

H.M. YACHT 'BRITANNIA'

BY

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Job. No. 691 was laid down at John Brown's Shipyard, Clydebank, in June, 1952, as a small hospital ship to be used in peace time as a Royal Yacht.

Ten months later, on 16th April, 1953, Her Majesty launched and named this vessel *Britannia*. She is due to complete at the end of 1953. Thus readers will appreciate that the time taken for construction is somewhat shorter than is usual with the normal run of H.M. ships.

With a load displacement of about 4,000 tons the ship is 412 ft. long overall and her beam is 55 ft. She has been designed as a sea-going vessel capable of operating in any waters. Experiments on the hull form have been carried out both at Clydebank and Haslar to ensure her seaworthiness under all weather conditions, and that she will attain her designed service speed of 21 knots. Further research work has been done at the National Physical Laboratory on the funnel design so that the ship will be kept as free from smoke and soot as possible.

The main engines develop 12,000 s.h.p. at full power and the endurance of the ship at 20 knots is over 2,000 miles under normal load conditions. The hull will be painted 'Bluebottle' blue with a gold band below the upper deck and the Royal Coat of Arms mounted on the bow. The upperworks will be white and the masts and funnel buff. The Royal and State Apartments together with household and staff accommodation are contained in the after part of the Yacht, and naval officers and ship's company are accommodated forward.

A lift is fitted to carry persons from the Royal Entrance in the ship's side on the main deck to the upper and shelter decks. This lift could be used in the hospital ship role to carry patients to the Royal Apartments which would be converted into wards.

The design and layout of the main machinery is based on the S.S. *Arnhem* and *Amsterdam*, both built by John Brown's, which are employed in the British Railways' service between Harwich and the Hook of Holland.

Two Foster Wheeler 'D' type main boilers fitted with superheaters and economizers generate steam at 300 lb/sq. in. and 600°F. at a rate of 75,000 lb/hr each. An auxiliary boiler of the same type is fitted for harbour use and possesses a capacity of 20,000 lb/hr.

To satisfy the A.B.C.D. requirements for a hospital ship the stokehold is 'open,' combustion air being trunked down from the shelter deck to fan compartments situated in the wings of the boiler-room, from whence it is discharged by electrically driven forced draught fans to the air casing at the back of the boilers, passing under the floors to the burners.

Ventilation air is supplied by four fans of 35,000 cu. ft/min. total capacity, sucking from mushroom heads above the combustion air intakes and discharging on to the floor plates. This air then passes around the boilers to the back, exhausting up into the combustion air intake on deck. Electric induced draught fans are fitted in each boiler uptake discharging through a set of three dust collectors per boiler. Each dust collector consists briefly of a cylindrical

chamber at the base of which is fitted a set of swirl vanes. The gases on entering are rotated, the particles of dust being thrown outwards by centrifugal force. These particles are caught by a tangential slot admitting them to a second and smaller chamber, where they fall down into a hopper and are washed overboard through rubber lined pipes by the admission of salt water.

The number of dust collectors in use at any time is dependent on the rate of forcing of the boiler. The efficient operation of the dust collectors depends on a high uptake velocity which can be kept in the region of 110 ft/sec. down to 1,000 s.h.p. when it falls to 90 ft/sec. To achieve this at varying powers, dampers, hydraulically operated from the floor plates, are fitted immediately below the dust collectors, which admit the uptake gases to one or more collectors.

An unfortunate feature of the electric boiler-room fans—and indeed of all D.C. electric auxiliaries—is the size of the controllers. The overall height of the main forced draught fan controller is about 4 ft. 6 in., and of the induced draught fan controller 5 ft. 6 in. Thus an otherwise fairly spacious floor is spoilt by four large main controllers and two not-much-smaller auxiliary ones.

The furnace fuel oil pumping and burning equipment follows the usual merchant service practice where two electrically driven rotary displacement pumps fitted with spring loaded regulating valves discharge through steam heaters, all of which form a unit mounted on a tray. Low-water alarms are fitted in each boiler, which will automatically shut off the hot oil discharge to burners and ‘sound off’ in the event of the boiler water level becoming dangerously low.

There is nothing unusual about the main engines which develop 12,000 s.h.p. at full power on two shafts. The 8-stage impulse H.P. turbines running at 4,730 r.p.m. at full power exhaust into single flow L.P. turbines running at 3,430 r.p.m. Single reduction gearing gives a shaft speed of 275 r.p.m.

The closed-feed arrangement allows for two extraction pumps, air ejectors and main feed pumps each being capable of dealing with full power conditions.

The engine-room is crowded by the many auxiliaries which are not connected with the main steam system. These include the sprinkler tank, its compressor and pump for the automatic fire-fighting arrangements in the after part of the ship, a 300-gallon calorifier for hot water aft, an oily-bilge separator and the ‘Pneupress’ tank for the after fresh water systems. (The ‘Pneupress’ tank fulfils the function of a gravity fresh water tank by being charged with air and acting as an accumulator.) In addition, there is a fresh water evaporator for distilling shore water for feed purposes. These items, necessary for the special function of the vessel, are comparatively bulky.

The arrangement of the starting platform is such that the gauges and indicators connected with the steaming of the ship are mounted on the port side of the platform, whilst a completely separate board devoted to ‘Hotel Service’ gauges and indicators is mounted on the starboard side. The latter includes gauges for fresh water pressure for’d and aft, firemain pressure, sprinkler system, sanitary system, heating steam and warning indicators for the sewage plant and air-conditioning arrangements.

Abaft the engine-room two Foster Wheeler vacuum refrigeration plants each of one million B.Th.U.s per hour capacity are housed in a separate compartment. In hot weather these plants supply chilled water to thirteen air-conditioning units made by Thermotank. Fans taking fresh air from the deck, pass air through these units where it is overcooled before being reheated by small steam heaters. The temperature of the air is controlled by thermostatic steam valves on the reheaters which can be set from the compartments themselves. In this way the humidity of the air is reduced, since moisture will tend to

condense when the air is cooled prior to passing through the reheater. Under cold weather conditions two calorifiers fitted in the V.R. plant compartment heat the water supplied to the air-conditioning units and the reheaters again provide the necessary variation for control.

Forward of the boiler-room, three 500-kW Metro-Vickers turbo generators and one 270-kW Paxman diesel generator supply electric power to a main switchboard in the same compartment. An emergency diesel generator (60 kW) is fitted forward of the funnel on the shelter deck. Also in the generator room are two sets of salt water evaporators, each of 60 tons per day capacity. The fresh water tank capacity is just short of 200 tons.

A small auxiliary closed-feed plant is fitted in the boiler-room, which will allow a complete shut-down of the engine-room in harbour. This plant consists of a small auxiliary condenser, air ejector and extraction pump. The latter discharges to either the auxiliary feed pump or a small direct acting reciprocating pump for use with the auxiliary boiler.

Denny-Brown stabilizers are fitted forward of the generator room, and are designed to reduce a roll of 10° each side to 3° at 17 knots. The fin boxes are staggered so that the starboard box lies just forward of the port one, allowing for full retraction, when not in use, within the limited width of the ship at this point. The movement of the gyro, which is sensitive to angle of heel and velocity of roll, is transmitted through a series of servomotors to the swash plate of the main Williams-Janny type power unit operating the fins and altering their angle of attack by means of hydraulic jacks.

Two separate sewage systems are fitted, forward and aft. The sewage runs by gravity into cylindrical tanks fitted in compartments on the hold deck, one forward one aft. Each tank of 320 gallons is emptied by one of two pumps mounted adjacent to the tanks. They discharge through the ship's bottom and are operated automatically by float controlled switchgear.

Seven electrically operated sliding watertight doors are fitted in the main watertight bulkheads on the lower deck. These can be operated locally, or in case of emergency can be closed from the bridge. Four 70-ton per hour fire and bilge pumps are fitted, one in each machinery compartment and one aft, plus one 20-ton per hour hull and fire pump forward. These pumps are connected to a main suction line running the length of the ship.

The ship is fuelled with furnace fuel oil through the furnace fuel oil suction line to all thirteen tanks. The total capacity is 330 tons under normal load conditions, and 518 tons deep load conditions. Each tank can overflow into a line led to two large tanks forward, to which are fitted alarms that 'sound off' when the level reaches 75 per cent. full. This arrangement should prevent any smell during oiling.

The comparatively large laundry is fitted with the latest equipment and is capable of satisfying the needs of the Royal and household parties as well as officers and ship's company. The duplication of machines allows for the two tasks being kept entirely separate.

The cold and cool rooms are kept at their required temperatures by two Lightfoot Arcton 6 refrigerating plants each of 40,000 B.Th.U. per hour capacity. A number of the usual Electrolux type D.R.s and a small ready-use cool cupboard, six water coolers and a conservator are also fitted in the ship.

The Royal, ship's and officers' galleys are fitted with the latest electrical equipment.

The steering gear follows the usual Brown Brothers electro-hydraulic practice with telemotors.

The 40-ft. Royal Barge, already in service, was designed and built by Vosper to special requirements and is fitted with three Perkins P6M engines fitted with Meadows type clutch. Two new design 35-ft. medium-speed motor boats with round bilges and two Foden F.D.4 engines ; two new design 27-ft. motor sea boats each fitted with one Perkins P4 ; and one 32-ft. motor cutter also with the Perkins P4 engine, comprise the other boats, apart from the two normal Service ' skimmers '. These boats are handled by the latest design of Welin-Maclachlan gravity davits operated by electric boat winches.

It is hoped that this description will help to give readers some insight into the more unusual technical aspects of the ship in the light of normal Service practice, but it is by no means exhaustive. A lot of machinery has been packed into a small passenger-type ship.

It is not possible at the time of writing to say anything of the method of operation of any of the machinery since much will depend on experience gained during trials and the working-up period.
