

Original

20

Engine No. *183A.*

S.S. No. *505.*

SPECIFICATION

OF A

TRIPLE COMPOUND DIRECT ACTING
SURFACE-CONDENSING

Marine Engine

MADE BY

BLAIR & Co., LIMITED,

STOCKTON-ON-TEES,

FOR



Messrs. *Proprietors*

Owners *R. F. A. "Olympe"*
J. Ashleaf

14/2/14.—500.

E. J. ARNOLD & SON, LTD., PRINTERS, LEEDS.

W970-0111

Engine No. *1034*

S.S. No. *505*

SPECIFICATION

OF A

TRIPLE COMPOUND DIRECT ACTING
SURFACE-CONDENSING

Marine Engine

MADE BY

BLAIR & Co., LIMITED,

STOCKTON-ON-TEES,

FOR

Messrs. *Ropner & Sons Ltd*

Owners *S. J. A. "Olga"*

14/2/14.—500.



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Specification

OF A TRIPLE COMPOUND DIRECT ACTING
SURFACE-CONDENSING MARINE ENGINE WITH ONE
HIGH, ONE INTERMEDIATE, AND ONE LOW PRESSURE
CYLINDER, MADE BY

BLAIR & CO., Ltd.,
STOCKTON-ON-TEES.

STEAM PRESSURE 180 LBS.

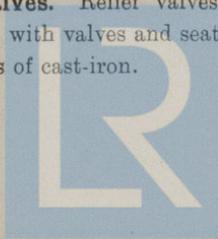
1. **Cylinders.** Of cast-iron of the following diameters, viz.:—
high pressure 25", intermediate pressure 42", and
low pressure 68", the pistons having 48" stroke in
each case. Cylinders lagged with wood, and covered with
sheet iron, secured by round-headed iron screws. Brass
indicator cock with copper pipes fitted to take diagrams from
top and bottom of each cylinder. Starting valve fitted to
admit steam to I.P. and L.P. steam chests, gear for working
same led direct to starting platform.

H.P. cylinder body fitted with hard close grained cast-
iron liner. ~~When H.P. cylinder has a piston valve the~~
~~chamber to have a liner fitted, or to have a detachable slide~~
valve face if flat side valve is fitted. I.P. cylinder to have a
detachable slide valve face.

~~Piston valve liner and~~ detachable slide valve faces of
our special cast-iron mixture.

Eyebolts fitted under cylinders for lifting main bearings.

2. **Relief Valves.** Relief valves fitted to I.P. and L.P. steam
chests, with valves and seats of brass in turned and polished
casings of cast-iron.



✓ 3. **Cylinder Covers.** Of cast-iron, double section strongly ribbed with fluted top. Flanges turned and polished. Each cover fitted with starting bolts.

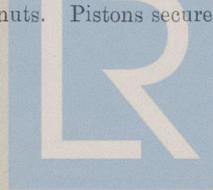
✓ 4. **Steam Chest Covers.** Of cast-iron, double section strongly ribbed with fluted top. Flanges machined and polished. Each cover to have polished cast-iron dome with brass bush to receive top end of slide spindle where flat slide valve is fitted. Starting bolts fitted to each cover.

✓ 5. **Drains.** Brass drain valves fitted to bottom of all three cylinders and steam chests, with rods and handles led direct to starting platform. H.P. drain pipes led to bilges, others to condenser. Drain pipes of copper.

6. **Pistons.** Of cast-iron, hollow in form and strongly ribbed, H.P. and L.P. pistons having cast-iron junk ring and block piece combined and fitted with cast-iron Ramsbottom rings of our own make. L.P. piston fitted with junk ring of cast-iron and plain packing ring and our make of "Volute" springs. All junk rings secured by wrought-iron bolts and brass nuts. Pistons secured to piston rods by iron nuts.

Pistons.

✓ Lockwood & Carlisle rings & springs in
M. & L.P. pistons.



Throttle & Stop Valve.

Intermediate Stop Valve in Engine room to be covered with non-conducting Compo. & cleaded.

Condenser

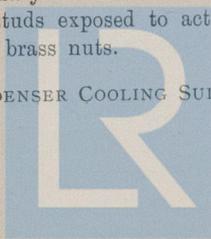
Screwed Brass Condenser Ferrules. ✓

✓ 7. **Slide Valves.** Our style of flat valve of cast-iron, passages therein arranged to suit double ports on cylinders, and worked by link motion. High pressure slide valve of balanced type on "Church's" principle ~~or piston valve with adjustable rings at owner's option.~~ Each slide valve supported by large wrought-iron turned washer at bottom, and secured with clamp at top end. Automatic Lubricator fitted to H.P. steam chest.

✓ 8. **Throttle and Stop Valve.** Chest of cast-iron with brass valve, seat, and spindle. Stop valve fitted with outside screw and hand wheel. Throttle valve handle and stop valve wheel worked from starting platform.

9. **Condenser.** Of cast-iron, with three standards cast on for supporting cylinders, one of these standards forming the exhaust pipe between L.P. cylinder and condenser. The tubes of solid drawn brass $\frac{3}{4}$ -in. external diameter, 18 B.W.G. thick, horizontal and properly fitted into rolled brass tubeplates 1-in. thick and secured with ~~wood~~ ferrules. Supporting plate fitted at centre of tubes. Seats for air and circulating pumps cast on condenser, and necessary faces for bolting to bedplate. Auxiliary feed cock and all necessary cocks and valves for efficient working fitted. All studs exposed to action of salt water of Muntz metal with brass nuts.

CONDENSER COOLING SURFACE 2780. SQUARE FEET.



- ✓ 10. **Front Columns.** Of forged scrap, machined all over and fitted into deep bosses cast on cylinders. Top end of columns fitted with turned nuts, and bottom end forged with solid flange secured by bolts and nuts to bedplate.

Four COLUMNS, EACH *8"* DIAMETER.

- ✓ 11. **Bedplate.** Of cast-iron of heavy section, with flanges for attachment of condenser, and facing pieces to receive front columns.

Machined recesses provided in bedplate to receive crank shaft bearings.

Bedplate efficiently packed with cast-iron packing pieces and hard wood wedges, and firmly secured to engine seating.

- ✓ 12. **Crank Shaft Bearings.** Six in number of heavy section, made of cast-iron carefully fitted into machined recesses provided in the bedplate. Polished forged keeps for top half bearings. Bolts for securing keeps to go through bedplate with nuts at top and bottom. Bearings fitted with cast-iron syphon oil box with hinged brass lid.

Bearings tinned and lined with our own special "Admiralty" mixture of white metal.

LENGTH OF BEARINGS *Four 15 1/2", Two 14 1/4"*

COLLECTIVE LENGTH *7' 6 1/2"*



Piston Rods.

United States Metallic Packing fitted to all 3 piston rod stuffing boxes instead of the usual glands & packings.

13. Cooling Pipes. Main pipe of copper provided with brass cocks and telescopic pipes for main bearings, crank pins and eccentrics. ~~Pipe fitted along tunnel with cock and pipe to each tunnel shaft bearing and connected to engine room cooling pipe. This pipe along tunnel arranged to serve as a handrail.~~ Stand pipe with shut-off cock fitted on platform for engine room hose.

14. Piston Rods. Of forged scrap. Crosshead forged with rod and fitted with adjustable cast-iron shoe. Brass bush of large surface fitted in bottom end of each piston rod for connecting rod gudgeon, and fitted with machined wrought-iron keep, bolts, and nuts. Necessary lubricating boxes and brass pipes fitted. ~~H.P. stuffing box fitted with metallic packing of our own make. Inner rings of white metal and backing rings of brass.~~

Guide Bars separate castings and bolted to back columns. Headway guides fitted with connections for water service behind plate and sternway guide bars removable for withdrawing piston rod shoe at sides.

DIAMETER OF PISTON RODS 7



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15. **Connecting Rods.** Of forged scrap, machined all over, bottom ends having flat palms fitted with bearings to take crank pins and secured with wrought-iron keeps, bolts, and nuts. The bearings are fitted with cast-iron distance pieces and loose liners for convenience in adjusting without removing bolts. Top ends of rods are forked. Gudgeons at top ends of rods of iron contracted into rods and fitted to receive piston rod brasses. L.P. gudgeon extended to receive pump link brasses. Necessary lubricating boxes and brass pipes fitted.

Cast-iron ~~or steel~~ crank pin bearings tinned and lined with our own special mixture of "Admiralty" white metal.

DIAMETER OF RODS:—AT TOP..... 7"
 AT BOTTOM..... 7³/₄"
 LENGTH BETWEEN CENTRES 8"6

Slide Spindles.

United States Metallic Packing fitted to all 3 Slide Spindle Stuffing Boxes instead of the usual glands & packings.

16. **Slide Spindles and Crossheads.** Of forged scrap turned and finished bright on working parts and fitted with brasses for links at bottom ends, top end of each slide spindle where flat valves are fitted working in cast-iron dome bushed with brass fitted on steam chest covers. Guides with adjustable brass bushes fitted under cylinders. H.P. slide spindle stuffing box fitted with metallic packing of our own make. Inner rings of white metal, backing rings of brass.

DIAMETER OF RODS AT WORKING
 PART THROUGH GLAND..... 4⁵/₈"



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17. **Valve Gear.** Expansion links of double bar type with pins forged solid on links. All pins and eyes in the working gear fitted with adjustable brasses with large bearing surfaces, the whole finished bright all over. Eccentric sheaves of cast-iron in halves held together by wrought-iron cotter studs.

Eccentric straps of tough cast-iron of strong section lined with white metal. Headway and sternway straps interchangeable, and all straps reversible tops and bottoms. Galvanized iron troughs fitted under each group of eccentrics. Cast-iron adjustable distance pieces fitted between top and bottom halves of straps. Studs fitted in top half straps for attaching to eccentric rod feet. Reversing weigh bar fitted with cast-iron ~~or cast-steel~~ reversing levers. Each reversing lever fitted with expansion gear for adjusting cut-off.

18. **Steam and Hand Reversing Gear.** All round type of reversing gear driven by separate engine, fitted on one of the front columns. Engine to run in both directions, controlled by brass piston valve actuated by lever fitted with spring catch working on quadrant attached to engine. Cast-iron polished hand wheel fitted for reversing by hand. Exhaust pipe of copper led to condenser. Index plate fitted to show positions of gear.

(Eccentric sheave studs not left longer)



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Air Pump

Edwards type of Air Pump fitted.

19. **Starting Gear.** Rods and handles for working the stop valve, throttle valve, starting valves, drain valves, and reversing engine, arranged to be worked from starting platform.

20. **Air Pump.** Single acting, chamber of solid brass. ~~Air pump bucket of brass.~~ Head ~~and foot~~ valve seats of brass, all fitted with Kinghorn's metallic valves fitted on Muntz metal studs with brass nuts and split pins. The rod of Muntz metal secured to pump crosshead by nut at top end. Cover of cast-iron finished bright and strongly ribbed. Cast-iron stuffing box with brass-lined gland and brass neck ring.

DIAMETER OF PUMP $2\frac{1}{2}$ " x $3\frac{1}{4}$ " STROKE.

21. **Circulating Pump.** Double acting, chamber of solid brass, fitted with brass plunger. The rod of Muntz metal secured to pump crosshead by nut at top end. Cover of cast-iron finished bright and strongly ribbed. Cast-iron stuffing box with brass lined gland and brass neck ring. Cast-iron valve box fitted with brass seats and guards and india rubber falls and large air valves. All studs exposed to action of sea-water of Muntz metal with brass nuts.

DIAMETER OF PUMP $1\frac{1}{2}$ " x $2\frac{1}{4}$ " STROKE.



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Independent Feed Pumps.

In addition to the Main Engine Feed Pumps - one of Weirs (single) independent feed pumps with Cast Iron Water end, Brass fitted, is to be supplied & fixed in Boiler room.

Pump 7 x 9 1/2 x 24

This pump is to have suction from the Sea, Main Engine feed receiver, & drain Tank in connection with Cargo exhaust arrangements, delivering to Main Boiler through the usual Donkey feed connections.

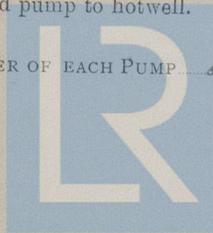
The suction of Weirs Pump from above Drain Tank to have a Filter fitted in pipe

✓ 22. **Air and Circulating Pump Crosshead.** Forged from scrap turned and finished bright all over, holes bored in it to receive air and circulating pump rods and feed and bilge pump rams, and worked by levers and links from gudgeon of L.P. engine. Guide bar with adjustable crosshead for guiding pumps.

✓ 23. **Pump Levers and Links.** Levers, gudgeons, etc., of best selected scrap working in adjustable brass lined bearings fitted on seats provided for them on condenser standard. Links of wrought-iron fitted with adjustable brasses at each end, and connected to gudgeon on L.P. connecting rod and pump crosshead. Oil cups fitted where necessary.

✓ 24. **Feed Pumps.** Of cast-iron, two in number, arranged so that they can be worked independently. Both feed pumps fitted at forward end of crosshead. Rams of brass. Each pump fitted with separate suction and discharge valve chests of cast-iron with brass internal fittings and Kinghorn's valves. Large air vessel fitted direct on pump discharge chests, and spring relief valve fitted. Stuffing boxes to have brass neck rings and brass-lined glands, and fitted with white metal packing of our own make. Brass snifting valves to be fitted to each pump, snifting valve on one pump fitted with tail piece to act as soda cock. Brass air pipe and cock from each feed pump to hotwell.

DIAMETER OF EACH PUMP 3 1/4" x 34" STROKE.



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Bilge Pumps.

One Bilge Pump to draw from sea and discharge on Deck through Wash Deck pipes.

25. **Bilge Pumps.** Of cast-iron, two in number, fitted at after-end of crosshead. Cast-iron rams. Stuffing boxes to have brass neck rings and brass lined glands. Valve chests of cast-iron fitted with Kinghorn's valves and separate air vessels and overboard discharge pipes.

DIAMETER OF EACH PUMP $4\frac{3}{4}$ " x $3\frac{1}{2}$ " STROKE.

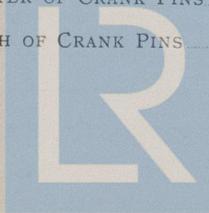
26. **Discharge Valves.** Cast-iron chests with brass valves, seats, and spindles. Separate discharge valve for circulating pump, ballast donkey, and each bilge pump.

27. **Crank Shafts.** Built type, journals and pins of British manufactured ingot steel. Webs forged from selected scrap. Cranks made in three duplicate interchangeable pieces, each working in two bearings of cast-iron lined with white metal fitted in bedplate. Cranks placed at angles of 120° . Machined all over and coupled together with turned and fitted wrought-iron parallel bolts and nuts.

DIAMETER OF CRANK SHAFT $1\frac{1}{2}$ "

DIAMETER OF CRANK PINS $1\frac{1}{2}$ "

LENGTH OF CRANK PINS $1\frac{1}{2}$ "



28. **Thrust Bearing.** An independent thrust bearing fitted with cast-iron horse shoe collars of large surface, lined with white metal on sternway side and fitted with adjustable loose white metal liners on headway side. A bearing at each end of carriage lined with white metal. Collars cast hollow and fitted for internal water circulation, and arranged so that headway liners may be separately adjusted for wear, or collars removed without lifting shaft.

29. **Thrust Shaft.** Of British manufactured ingot steel, coupled to after piece of crank shaft, machined all over. Water-tight stuffing box fitted on bulkhead where shaft passes into tunnel. Parallel coupling bolts.

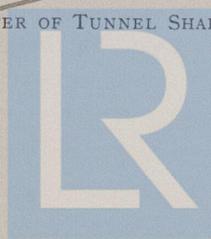
DIAMETER OF SHAFT THROUGH THRUST $1\frac{1}{2}$ "

30. **Tunnel Shafting.** Of British manufactured ingot steel, machined all over. Shafts coupled together with turned and fitted wrought-iron parallel bolts and nuts. Sheet-iron guard plates fitted over each coupling in tunnel.

DIAMETER OF TUNNEL SHAFTING $1\frac{3}{4}$ "

Note:-

Engines are to be fitted aft in the Vessel in accordance with agreed plan.
No intermediate shafting fitted between Thrust shaft & propeller shaft.



Note: Engines fitted aft.

Intermediate bearings between Thrust Block & Tail shaft coupling to have save all cast on each end.

Propeller shaft.

Fitted with continuous liner, the liner to be increased $\frac{1}{4}$ in dia. in way of Stern Bush.

31. **Tunnel Bearings.** Of cast-iron, bottom halves lined with white metal, adjusted to shafting and firmly bolted to seatings. Keeps of cast-iron, having pipe boxes cast on for lubricating purposes. ~~Cooling pipe fitted along tunnel with service pipe to each bearing.~~

32. **Propeller Shaft.** Of British ~~manufactured~~ ingot steel or forged from specially selected scrap iron ~~at purchaser's option,~~ turned all over and fitted with brass liners, ~~at stuffing box and stern bush, after-~~ liner carried into a recess in propeller boss. After end of shaft tapered to fit bore of propeller and fitted with wrought-iron nut with lugs for tightening up. Parallel coupling bolts.

DIAMETER OF PROPELLER SHAFT..... $15\frac{1}{2}$ "

THICKNESS OF LINER $5\frac{7}{8}$ " $\frac{3}{4}$ " in way of Stern Bush.

33. **Stern Pipe.** Of cast-iron, with heavy brass bush at after-end, lined with lignum vitæ, with brass bridle ring for securing wood in place. Bottom half of bush lined with "end grain wood." Secured by turned wrought-iron nut outside the boss of stern post and to bulkhead by iron bolts and nuts. Long neck ring of brass, and cast-iron gland with brass bush at inner end. Stern gland studs of Muntz metal with brass nuts.



Wash Deck Pipes.

Shut off Cock in Wash Deck pipe with overboard discharge.

Valves for attachment of Hose with Admiralty Standard connections are to be provided in Wash Deck pipes instead of the usual Tees & Caps.

34. Propeller. Solid type, of cast-iron with blades of ample strength and suitable pitch and surface, carefully fitted on shaft with feather key full length of propeller boss. Propeller secured to shaft by wrought-iron nut with lugs for tightening up. Nut to work reverse way of propeller and secured with efficient stop.

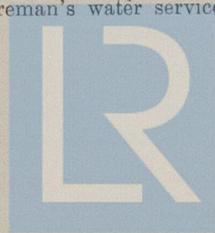
35. Wash Deck Pipes. Of galvanized wrought-iron, $2\frac{1}{4}$ -in bore, fitted along one side of ship with Tee pieces and brass couplings with cast-iron caps at intervals for attaching hose pipe. Wash deck pipes connected to main boiler feed donkey.

36. Sea Injection Valve, &c. Fitted to comply with classification regulations. Chest of cast-iron with brass valve, seat, and spindle, and fitted with strum.

Separate bilge injection valve fitted in connection with circulating pump suction.

Scum and blow off cocks on ship's side, of brass with spigot and washer on outside. Scum and blow off cocks double glands.

Separate suction fitted for feed donkey with branch for fireman's water service fitted.



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37. **Telegraph.** Mehan's reply telegraph with illuminated dial to be fitted from bridge to engine room. Brass heads on deck pedestals.

38. **Whistle.** A large organ whistle supplied and connected to shut-off valve on auxiliary steam pipe on top of main boilers. Automatic drain fitted to pipe.

Donkey Feed Engine

Instead of the ordinary Feed Donkey provided for in paragraph 39, a large Duplex feed donkey is to be fitted in Engineer room with suction from the sea, after Ballast Tanks, & Boilers, with discharges overboard, on deck, & to Boilers. The discharge to deck will serve for fire purposes.

Pump of Duplex type by Thom Lamont & Co. Paisley (size 8" x 6" x 8") with cast iron water end Brass fitted.

39. **Donkey Feed Engine.** ~~Of our own make, double acting, for feeding boilers, washing decks, etc., fitted with brass bucket, brass chamber, Muntz metal rod and brass internal fittings, seats held securely in place by through bolts from top covers and fitted with Kinghorn's valves.~~

~~Large air vessel with relief valve. Pump rod of Muntz metal.~~ Arrangements are made so that this donkey can circulate water in main boilers while getting up steam, and pump water out of hotwell into boilers. Separate sea suction fitted. Feed donkey also connected to ballast tank suction.

DIAMETER OF STEAM CYLINDER ✓

DIAMETER OF PUMP ✓

STROKE



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Donkey Ballast Engine

Duplex type by Thom Lamont & Co. to pump 200 Tons per hour. To have Cast Iron water end, Brass fitted, with rubber valves size 9 x 11 x 10.

Pipes

Main steam pipes independent from each Boiler to junction piece on Bulkhead. Pipes may be of solid drawn steel with good bends for expansion, both for main & auxiliary steam & exhaust pipes.

Arrangements made in Engineer room for pumping up the After Peak Tank through suction pipe if ballast is carried in this tank.

Feed Tank: - suction pipes to be fitted so that the Engineer room feed donkey can draw from the double bottom & after peak tanks by independent connection and discharge pipes fitted to either tank from donkey.

40. Donkey Ballast Engine. ~~Of our own make, double acting, for pumping out water ballast and bilges. Large air vessel and relief valve fitted. Pump rod of Muntz metal, brass internal fittings, seats held securely in place by through bolts from top covers and fitted with Kinghorn's valves. This donkey arranged to turn the main engines while the vessel is in port, and also circulate water through condenser. To discharge overboard through separate discharge valve on ship's side.~~

DIAMETER OF STEAM CYLINDER ✓

DIAMETER OF PUMP ✓

STROKE ✓

41. Pipes. ~~Main steam pipes across boiler top of copper fitted with stuffing box with gland with branch connection to engine. Auxiliary steam pipe with separate shut off valve from each boiler. Main and donkey feed pipes of copper. Exhaust pipes of copper with change connections where necessary. Scum and blow-off pipes of copper with separate valves on each boiler and cock on ship's side. Separate discharge pipes from circulating pump, each bilge pump, and ballast donkey. Straight lengths of piping of cast-iron, bends of copper. Waste steam pipe from safety valves made of copper above casing and carried well up funnel. Tank and bilge suction pipes of cast-iron with lead bends. Tank and bilge suction valves of brass in cast-iron chests. All bilge valves non-return type.~~



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42. Branches for Shipbuilder. Branch for deck steam on auxiliary steam pipe, and on waste steam pipe for steering gear exhaust in position required. Branch on bilge suction pipe for hand pump, and Tee piece in main feed donkey delivery pipe for donkey boiler feed if required.

43. Gauges. One pressure gauge to each boiler, fixed in stokehole. One gauge for H.P. steam chest, one for I.P. steam chest, and one compound gauge for L.P. steam chest with vacuum gauge for condenser. All gauges in engine-room conveniently arranged in front of engine.

44. Ladders. Ladders and gratings fitted for access to engine-room and stokehole. Gratings fixed about engines to enable the working parts to be oiled easily. Ladders and handrails where necessary.



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45. **Store Room.** The store-room fitted with all requisite lockers, drawers, shelves, and racks, for eyebolts, etc., with grating in front for light and ventilation.

46. **Lifting Gear.** One Warwick Screw with roller for lifting cylinder covers and pistons to be supplied and fitted. One pair 3 ton worm blocks with roller and shackle for lifting beam.

47. **Turning Gear.** A large cast-iron wheel securely keyed on thrust shaft and fitted with worm gearing and wheel, ~~driven by rope from pulley fixed on ballast donkey~~, for turning the engines round in port.

48. **Floor Plates.** Stokehole and alleyways laid with cast-iron chequered plates. Floor at front of engines laid with wrought-iron chequer plates, and at back of engines with wood.

Turning Gear.

Driven from Reversing Engine by Belt drive.

Floor Plates: - supply & fit Wrought Iron floor plates round back of Engines & at after end of Engine room. No wood to be used in fitting of Engine room floor

Pulled steel chequered plates approved - see letter 19 - 29. 5. 16 WMS



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Auxiliary Boiler:— An Auxiliary Boiler 12'0" outside dia. & 10'0" outside length, 180 lbs. pressure of steam to be fitted in conjunction with the two main Boilers specified under par. 49

Boiler to be fitted with two plain withdrawable furnaces, upstack, furnace fittings, & mountings complete & connected up to main Engines & covered with non-conducting Compo. & sheet Iron (see also page 19)

Auxiliary Boiler funnel carried up inside main funnel & formed from plate attached to main funnel, with double damper.

Heating surface in Auxiliary Boiler 1150.
Boiler Arrangements:— The two main Boilers are arranged abreast & auxiliary Boiler in recess forward with one stokehole common to the three Boilers.

Shipbuilders fit a complete water tight bulkhead between Engine room & Boiler room. No water tight doors or openings for ventilation &c. are to be fitted in this Bulkhead. All water Gauges will be arranged at stokehole end of Boilers.

Oil Fuel Arrangements:— The main & auxiliary Boilers are to be arranged for burning Oil Fuel only. All fittings for burning Coal Fuel are to be discarded. The Wallsend system (Natural Draught) to be fitted in accordance with Builders plans to be submitted for approval

Heating arrangements for Oil Bunkers to be fitted up by Engineers.

Tubes:— The Combustion chamber ends of Tubes to have Malleable Cast Iron Capped ferrules fitted. The Tubes of main & auxiliary Boilers are to be fitted with retarders from 2 1/2 to 3 twists.

Boilers.

No. Two OFF STEAM PRESSURE 180 LBS.
TYPE Single Ended
EXTERNAL DIAMETER 17'6" EXTERNAL LENGTH 11'6"
Four FURNACES IN EACH 3'2" INSIDE DIAMETER.
TOTAL HEATING SURFACE 6600 SQ. FEET.
CLASSIFICATION Lloyds.

49. Boilers. Cylindrical, multitubular type, with Morison section patent withdrawable furnaces, of Leeds Forge or John Brown & Co.'s make, each furnace properly fitted with firebars, etc. Furnace fronts and balanced doors of steel with hinges properly secured to boiler fronts and fitted with efficient baffle plates. The boiler fronts flanged to receive furnaces and cylindrical parts of boiler shells. Cylindrical parts of boiler shells made of steel in one length fore and aft. Butt straps outside and in, treble riveted. Circumferential seams double rivetted. All plates and rivets of the best Siemen's Martin steel. Plain and stay tubes best quality of wrought-iron. Stay tubes screwed into both tube plates. Flanging and rivetting as far as practicable done by hydraulic pressure. Longitudinal stays of steel. Combustion chamber stays of steel screwed into both plates and nutted at fireside end. Manhole in top, and at front end of each boiler. Front manholes flanged inwards and fitted with recessed doors. The boilers constructed to classification requirements, and efficiently stayed to sustain the working pressure, and proved by hydraulic test to double the working pressure. Boilers fitted with double spring safety valves with easing gear brought down to starting platform, brass scum and blow-off valves, separate brass feed valves for main and donkey feed pumps. Brass water gauge cocks fitted on cast-iron column on back of each

Boiler Covering:-

Bottoms of the Two Main Boilers & Auxiliary Boiler covered with Newallite blocks $1\frac{1}{2}$ thick secured circumferentially with Galv^d Iron Straps.

Lower part of back ends of Main & Auxiliary Boilers also covered with our non-conducting Compd.

Funnel.

A complete outer casing (10" Air space) to be fitted round Main Funnel for Ventilation of Boiler Casings &c.

To be as high as possible consistent with passing Manchester Canal Bridges.

Ventilators

Slewing Gear fitted to the two Stokehole Ventilator heads, worked from Stokehole floor.

Hand Ash Hoisting Gear fitted to one Ventilator with steel wire hoisting rope.

boiler with necessary try cocks. Stop-valve of brass in cast-iron chest fitted on each boiler with external screw, as well as wing throttle valve and stop valve on engine end of main steam pipe. Boilers above seatings covered with non-conducting composition and lagged with sheet iron on circular parts and on back of boilers. Boilers fitted with uptake and smoke boxes of iron with baffle plate over front end plate, uptake doors fitted with inside and outside baffle plates and all necessary rings and catches. Ashpit dampers fitted. Chain blocks supplied for lifting smoke box doors.

50. **Funnel.** Of ample diameter and height, built of steel with ventilating caping on lower part above caping. Wire rope stays with stretching screws. Jewel blocks fitted at top for convenience in painting. Ladder fitted up funnel to height of whistle. Damper fitted with suitable gear for working. Owner's house mark painted on funnel. Waste steam pipe above casing made of copper and carried well up outside of funnel.

51. **Ventilators.** Two to each stokehole fitted with moveable cowls and each fitted with ash doors with hand winches for heaving ashes. Iron strips fitted for guiding ash buckets.



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52. Guarantee Clause. We undertake to make good, but only in a port in Great Britain, without charge, any defect arising from bad material or bad workmanship appearing in these engines and boilers within six calendar months from the date of the trial trip; but it is an express condition of this specification and of the contract based thereon, that we are not to be responsible for any accident, or for any consequential damages arising from such defect as above-mentioned or from any accident.

It is understood as a condition of our liability under the foregoing undertaking that, during the above-mentioned six months, we are to appoint the sea-going engineers, who are to be paid the usual and customary wages by the owners of the steamer, and that if any of such engineers be removed from his appointment, our responsibility under the foregoing undertaking shall cease.



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Distilling Plant.

A Weirs or other approved make of distilling plant is to be fitted. Plant to consist of - A Weirs or approved Evaporator of 25 Tons capacity with distilling Condensers & combined pump for circulating, fresh water, & brine.

Engine builders work in connection with this plant will include the Test Tank but all connections after this Tank, including the supply of the Storage Tanks & supply pipes & pump from Storage Tanks will be shipbuilders work.

Workshop.

The following Machinery to be supplied & fitted up with necessary Shafting &c

- 1 Gap Lathe (6" approximately)
- 1 Pillar Drilling Machine (1 1/2" Spindle)
- 1 Shaping Machine (about 12" travel)
- 1 Grindstone & Stand (24")

The above are to be driven by one 5 B.H.P. Motor supplied & fitted up complete by engine-builders. Wired by Electricians but secured in place by enginebuilders who also supply belts.

Engine Counter.

Seven figured Engine Counter supplied & fitted up complete.



53.

Furnishings and Tools.

- 1 Ash cock fitted in stokehole
- 2 Ash shoots
- 1 Anvil and set of smith's tools
- 1 Axe
- 1 Augur
- 180 Bolts and nuts
 - 1 Pair blocks and rope fall (2 and 3 sheave)
 - 1 Pair blocks (chain) for smoke box doors for each boiler
 - 1 Pair blocks (worm type) to lift 1 ton
 - 3 Buckets (ash) with name of ship painted on
 - 3 Buckets (water) " "
 - 1 Bottle jack
 - 1 Brush (hand)
 - 5 Brushes (tube)
 - 1 Box for lamp wick (tin)
 - 1 Box for emery cloth
 - 1 Box for black lead
 - 1 Copper set
 - 1 Coal measure
 - 4 Caulking tools
- 12 Chisels (cold) assorted
 - 4 Chisels (smith's)
 - 1 Chisel (joiner's)
 - 1 Length of canvas hose for engine room
 - 1 Clock (engine room)
- 12 Drills (assorted)
 - 1 Drill stand and clamp
 - 1 Set eyebolts
 - 1 Set eyebolts and shackles, cylinder covers
 - 2 Eyebolts for piston rods
 - 2 Funnels
 - 1 Funnel with sieve
 - ~~1 Ferrule machine for wood ferrules~~
 - 2 Ferrule tools *for Brass Ferrules.*
 - 9 Files
 - 1 Gauge for crank shaft

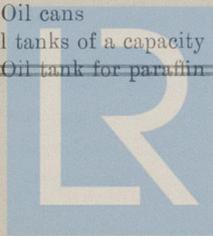
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Extra Oil Tanks - addition to specification opposite.

1 Tank	100 gallons	Engine Oil
1 "	50 "	" "
1 "	75 "	Cylinder Oil
1 "	50 "	Olive Oil
1 "	50 "	Rape Seed Oil
1 "	75 "	Sperm Oil
<u>Total 900 Gallons.</u>		

- 1 Grindstone and trough
- 1 Gouge
- 6 Hammers (scaling)
- 1 Hammer (lead)
- 1 Hammer (quarter) 7 lb.
- 4 Hammers (hand)
- 1 Hammer (copper)
- 2 Hammers (coal)
- 2 Hammers (sledge) 14 and 28 lb.
- 1 Length hose (leather) for wash deck pipes with brass couplings, and with one director
- 1 Key for each size nut
- 1 Key for column nuts
- 1 Key (crowfoot) for foot valve
- 1 Key (small crowfoot) motion bar combs
- 2 Keys for set pins
- 7 Keys for glands (polished)
- 1 Key (skeleton) top and bottom ends
- 1 Key (star) top and bottom ends
- 1 Key (box) and wrench for steam chest doors
- 1 Kettle (black)
- 6 Lamps (hand) for bunkers
- 2 Lamps (brass) engine room
- 2 Lamps (brass) gauge glass
- 2 Lamps (japanned) stokehole
- 1 Lamp (engineers)
- 4 Lamps (flat)
- 2 Lamps (brass) paraffin
- 1 Lamp (safety) for bunkers
- 1 Ladder (wood)
- 1 Pair lamp scissors
- 1 Piece lamp cotton
- 2 Levers (indicator)
- 1 Lever for stop valve wheel
- 2 Mud rakes
- 8 Oil cans
- Oil tanks of a capacity of 500 gallons for Engine Oil
- 1 Oil tank for paraffin oil (40 gallons)



- 2 Oil cans (pint)
- 1 Oil can (quart)
- 1 Oil bottle (gallon)
- 1 Oil measure (gallon)
- 1 Oil measure (half gallon)
- 1 Oil cock for barrels
- 3 Paint tins
- 2 Paint scrubbers
- 1 Pair pliers
- 6 Packing drawers
- 6 Packing sticks
- 1 Rack for holding keys
- 1 Rack for holding eyebolts
- 1 Ratchet brace
- 1 Set ringbolts for cylinder covers
- 1 Soldering tool
- 1 Bottle spirits salt
- 1 Salinometer and cooler
- 1 Saw (hand)
- 1 Set of stoking irons for each Main Boiler
- 5 Shovels (firing)
- 3 Shovels (trimming)
- 1 Saveall (large)
- 1 Saveall for greaser
- 6 Scrapers (tube)
- 1 Screwdriver
- 6 Stemmers
- 1 Box split pins (assorted)
- 6 Slices for each boiler
- 1 Syringe
- 2 Sticks of solder
- 1 Shifting spanner (large)
- 1 Shifting spanner (small)
- 1 Sling chain for lifting cylinder covers, etc.
- 4 Pair tongs
- 1 Tallow tank
- 1 Thermometer

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- 1 Tank, daily service
- 1 Tank for fresh water
- 3 Tube stoppers (common)
- 3 Tube stoppers (patent)
- 1 Pair tinner's shears
- 1 Box taps and dies $\frac{1}{4}$ " to $1\frac{1}{4}$ " (2 taps each size)
- 1 Tube expander
- 1 Vice and bench
- 1 Pair vice grips (copper)
- 1 Ball wire (copper)
- 1 Ball wire (lead)
- 9 Wedges
- 1 Wrench and key for pistons



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Spare Gear-Main Engines.

Spare Tail End shaft with continuous liner.

Spare Gear-Distilling Plant.

- 1 Complete set of Coils for Evaporator
- 1 " " " Tubes, Distilling Condenser
- 1 Piston rod & pump rod Circulating Pump.
- 1 set Metallic Valves for all Pumps.
- 1 " Packing Rings for Steam pistons.
- 1 " " " " Water "
- 1 " Slide Motion Rods or gear complete
- 1 steam actuating & distributing Valve & chest complete.

Spare Gear-Weirs Feed Pump.

- 1 Piston & pump rod complete with Nuts & head.
- 1 complete set of Pump Valves & Springs.
- 1 " " " Packing rings, Steam & water pistons.
- 1 set of Valve Motion gear complete.
- 1 steam actuating & distribution Valve box complete.

54.

Spare Gear.

- 1 Propeller
- 6 Gauge glasses
- 2 Top end bolts and nuts
- 2 Bottom end bolts and nuts
- 2 Mainbearing bolts and nuts
- 1 Set coupling bolts
- 2 Feed pump valves and seats
- 2 Bilge pump valves
- 1 Set Ramsbottom rings for high pressure piston
- 1 Set Ramsbottom rings for middle pressure piston
- 1 Set volute springs, low pressure piston
- 6 Bars iron (assorted)
- 3 Plates iron (assorted thicknesses)
- 6 Sheets tin
- 2 Sheets copper
- 12 Spare pricker blades
- 100 Condenser ferrules (~~wood~~) Brass
- 3 Condenser tubes
- 6 Boiler tubes (plain) 4 main & 2 aux. Boilers.
- 2 Main feed check valve lids
- 2 Donkey feed check valve lids
- 3 Piston bolts
- 3 Piston nuts
- 12 Assorted studs for glands and covers



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