Abstracts of the Technical Press

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Corrosion Inhibitors in Condenser-tube Alloys.

An article by A. R. Zender and C. L. Bulow in the U.S. periodical *Heating, Piping, Air Conditioning* describes a series of tests which were carried out in flowing sea-water at Kure Bay, N.C., with A.S.M.T. sheet tension specimens 0·050in. thick, supported on Bakelite insulated rods with Bakelite spacers. An addition of 0·04 per cent. of arsenic to Admiralty metal helped to inhibit dezincification in sea-water and also slightly lowered the overall corrosion rate. No intergranular corrosion or dezincification occurred during the first year in sea-water. An additional 0·1 per cent. of arsenic to Muntz metal very markedly inhibited dezincification in sea-water, with an effect almost equal to that of 0·75 per cent. of tin.—*"Journal of the Institute of Metals", Vol. 12, August, 1945, Metallurgical Abstract on p. 252.*

Marine Pumps.

An article by Dr. Ing. G. Hutarew in the German technical periodical *Schiff und Werft*, points out that the principal requirements of pumping plant for service on board ship are reliabilility and economy. In considering pump efficiency, a distinction must be drawn between pumps used for cooling purposes (such as circulating-

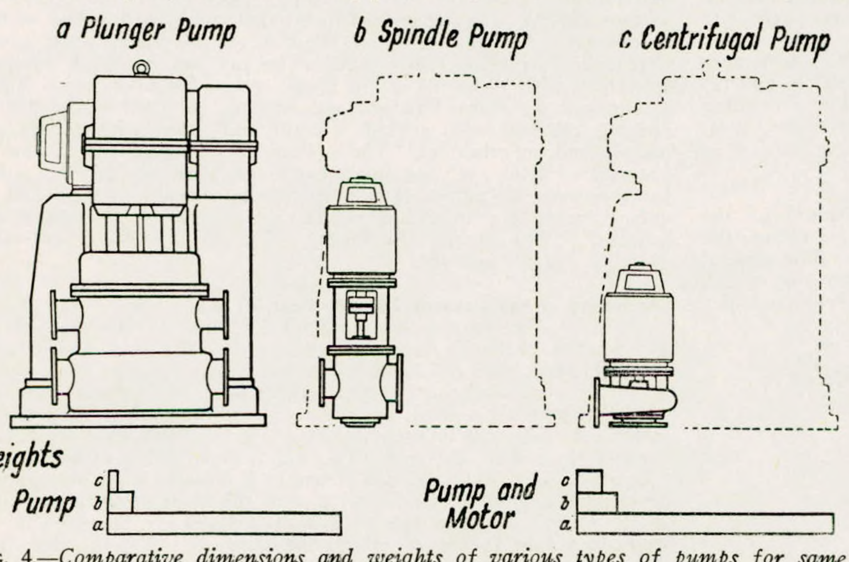


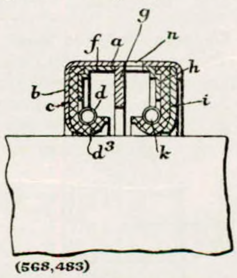
FIG. 4.—*Comparative dimensions and weights of various types of pumps for same capacity.*

water and lubricating-oil pumps in which the heat corresponding to the pump losses is carried away with the liquid and is lost) and those which deliver, *e.g.*, boiler feed water, where the pump losses are recovered in the liquid pumped. The latter type can operate satisfactorily with a lower pump efficiency provided that the addition of the heat corresponding to the pump losses is not a disadvantage. The four factors which affect the reliability and economy of a marine pump are the operating conditions, the design and construction, the control and attention, and the upkeep of the unit. As regards operating conditions, it is essential that these should be considered in selecting a pump for a specific purpose. Every pumping unit is either a discharge pump or a suction pump, the former delivering fluid into a working system connected to the discharge pipe, the total delivery being determined by the total requirements of the system, whilst the suction side must always have an ample supply of fluid available. Suction pumping plants, however, have to empty or maintain empty a closed space or tank connected to the suction side of the pump, the quantity delivered by the latter being determined by the amount of fluid available on the suction side. The regulation of discharge pumps, such as cooling-water pumps, can be effected either by altering the pipe characteristics with constant speed or by speed control. In dealing with the design and construction of pumps, the author draws comparisons between reciprocating and rotary pumps. Fig. 4 shows the relative dimensions and weights of plunger, rotating-spindle and centrifugal pumps, from which it may be seen that the last-named type are by far the smallest and lightest of the three. The author lays stress on the need for easy maintenance and overhaul, declaring that every pump should be capable of being rapidly taken apart and such components as are subject to wear quickly and easily replaced. Much time can be lost in fitting such items as new packing; some awkward designs necessitate the removal of the complete rotor to renew the packing. Standardisation could be used more than it is to reduce the number of designs, facilitate overhaul and simplify the question of spare parts.—*"The Marine Engineer", Vol. 68, No. 818, September, 1945, pp. 501-502.*

Oil Seal for Shaft Bearings.

A new British patent covers the design of an improved form of oil seal for bearings developed by a Birmingham firm of engineers. The seal, which is illustrated in the accompanying sectional diagram, holds a charge of grease and is claimed to be particularly suitable for use in bearings which are submerged, such as propeller-shaft bearings.

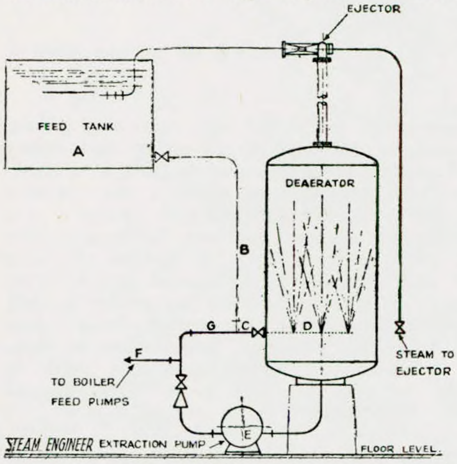
A rigid sheet-metal housing in the shape of a cylindrical shell (*a*) is formed at one end with an inturned flange (*b*). Within the shell is a flexible synthetic rubber ring (*c*), which fits closely against the flange (*b*), and has an inner bead of semi-circular cross section which accommodates a coiled spring wire ring (*d*). This ring presses



a central ridge (d^3) on the outer edge of the bead into close contact with the shaft. The flexible ring (*c*) is held in position by a flanged sheet-metal retaining ring (*f*), which fits closely into the interior of the shell (*a*). After the insertion of the rings (*c*) and (*f*) into the shell, a central annular division plate (*g*) is fitted into the shell housing, and on the other side of this division plate a similar assembly is fitted. This assembly comprises a flexible synthetic rubber ring (*i*), a retaining ring (*h*) and a coiled spring wire ring (*k*), all of which are of opposite hand to the corresponding components in the first set. The shell (*a*) is adapted to fit closely upon a cavity in a bearing, and is drilled at (*n*) to enable grease to be introduced into the space between the flexible rings (*c*) and (*i*).—*"Engineering", Vol. 160, No. 4,156, 7th September, 1945, p. 200.*

De-Aerating Plant for Feed Water.

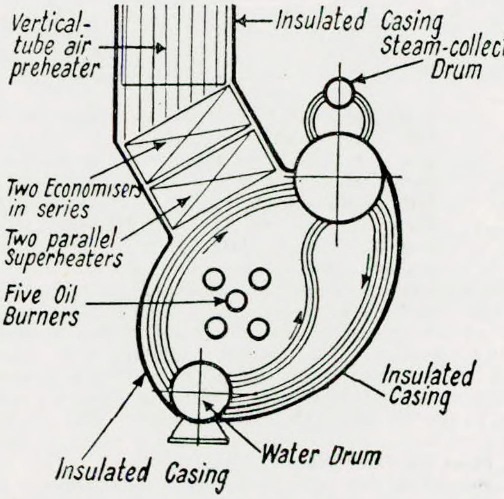
The accompanying diagram shows the application of a Hicks, Hargreaves atomising-spray de-aerator to an open feed system; it is claimed that its use results in no measurable trace of oxygen remaining in the feed water entering the boiler feed pumps. The principle on which this arrangement operates consists in allowing the oxygen-bearing feed water to flow from the elevated open feed tank (A) at a temperature of not less than 130° F. through the pipes (B and C) to the de-aerator, which it enters through specially designed nozzles (D) in the form of a finely atomised spray. The de-aerator is maintained under vacuum by a steam-operated air ejector, and by this means the oxygen and other contained gases are released from the feed water, which is then withdrawn from the de-aerator by an extraction pump (E), that has a larger capacity than the boiler feed pump to which the feed water is discharged through a pipe (F), the balance being passed back through the pipes (G and C) and recirculated through the de-aerator. The arrangement is claimed to ensure the maintenance of a high degree of efficiency, with a constant head on both the extraction and boiler feed pumps, thus enabling them to operate under favourable conditions. The nozzle pipes (D) through which the feed water is sprayed into the de-aerator, may be two or three in number, and are each fitted with a valve for controlling the flow of water to the spray nozzles, so that when operating on reduced load, one or more of the valves can be shut off, with a corresponding reduction in the pumping power of the extraction pump. A non-return valve is included in the circuit between the de-aerator inlet and the extraction pump delivery, so that in the event of a stoppage of the extraction-pump motor, the boiler feed pump can draw water direct from the feed tank, into which the steam-operated air ejector is then discharged in order to raise the temperature of the feed water. A de-aerator of this type at a large iron and steel works in India deals with over 130 tons of feed water per hour at a temperature of 150° F. and reduces the oxygen content to 0·025 c.c. per litre (Winkler's titration test).—*"The Steam Engineer", Vol. XIV, No. 168, September, 1945, pp. 383-384.*



Arrangement of Hick Hargreaves feed-water de-aerator.

Boilers of the German Torpedo Boat "T-35".

The "T-35" has four double-ended watertube boilers of the Wagner-Schichau two-drum type arranged in two boiler rooms, the after one being located between the two engine rooms. The general arrangement of these boilers in shown in the accompanying rough sketch. The design differs from that of the Babcock-Johnson boiler



in that the drums are not vertically above one another, neither are the heating surfaces equally divided between the two sides of the boiler. A small steam-collecting drum is located above the main steam drum. All the drums are solid-forged. Each boiler has two superheaters operating in parallel, with two economisers (working in series) above them. The air preheater has plain vertical tubes. The manhole doors are of the screwed-in type, a coarse thread being used. Each manhole door has a separate cone-jointed centre cap with soft iron packing. Five Blohm and Voss oil burners are installed at each end of every boiler and are controlled by Askania automatic combustion control gear. The air pressure in the closed stokeholds is 11·8in. w.g. at full power, when the steam pressure is 1,050lb./in.^{2}. The ordinary working pressure is 800lb./in.^{2}. The steam is superheated to 790° F. at full power, and no desuperheaters are considered necessary for use when manœuvring. It is the practice to steam with all four boilers whatever the speed of the ship—even at the "economical" speed of 16 knots.—*G. R. Hutchinson, "The Marine Engineer", Vol. 68, No. 818, September, 1945, pp. 471-473.*

Propelling Machinery and Boilers of R.F.A. "Olna".

The "Olna" and her sister ship are equipped with B.T.H. turbo-electric propelling machinery with a normal output of 11,000 s.h.p., but capable of maintaining 13,000 s.h.p. continuously. They are probably the highest-powered tankers so far built and are also the most powerful single-screw ships afloat. There are two turbo-alternators taking steam at a pressure of 425lb./in.^{2} and total temperature of 740° F., and developing 4,200/5,000 kW. at 3,900/4,150 r.p.m. with a vacuum of 28½in. of mercury. The propulsion motor is a synchronous machine comprising two separate half motors built into one casing. For propeller speeds of up to about 90 r.p.m. only one half motor is used, but for higher speeds both units are required. The starboard turbo-alternator is normally associated with the forward half-motor unit, and the port set with the after unit. When both alternators are running to supply power to drive the propeller shaft at speeds between 90 and 122 r.p.m., the maximum continuous rating of each alternator is 5,000 kVA, 3,200 volts, unity power factor, 4,150 r.p.m. When one alternator is running, driving the propeller shaft at a speed of 190 r.p.m. or less, the maximum continuous rating is 4,000 kVA, 2,460 volts, unity power factor, 3,060 r.p.m. Fans on each alternator rotor circulate cooling air through a closed circuit system with a sea-water-cooled surface type air cooler. The propulsion motor is rated at 11,000/13,000 s.h.p. at 115/122 r.pm., 3,000/3,200 volts, three-phase, unity power factor. It is cooled by two motor-driven axial-flow fans. Auxiliary electric current is generated by two 550-kW. 220-volt geared turbo-alternators, with self-contained condensers. The gearing is of the S.R. double-helical type, giving a reduction of 8,000/1,000 r.p.m. The turbines of these auxiliary sets work with the same steam conditions as the main sets. Steam is supplied by three Babcock and Wilcox sectional-header boilers burning oil fuel with forced draught and fitted with tubular air heaters and superheaters. The boilers are designed for a working pressure of 450lb./in.^{2} and superheat temperature of 750° F. Steam for the cargo oil pumps is supplied through desuperheaters and reducing valves, but an auxiliary boiler of the cylindrical type is also installed.—*"The Marine Engineer", Vol. 68, No. 818, September, 1945, pp. 491-492 and 478.*

Machinery of the German Torpedo Boat "T-35".

The ex-German torpedo boat "T-35", one of the few of the 36 so-called "Elbing" class to have survived the war, was recently brought over from Wilhelmshaven by a British crew, and is now at one of our naval ports. Although classed as a torpedo boat, the "T-35" is actually a small destroyer of approximately 1,000 tons displacement. She was only completed at the Schichau yard, of Elbing, towards the end of last year. The ship is about 331ft. in length, with a beam of 32ft. 10in. and can steam at 31·8 knots with her turbines developing a total of 31,450 s.h.p. and the twin propellers running at 455 r.p.m. The two sets of geared turbines are arranged in two separate engine rooms, of which the forward one (separated from the after one by a boiler room) contains the starboard turbines, the port set being in the after engine room. Each set of turbines comprises H.P., I.P. and L.P. units, with their spindles coupled to separate pinions of the single-reduction gearing. The H.P. and I.P. turbines are of the impulse type, whilst the L.P. units are impulse-reaction machines. The H.P. turbines, when running at full power, take steam at a pressure of about 1,000lb./in.^{2} with a temperature of approximately 790° F. The H.P. turbines then run at 7,860 r.p.m. to develop 3,894 s.h.p., whilst the I.P. units develop 5,042 s.h.p. at their running speed of 7,280 r.p.m. and the L.P.s turn at 4,370 r.p.m. and develop 7,730 s.h.p. per turbine. Astern turbines are incorporated in the casings of the I.P. and L.P. ahead units respectively, but the total astern power obtained with both shafts is only 4,300 s.h.p. The H.P. turbines, which are very small, are divided into two sections, the steam entering at the centre and passing through a two-row Curtis wheel to three stages of impulse blading, before returning to the change valve through which it entered the turbine; the steam is then made to pass through the other half of the turbine, which comprises a single-row Curtis wheel followed by three impulse stages. When high powers are required, the change valve is adjusted to permit the steam to flow through both halves of the H.P. turbine in parallel instead of in series. This arrangement is claimed to eliminate the need for separate cruising turbines, but the results, as regards fuel economy, are not impressive; at the so-called "economical" speed of 16 knots, the oil-fuel consumption is 2·5 tons/

hr. (2·161lb./s.h.p.-hr.), whilst at full power it is only 13·35 tons/hr. (0·84lb./s.h.p.-hr.). From the H.P. turbines the steam passes to the I.P. units, which are impulse turbines with one Curtis wheel followed by five ordinary impulse stages. The same casings also incorporate the two-stage Curtis wheels of the H.P. astern turbines. On leaving the I.P. turbines the steam goes to the double-flow L.P. turbines, comprising one impulse wheel and ten reaction stages on either side of the central steam inlet, the L.P. astern turbines being built into one end of each L.P. ahead turbine casing. The H.P. turbine casings are of molybdenum cast steel, whilst those of the other turbines, like the reduction gear-cases, are of welded steel construction. The H.P. turbine blades are stated to be of stainless chrome-nickel molybdenum alloy steel. All the turbine rotors are hollow. The condensers are of the underslung regenerative double-flow type with welded steel bodies and Muntz-metal water boxes and doors. Each condenser has 3,736 aluminium bronze tubes, which are expanded into the tube plates at both ends. A closed feed system is employed, a turbine-driven extraction pump raising the water to an elevated feed tank, which is maintained at about 220° F. Two-stage air ejectors are employed. On leaving the feed tank the water passes through a cooler which reduces its temperature to 204° F. for easy handling by the two-stage turbo feed pumps, which deliver the feed water to the boilers at a pressure of about 1,200lb./in.^{2}. These feed pumps, like the turbines used for driving the F.D. fans, take steam at full boiler pressure and temperature. On leaving these auxiliary turbines, the steam is passed at a pressure of 220lb./in.^{2} to the other turbine-driven pumps in the engine rooms and thence to the evaporators. The latter are of considerable size, being in continuous use in conjunction with the closed feed system; make-up feed is constantly passed to the latter, the balance going to the reserve feed tank. If the steam supplied to the evaporators exceeds their requirements for a given boiler load, an automatic valve opens and allows the excess steam to pass direct to the main condensers. An unusual feature of the geared turbine installation is the inclusion of toothed flexible couplings between the thrust shafts and main gear-wheels, similar couplings being fitted between each turbine spindle and its pinion. It is reported that when the turbines are shut down, the motor-driven turning gear is used for about three hours to ensure uniform cooling down and avoid rotor distortion. Before starting up, if time permits, the turning gear is used for about 1½ hours while the turbines are being warmed through. The motor-driven forced-lubrication pumps are also run when the turning gear is in use, to circulate oil through the bearings and gearing. Electric current is supplied by one 196-kW. geared turbo-generator set and two 90-kW. d.c. generators driven at 1,200 r.p.m. by 8-cylr. Deutz Diesel engines. The fuel capacity of the ship is about 400 tons, carried in a large number (about 24) of small fuel tanks. At her cruising speed of 16 knots, this fuel supply allows the ship to steam about 2,160 miles, this range being reduced to about 800 miles when steaming at full power.—*G. R. Hutchinson, "The Marine Engineer", Vol. 68, Nos. 817 and 818, August and September, 1945, pp. 408-410 and 471-473.*

Furnace Repairs by Welding.

While a ship was on a voyage from Calcutta to the West Indies, two furnaces in one of her cylindrical boilers collapsed badly, making it necessary for the vessel to put into Durban for repairs. The damage to the furnaces (which were 3ft. 9in. in diameter) was so extensive that the portion cut out from the top of each furnace measured 5ft. 6in. in circumference and 2ft. 6in. in width, making it necessary to cut the damaged plates in two pieces in order to get them through the furnace mouths. The furnaces were also found to be about 1½in. out of round, so they were jacked up and faired before templates were prepared and the corrugated plates built to shape, the edges being bevelled for welding. These plates had also to be made in two pieces, which were first fitted into position by tack welding. Having made certain that they formed a true circle with the furnace, welding then proceeded, most of this work being done in the water space of the boiler with a view to having as much of it carried out by down-hand welding as was possible. On the completion of the job, which took 13 days, the boiler was tested to 250lb./in.^{2} by water pressure and proved satisfactory in every way. In addition to the saving of money by having the work done at the South African port, there was also a substantial saving of time, as new furnaces would have had to be obtained from this country.—*"Shipbuilding and Shipping Record", Vol. LXVI, No. 12, 20th September, 1945, p. 267.*

Smoke Density Measurement.

An article by H. E. Baumgardner in a recent issue of *Combustion* describes the development and use of an improved light-absorption apparatus for indicating and recording the density of smoke and dust in the flue gases of the boilers at a large U.S. power station. The instrument is fitted in the breeching and gives percentage readings equivalent to those at the uptake outlet as determined by smoke chart method. Accurate operation is ensured by the following conditions: A voltage regulator is provided to render the light source independent of fluctuations in the mains supply voltage; the light-sensitive cell is of the selenium type and is protected against heat and other injurious factors; fouling of the lamp and cell is prevented by lenses, and by installing these components where the pressure in the breeching is slightly below atmospheric, so that the air infiltration through holes provided for the purpose keeps the lenses clean for several days without attention; means are provided for checking the calibration while the boilers are in operation and for determining how much each boiler is smoking when two are in operation; and an alarm is given automatically at a predetermined smoke density. None of the instruments formerly used for smoke measurement proved satisfactory when tested, in that the readings they showed bore no relation to the smoke-chart values. This requirement was met by housing the lamp and cell respectively in sleeves, leaving only a relatively small thickness of gas (15in. to 25in.) for the absorption measurement. A separate breeching installation is provided for each boiler, making individual measurements possible, and it is claimed that the aggregate reading of the recorder agrees closely with the smoke-chart value for the uptake discharge.—*"Boiler House Review", Vol. 59, No. 9, September, 1945, p. 253.*

Boiler Tube Coatings.

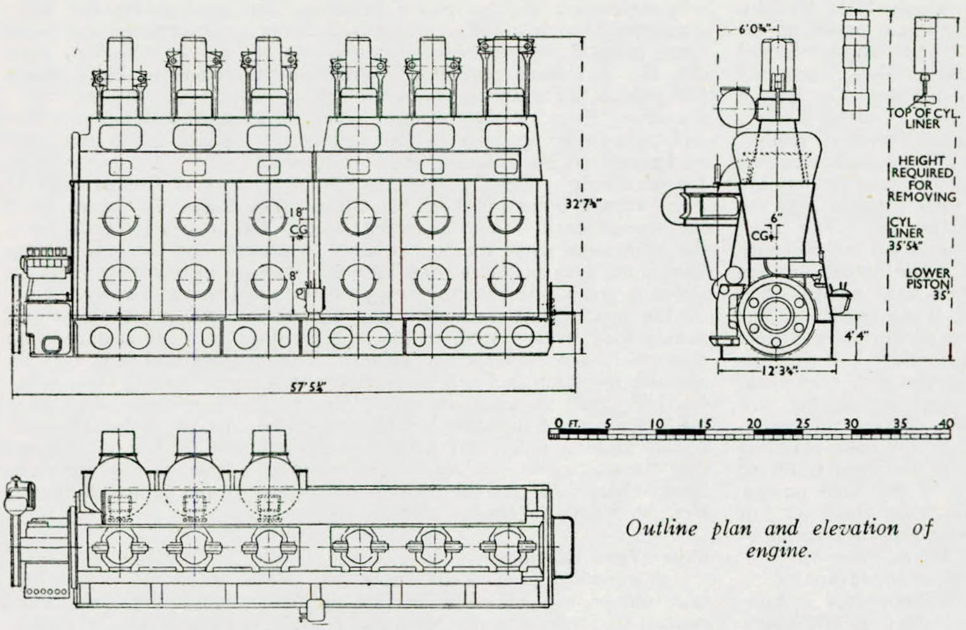
A chemical preparation known as "Apexior No. 1", which has been put on the American market, is claimed to protect the steam contact surfaces of boiler tubes and drums from the effects of corrosion. The preparation is brushed on by hand in boiler drums, while the tubes are coated internally by means of revolving expanding brushes operated by an air turbine or flexible shaft driven by an electric motor. Two coats of the preparation are applied in this manner, the total thickness thus obtained being about 0·0025in. Apexior No. 1 is chemically inert and does not retard heat transmission. It is claimed to be equally suitable for both new and old boilers, with steam pressures of up to 1,350lb./in.^{2}. One of the characteristics of the preparation is the improvement in internal cleanliness which its use brings about, since scale and grease do not adhere to the coating as they do to the bare metal. Apart from the reduction of deposits on the steam surfaces treated with the material, such impurities as are deposited on it are easily removed. The protective coating, if correctly applied, should last for at least two years, after which time it can be renewed by the application of a single coat of the preparation.—*Wm. Richards, "The Nautical Gazette", Vol. 135, No. 5, May, 1945, p. 116.*

A New Two-stroke Engine.

This brochure is published in Swedish, but includes a summary in English. The author describes a new type of 2-stroke oil engine of the uniflow scavenging type with air-inlet valves in the top of the cylinder and exhaust ports of exceptionally small height. The effect of this feature is that scavenging is completed in half the time required for this process in a comparable 2-stroke engine of the conventional type. The author states that this is due to the kinetic energy of the exhaust gases which produce a partial vacuum in the cylinder. The engine crankcase serves as a compressor and the air or gas mixture is pumped up to a container situated above the valves which are of the automatic type and open when the pressure in the container can overcome the spring pressure. Several experimental engines of this type have been built, and one of them underwent tests under the supervision of representatives of the Gothenburg University of Technology. A 350-c.c. engine of this type could, it was found, be run at speeds of 4,000 r.p.m. or more and the peak point of the power output curve was found to be at 3,200 r.p.m., at which speed the engine developed its maximum output of 11·8 b.h.p. The output was the same at 4,200 r.p.m. The fuel consumption of the engine proved to be far lower than that of any comparable 2-stroke engine of conventional type and was even less than that of a 4-stroke unit of the same size. The lowest consumption measured was 225 gr. per b.h.p./hr. (equivalent to about 0·5lb./b.h.p.-hr.). The engine also displayed good idling qualities and consumed a very small quantity of lubricating oil. All the bearings of these new engines are of the ball- or roller-bearing type, the gudgeon-pin bearing being of the last-named design. The patent rights of the engine belong to the Swedish SKF Co., of Gothenburg.—*K. E. Kylén, "Technical Information Bulletin", No. 2, 1939.*

A Modified Doxford Engine.

Nearly all the Doxford engines built during the past 25 years have been equipped with a single engine-driven scavenging pump, either located at the centre of the engine and driven directly off the



Outline plan and elevation of engine.

crankshaft, or at the back, and driven by means of a pair of rocking levers from one of the cylinder crossheads. A modified scavenging arrangement has, however, been adopted in a number of Doxford engines now under construction, which, it is thought, may prove advantageous in certain cases. The engines in question are 6-cylr. units and are equipped with three scavenge pumps driven off Nos. 1, 2 and 3 cylinder crossheads. This arrangement ensures an absolutely regular supply of scavenging air with a maintenance of constant pressure in the scavenging trunk, the effect of which permits the employment of a slightly lower scavenging-air pressure and a somewhat smaller ratio of volume of scavenging air to total swept volume in the working cylinders. As may be seen from the accompanying diagram, these 6-cylr. engines are about 3ft. shorter than they would have been with a crankshaft-driven scavenge pump between Nos. 3 and 4 cylinders. The first of these new 6-cylr. Doxford engines to be completed, was built by Swan, Hunter and Wigham Richardson for installation in a Port Line motorship under construction by the same firm. The engine cylinders are 670 mm. in diameter with a combined piston stroke of 2,320 mm. and the unit develops 6,600 b.h.p. at 115 r.p.m. with an m.e.p. of 87lb./in.^{2}. The mechanical efficiency is stated to be about 83 per cent. Another improvement in the design of this Doxford engine is the introduction of whitemetalled bearings in the chain drive to the camshaft and fuel pumps.—*"The Motor Ship", Vol. XXVI, No. 307, September, 1945, pp. 194-196.*

The Failure of Auxiliary Diesel Engine Connecting Rod Bolts.

The paper is a survey of the causes for the breaking of the crankhead bolts in auxiliary Diesel engines and of the measures to be taken to prevent such breakages from occurring. Extracts from a number of reports by various contributors are included in the paper. Among the matters dealt with in these reports are: bolt renewal procedure; bolt material; details of actual breakages; design and manufacture; heat treatment in service; maintenance; and "life" of connecting rod bolts. The concluding part of the paper contains a recommendation that where any doubt exists as to the condition of a connecting rod bolt, it is prudent to scrap it, even if it is comparatively new, and if it has been in service for more than 15,000 working hours, it should automatically be discarded, since the routine replacement of bolts is cheaper by far in the long run than the cost of repairing a wrecked engine.—*Paper by W. S. Burn, M.Sc., J. Calderwood, M.Sc., and H. J. Wheadon, "Transactions of the Institute of Marine Engineers", Vol. LVII, No. 7, August, 1945, pp. 85-90.*

New Use for Marine Auxiliary Engines.

An article in the June, 1945, issue of *Diesel Progress* describes how an Ohio firm has been engaged in assembling on skids emergency Diesel generating sets designed to provide temporary emergency current for military and civilian needs in the devastated areas in Europe and elsewhere. The engines were originally intended for use as generating units on board ship, and their cooling systems had therefore to be adapted for land service by the addition of radiators and fans. Three different types of 2-stroke engines were employed, *viz.*, Fairbanks-Morse opposed-piston, General Motors V-type and General Motors in-line engines, the G.M. units having been constructed by the Cleveland works. The powers of the various engines range from 241 to 590 b.h.p. and the generator ratings from 167 to 418 kW. In each case the set comprises a directly-coupled Diesel-driven generator with external exciter and a switchboard at one end of the skids, a large two-unit radiator with a motor-driven fan and expansion tank being arranged at the other end. The assembly includes an engine-driven starting-air compressor and an air receiver. The switchboard is mounted on a steel framework, and includes a circuit breaker, field switch and rheostat, voltage regulator, ammeter, power factor meter and frequency meter. The skids comprise deep section I-beams for the longitudinal members, reinforced by six welded-on lateral tubes, to form light but rigid structures.—*"The Marine Engineer", Vol. 68, No. 818, September, 1945, pp. 502-503.*

A Diesel-electric Tanker.

The Anglo-Saxon Petroleum Co. have placed an order with Hawthorn, Leslie & Co., for the construction of an oil tanker of their standard 12,000-ton d.w. 12-knot type, but equipped with four Diesel-engined 3-phase alternators supplying current at about 2,300 volts to a 4,000-b.h.p. propulsion motor which, at the normal ship's speed, will run at about 110-115 r.p.m. The whole of the electrical equipment will be supplied by the B.T.H. Co., but the four engines will be of the Hawthorn-Sulzer 4-stroke Büchi exhaust-turbo-charged type, with eight cylinders and running at about 350-365 r.p.m. The exhaust gases from three of these engines will be used to heat a 3-furnace composite boiler which will supply steam when the ship is at sea, whilst the fourth engine will exhaust direct to the funnel. This engine will be used to carry out investigations with various grades of fuel oil to provide the owners with information on the performance of the unit when running on these fuels. A steam-engined generator will be installed and steam will be used for heating and other purposes, but the cargo pumps are to be electrically driven. They will have 3-phase totally-enclosed motors, fitted on deck and operating at a voltage of about 800.—*"The Motor Ship", Vol. XXVI, No. 308, September, 1945, p. 202.*

Coaster for Far Eastern Service.

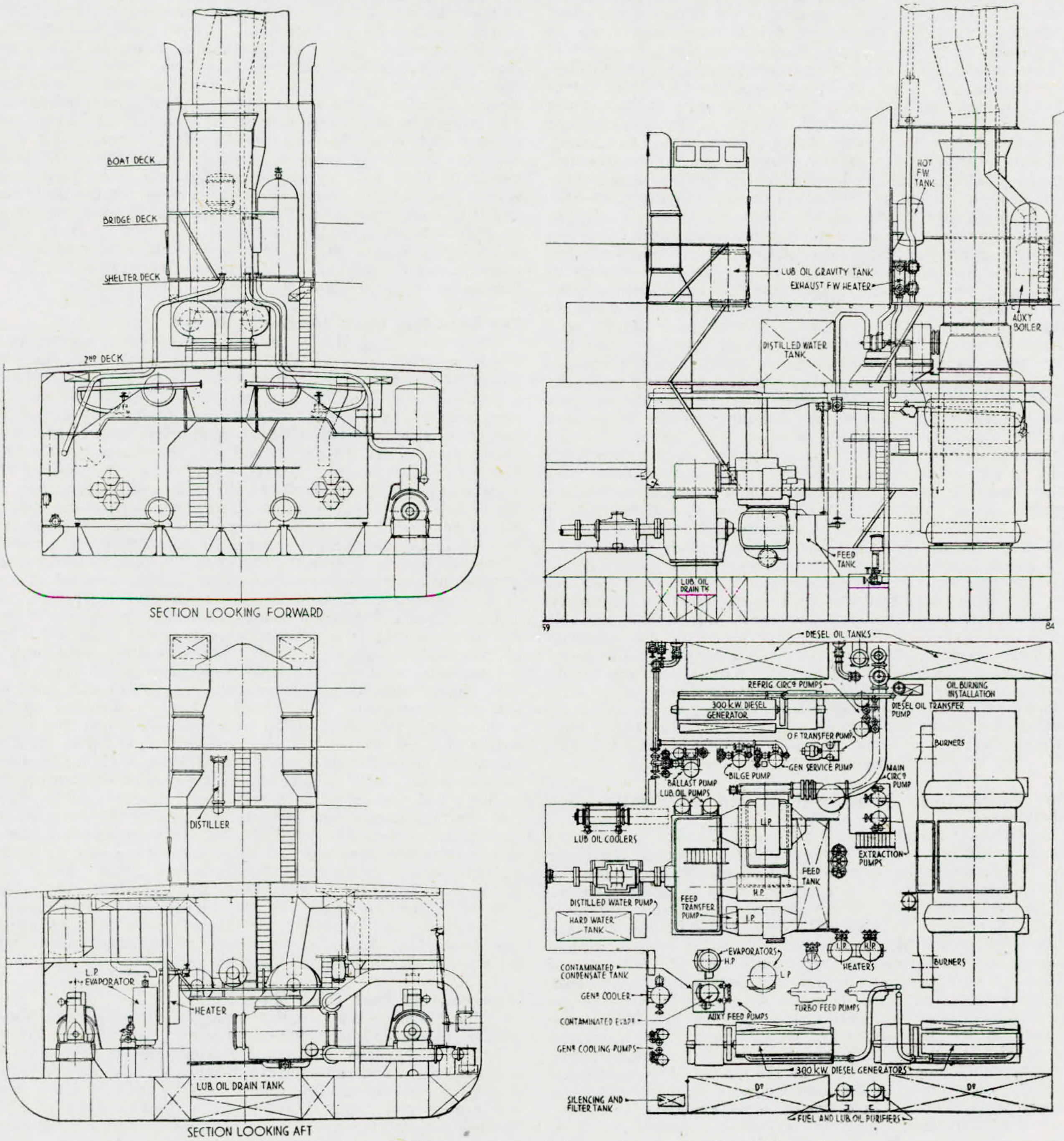
The single-screw cargo steamer "Empire Pacific", recently built by the Burntisland Shipbuilding Co., Ltd., to the order of the M.O.W.T., is one of the first of a special series of such vessels to be completed for coastal service in Far Eastern waters. She is an open shelter-decker 210ft.. b.p., 36ft. 6in. in breadth, and 21ft. 8in. in depth to the upper deck, and can carry about 1,200 tons d.w. on a 14-ft. draught. There are two cargo holds with corresponding spaces in the 'tween decks, to which access is obtained through large cargo doors. The cellular double bottom is arranged for the carriage of oil fuel and water ballast, fresh water being carried in the forward D.B. tank, the after peak and in large tanks between the forepeak and No. 1 hold. The cargo-handling equipment includes four 5-ton and two 10-ton derricks served by six steam winches. The anchor windlass, warping capstan and telemotor-controlled steering engine are likewise steam-driven. Insulated provision rooms are provided, with a refrigerating plant in the after deckhouse. The propelling machinery consists of a triple-expansion engine, installed aft, with cylinders 13½in., 22¾in. and 33in. in diameter, and a stroke of 27in. Steam at a pressure of 200lb./in.^{2} is supplied by two oil-fired cylindrical boilers, working under forced draught. The E.R. auxiliaries include ballast, feed and fresh-water pumps, a feed heater of the exhaust surface type and a feed filter. The main condenser serves both the main and auxiliary engines. The living quarters of the European and Chinese crew are roomy and well-equipped, mosquito protection being fitted throughout. After successfully completing her acceptance trials, the ship was handed over to the Singapore Straits Steamship Co., Ltd., who are managing her on behalf of the M.O.W.T.—*"Lloyd's List and Shipping Gazette", No. 40,797, 5th September, 1945, p. 14.*

Small "Two-draught" Cargo Vessel.

A new and unusual type of small all-purpose cargo vessel is being developed by Higgins Industries, Inc., New Orleans, in the belief that it can be produced and delivered at prices so reasonable as to compete in overseas markets against the products of low-cost shipyards in other countries. No details of the prototype vessel of this type now under construction at the Higgins New Orleans yard have been released, beyond the fact that she is an oil-engined ship 300ft. in length, with a very broad beam and a cargo-carrying capacity of 2,500 tons. An unusual feature of the design is the "two-draught" characteristic, as it is claimed that the vessel will be capable of operating with equal efficiency with a light cargo and a shallow draught on inland waters, and when loaded to capacity with a deeper draught in the ocean trades.—*"The Journal of Commerce" (Shipbuilding and Engineering Edition), No. 36,679, 6th September, 1945, p. 12.*

Refrigerated Cargo Steamers for New Zealand.

The accompanying drawings show the arrangement of the propelling machinery of the New Zealand Shipping Co.'s refrigerated cargo steamer "Papanui", of 10,000 gross tons, built by Alexander Stephen & Sons, Ltd. There are three turbines in series, viz., H.P., I.P. and L.P. units, exhausting to an underslung regenerative condenser and driving a single propeller shaft through D.R. double-helical gearing. The normal full power of the turbines is 8,000 s.h.p. at 100 r.p.m. of the propeller. Astern power is provided by astern turbines in the I.P. and L.P. casings. All the turbines are of the Parsons all-reaction type with axial clearance, the power being equally divided between the three ahead turbines. The condenser is of the Weir regenerative 2-flow type, designed for a 28½in. vacuum with a sea-water inlet temperature of 65° F. The usual sliding feet at the forward ends of the turbine casings have been dispensed with and replaced by a flexing beam rigidly bolted to the seating and to the underside of the forward bearing block. This arrangement has proved quite satisfactory in service. The fabricated gear case is bolted direct to the inner bottom of the ship by its lower flange, thus reducing the shaft height. The entire built-up gear assembly is far lighter than a comparable one having C.I. gear wheels and a C.I. case. The turbines are supplied with steam at a pressure of 430lb./in.^{2}



General arrangement of machinery of s.s. "Papanui".

and 740° F. total temperature by two oil-fired Foster Wheeler watertube boilers. The steam pressure in the boiler drums is 460lb./in.². The boilers have radiant U-tube superheaters, economisers and air heaters, and the combustion chambers have completely water-cooled walls except the front wall which is air-cooled. The boiler design provides for an efficiency of 88 per cent. at full load with a funnel gas temperature of 280° F. at the air-heater outlet. The uptakes are designed for a high gas velocity and are enclosed by an air casing from which the forced-draught fans take their suction. The air entering the air heaters is therefore preheated and dried, and it is claimed that this feature eliminates the risk of dew-point corrosion trouble with the air-heater tubes. The forced-draught fans are cross-connected by means of dampers to serve either boiler and are installed at the same level as the air heaters, the fan controllers being at the starting platform. The fan outputs and heads are designed to give a boiler overload of 10 per cent. over the normal rating. The closed-feed system includes two extraction pumps, an air ejector, a drain cooler, a feed-control valve on the condenser and three feed-water heaters. The final feed temperature at the outlet of the third or H.P. heater is 310° F. The I.P. and H.P. feed heaters are on the discharge side of the main feed pumps, while the L.P. heater is on the suction side of this pump. Bled steam from the main turbines is used for heating the H.P. and I.P. heaters, the turbo-feed pump exhaust and the make-up feed evaporator. Vapour is utilised in the L.P. heater at a pressure of about 10lb./in.² abs. The whole of the auxiliary machinery is motor-driven, except the two main feed pumps, which are turbine-driven units taking steam at full boiler pressure. Each pump is capable of feeding both boilers at their designed overload rating. Electric current at 200 volts is provided by three 300-kW. generators, each directly driven at 465 r.p.m. by an 8-cylr. Ruston and Hornsby oil engine. The evaporating plant is arranged for single or double distilling, an H.P. evaporator and distilling condenser being provided for first distilling and an L.P. evaporator for make-up to the feed system. Each of these evaporators has an output capacity of 30 tons of distilled water per 24 hours. A third evaporator or steam generator is provided for fuel-tank and plant heating and domestic heating, etc. This system is entirely separate from the main boiler water system. De-superheated steam at a pressure of 230lb./in.² is supplied to this evaporator coil and generates steam at 100lb./in.² at sea. This steam is then distributed to the various ship's services and returns *via* an observation and filter tank to be re-used within its own system. In port this duty is dealt with by a small oil-fired Cochran boiler. It is claimed that this system precludes the possibility of contaminating the main feed circuit from any source other than the main condenser. The mechanical ventilation of the engine room is a special feature of the vessel, and the general habitability of the machinery space is enhanced by the provision of small condensers for the turbine glands. These small condensers—one at each gland—are circulated by the main extractor pump, and by this means the humidity in the engine room is very much reduced and a small conservation of feed water achieved. The total machinery weight, including water in boilers, condensers and system, and oil in drain tank and system, is 740 tons. The length of the combined engine and boiler room is 56ft., while part of the breadth of the vessel is utilised for wing tanks for Diesel fuel oil. Even so, there is ample overhauling space around all the main and auxiliary machinery. The fuel consumption of the "Papanui" under service conditions at an average speed of 11 knots and a displacement of 13,000 to 16,850 tons, does not exceed 0·6lb./s.h.p.-hr.—*"Shipbuilding and Shipping Record", Vol. LXVI, No. 10, 6th September, 1945, pp. 233-235.*

A 15-knot Danish Cargo Vessel with B. and W. Double-acting Machinery.

The single-screw cargo motorship "Trein Mærsk", 6,706 gross tons, recently completed at the Odense yard, Denmark, to the order of Mr. A. P. Møller, is an open shelter-decker with five holds and nine W.T. bulkheads. The total cargo capacity is 609,950 cu. ft. (bales), including 8,450 cu. ft. of refrigerated space and a silk room of 19,710 cu. ft. There are also eight deep tanks for the carriage of vegetable oil, with a total capacity of 3,102 tons at 38·8 cu. ft./ton. Special heating coils are fitted in these tanks. About 1,900 tons of water ballast can be carried in the D.B. and peak tanks, if required. The deck machinery comprises 16 motor-driven cargo winches, an electrically-driven anchor windlass and a warping winch, but the steering gear is of the steam-hydraulic type. The propelling machinery consists of a 5-cylr. Burmeister and Wain double-acting 2-stroke engine developing 7,100 i.h.p. at 115 r.p.m. The mechanical efficiency is 82·5 per cent., so that the engine rating is 5,850 b.h.p. or 1,170 b.h.p. per cylinder. The diameter of the cylinders is 620 mm. and the stroke 1,400 mm. Electric current is supplied by three 150-kW. generators driven by 4-cylr. 225-b.h.p. Bukh engines. Two vertical boilers are installed, one being oil-fired and the other of the exhaust-gas type. The working pressure of both boilers is 100lb./in.². The ship has accommodation for 12 passengers in eight staterooms with private bathrooms. All the living quarters throughout the vessel are air conditioned. The "Trein Mærsk" attained a speed of 15½ knots on her trials, which she carried out in a fully-loaded condition. The daily fuel consumption is stated to be 24 tons for all purposes.—*"The Motor Ship", Vol. XXVI, No. 308, September, 1945, p. 212.*

New 21½-knot Passenger Ship "Kronprins Fredrik".

The twin-screw passenger motorship "Kronprins Fredrik", which was built for the Harwich-Esbjerg service of the United Shipping Co. at the latter's Elsinore yard during the war, is now being completed for service. She is 373ft. in o.a. length, with a beam of 49ft. 9in. and has a full-load draught of 18ft. 9in. at a displacement of 5,147 tons. The gross register is 3,895 tons and the d.w. capacity 1,730 tons, including fuel oil. There are four refrigerated holds with a total capacity of 7,500 cu. ft. for the carriage of dairy produce. Temperatures down to 40° F. can be maintained in three of the holds and 25° F., in the fourth. Independent temperature control is provided for all four holds. There is sleeping accommodation for 302 first- and third-class passengers, while the public rooms include dining, smoking and writing rooms. The vessel is equipped with air conditioning in all living spaces, as well as with steam and electric radiators. The air-conditioning plant is installed in the funnel. The propelling machinery consists of two sets of 10-cylr. s.a.. Burmeister and Wain 2-stroke engines of the trunk-piston type, with cylinders of 500 mm. bore and a stroke of 900 mm. The total power output of 7,100 b.h.p. (or about 8,400 i.h.p.) is designed to give the ship a speed of 21½ knots. Electric current for the deck machinery and E.R. auxiliaries, as well as for heating, lighting, etc., is provided by four 340-kW. generators each driven at 500 r.p.m. by a 360-b.h.p. s.a. 4-stroke B. and W. engine with a cylinder bore of 245 mm. and piston stroke of 400 mm.—*"The Motor Ship", Vol. XXVI, No. 308, September, 1945, pp. 206-207.*

The Royal Mail Lines' Motorship "Drina".

The new Royal Mail Lines' refrigerated cargo motorship "Drina" is a twin-screw vessel of 9,789 gross tons with a d.w.c. of 8,905 tons. The ship has an o.a. length of 468ft. 10in., a breadth of 65ft. and a depth of 36ft. 10in., with a draught of 26ft. at her full load displacement of 16,535 tons. There are three holds forward of the machinery space and two aft of it, with orlop, lower, upper and bridge 'tween decks above the former and only lower and upper 'tween decks aft of the engine room. Except for a space of 10,464 cu. ft. at the after end of the bridge deck, all the ship's cargo spaces are insulated for the carriage of refrigerated cargo, their total net capacity amounting to nearly 500,000 cu. ft. Over 1,200 tons of fuel oil is carried in deep tanks. A limited number of passengers are accommodated in two-berth and four-berth cabins. The refrigerating machinery, installed in a compartment on the awning deck forward of the engine casing, comprises three horizontal twin-compressor CO_2 machines and a vacuum refrigerating plant. The latter utilises waste heat from the main engines to provide refrigeration and takes about one-third of the total refrigerating load. The propelling machinery consists of two sets of 6-cylr. d.a. two-stroke Harland-B. and W. engines with upper and lower piston valves for exhaust, and vane-type scavenging blowers. The cylinders have a diameter of 530 mm. with a piston stroke of 1,250 mm. At 105 r.p.m. the total power output is 8,000 b.h.p. for a service speed of 15 knots. All the deck machinery is motor-driven, as are most of the E.R. auxiliaries. Direct current at 220 volts is supplied by four 320-kW. generators driven at 400 r.p.m. by 485-b.h.p. 5-cylr. Polar Diesel engines. There are two Nelvin thimble-tube boilers, one heated by exhaust gas only and having a capacity of 1,000lb./hr. evaporation, while the other is of the composite type and can be oil-fired if necessary. Both boilers generate steam at a pressure of 100lb./in.². The "Drina" was built and engined by Harland and Wolff, Ltd., who have also completed a sister ship, the "Durango", for the same owners. Two earlier vessels of this type, the "Descado" and "Darro", were built and engined for the Royal Mail Lines by the same firm.—*"The Motor Ship", Vol. XXVI, No. 308, September, 1945, pp. 186-193.*

High Powered Fleet Oiler "Olna".

The Royal Fleet Auxiliary "Olna" was originally one of two similar high-speed oil tankers ordered from Swan, Hunter, and Wigham Richardson, Ltd., by the Anglo-Saxon Petroleum Co., but both vessels were subsequently taken over by the Admiralty and adapted for service as fleet oilers. The "Olna" (like her sister ship) is a single-screw ship of 12,667 gross tons with a d.w.c. of 17,520 tons. She has a length b.p. of 550ft., a moulded breadth of 70ft., a moulded depth of 40ft. 6in. and a draught of just over 31ft. 8in. in a loaded condition. The ship's fuel tanks have a capacity of 2,130 tons, whilst that of her cargo fresh-water tanks is 458 tons. The designed speed, fully loaded, is 17 knots. As originally designed, the ship had nine sets of main cargo oil tanks sub-divided into three compartments transversely by two longitudinal bulkheads, with two cargo pump rooms. The propelling machinery was installed aft, whilst the fuel tanks were located forward of No. 9 (the foremost) cargo oil tank and on either side of the boiler room. The cargo oil tanks were numbered from aft. As adapted for service as a fleet oiler, the "Olna" now carries oil fuel only in Nos. 2 to 5 sets of tanks and Nos. 1 and 6 wing tanks, No. 7 set of tanks and No. 6 centre tank being used for Diesel oil, whilst Nos. 8 and 9 sets of tanks are adapted for petrol, with wing tanks just abaft the petrol cargo tanks for lubricating oil. The space between these lubricating-oil tanks has been converted into an additional pump room. Cargo fresh water is carried in a deep tank abaft the machinery space which, in the original commercial design, was intended for use as a fuel tank. No. 1 centre tank has been converted into storerooms, three flats having been built for this purpose, with further storerooms on the upper deck directly above. The ship's officers' accommodation is arranged in a large deckhouse under the bridge, while the crew are berthed under the poop and in a long deckhouse on the poop deck. The war complement of the vessel numbers 183 officers and men. The deck machinery and telemotor-controlled steering gear is steam-driven, as are the cargo oil pumps. Special equipment is provided for oiling ships at sea. Heating coils are fitted in the tanks intended to carry oil fuel. Electric current is supplied by four d.c. generators, two of which are 50-kW. units driven by Diesel engines, one is a 60-kW. dynamo driven by a steam engine and one a 60-kW. generator driven by an electric motor.—*"The Marine Engineer", Vol. 68, No. 818, September, 1945, pp. 484-491.*

German Cruiser "Prinz Eugen".

The heavy cruiser "Prinz Eugen", the only surviving big ship of the German Navy and now in British hands at Wilhelmshaven, has a nominal displacement of 10,000 tons, although her actual displacement is considerably greater. She has a length of 654ft. 6in., a beam of 71ft. and an unusually light draught for so large a vessel. Her armament includes eight 8-in. guns, twelve 4-in. AA guns and 12 triple-mounted torpedo tubes, in addition to four aircraft catapults. The ship's propelling machinery installation comprises three sets of lightweight geared turbines with a rated output of 135,000 s.h.p. for a speed of 32 knots, when the triple propellers are running at 360 r.p.m. There are altogether five main and auxiliary engine rooms and three boiler rooms arranged in the following order (from forward) : a generator room containing one 2,000-amp. d.c. geared turbo-generator, three 650-amp. d.c. Diesel-driven dynamos and one 400-kVA Diesel-driven alternator; "A" boiler room, containing four La Mont forced-circulation, high-pressure boilers; "B" boiler room, containing four similar boilers; an engineers' control room; "C" boiler room, containing four more boilers; the forward main engine room, containing the two wing sets of geared turbines, each comprising H.P., I.P. and L.P. units and driving the propeller shaft through S.R. gearing. The reduction ratio for the H.P. and I.P. spindles is 12 to 1, whilst that for the L.P. is 9 to 1. The turbines are of Wagner design, the H.P. and I.P. units being of the impulse type, whereas the L.P. turbines are of the double-flow impulse-reaction design with underslung condensers of the two-flow type. Each condenser has a vertical-spindle turbo-driven circulating pump of the high-speed lightweight type, but this is only used when getting under weigh or manœuvring. At approximately 10 knots in summer time the circulating pumps are cut out and scoop circulation is then relied upon up to maximum speed and power. In winter a satisfactory vacuum can be maintained with scoop circulation at all speeds above 6 knots. Aft of the forward engine room is No. 2 generator room containing two 2,000-amp. d.c. geared turbo-generator sets, abaft which is the after engine room containing the geared turbines driving the centre propeller shaft. The two wing propellers turn inwards, the direction of rotation of the centre propeller being the same as that of the P. screw. The thrust of the solid bronze propellers is absorbed by single-collar thrust bearings resembling those of the Michell type. The shafts are carried in plain bearings. The after generator room contains a 2,000-amp. d.c. geared turbo-generator, a similar 1,000-amp. set and a 1,500-amp. d.c. Diesel-driven generator. In harbour, two of the larger turbo-generator sets can carry the electrical load, their working pressure being 370lb./in.^{2}. These units run on superheated steam, but those auxiliaries which operate at 150lb./in.^{2} use saturated steam. The closed feed system is employed, the extraction pumps being compact vertical-spindle turbine units, as are nearly all the principal pumps in the ship. The feed water leaves the first stages of the two-stage feed pumps at a pressure of about 150lb./in.^{2} and passes through a surface type feed heater where its temperature is raised to about 230° F., auxiliary steam being the heating medium. It then passes to the second stage of the feed pump and is delivered to the boiler economisers at a pressure of over 1,200lb./in.^{2}. The 12 La Mont boilers of the "Prinz Eugen" constitute what is probably the largest marine boiler installation of this type afloat to-day. Their design working pressure of 1,130lb./in.^{2} was later reduced to about 880lb./in.^{2}. The total steam temperature at full power is stated to be 840°-930° F. The boilers work on the closed-stokehold system of forced draught, with 14in. w.g. pressure at full power. The forced-draught fans are geared-turbine driven, as are the compact vertical-spindle circulating pumps, two of which are provided for each boiler. The boiler tubes are only about 1in. in diameter. Two Saacke rotary oil burners are fitted to each boiler, the air for driving their turbines reaching them through the air jacketing around the boiler. Their normal running speed is about 4,000 r.p.m. with an oil-fuel pressure of some 60lb./in.^{2} at the burners, the fuel being heated to 112° F. Motor-driven forced-draught fans are used for starting up the boilers, but as soon as sufficient steam is available the turbine-driven fans take over and the electrically-driven ones are stopped. Steam can be raised to normal working pressure in 45 minutes if the boilers are empty, and in less than two hours if they are full to normal working level. In general design the boilers appear to be normal La Mont drum-type forced-circulation units, with superheaters, plain-tube economisers and tubular air heaters. The steam pipes throughout the ship have screwed flanges, and corrugated sections of piping provide for expansion where necessary. At normal full power the feed-water losses are stated to be about 150 tons per day, but the six evaporators installed in the ship are each capable of producing 50 tons of fresh water per day. The geared turbo-generators are of German Brown Boveri make, while the Diesel engines are 6-cylr. M.A.N. units of the medium-high-speed type. The total capacity of the oil-fuel tanks is 3,230 tons, but this can be increased to 4,000 tons by using the bulge tanks. In addition, 130 tons of Diesel oil, 4½ tons of Diesel lubricating oil and about 116 tons of turbine lubricating oil are carried, with a further 10 tons in each set of main turbines and gears. The fresh-water tanks hold 600 tons of reserve feed water, 120 tons of drinking water and 160 tons of washing water, making 880 tons in all. No cruising turbines or Diesel engines are installed, and the so-called economical speed of the ship is therefore between 15 and 17 knots, giving her a maximum cruising range of some 5,500 sea miles. This is reduced to 2,500 miles at full speed. In general, the fuel consumption is fairly high and compares unfavourably with that of any British ship of corresponding size and s.h.p. The extensive use made of automatic controls for every part of the main and auxiliary machinery installation, as well as for the boilers, is remarkable; no provision appears to have been made for a possible failure of any portion of this equipment. The reduction gear-cases of the main turbines are of cast steel and not of welded steel construction as might be expected. From the point of view of maintenance, the machinery arrangements leave much to be desired and the general design would not find favour with engineer officers of the Royal Navy.—*G. R. Hutchinson, "The Marine Engineer", Vol. 68, No. 818, September, 1945, pp. 457-464.*

Merchant Ships Completed by U.S. Shipyards.

The American Bureau of Shipping recently published a table giving particulars of merchant ships of 2,000 tons gross each and over completed by U.S. shipyards for the Maritime Commission and private interests in the past 6½ years—from the beginning of 1939 to the end of June, 1945. During this period 4,709 vessels of 35,838,764 gross tons and 20,903,948 h.p. were completed. During the 6½ years from the beginning of 1914, the total production of the *world* was approximately 24,200,000 gross tons, although the total number of ships built was over 9,000. The pre-war merchant fleet of the U.S., including vessels on the Great Lakes, was 2,953 ships of 11,361,533 gross tons.

The total h.p. of 20,903,948 was made up approximately 43 per cent. geared-turbine, 20 per cent. turbo-electric, 33 per cent. reciprocating steam and 4 per cent. Diesel propelling machinery.—*"The Journal of Commerce" (Shipbuilding and Engineering Edition), No. 36,679, 6th September, 1945, p. 12.*

United States Navy.

An interesting sidelight on the remarkable expansion of the U.S. Navy is the announcement that the 1,800th watertube boiler built by the Babcock and Wilcox Co. in connection with the U.S. naval shipbuilding expansion programme has recently been installed in the aircraft carrier "Franklyn Delano Roosevelt", a sister ship of the U.S.S. "Midway", launched by the Newport News yard last March. A third aircraft carrier of this type is building at this yard. These three vessels, claimed to be the largest and fastest of their kind, will have single-uptake express-type Babcock boilers. The carriers are about 1,000ft. in o.a. length, will carry about 80 aircraft of a new type and will each have a complement of approximately 3,000 officers and men. New American battleships built or completing, include several of the 45,000-ton "Iowa" class. The quadruple screws of these ships are said to be driven by Westinghouse turbines through locked-train type double-reduction gears, and each set of turbines and gears is said to have a power output of over 50,000 s.h.p. The auxiliary machinery of each of these battleships includes eight 1,250-kW. turbo-generator sets.—*"The Marine Engineer", Vol. 68, No. 818, September, 1945, p. 509.*

The Swedish State Shipbuilding Experimental Tank.

This brochure is published in Swedish, but includes a summary in English. It is concerned entirely with the Experimental Tank at Gothenburg, constructed for the Swedish Government and put into service in the autumn of 1940. The basin of the tank is about 850ft. in o.a. length, with a breadth of 33ft. and a depth of 5ft. Chapter I, by Dr. Hugo Hammar, gives a brief history of the origin of the tank; Chapter II by Prof. H. F. Nordström, Director of the Tank, contains a short survey of the general principles on which model experiments are carried out, as well as a concise description of the plant. Chapter III, by Prof. M. Wernstedt, deals with some of the points which led to the decision to build the tank on rocky ground, together with a discussion of the heating and ventilation problems which arose during the building; in Chapter IV Prof. Sven Hultin discusses the construction of the tank; Chapter V, by R. Rödström, is devoted to a description of the measuring and testing equipment; Chapter VI, by K. Tiselius, deals with the electrical equipment; and Chapter VII, by Prof. H. F. Nordström, concerns the organisation of the establishment and its various functions.—*"Publications of the Swedish State Shipbuilding Experimental Tank", No. 1, 1942.*

Some Experiments with Models of High-speed Cargo Liners.

This paper describes some experiments carried out at the Gothenburg Experimental Tank with a series of models of fast cargo liners designed for speed/length ratios $\left(\frac{V}{\sqrt{L}}\right)$ up to about 0·80 or 0·85. Most of these vessels have a length of 400ft. to 450ft. They are generally run at speeds of 16 to 17 knots in the case of the 400-ft. vessels, and 17 to 18 knots in that of the 450-ft. ships. Some of these ships have single screws, but the majority have had twin screws. Some wake measurements were made during the experiments, but in the present paper only the question of resistance has been considered. The main object of the tests was to determine the effect of the longitudinal distribution of the displacement and, if possible, the optimum position of the centre of buoyancy. The conclusions reached by the author are: (*1*) At the higher speeds the centre of buoyancy should be placed well aft, although in the particular series of models used in the tests the centre of buoyancy could be moved within wide limits without any appreciable effect on the resistance; (*2*) it would seem that one of the original models used (model 72) could with advantage have been made somewhat fuller at the bow and that a small increase in the total prismatic coefficient would have been permissible; (*3*) the moderately U-shaped frame sections in the series of models appear to give low (C) values over the entire useful speed range, but it is clear that frames approximating more closely to a V-shape could be employed without any undue increase in the resistance; and (*4*) ships of the fullness considered in the paper, when operating at their service speed often run into a speed range where marked wave interference is present, the bad effect of the "hump" around the (P)=0·67 point being noted in several of the models tested.—*A. Lindblad, "Transactions of the Chalmers University of Technology of Gothenburg", No. 25, 1943.*

Tests with Models of Fishing Craft.

This brochure is published in Swedish, but includes a summary in English. It gives an account of tests carried out in the Swedish State Shipbuilding Experimental Tank at Gothenburg with three fishing-boat models and three types of model screw propellers. One of the latter was a two-bladed adjustable-pitch propeller, the second was designed for free running (without towing) and had a boss similar to that of the first, whilst the third propeller had the same boss as the first two, with blades of the same form as those of the second, but symmetrical in section. The results of the tests are set out in tabulated form. The most important definitions, etc., in the various diagrams illustrating the Swedish text are given in English. —*H. F. Nordström, "Publications of the Swedish State Shipbuilding Experimental Tank, No. 2, 1943.*

Cruiser Sterns Applied to Merchant Vessels.

This paper is published in the Swedish language, but an English summary of the text is given. Some historical notes on the development of the cruiser stern are given and its advantages as compared with the overhanging elliptical form of stern are briefly discussed. A series of tests made at Gothenburg with a 20-ft. model of a high-speed cargo liner equipped with a cruiser stern of various lengths and depths are briefly described and the results are presented in graphical form. The author points out that the length of the cruiser stern is the important factor, and that in the case of a full-size ship having the hull characteristics of the model used for the tests, a stern length of 3·5 to 4·0 per cent. of the length b.p. seems to be the most satisfactory. The depth of the stern is less important and a very deep stern does not offer any advantage. A depth equal to about one-third of the draught gave the model the lowest resistance. —*Paper by A. Lindblad, "Transactions of Chalmers University of Technology, Gothenburg", No. 45, 1945.*

Ships' Proportions and their Effect upon Stability.

This brochure is published in Swedish, but includes a summary in English. The author points out that the term "stability" as used by him, covers the sea-going qualities of the ship and the manner in which it behaves at sea. The paper discusses various points relating to the stability of sea-going vessels in this broad sense and indicates the principles which determine the hull dimensions, proportions and forms for vessels carrying cargoes of various categories and weights, due allowance being made for ballast and fuel. The classes of ships dealt with by the author in this paper are the following five: (*1*) Those designed to carry homogeneous heavy cargoes entirely below deck; (*2*) those designed for the carriage of general cargo to be loaded and discharged in a number of different ports; (*3*) vessels designed expressly for the carriage of timber and other light homogeneous cargoes; (*4*) ships designed for the occasional carriage of ore cargoes; and (*5*) vessels designed for liquid cargoes.—*G. Ambjörn, "Transactions of the Chalmers University of Technology of Gothenburg, Sweden", No. 21, 1943.*

Experiments with Bulbous Bows.

The first part of this paper is devoted to a review of some of the results that have been obtained by Taylor, Bragg and other investigators who have carried out research work with models equipped with bulbous bows. An attempt is also made to present these results in the form of diagrams suited for design work. The second part of the paper describes some experiments conducted with models representing an intermediate liner of moderately high speed. One model of the ordinary form was tested and compared with other models having bulbous bows of different sizes and forms of construction.—*A. Lindblad, "Publications of the Swedish State Shipbuilding Experimental Tank", No. 3, 1944.*

Propeller Pitting and Erosion.

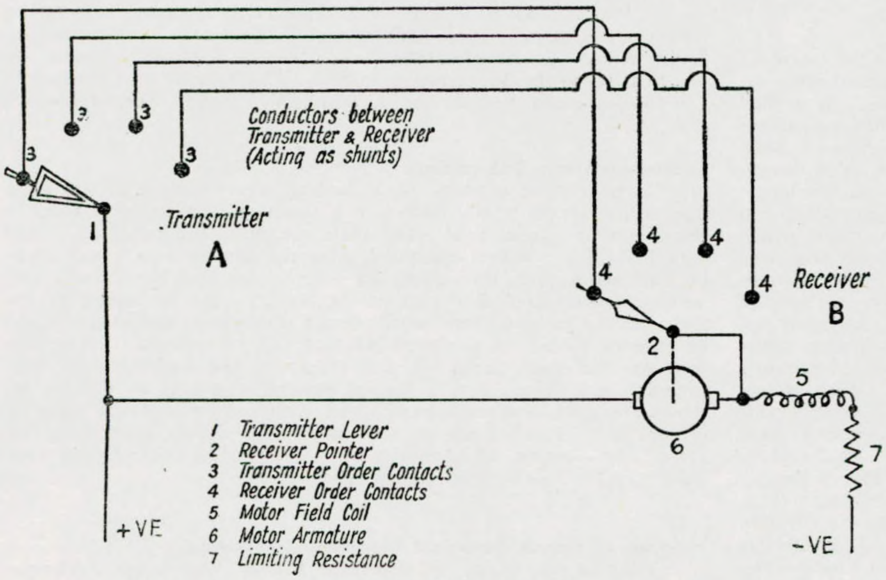
The writer, who is superintendent of a large fleet of tugs on the Clyde, states that 12 months ago one of his tugs had to be dry-docked six months after her propeller had been renewed. The propeller was again found to be badly pitted and eroded over a length of 14in. to within 2in. of the blade tips, the blades being perforated in several places. The affected area was thoroughly cleaned and the pits were then filled in with a plastic preparation having a latex base, which is generally used for smoothing the overlap on ship's side shell plating. The result proved highly satisfactory, and the tug, after operating continuously for eight months, was again dry-docked. On examining the propeller, it was found to be in good condition, with no sign of pitting or erosion. The compound had a hard and smooth surface and showed absolutely no sign of deterioration or tendency to break away. The writer points out that it is essential to have the pitting well cleaned out and thoroughly dry before the solution is applied, the application being done in a cold state.—*R. Beattie, "The Journal of Commerce" (Shipbuilding and Engineering Edition), No. 36,691, 20th September, 1945, p. 5.*

Propellers with Adjustable Blades—Results of Model Experiments.

The paper gives an account of tests carried out with adjustable blade propellers during 1943 and 1944 at the Swedish State Shipbuilding Experimental Tank at Gothenburg. The tests, which were made with models of such propellers and a 9-ft. wooden ship model, included resistance tests, propeller tests in open water and self-propulsion tests. The second half of the paper deals with constant *v.* varying initial pitch, the influence of revolutions on the properties of the propeller and fixed blades *v.* adjustable blades for operation both ahead and astern. A number of diagrams and tables serve to amplify the text of the paper, and two appendices deal with the calculation of the propeller dimensions when free of tow, and the calculation of propeller dimensions for "heavy" towing, respectively.—*Paper by H. F. Nordström, "Publications of the Swedish State Shipbuilding Experimental Tank", No. 4, 1945.*

A Modern Electric Telegraph.

The accompanying diagram shows, in simplified form, the operation of an electric E.R. telegraph system developed and patented by A. Robinson & Co., Ltd., of Liverpool. Eight transmitters and four receivers worked by this system have been installed in a large Diesel-electric car ferry now building in Canada (*see abstract on p. 109 of* TRANSACTIONS, *October, 1945*). The transmitter used with this system



Schematic diagram of electric E.R. telegraph.

consists of what is virtually a feeder ring and a number of contact studs—one for each order on the dial—and an arm which connects the feeder ring to the relevant contact stud; the arm is itself operated by the usual lever on the instrument. Positive locating gear is fitted to prevent the lever from moving from the order at which it is set. Multi-core cable is used between the transmitter and motor-driven receiver. The latter incorporates a row of studs with a feeder ring as in the transmitter, but the rotating arm of the receiver is operated through worm gearing by an electric motor, the field coils of which are protected by a limiting resistance. The call bell system is not shown in the diagram, but when the motor is started by the transmitter lever the rotating arm moves over to bell contacts at the same time as to the order contacts, and the bells at both transmitter and receiver ring until the engineer turns the reply lever into line with the receiver pointer, thereby putting a gap in the bell supply lead opposite the bell contact and causing both bells to cease ringing until another order is given. The reply handle is positively located, so that any possibility of inadvertent movement is eliminated. The sequence of operation is that the armature of the receiver motor is by-passed and held in position by the field magnets until the transmitter lever is moved to another order, whereupon the armature is released; it then revolves until an arm, attached to it by gears, comes into contact with the stud in the receiver corresponding to that on which the transmitter lever stands, when the armature is again by-passed and locked by the field magnets. Any number of receivers may be coupled to one transmitter, and more than one transmitter may be employed simultaneously, if necessary, by mechanically connecting additional ones. Thus, *e.g.*, one electrical transmitter can be installed in the wheel-house with additional mechanical transmitters fitted on each side of the bridge. For Diesel engines and similar applications, the receiver spindle can be extended at the back of the instrument for connection to locking gear on the engine direction controls. Contacts can also be incorporated in the receiver to give audible and/or visible warning if wrong-way manœuvre. The Robinson electric telegraph can be arranged to operate with any normal d.c. supply from 24 volts upwards. The current consumption is very low and does not exceed 1·5 amp. for an installation comprising one twin transmitter and two receivers. The transmitters are made in the single-dial and double-dial forms for single-screw ships and in twin types for twin-screw vessels; they can be arranged for bulkhead or deck mounting, as required. The receivers are usually arranged for bulkhead mounting, but can be pillar-mounted, if desired. The number of conductors between the transmitter and the receiver is one for each order on the dial plus two for the mains, one for the bell circuit and four for field reversal, so that a nine-order dial requires a total of 16 cores.—*"The Marine Engineer", Vol. 68, No. 818, September, 1945, pp. 474-475.*

U.S. Recommended Methods for Repairing Defective Iron Castings.

Recommendations for the repair or salvage of defective iron castings are contained in *Ordnance Engineering Bulletin No. 152*, issued by the U.S. Army Ordnance Bureau after consultation with the War Emergency Board of the American Society of Automotive Engineers. Flaws are first to be opened and cleaned. Chipping and sand blasting are not considered to be sufficiently reliable for this purpose, but flame gouging carried out by a skilled operator will indicate when all the defective metal has been removed by the change in colour of the flame. In doubtful cases, inspection by magnetic or crack detection methods should be resorted to, or chalk in paraffin or petrol should be applied. An alternative method of dealing with a defective area is to define it by drilling and then grind out all the metal in the drilled area. For welding, a preheat temperature of 900° to 1,100° F. is suggested, and rather more (1,050° to 1,250° F.) for high-strength iron, but in any case not less than 50° below the critical temperature of the metal, the heat being applied gradually. The welding should be completed rapidly, and before the temperature drops to 900° F. The casting must be stress-relieved after welding by heating to the same temperature as for pre-heating and then cooling slowly in the furnace, or in asbestos or similar material. Small flaws may be "cold-welded" without pre-heating, using 94 per cent. nickel bare wire electrodes at 6 to 12 volts and about 350 amp. The nickel is deposited in a plastic state obtained by the use of an intermittent arc. Gas welding, with local heating before and after welding, should only be resorted to for places where expansion and contraction are not restricted. Brazing with tobin brass and a special flux for cast iron, may be carried out with a blowpipe. Soldering is permissible on small machined surfaces showing imperfections, the soldering metal consisting of 97·6 per cent. zinc and 2·4 per cent. copper. Strong hydrochloric acid is given as the flux, and the soldering iron must be kept at a dull red heat. When tapered screwed plugs are used to repair leaks in iron castings in areas subjected to compressive or only low tensile stresses, the threads should be covered with litharge and glycerine. Synthetic resin should only be used to repair leaks which "spray"; a pressure of at least 50lb./in.^{2} should be applied with subsequent baking to produce polymerisation. The use of salammoniac for rusting is also referred to. A 10 per cent. solution should be applied at a pressure of 65 to 100lb./in^2 to repair leaks which did not exceed two drops per second when the casting was subjected to the test pressure.—*"Mechanical World", Vol. 118, No. 3,064, 21st September, 1945, p. 320.*

Steel Castings by the Thermit Process.

A special type of thermit, known as Thermicast, for the production of steel castings, has been developed by the Metal and Thermit Corporation, of New York. It is claimed that this new type of thermit makes it possible to produce sound, clean, steel castings of any size or shape, however intricate, quickly and simply, without the aid of regular steel melting facilities. Thermicast is specially designed for the production of steel castings and is not to be associated with conventional thermit welding, for which it is not suitable. The new casting material utilises the well-known thermit reaction, which is carried out in a specially designed conical-shaped crucible of sheet steel lined with refractory material. Most of the equipment required to produce the castings can be improvised, and little experience to produce steel castings by the process is necessary. Thermicast is available in 41-lb. bags, each of which produces approximately 25lb. of steel. The Thermicast steel, as cast, has the following average mechanical properties: Yield point, 17·5 tons/in.^{2}, tensile strength, 31·3 tons/in.^{2}; elongation in 2in., 30·1 per cent., and reduction in area, 51·2 per cent.—*"Foundry Trade Journal", Vol. 77, No. 1,517, 13th September, 1945, p. 36.*

Centrifugal Refrigerating Compressors.

A well-known firm of refrigerating engineers in this country have developed an improved type of centrifugal refrigerating compressor suitable for marine service. This compressor is designed to operate with refrigerants having a large specific volume and requiring a relatively low maximum compression pressure. The machine is essentially a multi-stage high-pressure fan, each stage consisting of a narrow large-diameter impeller which fits closely in a casing having a spiral volute, guide vanes being interposed between the periphery of the impeller and the volute itself. Thence, the discharge of the first stage is led to the suction of the second stage and so on until the desired pressure is reached. The subsequent cycle of operations is, of course, the same as that of a reciprocating compressor installation.—*"Shipbuilding and Shipping Record", Vol. LXVII, No. 10, 6th September, 1945, p. 219.*

Combating Magnetic Mines.

An examination of the first magnetic mines laid by the Germans in November, 1939, indicated a remedy in the demagnetisation of ships. Later investigation showed that the magnetic field of a steel ship at the relevant distance could be accurately calculated by assuming the hull to consist of a row of vertical dipoles, a row of horizontal (athwartship) dipoles and a longitudinal dipole of a length rather less than that of the ship. It was also shown that the longitudinal magnetism consisted of a "permanent" component, which did not vary with the ship's heading, and an induced component, which varied from zero on an east-west heading to a maximum that was roughly proportional to the earth's horizontal field on a north-south heading. Before that time chief consideration was given to buoyant mines and it appeared unlikely that ships could be demagnetised sufficiently to protect them at the short ranges at which such mines operate. Mine-destruction ships were therefore magnetised strongly enough to cause the mines to explode at a safe distance. When it was discovered that magnetic mines laid on the sea bed at considerable depths were capable of inflicting heavy damage, experiments were carried out that proved that the vertical field under a ship could be substantially reduced by demagnetising the hulls. Heavy copper strip was fastened round the outside of the ship in rubber channelling, but later the coils were fitted inside the hull. Changes of effective field proved to be proportional to the current in the coils, hysteresis was negligible and the permanent magnetism was not changed by prolonged running with the coils in circuit. Wiping with current-carrying conductors to cancel induced vertical magnetisation over a wide area was tried successfully in 1940 and was used at Dunkirk. The magnetism, however, gradually decayed and the work of rewiping restricted the number of merchant vessels that could be treated. By the end of that year 1,704 warships and 4,400 merchant ships had been fitted with degaussing coils. The current in the coils had to be adjusted to suit the value of the earth's magnetic field in different latitudes. Rapid developments in underwater magnetometers aided the work.—*"Electrical Review", Vol. CXXXVII, No. 3,539, 21st September, 1945, p. 412.*

Delaron Laminated Plastic.

A new form of plastic known as Delaron is claimed to be suitable for propeller-shaft bearings, rudder-stock bearings, gearing, pump valves, plunger rings, switchboard panels and other items of electric equipment where good dielectric properties are called for. Delaron is a high-duty thermo-setting plastic manufactured from paper or fabric impregnated with synthetic resin (phenol formaldehyde) and compressed under heat into a homogeneous mass having physical properties and dielectric characteristics of a high order. The material is of laminated construction, the number of impregnated sheets employed being dependent on the final thickness required. These sheets are subjected to hydraulic pressure at a high temperature until polymerisation occurs and the whole mass is bonded into a solid sheet. The material is made in a number of grades, with a tensile strength of up to 20,000lb./in.^{2}, a shearing strength of 18,000lb./in.^{2} and a yield of 2 per cent. under a compressive loading of 10,000lb./in.^{2}. The sp. gr. of Delaron is about 1·35 and it is available in sheets of various sizes and thicknesses of from 0·080in. to 3in. (or more).—*"The Shipbuilder", Vol. 52, No. 438, September, 1945, pp. 408-409.*

North-East Coast Institution of Engineers and Shipbuilders.

The 62nd session of the N.-E. Coast Institution will be opened on October 19th, when the annual general meeting will be held, and the president, Sir Summers Hunter, will deliver an address. The Andrew Laing Lecture on November 2 will be given by Sir Lawrence Bragg, on "Problems of the Metallic State". The papers to be presented at subsequent meetings during the session will include: "All-welded Oil Tankers", by W. A. Stewart; "Electronics: Their Scope in Heavy Engineering", by W. G. Thompson, Ph.D.; "Flow of Boiling Water Through Tubes and Orifices", by R. S. Silver, D.Sc., and J. A. Mitchell, B.Sc.; "Labour and the Advancement of the Sciences of Engineering and Shipbuilding", by J. W. Stephenson; "Some Recent Developments in Marine Watertube Boiler Design", by R. E. Zoller; "Some Aspects of Gas Turbine Developments for Aircraft Propulsion", by S. G. Hooker, B.Sc., D.Ph.; "An Investigation into the Phenomenon of Screw Propeller Action", by A. Kari, M.Sc.; "Two Aspects of the Dynamic Launching Problem", by C. Ridgely-Nevitt, S.M., and A. R. Anderson, S.D.; "Marine Propeller Blade Vibrations: Full-scale Tests", by Professor L. C. Burrill, M.Sc., Ph.D.; "Some Recent Developments in Connection with the Sulzer Oil Engine", by J. Calderwood, M.Sc.; and "Application of Light Alloys to Superstructures of Ships" (including results of practical tests), by W. Muckle, M.Sc.—*"The Journal of Commerce" (Shipbuilding and Engineering Edition), No. 36,691, 20th September, 1945, p. 2.*

Locked-up Stress Due to Fire.

An interesting example of locked-up stress in a cast-iron plate due to fire, serves to illustrate how a machined surface may react to the effects of intense heat. The plate measured 8ft. by 2ft. 6in. and was 1in. thick. When examined after the fire, it was found to be buckled about $\frac{5}{16}$in. throughout its length, and to bring it back into service it was decided to replane the surface. As the centre of the plate did not have to carry much weight it was estimated that it could be reduced to $\frac{3}{4}$in. in thickness without risk of collapse. After the first cut had been taken off, the extent of the buckling had been reduced to 0·018in., and a second cut reduced this to 0·003in, at which the plate was considered to be sufficiently true to be replaced in service. The thickness at the centre then showed an average of $\frac{5}{8}$in.—*"The Journal of Commerce" (Shipbuilding and Engineering Edition), No. 36,649, 2nd August, 1945, p. 10.*

Meeting of French Technical Maritime Association.

After an interval of six years, the French *Association Technique Maritime et Aèronautique* has resumed its activities, and held its Forty-fourth Meeting in Paris on the 19th, 20th and 21st June, 1945, when a number of papers were read and discussed. Among these papers were the following:—

"The Morphological Analysis of Fractures", by H. de Leiris.
"Choice of Propelling Machinery and Speed for Cargo Vessels", by Gilbert Wall.
"Effect of Prolonged Immersion on Electrical Switchgear", by M. Le Gouellec.
"An Investigation of the Diving Bell and of the Possibilities of its Application to Salvage Work in the Raising of Wrecks", by M. Flaissier.
"The Flow of Gases through Pipes of Different Sections as Applied to Supersonic Blowers", by E. Jouguet.
"A Note on Entropy", by M. Delaporte.
"Definitions and Basic Formulæ for Axial Reaction Systems of Propulsion", by M. Roy.
"Researches on the Pitching of Ships", by R. Brard.
"Tank Tests of Model Yachts", by M. Aupetit.
"Principles of Automatic Regulation", by R. Legendre.
"Concerning the Oscillations of Governors Operating on the Léauté Cycles", by Chas. Macherey.
"A New Variable Output Oil Burner Incorporating a Variable-Output Pilot Atomiser", by M. Waeselynck.
"The Influence of High Gas Velocities on the Efficiency of Small-tube Watertube Boilers of Standard Design", by M. Waeselynck.
"A Note on the Form of Inlet Scoops", by Chas. Igonet.
"Methods of Calculating Couples on Rudder Posts and Results of Tests", by M. Baroin.
"An Investigation of the Flexing under Load of Straight Beams of Variable Section and its Application to Steel Cargo Derricks", by M. Salet.
"A Method of Calculating the Stresses in a Flexible Rotating Casing Subjected to a Normally Uniform Pressure and its Application to the Bases of Cylindrical Containers", by MM. Barthélemy and Salet.
"A Note on Calculations for the Design of Full, Circular and Plane Threads of Uniform Thickness", by M. Waeselynck.
"The Use of Graphic Statics for Calculating the Reinforcement of Watertight Bulkheads", by Jules Pinczon.

—*"Journal de la Marine Marchande", Vol. 27, Nos. 1,338 and 1,339, 9th and 16th August, 1945, pp. 771-773 and 792-795.*

The President.
SIR WILLIAM CRAWFORD CURRIE.