends, eyebolts, proper lashings, trip hooks with rings, etc., shall be provided.

The underside of the upper deck in the way of the cradles and ringbolts shall be reinforced. Ironwork shall be galvanized where directed.

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84. Steam Hoister.—A steam hoister of approved make having two horizontal cylinders about 4 by 4 or 4 by 6 inches, fitted with two winch heads for manila rope, and all handling gear for use in hoisting the boats, provisions, coal, etc., shall be furnished and installed. It shall be mounted as specified under "Engine, boiler, and other foundations," connected with the auxiliary steam pipe and exhaust below deck into the main escape pipe. The engine and all pipe connections must be properly lagged and drained to prevent freezing. A removable wooden housing shall protect the engine when not in use.

85. Mast and Spars.—The vessel shall be rigged as shown on the plans, with a steel lantern mast forward and a wooden jiggermast with boom and sail aft.

Lantern mast.—The lantern mast will be stepped on the main deck with a mast partner at the spar deck; it shall be built of steel in accordance with the rules for the construction of vessels approved by the Bureau, except where otherwise stipulated in these specifications. The outside diameter shall be 16 inches throughout; the focal plane of the lens shall be 45 feet above the water line. There shall be two strakes of plates in the circumference, the plates to be 10 pounds per square foot; the plating and riveting must be flush for its entire length. The butts must be properly shifted and be treble riveted; all butt straps shall be 2½ pounds heavier than the plates; also all doubling plates at mast partners, hounds, rigging lugs, etc. The inside stiffners, three in number, shall be 2½ by 2½ by $\frac{5}{16}$ inch angles; they shall extend the full length of the mast.

The angle rings on the mast shall be 3 by 3 by $\frac{5}{16}$ inch and welded. The straight and the dished top plates which form the foundation for the lantern shall be 15 pounds per square foot.

The mast shall step in a 3 by 3 by ⅜ inch angle ring riveted to the heel of the mast and the main deck. The partner at the spar deck shall consist of a welded deck ring of 3 by 3 by ⅜ inch angle and a 15-pound plate, coned for wedging, reinforced by a 2-inch diameter half-round at the top and secured by a double-riveted butt strap above and below the deck angle; the mast shall be tightly held with white-pine wedges in the partner ring and made water-tight with a mast coat of heavy lead properly secured. (See "Deck house and bridge" for constructtion at mast opening in top of deck house.)

Attachments for the ship's lights, with guide blocks, cleats, etc., as necessary shall be fitted on the forward side of the mast.

A suitable ladder shall be fitted to the afterside of the mast. The gallery about the top of the mast shall be 6 feet in diameter; the outer ring shall be made of 3 by 3 by ⅜ inch angles connected with the mast ring by six 4 by 2½ by $\frac{5}{16}$ inch T bars, all supported and stayed by six round braces 1¼ inches in diameter, properly shaped, and their palms securely riveted to the mast and the outer ring. Five of the sections formed by the T bars shall be fitted with round-bar gratings, the other section, just over the ladder, shall be covered with diamond-pattern steel plates and fitted with a hinged steel trapdoor of the same material, opening up and aft; the door and plates to be perforated with ¾-inch holes to prevent accumulation of snow or ice. The sectional circular grating shall be made of long and short $\frac{9}{16}$-inch rounds with 2¼ by ¼ inch side bars, all riveted over and secured in place.

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The circular rail shall be 40 inches high above the platform, consist of a 1-inch galvanized-iron pipe top bar reeved through the stanchion heads; the three intermediate bars shall be of 2 by ¼ inch flat steel riveted to the stanchions.

The stanchions shall be of forged steel ¾ by 1⅛ inches, rectangular in section, with properly shaped heads bored out to suit the pipe rail; the feet shall be fastened with two rivets to the outside of the gallery angle ring; the flat bars must have two rivets on each stanchion, and butts must be fitted with doublers on the inside and riveted.

A catch must be fitted to hold the door when open; a flush handle and substantial composition hinges shall be fitted.

The iron screen-wire cloth for the day mark shall be of No. 2 wire, securely fastened to the circular rail, as shown, and shall be 3 feet wide and have 1¼-inch space between the wires.

A lightning rod consisting of sharp-pointed ⅞-inch diameter polished copper spindle 15 inches long shall be soldered to the top of the lantern and connected on the after side with the steel structure of the mast, forming a good metallic contact.

The lugs for the shrouds, stays, etc., must be extra strong, shaped to suit the conditions, of forged or cast steel, and strongly riveted to the mast and doubling plates. A single metal block with flag halyard shall be secured at each side of the gallery to its outer base angle.

Type plans of mast and lantern will be loaned upon request.

86. Signal Light System.—The Bureau will furnish and deliver at the works of the contractor a 375-millimeter acetylene gas lantern, arranged to display the desired characteristics, with electric flasher clock and batteries and twelve acetylene gas tanks; the latter are 9⅛ inches outside diameter by about 69⅝ inches long, including the valve cap. These tanks shall be placed vertically and secured in properly designed racks where shown, arranged for easy removal. The Bureau will also furnish the gas manifolds, the necessary lengths of piping, unions, and valves. The contractor shall assemble, mount, and install the apparatus, furnish the electric conduit and wires for the flashing apparatus, and supply and fit all necessary hangers and additional fittings, as may become necessary. The gas-pipe conduit and wires shall be carried to the burner within the lens and properly secured and fastened to the mast and as may become necessary. All necessary wrenches, spanners, and tools, etc., for the operation of the apparatus shall be properly stowed in the most convenient manner.

87. Jigger Mast and Boom.—A jigger mast shall be fitted and rigged as shown. The mast shall be in one piece, of Oregon pine or spruce, free from loose or decayed knots, sap, or other defects, and shall be stepped on the spar deck as shown. It shall be 29 feet in length to the stay band, 32 feet over all, 9 inches diameter at the spar deck, and tapered to 7 inches diameter at the stay band. A lignum-vitæ truck 8 inches in diameter, with brass sheaves for halyards, shall be secured at the masthead. The boom shall be first-grade spruce or Oregon pine about 17 feet long and 6 inches maximum diameter.

The mast shall be stepped into a square cast-iron ring step, which shall be payed with thick red lead at the time when the mast is finally stepped. A band ½ by 2½ inches shall be shrunk on the heel of the mast.

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88. Ironwork for Spars and Rigging.—The jigger mast shall be fitted with a forged or cast steel band with lugs for the attachment of the shrouds, stays, topping lift, and halyard, a boom gooseneck band, travelers for the masthead light and sail, and a pin-rail band. Four galvanized belaying pins shall be fitted in the pin rail. The boom shall be fitted with wrought-steel gooseneck, a sheet band, a clew and topping lift band, and traveler for brailing the sail. All additional ironwork and attachments shall be fitted as may be necessary for the completion and operation of the rig.

Chain plates and deck pads for securing the lower ends of shrouds and stays, pad eyes for sheet blocks, and cleats and belaying pins shall be securely riveted where shown and required.

The lantern mast shall be rigged as shown on the plans, fitted with annealed forged-steel lugs for the attachment of the stays, etc.

Chain plates of forged steel for securing the lower ends of the shrouds and stays shall be securely riveted where shown and required. All ironwork shall be of extra strong proportions, and lugs on the lantern mast and the chain plates shall be fitted in the line of the rake of the shrouds and the center line of the mast.

89. Standing Rigging.—The fore stay shall be 1⅛ inches and back stays and shrouds shall be ⅞ inch diameter, galvanized, crucible, cast-steel wire rope with hemp center, and six strands of seven wires each. All stays at each end shall be fitted and secured with open pattern, weldless rope sockets; the hemp center must be removed for the length of the socket, the wires cleaned, turned back and securely fitted, after which babbitt metal must be used for the filling in securing the sockets to the wire rope.

The stays for the jigger mast shall be ⅝ inch diameter and of the same material as above specified.

Wrought steel turnbuckles with lock washers and split pins shall be fitted on all stays and shrouds.

Galvanized-iron belaying pins or cleats shall be fitted where required for hoisting ropes, halyards, etc.

All ropes and blocks required for the running rigging, the running lights, the boat davits, for the jigger and lantern mast, etc., with all necessary shackles, ringbolts, cleats, etc., also four 3½-inch manila fasts, each 30 fathoms long, and two heaving lines of 15-thread hemp rope, each 25 fathoms long, shall be furnished.

90. Blocks.—All blocks shall be of wood and have an approved type of graphite bronze bushed sheaves, galvanized-iron straps, except where otherwise specified, and be fitted complete, each for its purpose.

The principal blocks shall be as follows:

Boat davits, 4 double of 9 inches; loose swivel hooks.

Boat davits, 4 triple of 9 inches; fitted with shackles and bolts to suit davits.

Spare, 3 snatch, one each of 10, 8, and 6 inches.

Watch tackle, 6 double, two each of 6, 8, and 10 inches.

Relieving tackle, 4 double of 6 inches.

Boat hoisting arrangement, 10 snatch blocks, 9 inches.

Additional blocks for signal halyards, lights, boom brails, sail, ash hoist, etc., shall be fitted as may be required for the satisfactory operation of all parts of the rig.

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Manila ropes of ample length and proper diameter shall be furnished for the above.

91. Sail.—The sail shown shall be furnished. It shall be strongly made of the best quality of No. 4, cotton canvas, and properly finished and furnished with downhauls, sheets, boltropes, travelers, and all other necessary fittings in complete working order. The sail shall be of proper cut and set.

92. Awnings, Covers, etc.—Awnings shall be furnished and fitted over the upper deck from the jigger mast to the stern, and forward from the after end of the deck house as shown. They shall be of No. 6 canvas and fitted complete with portable stanchions, ropes, lashings, etc.

Suitable covers of No. 6 canvas shall be fitted for the boats, sails, steering wheels, binnacles, etc. The canvas covers fitted on the steering stands and wheels shall be painted and lettered U. S. L. H. S., L. V. No. 103, or No. 104. The covers shall have brass eyes sewed in and lacings or lashings to secure them to similar eyes screwed to the beds or at other convenient places.

93. Flagstaffs and Flags.—Two flagstaffs shall be fitted where shown with the necessary step, fastening, cleats, truck, brass sheave, halyard, etc. Two ensigns, 3.52 feet by 6.69 feet and 1.31 feet by 2.49 feet, respectively, two Lighthouse Service pennants, and a full set of international code signals 4 by 4 feet will be furnished by the Bureau.

94. Galvanizing.—All rails, rail and awning stanchions, braces, rail cleats, fair-leads, ringbolts and eyebolts, foot blocks, and small fittings on the decks, etc., and the ironwork on the rigging, boats, lantern, etc., where directed, shall be galvanized by the hot process.

95. Life Preservers and Buoys.—Fifteen life preservers with shoulder straps and waist fastenings, and four canvas-covered ring life buoys with lines and two Coston rescue water lights shall be furnished. The life preservers and buoys shall be neatly lettered (not stenciled) "U. S. L. H. S., L. V. No. 103," or "U. S. L. H. S., L. V. No. 104," and stowed as will be directed.

Each life buoy shall be fitted with 30 fathoms of line.

96. Binnacles and Compasses.—The contractor shall furnish two Navy standard compensating binnacles, with all correctors, and two 6¾-inch liquid compasses, with azimuth instrument, and install same as shown and as will be directed.

The compasses shall be adjusted by the contractor immediately prior to the delivery of the vessel and at such time as will be approved.

97. Bulkhead Lamps, Side Lights, Screens, etc.—There shall be furnished and secured as will be directed 8 brass and 16 galvanized-iron 9 by 13 inch bulkhead lamps with guards.

All running, towing, and anchor lights, with screen boxes, etc., constructed and located in accordance with the regulations of the Steamboat-Inspection Service and pilot rules for seagoing vessels, shall be furnished and properly installed with all gear for raising and lowering, etc. All lanterns to be of brass, with fresnel lenses not less than 8 inches in height.

98. Ventilators and Ash Hoist.—There shall be three 15-inch ventilators for the fireroom with trunks extending below the main deck,

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the after one to be fitted with a door between decks in the boiler-room casing, a strong back, sheaves, blocks, etc., complete for hoisting ashes. They shall be fastened with 3 by 2½ by $\frac{5}{16}$ inch angle rings to base plates riveted to the spar-deck beams with the 3-inch leg vertical and calked water-tight; the trunks shall be built of $\frac{3}{16}$-inch steel plates, with flared cones on the bottom; the cowls shall be made of No. 16 B. W. G. galvanized plate steel; the mouth shall be circular and twice the diameter of the trunks; brass pipe ½-inch in diameter shall be split and securely riveted and soldered around the mouth. The cowls shall turn on machined cast-iron sleeves fitted with grease cups, butterfly stop screws, and handles for turning. Wooden margin pieces shall be fitted about the base to take the ends of the deck planking.

Three 9-inch ventilators shall be fitted on the spar deck forward, with trunks, as shown, reaching below the main deck, with flared cones at the bottom. Two shall ventilate the storerooms in the hold, the other the paint locker in the forepeak. They must be removable and adjustable at the spar deck; the trunks above deck shall be of ⅛-inch galvanized steel plate, and be secured to the deck by composition plates or rings with flush screw covers all made water-tight at the spar and main decks; the cowls shall be as above specified, fitted with ⅜-inch brass pipe around the rim.

Four mushroom ventilators shall be fitted, two on the spar deck aft and two on top of the acetylene-gas tank-storage room, where shown. They shall be 10 inches in diameter and shall consist of a composition casting fitted water-tight to the spar deck and the steel plating on top of the deck house, with a composition cover with rubber gasket with handwheel and screw for operating the cover from below with extension rod as may be required. Webs shall be fitted in the ventilator with threads for the screw and guides for the cover. The two after ventilators for the illuminating-oil storage room shall have rectangular trunks of steel plate sloped out just under the spar deck to suit the opening of the mushroom.

Guidance plans of similar ventilators will be loaned upon request.

99. Boats.—The 20-foot power boat shown on the starboard and the 18-foot sailboat shown on the port side of the spar-deck plan shall be furnished by the contractor.

POWER BOAT.—One power boat shall be furnished in accordance with these specifications and installed complete with cradles, leather-covered grips, lashings, eyebolts, canvas cover, etc.

	Ft.	in.
Length over all (exclusive of rudder)	20	6
Breadth outside of planking	6	¾
Depth (top of keel to top of covering board amidships)	3	0

General description.—To be an open, carvel-built boat, with side seats, fitted with a removable double-folding spray hood and propelled by a 6 to 8 horsepower two-cylinder, two-cycle engine using kerosene and gasoline for fuel. A drawing of the boat, showing the general arrangement, the lines and table of offsets, etc., will be furnished to the successful bidder.

Material and construction.—Stem, apron, deadwood, keel, shaft log, and stern post to be of well-seasoned white oak, without black or loose knots, checks, or sap. The stem and deadwood are to be sided 2¾ inches. Keel is to be sided 2½ inches. Shaft log is to

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be bored out of one piece of 4-inch white oak and as shown, without knots, checks, or sap, and decreased in thickness above and below the center line of shaft to make a graceful cross section without noticeable corners or hollows. There is to be a 1½-inch extra heavy galvanized-iron pipe running through shaft log to form a casing for propeller shaft, screwed at ends, if possible, to stuffing box and stern bearings. Deadwood above shaft log and stern post to be sided 2¾ inches. There is to be a white-pine stop water at each intersection of a scarph, with the rabbet line. All scarphs in keel, deadwood, shaft log, apron, and stern post to be forelocked and well bolted or riveted together with galvanized-iron bolts or rivets of sufficient size to insure proper strength with galvanized-iron washers under all rivets or rivet heads. Limber holes are to be at each floor timber to allow free passage of bilge water.

Frames.—To be of tough, straight-grained white oak, without checks or sap, and are to be steam bent, without any loose slivers or breaks in the grain, which would weaken the frame, sided 1¼ inches, molded 1¼ inches at head and 1¾ inches at heel, tapered uniformly, and spaced 8 inches from center to center.

Floors.—To be of sound white oak, sided 1⅛ inches and molded deep enough to form foundation for floor, well fastened to frame by $\frac{5}{16}$-inch galvanized carriage bolts over galvanized-iron burrs. Near bow and stern, where frames are not connected by floor timbers, they are to be mortised into keel or deadwood and well fastened by galvanized-iron fastenings. Each floor timber is to be fastened to keel and keelson by one ⅜-inch galvanized-iron rivet over galvanized-iron burr, as per drawing, running forward to frame 4 and aft to frame 23, inclusive.

Planking.—Planking, with the exception of plank-sheer and garboard, to be of clear soft Louisiana red cypress, free from sap and knots and of uniform thickness when finished, not less than $1\frac{3}{8}$ inch at any point. Ends are to be the same thickness as the rest of planking. The plank-sheer is to be of clear white oak in two pieces 6 inches wide amidship, decreased proportionately at ends. The garboard strake is to be of white oak and not to be wider than 5 inches amidship. The intermediate strakes are to be of equal widths, not more than 4 inches nor less than 3½ inches in width amidship, and so tapered as to keep the strakes of equal width at any point, fore or aft of amidship. Only one butt joint, on 1⅛-inch oak-butt block, fitted inside of planking to be allowed in any strake. Butt blocks in adjacent strakes not to be closer than three frames apart and not more than one butt block to be between same frames on either side. Planking to be fastened to frames with copper rivets headed over on burrs with heads countersunk and putty plugged; two rivets through each plank at each frame. Ends of strakes to be fastened with brass screws, about 1¾-inch, No. 12. Ends of strakes are not to be split at fastenings. All surfaces in scarphs in keel, deadwood, frames, and floors, hidden in course of construction must be painted with a thick priming coat of pure white lead and linseed-oil paint before the surfaces are to be put together. The seams in hull, including garboard seam, to be of the bevel type, closed on the inside, with enough opening on the outside to make a good calking seam. Seams to be calked with calking iron and mallet with yacht spun cotton, then payed with thick paint and puttied flush. Provide

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one automatic composition screw plug, 1¼-inch size, amidship for drainage.

Other framework.—Covering boards to be of clear white oak, 1 1/16 by 6 inches amidship. Scarphs to be not less than 18 inches in length, of the hooked type, bolted or riveted with at least three 5/16-inch bolts. Clamps to be of clear white oak in one piece, 2½ by 3 inches, tapered at ends if necessary. Fender strakes at top and bottom of plank-sheer, the upper to be 3½ by 1½ inches half round, and lower to be 2 inches by ⅞ inch half round, each of one piece clear white oak, tapered at ends. There is to be one ⅜-inch carriage bolt through upper half round, plank-sheer, frame, and clamp, and ¼-inch carriage bolt through lower half round, plank-sheer, and frame at each frame, with the underside of head of bolt even with the outside of gunwale strip and not countersunk. Ends of fender strakes to be fastened with brass screws.

Engine timbers.—Engine-bed timbers of white oak shall extend and be notched over at least six frames, landing on the planking, and will be through fastened to the floors and planking with ⅜-inch galvanized-iron bolts.

Decks.—At forward and aft ends of cockpit there are to be substantial oak deck beams connecting the covering boards, well bolted to the covering boards and fastened to frames, covering board to follow deck line from steam to sternpost. Forward and after deck to be of ⅞ by 2 inch clear white oak, calked, seams filled with marine glue.

Coaming.—A coaming of clear white oak in four lengths, 9 by 1 1/16 inches, is to extend around cockpit, gradually sloping to 12 by 1 1/16 inches at center of forward end, as shown on drawing, to be steam bent, without fracture, and fastened to side pieces with 4-inch butt block and brass screws. A ⅞-inch quarter round of white oak to be placed in corner formed by coaming and decking, to be flashed with 3-pound lead laid in white lead.

Inside finish.—There is to be a cover over shaft, aft of engine coupling. Floor to be ¾ by 4 inch No. 1 white pine or cypress flooring, made in portable sections. There are to be partitions or bulkheads amidship forward of engine and at forward and aft ends of cockpit, with doors in two last mentioned. Seats as indicated, with tops of same hinged to form lockers of suitable height.

Deck fittings and rigging.—One 3 by 3 inch white oak tow post, as shown on attached drawing, with ⅜ by 9 inch brass pin. There is to be one 3 by 3 inch white oak bit in forward deck, as shown, and a galvanized-iron ringbolt at bow and stern of 1-inch stock, through 1/4 by 3 inch square washers, fastened to deck with four 3/16-inch carriage bolts. Lower end of rod to be fastened with nut and cotter pin to bracket on stern and sternpost. Brackets to be bolted through stem and sternpost. Rings to be 5 inches outside diameter of ⅞-inch stock.

Rudder and steering gear.—The rudder to be of size and form as shown, of 1⅜-inch clear white oak, with at least four ⅜-inch galvanized-iron rods through same at points along its greatest width, riveted over burrs at ends. The pintle is to be formed by a 1-inch galvanized rod, of length as shown, screwed into steel shoe at bottom the full thickness of the shoe, and a 1-inch heavy brass-pipe sleeve to be fastened to brass jaws over rudder forming upper bearing and

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to turn on iron rod when rudder is in place. Bottom bearing will consist of a substantial forged jaw, made of one-piece good wrought iron, with hole for rod, bored, and well fastened through rudder, with rivets countersunk on each side. A similar jaw is to be fitted to sternpost, to form bearing for brass tube. At top of rudder there is to be a galvanized-steel or composition casting, as indicated in drawing attached. Casting to be not less than ¼ inch in thickness at any point and to fit snugly over rudder head and to be fastened by galvanized bolts, riveted and countersunk.

The tiller is to be made of 1¼-inch steel shafting, welded to substantial steel jaws, turned true and fitting without avoidable play, over casting on top of rudder, with 1-inch bolt through jaws and rudder. At inboard end of tiller there is to be a steel pin to prevent loss of tiller when unshipping same. Sliding on inboard end of tiller will be a cast brass sleeve with two eyes for connecting tiller rope, cylinder of sleeve to be not less than ¼ inch thick, provided with a small oiling hole at top. Sleeve to be 4 inches long. One-fourth inch pliable wire tiller rope is to be furnished and run through brass-sheave cheek blocks not less than 3 inches inside diameter, substantially set and fastened as shown. Tiller rope to run below deck through Babbitt-metal fair-leads. Steering wheel to be of approved design, with galvanized-iron or composition drum and 16-inch wood rim without handles. Steering-drum shaft to turn in brass bearings provided with oil holes for lubrication, substantially fastened and braced to framework of boat.

Stem band and keel protection.—Stem band is to be 1-inch half-oval galvanized iron, bent over stem at top, and well fastened to stem with galvanized screws countersunk, flattened at lower end to cover forward end of keel. Shoe will be ¼ by 2½ inches in cross section at forward end and increased to 1 by 2½ inches at end of keel, and taper to ¾ by 2 inches at lower rudder bearing. A ⅜ by 3 by 9 inch plate to be welded on each side of shoe and let in flush with sides of keel. Galvanized countersunk bolts to go through keel and both plates, riveted.

Fuel tanks.—There are to be two 25-gallon fuel tanks of extra-heavy galvanized iron fitted inside of air tanks as shown. Feed pipes to be ¼-inch annealed copper tubing, with a brass valve at or under each tank, and suitable connection at carburetor. Brass deck filler plates to connect with tanks at top. Fuel tanks to be fitted with splash plates.

Spray hood.—Boat to be fitted with a removable double-folding spray hood, front and rear sections, lengths to be approximately as shown on drawing. Hood to be of best grade No. 8 canvas, well and carefully sewed. Lower edge hemmed not less than 2 inches deep; hoops to be incased in canvas pockets. Front sections to have apron for lapping over rear section about 6 inches; to be fastened to rear section by snap fasteners, similar to the Broga automatic closed-top fasteners, spaced approximately 6 inches, center to center. Each section to have a 12 by 12 inch pocket fitted with celluloid window. Rear section to pocket over towing post. No. 3 brass grommets are to be placed in lower edge of hood, located approximately as shown, spaced approximately 9 inches, center to center, and fasteners similar to the Excelsior curtain fasteners are to be fastened by screws to cockpit coaming, for fastening lower edge of hood to coaming. One

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15-thread manila lanyard, 6 feet long, to be spliced in grommet on each side of each section of hood. Hoops to be ¾-inch galvanized-iron pipe, bent to fit around coaming ends. Lower end of hoops to be fitted with eye for sliding on 1-inch galvanized-pipe rail. Rail to be fastened to covering board with $\frac{5}{16}$-inch galvanized bolts through covering board and clamp, countersunk heads on outside. Ends of rail to be so shaped that hood will fold down around ends of cockpit coaming.

Propelling engine.—A 6 to 8 horsepower two-cylinder, two-cycle engine with "make-and-break" ignition, of the Kahlenberg or other type having approved similar characteristics with cylinders 4 inches diameter and 4 inches stroke, using gasoline and kerosene for fuel, shall be furnished and installed.

The engine must be reversible, fitted with extra-heavy steel crank and Tobin bronze propeller shaft with a 16-inch or 18-inch heavy three-bladed bronze propeller, making approximately 600 revolutions per minute, its weight in total to be about 450 pounds. It must be fitted with an approved friction clutch for use in starting, stopping, and running at various speeds, with a convenient reversing mechanism and all piping, valves, etc., necessary for its satisfactory and successful operation.

The stern bearing and stuffing box are to be of extra-heavy bronze and stern bearing connected with shaft pipe. The shaft couplings to be flanged. The mufflers to be cast in one piece and properly baffled to prevent back pressure on the engine.

The water-circulation pump to be made of bronze. All journal boxes are to be extra long and to be lined with highest grade Babbitt metal or phosphar bronze. The cylinder and crank cases are to be cast in one piece with separate cylinder heads, journal boxes, and handhole plates.

Engine to be fitted with approved magneto attached to engine, 6 cells, 30 ampere, dry battery, double-pole, double-throw switch, spark coils, etc., primary low-volt insulating wire and secondary high-voltage insulating wire, proper timer and switch, all necessary oil cups, etc., complete ready for installation, together with all necessary oil cans, set of tools, and three copies of instruction book and repair-part list. All material and workmanship shall be of the highest quality, well adapted to the service for which used and capable of rendering long and satisfactory service.

Bidder is required to furnish complete detailed description of the engine and outfit he proposes to furnish with all necessary cuts and drawings necessary to describe same clearly.

Painting.—Outside of boat, with the exception of plank sheer, half rounds, covering boards, and decks to be painted one priming coat and two coats of color as ordered. Above portions excepted to be given two coats of boiled linseed oil, where exposed to the weather, and three coats of best spar composition. Interior painted three coats lead color. Identification letters shall be painted in 3-inch letters on the bow as directed with the number of light vessel cut into the stem.

Ice sheathing.—Outside of hull from keel to a line 9 inches above water line No. 2 to be properly and smoothly covered with No. 26 galvanized iron, painted on inside before fastened, butt jointed, and

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fastened securely with galvanized cone-pointed nails, not reaching through planking.

Equipment.—One pair of 10-foot ash oars, two 7-inch boat hooks with 8-foot handles, cork-filled canvas cushions for locker seats; a bow and stern painter of 2-inch circumference manila rope, each 6 fathoms long; and portable side-light screens are to be fitted in accordance with regulations for motor boats, class 2, Department of Commerce.

Cover, ridgepole, and spreaders.—A removable, double-folding spray hood with all fittings, a suitable waterproof cover fitted over the engine shall be furnished, also a ridgepole and spreaders of pine properly fitted in place; a boat cover made of No. 6 canvas, fitted with brass eyes sewed in and proper means provided for lashing and securing same shall be furnished and fitted.

Fastening.—All material used for fastening not herein specified to be copper or galvanized iron.

Trial trip.—A trial trip is to be made at the contractor's expense and risk, of about one hour's duration, or as may be directed, with full power, the trip to be repeated if necessary, to the satisfaction of the repesentative of the Bureau of Lighthouses, that full assurance may be given of the satisfactory working of the motor boat and appliances in all their parts and in all respects.

SAILBOAT.—One 18-foot sailboat shall be furnished in accordance with these specifications and installed complete with cradles, leather-covered grips, lashings, eyebolts, canvas cover, etc.

General description.—To be an open carvel-built type, with athwartship and stern seats, steel centerboard, mast and sail, etc. A drawing of the boat showing the general arrangement and lines, etc., will be furnished to the successful bidder.

	Ft.	in.
Length from rabbet to rabbet	18	0
Breadth, molded	6	0
Depth, top of keel	1	10½

Keel.—To be of white oak, sided 6 inches in center, and diminished to 2 inches at ends to correspond with size of stem and sternpost; in depth to be 2 inches and rabbetted to receive garboard strake.

Stem.—To be of white oak, sided 2¼ inches, and well secured to keel with galvanized bolts riveted on rings; deadwood to be of white oak, sided 3½ inches, and fastened to stem with galvanized bolts riveted on rings, and fitted with 1-inch half oval stem iron.

Sternpost.—To be of white oak, sided 2¼ inches, deadwood to be white oak, sided 3½ inches, and of proper depth to receive timbers and plank; to be properly secured to keel with galvanized bolts riveted over rings.

Centerboard.—To be of steel plate $\frac{3}{16}$ inch thick and brass chain for hoisting. Centerboard pin to be brass, ¾-inch diameter. Centerboard casing to be framed with clear white oak and sided with cypress ¾ inch thick.

Frames.—To be straight-grained white oak, in one piece, as far as practicable, bent to conform to the shape of the boat; frames sided 1 inch; mold at keel 1¾ inches; at head 1 inch; frame space 12 inches center to center. In the space between frames will be intermediate floor frames, sided 1 inch, forward and aft of centerboard case as far as is practicable. Along the centerboard the frames will be kneed to

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the center board case and securely fastened to frame keel and centerboard case.

Planks.—To be of white cypress, ¾-inch thick, nine strakes on each side, properly fastened with copper rivets headed over on burs, with heads countersunk and putty plugged, and in upper corner of each strake at stem and stern will be 2-inch brass screws.

Thwarts.—There will be three thwarts of white oak, 8 inches wide, kneed to the sides; forward and middle thwarts will have two knees at each end and one knee on underside to centerboard case. The afterthwart to have one knee at each end and support under center. The seat aft of afterthwart to be of cypress, size and shape as shown.

Deck.—To be of white pine, ¾ inch thick, of width and shape given on plan; in the middle of deck forward will be a strake of Georgia pine, 1¼ inches thick by 8 inches wide.

Washboard.—To be of straight-grained white oak, 5½ inches in depth and ⅞ inch thick, extending around the inside of deck and properly fastened. A white-oak monkey rail, 2½ by 1⅛ inches, is to extend 4 feet aft from stem and 4 feet forward from sternpost, as shown on drawing. On the top of the sheer strake will be a half-round riband or chafing strake, 2½ inches deep and 1¼ inches thick, slightly tapered toward the ends; to be of white oak, one piece from stem to stern fastened with ¼-inch brass screws, covered with oak plugs, cut cross grain. To the washboard will be secured proper pieces for four rowlocks.

Ceiling.—To be of cypress, ⅝ inch thick, four strakes on each side of center strake, all to be fastened with brass door buttons except strake next to thwarts, which is to be fastened with brass screws.

Fastening.—All fastening where not otherwise specified to be of brass or galvanized iron.

Spars, sail, etc.—Mast, 4½ inches diameter at deck and 17 feet long from step to head. Boom, 3 inches diameter, 15 feet 6 inches long, fitted with gooseneck and bands. Gaff, 3 inches diameter, 7 feet 3 inches long, fitted with oak jaws. Mast, boom, and gaff to be made of the best grade, straight-grained spruce. All blocks, bands, mast hoops, traveler, cleats, etc., that may be required are to be furnished; all to be of galvanized iron. All halyards, sheet, painters, etc., that may be required are to be furnished as directed. Sail to be of size shown on drawing; to be well and carefully made of the best quality 8-ounce cotton canvas, 21 inches wide.

Calking and painting.—Both deck and bottom to be thoroughly calked with cotton, all seams payed with white lead and puttied flush. Boat to be given three coats of best linseed oil and white-lead paint, color of the deck and inside to be lead color, the color of the hull outside to be as ordered, and the washboard, chafing strake, and monkey rails forward and aft to be natural finish and given two coats of boiled linseed oil and three coats of best spar composition. Identification letters shall be painted in 3-inch letters on the bow as directed, with the number of the light vessel cut into the stem.

Oars and rowlocks, etc.—There are to be furnished four rowlocks of galvanized iron of proper size, and two pairs of 10-foot white-ash oars fitted with 8-inch leathers and collars, copper tipped; two 10-foot boat hooks with galvanized-iron fittings.

Rudder.—To be of white oak, 1⅜ inches thick, fitted as shown on drawing, so as not to unship, only at will. To have a tiller of proper length, to ship and unship.

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Lifting ring, bolts, and cleats.—Ringbolts of 7/8-inch galvanized iron, for lifting boat out of water, are to be fitted forward and aft; cleats and miscellaneous fittings shall be located to suit the work.

Brass drain plug.—To be of the automatic type, with screwed cap fitted where directed.

Cover, ridgepole, and spreaders.—The ridgepole and spreaders shall be of yellow pine, properly fitted in place; the cover shall be made of No. 6 canvas, fitted with brass eyes sewed in and proper means provided for lashing and securing same.

100. Steam-Heating System.—A complete system of radiators, piping, etc., suitable for operation on 25 pounds pressure, shall be installed and properly connected with the boiler.

A relief valve set to blow at 25 pounds and a double-tube steam gauge with brass case for recording the pressure on the system after steam has passed the reducing valve shall be furnished and fitted; the reducing valve shall be similar to the Leslie type.

The radiators shall be generally cast iron, of the wall type, and as indicated on the plans. All pipes, gauges, fittings, stop valves, etc., shall be furnished and fitted. The radiator in the pilot house shall be of iron pipe. Radiator valves shall be suitable for marine work. Air valves shall be fitted on all radiators.

The piping shall be of the best quality of iron or steel with cast-iron fittings. No bushings shall be allowed; reducing fittings only shall be used for changes in the sizes of adjoining pipes; coned ground-joint unions shall be used throughout.

The entire heating system shall be properly drained overboard through traps of an approved type; each trap shall be by-passed with pipes and valves for convenience in overhauling. Allowance shall be made for expansion in all piping. Pipes passing through divisional bulkheads shall be thimbled; those passing through watertight structural bulkheads and through decks shall be fitted with approved stuffing boxes. All pipes shall have drains to remove all water.

The radiators shall be securely fastened in place, and all pipes shall be firmly supported and stayed.

The heating plant shall be complete in every detail with all appliances and tools for its safe and economical operation.

The heating surface of radiators shall be as follows:

Location.	Radiators.	Heating surface, one radiator.
		Sq. feet.
Officers' mess room	Circular 1	64
	Wall type 2	14
Master's stateroom	Wall type 1	14
Mate's stateroom	Wall type 1	14
Chief engineer's stateroom	Wall type 1	14
Assistant engineer's stateroom	Wall type 1	14
Crew's space	Wall type 3	18
Cook's room	Wall type 1	9
Officers' toilet	Wall type 1	9
Crew's toilet	Wall type 1	9
Windlass space	Wall type 2	45
		36
Pilot house	1 trombone coil of 1-inch iron pipe containing 30 square feet of heating surface.	

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101. Plumbing—*General.*—The contractor shall furnish and install the plumbing systems specified complete, with all fittings and fixtures necessary for their efficient operations.

For the purpose of illustrating the type, quality, and construction of the fixtures and fittings required by these specifications, reference is made to catalogue plate numbers of certain manufacturers mentioned hereinafter, but the supplying of the fixtures, fittings, etc., are not restricted to the firms named, but shall be similar to those shown except as they may be modified to suit the conditions on the vessel.

All fixtures shall be of extra heavy marine type and guaranteed by their respective manufacturers. They shall be properly connected with supply, waste, and soil pipes. Supply pipes shall be generally of galvanized iron with heavy beaded malleable iron fittings. The supply to each fixture shall be controlled separately by a brass angle or gate valve located near the fixture. The supply pipes to closets shall be 2 inches in diameter, reduced to 1½ inches at the closet, and soil pipes shall be at least 3 inches in diameter and discharge overboard just above the water line through a flap-valve scupper; ¾-inch vent pipes shall be fitted to soil pipes below and near the closets.

Faucets shall generally be polished brass, of a low, self-closing compression, ball-wheel handled type, and shall be marked "Hot" and "Cold" with china name plates.

Officers' toilet and bathroom.—The space shall be furnished as follows: One shower bath of approved design, fitted with a suitable steam water heater and connected to the water-service system; pipes shall be of galvanized iron; valves, shower, hood, heater, etc., shall be of brass. All connections, drains, waterproof curtains, etc., shall be provided to make the installation complete. One nonreturn valve closet with nonsoiling rim, extra heavy base, threaded sanitary screw-outlet connection, polished oak cover and seat, with brass reinforcing plate, rubber bumpers, and a lever-handle flushing valve; the closet and valve shall be similar to those shown in Plate S–2278, issued by the A. B. Sands & Son Co., New York, N. Y.

Lavatories in officers' and the cook's staterooms.—Each room shall be fitted with one porcelain-enameled iron lavatory with integral back and apron, with all fittings, etc., as shown on Plate P 4205D and P 4955D, catalogue of Standard Sanitary Manufacturing Co., Pittsburgh, Pa., to suit conditions on board the vessel. Hot and cold water faucets and a brass soap dish shall be fitted at each lavatory. Metal filling-in plates shall be fitted in way of all lavatories where the adjacent structure does not afford a neat fit.

Crew's toilet and bathroom.—The room shall be furnished as follows: One shower bath of approved design in general similar to that fitted for the officers. One nonreturn valve closet as specified for the officers' bathroom.

Crew's sink.—One porcelain-enameled iron deep sink about 22 by 18 by 12 inches, complete with chain and rubber stopper water plug and coupling, and a rough brass S trap overboard shall be fitted in the windlass room where shown, also one 2½-inch brass force pump connected to draw from the sea and to deliver to the sink and into the water-service system. All necessary check and stop valves shall be fitted, also a cold-water faucet connected with the water-service system.

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Galley.—The galley sink shall be of enameled iron, similar to Plate S–820, No. 2, shown in the catalogue of A. B. Sands & Sons Co., New York, N. Y., fitted with hot and cold water faucets, and discharge overboard through a rough brass trap which can be freed from sediment and grease. A hand pump with brass cylinder connected to draw from the fresh-water tank and the sea and discharge at the sink, with a suitable cock, and into the bottom of the hot-water boiler; check and stop valves shall be fitted.

102. Hot and Cold Water System.—The water-service pump as specified under "Steam pumps" shall serve both systems with the main discharge pipe connected to an extra heavy galvanized-iron pneumatic storage tank of about 50 gallons capacity.

Cold-water system.—The supply shall be taken from the sea and delivered to the various "Cold" faucets, water-closets, etc., through the pneumatic storage tank.

The hot-water system.—The water will be heated by the galley range water back, pass through the range boiler, and deliver hot water to all "Hot" faucets. A return flow pipe shall be fitted to the hot-water system to insure perfect circulation and a constant and prompt supply of hot water to the faucets.

MACHINERY.

103. Propelling Engine.—There shall be furnished and installed complete in perfect working order a two-cylinder, vertical, direct-acting, noncondensing marine engine, with cylinders 12 inches in diameter each, arranged fore and aft, having a common stroke of 14 inches, cranks set at an angle of 90° to each other, having piston or slide valves, operated by a Stephenson link motion, reversible by hand lever or worm gear in easy reach from the lower engine-room floor.

The engine shall be of a good standard marine design, built from the contractor's own plans, or may be purchased from a recognized marine-engine manufacturer. Blue prints and specifications of the type of engine proposed by the contractor must be submitted with the bid. Variations in minor details will be allowed from the following specifications if such variations do not, in the judgment of the Bureau, interfere with the conditions on board the vessel or lower the efficiency of the part modified. The adjustment of the engine and gear, the workmanship, and materials must be guaranteed by the contractor.

The engine shall be constructed to withstand a working pressure of 120 pounds, making approximately 200 revolutions per minute, cutting off $\frac{5}{10}$ of the stroke, exhausting through the feed-water heater into the atmosphere; it shall drive a right-handed, four-bladed, cast-iron propeller 5 feet 9 inches diameter, about 5 feet 3 inches pitch, and a surface ratio of 40 per cent.

The underside of the engine bedplate in the way of the holding-down bolts shall be planed.

All moving parts of the engine shall have lock nuts or split pins, or both.

104. The Steam Cylinders shall be made of hard, close-grained cast iron, cast separately, well proportioned in all their parts to withstand a working pressure of 120 pounds per square inch, provided

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with bosses cast on for relief and drain valves, indicator cocks, etc., accessibly located on the cylinders and valve chests. The steam and exhaust connections to be so arranged that they will not interfere with the removal of the bonnets or pistons.

The sides of the steam cylinders and valve chests shall be covered with magnesia blocks and inclosed with planished steel plates neatly secured with bands and round-headed brass screws.

The stuffing boxes for the piston and valve rods shall be brass. bushed, and fitted with approved metallic packing.

The cylinders and valve chests must be provided with all necessary composition drain valves.

Cylinder covers to be of cast iron, strongly proportioned, formed to clear the follower bolts and to allow an easy entrance of steam at the ports and indicator cocks. The covers shall be polished on the flanges and exposed surfaces, secured with a sufficient number of steel studs and case-hardened nuts and fitted with relief valves; two screw eyes shall be fitted in each cover for starting and lifting the cover.

105. The Pistons shall be of cast iron, the piston rings shall be of the spring or other approved type and fitted steam-tight; the piston rods to be of steel turned true and polished.

106. Crosshead Blocks shall be of the box type, made of cast steel, annealed. The bearings for crosshead pin shall be of composition; the box slide shall be lined with antifriction metal cast and peened in their sliding surface; both shall be easily removed and arranged to take up the wear.

107. The Crosshead Guides to be cast iron or wrought steel of ample strength, fitted and secured to each of the back columns.

108. Connecting Rods shall be properly proportioned, forged of mild steel with a fork on the crosshead end and a at the crank-pin end, polished all over, and fitted with complete sets of brasses. The crank-pin brasses will be lined with antifriction metal, brass distance pieces, and a suitable number of thin brass or sheet-iron liners for adjustment and taking up the wear shall be fitted.

109. Reversing Links shall be of the Stephenson type made of the best quality of steel, the radius of the links and the distance between centers of the eccentric rod pins, etc., to suit the arrangement and to reduce the slotting motion of the link to a minimum.

110. Eccentric Rods, Sheaves, and Straps.—The rods shall be of machine steel finished all over and properly proportioned; to work without vibration. The eccentric sheaves to be in one piece, of cast iron bored to suit the crank shaft. The eccentric straps to be of cast iron strongly proportioned, ribbed, and lined with antifriction metal.

111. Suspension Links, Reverse Shaft and Brackets.—The supension links to be forged steel of suitable length between centers and connect to the pins in the center of the reversing links. The reversing shaft to be of machine steel finished all over; it will rest in strongly proportioned brackets bolted to the under side of the steam chests. The reversing arms and reverse levers to be of forged steel. The reverse gear and throttle valve levers shall be arranged to be conveniently operated from the lower engine-room floor.

The eccentrics shall be keyed on the shaft to give a maximum cut-off at $\frac{5}{10}$ stroke of the engine; the reverse lever quadrant shall be

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notched so that the engine can be operated on $\frac{5}{10}$, $\frac{4}{10}$, $\frac{3}{10}$, and $\frac{2}{10}$ of its stroke.

The entire valve system must be perfect in every respect and work to the entire satisfaction of the Bureau's representative.

112. Front and Back Columns.—Each cylinder shall be supported by one front and one back column. The front columns to be of forged steel machined all over and secured at the cylinders and bedplate by body-bound steel bolts. The back columns to be of cast iron with suitable ribbed flanges, brackets for the cross-head guides, etc., secured at the cylinders and bedplate with body-bound through bolts where practicable; otherwise studs of the same diameter may be used.

113. Bedplate to be of cast iron in one piece with three or four bearings; the underside of the bedplate in the way of the holding-down bolts shall be rough planed. The main bearing brasses shall be cast of bearing bronze filled with an approved antifriction metal. They will have end flanges and upper and lower halves. Distance pieces of brass must be fitted between the upper and lower halves of bearing and thin metal liners provided to take up the wear. The main bearing caps shall be strongly proportioned with holes drilled for suitable grease cups or wick tubes. The cap bolts shall be of steel, spaced as closely together as practicable. All necessary eye-bolts and attachments for removing and oiling the parts must be furnished.

The base flange of the bedplate must be spot faced for the nuts of the holding-down bolts.

114. Crank Shaft.—The crank shaft shall be forged in one piece, of the best quality steel, not less than 5 inches in diameter, with main journals of proper length. The cranks shall be at 90 degrees, counterbalanced; the crank pins shall be not less than 5 inches in diameter; all bearings must be well proportioned and work without heating. The coupling on the after end of the shaft may be forged on, or of cast steel well annealed and keyed to the shaft; coupling bolts shall have a machine fit. The crank shaft to be of the best workmanship, free from all defects, and polished all over, excepting the webs, which shall be machine finished only and painted.

115. Throttle Valve and Stop Valves.—The throttle valve shall be of cast iron, of an approved make. A type plan will be loaned to the successful bidder upon request. It shall be bolted to a gun-metal **Y** fitting, which shall connect to the two steam chests by No. 8 gauge copper pipes.

At the steam inlet end of the throttle a sight-feed cylinder lubricating oil cup having a capacity of $\frac{2}{3}$ pint shall be fitted, the operating lever for the throttle valve shall be conveniently located near the reverse lever, all to be operated from the lower engine-room floor.

An additional stop valve shall be fitted in the main steam line next to the throttle, also one in the main exhaust pipe close to the engine.

116. Indicator Gear.—The steam cylinders shall be furnished with brass piping, angle valves, three-way cocks, etc., and all necessary working gear for taking indicator diagrams.

117. Oiling Gear.—Oil cups, compression grease cups, brass reservoirs with tubes and wicks, brass piping, wipers, and drip pans at the crosshead guides, etc., shall be furnished, properly fitted, and secured in convenient places. The entire lubricating gear shall be complete and efficient each for the intended purpose.

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118. Cooling Water Service shall consist of ½-inch brass valves and double swivel-joined pipes for the main bearings, and two ¾-inch brass pipes to each crank pin, extending across on each side, perforated on the bottom, the main supply pipe shall be connected with the pumps on board the vessel; removable splash plates shall be fitted to the front columns in the way of the cranks.

119. Hand Turning Gear to consist of a cast-iron mortised wheel of suitable diameter, made in halves or in one casting. It shall be fitted, bolted, and keyed to the crank shaft; it shall be ballasted to serve as a counterbalance for the cranks, connecting rods, etc., if the cranks are not counterbalanced. A forged-steel lever shall be furnished to fit the mortises of the turning wheel for prying it around. A suitable fulcrum shall be furnished for the above and bolted to the foundation or engine bedplate.

120. Thrust Block.—The thrust block shall be of the horseshoe type with a steady bearing on each end of the pedestal box. The pedestal shall be of cast iron with facings where it shall attach to its foundation and shall be secured by a suitable number of forged-steel body bound bolts. The pedestal shall form a box for an oil bath and the ends and sides shall form a "catch all" for oil. The oil bath shall be cooled by circulating water passing through a ¾-inch brass pipe coil which shall attach to pipe nipples, screwed through the walls of the pedestal with a lock nut inside and outside, packed oil tight.

The bottom half of the steady bearings shall be cast with the pedestal. The caps shall be of cast iron, cast with an oil box on the top for wick feed, and shall be secured in place by four studs with proper liners allowed for taking up wear. They shall be designed with a stuffing box and gland on each end of the pedestal to prevent the escape of oil.

The horseshoes shall be cast iron, lubricated as stated above, adjusted by steel nuts on wrought-steel side rods, passing through open bosses, on each end of the pedestal, with adjusting nuts on each side of each boss.

The horseshoes shall be held down by vertical bolts passing through the ends of the shoes, and through slotted holes in the pedestal, the shoes bearing against the flange on the pedestal.

The bearing surface on the thrust shoes shall be such that the maximum thrust shall not exceed 40 pounds per square inch of surface on the shoes.

End bearings, end-bearing caps and horseshoes shall have white metal cast and peened in dovetail recesses, accurately machined and with proper oil grooves in the bearing surfaces.

A sheet-iron cover shall be fitted over the thrust bearing. This cover shall be provided with a hinged galvanized-iron lid for access to the horseshoes. The cover shall be fitted in such a manner that oil shall not be thrown out of the bearing when the engine is in operation, but shall permit the use of cooling water spray pipes on the collars when necessary.

121. Spring Bearing.—There shall be one spring bearing. It shall be made of cast iron, with faced flanges, secured to foundation by forged-steel bolts, fitted in reamed holes. The bearing shall be lined with white metal, cast in dovetailed recesses, hammered in place, channeled for oil distribution, and accurately fitted to the shaft. The

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ends of the bearing shall be provided with oil drip pans. The cap of cast iron shall have, cast on top, an oil box fitted with a hinged cover, etc., for wick-feed lubrication.

122. Thrust Shaft.—Shall be of forged steel finished all over, 5 inches in the least diameter, with 7 thrust collars and the forward coupling forged on. The forward end shall fit the coupling on the crank shaft and the after end shall be fitted with a split cast-steel coupling forming the connection with the propeller shaft. All coupling bolts shall have a reamed fit.

123. Propeller Shaft.—Shall be 5 inches in diameter, forged from the best quality of wrought steel; the forward end will adjoin the thrust shaft and fitted to suit the split coupling. The after end shall be turned to a taper ¾ inch to the foot to fit the propeller hub and have a left-hand thread with steel nut and locking device for same. The taper shall have a feather key of ample proportions to drive the propeller. The propeller shaft shall be inserted and withdrawn from the outside of the vessel.

124. Split Muff Coupling.—The thrust and propeller shaft shall be aligned in perfect end contact and connected together by an approved cast-steel flanged coupling (in halves), within which must be turned two inward-projecting belts ½ inch deep by ¾ inch wide fore and aft to fit into the corresponding grooves in the adjoining ends of the thrust and the propeller shaft to take the stress of the forward and backing action of the propeller. Feather grooves $\frac{5}{16}$ inch deep will be planed fore and aft in the two halves of the coupling, to take the splines or feathers which are to rotate the propeller shaft. The width of the feathers must be properly proportioned for their work. The half couplings will be drawn together with eight 1⅛-inch body-bound bolts and nuts in each pair of its flanges.

The inside of the coupling must be accurately bored to perfectly fit the shafts. The surfaces for the boltheads and nuts must be spot faced for a full bearing.

125. Propeller Wheel.—There shall be furnished and fitted to the propeller shaft a right-hand, 4-bladed, solid, cast-iron propeller similar to the Trout type, having a diameter of 5 feet 9 inches, with about 5 feet 3 inches pitch and a surface ratio of about 35 to 40 per cent. A cast-iron cap shall be fitted over the nut and made water-tight on the after end of the hub, held in place by a tobin bronze tap bolt screwed into the shaft. The cap will be drilled and tapped for a ¾-inch pipe plug of brass for filling cavity with hot tallow. A similar plug for the same purpose shall be fitted into the propeller hub. A sheet-iron template to fit the bore of the hub and notched for size of the cross section of the key shall be furnished.

126. Wrenches.—The contractor shall furnish complete sets of drop-forged steel wrenches necessary for the overhauling and caring for any and all parts of the engine and auxiliary machinery, the thrust bearing, and shafting; also a substantial steel wrench to fit the propeller nut. All to be stowed in steel racks as will be directed.

127. Securing the Engine in the Vessel.—The engine shall be erected, accurately adjusted, and aligned upon its foundation; tightly fitting wrought-iron liners shall surround all holding-down bolts in the bedplate; the bolts shall be firmly screwed up and their nuts locked in place; pieces of hardwood shall be driven between the liners. When finally secured all shafting must be accurately in line.

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128. Fog-Signal Apparatus.—The Bureau will furnish a deep-toned chime, 12-inch diameter fog whistle, fitted with a flange-connected compound automatic whistle valve; it shall be mounted at the top of the smokestack, and securely stayed as shown and as will be directed.

The automatic valve and whistle shall be connected by a 3-inch copper pipe to take steam from the cast steel T-branch on the boilers; a stop valve and drain shall be fitted there.

The Bureau will also furnish two automatic clockwork mechanisms with steam-driven cylinders and attached gear, each to operate the fog whistle at the characteristic required. The contractor shall install these clockworks where shown on the plan and furnish parts in accordance with the following and such additional valves, connections, etc., as required for the complete and successful operation of the signal: The clock levers shall be connected with the whistle-valve lever by balanced adjustable steel rods, properly supported and fitted with shafts, bearings, turnbuckles, springs, supports, etc., as necessary. Each of the steam cylinders operated by the clockworks must be connected with the main boiler by ½-inch brass pipes, iron size, and each must have a reducing valve similar to the Leslie type, set at 50 pounds, and a 3½-inch polished-brass steam gauge; the reducing valves must be by-passed; the exhausts shall be connected with the feed-water heater and the escape pipe. All the necessary valves, fittings, etc., to make the installation complete and successful in its operation must be furnished. A guidance plan showing a similar installation will be loaned to the contractor upon request.

129. Running Whistle.—An approved deep-toned chime whistle 6 inches in diameter, fitted complete with a compound automatic whistle valve, shall be furnished and secured to the forward side of the smokestack about 6 feet above the top of the pilot house. The whistle shall be properly connected to the boiler and will be operated from inside of the pilot house and from the bridge.

130. Shifter Valve and Exhaust Nozzle.—The valve shall be of cast iron, not less than 5 inches in diameter at flanges. The inside plug shall work freely in the casing when hot. The counterbalance weight on the operating lever shall be adjustable, arranged to keep the valve open to the main escape pipe, the other end of the lever will be fitted with a shackle for a light chain, which will be operated from the fireroom. The valve shall be so arranged as to split the exhaust steam from the engine that a portion or all of the exhaust may be turned into the exhaust nozzle in the smoke pipe or go to the atmosphere through the escape pipe. The exhaust nozzle shall be of cast iron, not less than 5 inches at flanges and 2 inches at the top. A type plan of the above will be loaned upon request.

131. Steam Pumps.—All pumps will be independent, vertical, and similar to the Blake L. O. type or other approved make of similar characteristics with brass-lined water cylinders; the steam cylinders shall be covered with magnesia and lagged with planished sheet steel.

The feed pump shall be of the vertical duplex type, having steam cylinders 4½ inches in diameter, water cylinders 3 inches in diameter, with a stroke of 4 inches. It shall draw from the sea and deliver through the heater into the boiler.

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The fire deck and bilge pump shall be of the vertical duplex type having steam cylinders 7½ inches diameter and water cylinders 4½ inches, with a stroke of 10 inches; it will be located as shown. It shall be connected to draw from the sea, from all compartments through a manifold valve, and deliver to the forward and after trimming tanks, the fire-service pipes, overboard through an outboard delivery valve, and be also connected to the main feed pipe to act as an emergency boiler feed pump.

The water-service pump shall be of the same type and size as the main feed pump and operate in connection with the pneumatic storage tank located in the engine room. It shall be connected to draw from the sea and deliver to the entire plumbing system, also be connected to fill the drinking-water tank in the hold when the vessel is on its station. The discharge pipe shall be fitted with an outside spring brass pop valve set at 25 pounds, to discharge in full sight in the engine room. This pump shall be fitted with a governor similar to the Auld or Ideal type to maintain a constant pressure on the system.

All pumps shall be fitted with the necessary stop valves, drain valves piped to the bilges, and relief valves, pipe connections, sight-feed lubricators for the steam cylinders, etc., to make each system complete and perfect in its operation. A brass-case pressure gauge shall be fitted in the discharge lines from the fire deck and bilge, and the water-service pumps.

The steam and exhaust pipe connections to the pumps and other auxiliary machinery must have stop valves close to their respective steam chests.

The pumps will be located as may be directed and secured to strongly built seatings of steel plates and angles. They will take steam through the auxiliary pipe from the boilers and exhaust through suitable valves and auxiliary exhaust pipe into the feed-water heater or through the main exhaust pipe into the atmosphere. All pump suctions from the sea and bilge must be fitted with suitable strainers, as specified in paragraphs Nos. 136 and 142.

132. Hand Pumps.—*A hand pump for water-service system* shall be furnished and installed in the lower engine room. It shall have a brass bushed cylinder 6 inches in diameter with composition valves fitted complete with brakes, pipes, and valves to operate the water-service system if the steam is off the boiler.

A hand bilge pump of the same type as specified above, with double hand brakes, shall be furnished and secured on the spar deck as will be directed; its suction shall draw from the sea and from the bilge manifold. An adapter shall be furnished for the discharge end to fit the 2-inch fire-hose connections.

A brass hand force pump with 2½-inch cylinder shall be fitted in the galley and be piped to draw from the fresh-water tank and sea and discharge into the sink and into the hot-water system.

A brass hand force pump shall be fitted at the crew's sink in the windlass space; it shall be of the same size as specified above, piped to draw from the sea, discharge into the sink, and into the water-service system.

133. Fire Service.—There shall be two 2-inch brass gate valves with screwed outlets for a hose attachment on the main deck and two 2-inch on the spar deck, suitably connected with galvanized-iron pip-

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ing to the fire deck and bilge pump. The hose threads on the outlets shall be standard pipe threads; the outlets shall be fitted with screwed covers secured with brass chains. The gate valves will be located as shown on the plans.

Hose, hose reels, etc.—There will be furnished 100 feet of 2-inch and 75 feet of 1½-inch rubber-lined cotton fire and deck hose of the best quality, with brass couplings to fit the fire-pump connection and deck-wash plugs. Hose reels or racks in sufficient number to contain all the hose must be furnished and secured where directed. Two brass nozzles and two reducing couplings or adapters with different diameters of threads at their opposite ends to fit the 2-inch deck plugs and the 1½-inch deck wash hose, and six spanners to fit each of the couplings, shall be furnished; the spanners must be securely stowed convenient to the plugs.

Buckets, bucket racks, etc.—There will be distributed about the decks eight round-bottom galvanized-iron fire buckets contained in steel racks on the main deck and in racks around the smokestack; four fire axes shall be furnished and located as directed and in accordance with the United States Steamboat-Inspection Service; also suitable racks for the hand-pump levers.

134. Injector.—A double-tube injector of approved size and type is to be furnished for the boiler, with all necessary copper delivery and galvanized-iron suction piping, valves, and fittings complete, and be connected to draw from the sea and deliver into the boiler. A valve with a 1-inch hose connection shall be fitted in the discharge from the injector for the purpose of washing out the bilges. The steam connection to be of copper and must be taken direct from the boiler.

A suitable strainer shall be fitted in the suction pipe just below the injector.

135. Siphon.—A 2-inch bilge siphon will be furnished and located in the engine compartment and connected to the bilge manifold, which shall drain the various compartments and discharge overboard through a stop-swing check valve at the ship's side, located not less than 1 foot above the load water line of the vessel. It shall also draw from the sea and discharge on the spar deck through a composition stop valve having a 1½-inch hose connection fitted with standard thread and a water-tight cap.

136. Sea Valves and Strainer Boxes.—There shall be two sea chests suitably located in the engine room on the port and starboard sides, and to each inlet opening cut through the hull plating there shall be fitted and riveted a cast-steel sea chest surmounted by cast-iron bodied angle sea valves. The fittings of the valves, seats, stems, glands, and gland bolts must be of composition; all valves properly proportioned for the areas of the connecting pipes, and fitted and secured to the sea chests with steel studs and composition nuts ¾ inch diameter. Each sea chest must be fitted with a suitable steam connection to blow out and clear it from ice or other obstructions, also for filling same with oil during the winter season. All inlet-valve openings will be fitted with removable steel plate strainers having an area through the holes of not less than twice the area of the valves. For additional strainers, see paragraph No. 142. The sea valves will be for the fire deck and bilge pump, the water service, the feed-pump

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suctions, and for the feed injector suctions. There must be suitable sea connections for the hand pumps and for attaching a hose for wetting ashes in the fireroom.

137. Drip Pans for Crank Pits and Pumps.—There shall be furnished and secured to the bedplate of the engine suitable oil-tight crank-pit and eccentric pans of No. 18 plate steel so shaped as to prevent oil from reaching the bilge and made readily removable. Similar pans shall be placed under the steady bearings of the thrust shaft and the fog-signal apparatus fitted with drip pockets and drains.

The crank-pit pans shall be fitted with suitable drain plugs of brass located as directed.

Beneath each steam pump there shall be fitted a flanged, steel-plate drip pan fitted with a drip pocket and drain.

The drip pan for the windlass and the hoisting engines shall be constructed as specified under "Boiler, engine, and other foundations."

138. Feed-Water Heater.—There shall be furnished and properly secured to the underside of the main deck beams one horizontal feed-water heater similar to the spiral corrugated-film type, having ample capacity to heat the feed water from 40° to 210° or more, with an exhaust back pressure of 5 to 8 pounds fitted with a by-pass to permit overhauling.

A branch from the main exhaust pipe of the propelling engine and the auxiliary exhaust pipe, also a branch from the auxiliary steam pipe, shall be connected with the heater; an adjustable back-pressure valve, of an approved type, set at 5 pounds, shall be put in the exhaust line. The heater shall be drained through a suitable trap and a by-pass connection discharging overboard above the load water line through a check stop valve at the side of the ship, also have a drain connection to the bilge.

All the necessary fittings, including a spring relief valve, set at 5 pounds, a water gauge, brass steam gauge, valves, etc., to make the installation safe and complete must be furnished and fitted, also one thermometer in the main feed pipe leading to the heater and one in a convenient place between the heater and the boiler.

139. Main and Auxiliary Steam Pipes.—The main steam pipe shall be of copper, in diameter to suit the engine; the thickness of all pipes must comply with the General Rules and Regulations of the Steamboat-Inspection Service, with ample allowance in thickness for bends.

It shall lead from the stop valve on the boiler to the stop valve at the throttle valve with the necessary loops for expansion and contraction. All pipes shall be fitted as described under the heading "Pipes and flanges."

The auxiliary steam pipe shall be of copper 2½ inches in diameter with branches leading to the pumps, fog-signal apparatus, the bilge siphon, the feed-water heater, the sea chests, the water heaters in the bathrooms, and heating system, also a separate line to the windlass engine. There also shall be a branch connection and valve for a ¾-inch steam hose for the purpose of blowing and cleaning out the boiler tubes. In each branch leading from the auxiliary steam pipe there will be a stop valve close to the pipe as well as stop valves close to the steam chests on all machinery in the steam and exhaust pipes. Pipe branches of 1 inch in diameter and under may be of brass, iron pipe size.

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140. Main and Auxiliary Exhaust Pipes.—The main exhaust pipe shall be of copper, lead from the exhaust stop valve on the main engine to the shifter valve and through the shifter valve into the escape pipe. It shall have a 3-inch branch and stop valve connecting with the feed-water heater, and one branch from the shifter valve shall lead into the smoke pipe where it must be reduced by a taper to a 2-inch diameter cast-iron nozzle for forcing the draft.

The auxiliary exhaust pipe shall be of galvanized iron, connect with all pumps, the exhaust to lead into the feed-water heater and through a back-pressure valve set at 5 pounds into the escape pipe. The escape pipe shall be of copper not less than 6 inches inside diameter connected with the shifter valve, the auxiliary exhaust pipe, the escape from the safety valve, and the exhaust from the fog-signal apparatus. Above the umbrella there shall be fitted a suitable cyclone head made of steel plate and fitted with a 1-inch drain to lead overboard below main deck. The escape pipe shall extend to the top of the smoke pipe, where it shall be fitted with a copper bell mouth, as shown on the plan. Drain valves and pipes fitted to the lowest point of the escape pipe, the safety valves, and the cyclone head must lead overboard below the main deck.

All pipes where passing through the umbrella must be made watertight by means of angle rings lined with sheet lead or with composition castings fitted in halves and secured to the umbrella.

The escape pipe must be properly supported, and stayed to the smoke pipe by means of bolted brackets as will be directed.

Boiler Feed Pipes.—The main and injector feed pipes to the boiler shall be of copper, No. 12, B. W. G., 1½ inches in diameter, connected by a suitable reducing T of gun metal to the 2-inch discharge on the feed pump. A relief valve set at 130 pounds shall be bolted to the T branch. All parts of the pipe must be visible above the floor and all flanges shall be of brazing metal rough turned. Properly tapped bosses must be brazed into the feed pipe near the inlet and outlet of the feed-water heater and fitted with suitable thermometers. A 2-inch hose connection with valve shall be fitted to fill the boiler.

Union strainers similar to those manufactured by the Hayden & Derby Manufacturing Co., of New York, shall be fitted in the suction lines for and near the feed pumps, injectors, and sanitary pump.

141. Reducing Valves.—Reducing valves similar to the Leslie or other approved design will be fitted in the steam pipes of the auxiliary machinery, in the steam pipes to the heating system, and wherever directed.

142. Pipes and Flanges.—Steam and exhaust pipes, boiler feed and blow pipes shall be of copper. Steam and exhaust pipes of 1 inch in diameter and less may be brass of iron-pipe size with screwed flanges or ground-joint unions, and fittings of strong composition.

All flanges for copper pipes must be of brazing metal, the pipes must be constructed in accordance with the General Rules and Regulations of the Steamboat-Inspection Service, except where otherwise specified or directed. All pipes and joints must be perfectly steam-tight.

The faces of the flanges for copper pipes shall have recesses into which the ends of the pipes must be riveted over and the flanges must be brazed to the pipes at their backs.

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Manifolds for the bilge suctions and the water-service system shall be of cast iron with brass mountings and fittings.

Water service and bilge suction pipes and fittings shall be of the best quality galvanized iron. Each suction pipe leading from the bilges shall be fitted with a galvanized-iron strainer box at the bottom and a Macomb or other similar approved strainer above the floor. All pipes must have proper provisions made for their expansion and contraction, be firmly supported and secured, and thoroughly drained.

Screwed bushings must not be used, but changes in size of pipes must be made with reducing fittings. Bulkheads must not be made parts of joints in pipes of any description; stuffing boxes or bulkhead flanges shall be used on all pipes where they pass through water-tight bulkheads. All flanges to be rough turned and grooved for gaskets.

143. Gauges, Gauge Board and Clock.—Gauges and a guage board of steel plate neatly finished, shall be furnished for the upper engine room. To the gauge board there shall be secured a double-spring steam gauge for the boiler, one gauge for the heating system and one for the water-service system of approved make and accuracy, also one eight-day clock with Howard or similar movement; all to have 6½-inch dials. A pressure gauge with an 8-inch dial will be piped to the boiler in the fireroom. Gauges shall be of polished brass with screwed bezels, and such additional gauges fitted as herein specified and required.

All gauges and the clock shall be marked on the dial with the letters U.S.L.H.S. L.V. No. 103 or 104 as may be required and directed.

The gauge board shall be fitted with iron brackets and bolted to a bulkhead with distance pieces in a convenient location.

144. Lubrication.—Proper lubrication must be provided for all parts of the engine, pumps, and all apparatus and moving parts requiring lubrication on board the vessel. Sight-feed oil cups, oil pumps, oil and compression grease cups, wipers, brass reservoirs with tubes and wicks, brass piping, oil holes, etc., shall be furnished and properly fitted subject to the approval of the Bureau's superintendent of construction.

145. Thermometers.—There shall be furnished and permanently secured in place the following-named thermometers, having casings of brass and each suitable for its intended purpose.

One in the discharge pipe from the main feed pump close to the pump, the other in the main feed-pipe line between the boiler and the feed water heater, and one spare. Four atmospheric thermometers, one to be secured in the lower engine room, one in the officers' and one in the crew's mess rooms, and one to the outside of the upper deck house. There shall also be two portable atmospheric thermometers for general ship use.

146. Machinery-Room Accessories, Stores, and Tools.—A neatly made tool rack shall be furnished and secured in the machinery room, to contain two hammers, three selected monkey wrenches, and a complete set of casehardened straight and **S** wrenches from ¼ to 1¼ inches, advancing by ⅛ inch in size. All wrenches and tools for the boiler, pumps, windlass, etc., shall be furnished by the contractor and placed in steel racks conveniently to the machines they are to serve.

Two lubricating-oil tanks of a capacity of 60 gallons each shall be furnished and properly secured on steel-plate shelves in the lower

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machinery room. They shall be steel, $\frac{3}{16}$ inch thick, with proper pipe connections, valves, air cocks, and be filled through a screw plug composition deck plate on the main deck. There shall be fitted long, guarded glass gauges, a lock cock for drawing oil, and galvanized-iron drip pans. The tanks shall be galvanized and be perfectly oil-tight. Two sets of brass oil cans, oilers, and trays for the machinery spaces shall be furnished, supported by neatly made shelves as will be directed.

There shall be furnished and secured as directed a plate-steel cotton-waste tank with a lock; capacity about 25 pounds, shaped to suit the space available, also all necessary deck wrenches, hose spanners, etc., shall be furnished and stowed most convenient for their intended purpose.

An efficient lifting gear, consisting of traveler bars and trolleys, deck-beam clamps, turnbuckles, shackles, hooks, eyebolts, etc., will be fitted and supplied as required for lifting the various parts of the machinery in the engine room for overhauling and repairing.

147. Boiler—*General description.*—The vessel shall have one steel cylindrical boiler of the Scotch type about 9 feet 6 inches in diameter inside of the shell and about 9 feet 10 inches long over all; designed for a working pressure of 110 pounds per square inch, having a heating surface of about 955 square feet and a grate area of about 28 square feet. It shall be built and installed in the vessel in conformity with the requirements of the United States Steamboat-Inspection Service laws unless otherwise herein specified or directed.

The boiler may be of the builder's standard design; variations in minor details will be allowed from the following specifications if such variations do not in the judgment of the Bureau alter the efficiency or strength of the part modified.

Each bidder shall, if practicable, submit, with his bid, plans and specifications of the boiler which it is proposed to furnish and a statement showing the differences, if any, from the exact requirements of these specifications. Plans and details of the boiler as actually to be constructed shall be submitted to the Bureau for approval before work is commenced.

148. Inspection of Materials.—All materials entering into the construction of this boiler shall meet the requirements of the Steamboat-Inspection Service and shall be subject to their inspection.

149. Shell.—To be formed of two plates $\frac{11}{16}$ inches thick, double riveted to the heads; the longitudinal seams, one of which shall be located above the water level, shall be treble riveted through double butt straps. All seams and butts must be accessible for calking after the boiler is installed on board the vessel.

Each of the boiler heads shall be made in one plate $\frac{11}{16}$ inches thick; the upper part of both heads shall be reinforced inside by properly riveted doubling plates $\frac{3}{8}$ inches thick for the longitudinal stays.

The doubling plates shall extend upward to the beginning of the curve or fillet of the flange and downward to the top of the tubes and to the height of the combustion chamber, respectively.

The front and the back head shall be flanged inward, furnace flanges turned outward.

150. Furnaces—There shall be two corrugated furnaces of the Morison type $\frac{3}{8}$ inch thick and 31 inches least diameter inside of the cor-

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rugation; they shall be so fitted as to be easily removable and replaced by others if necessary.

The flanged holes in the front head and the connections at back tube sheet for the furnaces shall fit neatly to the ends of the furnaces. Special care shall be taken to fit the furnaces; there shall be perfect contact between the surfaces in way of all riveted seams.

The furnace fronts shall be designed to take all attachments that shall be required for the furnace and ash pit doors, etc.

151. Combustion Chamber.—The combustion chamber and the water spaces shall be of proper proportions. The plate for the tubes and furnaces shall be $\frac{11}{16}$ inch; the crown, sides, and back, $\frac{5}{8}$ inch thick.

The crown and sides shall be formed of two plates with the seams located just above the center line of the boiler.

152. Braces and Stay Bolts.—The crown of the combustion chamber shall be supported by wrought-steel girders; each of the girders shall be connected to the crown sheet by three $1\frac{3}{8}$-inch diameter stay bolts screwed through the plates, having nuts inside the chamber and thimble distance pieces between the crown sheet and the girders. They shall also have neatly fitting wrought-steel plate washers and nuts for the top of the stays. The heels of the girder plates shall be carefully fitted to the round of the back tube sheet and the combustion chamber back sheet. Distance pieces between the girder plates shall be of wrought steel. The use of cast iron in connection with any of the bracing will not be permitted.

The sides and back of the combustion chamber shall be stayed with $1\frac{3}{8}$-inch diameter stay bolts, screwed into the plates and neatly riveted over. The holes for the screw stays must be tapped fair and true and have full threads. Each stay bolt shall be drilled at each end with a $\frac{3}{16}$-inch drill to a depth of at least $\frac{1}{2}$ inch beyond the inside surface of the sheet.

In addition, the tube sheet of the combustion chamber shall be braced to the front head of the boiler by not less than eight $1\frac{3}{4}$-inch longitudinal stays. They shall be properly upset at each end for threads, and all shall be fitted with wrought-steel nuts and asbestos cord packing.

The heads of the boiler shall be braced with eight 2-inch least diameter longitudinal steel stays spaced to suit. The ends of the stays shall be properly upset for threads and fitted with wrought-steel cap nuts outside and ordinary nuts inside. The space around the stays and between the nuts shall be tightly packed with asbestos cord packing. Calking of nuts will not be permitted. The cap nuts and inside back nuts shall have a full and even bearing upon the plate and shall be slightly concaved to hold the packing.

All surfaces unsupported by stays or stay tubes, etc., must be properly strengthened by angle bars, brackets, or other means.

153. Tubes.—The boiler shall contain about 134 tubes, $3\frac{1}{4}$ inches outside diameter and not less than 82 inches long inside of the tube sheets. They shall be made of the best charcoal iron, lap welded.

The edges of the holes in the tube sheets must be slightly rounded by filing; the tubes shall be tightly expanded in the holes and beaded over in the best manner at both ends.

154. Man and Hand Holes, Plates, etc.—The boiler shall have a suitable number of oval manholes, one 12 by 16 inches in the shell and four 10 by 14 inches in the front head, located to make all parts of the

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boiler accessible. The manhole in the shell of the boiler, at the top, shall be reinforced by a separate plate ¾ inch thick, flanged inward. This plate shall be properly fitted and double riveted to the inside of the shell. The manholes in the front head shall be flanged in as approved. They shall have ¾ by ¾ inch steel rings shrunk around the flanges and will be machined for gasket joints.

All manholes shall be fitted with cast-steel covers, forged steel double bridge bars, tee-headed bolts with their nuts and washers and grips for handling.

Two oval handholes 4 by 6 inches shall be cut in the lower part of the back head as approved and each fitted with a cast-steel plate, gasket, forged-steel crab, bolt, nut, and washer.

All manholes and manhole plates and all handholes and handhole plates shall be machined and fitted to a true and even bearing at the joint.

All dogs shall be carefully fitted in place. All plates, dogs, etc., to be carefully numbered and marked for position.

155. General Instructions.—All calking edges of the boiler plates shall be machine planed; seams, butts, and laps must fit closely. All seams calked inside and outside.

Rivet holes shall be drilled in place, accurately matched, and absolutely free from imperfections; the plates shall be taken apart after drilling and the borings, burs, and ragged edges removed.

All work must be tightly drawn up *metal to metal* before riveting.

Rivet heads shall be calked inside and outside where directed.

Holes for stays and stay bolts shall be drilled and tapped in place, and they shall be spaced with the margin of safety prescribed by the Board of United States Supervising Inspectors.

Holes of 6 inches diameter and over, cut through the boiler plates, are to be properly reinforced with riveted steel rings.

The tensile strain on any stay shall not exceed 8,000 pounds per square inch of sectional area at the bottom of the thread. Stays shall be made without welds. If clevises or jaws are used the section shall be increased or upset by pressure or hammering and slotted and drilled afterwards. The stays shall be of the best material, perfectly fitted and connected.

156. Internal Feed, Surface and Bottom Blow Pipes, etc.—The boiler shall be fitted with internal feed, surface and bottom blow-off pipes and scum pan, completely connected, arranged, and secured as approved. All pipes and fittings within the boiler shall be of iron.

The boiler shall have two long shank fusible plugs of an approved make, installed in the crown sheet from the fire side of the combustion chamber located in accordance with the rules and regulations of the Board of Supervising Inspectors.

A wrought-iron dry pipe shall be assembled and installed. It shall have holes drilled along the top of a total area through the holes equal to two times the combined area of the steam connections. A ¾-inch drain hole shall be drilled in the bottom of the pipe at both ends. The pipe shall be run close to the top of the boiler shell and be firmly secured to the cast-steel T fittings and to the longitudinal stays.

In the water spaces of the boilers there must be distributed a number of slabs of rolled zinc (not cast zinc) in the proportion of at least 1 square foot of zinc to 100 square feet of heating surface.

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These slabs must be suspended by bolted straps from the boiler stays and not carried in baskets. The surfaces of contact of the straps must be made bright.

No copper or brass pipes or brass castings shall be used for the interior fittings of the boiler.

157. Boiler Fittings.—All valves shall be of composition, and be of the regrinding type. The boiler shall be fitted with the following:

One 2½-inch duplex safety valve (consolidated type) with 3½ inches inlet and outlet.
One 4½-inch main steam stop valve (angle).
One 2½-inch auxiliary steam stop valve (angle).
Two 1½-inch angle stop valves for main and auxiliary feed.
Two 1½-inch screw-down check valves for main and auxiliary feed.
One 2-inch angle valve for bottom blow.
One 1½-inch angle valve for surface blow.
One 1½-inch angle valve for water column (top end).
One 1½-inch angle valve for water column (bottom end).
One 3-inch angle valve for fog-signal apparatus.
One 1½-inch valve for running whistle.
One 1½-inch angle valve for injector.
Two ¼-inch angle valves for steam gauges.
One set ¾-inch crank-handled, quick-closing, water-gauge fittings with safety chains, similar to those of the Star Brass Manufacturing Co., Boston, Mass.
Six ¾-inch United States Navy standard, crank-handled, regrinding gauge cocks—three for the water column and three for the back head of the boiler.
One composition water column with flange connection.
One double-tube brass-case steam gauge with 8-inch dial and graduated to 220 pounds.
One cast-steel main steam casting.
One approved salinometer pot connected to the boiler and two thermometers and two hydrometers.

158. Safety Valves.—The boiler shall be fitted with a 2½-inch duplex marine outside spring safety valve, having a gun-metal body with 3½-inch inlet and outlet.

The valves will be fitted with mechanism for lifting them from the engine room.

The outlet nozzle will be in the base casing, so that the joint at the escape pipe will not have to be broken when taking the valves out.

There will be a 6-inch escape pipe, located abaft the smoke pipe, extending to the top and secured in a neat manner. The pipe will have 3½-inch branch leading to the safety valve on the boiler; the main-engine and auxiliary exhaust pipe will also lead into the escape pipe, as elsewhere specified; all properly drained.

159. Main and Auxiliary Steam Stop Valves.—The main steam stop-valve bodies shall be of cast steel or composition and of approved design and strongly ribbed. Their flanges shall be spot faced for bolt heads and nuts. All fittings of the valves shall be of gun metal or other approved composition.

Valves of 3-inch diameter and less and their fittings shall be of strong composition. These valves must be of the regrinding type of an approved make.

160. Feed Check Valves.—The main and auxiliary feed check valves shall be of the screw-down type to allow for the adjustment of their lift. To permit overhauling, each check valve shall have an approved stop valve installed between it and the boiler.

All valves shall be of a standard commercial make and be marked with the name or trade-mark of the firm by whom they were fur-

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nished. The valves shall also be marked with the working pressure for which they are intended.

All valves and other fittings of composition attached to openings in the shell of the boiler shall be of approved design and bolted to faced steel flanges riveted to the boiler plate. Short pieces of flues shall be expanded into the opening of the pads on the boiler and beaded over inside and out.

161. Steam Castings.—One cast-steel T fitting for the main steam and safety valves and the auxiliary steam whistle, and injector valves, etc., to be furnished and riveted to the boiler as approved. The main steam casting shall have a boss cast on each side, drilled and tapped for steam gauge and air-valve connection. The casting shall be strongly ribbed and be carefully fitted to a true bearing on the boiler shell before being riveted in place. All flanges of casting shall be spot faced for bolts, and the flange faces of the casting shall be machined.

162. Holding-Down Lugs and Rolling Pads.—Forged steel lugs shall be made and located as approved to support the boiler. They shall be accurately fitted, riveted, and calked to the boiler shell and be of ample strength to resist all strains.

Four rolling pads of forged or cast steel shall be riveted and calked to the top of the boiler, located to suit the deck beams and conditions on board the vessel.

163. Furnace Fittings.—The furnace fronts and doors shall be of the Morison or other approved type having similar characteristics. The furnace fronts shall be of steel, flanged, $\frac{5}{8}$ inch thick, properly protected by perforated cast-iron liners, and secured to the ends of the furnaces outside of the calking seam with stud clips and nuts. The furnace doors shall be of the balanced type, arranged to open upward and outward, and be so counterweighted as to remain either open or closed. For slicing fires each door will be fitted with a small opening about 5 by $5\frac{1}{2}$ inches fitted with a hinged cover.

Dead plates, bridge-wall supports, grate, and side bars of cast iron of approved design shall be properly fitted and secured in place. Lazy bars and suitable supports or hangers for them are to be provided.

The bridge walls shall be composed of cast-iron bars, with suitable air openings between them, securely locked in place, but provided with means for readily removing any bar when necessary without disturbing the balance. The dead plate shall have openings to admit air freely from the ash pit to the back of the bars and through the spaces to the fire. Longitudinal air openings not less than $\frac{1}{4}$ inch wide shall be provided through the bars at the crest of the bridge to admit heated air to the gases from the furnaces.

A door will be fitted to a suitable opening in the lower part of each bridge wall under the grate, arranged to be readily opened or closed. A guidance drawing of the bridge walls will be furnished on request of the successful bidder.

A full set of double and single grate and side bars made in two lengths will be furnished for each furnace supported at mid length upon two bearers resting on and notched over steel plates riveted to half-round bars of steel fitted in one of the corrugations of the furnace.

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Doors made of ⅛-inch steel plate with handles and fastenings will be fitted to the mouths of the ash pits; racks or clips must be provided for stowing these doors against the bulkheads or elsewhere when not in use.

Two full sets of fire tools consisting of hoe, rake, slice bar, and steel scoop shovel, a complete set of spare fittings for one furnace consisting of single and double grate bars, side and center bearing bars, also one set of removable cast-iron bars for the bridge walls, shall be furnished and arranged to stow as will be directed.

The patterns of all furnace fittings including double and single grate bars, side bars, bridge walls, dead plates, furnace front liners, etc., shall become the property of the Government.

164. Boiler Circulator.—The boiler shall be equipped with a water circulator, or temperature equalizer, similar in characteristics and design to that manufactured by the Stewart Boiler Circulator Co., New York, N. Y., all properly connected.

165. Uptakes.—The uptake shall be of approved design, built double, and designed to permit of expansion. The area in the passage for the gases shall not be less than one-fifth of the total grate area at any point. The front of the uptake shall slope outward and be so framed that their door openings shall permit the removal of the tubes without disarranging any part of the structure.

The uptake doors shall be hinged at their top edges to swing vertically, and shall be furnished complete with clamps, eyebolts, shield plates, rings, hooks, pulleys, cleats, and lifting chains leading to a conveniently accessible place. Clamp handles shall hang vertically when disengaged.

A ballasted damper of $\frac{3}{16}$-inch steel plate, operated from the fireroom, shall be fitted into the uptake below the steam jet and the exhaust nozzle from the engine.

166. Smokestack and Umbrella.—The height of the smokestack will be about 36 feet above the grates; it will be built double to inclose an air space; the lower courses of the inside stack will be $\frac{3}{16}$ and the upper courses ⅛ inch and have an inside diameter of 2 feet 9 inches; the outside casing will be ⅛ inch thick and 3 feet 5 inches in diameter; reinforced in the way of the whistle platform and strongly riveted and stayed to the inner stack; the air space at the top will be covered with suitable hood to prevent the entrance of rain, but open underneath the hood for the escape of heat. The stack will be fitted with bands, eyebolts, shackles, etc., and six stays of galvanized-wire rope. The stack must be strongly supported by a suitable framework of angles and plates.

A suitable steam jet with ring or spider, etc., shall be fitted in the stack for accelerating the draft.

The stack casing and umbrella on the upper deck will be $\frac{3}{16}$-inch steel plate of neat and smooth construction. The umbrella will have six ventilating openings of about 10 inches in diameter, each surrounded by a light angle coaming; the flanged-steel covers shall be hinged and held open by catches; the openings for the escape and whistle pipes through the umbrella will be protected by flanged collars in halves and fitted water-tight.

A suitable rack for the fire buckets constructed of flat bar iron shall be secured to the casing.

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A platform built of steel plates and angles shall be constructed at the top of the smokestack to support the fog whistle. Grab rails shall be fitted thereto.

A light steel ladder shall lead from the upper deck to the top of the smokestack to give access to the whistle platform.

167. Securing Boiler in Vessel.—The boiler shall rest on the fore and after girders, as specified under "Engine, boiler, and other foundations." The heavy plate lugs on the boiler shall be securely bolted to the girders. Braces of round iron 1½ inches in diameter, fitted with forged jaws at each end and turnbuckles with lock nuts in the center for adjustment, shall secure the boiler on top to the main deck beams as will be directed. The boiler must be secured in the vessel in the most approved manner and be absolutely immovable.

168. Testing the Boiler.—Before the boiler is placed in the vessel it shall be subjected to a hydrostratic test pressure of 165 pounds per square inch by standard gauge in the presence of the representative of the Bureau of Lighthouses. All leaks shall be carefully and effectually made tight. Should rivets or stays show such leaks as, in the opinion of the representative of the Bureau of Lighthouses, would necessitate their being cut out, this shall be done; the holes shall be made true if necessary and new rivets or stays driven or fitted. Hydrostatic tests shall be repeated until no leaks can be detected and until the result is entirely satisfactory.

After the boiler is installed and secured in the vessel, connected, and provided with all pipe fittings, valves, instruments, and appliances necessary for working, it, together with all steam and feed pipe connections, shall, before the builder's dock trial, be inspected and tested to the satisfaction of the inspectors of the Steamboat-Inspection Service and to the satisfaction of the superintendent of construction. The test by hydrostatic pressure shall be 165 pounds per square inch, indicated by a standard test gauge; the safety valves shall be adjusted under steam, allowing a working pressure of 110 pounds per square inch.

Should it be found during this inspection and test that in any part of the boilers, pipe connections, or their fittings, the rules of the United States supervising inspectors have not been fully complied with, or should any defects develop, the defects shall be made good at once by and at the expense of the contractors.

169. Painting the Boiler.—After the boiler shall have been satisfactorily tested in the shop it shall receive on the outside one coat of best red-lead paint. Two additional coats shall be applied after it is installed in the vessel and all connections made: the last coat to be applied to boiler and uptakes immediately before covering the boiler and uptakes with nonconducting material.

170. Magnesia Covering and Lagging.—After the vessel's dock trial all main and auxiliary steam and exhaust pipes and their valves, the feed pipes, whistle pipes, etc., shall be covered with magnesia covering; in places where the use of blocks is impracticable nonconducting paste may be used as will be directed. The boiler and the uptakes shall be covered with magnesia blocks about 2 inches thick.

The magnesia covering material shall contain 85 per cent of magnesia and 15 per cent of asbestos fiber.

Supporting angles upon the boilers and uptakes and galvanized-iron wire netting shall be used to secure the covering in place.

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In addition, the boiler shall be covered over with No. 6 canvas carefully sewed on. The covering on the pipes, etc., shall be securely fastened with copper wire, and No. 7 canvas shall then be sewed on; on short-radius bends lighter canvas may be used, special care being taken to obtain a smooth surface, particularly at the bends. Hard finish and staples may be used where sewing is impracticable.

The sides of all steam cylinders and valve chests, together with steam cylinders of all pumps and auxiliary engines, and the feed-water heater shall be covered with magnesia blocks and inclosed with sheet steel neatly secured with bands and round-headed brass screws; the plate lagging will be stayed and backed with wood where necessary.

171. Spare Parts.—The following spare parts, in addition to others specified elsewhere herein, shall be furnished for the engine, etc., having been fitted in place and ready for use: One complete set of bearing brasses, with bolts, for 1 connecting rod, crosshead, and crank-pin ends; 1 set of follower bolts and nuts for 1 piston if so fitted; 1 set of metallic packing for each piston rod and each valve rod; 1 set of spare springs for the safety valve; 1 spare spring for each relief valve; 1 complete set of valves, valve bolts, and springs for each pump in the vessel, properly marked; 6 gaskets for the manhole in the boiler shell; 12 gaskets for the manholes in the front head; 6 handhole gaskets; 6 manhole gaskets for the fresh-water tank; 1 spare strainer basket for each strainer.

TRIALS, DOCKING, AND DELIVERY.

172. Trials.—After all parts of the hull, machinery, equipment, and outfit have been installed and operated to the satisfaction of the superintendent of construction, who will require adequate dock and running trials, the contractor may assign a date for the official trial and shall notify the Bureau at least one week in advance of such date, to permit of the appointment and gathering of a trial board.

The trial board will carefully inspect the hull and test the machinery, equipment, and outfit of the vessel at rest and in service action. All omissions, errors, defects, etc., of whatever nature that may appear to the trial board, shall be corrected by the contractor at once, and subsequent trials performed to the satisfaction of the trial board.

The trials, tests, and compilation of data shall be performed entirely by and at the expense of the contractor and shall include the following and such additional operations as the trial board may direct:

1. Six hours' continuous running of the propelling engine. During this time the speed of the vessel, the slip of the propeller, the revolutions and horsepower of the main engine, the boiler pressure, and the fuel consumption shall be accurately determined. The necessary additional data for a complete analysis of the performance of the machinery, such as the revolutions of the feed pump, temperatures of the feed water, etc., shall be carefully taken. The boiler pressure shall be kept continuously at approximately 110 pounds gauge, the speed of the engine as nearly constant as practical, and indicator cards shall be taken from both ends of all the cylinders of the engine as nearly simultaneously as practicable. At the beginning of this trial the condition of lading, including the quantity of fuel,

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feed, and drinking water, etc., shall be accurately observed and recorded, and the draft of the vessel forward and aft noted.

2. Runs of sufficient duration shall be made under the general conditions of the six-hour trial to determine the speed of the vessel and the horsepower at three different point of cut-off.

3. The turning radius at full speed, the time necessary to stop, back, and the general maneuvering qualities of the vessel shall be demonstrated.

4. One hour's continuous operation of the fog-whistle apparatus, during which time the characteristic shall be correctly given by the fog whistle.

5. Adequate tests of the signal-light systems shall be made and the entire apparatus shall function accurately in all its details.

6. The water-service pump shall be in continuous operation during the trials; each outlet, faucet, closet, shower, etc., together with all fittings, shall be operated and the automatic governor shall work properly and a pressure of 25 pounds be maintained on the systems.

The fire deck and bilge pump shall be operated on the bilges and on the fire system. The forward and after trimming tanks shall be filled and emptied by this pump and the time noted for each operation, also the changes in the draft of the vessel.

7. The anchors shall be dropped and the entire lengths of the chain cables paid out. The method of securing the chain ends in the lockers shall be noted. The chains shall be hove in and both anchors stowed and the time required for each operation noted.

8. The steam-heating plant and the galley range, the hot-water system, with all pipes and fittings, shall be in operation during the entire trial and as may be deemed necessary.

9. Adequate operations and tests shall be made with the boat davits and boats, the sail, the running whistle and fog bell, the speaking tubes, engine-room gongs and bells. The awnings over the spar deck shall be set and then stowed, as will be directed. All hatches, cargo ports, air ports, scuttles, doors, locks, etc., shall be operated, proved to be water-tight, if so specified, and to be fitted with all appliances to hold them open or shut, and secure same as required by the specifications.

All moving parts of the machinery and the auxiliaries shall operate smoothly without undue heating or gripping. All connections shall be tight.

The methods and instruments used in conducting all tests shall be subject to the approval of the trial board and the data of all tests shall be accurately worked up, properly tabulated by the contractor, and promptly delivered to the Bureau for its guidance relative to the acceptance of the vessel.

If any stores, tools, hose, or other articles belonging to the vessel are used during the trial, or at any other time, and injured, they shall be repaired or replaced as required by the superintendent of construction.

173. Docking and Delivery.—Upon notification by the Bureau of a satisfactory trial, the vessel shall be docked and the bottom thoroughly cleaned and painted immediately prior to delivery to an authorized representative of the Bureau of Lighthouses. The rooms and other spaces, bilges, decks, all painted work inside and outside, the machinery throughout, all valves, valve chests, pipes, instruments,

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machinery-room tools, oil and water tanks, etc., shall be made perfectly clean; all movable articles shall be in perfect shape and properly stowed.

174. Articles to be Furnished by the Government.—The Bureau will furnish the following-named articles, in whole or part, as specified in detail under the proper heading, but the contractor shall stow and install, secure, and operate the same satisfactorily under working conditions, each for its intended purpose and as will be directed:

One 5,000-pound mushroom mooring anchor.

Two 1⅜-inch stud link chain cables, each 75 fathoms long, each cable consisting of two 30-fathom shots and one 15-fathom shot, with all swivels and shackles.

Characteristic signal-lighting system, consisting of a 375 millimeter acetylene-gas lantern with electric flasher clock and batteries, 12 acetylene-gas tanks, gas manifolds, piping, unions, and valves.

Characteristic fog-signal apparatus, consisting of one 12-inch chime whistle with compound automatic whistle valve, two automatic clockwork mechanisms with steam-driven cylinders.

Bracket lamps for state and mess rooms and hand lanterns.

Three fire extinguishers and 6 gallons of composition.

Two boat compasses and binnacles for small boats.

Nautical instruments.

Hair mattresses for beds in officers' and crew's quarters, all bedding, bed covering, and linen.

All plated silverware, cutlery, china, crockery, galley utensils, and glassware.

Chairs and stools for staterooms and quarters.

All loose floor covering, such as mats, rugs, etc., except where otherwise specified.

Hawsers, towing lines, spare tackle, etc., except where otherwise specified.

Engineer's and carpenter's tools, excepting those otherwise specified.

All flags, consisting of two ensigns, two Lighthouse Service pennants, and a full set of international code signals, 4 by 4 feet.

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175. General Requirements.—Name plates of white porcelain or other approved material, with neat, black, durable lettering to designate the staterooms, storerooms, and other spaces throughout the vessel, shall be secured above their doors, or where directed.

Portable fittings, such as toggle pins, etc., shall be attached with brass or galvanized chain. All toggle pins shall be fitted with brass toggles. Hinge pins in steel hinges shall be of brass.

Valves about the pumps, manifolds, and elsewhere necessary to designate leads on the various systems, shall be named with stamped letters on flattened surfaces of handwheels or designated by metal label plates to show their purpose.

All valves and their fittings, if manufactured by the contractor, shall be of composition "G," with renewable disks, except where otherwise specified. All valves purchased shall be of the highest commercial grade and of an approved make and properly fitted. Valves over 3 inches in diameter in exhaust pipes may have cast-iron bodies, with composition mountings.

Special fittings manufactured by the contractor shall be of composition "G" where directed.

All nuts shall be hexagon, unless otherwise specified or directed, and they shall be of iron, steel, or other material, as will be approved by the superintendent of construction.

All moving parts of the main and auxiliary machinery shall have lock nuts or split pins, or both.

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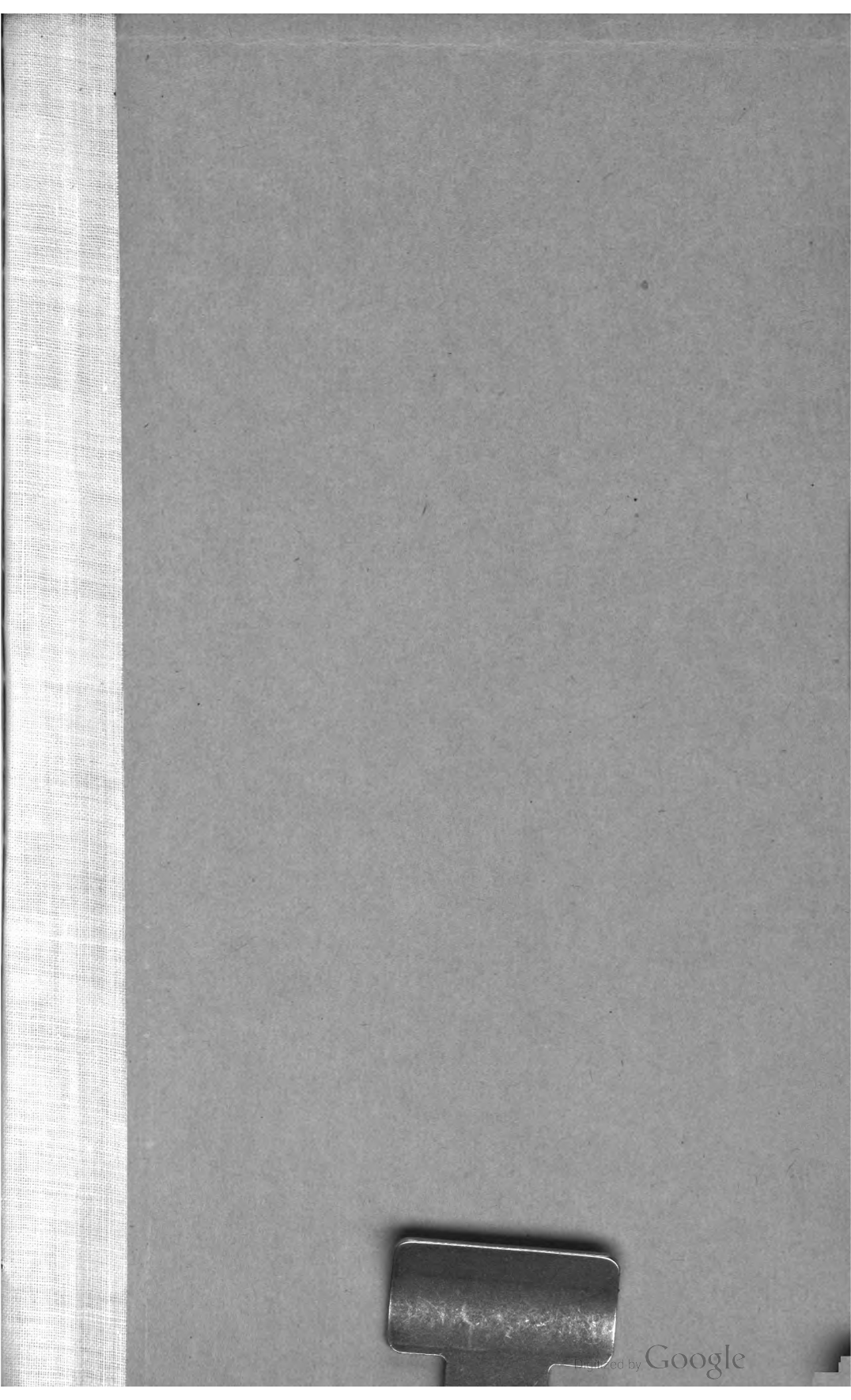
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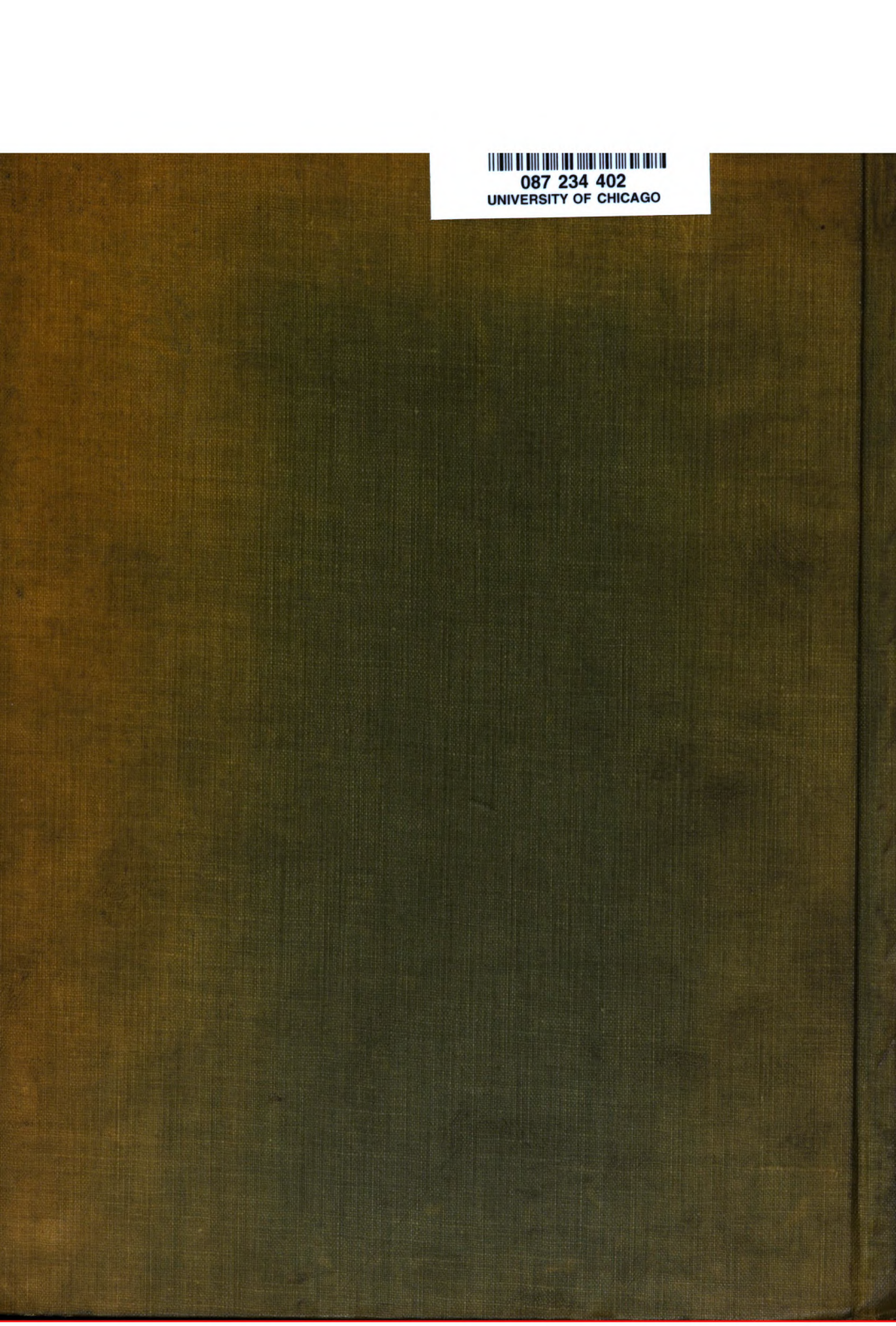
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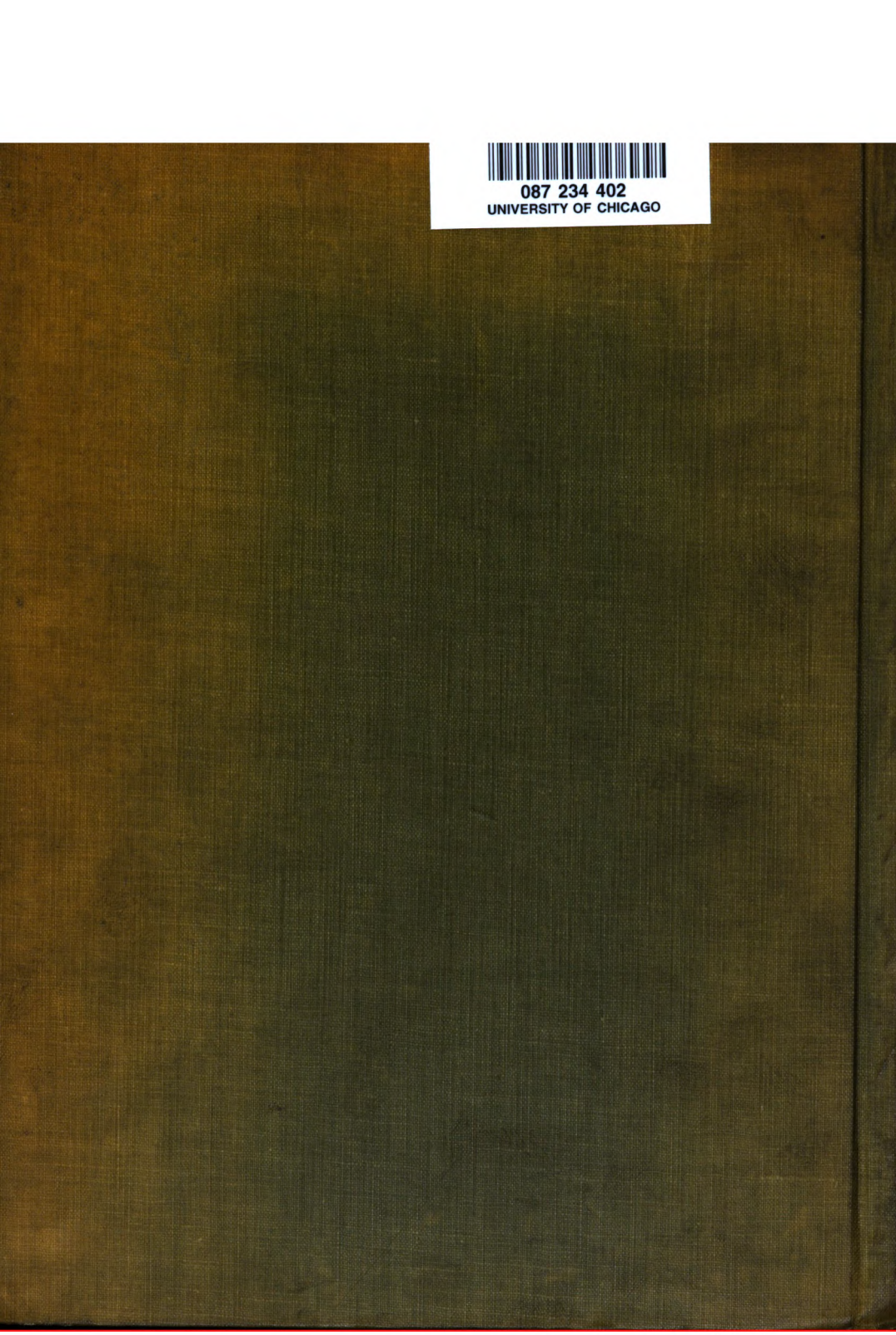
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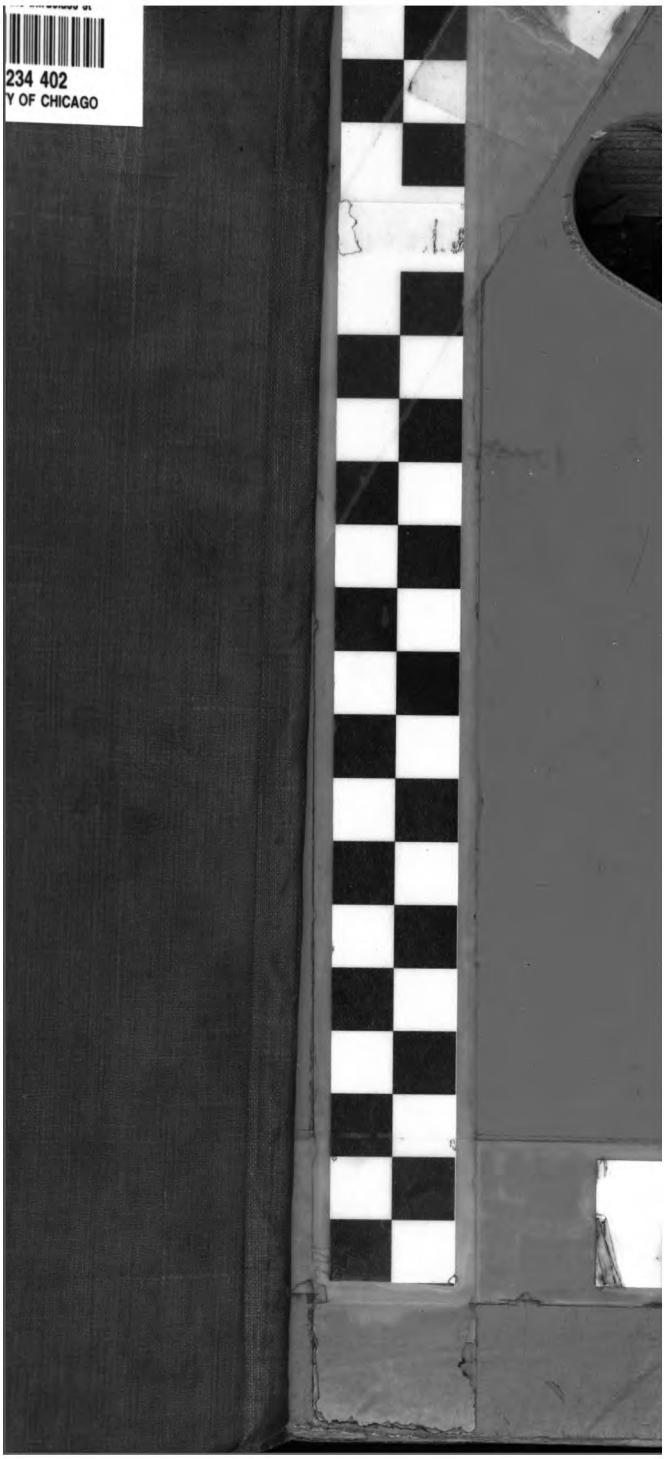
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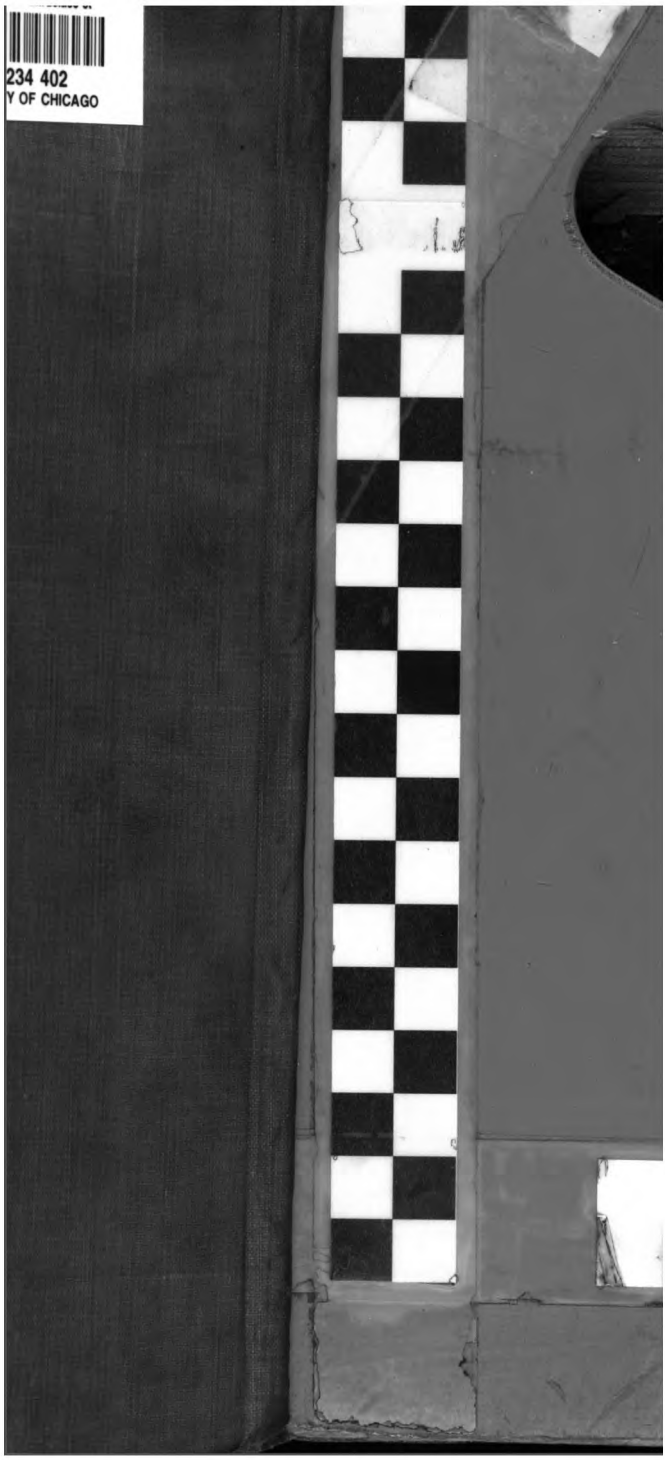
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