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Portable Lifeboat Radio

A new portable radio transmitter and receiver, for use in ships' lifeboats, has recently been introduced by the Marconi International Marine Communication Co., Ltd., of London. Known as the Salvita, it is completely self-contained and watertight, and will float after having been thrown into the sea from the deck of a ship in distress. The Salvita is housed in a cylindrical case a little over two feet in height, which is painted bright yellow for easy recognition in the water. The upper portion of the case contains a medium and short-wave transmitter and medium-wave receiver, all the operating controls being placed on a circular-top panel, which is covered by a watertight lid when not in use. Batteries are completely dispensed with, all the power for transmission and reception being supplied by a hand generator, which occupies the lower portion of the case. The generator shaft protrudes through watertight glands and is rotated by two handles, which fold flat against the case and are protected by detachable covers when not in use. When the unit is in operation, these covers serve as sinkers for the earth wire. The aerial can be of the telescopic-rod type, or can be of wire rigged on the lifeboat's mast or suspended from a kite or balloon. The transmitter, which is crystal-controlled, can be switched to either 500 kc/s or 8,364 kc/s. A hand key is provided; but, in order that the set may be operated by untrained personnel, arrangements are made for the automatic transmission of the S.O.S. signal, followed by a long dash for direction-finding purposes. When automatic transmission is used on 500 kc/s, the auto-alarm signal precedes the S.O.S. signal. The receiver is pre-tuned to the distress frequency of 500 kc/s and lightweight headphones are permanently connected to the set, the cable being led through a gland in the top panel. The control panel is spray-proof, even when the top cover has been removed.—*The Shipbuilder and Marine Engine-Builder, August 1954; Vol. 61, p. 504.*

Experimental Tank in Paris

The current programme of expansion at the Paris Experimental Tank Establishment (Le Bassin d'Essais des Carènes) includes the construction of a new testing tank which will eventually be one of the longest in the world, for in its final stage it will have an overall length of 320 metres (1,050ft.). Le Bassin d'Essais des Carènes forms part of the Service Technique des Constructions et Armes Navales, and its director, M. Brard, is one of the chiefs of the Service Technique. The establishment was founded in 1906, when a testing tank 160 metres long (525ft.), 10 metres wide (33ft.) and 4 metres deep (13ft. 2in.) was built to enable towing tests to be carried out on model hulls. It was not until 1925, however, under the directorship of M. Barrillon, that the work of the establishment began to expand in other directions. Between 1934 and 1937 three hydrodynamic laboratories were built, each building being 40 metres long (131ft. 9in.) and 10 metres wide (33ft.). In 1938 work was begun on the immense steering pond, whose construction was completed in June 1940. After the war the programme of expansion was continued, and it was possible to bring the unique steering pond into operation within a few months of the Liberation. Two smaller testing tanks were also built, as well as a cavitation tunnel and more workshops. By 1948 a tank specially designed for the study of results in shallow water was completed. Since the war, too, the services of the Paris tank have been available for merchant ships, and several liners built since the war for transatlantic service have hulls which were designed by the Paris Experimental Tank. The towing tanks are used not only for determining the resistance of hull forms but also for studying the performance of different types of propeller with self-propelled models and for various studies such as manœuvrability and the measurement of hydrodynamic forces. In addition to the original testing tank there is a smaller tank, measuring 18·80 metres long (61ft. 8in.), 3·70 metres wide (12ft. 4in.) and 1·10 metres deep (3ft. 8in.), which is used for yachts and barges. The large new tank which is now nearing completion has a depth of 4 metres, a width of 13 metres and at present a length of 181 metres (about 595ft.); this will be extended, in two stages, to 220 metres and later to 320 metres. The special, shallow-draught testing tank is designed for the study of the resistance of hull forms and their propulsive efficiency and manœuvrability in restricted waters and canals. In addition to the usual towing platform, this tank is equipped with adjustable walls which enable the characteristics of a specific waterway, such as the Suez Canal, to be simulated. The length of the shallow tank at present is 55 metres (180ft. 6in.), with a width of 8 metres and a maximum depth of 0·80 metres (about 32in.); but it is proposed in the near future to extend the length to 155 metres (nearly 510ft.) and the depth to 2 metres. The steering pond, which is contained in a huge circular building, is a unique establishment, having a diameter of 65 metres (213ft. 3in.) and a depth of 5 metres (nearly 17ft.). On an island in the centre rests one end of a revolving bridge which can be used for towing models; but free-running steering trials are carried out by means of radio-controlled models. With these the operator at the side of the tank can achieve perfect control of helm angle and engine speed and direction of the model hull, which is completely free-running. When the present works are completed, this steering pond will be directly connected by an approach channel to the new large towing tank. Among the other experimental facilities at the Paris establishment is a cavitation tunnel which is one of the most powerful in the world. The stream has a diameter of 800 mm. and attains a maximum speed of 18 metres per second. There are also three special tanks, with wave-making apparatus, which are used for studying the rolling and pitching of models in waves, and tests can be made with the models fixed or moving. From these, important results have been obtained concerning the seakeeping qualities of ships in different conditions of stability and trim.—*The Shipping World, 28th July 1954; Vol. 131, pp. 110-111.*

German Supercharged Four-stroke Engine

During the war the specific output of the four-stroke Diesel engine had been further raised by steadily increasing exhaust-gas turbo-charging with the object of attaining the highest power in the smallest space. Fuel consumption and overall efficiency played a secondary rôle. After the war, however, the M.A.N. endeavoured to make use of the wartime experience to build an engine with maximum efficiency, namely, with (1) lower fuel consumption; (2) lower lubricating oil consumption; (3) the possibility of operation on poorer grades of fuel; and (4) the smallest possible space requirements. To attain these aims it was necessary that the engine should be highly supercharged. After certain preliminary tests had been carried out on normal mercantile ships' engines, a three-cylinder experimental unit was built, with a piston diameter of 300 mm. and 450 mm. stroke, having independent supercharging. After thorough and successful experiments were completed, the engine was enlarged to a six-cylinder unit with exhaust gas turbo-charging. The smallest power with which the low fuel consumption of 140 gr. (0·31-lb.) per b.h.p.-hr. could be anticipated was 1,200 b.h.p. (on account of blower efficiency) and the engine with the dimensions given was suitable for this output. It was not desired to build a larger unit because the expenditure on construction and research would have been too high. Since the results achieved with this experimental engine proved remarkably satisfactory—a minimum fuel consumption of 137 gr. (0·30lb.) per b.h.p.-hr. was recorded—and, above all, as a high efficiency was maintained over long periods of operation a somewhat larger engine was next built. As is known, the efficiency of larger engines and supercharging blowers is higher than with small units, and it is hoped that a still more favourable fuel consumption will be attained than with the first experimental engine K6V30/45. This new engine has a piston diameter of 450 mm. and a stroke of 660 mm. The normal speed is 250 r.p.m., corresponding to a piston speed of only 5·5 m. per sec. (1,082ft. per min.). With a mean effective pressure of 16 kg. per sq. cm. (227 p.s.i.) the six-cylinder engine develops 2,800 b.h.p. and an eight-cylinder unit 3,700 b.h.p. In order to take account of all the factors upon which the efficiency of Diesel machinery depends, this engine was designed as a crosshead type so that it might be suitable for running on heavy oil. The general construction of the engine is seen in Fig. 1. The bedplate is welded. On it are erected separately cast columns to which the guides are attached, and on which the complete cylinder block is carried. The air inlet piping is cast with the block and serves at the same time as a support for the camshaft bearings and the fuel pump blocks. The crankshaft is dimensioned to comply with the various Classification Societies' rules and is interesting insofar as it has absolutely no planed surfaces and no bored oil ducts. The crank webs are of circular construction. The lubricating oil for the connecting rod bearings is taken from the piston cooling oil circuit and is delivered to the rods from below. The oil for the bearings in the bedplate is delivered in the usual way through the bearing caps. In order that the relatively high ignition pressures may be transmitted to the bedplate bearings in the most direct manner, tie-rods are employed. These are

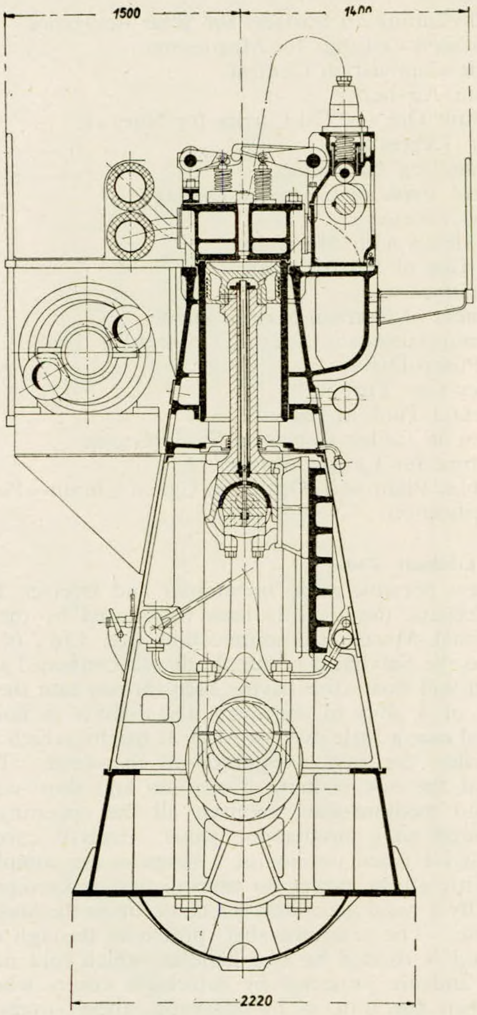


FIG. 1—*Sectional elevation through a cylinder of the engine*

fitted as near as possible to one another. Hence, it is necessary to provide pressure studs for securing the top halves of the bearings. The studs are located in the column openings. The upper end of the connecting rod is not forked as in the usual design, but has a pin screwed to it and which swings in the crosshead. With this construction is ensured a direct power transmission from the piston, through the piston rod, and the crosshead. Moreover, the whole breadth of the crosshead is available as a bearing surface for the crosshead pin, so that the specific surface pressure is maintained within normal limits despite the high ignition pressure which is employed. The exhaust-gas turbo blower, which comprises a 14-stage axial rotor driven by a three-stage turbine, is arranged longitudinally on the exhaust side of the engine. As a result of the supercharging system employed, the exhaust temperatures are notably low. With an m.e.p. of 16 kg. per sq. cm. the temperature is about 450 deg. C. at the discharge from the cylinder cover and 480 deg. C. at the entry to the turbine. The engine operating with 16 kg. per sq. cm. m.e.p. is thus far removed from its limit of maximum loading if this limit is considered to be reached with an exhaust temperature of 600 deg. C. This would be attained if the m.e.p. were approximately 21-22 kg. per sq. cm.—*D. von Lassberg, The Motor Ship, August 1954; Vol. 35, pp. 184-185.*

British Built Ore and Oil Carrier for Norway

The first of a group of four ore and oil carriers of 18,000 tons deadweight ordered from the Fairfield Shipbuilding and Engineering Co., Ltd., by the Liberian Navigation Corporation, has recently been delivered. This vessel, the *Chateaugay*, is registered at Oslo under the ownership of Skibs A/S Orenor (Gorrissen and Klaveness, managers), and is flying the Norwegian flag. These ships are intended for the trade between West Africa and the East Coast of the United States, carrying ore on the westbound and oil on the eastbound trip. In appearance the *Chateaugay* resembles a tanker, with bridge house amidships and machinery aft. She is a versatile vessel, as in addition to the main cargo carrying spaces for ore and oil, two tanks are fitted for the carriage of latex in bulk (a cargo of growing importance), while the centrecastle 'tweendeck is insulated for the carriage of chilled or frozen cargo. In contrast to the common Scandinavian preference for Diesel engines in vessels of this size, she is a steamship. The principal dimensions of the ship are as follows: —

Length b.p.	600ft.
Breadth moulded	80ft.
Depth moulded to upper deck ...	43ft.

The ore is carried in four holds, each 80ft. long, between two longitudinal bulkheads. Two holds are aft and two forward of a deep tank, placed approximately amidships under the bridge structure. The ore is loaded by chutes and discharged by grabs, no cargo handling arrangements being provided for the ore cargo. Each hold is served by two hatches, and each hatch is fitted with MacGregor patent sliding covers. The oil cargo is carried in tanks at the sides of the ore holds, and also in double bottom tanks beneath the holds. A forward deep tank is fitted for oil fuel or water ballast, and above this tank are fitted a further two tanks for the carriage of latex. Between these tanks the forward pump room is arranged. The main machinery and boilers are arranged aft, with the after pump room at the forward end of the engine room. The main propelling machinery consists of a single-screw set of turbine machinery of the latest design, driving a five-bladed propeller through double reduction articulated gearing. One h.p. impulse-type turbine and one l.p. reaction turbine of the single-flow type are provided for ahead running, and for astern running there is a two-row impulse wheel overhung from the forward end of the h.p. ahead rotor and a two-row impulse wheel followed by a single-row impulse wheel incorporated in the l.p. ahead turbine casing. Steam is provided by two watertube boilers of the Babcock and Wilcox integral furnace type, incorporating superheaters, economizers and tubular air heaters, and constructed for a safety valve pressure of 650lb. per sq. in., and final steam temperature of 850 deg. F. at superheater outlet.—*The Shipping World, 28th July 1954; Vol. 130, pp. 103-104.*

Electric and Automatic Steering Control for Tankers

One of the interesting features in the equipment of the fleet of tankers now under construction for Shell Tankers, Ltd., of London, in home and overseas yards, is the use of a new type of steering-control gear, viz. the Sperry electric and automatic steering control. The *Haustrum*, of 18,000 tons deadweight, recently completed by R. and W. Hawthorn, Leslie and Co., Ltd., at Hebburn-on-Tyne, is one of the first oil tank vessels to have this gear in its latest form—the Type "C". This comprehensive system provides hand, automatic and auxiliary steering control from a single bridge control unit installed in the wheelhouse. The bridge control unit operates a power unit in the steering gear compartment, which controls the valve gear of the steering engine. In effect, the electric and automatic steering control combines in one system the services hitherto provided by the telemotor and gyro pilot. This single unit makes a compact installation in the wheelhouse. Electric control causes the steering engine to respond immediately to wheel movement, making both hand and automatic steering more positive and accurate. The bridge control unit is outwardly similar to the bridge unit of the Sperry two-unit gyro pilot, and its large hand steering wheel, enlarged-scale steering repeater, selector levers and controls, which enable the different types of control to be selected, and adjustments of response to be made to suit the prevailing conditions of sea, weather and the vessel's trim. In addition, however, it incorporates the auxiliary control, which is effected by a reversible switch (port and starboard) with central neutral point. A large factor of safety and reliability is provided in the installation by the duplication of electrical services and equipment. Two alternative cables, running between the bridge control unit and the steering gear compartment, are installed for the "hand" and "gyro" systems, while a third cable is used for "auxiliary", so that a choice of five control circuits is available for selection. The main power unit motor is operated by the "hand" and "gyro" control, and moves the rack attached to the steering engine valve gear. A second motor is incorporated in the power unit for the auxiliary control, but this is only clutched in to the rack drive when "auxiliary" control is selected. In addition, a second auxiliary controller is provided at the after steering position on the poop deck, for emergency steering purposes. The use of the equipment is similar to that of the normal Sperry two-unit gyro pilot for hand-electric and automatic steering, but the electric and automatic control has, in addition, the factor of auxiliary control. This control functions in such a way that if the spring-loaded control-lever switch is applied to starboard, it causes the rudder engine to run continuously to starboard, until the lever is released to the central neutral position, or the rudder limit switches are broken, that is, at hard-over starboard rudder. The rudder remains applied, however, until the auxiliary switch lever is put over to port, when the rudder engine runs in the opposite direction, i.e. to reduce starboard rudder or to apply port. A self-synchronous rudder-angle indicator system is thus an essential part of the complete installation. An indicator is mounted on the forward bulkhead of the wheelhouse, a duplicated indicator is located at the after steering position on the poop deck, and the associated transmitter, operated by the rudder stock, in the steering compartment. The complete Sperry installation in the *Haustrum* and all the new Shell tankers now under construction comprises: —

(1) Mark 14 master gyro compass (TB3) installed in a separate gyro room.

(2) The electric and automatic steering control, which consists of the following: —

Bridge control unit in the wheelhouse, complete with auxiliary control and enlarged-scale steering repeater.

Auxiliary controller at the after steering position.

Power unit, control panel, two contactor panels, two electrical rectifiers, in the steering gear compartment.

(3) One or more bearing repeaters.

(4) Rudder-angle indicator, including one indicator in the wheelhouse and one at the after steering position.

(5) Course recorder, operated by the gyro compass and installed in the chartroom or wheelhouse.—*The Shipbuilder and Marine Engine-Builder, August 1954; Vol. 61, pp. 487-488.*

Cavitation Erosion

One of the most severe forms of metallic-surface deterioration is associated with damage sustained by cavitation erosion. Under the suction conditions of dynamic fluid flow, the surfaces of propellers, impellers, and similar hydraulic-machinery components may suffer this form of erosion. The collapse of cavities formed on these surfaces is considered to release quantities of energy in the form of localized forces, similar in nature to water hammer. The magnitude of these forces may be sufficient to bend propeller blades, but their confined character more commonly induces highly localized stresses in the metal, producing surface rupture and severe distortion of the crystal structure. Damaged surfaces tend to increase local turbulence, enhancing cavitation tendencies and extending the depth and area of the eroded zone. The mechanism of failure is not fully understood, and controversy exists as to the part played by corrosion. Marine propellers experience this form of damage to varying extents, depending on the design, the conditions of operation, and the material of which they are made. Cast iron and cast steel are prone to have local regions of porosity which are easily eroded and give rise to a deeply pitted form of attack. Bronzes, which are of a more resistant nature, exhibit eroded regions having the appearance of areas that have been subjected to intense local sand-blasting. Despite their more resistant nature, however, bronze propellers have been known to decrease in weight during service by as much as 10 per cent, attributable to overall corrosion and erosion losses. Such losses not only impair the propeller's efficiency, but also reduce its inertia. In consequence, the one-node mode of torsional vibration of the machinery dynamic system will be raised, and critical vibrations may be placed out of barred speed ranges or brought in close proximity to service or operational speeds. Improved propeller designs based on extensive hydrodynamic studies are expected to reduce cavitation conditions, but the higher powers transmitted and the turbulent flow imparted by the stern of the ship will limit the benefits likely to be obtained. The application of alloys having the maximum resistance to this form of cavitation erosion has therefore been considered. In order that the relative merits of the available alloys might be ascertained, experimental techniques simulating extreme cavitation conditions on the surfaces of suitable specimens have been adopted. Erosion-resistances were based on weight losses in standard exposure times and, whilst some degree of variation of results is inevitable, good guidance is given to the relative resistance of the alloys involved. A reasonable assessment of the erosion-resistance of an alloy is given by the product of the surface Brinell hardness number and the corrosion-fatigue resistance expressed in tons per sq. in. for fifty million cycles of reverse bending. The more highly resistant alloys have values in excess of 800, and in descending order of merit they include austenitic stainless steels, aluminium bronzes, with or without nickel additions, low-nickel stainless steels, silicon Monel, Monel metal, high-tensile bronze, and Turbadium bronze. Below 800, the normal manganese bronzes, silicon bronzes, phosphor bronzes, gun-metals, cast irons, and aluminium alloys are placed. This does not imply that the manganese bronzes which have given such good service have poor resistance, but they are used purely as a basis of comparison. Cast iron, which is still widely used as a propeller material, should have its surface skin intact, as this increases its resistance to erosion, as do additions of copper, nickel and chromium. Soft alloy "stopper" metals employed to plug local casting defects are of negligible value. Nickel deposits, applied to the surfaces of cast iron propellers of trawlers, have provided increased corrosion- and erosion-resistance in service. The severe corrosion, which occurred at fractured sections, and the high cost of the deposit caused this practice to be abandoned, however. Similar deposits applied to bronze propellers have also proved uneconomical. Spray coatings of zinc, lead, and aluminium have been applied to cast iron propellers in service. Of these metals, pure aluminium was found to be the most reliable, although respraying of exposed areas became necessary at intervals. Erosion losses were found to increase with increase of sea water temperature, up to 50 deg. C., used in laboratory tests, and this feature must be taken into account when comparing the merits of the metals in service. Of the alloys tested showing cavitation-erosion characteristics superior to those generally used, the stainless steels and aluminium bronzes appear the most suitable for manufacture and service purposes. Since uniformity of cast structure is advantageous in providing homogeneous properties throughout the propeller mass, the grain refinement obtained from iron and manganese additions to 9-12 per cent aluminium bronzes should be beneficial.—*From "Metals and Marine Engineering", Presidential Address by S. F. Dorey, Journal Institute of Metals, July 1954; Vol. 82, pp. 497-510.*

Bled-steam Air-heater

Wellington Tube Works, Ltd., have recently completed three "Weldex" bled-steam air-heaters for pre-heating the combustion air for three large marine boilers, one unit being illustrated in Fig. 2. The duty of each heater is to raise 166,000lb. per hr. of air from 80 to 210 deg. F.; the steam condensed in

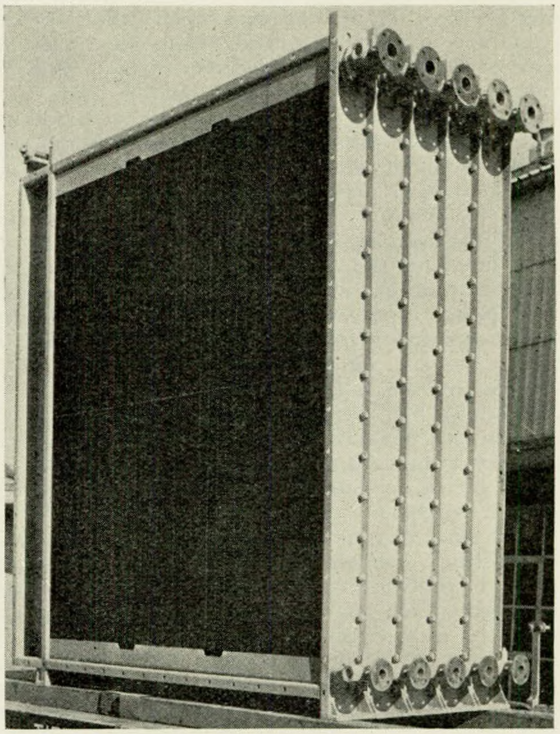


FIG. 2—*"Weldex" bled-steam air-heater capable of heating 166,000lb. of air per hour from 80 to 210 deg. F.*

performing this duty being 5,360lb. per hr. when supplied at 35lb. per sq. in. and 313 deg. F. Each heater is fitted with a bypass capable of handling about 25 per cent excess air during overload periods. The gilled tube elements consist of steel boiler tube into which are embedded, by a special process, flat steel gills measuring 3in. by 2in. by 18 s.w.g. These tubes are mounted vertically and welded into headers which form the steam and condensate connexions. The heater batteries are carried in pressed steel casings, which also accommodate the bypass passage with its associated control damper. A feature claimed in favour of the bled-steam air-heater is that it eliminates any trouble that may be occasioned by soot choking in flue gas heated units.—*Engineering and Boiler House Review, June 1954; Vol. 69, p. 184.*

Deadly Fumes

Two tragic cases of death due to asphyxiation by toxic fumes and lack of oxygen on two separate tank vessels have recently been reported. Death in each case was facilitated by ignorance, carelessness, misconception, and a complete disregard of basic rules of safety and common sense. The scene of the fatality in each case was the after pumproom of a T-2 tanker, on one of which the cargo being pumped was jet fuel and on the other, grade B gasoline. In each case the man who died was working in intense fumes without any breathing apparatus. On the first tanker, discharging jet fuel, all three cargo pumps were in operation. The cargo pump shaft glands had been slightly slackened at the beginning of the operation to allow for normal expansion as they heated up, and a slight trickle of cargo from these glands was noticed, but considered normal. The pumproom ventilation system was in operation and both doors to the main deck were open, but the pumproom skylight was closed. After two or three hours of operation, the vessel's chief pumpman noticed that gland leakage was increasing, and he attempted to tighten the glands and reduce leakage, but was unsuccessful. Upon leaving the pumproom, meeting the second pumpman on deck and talking over the situation with him, both men decided to return to the pumps and again attempt to stop the leakage. Together they descended into the pumproom without stopping the cargo pumps and without notifying any of the vessel's officers. While the chief pumpman was rigging a chainfall on an upper level, the second pumpman went below and worked on the pump glands. Neither man was wearing a breathing apparatus. In a few minutes the chief pumpman descended to the pumps and found the second pumpman on the verge of collapse. Within seconds the second pumpman fell, his body becoming lodged between piping and a bulkhead. The chief pumpman hurried out on deck and called for help. Standing on deck amidships, the second mate heard the call for help and was immediately appraised of the situation. He sent for the master and instructed a seaman to don the fresh air breathing apparatus. The chief pumpman, second mate, and seaman went below to attempt to remove the inert man. Since the unconscious victim weighed about 200 pounds, and was lodged in an awkward position, it was extremely difficult to move him. The rescue crew finally secured a lifesaving belt on the man and, with assistance from crew members above, pulled him up on deck. He was found to have been wearing a paint sprayer's mask. The local fire department had arrived in the meantime and immediately attempted to revive the victim with an inhaler. He was carried from the vessel and promptly removed to a hospital where oxygen was administered for half-an-hour, but he was pronounced dead at that time. The second mate and chief pumpman were both nearly overcome, but neither suffered ill effects other than nausea. The seaman who had been wearing the fresh air breathing apparatus suffered no effects at all. About two hours later, examination of the pumproom disclosed 3 feet of cargo in the bilges and the pump glands still leaking badly. All pumping was then ordered stopped until the cargo in the bilges was removed, the compartment gas freed, and all cargo pump shaft glands repacked. The venting system was found to be in good condition.—*Proceedings of the Merchant Marine Council, United States Coast Guard, June 1954; Vol. 11, p. 101.*

Canadian Icebreaker

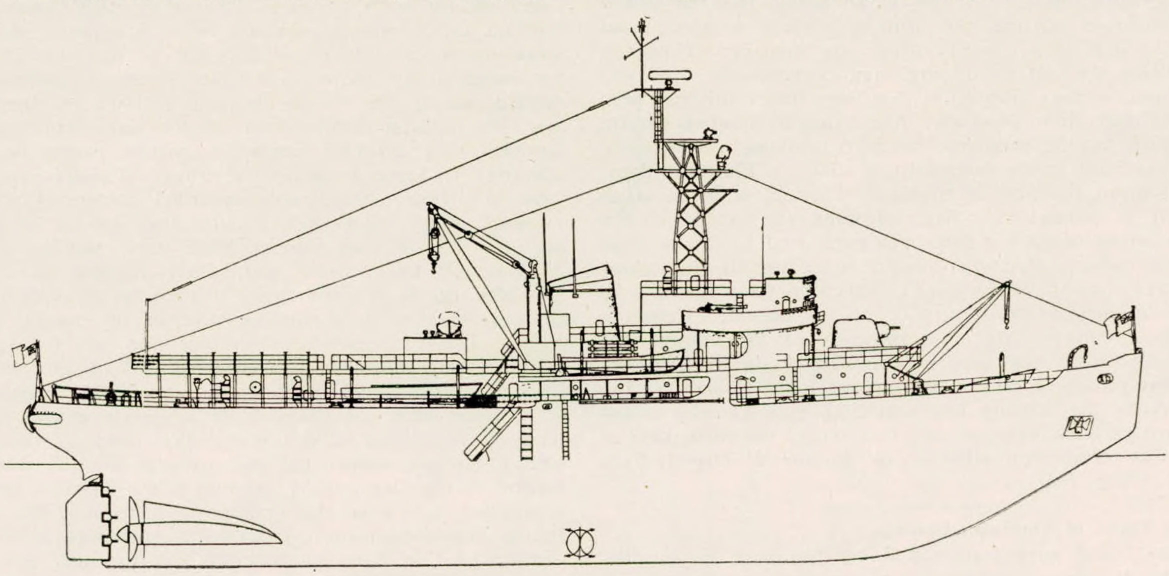
The Royal Canadian Navy's first icebreaker and arctic patrol vessel is essentially similar to the *Wind*-class icebreakers of the U.S. Coastguard service. The new ship is being built by Marine Industries, Ltd., Sorel, Quebec, and has principal particulars as follows:—

Overall length	296ft. 0in.
Length b.p.	250ft. 0in.
Extreme breadth	63ft. $9\frac{1}{4}$in.
Moulded depth	37ft. $9\frac{1}{2}$in.
Deep draught	29ft. 0in.
Full load displacement	6,400 tons

The main hull structure is all-welded and the shell is of $1\frac{5}{8}$in. steel. The ship is fitted with heeling tanks so that it can "rock" itself out of a heavy ice pack. Cathodic hull protection has been employed. H.M.C.S. *Labrador* has a complement of 26 officers and 204 men and the accommodation will be fitted up to the latest standards, with bunks, cafeteria messing, electric galleys and laundry, recreation spaces and games facilities on the 73ft. long flight deck. Direct current Diesel-electric propelling machinery has been installed. This consists of six Fairbanks-Morse ten-cylinder type 38D-$8\frac{1}{2} \times 10$ opposed-piston Diesel engines, rated at 2,000 h.p. at 810 r.p.m., each driving a Canadian Westinghouse 1,375 kW generator and supplying power to two 5,000 s.h.p. Westinghouse propulsion motors, driving after screws only. Control of the motor speeds is accomplished either from the control position in the engine room or from the bridge, by varying the field and speed of the propulsion generators. The bridge speed controllers are capable of being operated from the pilot house and from either of the bridge wings. Four Fairbanks-Morse seven-cylinder type 38E-$5\frac{1}{4} \times 7\frac{1}{4}$ opposed-piston Diesel engines, each driving a 250 kW alternator, generate all auxiliary power. Three oil-fired cylindrical boilers are installed in a separate room on the main deck for the ship's steam heating system and de-icing requirements.—*The Marine Engineer and Naval Architect, August 1954; Vol. 77, pp. 293-294.*

Nickel-plating Aluminium

A process for applying nickel directly to either raw or anodized aluminium results in an erosion-resistant surface and considerable material strengthening of the aluminium. This new electro-plating process will solve the major problem in coating aluminium with nickel by eliminating the need for intermediate bonding materials such as copper or adhesive cements. Very thin deposits of nickel on aluminium provide a surface that is resistant to erosion, pitting, gouging and corrosion. Coating both surfaces of aluminium sheets, the nickel deposit ensures increased strength of the aluminium sheet without materially increasing the weight. Complex designs and shapes such as castings can be given a uniform and accurate



Outboard profile of the Canadian icebreaker Labrador protection of both the interior and exterior surfaces. A ductile and pore-free surface can be applied with the new "Alni-Clad" process and the resulting material can be sheared, bent or fabricated without danger of separation even at high temperatures. A wide variation in the characteristics of nickel deposited can be obtained, hardness of the deposit being variable over a range from 150 to 550 Vickers. As the process permits nickel to be deposited in layers, a soft layer can be applied to the aluminium for resiliency and a hard layer for the outer coating. In addition, nickel can be deposited over the aluminium with either compressive or tensile stress.—*Design News, 15th June 1954; Vol. 9, p. 5.*

Underwater Scanning Locates Sunken Ship

A new underwater-scanning device utilizing sound waves ended a two-year search for a sunken oil tanker bearing an estimated million-dollar cargo of high-octane gasoline and kerosene, officials of a Montreal shipping firm revealed recently. The tanker, the 4,350-ton *Transpet,* which sank in a storm off Miscou Island in the Gulf of St. Lawrence in October 1951, had defied the efforts of salvage operators who had used all available means, including conventional depth-sounding equipment and other devices. The discovery was made by the *Transriver,* also an oil tanker, on a return voyage from Chatham, New Brunswick. The sonar unit which made the discovery possible is known as the sea scanar. Previously its chief commercial application has been in locating elusive schools of fish, including whales. The sonar unit, which is a new device made to scan underwater much like a sweeping searchlight, detected the sunken tanker after a forty-three hour search covering 450 miles. Most of the search took place in dense fog and snowstorms. The tanker was spotted only four-and-a-half miles from the point where it was reported to have sunk after an engine room explosion which took the lives of two crewmen. It was resting in some 120 feet of water.—*Marine Engineering, July 1954; Vol. 59, pp. 115-116.*

Coating Metals with Aluminium

There is no doubt that, for the protection of iron and steel against corrosion, aluminium offers definite advantages. However, the use of aluminium for this purpose has been extremely restricted because of the difficulty of producing an adherent coating on iron and steel surfaces, as compared with galvanized coatings. As a coating metal, aluminium is the superior of the two metals, since it forms a continuous, adherent and inert oxide film, while zinc forms a hydrated, loosely adherent oxide film. Moreover, for the same thickness of protective coating, aluminium has the advantage that the weight of an aluminium coating per unit of surface is only about one-third of that of a corresponding zinc coating. However, no difficulties exist in producing zinc coatings on iron and steel surfaces, while aluminium coatings have hitherto been found most difficult to produce. According to a recent patent, this difficulty can be overcome by first applying a water-base fluxing compound to the surface to be coated. This flux comprises zirconium fluoride or titanium fluoride, with an alkali metal such as potassium. After dipping the article in the aqueous solution of such a flux, it is permitted to dry, so that an adherent coating of finely divided zirconium-fluoride compound remains on the surface. The article is then dipped into a bath of molten aluminium and, after removal, exhibits a continuous, bright coating of aluminium. It is claimed that optimum corrosion resistance is obtained if the temperature of the aluminium bath ranges from about 1,220 to about 1,240 deg. F. After the coating has solidified it is quickly cooled by a quench in cold water, in order to retard the formation of a brittle aluminium-iron alloy.—*The Engineers' Digest, July 1954; Vol. 15, p. 266.*

Causes and Types of Corrosion Damage

In this broad survey presented by Professor E. Knuth-Winterfeldt at the Scandinavian Corrosion Conference at Copenhagen in May 1954, the author presented a general picture of the nature and causes of corrosion and the different kinds of corrosion damage encountered. True corrosion (sometimes confused with mechanical erosion, e.g. of ships' propellers) may occur in the form of self-inhibiting corrosion or continuously aggressive corrosion. The former is often a valuable means of protection; the latter is, of course, always undesirable. Turning to the specific problems of chemical corrosion, the author distinguished between purely chemical corrosion, such as the oxidation of metal under the influence of dry air, and electrolytical (or electrochemical) corrosion which can only take place in the presence of moisture. Dry-air oxidation is a problem of great practical importance. It normally has the effect of forming on the metal surface an oxide film built up from metal ions and oxygen ions forming a regular crystal lattice. This oxide film continues to grow, largely owing to the outward migration of metal ions. The greater the initial deficiency of metal ions on the surface (e.g. with sulphides) the higher the rate of corrosion, which can be represented as a parabolic function. In practice, the rate of corrosion is mainly governed by the incidence of "breaks" in the oxide film. The more breaks (and their incidence can be increased through changes in mechanical stresses, temperature, etc.), the greater is the possibility of ion migration. Oxide films of different metals differ in their proneness to breaking. Thin, elastic oxide films, such as those formed by aluminium and beryllium, are less liable to break than thicker but less elastic films; this is one of the reasons for the rust-protecting effect of aluminium which can be put to good use, e.g. by selective oxidation of alloys. Turning to electrolytic corrosion, the author discussed at length the anode-cathode effect responsible for this type of corrosion and the factors of phenomena having a bearing on this effect (effective electrode potential of a metal in a solution; concentration element; polarization and depolarization; electrolytic and galvanic voltage; and over-voltage), with special reference to iron in contact with oxygen-free or oxygen-containing water. Having thus discussed the causes of corrosion, the author classified the types of corrosion damage, distinguishing between (1) common surface corrosion; (2) pitting; (3) selective corrosion (e.g. graphitization); (4) intercrystalline corrosion; (5) stress corrosion; (6) corrosion fatigue cracks, i.e. cracks caused by a reduction in fatigue strength due to corrosion; (7) fretting corrosion; and finally (8) earth corrosion.—*Corrosion Technology, June 1954; Vol. 1, p. 101.*

Development of German Marine Engine

In reviewing the development of the Deutz V.M. marine engine, the author points out that important advances have been made in simplifying the engine controls and governing gear. Commencing with Series 5, the mechanical control of the starting valves was superseded by a pneumatic starting and reversing system. It is not unusual, in the case of a trawler, for example, for more than 1,000 reversing operations to be carried out in the course of a single trip, yet there has not been the slightest confirmation of the fears expressed in some quarters that cylinder heads or pistons might be adversely affected. In Series 5 engines the induction and exhaust passages have also been considerably enlarged compared with earlier versions, and to make this possible they are no longer located on one side of the cylinder head only, but on both sides. This layout has proved particularly suitable in conjunction with the Büchi exhaust-driven turbo-charger which has been fitted to a steadily increasing number of engines ever since 1927. The redesigning of the air and gas passages in the cylinder head has also proved beneficial in view of the fact that after only a few modifications the V.M. engine will run on a wide range of gases, such as producer gas (frequently used by vessels on inland waterways), and, in the stationary role, town gas, sewage gas and natural gas. A recent design feature of the Deutz V.M. engines is the flywheel brake which is applied whenever the engine is stopped—either from the engine control position or from some other point at any required distance. The flywheel brake is air-operated and cuts the duration of a reversing operation to a fraction of the time previously needed, e.g., from 40 sec. to 10 sec. The present

Deutz production programme incorporates V.M. engines in the power range from 250 to 1,800 h.p. with 6 and 8 cylinders without and with exhaust turbo-charging. The speed range of the smaller units is 350 to 500 r.p.m.; the big units have 250 r.p.m.—*K. Schmidt, European Shipbuilding, Vol, 3, No. 2, 1954; pp. 38-41.*

Anti-corrosion Coatings for Magnesium

A recently released report gives interesting information on efforts made to develop anti-corrosion coatings for magnesium. The report describes formulation and evaluation of three series of experimental primers and the further development of organic coatings to impede the corrosion of magnesium alloys. The constituents used in the first series of tests consisted of magnesium chromate, magnesium chloride, magnesium sulphate, and other magnesium compounds. Graded amounts of these various magnesium salts were used to replace an equivalent volume of zinc chromate in primers based on a phenolic resin vehicle. In the second series such constituents as zinc chromate, zinc oxide, micalith-G, and aluminium stearate were tried out. The third series consisted of such constituents as zinc chromate, zinc chromate selenate, strontium chromate, calcium chromate, barium chromate, etc., based on a phenolic vehicle in which the inhibitive pigment constituted 80 per cent of the total pigment volume of each primer. The panels used in the experiments were untreated magnesium alloy sheets which had been properly cleaned and degreased. After application of the various protective coatings, the panels were tested by marine exposure at various localities; salt-spray tests in the laboratory were also carried out. It was found that the substitution of magnesium chromate and magnesium fluoride for part of the zinc chromate in phenolic primer tends to improve protection against corrosion offered by the primer. For the inhibition of magnesium-alloy corrosion by paint films, barium chromate proved to be an unsuitable source of chromate, while zinc chromate and calcium chromate appear to be the best inhibitive films tested.—*The Engineers' Digest, August 1954; Vol. 15, pp. 304-305.*

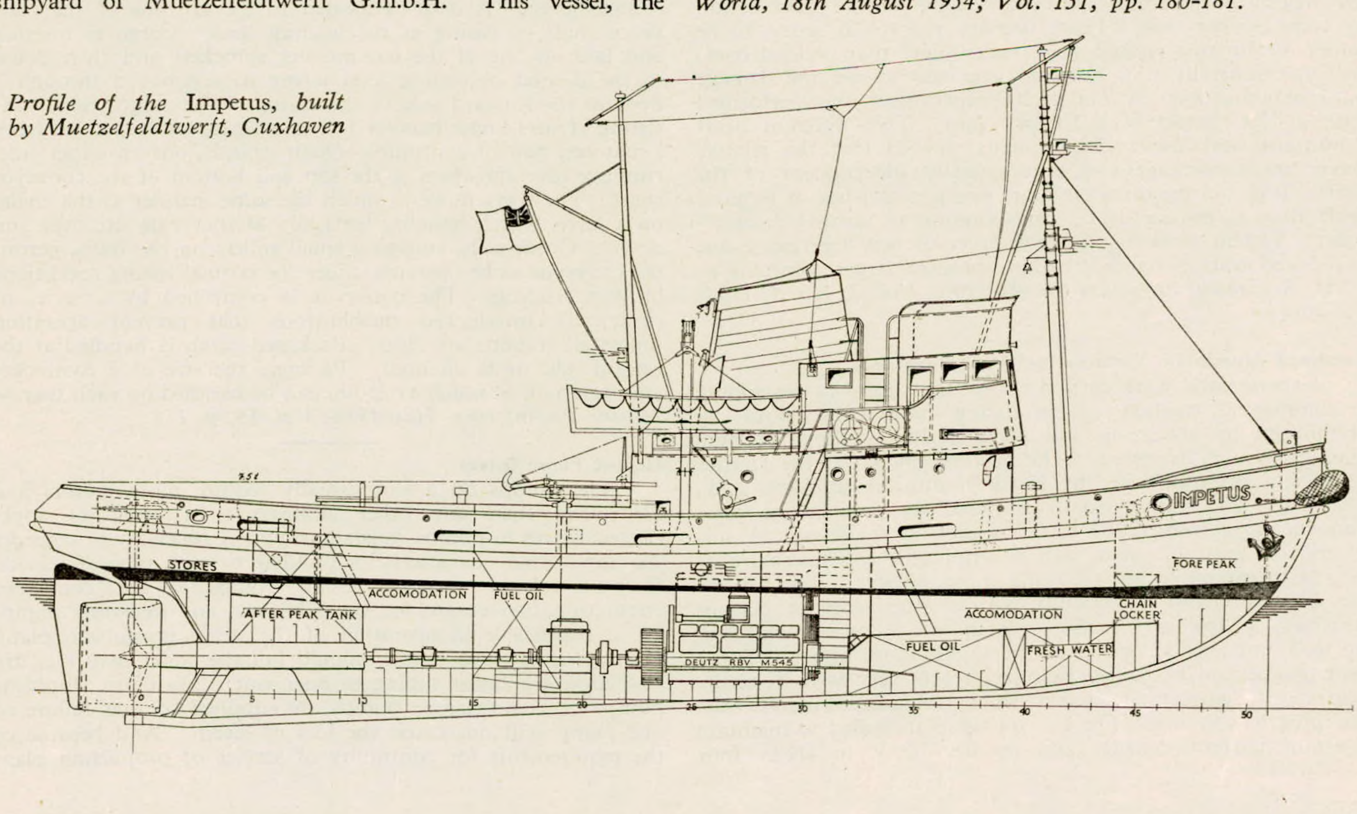
Tug with Kort Nozzle Rudder

An interesting little tug has been built for the Ridley Steam Tug Co. Ltd., Newcastle-on-Tyne, by the Cuxhaven shipyard of Muetzelfeldtwerft G.m.b.H. This vessel, the *Impetus,* is of 140 tons gross and is 97ft. long with an output of 750 b.h.p. She is notable particularly for the combined Kort nozzle and rudder with which she is equipped. It is a comparatively recent innovation even in Germany, which is of course the home of the Kort nozzle. The *Impetus* is only the third tug to be built by Muetzelfeldtwerft with this type of rudder. The advantages of the Kort nozzle rudder are briefly those of the Kort nozzle itself, together with those resulting from the ability to direct the slipstream from the propeller over a fairly wide angle. The Kort nozzle is generally accepted to increase the towing power of the tug, particularly in shallow water, and it also eliminates the well-known "paddle wheel effect" which tends to throw the stern of a vessel to one side when gathering sternway. Where a rotatable nozzle is employed in place of a rudder, the control afforded over the slipstream should give very much better qualities when the tug is towing and is stationary, or nearly so. It should obviate any risk of the tug being caught broadside on and pulled over. The principal particulars of the *Impetus* are as follows:

Length o.a.	97ft. 1in.
Length b.p.	84ft. 4in.
Moulded breadth	22ft. 2½in.
Moulded depth	11ft. 2in.
Maximum draught	10ft. 11in.
Gross tonnage	140·7 tons
Net tonnage	nil

The vessel has been built largely to the Ridley Steam Tug Company's own specification. She is to be employed in the company's service in the Tyne, principally in connexion with the Norwegian mail boats. The propelling machinery consists of a Klockner-Humboldt-Deutz Diesel engine, developing 750 b.h.p. at 375 r.p.m. and driving the propeller through 2:1 reverse-reduction gearing. It is a 6-cylinder engine, with cylinder bore and stroke of 320 mm. and 450 mm. respectively, and is fitted with a Brown Boveri exhaust turbo-charger. On trials the *Impetus* made 12 knots running free, and in a towing test a bollard pull of 14·25 tons was recorded. A further feature of the vessel which is of interest is the towing hook, which is arranged to swivel vertically to accommodate high angles of tow. The vertical pull of the tow is taken by rollers running beneath semi-circular trackways. The hook is fitted with bridge-controlled release gear.—*The Shipping World, 18th August 1954; Vol. 131, pp. 180-181.*

Profile of the Impetus, *built by Muetzelfeldtwerft, Cuxhaven*



Slamming

The maximum speed of a surface vessel is not determined by the power but by the ship's behaviour in a seaway. Speed of advance must be reduced to avoid too violent motions. The most violent attack of the sea on a vessel is probably the heavy blow delivered by the waves on the re-entering bow. The ship vibrates for some time after such an impact and plates under the fore foot are damaged. The present paper attempts to describe the practical aspects of the hydrodynamics of ship slamming. Many theoretical and experimental results are omitted in order to make the paper more concise, and the present article is only an extract from the original one. Slamming is felt by the ship's personnel in the sudden change of the acceleration. The sudden deceleration is intuitively associated with high pressures on the bottom and the captain therefore tries to avoid slamming. Another danger signal is the elastic vibration which is generated by the sudden buildup of pressure (generally called "blow") and which can be observed for quite some time (30 sec. 1 min.) depending on the violence of the slam. The integrated effect of the pressure on the bottom is the largest at the instant of slamming, since the sudden deceleration requires large forces which come from the pressure on the bottom plates, but this does not mean that the pressures cannot be dangerously high immediately before or after the maximum deceleration is reached. Contrary to the acceleration record the motion record does not show any peculiarity at the instant of slamming. The considerations above lead to the following definition of slamming which is applicable from the practical and acceptable from the theoretical points of view. *Slamming is the sudden change of the acceleration of the ship.* The most obvious and most frequently described stress generated by slamming is the one due to high pressures on the plates under the fore foot. The part most susceptible to damage due to slamming is the area of the bottom from ten to twenty-five per cent of the ship's length from bow; in the transverse direction the keel to twenty-five per cent of the beam is the most dangerous part. Ships of slender form suffer damage further aft than ships of full form. It should be pointed out, however, that vibration produced by slamming might also damage the superstructure. Severe stresses in light superstructure may result in cracked plates and loose rivets there. The third type of stress generated by slamming increases the sagging stress amidships produced by normal wave action by some 30 per cent. From damage reports, it seems to be rather certain that riveted ships suffer more than welded ones; also that generally it is not one slam that causes the damage but repeated action. A total of 200 experiments were performed with a 5½ft. model of a Liberty ship. Two different draft conditions were used. Experiments showed that the relative speed loss percentage-wise is practically independent of the draft. Bow out condition is more easily established at reduced draft than at heavier draft corresponding to normal displacement. Violent motion plus probability of bow emergence due to reduced draft go hand in hand to produce larger slamming.—*V. G. Szebehely, European Shipbuilding, Vol. 3, No. 4, 1954; pp. 80-85.*

Anodized Aluminium Surfaces for Wear Resistance

Experimental work carried out by the author in developing a commercial method of producing hard oxide films on aluminium by anodizing and particularly on alloys of high alloy content is described. The process, known as the Hardas process, is being operated by Hard Aluminium Surfaces, Ltd., Glasgow. The films usually required on engineering components range from 0·002 to 0·004 inch in thickness. A sulphuric or an oxalic acid bath is employed, a temperature of plus 4 to minus 4 deg. C. being most suitable. The process can be carried out successfully with a wide range of current densities; as low as 0·1 amp. per sq. in. in oxalic acid, and up to 3 amp. per sq. in., or more, in sulphuric acid. A 3 per cent magnesium alloy, for example, reacts very well in oxalic acid at 0·15 amp. total current density, obtained with 40 volts d.c. plus 30 volts a.c. The a.c. voltage is increased to maintain constant current density, and reaches 70 V in about four hours. An aluminium alloy with a high zinc content, such as RR 88 reacts favourably to d.c. alone, in sulphuric acid at 0·5 amp. per sq. in. The voltage, starting at 20, is raised to 50 in 15 minutes to produce a film thickness of 0·003in. Precleaning and preparation of the work are the same as for ordinary anodizing except that stopping-off with wax is frequently necessary on engineering components. The degree of hardness attained is difficult to measure, different methods give widely divergent results, which are influenced to some extent by the hardness of the basis metal. The coatings have practically no elasticity, but nevertheless have good adhesion. Wear resistance, under suitable load conditions, is approximately equivalent to that of hard chrome plating. Practically no wear occurs when a hard anodized surface slides against aluminium or aluminium alloy, or against plastic or fibrous materials, provided that any heat generated is effectively removed. Hard anodizing has been found to provide a very satisfactory finish for sliding surfaces such as valve faces where leak-free and non-wearing contact must be maintained and speed of movement is comparatively low. It is good when plastic is clamped against a moving aluminium surface, e.g. in fuel-pipe unions, and for coarse-thread aluminium screws used in unions. Aluminium jigs, fixtures and templates have also been treated to obtain hard-wearing surfaces with the convenience of lightness. Another interesting application is for producing lines, patterns or spots on aluminium tread plates or nosings to provide a non-skid surface. Electro-chemically the cost of the process is about three times as great as that of ordinary anodizing per unit of thickness. Moreover, hard surfaces are usually four to ten times as thick as ordinary anodizing, so that there is a corresponding additional increase in cost.—*Paper by W. J. Campbell, presented to the Institute of Metal Finishing. Abstract in Light Metals Bulletin, Vol. 16, No. 11; pp. 465-466.*

Vertical Cargo Conveyor

Food and other cargo now is being loaded into shipboard storage by vertical conveyors in one-half the time formerly required. The conveyors were designed and built for three ships—the *Barrett*, the *Upshur* and the *Geiger*—constructed by the New York Shipbuilding Corporation and now a part of the Military Sea transport fleet. The conveyor in each ship is located forward on the port side, and descends through all storage levels. A door is located in the aft side of the conveyor shaft or casing at the loading deck. Cargo is inserted and laid on one of the ten moving sprockets and then down to the desired unloading level where it is removed through a door in the forward side of the casing. The cargo trays, consisting of steel finger bars, or fork-like tines, are suspended from a matched pair of continuous-chain strands, one on either side, running over sprockets at the top and bottom of the conveyor shaft. The trays move in much the same manner as the chairs on a ferris wheel, hanging vertically as they ride up, over and down. Guide rails, engaging small rollers on the trays, permit the conveyor to be operated under the normal listing conditions of port loading. The conveyor is controlled by a series of electrically interlocked pushbuttons that prevent operation unless all stations are clear. Packaged cargo is handled at the rate of 480 units an hour. Packages the size of a footlocker and weighing as much as 250lb. can be handled on each tray.—*Marine Engineering, July 1954; Vol. 59, p. 118.*

Electric Pump Drives

The pumps on a ship usually require more motors and controllers than any other auxiliary. In order to apply electric drives to pumps satisfactorily, it is necessary to consider the application characteristics peculiar to each type of service. *Propulsion-Plant Pumps.* Such pumps as the condenser circulating, condensate, feedwater booster, and feedwater pumps are indispensable in operation of the steam propulsion plant. If any one of these pumps should fail the boiler may run dry and allow the boiler tubing to burn out. Therefore, duplicate pumps or dual-purpose pumps are supplied so that failure of one pump will not cause the loss of steam. And because of the requirements for continuity of service of propulsion plant pumps, the control for such pumps is usually of the low-voltage release type. Then, if a power failure occurs, these vital pumps will restart automatically upon restoration of power. However, one additional precaution is necessary. Because of the limited capacity of the ship's generators, the simultaneous starting up of a number of motors may cause an excessive voltage dip because of the large starting currents drawn. Because of this, in an a.c. powered ship, the generator capacity must be approximately ten times the rating of the pump motors being line-started simultaneously. *Oil Pumps.* Cargo-discharge, fuel-oil service and transfer, and lube-oil pumps are required to pump oils whose viscosities change radically with changes in temperatures. These pump motors should be selected with sufficient torque margins, both for starting and steady pumping service, to compensate for the large increase in load occurring during cold oil operations. *Variable-Pump Delivery.* In many applications, in addition to selecting a pump motor of the correct rating, the motor, with appropriate controller, must provide a means of varying the pump delivery. There are three ways to achieve this variation in flow. The first is by using a constant-speed motor to drive a positive-displacement variable-stroke type of pump. By varying the stroke, pump delivery may be varied in a continuous, stepless manner as desired. A second method of varying pump delivery is by using a throttling valve on the pump-discharge line. The boiler feedwater regulator with its automatically adjusted orifice valve is an example of this method of control. As the regulator indicates the need for increased feedwater delivery, the valve is opened to provide more feedwater to the boiler. Drive motors must be selected carefully where the throttling-valve method of varying pump delivery is used with the positive-displacement pump. Because of the tendency of a d.c. series motor to run away when unloaded because of an accidentally closed intake valve, loss of water on the intake line, or any number of possible accidents, a compound motor with a strong series field should be used for this duty. The light shunt field will prevent runaway of the motor. The third method of controlling pump output varies the speed of the pump and drive motor by electrical means. For very little increase in price, d.c. shunt motors whose speed can be varied over a 4 to 1 range by shunt-field control are available. A rheostat shunting current around the series field may be used to obtain speed control of d.c. motors, but this is seldom done because of the difficulties encountered in applying the low-resistance, high-current rheostat required. On a.c. powered ships the squirrel-cage induction motor finds the widest application for pump service. This motor is available in multiple-winding form to obtain two or more definite speeds to control pump delivery. The windings of this motor are switched to vary the number of poles. It is possible to obtain two, three or four different speeds in this manner, each of which is constant. At each of these speeds the speed-torque curve for the motor is similar to that for a typical single-speed squirrel-cage motor designed for that speed.—*A. M. Bruning, Marine Engineering, July 1954; Vol. 59, pp. 61-65.*

Formation of Tanker Corrosion Study Group

Formation of a technical committee to study tanker corrosion has been approved. W. S. Quimby, The Texas Company, New York, N.Y., has accepted the responsibility of temporary chairman of the committee, to see it through its formation stage. A permanent chairman will be elected following an organizational meeting. The committee will be formed as a Unit Committee under Group Committee T-3, General, and is to have the designation T-3H, Tanker Corrosion.—*Corrosion, July 1954; Vol. 10, p. 27.*

New German Cargo Vessel

The motor cargo vessel *Christianna Pikuritz,* built by the Nobiskrug yard and owned by the Atlanta-Schiffahrts Ges., Berlin, is of the open shelterdeck type and has the following principal particulars:

Length o.a.	114·78m.
Length b.p.	103·5m.
Breadth moulded...	15·0m.
Draft	6·535m.
Deadweight	4,522 tons

The vessel is propelled by a Borsig Diesel engine of the simple acting two-stroke type developing 3,600 s.h.p. at 125 r.p.m. The speed of the vessel in the fully laden condition is in excess of 16 knots as compared with a guaranteed speed of 14 knots. The engine operates on boiler fuel. In addition to a La Mont exhaust boiler, two oil fired boilers of 800 kg. per hour and 500 kg. per hour evaporation are also provided. The vessel is equipped with McGregor hatch covers and has two bipod masts of the Hallén type.—*Schiff und Hafen, June 1954; Vol. 6, pp. 360-364.*

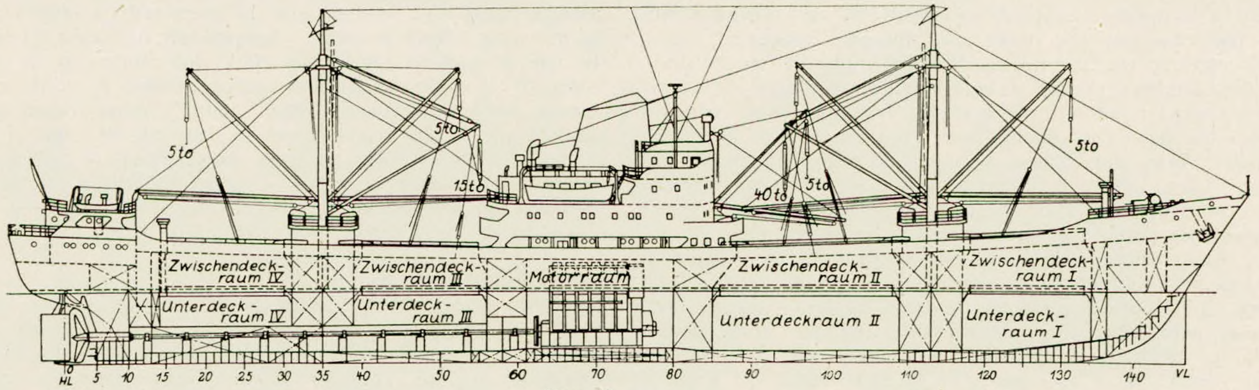


FIG. 3

Cargo Handling Appliances

The author believes that the time is still far distant when crane discharge and load and other shore applied mechanism will completely oust ship appliances. Undoubtedly the electric winch has been the greatest boon of recent years. Apart from any other considerations no steam winch allows the efficient operation of two simultaneously by one man, as is possible with electric winches. The whole question of electric versus steam winches has never been tackled broadly enough to give the economy which could result from combined operations on the part of managements and superintendents in consultation with producing firms. The result has been that too many electric winches have been turned out for ships—instead of shipping—at a higher cost than necessary. A standardized electrical winch could be made simple of upkeep by the provision of interchangeable spares, which would not need skilled labour to dismantle and replace and of which the worn parts could be left ashore for reconditioning at leisure. With winches comes the need for easier adjustment of topping lifts. It is astounding to see, even on modern vessels, an arrangement by which several men are needed to "hang off" a topper with a chain stopper, release a kinked wire from dangerous cleats, "take to" a winch from which the runner has had to be released, adjust the derrick after releasing the stopper, and then practically repeat the operation backwards to make the derrick safe for use again. Though one may rightly say that with an experienced crew the time occupied is not as long as the operation would appear to need, the total loss is considerable if, together with the time taken, one adds the delay caused to cargo work by the derrick failing in the end correctly to plumb the job. Since there is little need for inboard winch-ends today—since whips are seldom used, why should not topping-drums take their places? The single topping wire could run through a lead on the mast or deck to the drum, which could be clutch-operated to gear to the winch. In conjunction with this the topper could pass through a compressor, which would act as a stopper and preventer to save undue stress on the topping-drum and would also allow the topper to be instantly run off should the drum be needed for, say, taking a guy to it during a heavy lift. Some Scandinavian vessels have a separate hand-winch for topping derricks, but such winches are of necessity light and a preventer is still advisable, if not essential. The topping-drum would be an improvement on the hand-winch. Guys and preventer-guys have always seemed to do the same job and one should suffice. The only justifiable need for both is that the guy tackle, being of rope for easier man-handling, is subject to chafe not always discernible. As the "yard and stay" method of cargo work is most often employed, derricks need to be long enough to span an inside truck road or an outside barge. Often one sees a derrick that has to be lowered to a dangerous angle, involving not only undue strain upon the gear but the delay and damage consequent upon cargo catching the coamings, bulwark rails or truck sides. Derricks have been limited in length mainly through consideration of length of hatch and flat stow. In some cases nowadays one sees the flat stow ignored and a longer derrick stowed at an angle. Why not, where a longer derrick is desirable and the ship design does not permit of flat stow, allow the derricks to be stowed upright alongside the masts or the samson posts? Crutches that clamp the derricks in an upright position should not be much more costly and the stability factor would in few cases be noticeably diminished. Though less artistic, and perhaps more uncomfortable for the modern seaman, the increased self-sufficiency justifies the case for the upright derrick, in addition to the increased length that can be employed. Everyone knows that it is so much easier to lower a derrick into working position than to heave one up to it. The economy in time and man power here (especially in the many cases where it is not possible to prepare derricks before arrival at ports) would be considerable.—*F. D. Gardner, Journal of the Royal Society of Arts, 6th August 1954; Vol. 102, pp. 764-770.*

Transverse Bulkheads with Vertical Corrugations

The main advantage of corrugated bulkheads, as compared with plain stiffened bulkheads, is that they can be constructed easily, especially by welding. There are, however, certain objections to their use; the most important is that in tankers excessive corrosion may take place along the bends forming the corrugations. Research is in progress regarding this point, and if it is proved that the corrugations really weaken the metal's resistance to corrosion and if there is no way of avoiding this, the author submits that the use of corrugated bulkheads in tankers would no longer be justified. He is inclined to believe, however, that corrosion of bulkheads is not aggravated by the cold working of the metal during the formation of the corrugations, but depends on the quality of the steel that is in contact with the sea water. The author goes on to give an analytical study of the stresses in vertically corrugated bulkhead subjected to water pressure, and then compares the stresses in such bulkheads with those calculated for plain stiffened bulkheads. The numerical results of this comparison are given in a table. In general, the calculations show that the maximum stresses in the corrugated bulkhead are less severe and that the stress distribution is also more favourable. In tankers, the weight of a corrugated bulkhead would be approximately equal to that of the plain bulkhead, because the thickness of the sheet must in both types be greater than the minimum required from strength considerations alone, to allow for the corrosive wastage to be expected in service. In dry-cargo vessels, on the other hand, a corrugated bulkhead will result in an appreciable weight reduction because the plating can be made thinner; thus in a 10,000 tons deadweight vessel such bulkheads may be made 37 per cent lighter. It is also found that a corrugated bulkhead has a superior resistance to buckling. Finally, the calculated values of stress are compared with some experimental values, and it is seen that the general order of magnitude of the calculated stresses is correct, which confirms the analytical approach adopted.—*H. E. Jaeger, Paper read at Annual Meeting, 1954, of Association Technique Maritime et Aeronautique, Paris. Journal, The British Shipbuilding Research Association, July 1954; Vol. 9, Abstract No. 9060.*

Cold Starting of Small Engine

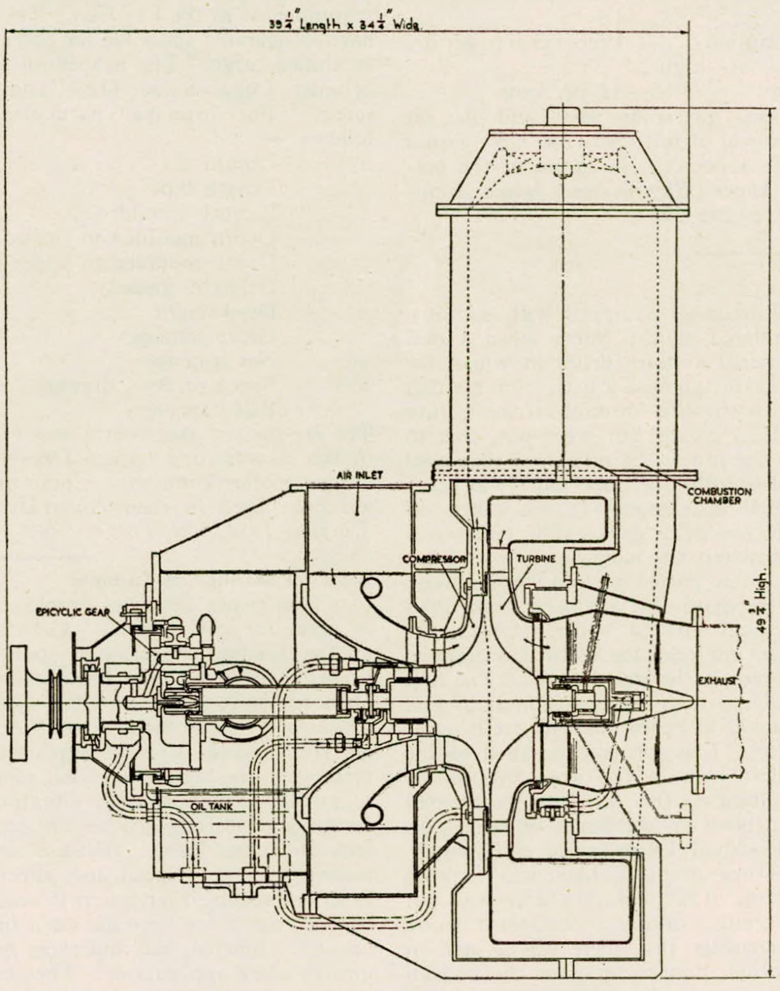
The British North Greenland Expedition is using in its headquarters establishment at Queen Louise Land, a Petter single-cylinder water-cooled oil engine and generator. That set has a strenuous life, particularly during the two mid-winter months when darkness persists all the way round the clock. During the winter the set is running for some twenty hours per day, but in summer for perhaps four hours daily. A 50-gallon water tank holds the coolant, and a paraffin stove has to be used to keep the water from freezing during non-running times. The normal routine is to drain the engine system after stopping and to thaw out the pipes with a blow-lamp in the morning. With an outside temperature of minus 40 deg. F., the temperature in the engine room has proved to be minus 5 deg. F. at waist height and minus 12 deg. F. at floor level during periods of engine shut down. After running, the temperature in the room rises to between 40 deg. F. and 45 deg. F. No trouble has been experienced, during a year's service, with starting by hand; neither the flame starting aid provided nor the battery starters have had to be used.—*The Oil Engine and Gas Turbine, July 1954; Vol. 22, p. 81.*

Surface Failure in Gears

The lubrication of gears poses two separate problems. The first one is how does the oil film form between gears, and what is the mechanism that allows the surfaces to be separated by oil, considering the huge pressures existing between them? The second is: having once got an oil film, what causes it to fail? A certain amount of work has shown that in gears the limiting factor is the amount of energy dissipated at the surface. If an attempt is made to analyse these results, difficulties occur almost at once. First, the temperature rise is very small. For discs, it is of the order of 40 to 80 deg. C, and in gears the same temperature rise is found, though the problem is rather more complex owing to the difficulties of the coefficient of friction. It does seem, however, that scuffing is correlated better by the temperature flash than by any other method. If this is so, what is the detailed mechanism causing the gears to scuff? There are various possibilities, but all require proof. In the first place, it may be bound up with the interesting fact, not hitherto applied to gears, that all steels, except those containing a large percentage of alloying metals, start to soften at about 250 deg. C. If it is assumed that the local temperature rise at the actual point of contact just prior to scuffing is at this value, there is a possible explanation. If the gear surface gets any hotter, the area of contact will increase as the surface starts to soften. This will cause the friction to rise, which increases the temperature, and the whole system fails. This, however, does not account for the effect of E.P. oils or silver plating which do not materially lower the coefficient of friction, but raise the scuffing load two or three times. Another hypothesis is that the temperature is required to be high enough to destroy the oxide film which always exists on the metal surface. This is an attractive idea, as it means that systems lubricated by extreme pressure oils, which form chloride or sulphide films, will fail when the surface temperatures are high enough to disrupt the chlorides or sulphides so formed. What does not seem so satisfactory is that a temperature very much in excess of 200 deg. or 300 deg. C. would seem to be required to disrupt these iron compounds, which chemically are very stable. There is also the theory that the temperature causes an oriented layer of oil, adsorbed on to the surface by chemical forces, to be ruptured. Against this can be raised the fact that the scuffing load of a completely neutral mineral oil is not very much increased if one per cent or so of a fatty acid, such as stearic or oleic, is added to it. The addition of this acid, which is known to form a strongly oriented film on steel, makes very little difference to its load-carrying capacity. The theory suggested, though with no experimental backing, is that scuffing is a type of "cold" pressure welding. This is brought about in normal welding practice by pressing two pieces of metal together, without any external means of heating, so that a considerable amount of plastic deformation occurs. This breaks, by mechanical means, any oxide film on the surface, exposing the pure metal below. The two metals then seize, or weld together, by molecular attraction. In gears, the sequence of events will be on this postulate approximately as follows: the local temperature reaches 250 deg. C., due to the flash temperature and possibly the adiabatic heating. This causes the surface to soften, and the consequent yielding will rupture the oxide film present on it. This temperature is high enough to ensure that any layer of oil or fatty acid is in an unoriented and easily removable condition. The two metal surfaces will then weld together as a result of the pressure exerted between them. The effect of E.P. oils and of silver plating fall directly into place. An experimental method has been attempted at Pametrada Research Station. It has been seen that there is a resistance at the contact point due to the oil film, hence if a very heavy electric current is passed an amount of energy of the same order as the energy produced by the friction of the two discs, just prior to scuffing, can be dissipated. The results from these experiments show that the total amount of energy dissipated at the contact is constant, whether it is made up of electrical or mechanical components. This indicates that heat, and hence the surface temperature, is the deciding factor in these scuffing experiments.—*A. Cameron, Journal of the Institute of Petroleum, July 1954; Vol. 40, pp. 191-196.*

Emergency Gas Turbine

A contract for a 200-h.p. emergency gas turbine-driven generator was placed by the Admiralty with W. H. Allen, Sons and Co., Ltd., some three years ago. This engine was assembled by the end of 1952, since when a series of performance, governing and endurance tests have been carried out in the company's fully-equipped and instrumented test house at Bedford. Fuel consumption and long life being relatively unimportant considerations, it was possible to construct a simple cycle single-shaft type of engine, with single-stage centrifugal compressor, a single combustion chamber and plain bearings. The compression ratio was limited to 2·5 : 1 which enabled a single-stage turbine to be used. The gas turbine engine was coupled to a D.C. generator taken from a German destroyer. This provided the necessary load for the trials. The illustration



Section through the 200 h.p. Allen gas turbine showing combustion chamber, epicyclic reduction gear and shaft bearings shows the single combustion chamber mounted on top of the main casing, and the Allen-Stoeckicht epicyclic reduction gears. In the early stages of development, rotor-blade tips rubbed on the casing. The reason for this excessive amplitude was not understood, and it was therefore decided to change to the present design with a lead-bronze bearing on either side of the rotor, with the result that the engine now runs well below its critical speed at all conditions. The initial fears for the bearing running in the hot exhaust gas stream have proved completely unfounded. As can be seen from the sectional drawing, air enters the centrifugal compressor from trunking above the set, and on leaving the diffuser it enters the main-air casing which is connected to the outer annulus of a reflux combustion chamber of the normal flame-tube-type, designed by the Shell Company. The burner, also of Shell design, is of spill-type, with a constant inlet pressure of 400lb. per sq. in. The combustion chamber discharges into a volute which feeds the radial turbine. The main-air casing surrounds this hot volute, so that the only "hot" part of the engine is the exhaust pipe. The turbine rotor runs at 23,000 r.p.m., and drives the generator at 3,000 r.p.m. through Allen-Stoeckicht epicyclic gears, which are contained in the main engine casing. The life of the rotor is 1,000 hours at full load. The weight of the turbine, reduction gear and all auxiliaries is 600lb. The following is the present measured full-load performance: —

Air inlet temperature ...	... 60 deg. F.
Output	... 200 h.p.
Turbine inlet temperature	... 780 deg. C.
Mass flow	... 5·1lb. per sec.
Pressure ratio	... 2·4
Specific fuel consumption	... 1·6lb. per h.p. per hr.
Thermal efficiency at high-speed coupling ...	... 8¾ per cent

The single-shaft design makes governing easy, and the set accepts the imposition or removal of full load (200 h.p.) with a temporary speed change only ½ per cent in excess of the permanent speed change.—*The Marine Engineer and Naval Architect, August 1954; Vol. 77, pp. 296-298.*

Man Scalded in Boiler Drum

A fireman serving on a freighter equipped with sectional header water tube boilers suffered painful burns when a puff of live steam accidentally entered a steam drum in which the fireman was working. The steam followed a path from another boiler which was steaming on the line through at least three valves which should have been closed but were not, due to carelessness and neglect. In the process of preparing the vessel to be laid up for a period of months the port boiler was being cleaned to prepare for annual inspection. It was taken off the line and allowed to cool for three days. The boiler was secured; the division valve between the blow-down lines from both boilers was closed; signs were posted on feed steam valves; blind joints were placed in the main and auxiliary steam lines and the principal valves closed on the boiler. Under the supervision of the first assistant engineer, the boiler was dumped and the manhole cover removed on the steam drum. The first assistant entered the steam drum with an extension light and determined that the drum should be hosed out with fresh water to remove mud and sediment. This job was assigned to the fireman who was the smallest man in the work group. It was a matter of established routine on this vessel for the fireman on watch to give the bottom blow on the boiler or boilers on the line a puff on the blow-down valves, once each watch. The fireman on watch at the time of this accident was working with a second assistant on the water columns and was not directly concerned with the group working at the steam drum. Consequently he had no knowledge that there was a man in the steam drum. In a routine manner he gave the bottom blow a short puff. The boiler on the line was carrying about 210 pounds of steam. This blow-down went overboard on the starboard side but also backed up, past the division valve at the drum which was open, the Okady quick-opening valve which was somehow cracked open slightly, the globe valve at the drum which was open, and into the steam drum of the port boiler through the scum pan. No one knew how the division valve or Okady valve had become opened. The globe valve at the drum was almost never closed on this vessel. There were no check valves installed in these lines. At this moment the small fireman was inside the drum beyond the scum pan and thus trapped with no escape except through the incoming steam and hot water. In desperation he sheltered himself as best he could, which was not very well, due to the cramped position, until he was able to crawl out of the drum when the hot geyser subsided. He was severely and painfully scalded on his body, particularly on his face, left side and arm. The engineering personnel rendered such first aid as they were able and took him to the hospital where he was given treatment for twenty-three days.—*Proceedings of the Merchant Marine Council, United States Coast Guard, June 1954; Vol. 11, p. 100.*

Hongkong Built Cargo and Passenger Vessels

Two motor vessels, the *Hervar* and the *Henrik,* have recently been completed by the Taikoo Dockyard and Engineering Co. of Hong Kong, Ltd., for Brussgaard Kiosterud and Co., Drammen, Norway, for service in the Far East. The owners, who have considerably increased their tonnage since the war, run a fleet between China and Siam known as the China/Siam Line. The vessels are mainly of small tonnage, about 2,000 to 4,000 tons, with the exception of one tanker of 10,259 tons and another of 12,000 which may not yet be in service. These vessels have been specially designed to suit the owner's requirements in the Far East. They carry eight passengers and have refrigerated space for the carriage of 1,500 cu. ft. of frozen or chilled cargo. The propelling machinery consists of a five-cylinder Taikoo-Sulzer Diesel engine driving through a single screw. The principal particulars of these vessels are as follows: —

Length o.a.	277ft. 0in.
Length b.p.	255ft. 0in.
Breadth moulded...	42ft. 6in.
Depth moulded to shelter deck...	25ft. 0in.
Depth moulded to upper deck ...	16ft. 0in.
Draught loaded	15ft. 10in.
Deadweight	2,000 tons
Gross tonnage	1,702 tons
Net tonnage	739 tons
Speed on load draught	12½ knots
Bale capacity	132,000 cu. ft.

The *Hervar* and the *Henrik* were built to comply with the rules of the classification society Det Norske Veritas and the Norwegian Sjofartskontoret. A high proportion of electric welding has been used in their construction.—*The Shipping World, 9th June 1954; Vol. 130, p. 599.*

Gears for Marine Gas Turbines

This paper describes problems associated with the design of gears for gas turbines. Gas turbines of sizes suitable for marine auxiliaries operate at speeds up to and beyond 40,000 r.p.m. Larger turbines being considered for main propulsion units for large vessels produce 5,000 h.p. or more and run at speeds of 5,000 to 8,000 r.p.m. A number of special problems are encountered in these applications. The first problem to be faced is the high speed. All rotating parts must be balanced accurately to give smooth vibrationless performance. Careful design and smooth finishes are required to minimize windage and churning losses. Fatigue and centrifugal stresses can become critical. Speed also affects lubrication, bearings, etc. Positive-pressure lubrication is required at all points. Loss of oil for even a few seconds on a bearing or gear can result in disaster. Journal, ball and roller bearings are used successfully in high-speed applications. They must be designed and tailored carefully for the individual application. Journal bearings are generally steel with babbitt or silver linings. Leaded-bronze bearings also are used, often in floating designs. Very high oil temperatures are encountered in the faster journals and special attention is required to obtain adequate circulation of cooling oil. Gas turbines produce comparatively large amounts of power in small amounts of space. To be compatible, the reduction gear also must be as compact and small as possible. To achieve the objective of minimum weight and space, aircraft practice usually is followed. The problems in the design of the geared elements are many and varied and require all of the designer's ingenuity and skill. To meet the space and weight requirements, the gears are loaded as highly as possible and the designer uses the most advanced-design techniques. The gears must be as accurate as possible. Common tolerances for the high-speed sets are 0·0005-in. pitch-line runout; 0·0002-in. tooth-to-tooth spacing error; 0·0003-in. involute profile error; and 0·0003-in. lead error per inch of face. Gear material is uniformly of the highest quality and must pass magnetic-inspection tests. Sometimes, it also is required to pass ultrasonic inspection of subsurfaces. Gear teeth sometimes fail by pitting of the tooth surfaces. This is a surface-fatigue phenomenon which is related directly to surface compressive stress. Surface wear is caused by abrasive material in the lubricating oil. With the high-class workmanship required for gearing of this nature and with adequate oil filtering, wear should not be a problem. Scoring is sometimes encountered in the highly loaded high-speed gearing. It results from rupture of the oil film and welding together of the teeth. The gearing problems which arise in designing for marine gas-turbine installations derive mainly from the very high speeds encountered and from the high temperatures often present. Many complex problems have to be solved to meet size and weight limitations, to provide drives for the many accessories, and to lubricate and cool the gear. Practically all types of gearing have been used successfully.—*Paper by R. J. Hoard and L. A. Acurso, read at the Spring Meeting of The Society of Naval Architects and Marine Engineers, 1954.*

Reinforced Plastics

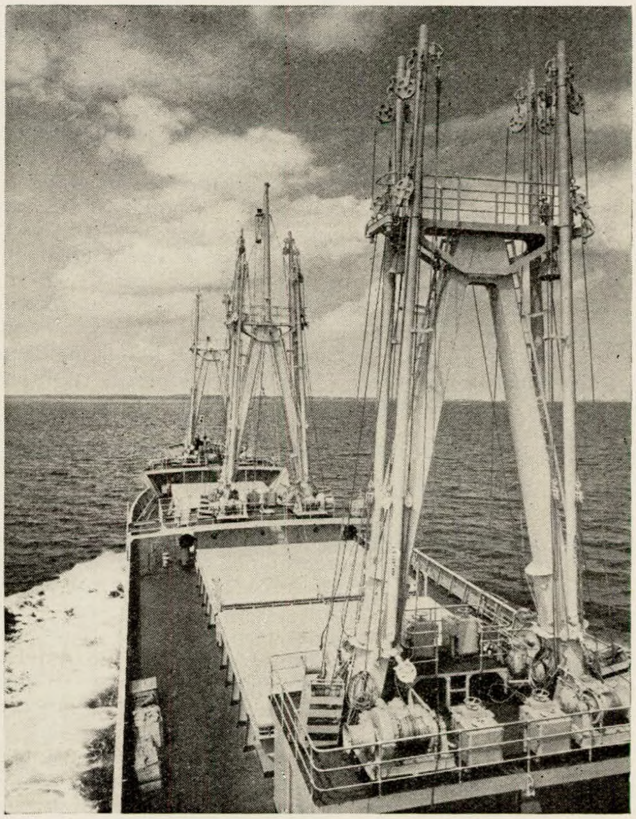
Today, plastics are used extensively aboard ship as electrical insulating materials, for transparent covers, windshields and other enclosures, for flotation and survival purposes, and for structural purposes. The materials used in structural plastics are durable under continuous exposure to sea water and widely varied environmental conditions. Good quality structural plastics are estimated to have an indefinite life, although only a little more than ten years of actual experience is available. Since these materials are not subject to corrosion, dry rot, borer attack and other infirmities of wood, items made from them are expected to have very low maintenance costs. Structural plastics offer many fabricating advantages. Complex shapes are formed easily. Close tolerances are held and reproduced easily. Identical units are produced in volume readily and with relatively few man-hours. Fastenings are at a minimum because of the ease with which monolithic structures are formed. Weight-strength ratios are high compared to other structural materials. Weight-stiffness ratios are favourable when sandwich constructions are used. The ready availability of the raw materials is another advantage in favour of structural plastics. The glass fibres are produced from silica or sand. The mechanical properties of structural plastics depend on several basic factors. These include the orientation of the reinforcing fibres, the per cent of fibrous glass, the presence of voids, the uniformity of resin and glass distribution and the efficiency of the bond between the resin and the glass fibres. Although monolithic structures are formed easily and usually used in reinforced plastics, there is the frequent need to make connexions. Connexions may be made by the use of rivets, bolts, and screws, and by the use of adhesives, usually supplemented with light mechanical fasteners, such as self-tapping screws. Several designs and applications are still in the development stage. A 57-ft. minesweeper hull is being designed and built of honeycomb core-sandwich construction. Many designs and combinations of materials have been considered for the construction of plastic LCVP. Gearcase covers and storage tanks have been made from various plastics. A great deal of research effort is going into the reinforcing plastic-pipe field.—*Paper by J. B. Alfers and W. R. Graner, read at the Spring Meeting of the Society of Naval Architects and Marine Engineers, 1954.*

Swedish Cargo Vessel with Three Bipod Masts

The Swedish shipowners, Aktiebolaget Arafart, Stockholm, accepted delivery of a bulk carrying vessel on 15th June from Oresundsvarvet A/B, Landskrona. This vessel, the *Arabert,* is the sixth bulk carrying vessel to be constructed for the same owners, and is a single-screw motorship of 4,000 tons deadweight, raised quarterdeck, with machinery aft and three bipod masts. The arrangement of machinery and deckhouses for accommodation and navigation aft leaves the best part of the hull available for the carriage of cargo, which, in the case of bulk cargo, is particularly valuable. The *Arabert* is propelled by a two-stroke Götaverken Diesel engine giving her a speed of 12 knots. The principal particulars of the *Arabert* are shown in the following table:—

Length b.p.	300ft. 0in.
Breadth moulded...	47ft. 0in.
Depth moulded to main deck ...	21ft. 3in.
Depth moulded to raised quarter-deck	26ft. 6in.
Draught, summer	19ft. 6¼in.
Deadweight	4,000 tons
Cargo capacity (grain)	200,000 cu. ft.
Contract speed (loaded)	12 knots
Speed on trial	13·73 knots
Power	1,750 s.h.p.

The *Arabert* has been built to Lloyd's Register class 100 A1 "strengthened for navigation in ice" and complies in her construction with the British regulations for "easy trimming". Apart from the main framing, which is riveted, and the deckhouses which are partly riveted, welding has been used throughout. The *Arabert* is designed as a raised quarterdeck vessel and has a soft bow, cruiser stern and poop. The cargo space



A view of the Hallen type self-staying bipod masts is divided into two holds, one below the main deck and one below the raised quarterdeck. The holds are separated by a deep tank which is arranged for the carriage of water ballast. It is divided into one starboard and one port tank. On top of these tanks there are two deck tanks located between the main deck and the raised quarterdeck for the same purpose. The fore hold, of 68,700 cu. ft. (grain) capacity, has two hatches in the main deck, and the after hold, of 131,300 cu. ft. capacity (grain) has three hatches in the quarterdeck. All the hatches are fitted with steel folding covers. The vessel has three self-staying bipod masts of the Hallen type with ten derricks arranged for 3 tons in single, and 5 tons in double purchase. The derricks are served by ten Thrige electric winches of 3 tons capacity, each powered by a 25-h.p. motor. The windlass and a 5-ton capstan on the poop deck are all electric.—*The Shipping World, 28th July 1954; Vol. 131, pp. 108-109.*

Strength Analysis of Mast Rigging

In few branches of ship design have empirical solutions been so long accepted as in that of rigging. The reason for this must undoubtedly be sought in the indeterminate nature of many of the forces induced in the rigging of a stayed mast, where the individual contributions made to the strength of the entire complex by the mast itself and by its supporting wires do not yet appear to have been assessed with any degree of accuracy. Nevertheless, within the last few years this problem has been the subject of renewed examination, and a number of advanced methods, based on considerations of deflection or of strain energy, have been put forward in the hope that they will serve to rationalize the approach to rigging problems. Excellent as many of these calculation routines are in conception, most of them are open to the objection that the amount of arithmetical work entailed to complete the analysis of a complex system is likely to make them unsuitable for use in the ordinary design office, except in very special circumstances. Another factor which, at the present stage of our knowledge, tends to minimize their usefulness is their need for an accurate evaluation of the elastic modulus of wire rope, a subject on which there would seem to be as many opinions as there are experts. As in the past, reliance is still frequently placed on purely empirical methods of design, always with a cautious eye on what has been done with success in previous ships. This practice of "designing from experience" cannot altogether be condemned out of hand—the very rare occurrence of failures in cargo lifting gear would appear broadly to suggest a fair amount of justification by results—but it might nevertheless be pleaded that some simple means of analysis would be useful in securing uniformity in the standard of strength adopted in successive installations. In the system of analysis given it is not pretended that all the factors are fully taken into account, nor that it will entirely withstand the strictest scientific scrutiny; but it is suggested that it may serve, failing any better system of equal simplicity, as a rough basis on which the overall strength of a rigging system may be compared with that of other similar systems which experience has shown to have given satisfactory results.—*J. H. Hughes, European Shipbuilding, 1954; Vol. 3, No. 3, pp. 56-60.*

Automatic Combustion Control

To apply automatic combustion controls to an integral type superheater boiler (single furnace), the control system remains relatively basic. Steam pressure is the only factor measured through a single Master Controller, and the system develops a relative impulse to control combustion rate and to maintain the desired steam pressure. As a result of controlling combustion rate and maintaining the proper air-fuel ratio the desired superheat outlet temperature is readily maintained. To apply automatic combustion controls to a separately fired superheater controlled boiler (divided furnace) is rather a complex problem, in that a near-perfect balance of the firing rates of both furnaces must be maintained at all load changes in order to prevent the controls from "hunting". In this application, two controlled variables, steam pressure and steam temperature, are measured by two Master Controllers. One Master Controller measures steam pressure and develops an impulse relative to it to control the combustion rate of the saturated furnace, while the other Master Controller measures steam temperature and develops an impulse relative to temperature change to control the combustion rate in the superheater furnace and maintain the desired steam temperature. The usual arrangement for an automatic combustion control system for this type of boiler is to allow the Master Controller, which measures the steam pressure, to vary the combustion rate on both furnaces when a change in steam demand occurs. The Master Controller measuring steam temperature then restricts or corrects the superheater furnace combustion rate to maintain desired temperature. To accomplish this, it is necessary to introduce several relays into the system that will permit the superheater furnace combustion rate to be changed in accordance with the impulse change originating in either of the two Master Controllers. In view of recent developments in naval boilers, and the experiences gained by the use of automatic combustion controls, it is believed by the authors that this type of boiler will eventually be eliminated.—*J. E. Schirmer and J. Grandpre, Journal of the American Society of Naval Engineers, May 1954; Vol. 66, pp. 335-342.*

River Tankers with Voith Schneider Propulsion

Shell-Mex and B.P., Ltd., is in process of augmenting its fleet of estuarial and river craft for service in the Bristol Channel and Severn, and in the Medway, Thames, Humber and Trent. Ten vessels for this type of service have been or will be ordered from British shipyards for completion in 1955-56. When commissioned they will be employed in distributing petroleum products from the six United Kingdom refineries of Shell and Anglo-Iranian, and be dovetailed into the main distribution system of Shell-Mex and B.P., Ltd. The vessels will be Diesel-engined and built to Lloyd's Register requirements. They will be fitted with modern radar equipment where desirable, and vessels so fitted will have telescopic masts of special design. The cargo pumps and pipelines installed will ensure the effective segregation of the petroleum products to be carried. Nine of the new vessels will have the Voith Schneider propeller as the means of propulsion. With vertical blades and aerofoil section rotating round a vertical axis, the Voith Schneider propeller will make it possible for the vessels to dispense with rudder, sternframe and ordinary steering mechanisms. The ships will have greater manœuvrability than with the ordinary screw propeller, a factor of great importance in the trade in which they will be employed. Crew accommodation and facilities will be to the customary high standard of the company's fleet. A new Shell-Mex and B.P. 530-tons coaster, now building at Clelands (Successors), Ltd., Wallsend-on-Tyne, will soon be launched. This vessel will be 160ft. long, with 29ft. beam, and a draught of 11ft. 3in. This new coaster, with the other ten vessels under construction, will bring the Shell-Mex and B.P. fleet of coastal, estuarial, bunkering and river craft to a total of forty-seven.—*The Shipping World, 18th August 1954; Vol. 131, p. 190.*

New Type of Cast Iron for Propellers

Lips Propeller Works have introduced a new type of nodular cast iron, known as Grafista, having an appreciable elasticity which can be increased by annealing to a figure comparable with that for cast steel. Tests have shown the tensile strength to be about the same as for cast steel, and that elongations of 2-7 per cent can be raised by annealing to 18 or 20 per cent, compared with 20-25 per cent for cast steel. As it corrodes more quickly than cast steel, Grafista is recommended for propellers for use in inland waters rather than salt water. The cost is only about half that of a cast steel propeller. More than 1,500 of these propellers have already been supplied, in sizes up to 10 feet.—*Dutch Shipbuilding, 1954; Vol. 3, No. 3, p. 16. Journal, The British Shipbuilding Research Association, July 1954; Vol. 9, Abstract No. 9,098.*

Three 29,500-ton Tankers

The fleet of tankers of the Compagnie Navale des Pétroles of Paris is comprised mainly of oil-engined ships, and the latest vessel of which they took delivery, the *Djemila,* of 12,000 tons, is equipped with the first French-built Doxford engine. There are now five super-tankers on order, all motor ships, and three of these, the *Biblos, Nineve* and *Samarrah* are of 29,500 tons d.w., the remaining two, the *Zubair* and *Butmah* having a deadweight capacity of 24,000 tons. The *Biblos* and *Nineve* are on order at the Ch. Navals de la Ciotat at La Ciotat, France, the *Samarrah* at the Penhoët yard, St. Nazaire, whilst the *Zubair* and *Butmah* are being built at Kockums' yard in Malmö, Sweden. The engine room and general arrangement plans of the *Biblos* and *Nineve* are now published. These and the *Samarrah* will each be equipped with single-screw 11,250-b.h.p. B. and W.-type turbo-charged two-stroke machinery, the first engine for the *Biblos* being built by Burmeister and Wain at Copenhagen, and the other two by the Ch. et At. de St. Nazaire Penhoët at St. Nazaire, under licence. In each case the engine is designed for the output mentioned for continuous service at 115 r.p.m., but in actual operation the rating will be 9,500 b.h.p. at 110 r.p.m. The main details of the vessels are as under:—

Length overall	198·43 m.
Length on waterline	189·20 m.
Length b.p.	185 m.
Beam	25·5 m.
Deadweight capacity	29,500 tons
Displacement	38,540 tons
Trial speed	15·6 knots

The hull is divided by transverse and longitudinal bulkheads into ten central tanks and ten tanks to port and starboard. Forward of the engine room are settling tanks and fuel tanks, and forward of these is the main pump room, in which are installed two steam-driven Rateau turbine-driven pumps each with a capacity of 1,000 tons hourly. At the forward end of the ship is a deep tank, with a dry cargo tank above, and aft is a second pump room with two stripping pumps, one electrically-driven with a capacity of 200 cu. m. per hr. and the other steam-driven with a capacity of 150 cu. m. per hr. The engine is of the now thoroughly standardized Burmeister and Wain type, having nine cylinders with a diameter of 740 mm., the piston stroke being 1,600 mm. and the output of 11,250 b.h.p. is attained at about 115 r.p.m. (or 9,500 b.h.p. at 110 r.p.m.). It is turbo-charged with two Rateau blowers, the mean pressure when the output is 11,500 b.h.p. being 8 kg. per sq. cm. or 114lb. per sq. in. The overall length of the engine is 41 feet. Alternating current is used throughout the ship at a voltage of 380, reduced to 110 for lighting purposes. There are three sources of supply, one being a 200-kW turbo-alternator, the second a 200-kW Diesel-engined generator while the third is a 50-kW set driven from the propeller shaft. Normally, sufficient steam will be raised from the exhaust gas boiler to supply the 200-kW turbo-alternator and this, with the 50-kW alternator, will supply all the power needed whilst the ship is at sea. The steam is also utilized for heating the fuel. The exhaust gas boiler is of the Spanner design and acts also as a silencer, no other silencer being provided. About 136,000lb. of gas are passed through the boiler per hr. at 330 deg. C. and 5,070lb. of steam per hr. are raised at 250lb. per sq. in. The engine is designed to operate on boiler oil except when starting and stopping, and there are two 31·5-ton mixing tanks in which the boiler oil can be mixed with gas oil to give the right viscosity, also two 80·5-ton fuel oil tanks and a 40·5-ton purified fuel oil tank. The fuel is purified by means of a group of De Laval clarifiers and purifiers in the normal manner, suitable arrangements for maintaining the requisite temperature being provided.—*The Motor Ship, September 1954; Vol. 35, pp. 247-249.*

Washer for Accurate Preloading of Bolts

A very ingenious two-part washer has been invented and is already being applied in the aircraft industries, thus making possible the accurate preloading of bolts in a particularly simple manner. Exhaustive tests conducted with the washer are said to have shown that it can be designed to ensure an average tension preload of 80 per cent of the desired bolt preload, with only slight deviations. It is expected that this will result in a sharp increase in the fatigue life of the bolts. The new washers are already in use on aircraft to join the lower half of the nose section to the fuselage, to join wing and fuselage, and for wing attachment. The new washer consists of two concentric metal rings, of which the thicker inner ring first takes the load when the bolt is tightened. Continued tightening then causes the outer ring to bind when the desired preload is reached. The point at which this binding occurs can be controlled by appropriate choice of washer dimensions and materials. During the tightening operation the operator "wiggles" the outer ring by means of a handle which can be discarded after it has served its purpose. It is claimed that this very simple method, which relies on the compressive properties of the washer, is greatly superior to the older method of preloading the bolt by means of a torque wrench. Close control of the compressive characteristics of the washer would appear to be most essential, since even small deviations from normal must inevitably lead to corresponding errors in bolt loading.—*The Engineers' Digest, September 1954; Vol. 15, p. 375.*

Turbo-electric Dredger for Suez Canal

N.V. Werf Gusto of Schiedam have launched the turbo-electric cutter suction dredger *Louis Perrier* for service in the Suez Canal. The *Louis Perrier* has machinery of 4,500 h.p. which makes her the most powerful vessel of her type yet built in Europe. Steam will be provided at 450lb. per sq. in., by three oil-fired Foster-Wheeler watertube boilers having automatic combustion. These boilers are being supplied by Verschure and Co's Scheepswerf en Machinefabriek, Amsterdam. Stork turbines will be coupled to electric plant supplied by Electro-Smit of Slikkerveer. The principal dimensions of the *Louis Perrier* are, length overall, 263 feet and breadth 48 feet. The dredger is designed for operation on a twenty-four-hour basis and air-conditioned accommodation is provided for a crew of 65, on two continuous upper decks. Special provisions have been made to enable the dredger to work in the centre of the canal. This means that work must be interrupted when ships pass and the long floating pipeline used for disposal of spoil must be quickly pulled to the bank of the canal. Werf Gusto are also constructing a self-propelling Diesel-electric floating crane for the Suez Canal. Another order in hand for the Suez Canal Company is the 4,500 h.p. *Edgar Bonnet,* building by one of the I.H.C. firms. She will be the most powerful tug in the world.—*Holland Shipbuilding, 8th May 1954. The Marine Engineer and Naval Architect, September 1954; Vol. 77, p. 338.*

Gas Turbine for Liberty Ship

In the United States eleven companies have submitted to the Maritime Administration seventeen proposals for the development and furnishing of a complete gas-turbine propulsion-power plant for experimental installation in a Liberty ship of the National Defence Reserve Fleet. The proposals are in response to invitations issued by the Maritime Administration as a first step toward development of a "power package" of advanced design. This will be employed and tested first in one of the Liberty ships of the reserve fleet and after evaluation will be made available for further conversions and modernization of existing vessels and for new ship construction. More than forty firms evidenced interest in this engine-improvement project. Included in the responses are two proposing use of devices of French manufacture and another proposing use of components of Swiss origin. All of the proposals are under intensive study by a specialized group and a thorough evaluation of all data submitted will be made. The plan to be utilized for the first Liberty ship conversion will be announced later.—*Marine Engineering, July 1954; Vol. 59, p. 102.*

Patent Specifications

Gas Turbine Plant with Open and Closed Circuit

This invention relates to gas turbine plants having both an open and a closed circuit with a common high pressure branch containing a final compression stage, a heat exchange stage, an air heater, and a high pressure turbine stage. Air for supporting combustion in the air heater is bled off into the open circuit and exhausted to the atmosphere after having completed the open circuit. In certain proposals for such plants, the closed circuit branches off from the open circuit immediately after the last compression stage and leads through a heat exchanger, air heater turbine, and cooler back to a suitable intermediate stage in the compression section of the plant, while the open circuit leads through another heat exchanger, a combustion chamber, one or more turbines, and heat exchangers out into the open air. In order to simplify plant layout and make it possible to operate at higher temperatures and pressures, the division of the air between the open and the closed circuits is postponed until after the compression, heating and partial expansion stages in a turbine. In the plant depicted in Fig. 7, a low pressure compressor (1) draws in atmospheric air through a suction branch (2) and supplies it to a succeeding compressor (4) through an intermediate cooler (3). After the compression has been terminated, the air is divided between the two pipes (5 and 6), the former of which leads through a heat exchanger (7) of the recuperative type in which the compressed air receives heat from the low pressure side of the closed circuit of the plant. The discharge pipes (9 and 10) of the heat exchangers are united at a point (11) from which a common pipe (12) leads to a tube coil (14) in an air heater (13) where the total quantity of air is heated indirectly to the highest working temperature. The total quantity of air in this high pressure and high temperature is led through a pipe (15), to a turbine (16), the shaft (17) which drives the compressor group (1 and 4) and yields useful power through a shaft (18) with a flange coupling (19). In the turbine (16) the air expands to a desired pressure which lies more or less above the atmospheric pressure, and then the air is divided between two pipes (20 and 26), so that the greater part is led through the pipe (20) to the heat exchanger (8) and thence through a pipe (21) to a point (28) of the compression section, viz. the entry to the intermediate cooler (3). Thus the closed circuit of the system is completed. The remaining part of the partially expanded air is led through the pipe (26) to a low pressure turbine (27) which yields work to the shaft (17, 18). In this turbine the air expands down to approximately the atmospheric pressure and is next led through a pipe (22) as combustion air through the air heater (13). The fuel is supplied in any optional manner, e.g. by injection through a fuel nozzle (23), and the products of combustion after having given off heat to the heating surface (14), pass through a pipe (24) which is led to the heat exchanger (7). Here residual heat is given off to the compressed air, after which the products of combustion are discharged to atmosphere through the pipe (25). It will be seen that products of combustion are only present in the parts of the plant where their presence is unavoidable, viz. in the combustion chamber of the air heater (13) and on the hot side of the heat exchanger (7). Consequently, only these parts will have to be designed with a view to easy cleaning, and the regards to space and economy will permit the plant to be provided with two or more units of each of these elements, so that one set of them can operate, while the others are disconnected for cleaning and repair. The two-shaft shown in Fig. 8 differs from the single-shaft plant shown in Fig. 7 substantially in that in the path of the products of combustion from the air heater (13) through the heat exchanger (7) to atmosphere, a turbine (31) is inserted. A pressure above atmospheric air is therefore maintained in the combustion chamber of the air heater corresponding to the pressure drop through this turbine.—*British Patent No. 711,885, issued to Aktieselskabet Burmeister and Wain's Maskinog Skibsbyggeri. Application in Denmark made on 17th August 1951. Complete specification published 14th July 1954. Engineering and Boiler House Review, September 1954; Vol. 69, pp. 287-288.*

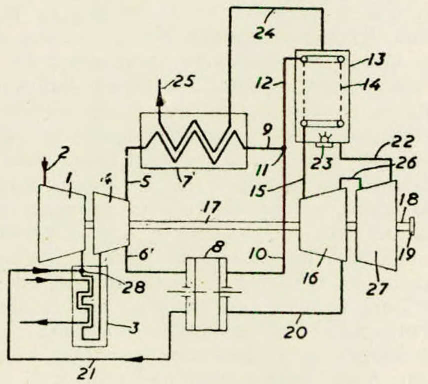


FIG. 7

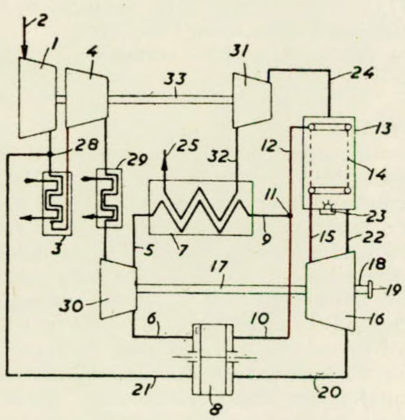


FIG. 8

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