Marine Engineering and Shipbuilding Abstracts

Volume 22, No. 7, July 1959

* Patent Specification

Controllable Bow Propellers

The first KMW bow steering propeller unit is now being manufactured for installation in a European ferry. Others are on order for two further ferries, and investigations are under way concerning units for large passenger liners and tankers, as it is thought that this type of propeller is especially suitable where powerful transverse thrust is required. The proposed installations consist of a KaMeWa controllable pitch propeller built into a streamline body. One end of the body contains a bevel gear drive, the other end the hydraulic control equipment. Three stays support the propeller body in a tube, the whole assembly being removable as one unit. This tube is secured inside a tunnel which is welded to the hull athwart the ship's bow. The position of the propeller blades will be controllable from the bridge. It is expected that a 25-degree shift to either side of the neutral centre line will be sufficient to enable the necessary thrust to be achieved to either port or starboard for immediate control of a ship's lateral movement. The propeller under construction is a 300-h.p. unit, giving a thrust of about 4 tons. It will be driven by an electric motor *via* a shaft, with universal joints at both ends to permit a certain amount of misalignment. The bevel gears are served by an independent lubricating system. The hydraulic controls are supplied with oil through an electrically driven pump, whilst a separate oil tank, situated well above the water level, will maintain a constantly high static pressure to prevent water from entering the propeller body. An automatic blocking device ensures that the electric power unit cannot be started unless the propeller blades are in the neutral position, avoiding the risk of an unexpected side thrust when the motor is started up in readiness. Provision is made in the assembly for the blade position to be indicated on the bridge. It is at present envisaged that this type of transverse propulsion system will be able to produce much higher thrusts, the maximum at the moment being considered about 20 tons, for applications on ships of much greater tonnage than the ferries fitting it at present. The prime advantage of transverse propulsion units is probably the economies implied in docking without the use of tugs. They also enable a vessel to turn in very confined waterways, and would be a special advantage to liners on a cruise which have to call at a number of small ports which lack adequate docking facilities. The outstanding advantage of the KMW controllable pitch propellers as bow propellers is the direct control afforded the captain on the bridge. With the blades running freely in the neutral position, a simple movement of the hand controls exerts an immediate thrust to port or starboard. In these bow installations it is anticipated that a blade of simple aerofoil section will be effective, and that only the angle to the centre line need be controllable. The fact that only a unidirectional drive is required makes it possible to install a large power unit without the complications or expense of reversing mechanism.—*Shipbuilding Equipment, February 1959; Vol. 1, p. 6.*

Carbon Dioxide Shielded Metal Arc Welding

The carbon dioxide shielded metal arc welding process utilizes pure dry carbon dioxide gas as a shielding medium around an arc established between the workpiece and a bare wire that is fed continuously into the molten arc pool with high current density. The advantages of this process are: (1) it produces high quality weld metal; (2) has high rates of deposition, therefore low costs; (3) it has a deep penetrating arc; and (4) the arc is open or visible. The weld metal deposited by this process has a low hydrogen content and is relatively free from slag. Disadvantages of the process might be listed as: (1) the deep penetrating arc is not suitable for extremely thin gauge material or where poor fit-up of the joint is unavoidable; (2) since the weld bead is quite narrow, tracking of the weld seam must be held to rather close limits; and (3) because it is a gas shielded arc, welding cannot be done in extremely draughty or windy areas. This process is adaptable for both fully automatic and semi-automatic welding equipment and can be used with both constant current or constant voltage types of power sources, providing the proper control circuits are used. A number of types of carbon steel plate have been successfully welded with this process with carbon contents up to 0·30 per cent. Filler wires have been developed for this process with sufficient amounts of deoxidizers in the wire to make satisfactory welds in rimmed, semi-killed and killed steels. Carbon steel plates have been welded up to and including 1½in. in thickness and repairs to steel castings have been made in very heavy sections with good results. The welds produced by this process are of high quality as measured by strength, ductility and notch toughness. The process is well suited for a wide variety of applications ranging from lap welds and fillet welds on mild steel in thickness from 3/32 to 5/16in., circular welds especially on small diameter applications, and on lap, fillet and butt welds on heavier gauge materials. When the normal precautions are taken to protect eyes and skin by the use of proper welding lenses and proper protective clothing, the carbon dioxide shielded metal arc welding process has been found to be safe.—*R. J. Keller, Welding Journal, January 1959; Vol. 38, pp. 27s-38s.*

The Stork Marine Diesel Engine

The Stork marine Diesel engine is a single acting two-stroke engine, with uniflow scavenging by means of scavenging ports in the cylinder liner, and four poppet exhaust valves in the cylinder cover. This type of engine is particularly suitable for turbocharging by means of exhaust gas driven turboblowers and so the majority of these engines are now ordered turbo-charged. The last normally aspirated engine ordered was delivered last year. There are now three standard sizes of this engine, namely:—

	Bore, mm.	*Stroke, mm.*	*Output per cylinder*
Small	540	1,150	500—520 b.h.p. at 135—145 r.p.m.
Medium	630	1,350	800 b.h.p. at 132 r.p.m.
Large	750	1,500—1,600	1,200—1,300 b.h.p. at 115—118 r.p.m.

This range thus covers outputs from 2,500 b.h.p. in five cylinders of 540-mm. bore up to about 15,000 b.h.p. in 12 cylinders of 750-mm. bore, all turbocharged. Normally aspirated engines of the small bore, but with a stroke of 900 mm. have been delivered for an output of 375 b.h.p. per cylinder at 155 r.p.m., whereas for ratings above 15,000 b.h.p. a new size of 850-mm. bore is being developed for an output of 20,000 b.h.p. in 12 cylinders. The engine frame is a rigid assembly of bedplate, columns and cylinder blocks, vertically connected by long tie bolts from the top of the cylinder block to the lower part of the bedplate. The tie bolts are tightened hydraulically and arranged to take the combustion forces and thus relieve the frame of tensile stresses. The jerk type fuel pumps, one for each cylinder, are mounted over the camshaft as near as possible to their relative cylinder covers, thus allowing high pressure fuel lines of minimum length, which is important for the use of residual fuel. The fuel pump is operated from the fuel cam in the normal way by means of a roller cam follower in a roller holder. The pump plunger is lapped in a case hardened steel barrel, both easily renewable. The pump is provided with a suction and delivery valve; fuel delivery is controlled at the end of the pump stroke by mechanical lifting of the suction valve by means of a gear with levers and push rods, actuated by the roller holder. The fuel delivery is regulated by one of these levers pivoting on an eccentric control shaft. As the suction valve has to be opened against injection pressure, it is provided with a small pilot valve, opening 0·5 mm. prior to the main valve and thus efficiently releasing the pump pressure and so decreasing the load on the control gear. The delivery valve is provided with a built-in release valve, opening at a pressure difference of 100 kg. per sq. cm. between the h.p. fuel line and pump chamber, thus ensuring immediate pressure release in the h.p. fuel line at the end of the pump delivery and so preventing any risk of after-dripping of the fuel valve. The fuel valve is of the normal needle valve type, which is spring loaded and opened by the fuel pressure. The engine is reversed by means of starting air, operating a reversing piston. The reversing piston effects the turning of a reversing shaft, running parallel to the camshaft, which moves the cam followers free from the cams prior to the axial displacement of the camshaft, which is also effected by the reversing piston. The engine is turbocharged by means of exhaust driven turbo-blowers (of the gas entry type); they are entirely self-regulating. The pulse system of turbocharging is used, which means that the turbine energy is derived from the kinetic energy of the exhaust gases (speed) in addition to their static energy (pressure and temperature). Maximum perfection of this system has been attained by the use of one turbocharger for two adjacent cylinders and by arranging them at cylinder head level to

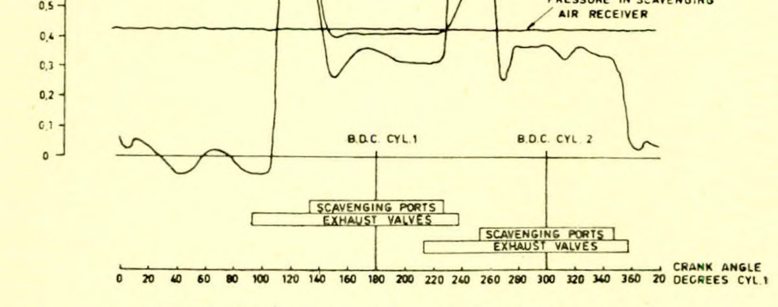
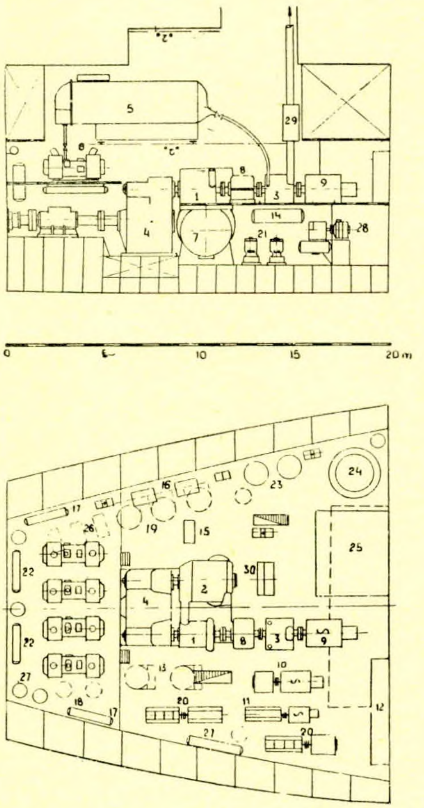


FIG. 12—*Exhaust pulse diagram of HOTLo 75/160*

achieve the smallest possible volume of exhaust piping between the cylinder cover and exhaust turbine. As, moreover, a rapid release of the exhaust gases is of paramount importance for this system, four exhaust valves have been provided for each cylinder. The exhaust pulse diagram, Fig. 12, clearly demonstrates the importance of the exhaust pulse energy in comparison with the static energy and also the possibility of a high exhaust peak pressure during pre-exhaustion in combination with a sufficiently low exhaust pressure to ensure efficient scavenging of the cylinder. The diagram also shows the requirement of a crank angle difference of at least 120 degrees between the cylinders which are connected to a common turbocharger in order to avoid the exhaust pulse of one cylinder disturbing the scavenging process of the other. This requirement can be satisfied by a crank sequence combining satisfactory engine balance with normal torsional vibration characteristics.—*Paper by A. Hootsen and E. A. van der Molen, read at a meeting of the Institution of Engineers and Shipbuilders in Scotland on 24th February 1959.*

Combined Steam-gas Propulsion Plant

A tanker propulsion plant of 12,500 s.h.p., using both steam and gas turbine drive, has been planned by a Polish engineer. The boiler combustion "air" is the hot gas issuing from four free piston gasifiers. This contains about 80 per cent of unburnt air at about 430 deg. C. so that combustion of oil in the boiler furnace takes place under very favourable conditions. The boiler furnace exhaust, at about 500 deg. C., is led to a gas turbine where it expands, doing mechanical work. The gas turbine is coupled to the h.p. steam turbine through a hydraulic coupling. It also drives a direct coupled 500-kVA alternator. The output of the gas turbine is about 25 per cent of the power provided by the whole plant. The gas leaves the turbine at about 300 deg. C. and is led to an economizer. The fuel consumption at full load is estimated at about 0·215 kg/s.h.p.-hr. It is about 30-40 per cent lighter than a conventional plant.—*Gas and Oil Power, February 1959; Vol. 54, p. 56.*



General arrangement of the Polish combined free piston and gas turbine propulsion plant

1. H.P. steam turbine
2. L.P. steam turbine combined with astern turbine; total output of the steam turbine set is 10,000 s.h.p.
3. Gas turbine, output 3,000 s.h.p.
4. Double-reduction gearing
5. Boiler with supercharged furnace
6. Four GS-34 free piston gasifiers
7. Main condenser
8. Hydraulic clutch
9. 500 kVA alternator
10. 500 kVA turbo-alternator
11. 240 kVA Diesel-alternator emergency set.

Marine Refrigeration

From the early days of marine refrigeration, a percentage of ships have had their chambers refrigerated by the forced circulation of air through a battery of pipes (air coolers) in which the refrigerant is circulated. Today the majority of refrigerated spaces are cooled in this manner. There are a variety of types of air cooler, as there are of the pipe arrangement in the coolers. An air cooler may serve one or more chambers, and there are many diverse arrangements for the air circulation in the chambers. A few small installations have had cold brine sparge (wet) air coolers. Some of these are of the Raschig ring (porcelain ferrules) type, where the cold brine is sprayed over a mass of the rings through which the air is circulated. A second layer of rings above the brine spray is provided to prevent brine carryover in the air stream. The brine drains to the lower part of the cooler housing and returns to the evaporator. The main advantage of the brine sparge cooler is that the brine absorbs odours and the air is purified. Its principal disadvantages are the difficulty of restraining brine in a moving ship and the fact that the brine is continuously absorbing moisture and the density must be maintained by adding calcium chloride. With the refrigerant (brine or direct expansion of the primary refrigerant) in the piping, the pipes have been arranged in vertical or in horizontal stacks, or in staggered horizontal grids, with air flow across the pipes or arranged to flow parallel with the pipes. There are plain pipes and finned pipes. There are arrangements with the fans blowing the air through and also with the fans drawing the air through the coolers, and in some installations the fan is located between two sections of the cooler. In other installations the air flows over screened grids on the sides of the chamber. Some fans are arranged for reversible flow, some have a fixed speed(s) and others have a speed range. There are centrifugal and propeller type fans. In the past they have been driven by steam engines, but now almost invariably by electric motors. The volume of air circulated by the cooler fans is generally referred to as the number of changes of the air per hr. in the empty cargo space at a stated duct resistance. The figures vary, but for general purpose installations 25—40 changes at the maximum speed of the fan is common practice. In the case of ships specially built for the cooling down and carriage of bananas, the volume of air provided is now appreciably greater; 60 changes per hr. is common, but in many cases it has been increased to 90 changes. This is due to the desire to reduce the temperature level of the cargo as rapidly as possible, bearing in mind the relatively high minimum air delivery temperature necessary in order to avoid damage to the cargo. The arrangement for the circulation of air within the individual chambers, which vary considerably in shape and size and in which there may be obstructions such as deep girders, brackets, casings, etc., has to be carefully considered in order to ensure an efficient flow through the whole of the cargo space. The common arrangements include (1) air delivered through a number of openings suitably spaced over the surface of a vertical duct on one side of the 'tweendeck or hold, with a similar arrangement for the suction on the other side; (2) air delivered from ducts placed fore and aft under the overheading in line with the sides of the hatch with branches through the hatch coamings, and main suction ducts under the overheading at the side of the chambers with branches behind the insulation lining between the frames, with openings near floor level; (3) air delivered from the air coolers at floor level and returned to the cooler through a false ceiling; (4) side ducts divided horizontally, the lower part suction with openings at near floor level, the upper part delivery with branches between the deck beams behind the overhead lining, with openings at suitable intervals. The latter is a common method and was introduced in the late 1930's after investigations by the D.S.I.R. with an experimental hold at Ditton laboratory, which was constructed to study temperature control in a cargo of boxed fruit, methods of stowage, and air circulation.—*Paper by H. R. Howells, read at a meeting of the Institution of Mechanical Engineers on 23rd January 1959.*

Ore Carrier

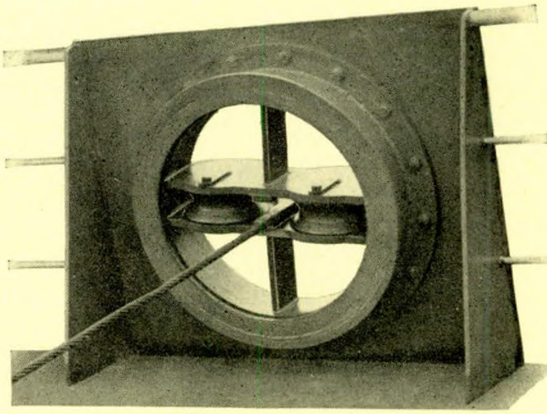
Following sea trials, the m.s. *Nordland,* owned by Vesteraalens Dampskibsselskab, Stokmarkness, Norway, proceeded on her maiden voyage on charter to the British Iron and Steel Corporation. Built by Kaldnes mek. Verksted A/S, Norway, the vessel has the following leading characteristics:—

Length, overall	504ft. 9⅝in.
Length, b.p.	473ft. 0in.
Breadth	63ft. 10in.
Depth to main deck ...	39ft. 0in.
Draught	30ft. 1⅝in.
Deadweight (summer freeboard)	16,400 tons
Gross register	10,707 tons
Net register	5,892 tons
Machinery	4,600 b.h.p.
Speed (trial)	12·5 knots

The vessel's hull, which is of all-welded construction, is longitudinally framed between the forward cargo hold bulkhead and that forward of the engine room with transverse framing at the fore and after ends. Under the main deck and at each side are two fore-and-aft passageways, one for use by ship's personnel and the other for cables and pipes. Both the longitudinal and the wing tank divisional bulkheads are of flat plate design, stiffened by welded angles. The transverse bulkheads in the centre cargo holds are of the vertically corrugated type. Ballast tanks are arranged on each side of the ore carrying holds Nos. 2, 3 and 4. General cargo is carried in No. 1 hold. The tank top longitudinals are closely spaced for stiffening purposes and in the main ore holds the tank top plating is 20 mm. thick. The main cargo holds are served by six hatchways, each fitted with single pull, MacGregor sliding steel hatch covers operated by two 5-ton hydraulic winches arranged amidships. On the forecastle deck are two 3-ton winches suitable for mooring duties and cargo handling while on the poop deck there is a mooring winch with a pull of 8 tons and a working speed of 12·2 m. per min. The windlass can raise two anchors of 4,360 kg. together with 50 fathoms of 2¼-in. anchor cable at 8 m. per min. Hydraulic power for the winches and windlass is taken from three pumps arranged under the forecastle deck and each driven by a 50-h.p., 860-r.p.m., 440-volt, three-phase, 60-cycle motor. Forward, on the forecastle deck, are two samson posts; a combined signal and radar mast is mounted on top of the wheelhouse. A 3-ton derrick is slung from the side of the funnel to handle engine room equipment. The propelling unit is a four-cylinder, opposed piston, 4,600-b.h.p. Horten-Doxford engine having a cylinder diameter of 670 mm. and a combined piston stroke of 2,320 mm.—*The Motor Ship, December 1958; Vol. 39, pp. 412-413.*

Swivel Fairlead

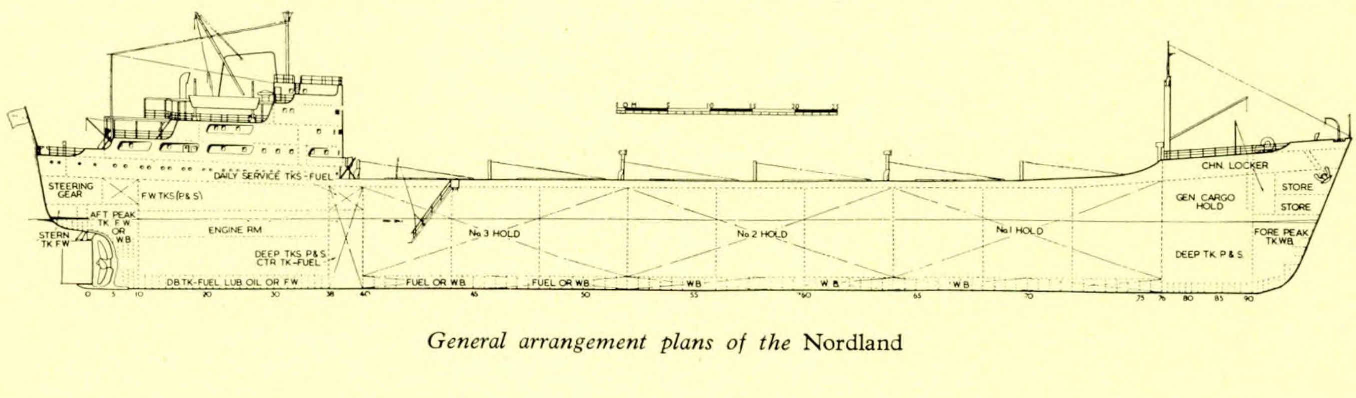
The opening of the St. Lawrence Seaway gives added importance to the problem of providing efficient fairleads for seagoing vessels which may have to be warped through locks and narrow passages. The Port Colborne patent fairlead has been specially designed to meet the requirements of this type of work. It is a ball bearing, universal fairlead which can revolve in any direction in one plane and so automatically ensures positive alignment of mooring wires. It is very simple in operation. The bronze bushed self-lubricating sheaves are in housings which revolve in a totally enclosed ball race, the



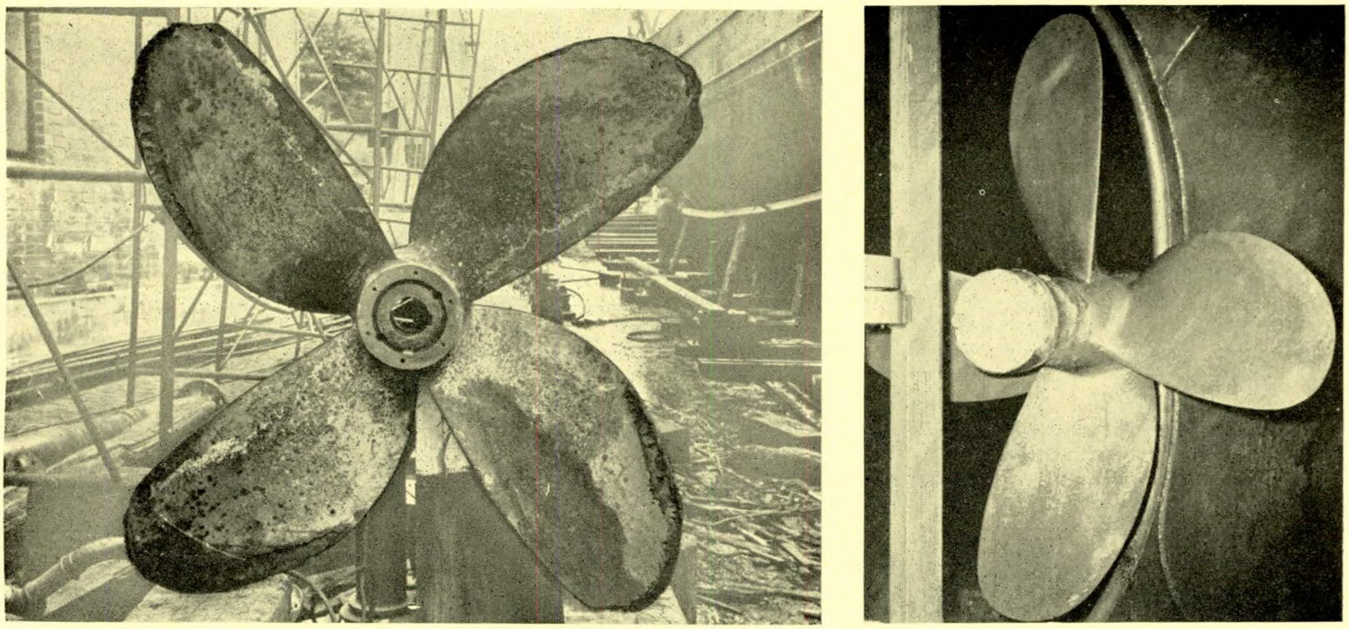
directional pull of the mooring wire aligning the fairlead. The fairlead can be fitted in any part of the ship; in plate bulwarks or with frame for deck fitting in way of rails and stanchions. It can also be used for leads from windlass or winches. Three standard sizes are available, the largest being able to take wires of up to 66¼-in. circumference. This type of fairlead was originally developed in Canada for vessels trading in the Great Lakes where, because of the amount of lock work, there was a particularly heavy rate of wear on mooring wires. The new fairlead has been developed for use in the larger seagoing vessel in which it can be used in conjunction with cargo winches. It has successfully been used in large tankers in with automatic mooring winches.—*Shipbuilding Equipment, May 1959; Vol. 2, p. 19.*

Propeller Boss Anodes

Test installations have shown that cast iron propellers can be effectively protected against corrosion by means of a simple and cheap form of boss anode. This answer to a serious problem has been developed after a long and exhaustive



General arrangement plans of the Nordland

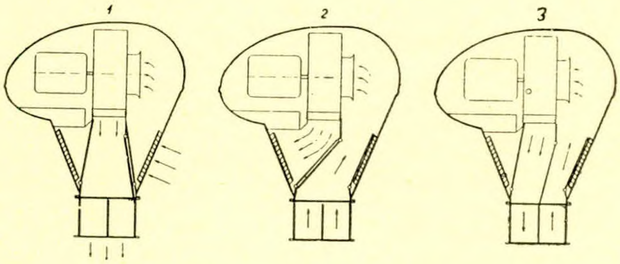


Unprotected trawler propeller after 13 months (left) compared with the new, protected propeller after 20 months (right)

series of experiments carried out by the British Cast Iron Research Association, sponsored by the British Shipbuilding Research Association. Two photographs reproduced illustrate the success achieved in protecting the cast iron propeller of the *Fairy Cove,* a trawler powered by a 400-h.p. Diesel engine. At 275 r.p.m., the propellers have a maximum tip speed of 91ft. per sec. The first unprotected propeller fitted had to be removed from service after 13 months because of the extensive pitting it had suffered. However, after the installation of the new form of boss anode, a second propeller was completely free from pitting after 20 months, and still perfectly serviceable when inspected after 30 months. The fact that cathodic protection can preserve the surface of cast iron propellers in this way indicates that the pitting is caused by corrosion and that erosion does not play a large part in the attack. On the *Fairy Cove* and other test vessels, which include coasters, trawlers and tugs, protection of the propellers has been achieved by bolting a cylinder of magnesium on the butt end of the tailshaft itself. An important feature which has been developed is a shroud of glass fibre reinforced resin which encases the portion nearest to the tailshaft. This has been found to prevent waste output and so enable the magnesium anode to produce sufficient protective current for a period of 12 months or over. This ensures that the propellers are fully protected between dry dockings, when the anodes can be conveniently replaced. The plastics shroud can be a prefabricated cover, or merely laid directly on to the surface of the anode. It is feasible that after the first installation, replacement could be effected by a diver if necessary. The magnesium cylinder, measuring 12in. across and 7in. long, is cast around a galvanized steel spider. The anode is secured by means of a central $1\frac{1}{8}$-in. Whitworth threaded steel bar which screws into a hole drilled and tapped centrally in the butt end of the tailshaft. To prevent rotation on the bar, two $\frac{3}{8}$-in. dowels locate in holes drilled in the shaft on either side of the centre hole. The cylinder is fastened to the bar by grub screws in the steel collar on top of the galvanized steel spider, and is secured by a self-locking nut. Maintenance of the system is extremely simple, consisting merely in ensuring that the surface of the anode is never obscured by paint or other similar materials, and in replacing it at regular intervals according to the protection achieved. There are certain limitations of the method which require particular emphasis. It is not practicable when electrical continuity exists between the rotating shaft and the metal hull. Where this continuity is due to conducting glands containing graphited soft packing or involving contact between two metal plates, it is sometimes possible to break it by substituting greasy or mica-lubricated packing, or by insulating the gland housing from the hull. If the continuity is caused by metallic contact through the engine mechanism, the only way to achieve success is to introduce an insulating coupling between the tailshaft and the intermediate shaft.—*Shipbuilding Equipment, April 1959; Vol. 1, pp. 6-7.*

Ventilating Device

G. W. Ventilation A/S, of Copenhagen, have introduced a powered ventilator head which incorporates dampers so that three quite different duties can be performed. Instead of the familiar goose neck or mushroom head ventilator, the ventilator head takes the form of an egg shape surmounting an inverted pyramid. As the sketches show, there is a motor driven fan within the head and three dampers which can be moved



Schematic drawing showing the electric motor driven fan with dampers in three positions

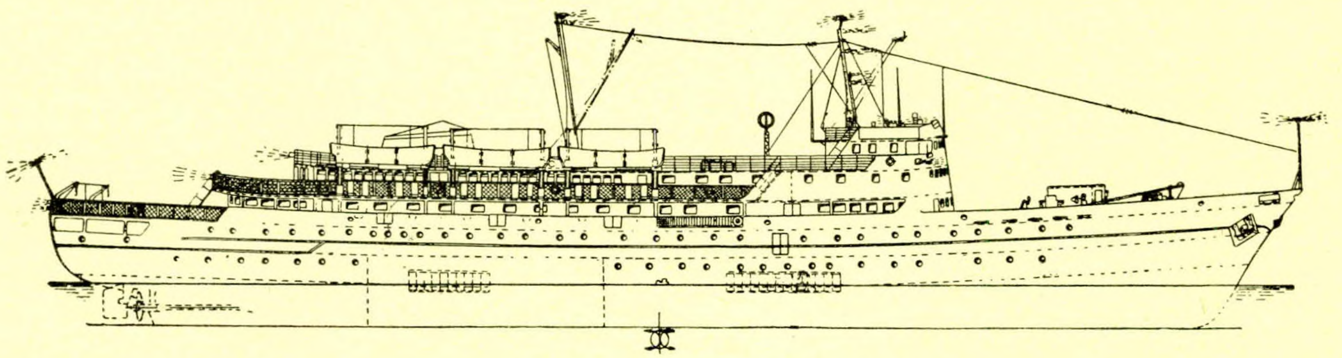
so that the fan performs different duties. The pipe on which the ventilator head stands is in two sections. In position *1* the fan is for supply purposes, drawing air through one set of louvres and discharging through both down pipes. In position *2* the fan is shown acting as an extractor, drawing upwards from both pipes and discharging to atmosphere. In the third position the fan is used as a circulatory device, drawing air up one pipe and returning it through the other one.—*The Marine Engineer and Naval Architect, April 1959; Vol. 82, p. 166.*

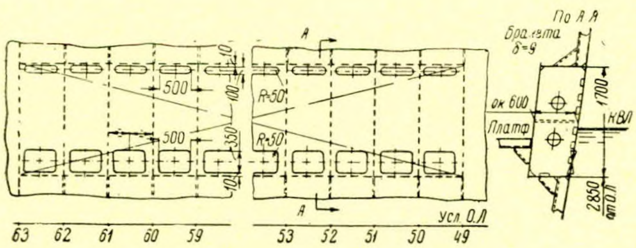
Russian Inland Passenger Motorships

The Russian Merchant Fleet is putting in service a group of interesting vessels in the Black Sea between Rostov—Odessa and Rostov—Batum and also, in the Caspian Sea, between Astrakhan—Baku and Astrakhan—Krasnovodsk. These are good looking vessels with considerable passenger accommodation and one small hold forward which is served by two electric deck cranes. The passenger accommodation is on the three decks and the public rooms on the bridge deck and main deck. Twin-screw Diesel engines are arranged three-quarters aft and the vessels have the following principal particulars:—

Length overall	101·5 m.
Length between perpendiculars	94 m.
Moulded breadth	14·6 m.
Maximum draught	3·76 m.
Mean draught	3·6 m.
Corresponding deadweights ...	2,960/2,750 tons
Cargo deadweight	576 tons
Machinery power	4,000 b.h.p.
Speed	16 knots
Accommodation—	
Passengers	250
Crew	76

An interesting feature of these ships is the use of open anti-rolling tanks in the side. There are two of these set in each side just on the waterline, one actually in the engine room (92-102) and one forward in the accommodation (49-63). These have the effect of reducing the moment of inertia at the active waterline during the initial rolling period. Structural details and dimensions of these tanks are shown in the sketch. Rolling should also be lessened through the influence of wide bilge keels (width 500 mm., length 35 m.). There is every reason to suppose that the period of rolling will not be less than 12 sec. The main engines are a pair of eight-cylinder loop scavenging two-stroke 43/61 Russki Diesels, each developing 2,000 b.h.p. at 250 r.p.m. There are also three 200-kW 500-r.p.m. 230-volt d.c. generators. The engine room is well laid out with a watertube heating boiler at the after end of the casing. *Sudostroenie,* December 1958.—*The Marine Engineer and Naval Architect, April 1959; Vol. 82, p. 160.*





Profile of Black Sea passenger motorship, showing location of anti-rolling tanks. To the left is seen a detail of one of the forward tanks

William Patterson

The propulsion plant of the *William Patterson* consists of six free-piston gas generators, called gasifiers, each rated at approximately 1,250 gas horse power, and two 3,000-s.h.p. reversible gas turbines connected to the ship's propeller through a double reduction, locked train gear. The free piston gasifiers are arranged side by side and placed athwartship. The gasifiers supply gas to a common athwartship manifold from which two gas lines lead to each split admission turbine. The exhaust from the turbines is independently led up through the smoke pipe. The gasifiers are started on Diesel fuel using ship service compressed air. All of the air for combustion and scavenging is taken from the engine room. The gasifiers operate on the two-stroke Diesel cycle. After a short running period on Diesel fuel, the gasifiers are changed to bunker C fuel. There are no restrictions on the properties of the fuel used by the ship. However, it is preferred that the fuel does not exceed a viscosity of 175 SSF at 122 nor have an API gravity less than 10·5. There is no special processing required, other than centrifuging. The fuel passes through a self-cleaning, continuous operating centrifuge at approximately 200 deg. F. From the centrifuge, the fuel goes to a 250-gal. service tank and then to the gasifiers *via* a secondary heater to maintain the temperature at 200 deg. F. All the air for combustion and scavenging is taken directly from the engine room, which is supplied with air from four mechanical draught fans. Prior to official sea trials, it was necessary to modify the air intake system for the gasifiers to reduce air pulsation within the engine space. After extensive testing aboard ship, an intake system was developed which reduced air pulsation to one-third of the original level without excessive pressure loss in the gasifier intake system. Each gasifier intake was fitted with a cylindrical chamber 30-in. diameter by 7ft. in length, perforated with 400 ½-in. diameter holes. The noise level in the engine room is comparable to a medium speed marine Diesel installation. Normally, the operating personnel use no protective devices for their ears. However, other personnel who are not accustomed to the sound of Diesel machinery usually find the engine room noise annoying. The ship has been in service a little over a year and had completed four voyages by November 1958. After voyage No. 1 there was an idle period of approximately 2½ months for repairs and modifications to various systems as well as to the gasifiers. Most of the ocean crossings have been in the autumn, winter and spring months, and weather conditions have not been too favourable. Because of this and numerous operating difficulties encountered with this new design power system, the average speed per crossing has only been 13·6 knots at an average displacement of approximately 9,000 tons. Conditions for the outbound passage of voyage No. 2 were reasonably favourable so that the ship was able to maintain an average speed of 14·5 knots at 13,350 tons displacement. The average power developed for the 3,620-mile passage was 4,100 s.h.p. The overall fuel consumption for the ship was 0·611lb. per s.h.p./hr. or 0·522 bbl. of fuel/mile. A summary of principal operating data is shown in Table 2.

TABLE 2—G.T.S. *William Patterson*

Principal Operating Data for Service Voyages 2 and 4

Voyage	*2*	*4*
S.H.P.	4,100	4,200
Average ship speed, knots ...	14·5	14·6
Passage distance, miles	3,620	5,142
Apparent slip, per cent	6·4	5·7
Total displacement, tons	13,350	13,650
Fuel consumption, lb./s.h.p.hr.:		
Gasifiers	0·537	0·519
Ship	0·611	0·593
Fuel consumption, bbls./day:		
Gasifier	158	152
Ship	181	173
Fuel consumption, bbls./mile:		
Ship	0·522	0·496
Cylinder oil consumption, gal./day	58·8	57·6
Engine room temperature, deg. F.	86	90
Average gas temperature, deg. F.:		
To turbines	770	798
From turbines...	492	509
Average gas pressure, lb. per sq. in. gauge:		
To turbines	3·56	34·6

Note.—Voyage 2 before turbine modifications. Voyage 4 after turbine modifications.

Shipboard operation showed that the turbines were not operating at their design point for optimum matching with the gasifiers. To correct this, the following modifications were made to the turbine prior to voyage No. 4: (a) A new inlet nozzle ring with reduced area was installed. (b) New blading for the first stage with a pitch angle compatible with the new angle of the inlet nozzles was installed. (c) The turbine internal clearances were reduced. This modification increased the turbine efficiency by reducing the leakage past the end of the blades and through the labyrinth seals. The effect of the foregoing can best be shown by comparing the performance data of the ship before and after the modifications—voyage No. 2 *versus* voyage No. 4. Conditions for the outboard passage of voyage No. 4 were almost identical to those for the outbound passage of voyage No. 2.—*The Motor Ship, April 1959; Vol. 40, pp. 18-19.*

Cargo Container Ships

The advantages of a container ship in comparison with conventional dry cargo ships are given in some detail. These advantages are mainly economic ones, and the values given in the paper are only indicative average values rather than accurate figures of a particular application. The problems encountered in container ship design are described in some detail. It is argued that a container ship is a specialized dry cargo ship that must be designed around a specific number of containers. For this reason, the design of containers for shipboard use is also presented. Methods of loading and unloading the containers are discussed and it is suggested that the use of gantry type travelling cranes, either on ship or ashore, is the most efficient method for loading and unloading containers. Different crane designs are presented. In general, it is stated that a container ship should have hatches almost as big as the holds so that easy loading and unloading of containers by gantry cranes can be achieved. It is also stated that containers should be stowed in the ship on top of each other in cells formed by guide angles installed in the ship within close tolerances. The problems of stability and structural strength of the ship are delineated. Several designs of container ships are presented. These include conversions as well as a new container ship design, as shown in the accompanying illustration (Fig. 13). It is argued that conversions of existing ships will serve well, if proper design procedures are followed, and it is shown that the conversion of an existing ship to a container ship might cost as little as one-third or less of a new building. For this reason, it is argued that converted container ships will serve several trade routes for many years to come. Finally, a design of a new building is given and discussed in some detail.—*Paper by D. A. Argyriadis, read at a meeting of the Institution of Naval Architects on 25th March 1959.*

Oil Tanker with Turbocharged Engine

The first of a new series of 14 oil tankers of 15,500 tons d.w. has been delivered to the BP Tanker Co., Ltd., London. This vessel, the *British Fulmar,* has been built by Alexander Stephen and Co., Ltd. The principal particulars of the *British Fulmar* are as follows:—

Length o.a.	525ft. 0in.
Length b.p.	495ft. 0in.
Breadth, moulded	69ft. 0in.
Depth, moulded	37ft. 0in.
Summer deadweight ...	15,500 tons
Summer draught	29ft. 5in.
Service deadweight	14,000 tons
Service draught	27ft. 6in.
Gross tonnage	11,186 tons
Machinery output, service...	7,750 b.h.p.
Service speed	$14\frac{1}{2}$ knots

The *British Fulmar* is of all-welded construction with the exception of two riveted seams in the bottom, the lower and upper edges of the bilge strakes, the lower edge of the sheer strakes, the stringer angle and two seams in the upper deck. Longitudinal framing is arranged in the cargo tanks, while at the ends and in the machinery space transverse framing has been provided. Two longitudinal bulkheads and the necessary eight transverse bulkheads subdivide the cargo oil tanks into a total of 27 compartments. There are two main cargo pump rooms and a forward oil fuel deep tank with a dry cargo hold above the cofferdam. The main propelling machinery for the *British Fulmar* consists of a Stephen-Sulzer type 7RSAD.76 single acting, two-stroke, turbocharged Diesel engine of 760-mm. bore and 1,550-mm. stroke. The engine is designed

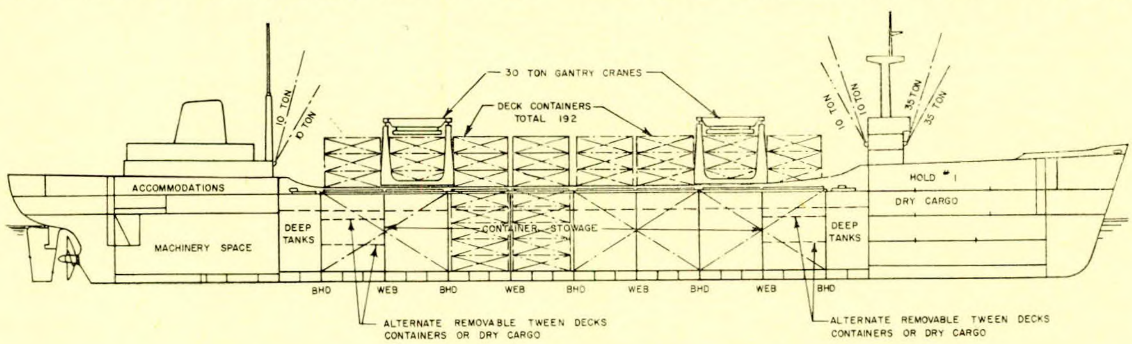
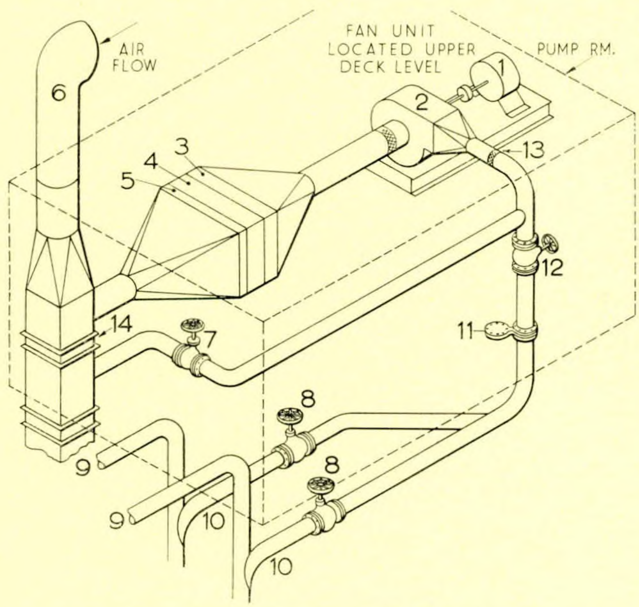


FIG. 13—*Profile of new container ship*

to develop 8,750 b.h.p. at 115 r.p.m. with an m.e.p. of 99lb. per sq. in., but in service under normal circumstances is not intended to exceed 7,750 b.h.p. at 110 r.p.m. Scavenge air is supplied by two exhaust gas driven turboblowers made and supplied by Sulzer Bros. One blower unit is supplied with exhaust gas by a separate pipe from each of four cylinders, while the other unit is supplied from three cylinders. The engine was originally designed to have one lever driven scavenge pump, but tests have proved that this pump could be dispensed with. The engine is largely of fabricated construction, the tensile stresses being taken up by long tie rods which extend from the bottom of the bedplate to the cylinder tops. Individual fuel pumps are provided for the cylinders and pairs of these are contained in blocks situated on the camshaft casing. The pump plunger at each element is driven by a fuel cam through a roller. The engine controls are interlocked with a telegraph and the turning gear so that it is not possible to run the engine in the opposite direction to that shown on the telegraph, neither is it possible to start the engine when the turning gear is engaged. In the event of failure of the lubricating and cooling oil supply, or of the cooling water supply, the engine is stopped immediately.—*The Shipping World, 1st April 1959; Vol. 140, pp. 341-342.*

Gas Freeing of Oil Tankers

A system of gas freeing oil tankers, which can be undertaken in a few hours, has been installed in a number of American and Scandinavian ships. The system has been patented by Gotaas-Larsen Inc., New York, and consists of an arrangement whereby air at ambient temperature, or preheated air, is delivered through the oil cargo lines from a turbine driven blower located in the pump room or engine room, to any tank within the ship. Compartments may be vented individually or collectively and control is by means of the cargo valves. Cargo tanks are rapidly rendered moisture free by the use of preheated air and a high measure of corrosion control is obtained. One of the vessels of the Gotaas-Larsen fleet which has been equipped with this system of gas freeing,



General arrangement of Golar system

1. Steam turbine
2. Fan
3. Heating coil
4. Humidifier
5. Filter frame
6. Vent duct to pump room
7. Valve B
8. Valves D
9. Deck filling line (existing)
10. Deck filling line (new)
11. Blank flange
12. Shut-off
13. Flex. duct connexion
14. Tight-closing dampers

is the *Siri,* a tanker of 32,000 tons d.w., built by the Kawasaki Dockyard Co., Ltd. The installation in this vessel consists of a steam turbine driven blower located on the main deck level in the pump room, taking suction from the pump room ventilation duct. An air heater is fitted on the inlet side of the fan. The fan discharge is connected with the cargo lines. A crossover also facilitates discharge to the bottom of the pump room. Double stop valves and blank flanges fitted in the line prevent back flow of cargo and vapour when the blower is not in use. The blower, which is powered by a de Laval steam turbine, is of sufficient power to deliver 8,100 cu. ft. of air per minute to No. 1 wing tanks: air flow to No. 10 centre tank reaches a maximum of 13,500 cu. ft. per min. If operating on the pump room only, discharge is in the order of 15,000 cu. ft. per min. The Golar system can be supplemented by a dehumidification coil fitted on the inlet side of the heater. This will speed up the tank drying process by a considerable degree, and will also greatly reduce the possibility of sweating recommencing. A new Gotaas-Larsen tanker, the *Martita,* has been equipped with this feature, and two other vessels are to be fitted with dehumidification coils at a later date. The coil will be served with cooled water from a packaged refrigeration plant. Used in conjunction with the air heater its design will enable 8,000 cu. ft. per min. of air at 95 deg. F. dry bulb (standard shipboard ambient conditions) to be processed to a lower dew point and a relative humidity of not more than 10 per cent. The dehumidifier air heater/blower combination which lowers both dew point and relative humidity substantially increases the load of evaporated water that the drying air can pick up. In addition it reduces the temperature at which resweating of the tanks can occur.—*The Shipping World, 18th March 1959; Vol. 140, p. 306.*

Creep Properties of Cast Iron

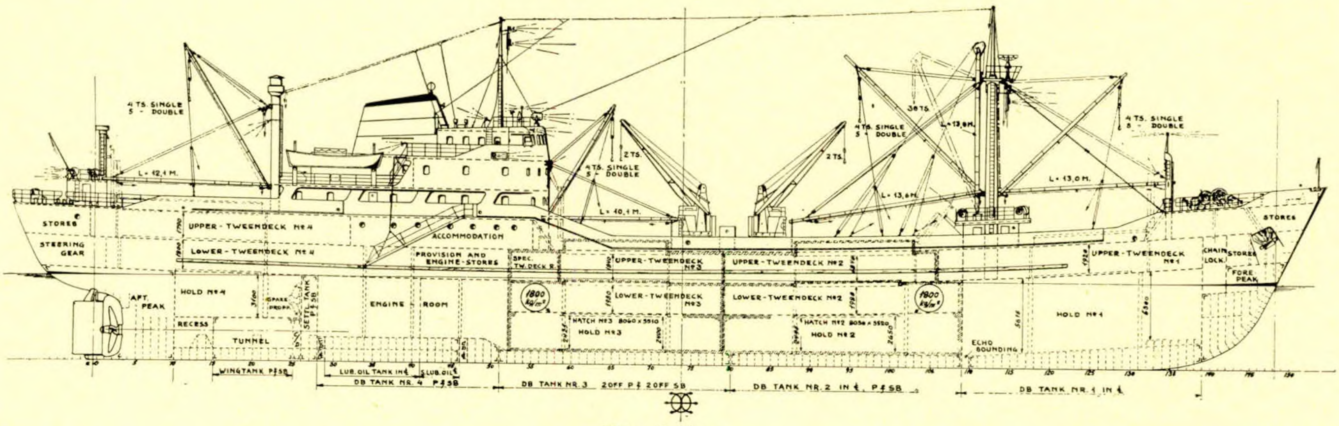
The stress analysis of an idealized piston and the examination of four cast iron Diesel engine pistons revealed that the stress and temperature conditions existing in these parts were such as to permit compressive creep and stress relaxation of the cast iron to take place. This paper describes the development of a laboratory containing miniature compressive creep and stress relaxation testing equipment for performing "quick sorting" tests to determine which type of cast iron, from those supplied by engine manufacturers, has the most creep resistant properties. The tests described here were performed on two medium flake graphite irons.—*Paper by C. Wheatley and J. A. Pope, read at a meeting of the North East Coast Institution of Engineers and Shipbuilders on 23rd March 1959.*

Icelandic Refrigerator Motorship *Selfoss*

Aalborg Vaerft A/S has delivered the *Selfoss* to the Iceland Steamship Co. of Reykjavik, Iceland. The ship has the popular engines three-quarters aft arrangement, and four holds, of which Nos. 2 and 3 are arranged as refrigerated space. The ship has been strengthened for navigation in ice and the main particulars are:—

Length overall	334ft. 10in.
Moulded breadth	50ft. 4¼in.
Depth to upper deck ...	29ft. 6½in.
Deadweight	3,400 tons
Hold capacity	194,000 cu. ft.

The *Selfoss* is an open shelter deck vessel with two complete decks, poop and forecastle. A light fruit deck has been built in holds Nos. 2 and 3. The two refrigerated holds are subdivided into seven compartments with a total capacity of 100,000 cu. ft. and the cargo can be cooled down to −20 deg. C. The remaining refrigerated spaces are divided up into five separate sections, which can be cooled down and used independently of each other. The blower duct system provides transverse ventilation. The glass wool felt insulation is covered with aluminium plates and the tank top is insulated by cork. The four hatches are served by eight 4-ton derricks and two deck cranes. The deck cranes have a lifting capacity of two tons at a hoisting speed of 130ft. per min. and a maxi-



The Selfoss

mum outreach of 33ft. They are able to slew 360 degrees and are carried on transverse rail tracks extending across the ship. There are eight overside hydraulic winches of 4 tons. The windlass and after capstan are hydraulically operated and the steering gear is all-electric. The Bipod foremast carries a 20-ton heavy derrick. All the weather deck hatches are closed by steel covers. The main engine is a seven-cylinder, two-stroke, single-acting B. & W. Diesel engine type 750-VTBF-110 capable of developing 3,980 i.h.p. at 162 r.p.m. for a service speed of 15 knots on a 20ft. 6in. draught. There are three Diesel alternator sets, one with three cylinders and two of five cylinders of the B. and W. 25-MTBH-40 turbocharged type delivering 212 KVA and 350 KVA respectively.—*The Marine Engineer and Naval Architect, April 1959; Vol. 82, p. 141.*

Rotary Regenerative Air Preheaters

Fuel economy, or boiler efficiency, is often thought of as one of the chief benefits of a rotary air preheater. This type unit accomplishes continuous counterflow heat exchange between flue gas and combustion air. Reliability and availability of the heat recovery equipment are other advantages which assure freedom from failure at any point in the operation of the plant and minimum of maintenance. Fuel data for a recent trip of the USNS *Upshur* between Naples and New York indicate the ship's boiler efficiency. The 12,500 normal s.h.p. ship consumed 1·197 bbl. of oil per mile. Total fuel consumption for the 4,207-mile trip was 5,037 bbl. Average speed was 19·21 knots. The 12,500-s.h.p. main propulsion plant of the Barrett class consists of a General Electric cross-compound turbine driving a single screw through double reduction gears. Two sectional header Babcock and Wilcox boilers furnish steam at 615lb. per sq. in. gauge and 850 deg. F. Four stages of external feed heating are provided. The boilers are at the forward end of the fire room and each is fitted with its own forced draught fan and its own individual stack. Each forced draught fan takes its suction directly from the upper engine room space. The forced draught fans are provided with both a two-speed electric motor and a steam turbine. Controllable inlet vanes are fitted to the fans to vary the air discharge capacity in accordance with the requirements of the automatic combustion control system. From the fans the forced draught air discharges through a duct to the air side of the preheater, which is mounted directly above the boiler and just outboard of the fore and aft disposed boiler drums. An integral air bypass of the regenerative air preheaters controls metal temperatures during low load operation. Cooling air for the boiler casing also is taken ahead of the preheater. Additionally, the heater itself is provided with a partial gas bypass. Both bypasses are controlled manually. Regenerative air preheaters are designed for either vertical or horizontal flow of gas and air streams. For highest effectiveness, gas and air should flow counter to each other. For vertical flow, the direction of either stream may be upward or downward. Vertical flow air preheaters generally are used in marine installations (Fig. 4). They are located directly above the boiler outlet and connected thereto with conventional ductwork. From the top of the heater on the gas side an uptake is led to the stack in the usual manner. Forced draught blowers may be disposed in the conventional manner and connected to the air side of the preheater, again through ductwork. Cooling and/or sealing air to be introduced into the boiler casing can be taken off the forced draught duct just ahead of the heater. Air bypasses are built into the corners of the heater housing for operation under partial loads.—*J. Waitkus, Marine Engineering/Log, March 1959; Vol. 64, pp. 71-73.*

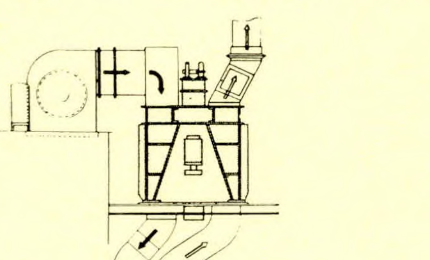


FIG. 4—*Arrangement of boiler and air preheater on MSTS roll-on vessel USNS* Comet

Effect of Residual Stress on Brittle Fracture

The authors made an experimental investigation of the effect of residual welding stress on brittle fracture. For this purpose, the specimens having sharp transverse notch in the region of high tensile residual stress were pulled by a testing machine under various temperatures. Through the experiment it was found that residual welding stress having no effect on the ductile fracture of welded structure may play an essential role in the case of brittle fracture. The complete fracture of a welded joint may be produced by merely applying low stress in a static manner when such unfavourable conditions as the use of materials of low notch toughness, existence of sharp notch, and high tensile residual stress are accumulated. The above-mentioned fracture at low stress level is one of the realization of brittle fracture which occurred in the actual damages. The effect of preloading at high temperature on the behaviour of a joint was also investigated and it was found that the preloading produces a favourable effect on the fracture strength at low temperature.—*H. Kihara and K. Masubuchi, Welding Journal, April 1958; Vol. 38, pp. 159-s - 168-s.*

Manufacture of Marine Oil Engines

In this paper the author has not attempted to describe all the processes in the manufacture of a Diesel engine: the scope is too wide. It has been necessary to confine the observations to general lines and to emphasize only those principles which appear to open up possibilities of progress and improvements in technique. A good deal of attention is paid to the mechanization of fabrication and the combining of heavy machine tools for their special application to the problem of machining the large components for direct drive Diesel engines. In view of the prime importance of machining processes in the production of marine engines, a large proportion of the paper deals with machine tools. While most of this plant would have a general application in any branch of heavy engineering, its particular suitability for marine engineering is emphasized.—*Paper by J. E. Smith, read at a meeting of the North East Coast Institution of Engineers and Shipbuilders on 13th February 1959.*

Cargo Liner for Far Eastern Service

Designed for Far Eastern service, the single screw, turbine driven steamship *Benloyal* is the twelfth new vessel to be completed for Ben Line Steamers, Ltd., of Edinburgh, since the war. Important features in the design of the *Benloyal* include large holds and spacious 'tweendecks for the carriage of general cargo; an insulated 'tweendeck space which is fully refrigerated; special tanks for the carriage of latex in bulk; edible oil tanks; and ample provision for fuel oil, fresh water and water ballast. Special arrangements have been made for the carriage of condensed milk. The principal dimensions and other leading particulars of the *Benloyal* are:—

Length overall	549ft. 5in.
Length b.p.	505ft. 0in.
Breadth moulded	71ft. 0in.
Depth moulded to upper deck	44ft. 6in.
Load draught	30ft. 0in.
Corresponding deadweight, tons	10,926
Gross tonnage	11,463
Net tonnage...	6,516
Passengers	10
Service speed, knots... ...	19
Service s.h.p.	14,000
Corresponding r.p.m. ...	105
Maximum s.h.p.	15,500

A comprehensive system of cargo handling appliances has been installed in the vessel. Situated between Nos. 2 and 3 hatches, the fore mast is of the Hallèn patent Bipod type. The main propelling machinery of the *Benloyal* has been manufactured and installed by David Rowan and Co., Ltd., of Glasgow.

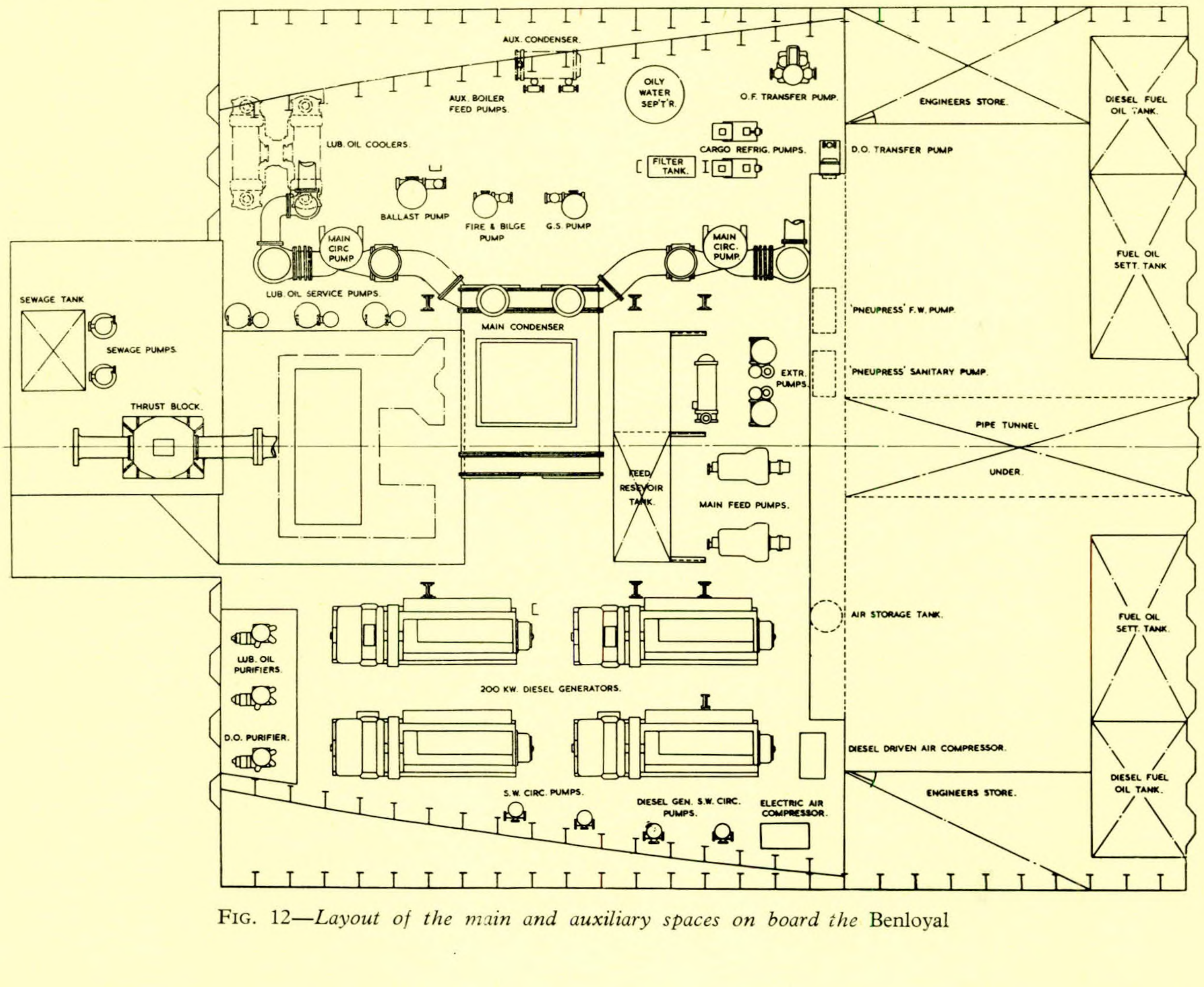


FIG. 12—*Layout of the main and auxiliary spaces on board the* Benloyal

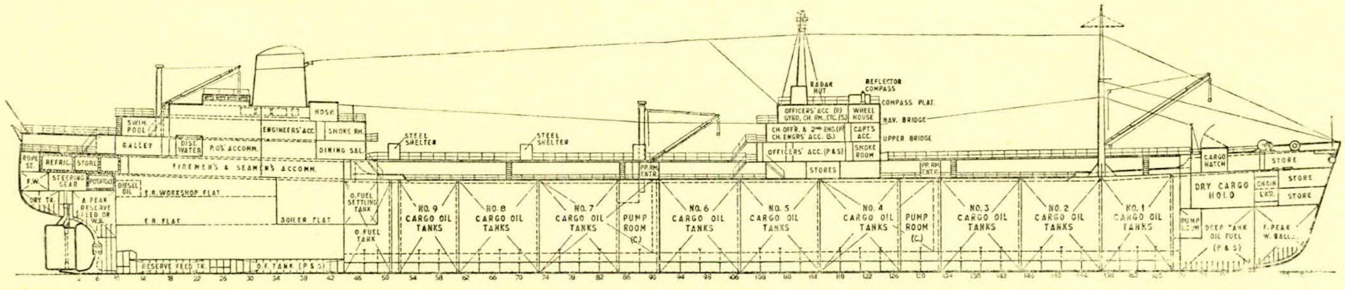
Drawings showing the layout of the main and auxiliary machinery are given in Fig. 12. The installation comprises a set of Pametrada geared turbines designed for a normal output of 14,000 s.h.p. at 105 r.p.m. at the propeller, and is capable of giving a maximum output of 15,500 s.h.p. Steam is generated at 600lb. per sq. in., and a temperature of 850 deg. F. at the superheater outlet, by two watertube boilers of the Babcock and Wilcox integral furnace, selectable superheat type, constructed under licence by the engine builders. Each boiler is arranged to burn fuel oil under a closed system of balanced draught. The main propelling machinery comprises one high pressure and one low pressure turbine driving a single Novoston alloy propeller, through double reduction articulated gearing. The h.p. ahead turbine is of the all-impulse type and the l.p. ahead turbine of the double flow reaction type. Astern power, of about 8,400 s.h.p., is provided by an h.p. two-row, impulse wheel housed in a separate casing, overhung at the forward end of the h.p. ahead turbine, and an l.p. astern turbine, of the two-row impulse type, incorporated in a separate casing in the l.p. ahead turbine. The turbines are controlled from a centrally located console, which carries the manœuvring wheels and essential instruments.—*The Shipbuilder and Marine Engine-Builder, April 1959; Vol. 66, pp. 185-193.*

Oil Tanker for P & O Group

The first of the seventeen oil tankers on order for the P. and O. group has now been delivered to the Federal Steam Navigation Co., Ltd. This vessel, the *Lincoln,* 18,615 tons d.w., has been built by John Brown and Co. (Clydebank), Ltd., and is now on charter to the British Petroleum Co., Ltd. The P. and O. group tanker programme consists of three classes of vessel: six general purpose tankers of 18,000 to 19,000 tons d.w., similar to the *Lincoln;* eight of 37,000 tons d.w. selected as being the largest proved design which would be able to pass through the Suez Canal on a draught of 36ft., and three ships of 48,000 tons d.w. All seventeen tankers are being built in Great Britain. The principal particulars of the *Lincoln* are as follows:—

Length o.a.	558ft. 3in.
Length b.p.	530ft. 0in.
Breadth, moulded	72ft. 0in.
Depth, moulded	39ft. 0in.
Draught	30ft. 2¼in.
Deadweight	18,615 tons
Machinery output	7,750 s.h.p.
Speed	14½ knots
Oil cargo capacity	843,140 cu. ft.
Dry cargo capacity	20,000 cu. ft.

Oil cargo is carried in twenty-seven tanks. The vessel is constructed on the combined longitudinal and transverse system of framing, with two longitudinal bulkheads. There are two main pump rooms, one forward and one aft, as shown on the accompanying general arrangement drawing. In each pump room there are two vertical compound duplex cargo oil pumps, each of 500 tons per hr. capacity, and one steam driven vertical duplex stripping pump of 150 tons per hr. capacity. The small pump room right forward contains a vertical duplex bilge/ballast and an oil transfer pump. The accommodation is air conditioned throughout by plant which includes three automatic direct expansion refrigerating plants of the Freon type made by J. and E. Hall, Ltd. The main propelling machinery in the *Lincoln* consists of geared turbines of Pametrada design, built at the works of John Brown and Co. (Clydebank), Ltd. The main turbines are capable of developing a service power of 7,750 s.h.p. at 117 propeller r.p.m., and a maximum power of 8,250 s.h.p. at 119 propeller r.p.m. Steam is supplied at 475lb. per sq. in. gauge and superheated to 790 deg. F. temperature. The turbines drive through double reduction articulated type gearing with forged nickel steel pinions, the secondary pinions being made hollow to accommodate the quill drive shafts. Each turbine is connected to the gearing by a flexible coupling of the fine tooth type, and the secondary pinions are driven through quill drive shafts and flexible couplings from the primary gears. The h.p. turbine runs at 5,670 r.p.m. and the l.p. turbine at 3,565 r.p.m., and the gear ratio is such that with these speeds the propeller runs at 117 r.p.m. when the turbines are developing a normal service power of 7,750 s.h.p. Two Foster Wheeler E.S.D. type watertube boilers supply steam at 500lb. per sq. in. and a steam temperature of 800 deg. F. at the superheater outlet. The air heaters, using bled steam as the heating medium, supply air at a temperature of 230 deg. F. to the boilers. Each boiler comprises a two-drum boiler with economizer, superheater and air attemperator, the latter capable of reducing the superheat by 50 deg. F. at the maximum boiler output. The boilers are arranged forward of the main engines, the space below the boiler flat housing the closed feed system and other auxiliaries. —*The Shipping World, 11th February 1959; Vol. 140, pp. 192-194.*



Oil tanker Lincoln, *18,615 tons d.w., built by John Brown and Co. (Clydebank), Ltd., for the Federal Steam Navigation Co., Ltd.*

Flash Evaporators for Merchant Ships

Early shipboard distilling plants operated at positive pressure and the difficulties with them were substantial. The principal problems were due, of course, to the heavy scale deposits resulting from high temperature operation. A major improvement came about with the development of the vacuum type, submerged surface evaporator. As a result of working with these plants over a period of years, certain design considerations were found to be so important they were almost universally included in distilling plant specifications. These design criteria, for the most part, do not apply to the flash type evaporator specifications. The following description will illustrate why submerged surface specifications are not applicable to flash type plants. The flash evaporator is an upside down version of the conventional submerged tube plant that has been used in marine service for many years. The tube bundle, instead of being submerged in a pool of sea water, is in fact separated from the brine by entrainment separators. The brine, instead of being boiled on the outside of the evaporator tube bundle, is actually cooled by flashing in a flash chamber. Also, in the conventional multiple effect, submerged surface distilling plant, the greatest heat loss is to the circulating water passing through the final condenser. In the flash plant there is an approximately equal loss of heat, but it is contained in the brine discharged from the plant. A typical flow chart for a

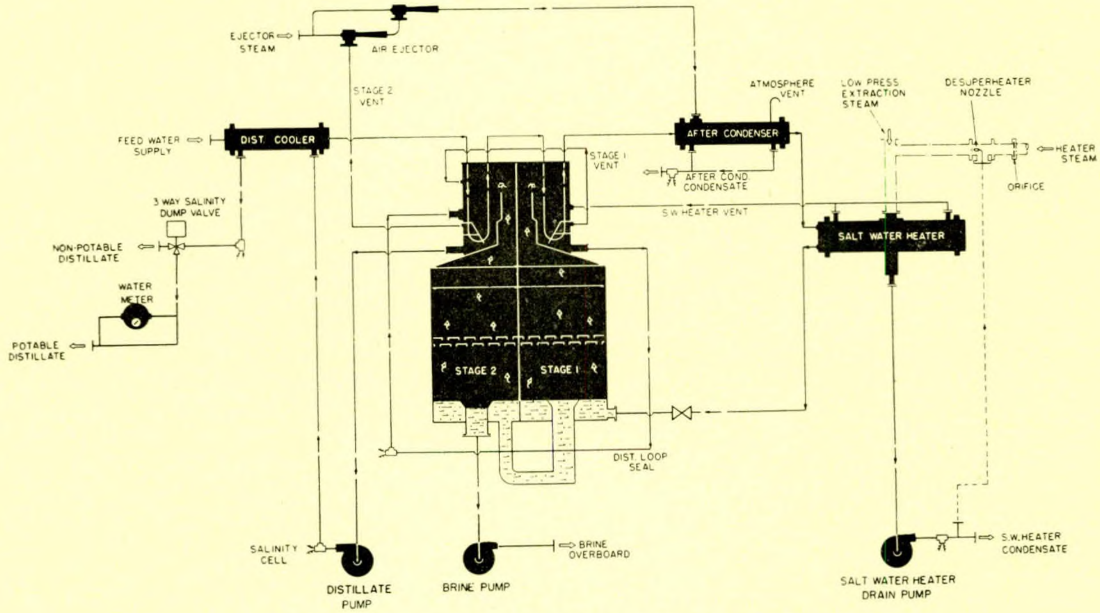
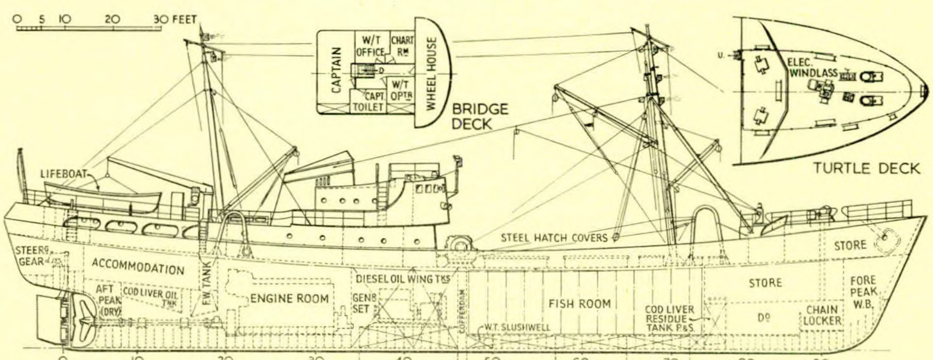


FIG. 1—*Schematic of two-stage flash distilling plant*

two-stage system is shown in Fig. 1. Total circulating water rate for a two-stage plant, with 85 deg. F. sea water, is about 20 gal. per gal. of distilled water produced. This is on the order of the total water requirements of a submerged surface, double effect plant. There are several things not on the flow chart that were formerly standard equipment on the marine evaporator: (1) There are no flow meters on the feed and brine. Since brine density is not controlled on the flash plant there is no need for a feedwater flow meter. (2) There is no brine sampling valve. Since brine density is not controlled there is no need for this periodic check. (3) There is no chemical feed treatment system. The flash plant when properly designed requires no feed treatment. (4) There are no provisions for cold shocking the evaporator. The flash evaporator operates at temperatures below which heavy scale deposits form. It does not boil the water on the tube surfaces. Thus, cold shocking is not required. A two-stage flash plant is normally designed to produce 1·76lb. of distillate per 1,000 B.t.u. of low pressure steam supplied. Some high pressure steam is required for the air ejectors. The economy for a two-stage flash plant considering both low pressure and air injector steam is normally 1·58lb. of distillate per 1,000 B.t.u. of total heat input. This thermal performance is approximately the same as for a double effect, submerged tube evaporator. One-stage, three-stage and five-stage plants also have been furnished for marine service, with corresponding changes in thermal performance. The flash plant is capable of operating for prolonged periods without shut-down for scale removal. There are several reasons for this: (1) The brine density in a two-stage flash plant during the heating cycle is 1·0 as compared with submerged surface evaporator practice wherein brine density is normally controlled at 1·5 to 2 times normal sea water. (2) The flash plant is a once-through system. Fresh sea water flowing past the tube surfaces at approximately 6ft. per sec. is heated to 170 deg. F. in only 18 to 20 sec. and is then pumped overboard. Thus, retention time is lower than for any other type of plant. (3) No sea water is boiled on the tube surface. In the flash plant, a back pressure is maintained on the sea water being heated. As a result boiling does not occur until after the water has left the steam heater. Thus, sea water concentration does not occur at the tube surface. (4) Since the steam heater is multipass, only in the last pass does the water reach its maximum temperature. It is known that scale formation is a function of temperature. By avoiding an entire effect at maximum brine temperature, as in the case of submerged surface evaporators, a major scale problem is avoided. These factors, when properly applied in a flash type evaporator, mark a new point in the progress of distilling plant design, comparable to the development of low pressure vacuum plants.—*G. F. Leitner, Marine Engineering/Log, March 1959; Vol. 64, pp. 68-70; pp. 148-149.*

British-built Trawler for French Owners

Trials were carried out in the Humber of the motor trawler *Saint Louis,* built by Cook, Welton and Gemmell, Ltd., Beverley, to the order of Pêcheries de la Morinie, Boulogne-



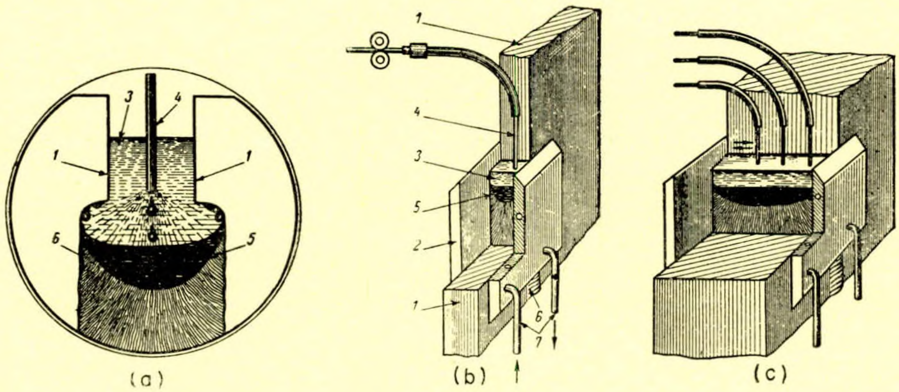
General arrangement of the Saint Louis sur-Mer. The vessel is similar in many respects to the *Prince Charles, Kingston Pearl* and *Kingston Beryl,* constructed by the builders for British owners, but she does differ in her propelling machinery, which consists of a turbocharged Deutz Diesel engine. The principal particulars are:—

Length b.p.	176ft. 6in.
Length registered	180ft. 0in.
Breadth moulded	32ft. 3in.
Depth moulded	16ft. 6in.
Gross tonnage	730 tons
Speed on trials	14½ knots

The hull form and propeller design were based on model tests at the National Physical Laboratory, Teddington. The fishroom, which has a capacity of 17,130 cu. ft., is insulated and wood lined and subdivided into pounds. The fishroom vertical and shelf boards and the fishroom stanchions and shelf rest angles are in aluminium alloy. The trawl winch, supplied by Messrs. Jas. Robertson and Sons (Fleetwood), is driven by a Laurence Scott electric motor of 208 h.p. and operates on the Ward Leonard system, current being supplied by a generator driven by a Mirrlees TLA6 type Diesel engine developing 305 b.h.p. at 650 r.p.m. Fuel tanks on each side of the engine room and in the double bottom, supporting the trawl winch generator, have a total capacity of 177 tons. A separate gas oil tank of 2 tons capacity is also provided. Propelling machinery, supplied by Klöckner-Humboldt-Deutz, Cologne, and installed by Charles D. Holmes and Co., Ltd., Hull, consists of an eight-cylinder turbocharged Deutz Diesel engine type RBV8M366 developing 1,650 b.h.p. at 245 r.p.m. Of the four-stroke direct reversing type, the engine has cylinders with a bore of 16½in. and a stroke of 26in. The turbocharger is of Brown Boveri make. On trials, the *Saint Louis* averaged 14·496 knots over the measured course, the draughts being 16ft. 6in. aft and 6ft. 9in. forward. The turning circle as measured on the radar screen was 425ft.—*Shipbuilding and Shipping Record, 30th April 1959; Vol. 93, pp. 567-569.*

Electro-slag Method of Welding

In recent years a highly productive method of welding very thick components has been developed in the Soviet Union. Unlike arc welding, the heat in electro-slag welding, as it is called, is obtained by the passage of electric current through a bath of molten slag. The diagram of this method is given in Fig. 1. A bath of molten slag is formed between the edges of the components to be welded and the watercooled copper plates which serve as slagholders. A melting electrode wire is continuously fed into the molten slag. The electric current passing through the electro-conductive liquid slag maintains the temperature at a high level; this causes the melting of the electrode wire and of the edges of the components to be welded and thus forms a bath of molten metal. The rate of upward movement of the slag-metal bath, and thus the slagholder plates, depends on the rate of melting of the electrode and the base metal. As heat is conducted away from the lower layers of the bath, solidification occurs, thus forming the welded connexion. By electro-slag welding it is possible to weld parts of a thickness up to 2⅜in., using one electrode with a stationary vertical axis. If the electrode is reciprocated in a direction normal to the plane of the welded parts, welds of 6 to 8in. in thickness can be obtained with a single electrode. By increasing the number of electrodes in the slag bath, the method can be extended to weld parts together of practically unlimited thickness. Electro-slag welding has been used successfully in boiler annular (circular, ring) welds in thick walled drums and other high pressure vessels. The process has also been employed for the manufacture of large components for heavy machinery. Application of the electro-slag welding process has enabled the replacement of heavy cast and forged parts by welded castings, welded forgings and welded rolled fabrications. This has considerably reduced the pressure of work on foundries and forging shops and promoted increased production without addition to the shop floor space.—*M. M. Barash, W. Heginbotham and P. B. Oxley, Welding Journal, February 1959; Vol. 38, pp. 132-134.*



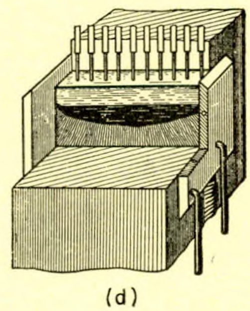


FIG. 1—*Diagram of electro-slag welding process*

a) Basic diagram of the process; b) Welding with a single electrode having a stationary axis for metals up to 2⅜-in. thick; c) Welding with three oscillating (reciprocating) electrodes for metals up to 17¾-in. thick; d) Multi-electrode welding, for practically unlimited thickness; 1) The welded metal; 2) Slag holders; 3) Slag bath; 4) Electrode wire; 5) Metal bath; 6) The weld; 7) Water pipes

Patent Specifications

Hydraulic Opener for Hatch Cover

This invention relates to a hydraulic opener for hinged hatch covers. Fig. 1 is a side elevation of a closed and an almost entirely opened hatch cover, both of which are equipped with an opener according to the invention. Fig. 2 is a plan view of the closed hatch cover. The hatch cover is composed of two approximately equally large parts (1 and 2) supported on a coaming (3) and held together by hinges (4). Part 1 has a hinged support at its end of the hatch opening so that the hatch cover can be opened by being swung upwards and simultaneously folded together, as is shown in the right hand portion of Fig. 1. The upward swinging movement is effected by means of a pulling link (5) connecting lug (6) on the cover part (1), to a support (7) which is fixedly mounted on the deck at the hinged end of the hatch. The two hatch covers shown in Fig. 1 open back to back and have a common support which is in the form of a portal so that it does not appreciably prevent the employment of the deck space between the hatches as a passage or for other purposes. The pulling link (5) is composed of two parts; one of these is an elongated box (8) which has one end anchored to the hatch cover lug (6) by a universal joint connexion (9) and its other end resting on a roller (10) in the support (7). The other part of the pulling link consists of a pair of pull rods (11) which are pivoted on a bolt (12) in the support (7) and extend over the hatch cover on both sides of the box (8). A single acting hydraulic jack comprising a cylinder (13) with a plunger (14) is mounted within the box (8), the closed end of the cylinder being hingedly connected to the box near the free end. On the end projecting from the cylinder the plunger (14) carries a yoke (15)

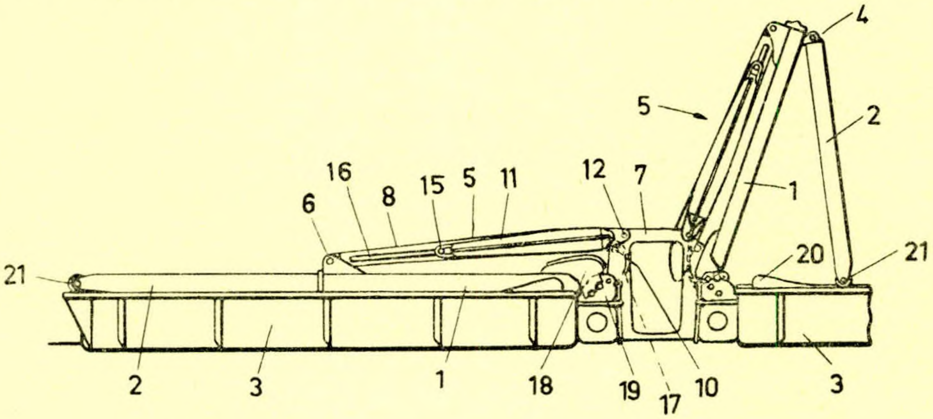


FIG.1

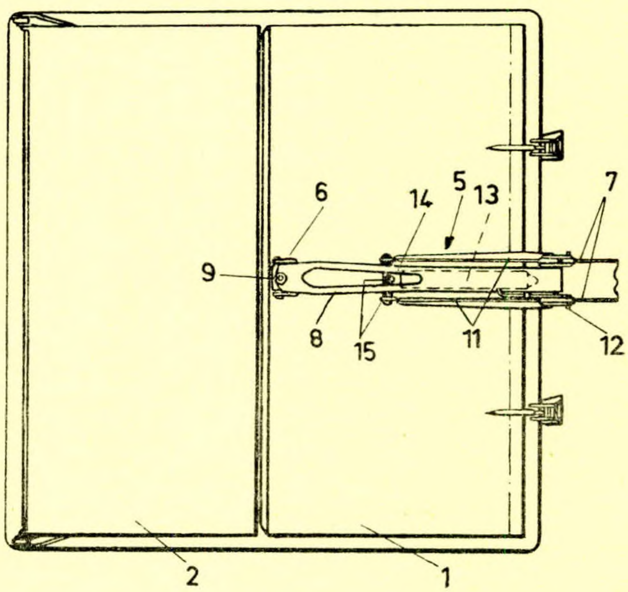


FIG.2

which projects through slits (16) in the side walls of the box (8) and on the ends of which the two pull rods (11) are pivoted. The hydraulic jack is connected by a hose (17) to a pump, and when the jack is supplied with hydraulic fluid so that the plunger is pressed outwardly, this results in a shortening of the pulling link (5) in that the box (8) is drawn towards the support (7) and the hatch cover is swung upward and opened. When the hatch cover is raised and also when it is lowered, its movement can be regulated by means of a throttling valve. During the opening and the closing movement the box (8) slides on the roller (10), and the bottom of the box is in the form of a curve so that during the entire movement it holds the yoke (5) in the plane containing the hinge bolt (12) of the pull rods (11) and the corresponding hinge bolt of the box (8) in the hatch cover lug (6). Then the hydraulic jack is not exposed to any bending stresses whatever, not even to such as arise by friction in the bolt connexions.—*British Patent No. 811,608 issued to Kockums Mekaniska Verkstads Aktiebolaget. Complete specification published 8th April 1959.*

Inflatable Craft

The object of this invention is to provide a craft with a fabric floor in which the tendency for rippling to occur when the craft is travelling through the water is reduced. In Figs. 1, 2 and 3 the inflatable craft is formed with a fairly pointed bow and comprises a tubular chamber (10) which extends from the bow along each side of the craft to its stern, the after ends of the chamber being connected by a rigid transom (11). The craft is provided with a floor having two skins (12 and 13) of air and waterproof fabric, which are sealed at their side and leading edges to the lower part of the chamber (10), the inner skin being secured to the chamber at a level a short distance

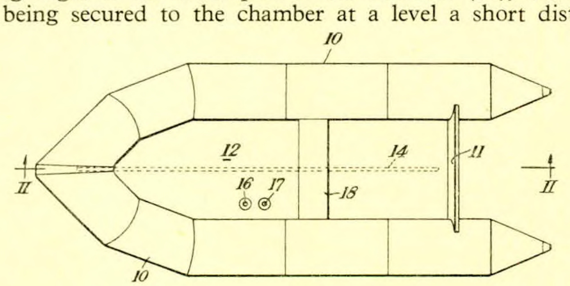


Fig. 1.

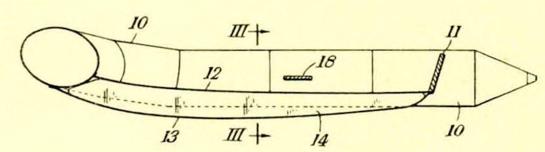


Fig. 2.

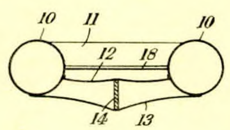


Fig. 3.

above that at which the outer skin (13) is secured. The two skins (12 and 13) are joined to each other along their after edges and the joined edge is sealed to the bottom of the transom (11). In the fore and aft direction of the craft, the floor is shorter than the overall length of the craft and the transom (11) on which an outboard motor may be attached is arranged a short distance forward of the tapered after ends of the chamber (10). The floor may however extend the full overall length of the craft and the transom may be arranged further aft. The floor of the craft is provided with a keel member (14) located between the inner and outer skins (12 and 13). This member serves to space the two skins apart along the central fore-and-aft axis of the floor, forcing down the outer skin (13) to form a "V" bottom for the craft and thus provide it with good planing characteristics. The inner skin (12) of the floor is fitted with a loaded valve (16) to allow air to enter the floor compartment when the outer and inner skins (12 and 13) are drawn apart by the inflation of the buoyancy chamber (10). The inner skin (12) is preferably also provided with a further valve (17) through which air may be withdrawn from the floor to maintain the required partial vacuum. The valve (16) is so adjusted that on the skins (12 and 13) being drawn apart by the inflation of the chamber (10), only sufficient air enters the floor compartment to obtain the partial vacuum required. The effect of maintaining a partial vacuum on the floor is to cause the two skins to be drawn towards each other; thus the outer skin is drawn inwardly and is stretched on either side of the keel to provide a slightly curved surface in a transverse direction of the craft. These surfaces on either side of the keel possess a substantial degree of rigidity in the longitudinal direction of the craft, and the tendency for the outer skin to ripple is largely eliminated.—*British Patent No. 811,045 issued to R. F. D. Company, Ltd. Complete specification published 25th March 1959.*

Steam Generator Unit

This invention relates to steam generating units for generating steam by heat extracted from hot fluids. The unit (10) shown in Fig. 13 comprises a vertically elongated pressure vessel (12) closed at the ends by a lower hemispherical head (16) and an upper convex head (14), arranged with a manhole opening (18). During normal operation of the unit there is a normal liquid level (22) which forms an upper steam space (24) and a liquid space (26). Plates (28, 30, 32 and 34) in conjunction with the walls of the pressure vessel (12) form a steam generation chamber (36) and an annular downcomer (38). The steam generation chamber (36) is vertically elongated and is of circular cross section less than the cross section of the pressure vessel. The baffle plate (34) is joined to the

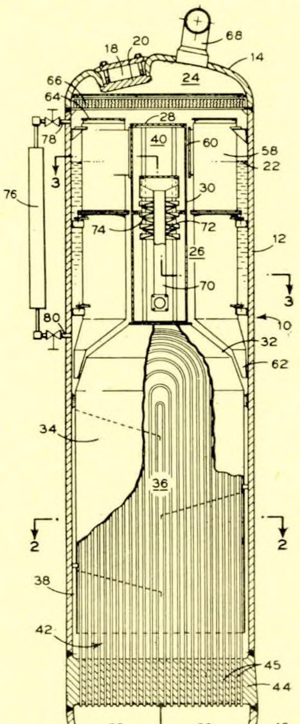


Fig. 13

plate (32) so that the upper portion of the steam generation chamber is essentially hemispherical. The hexagonal cap plate (28) and the plate (30) form an extension chamber (40) shaped as a six-sided regular prism for the collection of the water steam mixture. Within the chamber (36) there are a number of U-shaped tubes constituting a vertically elongated tube bundle (42) filling the lower portion of the steam generating chamber. A tube sheet (44) is located transversely of the longitudinal centre line of the pressure vessel (12) and has a number of tube seats (45). Tube ends of the U-shaped tube bundle (42) pass through the tube sheet (44) and are fastened in the tube seats for the flow of a hot heating fluid through them. The hemispherical head (16) is fastened to the outer edge of the tube sheet to enclose the outer face and form, in conjunction with a dividing baffle (48), a heating fluid inlet chamber (50) and an outlet chamber (52). Inlet and outlet nozzles (54 and 56) provide the means for passing the heating fluid into the inlet chamber (50), through the tubes of the tube bundle (42) and out through the outlet chamber (52) to the outlet nozzle (56), where the fluid is cooled. Six hollow upright whirl-chamber-type separators (58) are arranged in a ring in the upper portion of the pressure vessel to receive a steam/water mixture which is emitting radially outward from the outlets (60) of the collecting chamber (40). Each of these separators has an upper whirl-chamber portion and a lower downflow portion with a length to diameter ratio of approximately 6:1, and with the whirl-chamber portion being less than half of the total length. The whirl chambers (58) are arranged so that the normal liquid level (22) is positioned in the upper one-third of the height of the separator. Further, each separator has an outwardly directing extension piece (62) at the liquid discharge end, which is arranged to direct the separated liquid into the downcomer (38) outside the tube bundle (42). Separated steam passes out of the upper end (64) of the steam/water separators, through a corrugated-type steam scrubbing element (66) and then through the steam outlets (68) to a point of use.—*British Patent No. 812,500, issued to the Babcock and Wilcox Company, U.S.A. Complete specification published 29th April 1959. Engineering and Boiler House Review, June 1959; Vol. 72, pp. 203-204.*

Pound Boards

The holds of fishing vessels are divided into compartments or pounds, and each pound is fitted from floor to ceiling with shelves or pound boards on which fish is stacked as it is caught. The pound boards must possess considerable strength, and it is customary to make them from wood, e.g. mahogany, of considerable thickness, which makes them both heavy and expensive. Wooden boards are also unhygienic owing to their porosity. According to the invention, an improved pound board is of the type provided with angular corrugations of substantially channel section running substantially parallel to its length. In Figs. 1 and 2 a pound board is provided with a number of angular corrugations of substantially channel section presenting alternately, oppositely directed lands 3 and 4 respectively, the total area of lands (3) being substantially equal to the total area of lands (4). The longer edges of the board take the form of flanges (5), which are shorter in depth than

Fig. 1.

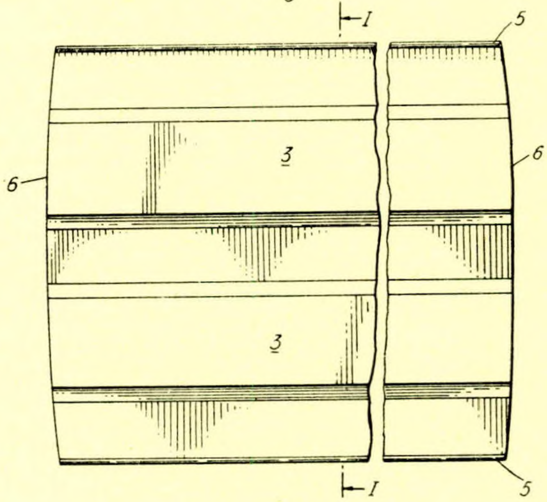
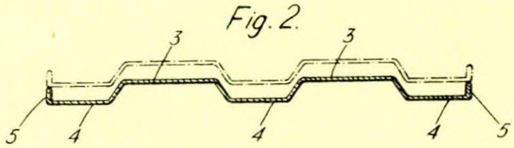


Fig. 2



the minimum distance between the plane of lands (4) and the plane of lands (3) by approximately the thickness of the material of the board. The shorter edges (6) of the board are curved to facilitate fitting. The chain dotted lines in Fig. 2 indicate the position of a pound board nesting upon the pound board shown in continuous lines, and it will be seen that the lands interlock to prevent transverse movement of the pound boards relative to one another.—*British Patent No. 811,594, issued to J. E. Eltherington. Complete specification published 8th April 1959.*

Marine Engineering and Shipbuilding Abstracts

Volume 22, No. 8, August 1959

Japanese Diesel Whale Catchers

An experiment was made in Japan in 1936 to determine the influence of Diesel engine noise on whales. Since the results were successful, Diesel catchers have gradually been developed, and thus cruising range can be extended. Good manœuvrability is maintained by the use of an "air brake" system. At first only small boats were used because it was thought that only they would have the necessary manœuvrability, but this was disproved, so that since 1941, and especially after 1950, the size has been increased. Several new devices have been introduced from time to time, such as the electrically driven whale winch, replacement of the bar keel by the flat keel, use of bilge keels, echo sounders, and friction clutches and metal brakes on steam powered catchers. A controllable pitch propeller was also tried but did not prove successful. In the field of fishing gear, the flat headed harpoon, radio buoy and nylon rope have also been introduced. Modern catchers of between 600 and 700 gross tons have been built recently, an example of the newest vessel of this size being the *Seki-Maru No. 18,* built in 1957, as shown in the accompanying illustration.—*Paper by T. Nakata, read at the Second World Fishing Boat Congress, Rome, 5th-10th April 1959.*

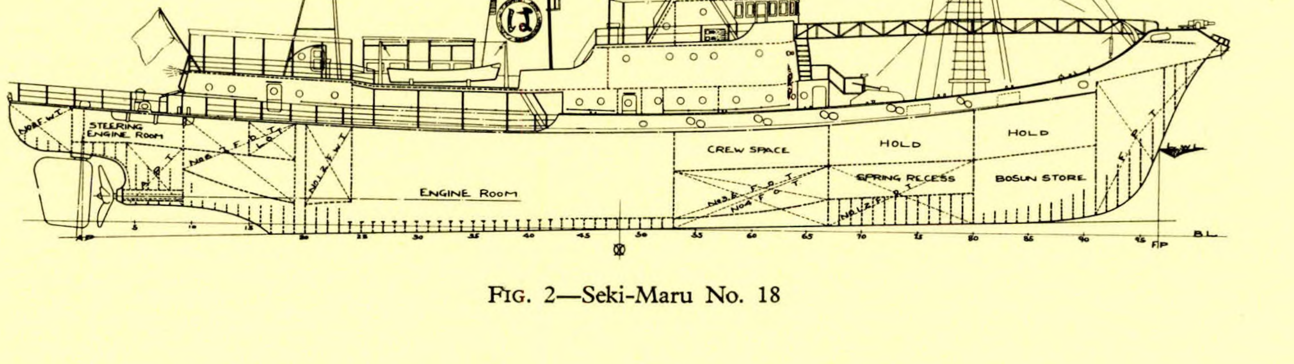


FIG. 2—Seki-Maru No. 18

Transistorized Buoy Flasher

A new buoy flasher and coder employing a transistorized circuit eliminates the cam and mechanical contact arm used in conventional flasher mechanisms and, in capsulated form, can be made to occupy a 4-in. cube. Flashing lights used on buoys can usually be flashed in groups so that flashes will be shown as 1, 2, 3 or 4 in each group. The intervals between each group vary according to the number in that group so as to maintain the ratio for which the light is shown to the total sequence interval at a fixed value. In practice this value is usually one in ten. The object of this equipment is to provide a design to fulfil these functions without moving parts. The number of flashes in a group, the time between individual flashes and the time between separate groups of flashes are governed by a plug instead of by a cam. To alter any of these variables in the conventional units it is necessary to cut a new cam, a procedure that is now eliminated. In the new coder they can be altered by changing the plug. It is intended to encapsulate the circuit in a synthetic resin to a volume roughly equal to a 4-in. cube that will weigh less than 1lb. With this transistorized technique, the life of the equipment is considerably increased. Such a coder, however, is not limited in its uses to buoy light flashing but may well be used for most other intermittently operated navigational aids such as main lights in lighthouses and light vessels and for fog signals. —*Shipbuilding Equipment, March 1959; Vol. 1, p. 16.*

Cargo Motorship for Danish Owners

A recent delivery from Aalborg Vaerft A/S, Aalborg, was the cargo motorship *Scandia,* built to the order of A/S Dampskibsselskabet D.F.K., Copenhagen. Built to the requirements of Lloyd's Register of Shipping, with strengthening for navigation in ice, the vessel is arranged as a self-trimmer and is provided with the latest navigational aids. The principal particulars are: —

Length overall	362ft. 6in.
Breadth moulded	49ft. 4in.
Depth to main deck	22ft. 1in.
Depth to raised quarter deck...	27ft. 4in.
Draught	20ft. 5in.
Gross tonnage	3,200 tons
Deadweight	4,830 tons
Speed	14½ knots

Designed with a raked stem and cruiser stern, the vessel has a single continuous deck, a raised quarter deck and fo'c'sle. The machinery spaces are arranged aft and deckhouses for accommodation are placed on the raised quarter deck and also amidships. Five watertight bulkheads are fitted and the double bottom extends throughout the ship. Masts are of the self-staying type. Four cargo holds are provided, the hatches being fitted with steel covers operated by the winches. The windlass and capstan are of the electro-hydraulic type while the steering gear is electrically operated.. Propelling machinery consists of a six-cylinder, turbocharged, two-stroke, single acting, crosshead type Burmeister and Wain Diesel engine type 650-VTBF-110 which develops 3,900 i.h.p. at 170 r.p.m. and gives the ship a speed of 14½ knots. The engine, which is arranged to burn heavy fuel, has cylinders with a bore of 500 mm. and a piston stroke of 1,100 mm. Electricity at 380 volts a.c. is provided by three 125 kW generators driven by three-cylinder, four-stroke, single acting, trunk piston, turbocharged, Diesel engines. Each engine, which is of the 320-MTBH-30 type, develops 150 h.p. at 600 r.p.m.—*Shipbuilding and Shipping Record, 7th May 1959; Vol. 93, pp. 598-599.*

Eliminating Gear Wear on C4 Vessels

During the past years, analyses have been developed to such an extent that the torsional characteristics of geared drives can be predicted with sufficient accuracy so that very little trouble can be expected in a new design from the torsional vibrations. This article deals with a vibratory problem of another nature which occurred in the propulsion units of the C4-type ships. The mode of vibration was longitudinal, in which the propeller excited the propulsion gears in a fore and aft direction. The C4 propulsion unit consists of a nested, double reduction gear driven by cross-compound h.p. and l.p. turbines. The unit nominally is rated at 9,000 s.h.p. at 85 turns. A schematic diagram of the unit is shown in Fig. 1.

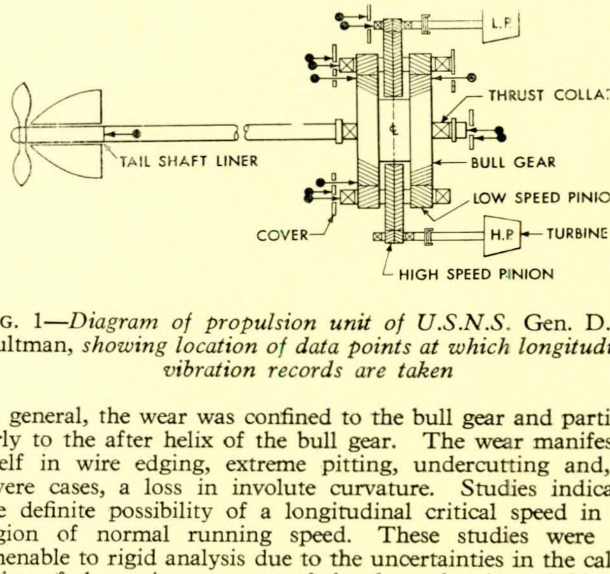
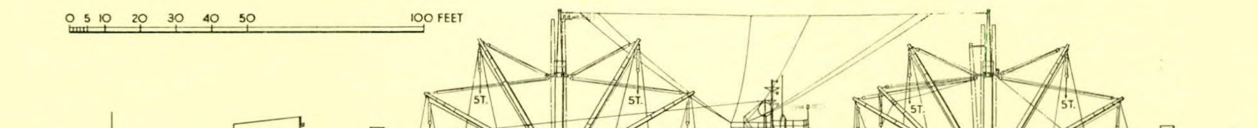


FIG. 1—*Diagram of propulsion unit of U.S.N.S.* Gen. D. E. Aultman, *showing location of data points at which longitudinal vibration records are taken*

In general, the wear was confined to the bull gear and particularly to the after helix of the bull gear. The wear manifested itself in wire edging, extreme pitting, undercutting and, in severe cases, a loss in involute curvature. Studies indicated the definite possibility of a longitudinal critical speed in the region of normal running speed. These studies were not amenable to rigid analysis due to the uncertainties in the calculation of the spring constant of the thrust bearing. This calculation involves the thrust bearing, gear case, gear foundation, and hull structure. In addition to the difficulty in determining the spring constant of the thrust bearing support, previous data indicated that the gear housing itself had appreciable vibration amplitudes. The vibratory system was idealized by considering



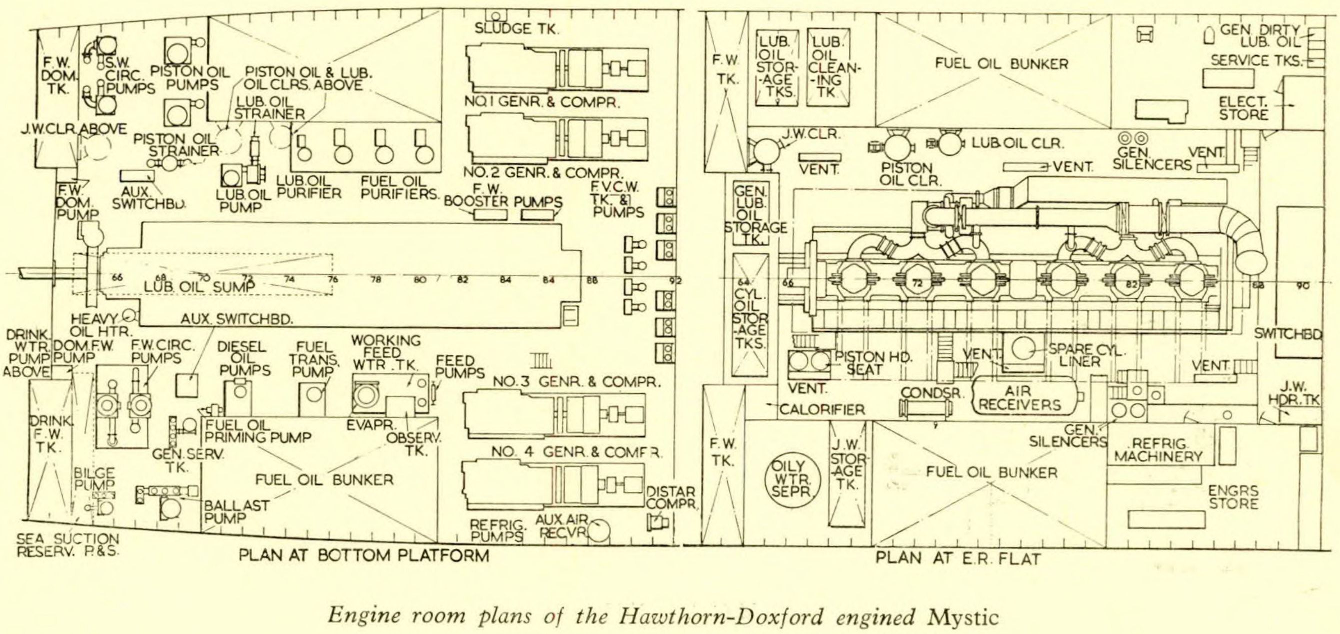
Cargo motorship Scandia, *built by Aalborg Vaerft A/S, for A/S Dampskibsselskabet D.F.K., Copenhagen* only the rotating parts. The propulsion unit was considered as a two-mass, two-spring system. The springs in the system were K_1, the line shaft, and K_2, the thrust bearing support. The masses were M_1, the propeller and half the line shaft, and M_2, the gears and half the line shaft. Since the magnitude of the thrust-bearing support spring-constant was unknown, the system was analysed in terms of thrust-bearing spring-constant and natural frequency. It was indicated that K_2 in the range of $2\frac{1}{2}$ to $3\frac{1}{2} \times 10^6$lb. per in. would give a longitudinal critical speed in the operating range. During November 1954, a de-pitched propeller was installed on the U.S.N.S. *Aultman*. The *Aultman* proved to be an excellent test vehicle since a new gear train had been installed a short time previous to this trip and the gear teeth were in very good condition. The data taken on this trip consisted of longitudinal vibration records taken at the points shown in Fig. 1. The instrumentation on this trip consisted of a Westinghouse L.E. Vibrograph. This instrument is a self-contained, hand-held vibrograph which records the vibration wave form on transparent tape. The results of these tests showed the definite presence of a longitudinal critical speed of the propeller, drive shaft, bull gear and low speed pinions, at about 83 r.p.m. of the drive shaft. An inspection of the vibration records showed that the critical speed was the eighth harmonic of the propeller running speed. Thus, when the ship was making 83 r.p.m., the system was vibrating fore and aft at 664 cycles per minute. In this problem there were two basic alterations which could be made stiffer, or a five-bladed propeller could be installed. To make the thrust bearing stiffer would entail a great deal of work. The thrust bearing housing is integral with the gear case. This meant that it would have to be removed from the case and relocated in the shaft alley and a new section of shafting made. This solution would be quite expensive. A more reasonable solution was to install a five-bladed propeller and thus "detune" the system. A five-bladed propeller was installed which was approximately the same weight as the four-bladed propeller. It was found that the critical speed had been removed from running speed and that the amplitude of vibration had decreased greatly at running speed and at the critical speed.—*J. J. Murphy, Marine Engineering/Log, February 1959; Vol. 64, pp. 79-81; p. 132B.*

Cargo Liner with Turbocharged Machinery

The cargo liner *Mystic* has been built by the Burntisland Shipbuilding Co., Ltd., to the order of the Johnston Warren Lines, Ltd., Liverpool (Furness, Withy and Co., Ltd., managers). Designed to carry 10,685 tons d.w.c., including cargo, bunkers, stores, spare gear, feed and domestic water, on a summer freeboard draught of 26ft. $8\frac{1}{8}$in., this vessel has been built under special survey for the highest class of Lloyd's Register and is of partly welded construction. The main characteristics of the ship are:—

Length o.a.	480ft. 0in.
Length b.p.	450ft. 0in.
Moulded breadth	63ft. 3in.
Extreme breadth	63ft. $5\frac{3}{4}$in.
Depth, moulded to upper deck	39ft. 6in.
Depth, moulded to lower deck	30ft. 6in.
Deadweight capacity ...	10,685 tons
Corresponding draught ...	26ft. $8\frac{1}{8}$in.
Gross register	6,656·05 tons
Net register	3,648·07 tons
Underdeck	5,711·24 tons
Service speed	15 knots
MACHINERY	
Make of engine	Hawthorn-Doxford
No. of cylinders	6
Bore	650 mm.
Combined piston stroke ...	2,320 mm.
B.H.P. (continuous service)	8,000
R.P.M.	115
Scavenge pumps	3 lever driven at cylinders 1, 2 and 3
Exhaust gas turboblowers ...	2 Napier MS 500Z/6

There are five cargo holds and 'tweendecks, all naturally ventilated, with two large deep tanks provided in No. 3 hold, these tanks being of welded construction except for the shell seams and the connexion of the frames to the shell. The deep tanks are suitable for the carriage of water ballast, general cargo or oils. Steel centre line bulkheads are fitted in all cargo holds and 'tweendecks and extend to the full height of each space. Built by Hawthorn, Leslie (Engineers), Ltd., the main engine is an exhaust gas turbocharged two-stroke unit of the latest Doxford opposed piston design, equipped to burn high viscosity fuels of up to 1,500 sec. Redwood I at 100 deg. F. It has six cylinders with a bore of 650 mm. and a combined piston stroke of 2,320 mm., the continuous service rating being 115 r.p.m. Three lever driven scavenge pumps are retained, these being at cylinders 1, 2 and 3, and draw from the scavenging air manifold, which is supplied by two Napier-type MS 500Z/6 exhaust



Engine room plans of the Hawthorn-Doxford engined Mystic gas blowers at the back of the engine, each supplied with exhaust gas from three cylinders. An independent lubricating oil system is provided for the turboblower bearings, this comprising a working and a standby pump of Hamworthy manufacture, two oil filters and a cooler. The six separate outlets from the main fuel pump are combined in a valve block adjacent to the pump, with a shut-off for each pump delivery. A single $\frac{3}{4}$-in. fuel delivery line serves all cylinders, this line extending from the valve block along the full length of the entablature. From this main line is taken a $\frac{5}{16}$-in. bore branch with a shut-off valve and filter to the timing valve for each cylinder. The engine drives a bronze four-bladed propeller 17ft. 10in. in diameter with a pitch of 15ft. 7$\frac{3}{4}$in., and a developed area of 140 sq. ft., supplied by Bulls Metal and Marine, Ltd. Exhaust gas from the engine is delivered through a Spanner Swirlyflo vertical boiler 6ft. 9in. in diameter and 10ft. 6in. long over the tube plates. The evaporation rate of this boiler is about 7,500lb./hr. of steam at a working pressure of 100lb. per sq. in. In addition, there is a Cochran oil fired boiler 6ft. in diameter and 15ft. 9in. high, with a heating surface of 400ft.^{2} and an evaporation rate of 2,400lb. per hr. with a working pressure of 100lb. per sq. in.—*The Motor Ship, May 1959; Vol. 40, pp. 66-68.*

Cargo Liner with Deck Cranes

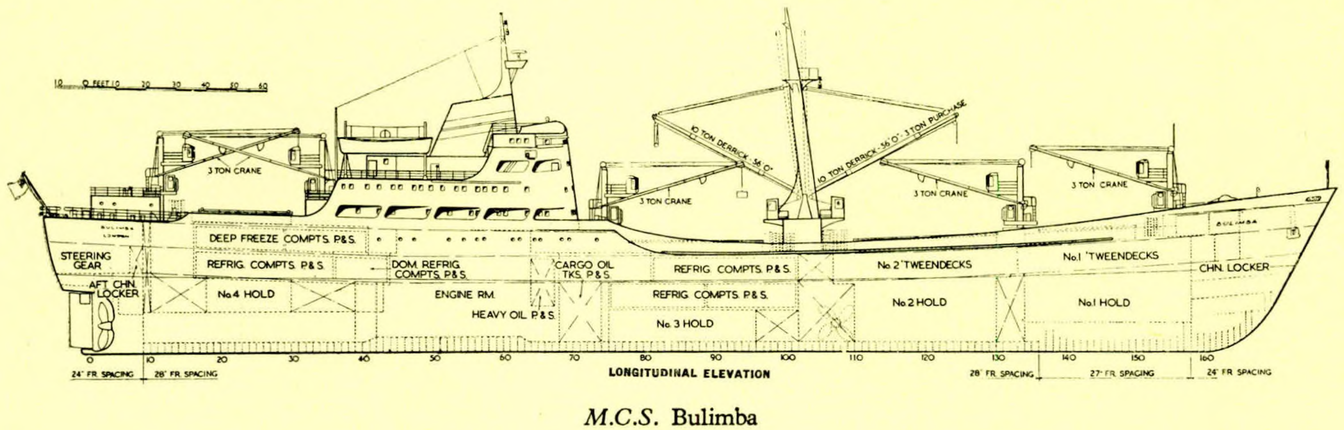
Many new features are incorporated in the design of the *Bulimba,* which is a joint effort between the owners, their consultants, Burness, Corlett and Partners, and the builders, Harland and Wolff, Ltd. Constructed at the builders' Govan shipyard to the highest class of Lloyd's Register and for service between Australia, Asia and the Persian Gulf, the new ship has the following particulars:—

Length, overall	426ft. 0in.
Length, b.p.	395ft. 0in.
Breadth, moulded	59ft. 0in.
Depth, moulded to upper deck	32ft. 6in.
Draught	25ft. 0in.
Corresponding deadweight ...	7,500 tons
Service speed	16 knots
Maximum cont. power ...	5,800 b.h.p.

Although of generally all-welded construction, certain portions of the hull are riveted to suit the shipbuilders' practice. The main riveted members are the stringer angle, sheer strake and bilge strake, while the second and third decks and the deckhouses are also riveted. The arrangement and design of the five, centre line-mounted, 3-ton deck cranes underlines the careful attention that has been given to cargo handling operations. These cranes are ASEA units of the level-luffing type, designed to handle full-rated load from the minimum slewing radius of 15ft. to the maximum of 46ft. Each crane is designed for a hoisting speed on full load of approximately 140ft. per min. and a light hook speed of 310ft. per min. The crane driver's platform and cabin are specially designed so as to give a good view into the hold, as well as an improved view over the bulwarks. The control of each crane's three movements, namely hoisting (or lowering), luffing and slewing, is by the Ward Leonard system. Alternating current from the ship's supply is fed to a crane-mounted converter set consisting of a dual d.c. generator, two smaller d.c. generators and an a.c. driving motor. All three generators are driven by a squirrel cage induction motor designed for direct-on-line starting. The hoisting, luffing and slewing motors are operated by two pedestal mounted master controllers on either side of the crane driver's seat on the control platform. Main propulsion is by a six-cylinder, two-stroke, opposed piston, turbocharged Harland B. and W. Diesel engine with a power output of 5,800 b.h.p. at 118 r.p.m. The cylinder diameter is 620 mm. and the combined stroke of the main and exhaust piston is 1,870 mm. The main engine exhaust gases pass through two Napier type MS.500/4 turboblowers, each arranged to take the exhaust gases from three cylinders, the gas then passing to an exhaust gas boiler. The engine is designed for operation on heavy oil. Alternating current is supplied by four English Electric 350-kW, 440-volt, three-phase, 60-cycle, 0·8-power factor generators, each driven by a six-cylinder, turbocharged, 500-b.h.p. English Electric engine running at 600 r.p.m. A dead front type switchboard is located at middle platform level at the starboard side of the engine room. From the board, the power supply for the engine room auxiliaries is taken to three starter panels. All the motors driving the pumps and compressors are of the squirrel cage, induction type designed for direct-on-line starting. Steam requirements are met by the exhaust gas boiler and a Clayton steam generator, the latter unit being of the fully automatic, oil fired type. For the production of fresh water there is a Maxim double effect, basket type evaporator with an output of 25 tons per day.—*The Motor Ship, April 1959; Vol. 40, pp. 14-17.*

Descaling by Ultrasonic Vibration

The use of high frequency sound pulses to prevent the build-up of scale in land based, fire tube boilers, introduced some five years ago, has proved both efficient and economical. The recent development of this technique for the prevention of scaling-up in shore evaporators brings it within the field of interest of the marine engineer. The Crustex descaling technique is based on the principle of magnetostriction: when ferromagnetic materials such as iron and nickel are subjected to a change of magnetic state they undergo a change in dimensions. If they can be made to undergo such changes in dimensions sufficiently quickly, acoustic waves are set up which can be transmitted through water to knock off the heavy scale that has accumulated in even the most inaccessible places of a boiler or evaporator. The Crustex apparatus consists of two parts: a generator comprising a simple rectifying circuit housed in a dustproof metal box measuring 13in. by 10in. by 6in. and an oscillating head or transducer 2in. in diameter by 5in. in length which is actually fixed inside the boiler. The oscillator can be fitted by means of a connecting pipe directly on to the front plate or shell of a boiler in a low position to ensure



M.C.S. Bulimba

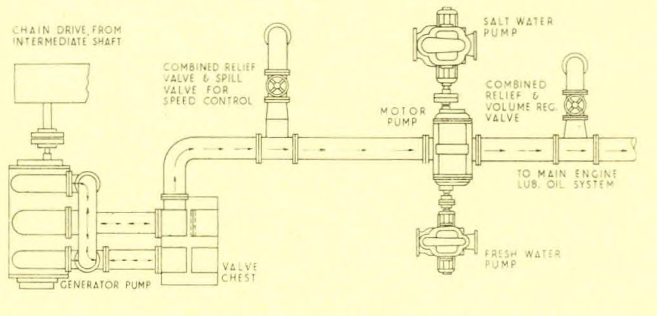
sufficient spreading of the ultrasonic waves without interference from large steam bubbles. When the apparatus is switched on, scale begins to form at first at the usual rate but on reaching a critical thickness of a few thousandths of an inch, it breaks off in small pieces because the fatigue strength of the brittle scale is not high enough to withstand the stresses imposed by the ultrasonic waves. The thin scale formation adhering to all heated surfaces may average about 0·020-in. thick; it appears that a thicker scale formation builds up to as much as 0·060in. and then breaks off. The scale, however, ceases to have firm adherence and, therefore, to act as an insulator in the 0·030–0·040 range. The fragments of scale fall off and can be ejected with the normal blow-down. Trials of the Crustex equipment have been made to study its performance in scale prevention in a sea water evaporating plant at the Aden installation of BP Refinery (Aden) Ltd. The apparatus was in commission in a Weir triple effect sea water evaporating plant. Three runs carried out with the apparatus showed that it was trouble free and needed a negligible amount of maintenance. Heavy scale formed prior to the installation of the equipment was not removed but when it was installed on a scale free effect, a thin hard scale was quickly formed. After 2,920 hours of operation a scale with a thickness of 0·03in. was reached. When the apparatus was applied to a lightly scaled effect (previously operating with anti-sea-scale compound injection) no build-up of scale occurred in 420 hours on the scaled tubes, while there was 0·003in. on the clean tubes. This compared well with a hard scale thickness of 0·025in. in an effect operated for the same period but using anti-sea-scale compound.—*Shipbuilding Equipment, March 1959; Vol. 1, pp. 6-7.*

Trawlers with Multiple Reduction Gears

The first trawler to be fitted with a multiple reduction gear was the *Belgian Skipper,* delivered in September 1953. Since then, 15 similarly fitted trawlers have been built or are under construction in Belgium, mostly powered by Diesel engines of 1,200 to 1,500 h.p. In France, 25 similar trawlers of smaller power have been built. The latest Belgian trawler, the 628 G.R.T. *Pierre,* which was model tested before being designed and built, has the following main dimensions: length overall, 192ft. 9in.; length between perpendiculars, 170ft. 10in.; moulded breadth, 30ft. 10in.; and depth, 17ft. 5in. Its hold capacity is 14,830 cu. ft. With a load of 288 tons of fuel, fresh water, ice and fishing gear, the *Pierre* did 15 knots on trials, while developing less than 1,400 h.p. at the engine coupling flange. The main propulsion engine is a four-stroke supercharged Diesel with a continuous output of 1,500 h.p. at 300 r.p.m. The reverse reduction gear has two ahead and one astern speeds. The ahead speeds are 154 r.p.m. for free running and 113 r.p.m. for trawling. With the astern gear clutch engaged, the propeller runs at 88 r.p.m. The fixed blade propeller has a diameter of 10ft. 11in. The propeller of a trawler must meet the very different working conditions of trawling and free running. Based on the propeller charts of the B4-70 Troost series, the author provides a comparison between a controllable pitch propeller of 10ft. 10in. diameter and a fixed blade propeller of 11ft. 4in. diameter and 11ft. 4in. pitch. This shows that unless the propeller diameter is strictly limited, there is no valid hydrodynamic reason for preferring one type of propeller to the other.—*Paper by A. Chardome, read at the Second World Fishing Boat Congress, Rome, Italy, 5th-10th April 1959.*

Oil Motor Pump Drive

A set of engine cooling and lubricating pumps driven hydraulically from the main engine are to be installed in the oil tanker *Regent Eagle,* 19,000 tons d.w., now under construction by the Blythswood Shipbuilding Co., Ltd. The *Regent Eagle* will be powered by a six-cylinder Doxford type Diesel engine and the hydraulic installation is being supplied and has been developed by Stothert and Pitt, Ltd. The use of hydraulically driven salt and fresh water cooling pumps has previously been largely confined to Danish-built vessels, and the system has been installed in a number of vessels fitted with



General arrangement of hydraulically driven pumps. The generator pump is chain driven from the propeller shaft and is a Stothert and Pitt positive acting, screw displacement pump of their unidirectional flow design

Burmeister and Wain main engines. The installation, which has been built by Stothert and Pitt, Ltd., consists of a generator pump, a motor pump, a salt water pump and a fresh water pump. The generator pump will be located alongside the propeller shaft and will be driven by Renold's chains through a step-up gearbox. The direct drive arrangement offers a considerable saving in fuel by taking the load off the ship's generators. The additional fuel consumed by the main engine is a good deal less than what would have been used in the auxiliary set, due to the higher efficiency. There is also the benefit of simplicity with the direct drive arrangement. The arrangement of the installation is shown on the accompanying drawing. The generator unit consists of a Stothert and Pitt horizontal, positive acting, screw displacement pump of their

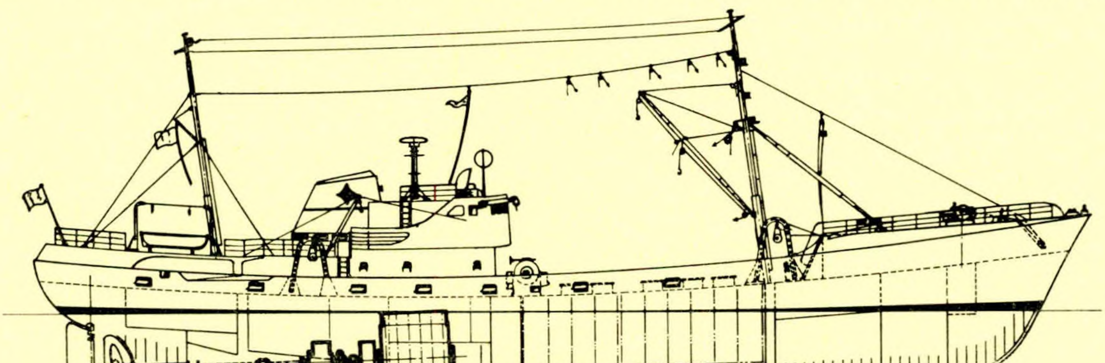
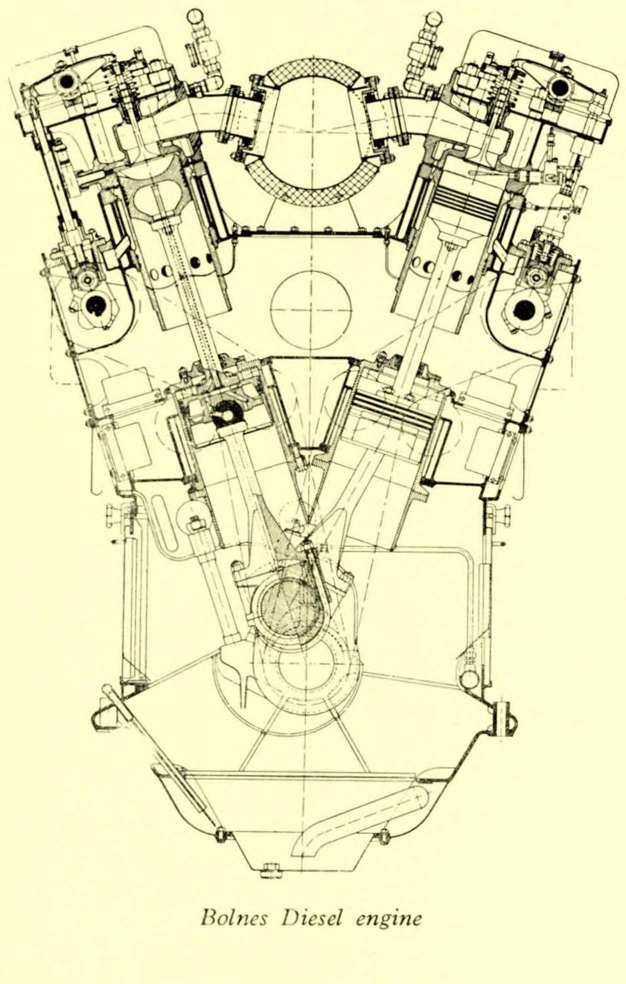


FIG. 1—*Trawler* Pierre

unidirectional flow design, having internal bearings and timing gears, and fitted with mechanical seals. The pump body is split and a pilot operated pressure relief valve with an external exhaust flange is fitted. The speed of the pump is 745 r.p.m. with a discharge pressure of about 300lb. per sq. in., the output being 250 tons per hr. The motor pump is an S. and P. horizontal, positive acting, screw displacement pump having internal bearings and timing gears, with shafts extended at each end for coupling to the water pumps. The suction and delivery branches are in the bottom half of the body, which is split through its centre line, the pump covers being designed to withstand 60lb. per sq. in. working pressure. Two mechanical seals are fitted and the pump is equipped with a relief valve having an external flange for returning oil back to source. This pump receives oil from the generator at approximately 300 lb. per sq. in. and delivers it at 1,450 r.p.m. at 60lb. per sq. in. at a rate of 250 tons per hr.—*The Shipping World, 29th April 1959; Vol. 140, p. 437.*

Dutch V-Type Two-stroke Diesel Engine

The N.V. Machinefabriek "Bolnes" v.h. J. H. van Capellen has developed a V-built two-stroke Diesel engine available in both naturally-aspirated and turbocharged types and in units from six to twenty cylinders. The first engine, a 1,000-h.p. unit, will be placed in the suction dredger *Vlaardingen,* under construction for Adriaan Volker, N.V., where it will drive the sand pump. The new V-built Bolnes engine is constructed in accordance with the standardized system adopted by the builders after the war and which makes use of welded construction on a large scale and of 50-h.p. units enabling the construction of in-line engines ranging between 100 and 500 h.p., that is, two to ten cylinders. For larger outputs twin sets are available. The V-built engine is available in six to twenty cylinder units up to a maximum output of 1,500 e.h.p. at 475 r.p.m., when supercharged. Twin arrangement enables outputs of up to 3,000 h.p. Like the in-line type of engine, the V-built version is of the crosshead type which uses the cylindrical crosshead and guide as a reciprocating scavenge pump. Uniflow scavenging is employed and circulation cooling is achieved by a pipe cooler. The fuel consumption is 170 grammes per h.p. per hr. and lubricating oil consumption 0·8 grammes per h.p. per hr. The bore is 190 mm. and the stroke 350 mm. The engine has an all-welded single-piece frame with box-type girders. The front columns are of steel and can be taken away for the removal of the built-up crankshaft.—*Holland Shipbuilding, January 1959; Vol. 7, p. 30.*



Bolnes Diesel engine

French Ore Carrier

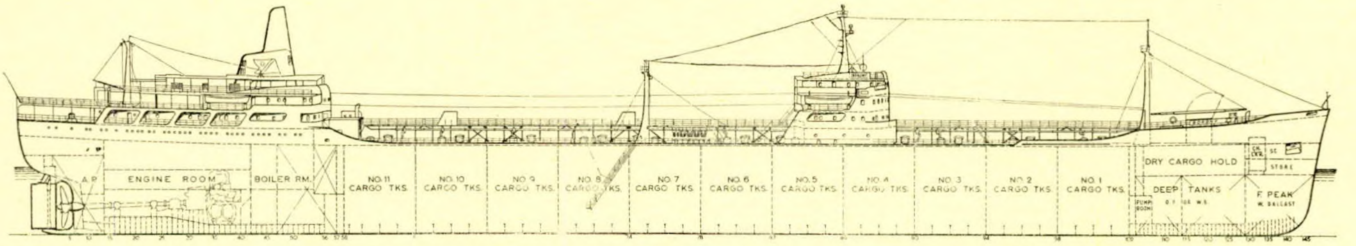
The 5,800-ton d.w. ore carrier *Jacqueline* built by the Chantiers et Ateliers de Provence for L'Union Industrielle et Maritime, is fitted with a 3,000-b.h.p. Provence-Doxford main engine. Two sets of bipod masts carry the eight 5-ton derricks serving the four self-trimming hatches. These are arranged in two groups separated by a deep tank. The hatch coamings extend continuously from the forecastle to the bridge. Constructed to comply with the rules of Bureau Veritas, the *Jacqueline* has an overall length of 111 metres, a breadth of 15·7 m. and a draught of 7·8 m. Current for the engine room auxiliaries and the deck machinery is supplied by three 150-kW Diesel generators and one of 40 kW. All the accommodation is arranged at the after end of the ship and individual cabins are provided for each member of the crew. Mechanical ventilating equipment is fitted and accommodation heating is by means of steam radiators.—*The Motor Ship, March 1959; Vol. 39, p. 579.*

Dutch-built Tanker for Norwegian Owners

The Norwegian shipowners, Fred. Olsen and Company, have taken delivery of the fourth of a series of oil tankers of about 39,000 tons d.w. This vessel, the *Borgny,* has been built by the Netherlands Dock and Shipbuilding Company, Amsterdam, where the sister ships *Naess Commander, Rein* and *Tank Earl* were also constructed. An unusual feature of the *Borgny* is the streamlined funnel which differs considerably in shape from the conventional design of funnel used for tankers. It is stated that the funnel is so designed to avoid soiling the decks due to the frequent soot blowing found necessary with this type of ship. The funnel is not unlike those fitted to the North Sea passenger liners *Blenheim* and *Braemar,* both of which are owned by Fred. Olsen and Co., Oslo. The *Borgny* is a single screw vessel powered by steam turbines and has a speed of $17\frac{1}{2}$ knots. Her principal particulars are as follows:—

Length o.a.	700ft. 0in.
Length b.p.	674ft. 0in.
Breadth, moulded	93ft. 6in.
Depth, moulded	48ft. 0in.
Draught	36ft. $2\frac{3}{16}$in.
Deadweight	38,830 tons
Displacement	50,470 tons
Gross tonnage	24,978 tons
Net tonnage	14,746 tons
Dry cargo capacity	1,841,147 cu. ft.
Fuel oil capacity	4,496 tons
Lubricating oil capacity ...	36·6 tons
Machinery output	17,500 s.h.p.
Fresh water capacity ...	584 tons
Speed	$17\frac{1}{2}$ knots

The *Borgny* has been constructed on the longitudinal system of framing. The cargo section is divided into 33 separate compartments consisting of 11 centre tanks and 22 wing tanks. The longitudinal bulkheads are of the horizontally corrugated type and the transverse bulkheads are vertically corrugated. Forward and aft of the cofferdams located at either end of the cargo tanks the transverse system of framing has been employed. The vessel is mainly of welded construction. The four deep tanks forward are used for the carriage of fuel oil. Two steam driven pumps, each with a capacity of 100 tons per hr., are

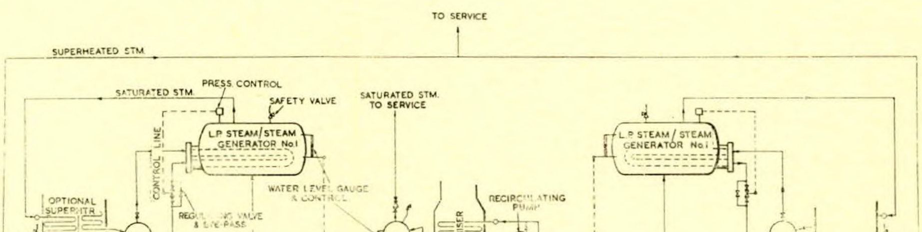


Oil tanker Borgny, *38,830 tons d.w., built by the Netherlands Dock and Shipbuilding Company, Amsterdam, for Fred Olsen and Company, Oslo*

installed in the forward pump room for handling this fuel oil as well as the water ballast carried in the forepeak. In addition to the deep tanks, fuel oil is carried in the starboard and port wing bunker tanks, in the settling tanks aft of the main pump room and in the double bottom tanks under the engine room. Lubricating oil and fresh water is also carried in double bottom tanks, and boiler feed water and drinking water in tanks on the upper 'tweendeck. A feature of the *Borgny* is the installation of two completely separate radar sets. The main propelling machinery in the *Borgny* consists of two N.D.S.M./Parsons steam turbines working in series for ahead duty. These are an h.p. and an l.p. turbine, the h.p. turbine being of the impulse reaction type, the l.p. turbine of the single-flow reaction type. The reaction section of the h.p. turbine is fitted with axial clearance blading and the l.p. turbine with radial clearance blading. An astern turbine consisting of two 3-row impulse wheels is incorporated in the l.p. casing. The double reduction, single-helical, articulated gearing is of the locked train type in which tandem secondary trains connect the high speed pinions to the main gear wheel. The gears were supplied by the Kon. Mij. "de Schelde", Flushing. The turbines have been designed to develop a normal ahead power of 17,500 s.h.p. at 98 r.p.m., and a maximum continuous output of 19,250 s.h.p. at 101 r.p.m. The total astern power is about 50 per cent of the normal ahead power. Steam is obtained from two N.D.S.M./Babcock and Wilcox integral furnace boilers, each having a continuous evaporation of 80,000lb. per hr. and a maximum evaporation of 100,000lb. per hr. The working pressure and steam temperature at superheater outlet are 600lb. per sq. in. and 800 deg. F. respectively. Water drum desuperheaters capable of desuperheating about 30,000lb. per hr. from 800 to 575 deg. F. are fitted to each boiler. Automatic combustion control equipment of Bailey, U.S.A., make is fitted. A Barr and Stroud smoke indicator has been fitted to indicate the density of exhaust smoke passing through the boiler uptakes. Use is made of Weir's closed feed systems. This part of the installation consists of a main closed feed system comprising two electrically driven condensate extraction pumps, two steam jet air injectors, glands condenser, deaerating vessel, h.p. feed water heater, an electrically driven three-throw reciprocating harbour feed pump having a capacity of 8 tons per hr. and two turbine driven three-stage main boiler feed pumps provided with cut-in gear and having a capacity of 200,000lb. per hr. Two turbogenerator set closed feed systems are also installed, each comprising an electrically driven, water extraction pump and a steam jet air ejector. The engine room equipment also includes an l.p. steam/steam generator with a capacity of 50,000lb. of saturated steam per hr. and two Monobloc l.p. evaporators, each with a capacity of 40 tons of fresh water per 24 hours. Electricity for power and lighting is supplied by two geared Werkspoor turbo-alternators, each having an output of 690 kVA, 450 volts a.c., 3-phase, 60 cycles and with a power factor of 0·8. In addition, there is one Diesel driven alternator with an output of 200 kVA. The Diesel unit is a six-cylinder Stork-Ricardo engine of 240 b.h.p. at 600 r.p.m.—*The Shipping World, 11th March 1959; Vol. 140, pp. 278-280.*

Exhaust Gas Boiler for 15,000-b.h.p. Engine

An exhaust gas steam raising plant to operate in conjunction with a 15,000-b.h.p. Diesel engine has been designed by John Thompson Water Tube Boilers, Ltd., which will provide 14,500lb. of steam per hr. at 150lb. per sq. in. The major portion of the steam will be used to drive a 450-kW turbo-



Diagrammatic arrangement of waste heat unit and auxiliary steam system alternator. In order that the plant will be able to handle exhaust gas at an inlet temperature of 630 deg. F. it has been necessary to design a new type of exhaust gas boiler which would extract the required heat without reducing the exhaust temperature to a level at which corrosion might occur. It will be seen from the accompanying diagram that a recirculating pump is placed between the economizer outlet and the economizer inlet headers. This is because with a feed water temperature in the region of 130 deg. F. it is necessary to obtain a reasonable metal temperature at the top of the economizer and a certain amount of recirculation is necessary to raise the feed temperature to 250 deg. F. If, however, the temperature of the feed could be raised by other means, such as the use of the main engine cooling water system, the recirculating pump would no longer be required. Without fitting an economizer the waste heat boiler evaporates 10,500lb. of steam per hr. at 150lb. per sq. in., but with the economizer an additional 4,000lb. per hr. of steam is available, making a total of 14,500lb., or approximately 6½ tons. The waste heat unit is shown with a separate steam/water drum although the low pressure steam/steam generator could be used as a steam and water receiver from the waste heat unit. Such an arrangement, while perfectly feasible, would involve the use of several isolating valves and a special connexion for recirculation of the waste heat unit economizer. It is intended that the new exhaust gas boiler unit will be used in conjunction with the John Thompson dual pressure oil-fired auxiliary boilers, two of which would supply all the steam required for the cargo pumps of, for example, a 50,000-ton d.w. motor tanker. At sea, if required, the boilers would meet the cargo oil tank heating requirements.—*The Motor Ship, March 1959; Vol. 39, p. 596.*

Auxiliary Boilers for Motor Tankers

By combining two well-tried steam generating units already in supply to marine contracts, John Thompson Water Tube Boilers, Ltd., Wolverhampton, have evolved the John Thompson-La Mont dual pressure boiler. The units forming this combination are a forced circulation boiler and a steam/steam generator and by building both pieces of equipment into one integral boiler, considerable savings in both weight and space are obtained. High pressure steam is generated in a water cooled combustion chamber with suitable evaporator elements and the mixture returned to the high pressure drum. This steam, at a pressure of 500lb./in.^{2} is then led to the inlet branch of the "U" tubes in the steam/steam generator and the drains are passed to the boiler circulating pump. The low pressure steam produced in the steam/steam generator is dried in a superheater fitted in the gas pass of the oil fired boiler uptake. Any contamination in the returns (condensate) of the low pressure system from heating coils or cargo pump condenser will be confined to the external surfaces of the "U" tubes without affecting the heating surface of the oil fired La Mont boiler. Fluctuations in the high pressure steam circuit caused by the demands on the steam/steam generator operate the oil fuel control valve to the burners so that the entire steam demand is under automatic control. The range of John Thompson pressure boilers extends from 10 to 15 tons per hr. and various combinations may be made to obtain the most economical layout. In the case of a 30,000-ton tanker, two 10 tons per hr. boilers would meet the estimated steam demand of the cargo pumps, feed pumps and condensate pump. An important feature of these units is their low weight, as the following particulars indicate.

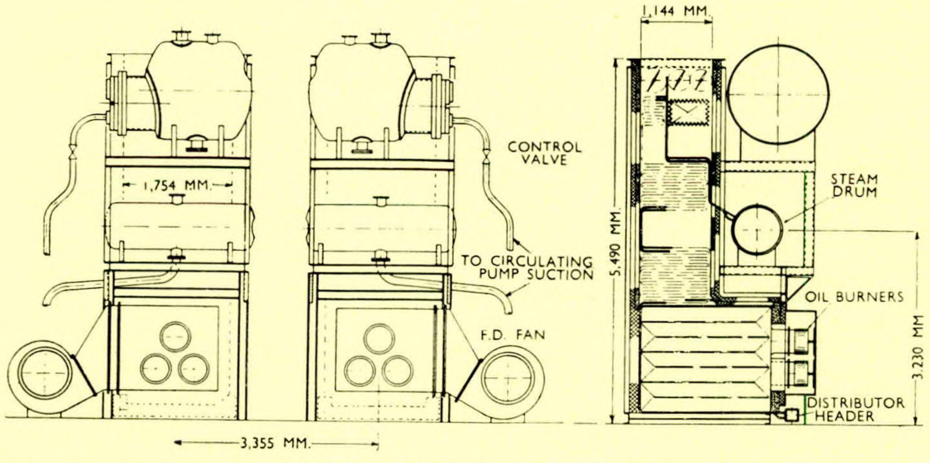
Estimated weights—

Evaporation	22,100lb./hr.	10 tons/hr.
Primary steam pressure	500 p.s.i.	35 kg./cm.^{2}
Working pressure ...	200 p.s.i.	14 kg./cm.^{2}
Superheat	45 deg. F.	25 deg. C.
Feed temperature ...	100 deg. F.	38 deg. C.
Primary and secondary units	26 tons	26,426 kg.
Burners	0·5 tons	508 kg.
Pumps and heaters ...	2·0 tons	2,032 kg.
Fans and motor ...	1·0 ton	1,016 kg.
Circulating pump ...	1·0 ton	1,016 kg.
	30·5 tons	30,998 kg.

The total weight of the auxiliary boiler arrangement to meet the steam requirements of a 30,000-ton Diesel tanker would be approximately 60 tons, compared with nearly 120 tons for a three-Scotch boiler installation of similar capacity.—*The Motor Ship, February 1959; Vol. 39, pp. 554-555.*

World's Largest Tanker

The sea trials of the 104,520-ton d.w. tanker *Universe Apollo* were completed on 29th January 1959. The trials were deemed highly successful, and the vessel was delivered on 31st January by her builders, the Kure Shipyard Division of National Bulk Carriers, Inc., of New York to Universe Tankships of Liberia, a subsidiary of National Bulk Carriers, Inc. The tanker is basically of all-welded construction, and particular care was taken with the welding involved. The butt welding of sections on the berth was all done after preheating. Edge preparation of butted ends was all of Vee-type pointed inwards, and X-type edges were not used. After welding, the intersections of seams and butts were inspected by X-rays. The Tee-welding of the longitudinal bulkheads to the ship's bottom and decks was done with U-type edge preparation, using preheating and low hydrogen electrodes. The main turbines and gearcase are installed right aft, with the engineers' control and alarm panels on the same level and adjacent to them, and the propeller shaft in full view below. The principal



Arrangement of two John Thompson dual pressure boilers. The dimensions shown are approximate and have generally been reduced particulars of the high and low pressure turbines are as follows:—

High pressure turbine—	
Horse power ...	25,000 s.h.p.
Speed	6,090/100 r.p.m.
Steam pressure ...	585lb. per sq. in. gauge
Steam temperature ...	850 deg. F.
Stages	9
Low pressure turbine—	
Horse power ...	25,000
Speed	4,050/100 r.p.m.
Steam pressure ...	50lb. per sq. in. gauge
Steam temperature ...	410 deg. F.
Stages	9

Installed on the next engine room level above the main turbines, the three Foster Wheeler boilers are arranged side by side. The main generators and switchboard and condenser distillers are on the same level as the boilers. The main generators are two Allis-Chalmers alternators driven at a speed of 1,200 r.p.m. by turbines supplied by the Terry Steam Turbine Co., Hartford, Connecticut. They are each rated at 800 kW, 1,000 kVA, 450 volts, 1,285 amperes, 60 cycles. An emergency power plant is enclosed in a steel deckhouse located near the funnel. It consists of a Caterpillar Diesel-electric set, with a continuous rating of 175 kVA, 140 kW, 460/230 amperes, 60 cycles. Supplied by John Hastie and Co., Ltd., of Greenock, Scotland, the steering gear is of the electro-hydraulic four-ram gear type. It is housed in a separate compartment, astern of the main engine. Two bow and two stern anchors are provided. The bow anchors weigh 18·5 tons and have 390 fathoms of $3\frac{7}{8}$-in. cable. The stern anchors are smaller (15,000lb.) and are secured with 300 fathoms of $2\frac{9}{16}$-in. cable. The stern anchor windlasses have a winding load of 88,733lb., a warping load of 20,000lb. and a speed of 30ft. per min. The bow anchor windlasses are rated at a capacity of 125,000lb. and 30ft. per min. For loading and discharging, a bank of three pipes and two banks each of five are provided on the port side of the deck and two banks each of five pipes on the starboard side. A samson post and 8-ton boom and winch are available at each bank to handle couplings to shore pipelines. There is also a samson post with 5-ton and 1·5-ton booms on each side of the poop deck. Each of the four cargo pumps is powered by a 1,000-s.h.p. turbine, which is driven by steam from the main boilers. It is estimated that the pumps will be able to discharge a full cargo of oil within 30 hours, a period that also would allow time for stripping. The main boilers also supply steam for the main feed pumps, generators, forced draught fans and deck machinery, as well as for heating and cleaning the tanks.—*The Shipping World, 4th March 1959; Vol. 140, pp. 259-262.*

Supercharger for Pressure Fired Boiler

The supercharged boiler cycle is attractive for marine propulsion in that it offers considerable size and weight saving over a conventional steam cycle. In this cycle the supercharger may be designed in conjunction with the boiler to produce external power or to operate as a self-sustaining unit without net power output. A self-sustaining gas turbine supercharger is a particularly attractive method of supercharging. The supercharging compressor is driven by an integral gas turbine utilizing energy from boiler exhaust gas. The supercharger supplies no output power, and is a complete unit in itself with no connexion to output shaft. Since the gas turbine supplies only enough power to drive the compressor, inlet temperatures are low and critical materials are unnecessary. The exhaust temperature is also low, so that an economizer is not necessary to utilize available energy. Efficiencies of compressor and gas turbine are not critical. Control of cycle is accomplished easily by bypassing gas around the turbine. Fig. 1 shows a cycle diagram for this type of power plant and illustrates that the supercharger may be considered as a "rotary air preheater", with energy transfer along the shaft rather than through surfaces. In distinction from aircraft gas turbine practice, a boiler supercharger is

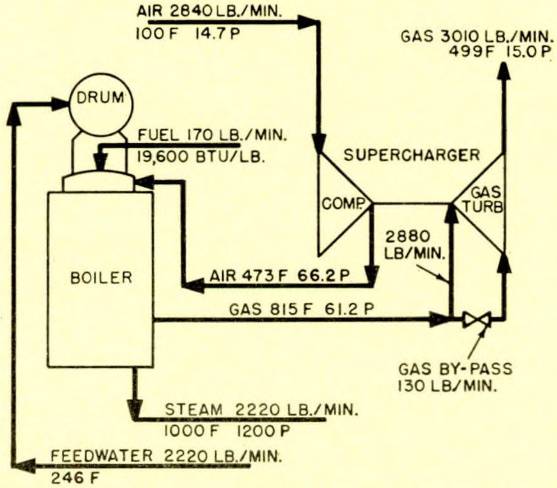


FIG. 1—*Cycle diagram. P = pressure, lb. per sq. in. F = temperautre in deg. F.*

designed with the emphasis on long life and accessibility for maintenance in line with usual industrial and marine requirements. In addition, all external connexions (air supply, stack, boiler connexions) must be ducted with low velocities. The latter, coupled with the necessity to provide accessibility for bearing replacement without dismantling casings, are the basic criteria establishing the overall size of the machine. For the typical axial flow boiler supercharger, the rotor dimensions have little effect on the overall machine size. Contrary to power gas turbine practice, the boiler supercharger is required to operate over a wide speed range at good efficiency. This affects the aerodynamic and mechanical design particularly with respect to stall and surge operation, and with respect to avoidance of critical speeds in the operating range. For marine service, in contrast to industrial service, a small, lightweight unit is desirable since space and weight are limited. An eleven-stage axial flow compressor supplies 40,000 c.f.m. air to the boiler at a pressure ratio of 4·5 at full load. Inlet conditions are 14·7lb. per sq. in. (abs) and 100 deg. F. The full load speed is 9,160 r.p.m. The compressor must operate safely and efficiently at speeds as low as 50 per cent of full load, which means that the compressor must be able to operate under conditions of rotating stall for considerable time. Avoidance of serious blade vibration due to rotating stall was an important consideration, so a bleed-off after the fourth stage was provided to increase flow through the inlet stages at low speeds. This reduces angles of attack and stall range. First four stationary blade rows were made adjustable so that stall patterns could be altered by changing angles. Provision was made for an air jet directed radially outward from the first-stage inlet hub in order to give some measure of control over the stall characteristics. The blades were designed to have high fundamental natural frequencies so as to avoid resonance with stall frequencies or their lower harmonics. Blades for the first three stages were chosen to operate at below their most efficient angles of attack at design speed, to provide more range between conditions and stall. The turbine is a two-stage axial flow reaction machine. Its rotor is integral with that of the compressor, and stator blade holders are housed in the same external casing. The turbine is designed for a flow of 48lb. per sec. at 61·2lb. per sq. in. (abs), 815 deg. F., though on test temperatures as high as 950 deg. F. have been handled. The design internal efficiency is 0·86.—*Paper by R. C. Reisweber, J. W. Glesner and J. R. Shields delivered at 1958 A.S.M.E. Gas Turbine Division Meeting. Abstract, Gas and Oil Power, January 1959, Vol. 54, pp. 16-18.*

Indirectly Heated Air Preheater

The indirectly heated air preheater arrangement shown in Fig. 1 is of the type in which water is circulated through

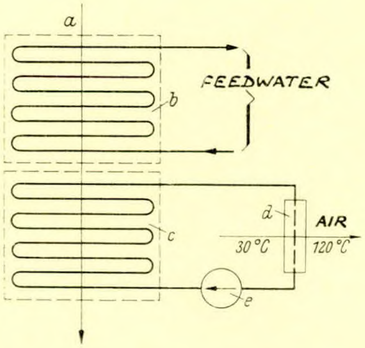


FIG. 1 (above)—*Diagrammatic arrangement of an indirect air preheater*

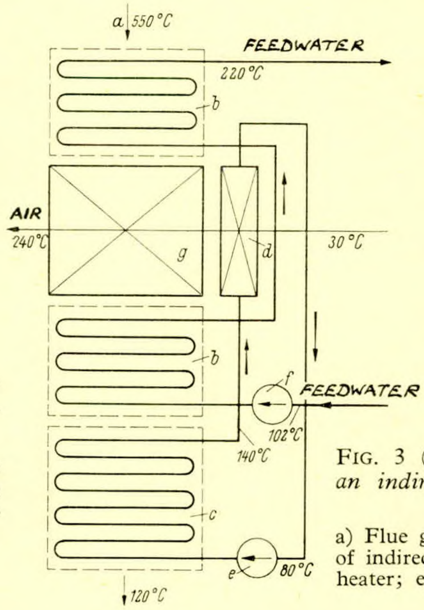


FIG. 2 (right)—*Diagrammatic arrangement of a combination flue-gas air heater with indirect air heater*

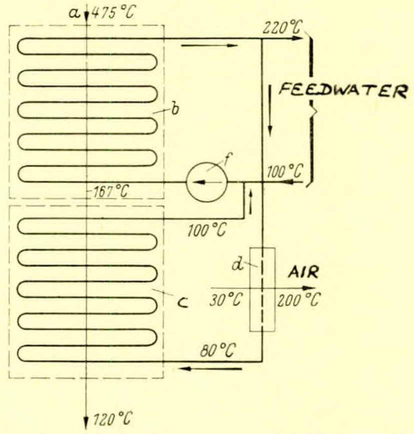


FIG. 3 (above)—*Diagrammatic arrangement of an indirect air heater with circulating water passing through economizer*

a) Flue gas entry; b) Economizer; c) Water heater of indirect air heater; d) Fin-tube type indirect air heater; e) Circulating pump; f) Feedwater pump; g) Flue-gas type air heater.

a tube bundle (c) located in the flue gas pass of a boiler after the economizer (b). This water, which is circulated in closed circuit by means of a pump (e) is used to transfer heat to the air in the air heater (d). The air preheater tubing is of the fin tube type. Assuming a water temperature of 140 deg. C. (284 deg. F.) at the air heater inlet, and a water temperature of 70 to 80 deg. C. (158 to 176 deg. F.) at the air heater outlet, the combustion air can be preheated to 120 deg. C. (248 deg. F.). This arrangement was developed some ten years ago and is still used in Swedish industrial plants. Its advantages are that leakage of air from the air side into the flue gas side of the air preheater is absent, and that because of the relatively high exit temperature of the water from the air heater, corrosion on the air side cannot occur. Preheaters of this type can be built for water temperatures up to 200 to 220 deg. C. (392 to 428 deg. F.). A mixed system installed in a boiler of 176,000lb. per hr. steam output is shown in Fig. 2. In this case it was not possible to use the flue gas heat content available for water preheating without incurring steaming. In addition to the indirect air heater system comprised of the tube bundle (c), the air heater (d), and the circulating pump (e), a flue gas type air preheater (g) is provided, which heats the air to a final temperature of 240 deg. C. (464 deg. F.). Here again, the water temperature at the air heater outlet is 80 deg. C. (176 deg. F.) so that the danger of corrosion is excluded. A disadvantage of this arrangement is its relatively high cost. In the latest design, shown in Fig. 3, the circulating water of the first stage leaves the air preheater at 80 deg. C. (176 deg. F.) and is heated in the tube bundle (c) to 100 deg. C. (212 deg. F.). It is then introduced into the feed-water stream which is at a temperature of 100 deg. C. (212 deg. F.) at the suction side of the feed pump supplying the economizer (b). The water exit temperature can thus be as high as 220 deg. C. (428 deg. F.) depending upon the boiler pressure and flue gas inlet temperature at the inlet side of the economizer. Water at 220 deg. C. (428 deg. F.) for supply to the indirect air heater is drawn off at the economizer outlet. In this way, an air temperature of 200 deg. C. (392 deg. F.) can be obtained. By controlling the amount of water drawn off at the economizer outlet, a degree of flexibility is achieved, which facilitates temperature equalization. An important advantage of this system is that the total flue gas swept heating surface is smaller than would be required for a system employing a flue gas-heated air preheater.—(*BWK*, December 1958; Vol. 10, pp. 569/571.)—*Engineering and Boiler House Review, March 1959; Vol. 74, p. 92.*

Danish-built Oil Tank Motorship

One of the most interesting features of the oil tank motorship *Haukanger,* constructed for Messrs. Westfal-Laren and Co., A/S., of Bergen, by Burmeister and Wain, of Copenhagen, is her classification, +1.A.I.F. The vessel has been built to the requirements of Det Norske Veritas and is the first from Messrs. Burmeister and Wain's shipyard to have the letter "F" added to the class designation. This indicates that she fulfils the many precautions against fire demanded by Det Norske Veritas for vessels of this type. The principal dimensions of the *Haukanger* are:—

Length, b.p.	534ft. 10½in.
Breadth moulded	71ft. 10in.
Breadth moulded to upper deck	40ft. 1in.
Summer draught	30ft. 10in.
Corresponding deadweight, tons (about)	19,450
B.H.P.	8,750
Corresponding r.p.m. ...	115
Speed on trials in laden condition, knots	15·5

Welding has been widely used throughout the *Haukanger,* the plating, decks, bulkheads, frames and beams being fully welded. Longitudinal framing has been adopted for the centre as well as the side tanks. Bunker fuel oil is stored in deep tanks under the fore hold and in deep tanks in the forward part of the engine room, as well as in the double bottom, in which there are also tanks for Diesel oil, lubricating oil and feed water. The cargo piping system consists of one 12-in. main pipeline through the side tanks and one 14-in. main pipeline through the four aftermost side tanks (with a connexion to the first main pipeline amidships), and 10-in. suction lines. In the main pump room there are four steam driven vertical duplex compound cargo pumps, each with a capacity of 500 tons per hr., and one steam driven bilge pump of about 50 tons per hr. capacity. In the pump room forward, one ballast pump and one transfer pump are situated, each of which has a capacity of about 50 tons per hr.; both pumps are steam driven. The propelling machinery has been constructed by the shipbuilders and consists of a B. and W. single acting, two-stroke cycle, crosshead type, turbocharged Diesel engine developing 8,750 b.h.p. at 115 r.p.m.; the cylinder diameter is 740 mm. and the stroke 1,600 mm. The main engine is arranged for running on heavy oil. Steam at a working pressure of 180lb. per sq. in. for cargo heating, deck auxiliaries, etc., is supplied by two oil fired watertube boilers and one exhaust gas boiler. Electric current is provided by two B. and W. type 25-MTBH-40, single acting, four-stroke cycle, five-cylinder, turbocharged Diesel engines, each direct coupled to an a.c. dynamo of 355 kVA. There is also a steam driven generator of 125 kVA.—*The Shipbuilder and Marine Engine-Builder, February 1959; Vol. 66, pp. 100-101.*

Location of Temperature Rise in Engine Crankcases

A sensitive instrument for detecting temperature rise in any of the main bearing and main working surfaces within the crankcases of Diesel or petrol engines has been developed by the Graviner Manufacturing Co., Ltd. The apparatus is suitable for installation on all types of Diesel and petrol engines up to 500 h.p. per cylinder, either supercharged or normally aspirated, whether direct or remote-controlled, up to a maximum of 3,000 h.p. The detector is highly suitable for use on auxiliary generators or on the main propulsion engines of smaller vessels. An advantage is that a warning signal may be located, if necessary, away from the apparatus in the engine room, so that it can be ranged alongside other remote control equipment, for example in the wheelhouse. The Graviner detector operates on the principle of measuring the density of oil mist drawn continuously through two separate tubes of precisely similar dimensions. A beam of light projected down the axis of both tubes energizes two photo-electric cells located at the ends of the tubes from the common light source. The electrical output from each photo-electric cell is proportional to the density of light falling on the surface of each cell and, as their output is opposed electrically, no current flows when the oil mist column contained in the tubes is of equal density. However, when a difference occurs in the density of the mist contained in one tube relative to the other, the light beam in that tube becomes more obscured and, consequently, the system becomes electrically out of balance. An electric current then flows and operates a sensitive relay which in turn causes an audible and visible warning to occur when the differential e.m.f. reaches an optimum value. The ability of the detector to measure the extremely small quantity of oil mist associated with a corresponding rise in temperature, provides a continuous safeguard against any mechanical trouble which might arise from oil starvation or dilution; in fact, from any set of circumstances which, if allowed to continue, would utimately lead to a major breakdown. This means that apart from the detection of overheated rotating or reciprocating engine components, the high sensitivity detector will quickly sense a broken piston ring. Furthermore, the extreme sensitivity of the apparatus provides positive protection against crankcase explosion by warning against generation of a dangerous concentration of oil mist within the crankcase.—*The Shipping World, 8th April 1959; Vol. 140, p. 362.*

Pressure-charged Engines

Two medium speed Diesel engines in the VCB range manufactured by Messrs. Ruston and Hornsby, Ltd., of Lincoln, have recently been pressure charged and are now known as class VCBX engines. Available in five and six-cylinder sizes, these 5 and 6VCBX engines have a bore of 8in. and a stroke of 10¾in., providing a power range of 255 to 330 b.h.p. (B.S. rating) at speeds of 600/650 r.p.m. Based on the well proved VCB engine, and incorporating an exhaust turbocharger, the up-rated engines extend the overall power range of the VCB class to 350 b.h.p., giving a total coverage of 102 to 330 b.h.p. in six engine sizes of the same cylinder dimensions, with a wide measure of interchangeability of components between the normally aspirated and pressure charged engines. The pressure charger employed consists of a single-stage centrifugal blower driven by an exhaust gas turbine and is air cooled. Mounted on the exhaust side of the engine, the pressure charger is lubricated from the main engine lubricating oil system. Apart from embodying a turbocharger, and the arrangement of the piston and camshaft to suit the timing of a pressure charged engine, the VCBX class is the same as the VCB engines, which enables complete component interchangeability to be maintained. As well as providing an extended power range in six engine sizes, with interchangeable components, the pressure charged units enable a lighter power unit to be installed where weight is an important factor. The pressure charged engine weighs little more than the equivalent size normally aspirated engine, giving a most favourable power/weight ratio for an engine of its type. The 5VCBX weighs 6 tons, and the 6VCBX, 7 tons. The class VCBX pressure charged engines are also suitable for marine propulsion or for auxiliary duties and are designated VCBXM and VCBXZ. The basic details of these types are given in Tables I and II.

TABLE I—VCBXM MARINE PROPULSION ENGINES

Engine	*R.p.m.*	*5VCBXM*	*6VCBXM*
Maximum service h.p. at gearbox output coupling	650	256	307
	600	238	285
Maximum continuous service h.p. at gearbox output coupling	650	230	277
	600	213	256

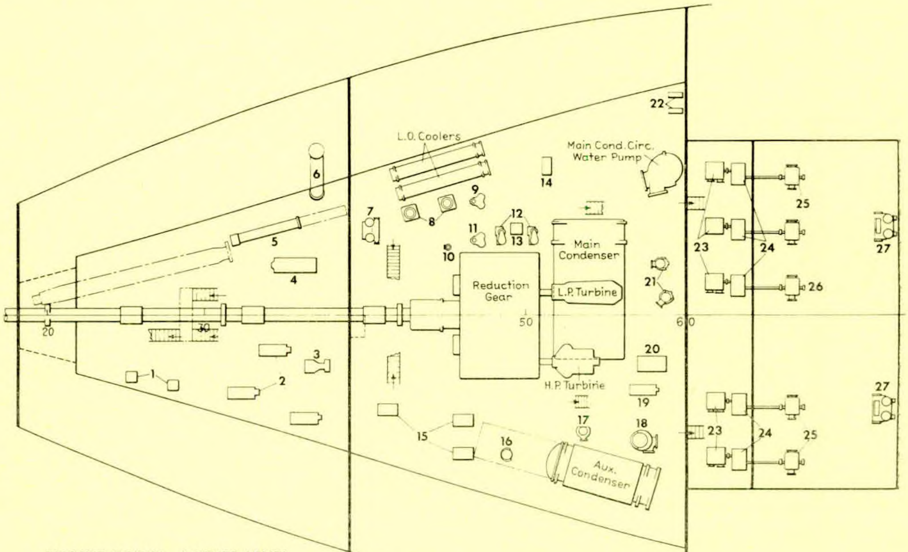
TABLE II—VCBXZ MARINE AUXILIARY ENGINES

Engine	*R.p.m.*	*5VCBXZ*	*6VCBXZ*
Continuous service h.p. ...	650	276	330
	600	255	306

—*The Shipbuilder and Marine Engine-Builder, February 1959; Vol. 66, p. 113.*

American-built Supertanker

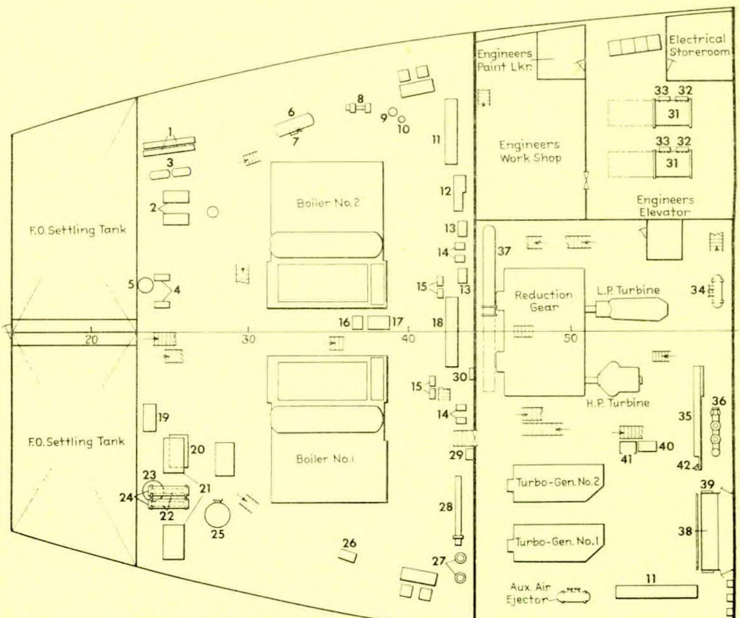
The 810-ft. long 60,000-d.w. tanker *Sansinena* was built by the Newport News Shipbuilding and Dry Dock Company for the Barracuda Tanker Corporation. Its displacement of 77,000 long tons places it among the top of the world's large commercial vessels. In fact, at the time of delivery, it was the largest commercial vessel built in the Western Hemisphere. The *Sansinena* is the first of three tankers of similar size built by the Newport News Shipbuilding and Dry Dock Company for Barracuda. The other two are the *Torrey Canyon,* which was delivered in January 1959, and the *Lake Palourde,* which will be delivered later this year. The general arrangement follows the arrangement which has become typical for large tankers. The peaks are piped for salt water ballast. Forward, there is provision for dry cargo on the upper and second decks served by 5-ton booms through a hatch on the forecastle deck. The cargo pump room is located at the after end of the cargo tanks. Its cargo oil space is divided into 12 tanks by athwartship bulkheads into centreline tanks and port and starboard tanks. No. 4 centreline tank and Nos. 5 and 7 port and starboard wing tanks are piped for ballast only. Machinery is, of course, located aft, the boiler room being aft of the engine room and above the auxiliary machinery room. The vessel is generally of welded design except for crack-arresting, riveted connexions. The sheer strake is connected to the upper deck by a riveting strap welded to the upper deck and riveted to the sheer strake. There are four riveted seams in the upper deck, two in the bottom shell, and the top and bottom of the bilge strake also is riveted. Bilge keels have been eliminated on this vessel. Framing within the tank spaces is run longitudinally with transverse framing at the ends of the vessel. The steering equipment aboard these vessels is of the double opposed ram, electro-hydraulic type. This steering gear incorporates the use of Hele Shaw variable and reversible flow discharge pumps. These servo-controlled pumps are of the latest design and are driven by 75-h.p. electric motors. Control from the bridge is accomplished by means of a "Hydrapilot" hydraulic steering control system as well as an automatic electric control. The main propelling machinery is composed of one set of Newport News designed and built cross compound turbines and De Laval double reduction gears. The unit consists of one single-flow, impulse type, high pressure turbine and one single-flow, impulse reaction, low pressure turbine. For astern operation, a high pressure astern element is built into the forward end of the l.p. turbine. The propulsion unit turns a Baldwin-Lima-Hamilton 73,100-lb. right handed, 24-ft., four-blade, nickel aluminium bronze propeller. The turbines are designed for a maximum rating of 25,000 s.h.p. at 106·5 propeller r.p.m. ahead. This is achieved when steam is supplied at 825lb. per sq. in. gauge and 850 deg. F. to the turbine throttle and



ENGINE ROOM—LOWER LEVEL

1) Fuel oil service pumps; 2) Sanitary and s.w. service pumps; 3) Bilge pump; 4) Fire and Butterworth pump; 5) Butterworth heater drain cooler; 6) Butterworth heater; 7) Gen. service and fire pump; 8) L.O. service pumps; 9) L.O. Disch strainer; 10) L.O. heater; 11) L.O. suction strainer; 12) L.O. purifiers; 13) L.O. purifier drain tank; 14) L.O. purifier work bench; 15) Main feed pumps; 16) F.O. transfer pump; 17) Aux. condensate pumps; 18) Aux. condenser circ. water pump; 19) Emergency fire pump; 20) Atmos. drain tank; 21) Main condensate pumps; 22) Dist. cond. circ. water pumps; 23) Turbine; 24) Reduction gear; 25) Main cargo pumps; 26) Main cargo tank ballast pump; 27) Cargo stripping pumps.

ENGINE ROOM – LOWER LEVEL



BOILER FLAT—OPERATING LEVEL

1) Refrig. condensers; 2) Refrig. compressors; 3) Freon receiver; 4) F.W. pumps; 5) F.W. pressure tank; 6) H.W. heater and storage tank; 7) H.W. circulator; 8) Cold blr. starting feed pump; 9) Chem. feed mixing tank; 10) Chem. feed pressure tank; 11) Group control panel; 12) Boiler water test equipments; 13) F.D. blower controller; 14) F.D. blower vane operators; 15) F.D. blower drum switches; 16) Sand box; 17) Work bench; 18) Combustion control and gauge board; 19) Control air compressor; 20) Ship service air compressors; 21) Air cond. freon compressors; 22) Air cond. freon receivers; 23) Control air receiving tank; 24) Air cond. freon condenser; 25) Ship service air receiving tank; 26) Cold blr. f.o. pump; 27) F.O. heaters; 28) F.O. heater drain cooler; 29) Lighting panel; 30) Power panel; 31) Distilling plants; 32) Distillate pumps; 33) Brine Ovbd. pumps; 34) Main air ejector; 35) Engineers' alarm panel; 36) Mn. stm. throttle valve; 37) 1st stage feed heater; 38) Main switchboard; 39) Aux. air ejector; 40) Logdesk; 41) Phone hood; 42) Engine order telegraph.

BOILER FLAT & OPERATING LEVEL

s.s. Sansinena

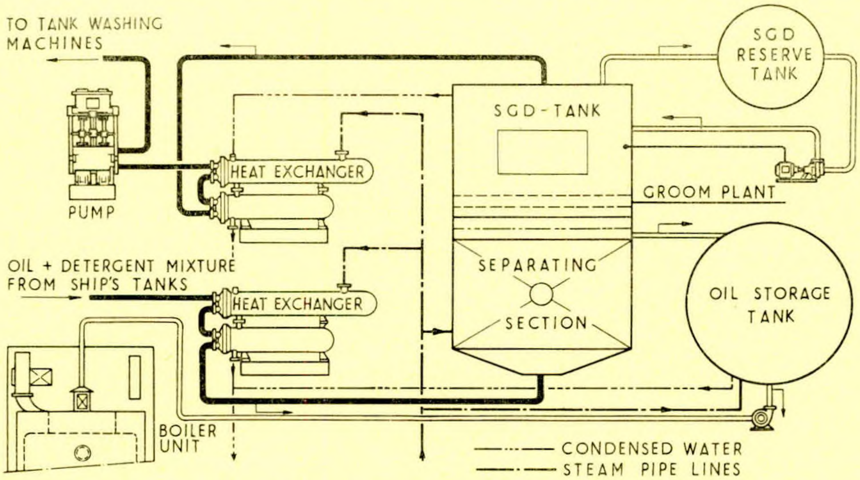
vacuum is maintained at 28·5-in. Hg. The designed speed and power for each turbine are as follows:—

Unit	*Power*	*Speed*
H.P. turbine ...	13,500 s.h.p.	5,851 r.p.m.
L.P. turbine ...	11,500 s.h.p.	3,381 r.p.m.
Propeller ...	25,000 s.h.p.	106·5 r.p.m.

At normal steam conditions and maximum rated ahead steam flow, the astern elements will develop 80 per cent of normal ahead torque at a propeller speed of approximately 53 r.p.m. A spring loaded, oil operated power valve, located at the end of the throttle manifold, actuates the main ahead throttle valve when the turbines overspeed or low oil pressure requires a quick-closing emergency stop. The turbines are designed for extraction of steam at the h.p. 3rd and 6th stages, the h.p. exhaust and the l.p. 3rd stage for feedwater heating, ship's heating system, fuel oil heating, auxiliary exhaust make-up and supply to the evaporators. The double reduction gearing of De Laval Company manufacture is a double helical articulated type, connected to the turbine rotor shafts with flexible mechanical couplings. The bull gear is 180-in. diameter at the pitch circle with 610 teeth having an active face width of 51½in. The steam requirements for the vessel are furnished by two Babcock and Wilcox two-drum watertube boilers located on a flat abaft of the propelling equipment. The boilers are completely air encased. They have a single furnace and integral steam and gas air heaters and are capable of supplying actual total steam of 182,000lb. per hr. (850 deg. F. at the superheater outlet) (normal), and 258,000lb. per hr. (875 deg. F. at the superheater outlet) (overload) at 850lb. per sq. in. gauge at the superheater outlet. Each boiler has a heating surface of 10,830 sq. ft., based on projected surface of the water walls and the circumferential surface of the generating tubes. A steam air heater also is provided. The air inlet design temperature to the air heater is 100 deg. F. The furnace volume is about 1,545 cu. ft. per boiler. The furnaces have water cooled side wall, rear wall and roof, refractory covered front; furnace floor water cooled, 2-in. diameter tubes, refractory covered. A main condenser is mounted athwartship beneath the l.p. turbine, and an auxiliary condenser is mounted fore and aft beneath the turbogenerators located on the 32ft. 6in. flat. Both are of the horizontal, two-pass, surface condensing, marine type. The main condenser has a cooling surface of 21,800 sq. ft. It is capable of maintaining a vacuum of 28·5in. Hg. at its inlet flange when its tubes are 85 per cent clean and cooled by sea water at 75 deg. F., in the amount of 21,280 g.p.m. when receiving steam in the amount of 121,000lb. per hr.—*Marine Engineering/Log, March 1959; Vol. 64, pp. 58-67.*

Tank Cleaning System

A combined chemical and physical process of cleaning the cargo compartments of oil tankers has recently been perfected and is being marketed by the International Groom Company, Hamburg. The Groom system is a British invention patented in Great Britain and has been used by the Admiralty since 1951. It is also being used by C. L. Whittaker and Co., Ltd., Grimsby, who are operating a small plant for cleaning tanks and fish rooms in their trawlers. With the Groom system, use is made of an aqueous detergent solution which is sprayed by a Butterworth or similar machine against the surfaces to be cleaned. The contaminated water in the tank is then separated into reclaimed oil, clean bottom sediments and recovered detergent for recirculation. An important feature of the process is that the special Groom detergent (SGD) is used in a closed circuit, so that only a relatively small amount has to be heated and correspondingly small heat exchangers are required. As well as releasing and recovering all oil adhering to the tank sides, bottoms, etc., the Groom system releases oil from its bondage with the bottom sediments, and reclaims it *via* the plant on shore in a pumpable and usable condition. Sludge can contain upwards of 75 per cent of oil which can be reclaimed in this manner. The operation of the Groom cleansing plant can be followed from the accompanying diagram. The main section of the unit consists of the combined separating section and SGD buffer tank: the latter is filled with SGD up to a specified level. From the buffer tank the detergent is drawn by means of a so-called projector pump, through a heat exchanger, and delivered to the tank washing machine. By means of the washing machine, which can either be a Victor Pyrate, Butterworth or Maersk machine, the SGD solution is projected against the surfaces to be cleaned. The solution then acts upon the deposits in the tank and removes them by a combination of dissolution, reduction of interfacial tension and a mild scouring action, leaving the plate clean. The resultant mixture of SGD and residual oil accumulates at the lowest point in the tank which is being cleaned, and is removed from there by the ship's pumps. It then passes through a second heat exchanger in order to obtain the heat necessary for demulsification, and thence to the separating section of the Groom plant. Here the reclaimed oil rises to the upper section of the automatically controlled constant oil/detergent interface level, and overflows into the oil storage tanks or is conveyed to a disposal point. The cleaned SGD flows into the SGD tank and, being immediately ready for use, is drawn from there through the heat exchanger to the projector pump, delivering a fixed amount to the washing machines and thus completing the cycle.—*The Shipping World, 15th April 1959; Vol. 140, pp. 386-387.*



Schematic arrangement of Groom tank cleaning system

Patent Specifications

Marine Propulsion Plant

In Patent Specification 759,500 is claimed a marine propulsion plant including a power driven means supported by the hull of a ship and adapted to produce a rearwardly directed pressurized stream in or adjacent to the hull so that the reactive force of the stream produces forward movement of the vessel. Conveniently the stream producing means takes the form of one or more rotary impellers drawing in water from the direction of travel of the vessel and discharging the water under pressure in the opposite direction. Fig. 1 is a longitudinal section of an impeller according to the invention. The electric driving motor in the impeller may be a submersible motor and will generally operate at about 1,400 r.p.m. at a rating of from 1,000 to 5,000 h.p. from a supply at a voltage of from one to three kilovolts. A single supply lead (32) may be used with an earth return through the water and casing to a generator housed within the space (11, 12) within the hull and driven by Diesel engines or other prime movers. The motor (16) is located forwardly of the turbine unit (15) and is mounted upon the hollow shafting (17). The motor shaft is carried by bearings (18 and 19) and by a forward thrust block (20). Epicyclic reduction gearing (21) drives a main bevel gearing (22) on a shaft (23) which is supported on bearings (24, 25, 25A) and the rotor shaft thrust block (26). The rotor blades may be adjustable about their axis to provide a pitch adjustment. Figs. 2 and 3 show a preferred method of attaching the impeller units to a vessel. The units 4 and 5 are positioned within the full width of the vessel indicated by the dotted line 10 and are supported in cradle attachments (6 and 7) from which depend streamlined distance fairings (8 and 9) (29 in Fig. 1) by means of which the units are attached to the vessel. The stern section is shown in full lines in Fig. 2 while the maximum hull width is indicated by the line W.L. Both units are mounted at a suitable depth below the water line (W.L.) and are preferably secured in position in a manner which allows them to be easily removed from the support cradles and lifted clear for servicing or replacement. By using readily releasable mountings to secure the units in the cradles it may be made possible to remove the units without drydocking the vessel. The engine room casing within the hull of the vessel is indicated at 11 and 12, and will contain a suitable generator driven by a prime mover such as a Diesel set or a steam turbine.—*British Patent No. 813,786, issued to E. Taylor and R. Shipp. Complete specification published 21st May 1959.*

FIG. 1.

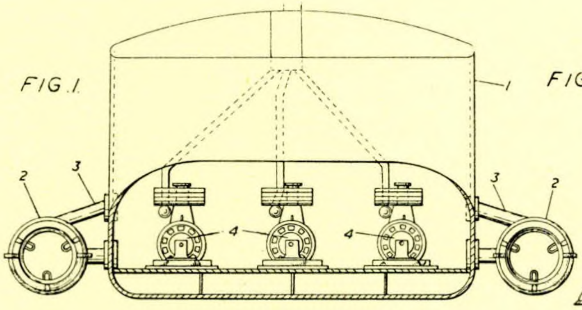


FIG. 2.

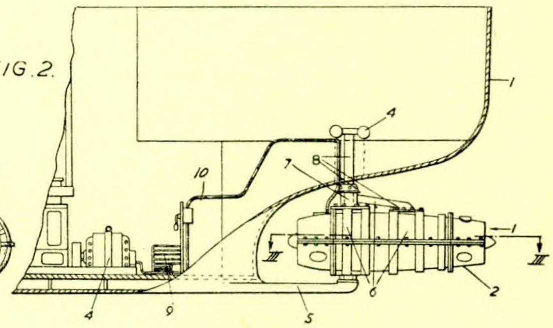
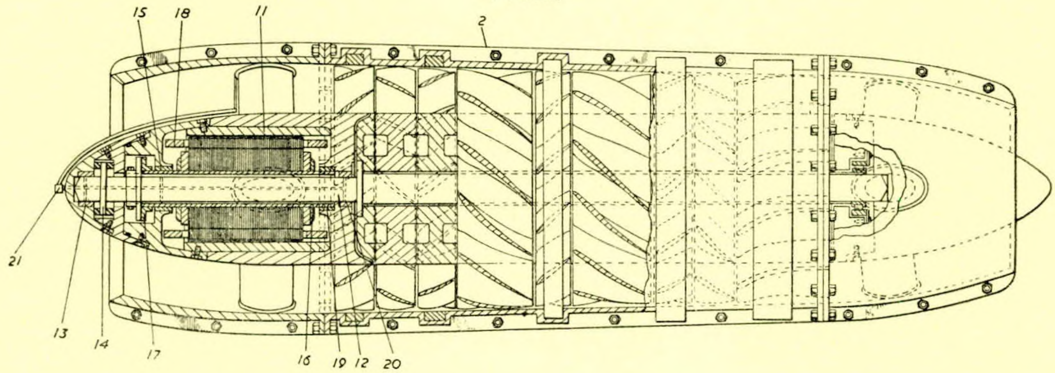
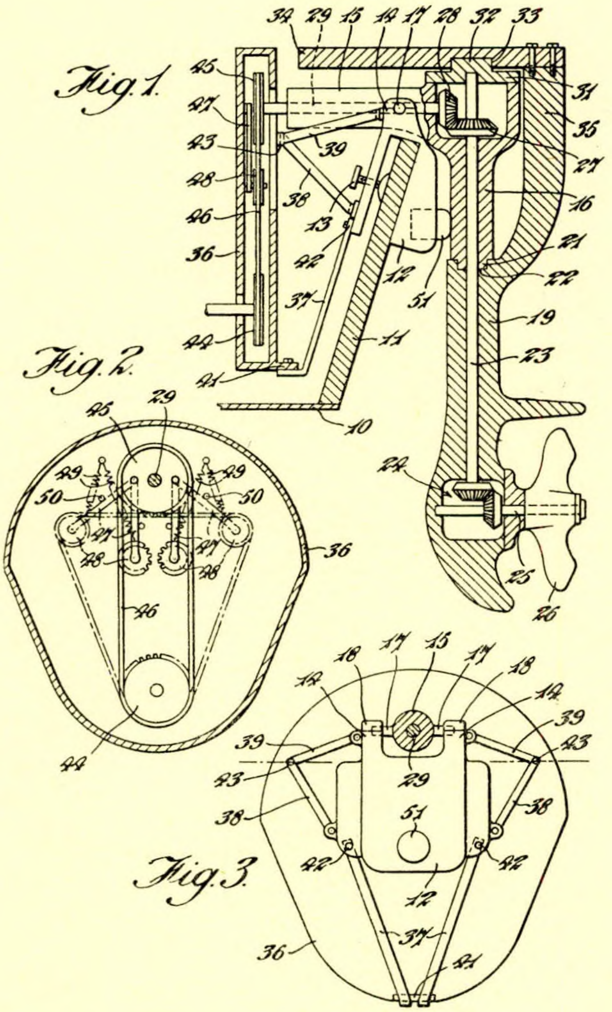


FIG. 3.



Propulsion System for Boats

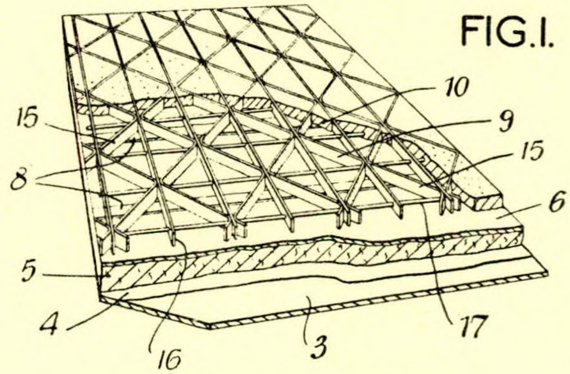
This invention relates to an engine mounted inboard of the boat which drives a screw propeller so mounted on a support that the axis of the propeller is movable relative to the fore and aft axis of the boat for steering, the support itself being pivotable about a horizontal axis to lift the screw propeller clear of the water. In Fig. 1 the engine shaft extends in a fore and aft direction into the lower part of the chain case (36) to carry a chain sprocket (44). The shaft (29) which extends through the arm (15) of the L-shaped member carries another

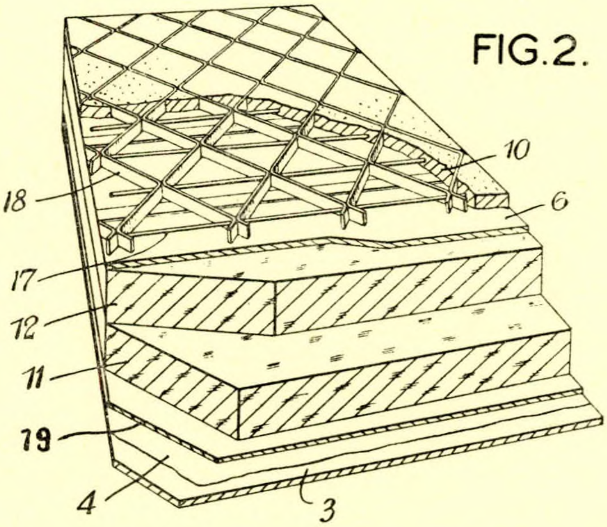


chain sprocket (45); this sprocket, when the L-shaped member lies within the chain case in the same plane as the sprocket (44) being adjacent with the upper end of the chain case. A sprocket chain (46) runs over the two sprockets. Two arms (47), pivotally mounted in the chain case and extending downwardly from their pivotal mountings, carry at their free ends sprockets (48) which engage the chain (46) inside its loop between the sprockets (44 and 45), the arms (47) being acted on by springs (49). The latter tend to urge the arms upwardly and outwardly. The upward and outward movement of the arms (47) is limited by stops (50) so as to ensure that they move through equal distances. It will be apparent that the propeller (26) can be lifted out of the water by rocking the L-shaped member (15, 16) rearwardly and upwardly about the trunnions (17) and such rocking movement will cause the sprocket (45) to swing downwardly and rearwardly. The upper part of the chain loop will tend to move downwardly with the sprocket (45) introducing slack in the chain (46) which will be taken up by upward movement of the idler sprockets (48). Ultimately, when the upper part of the chain (46) extends in a substantially straight line between the sprockets (48), as indidated in dotted lines in Fig. 2, the sprocket (45) will move away from the chain and the driving connexion between the engine and the propeller will be broken.—*British Patent No. 815,182, issued to E. J. Clerk. Complete specification published 17th June 1959.*

Flooring for Ships' Holds and Deck Covering for Tank Tops

This invention has a main object, to provide a flooring for ships' holds, and more particularly a deck covering for tank tops which protects the steel decking both from impact and grab or scraper damage and corrosion damage. In Fig. 1 the steel plates (3) forming the tank top, or floor or steel decking of the hold, are first cleaned from rust, grease and moisture and are then treated with a priming coat (4) as a protection against corrosion. Prior to the application of the priming coat, and if there is oil in the tanks below, the steel plates (3) must first be primed with any suitable petrol and oil resisting composition. On the top priming coat is laid a layer of felt (5) and upon this is laid a cushion layer (6) of a resilient or relatively soft hot asphalt, the coating being of the order of ½-in. thick. The application of the heated asphalt serves to soften the priming coat underneath the felt and causes it to adhere to the felt. Similarly the hot asphalt binds closely on to the felt so that creeping is avoided. Laid on to the soft asphalt layer which forms the cushion or resilient layer are a

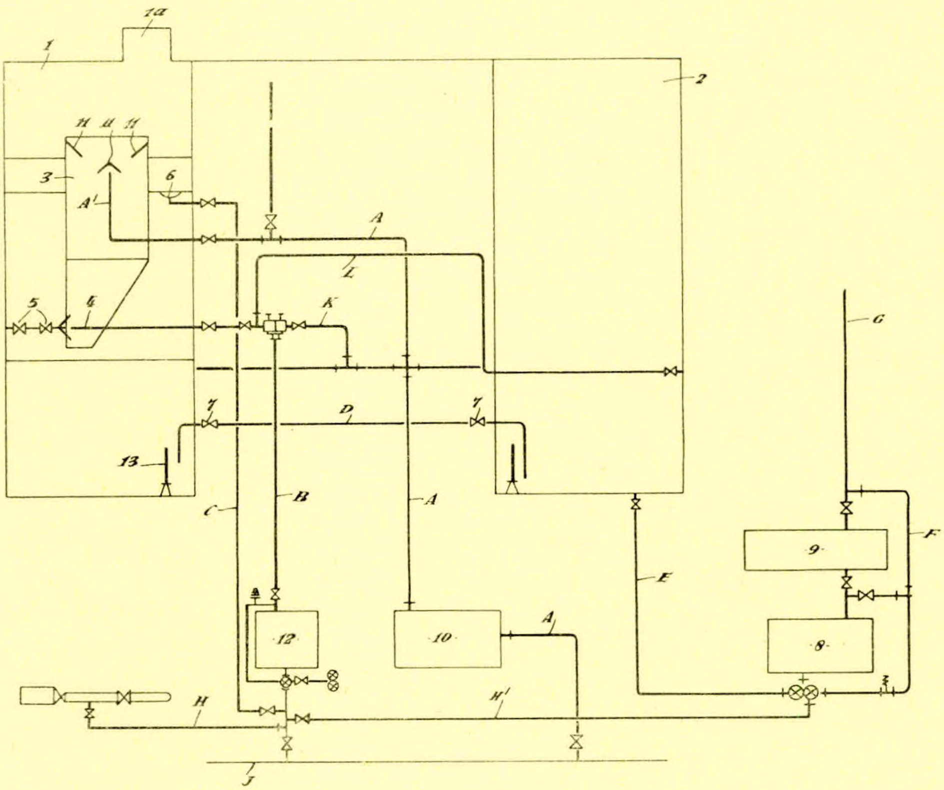




number of parallel steel bearer strips (8). On to these strips is applied a steel reinforcement mesh (9). On to this steel mesh reinforcement (9) is applied a layer (10) of a hard hot asphalt which is pressed into the interstices of the steel mesh so as to fill them completely and is levelled off with the top of the reinforcement mesh. The asphalt used for this upper layer (10) is a hard asphalt containing such fillers as slate flour, granite chips or the like so that it forms an impact resisting surface. The lower cushion or resilient layer (6) serves to protect the steel decking against any high localized impact and the two layers (6 and 10) effectively prevent moisture or other corrosive liquids penetrating from the floor of the hold to the steel decking or tank top. In Fig. 2 the steel plates are primed as described above, but with the addition of a layer of asphalt (19), and layers (11 and 12) of cork are then applied. On to the top layer of the cork (12) the cushion layer (6) is then applied.—*British Patent No. 815,191, issued to Bitulac Ltd. Complete specification published 17th June 1959.*

Cleaning Arrangement for Tanks

The arrangement comprises two supply tanks (1 and 2), each of suitable capacity, one port and one starboard, to carry fresh water when the ship is in ballast condition, or for the carriage of light kinds of spirit, when it is not necessary to clean down the tanks. Tank 1 only houses an open-topped sludge settling tank (3) for retaining and separation of sludge which settles from the dirty water in that tank. An ejector (4) discharges the sludge overboard through the valves (5) controlled from the deck. The cleaned water is used for washing down the next set of tanks. By a scumming arrangement (6) any residue of oil floating on top of the washing water can be drained off and pumped overboard through the pipe C. Pipe D equalizes the water levels in tanks 1 and 2 so that even water levels are maintained even when the isolating valves (7) are open. In operation, pump 8 draws water from the bottom of the tank 2 and discharges it through a water heater (9), or bypass pipe line (F) to the pipe (G) leading to an independent pressure pipe line on deck, to supply hot water to two or three washing machines in the cargo oil tanks. Pipe H draws in sea water and discharges it to the sludge ejector, or alternatively discharges salt water through pipe H′ to the heater if fresh water is not available. Pump 10 draws dirty water through pipe J from those oil tanks which have been washed, the pump discharge being to the main deck pipe line A from which branch A′ delivers the dirty water into sludge tank 3. The ejector (4) is fed from the stripping pump 12 from the sea suction pipe H. When an accumulation of oil has gathered in the port side washing water supply tank (1), the isolating valve (7) in the bypass line is closed so that the water level in the port tank will rise to the level of the scum pan (6) from which a suction line (C) is led to the stripping pump (12) or separator. The floating oil can then be discharged overboard to port through the ejector (4) or to starboard through the pipe K to the main deck pipeline (A) and so into a storage tank either direct or through an oil water separator.—*British Patent No. 816,432 issued to Sir James Laing and Sons, Ltd. Complete specification published 15th July 1959.*



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