ENGINEERING ABSTRACTS

Section 3. Shipbuilding and Marine Engineering

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An Unusual Coaster

A combined motor coaster-suction dredger has been ordered from Clelands (Successors) Ltd., Willington Quay-on-Tyne, by Bristol Channel owners. This 165 feet vessel will have a motor-driven suction dredging pump installed in a separate pump room forward to enable it to raise sand from the bottom of the Bristol Channel; it will be able to carry about 600 tons of sand. The Diesel generators for the pumping equipment will be located in the pump room and other Diesel generating sets will be installed in the main engine room, for most of the auxiliaries will be motor driven. A Ruston main engine of 665 b.h.p. will be used and this will drive the propeller through an oil-operated S.L.M.-type reverse-reduction gear.—*The Marine Engineer and Naval Architect, Vol. 72, June 1949, p. 346.*

Ship Tonnage Increased While Building

The Shipping Register and Shipbuilder (Canada) reports that the Paterson Steamship Co.'s grain ship *Cartierdoc,* of 1,919 tons gross, has been increased to 2,200 tons gross by jacking up the hull and making the main deck flush with the aft deck. This was done by cutting away the upper half of the ship from the stem to the after raised hull and lifting the upper half into position for new plating. This lifting job was done by using some sixteen small jacks, each with a lifting capacity of 30 tons. Duff-Norton jacks were employed, the actual lifting time being 9½ hours. The whole upper half of the ship was raised 4 feet, inch by inch, after it was cut away from the stem to the engine room, making a huge gap in the hull so as to increase the cargo capacity. Several hundred tons were jacked up in this manner, and when the operation was finished new 4-feet strakes of plating and additional sections of side framing were fitted in before the shores and jacks were removed. Cutting of the ship in two is done by burning out the rivets, and after all the rivets are burnt out and the upper half jacked up for the new plating, every hole is found to be true and to fit the new plates exactly. A similar operation was carried out a year ago on the same company's *Newbrundoc.—The Marine Engineer and Naval Architect, Vol. 72, June 1949, p. 340.*

Light Alloy Lifeboats

A new type of light alloy lifeboat has been designed and produced by Gregson and Co., Ltd., of London. Perhaps the main feature is the use of an extruded section which provides, in one integral unit, the keel, keelson and garboard strake flanges. The same section forms the stem and the stern frame in one continuous girder, being bent cold to give the profile required. The bottom of the boat, while having a normal rise of floor, is formed from flat plates of light alloy to which the deep floors are riveted at 3ft. 3in. spacing with intermediate frames. The buoyancy tanks are separately fabricated units in standard lengths of 3ft. 3in. and are connected to the boat bottom by riveted seams inboard of the tank front plating. The deep floors, intermediate frames, tank frames and divisions thus form the transverse strength members, in association with the brackets and knees, and the whole structure of the boat presents a stressed-skin construction of a highly developed nature. One of these Gregson boats has successfully undergone Ministry of Transport tests for strength, stability and seating. The 26 feet boat withstood a superimposed lowering load of 8½ tons without measurable deflexion in either the fore-and-aft or thwartship directions. The boat also withstood a water-filling test load of 19½ tons without permanent deflexion.—*The Shipping World, Vol. 120, 1st June 1949, pp. 559-560.*

New Twin-screw Liner

The launch took place recently from the Barrow-in-Furness yard of Vickers-Armstrongs, Ltd., of the passenger liner *Chusan,* designed for the Eastern service of the Peninsular and Oriental Steam Navigation Co., Ltd. The *Chusan* is a twin-screw turbine driven vessel of approximately 24,000 tons gross. Her principal particulars are as follows:—

Length overall	672ft. 6in.
Length b.p.	630 feet
Breadth moulded	85 feet
Draught	29 feet
Shaft horsepower	42,500
Anticipated speed on trials	23¾ knots

The *Chusan* is to be propelled by twin screws, each driven by a set of geared turbines of Parsons type, designed for a normal shaft horsepower of 34,000, and an overload of 42,500 s.h.p. with propeller revolutions of 130 and 139 per minute respectively. The astern turbines will be capable of developing not less than 65 per cent of the normal ahead power of 34,000 s.h.p. Steam is to be supplied to the turbines at 500lb. per sq. in. gauge and a max. temperature of 850 deg. F. The gearing for the h.p. ahead turbine is to be of double reduction type, comprising an independent primary set of gears driving a secondary pinion on to main wheel. The gearings for the i.p. ahead and l.p. ahead are of single reduction type. The h.p. ahead turbine is of the impulse reaction type, the i.p. turbine of the all reaction type, the l.p. ahead turbine of the double flow all reaction type. An h.p. astern impulse wheel is incorporated in each i.p. turbine, and an l.p. astern impulse wheel in the l.p. turbine casing. Weir's regenerative condensers are fitted to each set of turbines capable of maintaining a vacuum of 28 inch with seat water temperature of 68 deg. F. The propellers are of the four-bladed type, with boss and blades cast solid of manganese bronze. All shafting is of solid mild steel, the intermediate shafting being 21⅝ inch diameter. Steam is supplied by two large and two small water tube boilers of Foster Wheeler controlled superheat design, arranged to giv a superheat control from 850 deg. F. down to 600 deg. F. when manœuvring, the steam pressure at the superheater outlet to be 525lb. per sq. in. The boilers are arranged to burn oil fuel only under the balanced system of forced draught. Electrically driven forced and induced draught fans are to be fitted for this purpose. Air heaters of the tubular type are provided. Soot collectors of Howden's Dry Upflow Vortex type are to be fitted in the uptakes of each boiler.—*The Shipping World, Vol. 120, 6th July 1949, pp. 15-16.*

Single-screw Motorship *Carpentaria*

The single-screw motorship *Carpentaria* has been built and engined by Barclay, Curle and Co., Ltd., Whiteinch, to the order of the British India Steam Navigation Co. She is the first of an important class of motorships, with considerable refrigerated space, at present building on the Clyde and the Tyne. The new vessel has been constructed to the highest class of Lloyd's Register and has main particulars as follows:

Length	485ft. 0in.
Breadth	62ft. 6in.
Depth to shelter deck	40ft. 9in.
Deadweight capacity	9,700 tons
Gross tonnage, about	9,000 tons

The main engine is an airless-injection opposed-piston Barclay Curle-Doxford Diesel built at the North British Engine Works, Whiteinch, Glasgow, and having six cylinders 670 mm. diameter with a combined stroke of 2,320 mm. It is rated at 6,800 b.h.p. at 116 r.p.m. in service. The engine is perfectly balanced by adjustment of the upper and lower piston strokes combined with the weights of the reciprocating parts. Torsional oscillations in the crankshaft have been carefully calculated and any dangerous effects therefrom eliminated by means of a Bibby detuner fitted at the forward end of the crankshaft; at all service speeds there is no possibility of dangerous oscillations occurring. There are two boilers, one cylindrical multitubular oil-fired boiler unit, 16 feet in internal diameter and 11ft. 9in. long, suitable for supplying steam to the deck machinery in port together with all the essential engine room auxiliaries; this boiler has four furnaces 38½ inch in internal diameter. The other boiler is of the composite type, 16 feet in diameter and 11ft. 9in. long, with one nest of tubes to take the exhaust gases from the main engine and two oil-fired furnaces of 45$\frac{1}{16}$ inch internal diameter. It is capable of supplying all steam required for maximum sea requirements. Both boilers are arranged for cold air forced draught and the working pressure is 120lb. per sq. in. As the steam demand in this ship is considerable, having all independent steam-driven pumps, steam steering gear and three Allen-Sunderland Forge steam-driven electric generators each of 65 kW. capacity, it is necessary to have the oil-fired furnaces in use with the main engine exhaust and when manœuvring. The two oil-fired furnaces of the composite boiler can generate the full steam demand. —*The Marine Engineer and Naval Architect, Vol. 72, June 1949, pp. 314-319.*

Ocean Salvage Tug

The *Rode Zee,* built by J. and K. Smit's Scheepswerven N.V. at Kinderdijk for L. Smit and Co.'s International Towing Service, recently ran trials when a speed of 14 knots was attained. With a length of 160 feet a beam of 29 feet and a depth of 15 feet, she has a gross tonnage of 500 tons and has been built in excess of Lloyds Register's highest class requirements. The vessel is fitted with a six-cylinder, single-acting two-stroke main engine of Burmeister and Wain type, built under licence by P. Smit, Jnr., of Rotterdam, and developing output of 2,000 b.h.p. at 180 r.p.m. The bore and stroke are 420 mm. and 750 mm. respectively, and the engine is directly reversible. Engine cooling is by fresh water for the jackets and oil for the pistons. The circulating water, lubricating oil and fuel booster pumps are engine-driven units. Auxiliary power is provided, one Smit-M.A.N. three cylinder four-stroke Diesel engine driving a 65 kW. generator and two Burmeister and Wain two-cylinder four-stroke Diesel engines each driving a 30 kW. generator. Each of these generator sets are fitted with an air compressor which can be connected when required by means of a clutch. The main towing winch, fitted for 5½ inch wire rope, and controllable from the bridge is capable of heaving in a tow with the main engines developing their full output. Salvage equipment comprises a heavy salvage pump installed in the ship, with a similar portable pump which can be put on board a damaged vessel and supplied with power from the *Rode Zee.* A complete outfit of suction and discharge hoses is also carried. The bunker capacity is sufficient for 60 days, equivalent to a radius of action of some 15,000 miles.—*The Marine Engineer and Naval Architect, Vol. 72, June 1949, p. 324.*

Shipbuilding at Cape Town

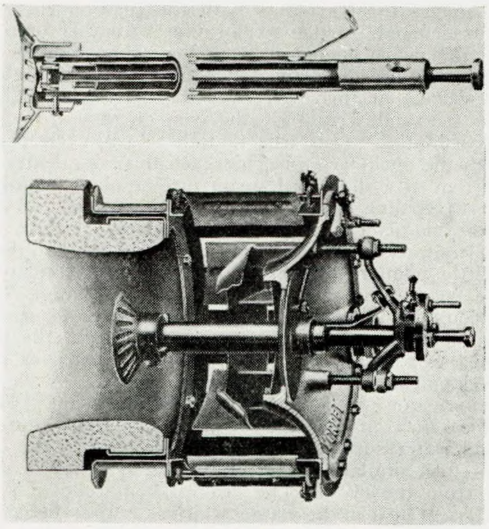
As soon as a site is provided by the Government, a Cape Town company intend to embark on the construction of large, modern steel trawlers. The firm expect that, at the latest, they will be able to start within the next twelve months. The local company believe that, in the event of another war, the projected shipyard would be invaluable, as it would be possible to construct there cargo vessels of up to 12,000 tons deadweight.—*The Shipbuilder and Marine Engine-Builder, Vol. 56, June 1949, p. 481.*

Dimensional Considerations in Fluid Mechanics

The author presents a compilation of available information on the subject of dimensional analysis and physical similarity in the field of fluid mechanics, beginning with a short outline of dimensional theory and applying the deductions to the consideration of similarity of physical systems. Several numerical examples are given to show the usefulness of a preliminary dimensional analysis when new problems are attacked, as in research work. It is also possible to determine to what extent strict similarity can be maintained between physical systems, and this knowledge can be used to assess the reliability of results obtained by model experiments. Advantages of the use of models in direct experimental work are shown to be reduction of expenses, accuracy of results because refined methods of measurement based on absolute standards are available, the fact that all the variable physical quantities and natural conditions are capable of adequate and separate control, and that modification of form, apparatus, or method can be made easily and quickly in the course of a research. The disadvantages are the difficulty of simulating working conditions with laboratory equipment, and "scale effect" due to the frequent absence of conditions physically similar to those obtaining in the prototype.—*J. G. LaBerge, National Research Council of Canada, Report No. MT-5. The British Shipbuilding Research Association, Journal, Vol. 4, June 1949; Abstract No. 2680.*

New Liquid Fuel Burner

In the Thornycroft system the fuel is sprayed at a controllable pressure and temperature into the boiler furnace, the proper mixture of air and fuel being obtained by the use of highly efficient atomizers and air registers. By simply changing the size of the atomizer parts, the standard burner and air register has an output range of from 150 to 1,500lb. per hr. When the boilers are provided with mechanical draught the air quantity is controlled by the speed of fans, but in the case of natural draught the amount of entering air is largely regulated by the temperature of the boiler fuel gases, i.e.,



Sectional view of the Thornycroft burner

by the amount of fuel being burnt. Generally speaking, fuel outputs up to about 300lb. per hr. may be burnt under natural draught, depending upon the height of stack, gas temperature and resistance. Above this output some form of forced or assisted draught is necessary. The large furnaces of water-tube boilers are usually fitted with a group of similar burner units arranged in a manner which concentrates the flames at a focal point near the furnace centre. The provision of a number of similar burner units per boiler enables quick power changes to be made without changing burner sizes. In the small cylindrical furnaces of Lancashire, Scotch and other firetube boilers large changes in steam output are met by changing the size of sprayer tips, a simple operation which can be done rapidly.—*The Shipping World, Vol. 120, 15th June 1949, p. 615.*

Welded Joints in Thick Aluminium Plates

Tests of argon-arc welds in 1½ inch thick plate of aluminium alloy containing 1·2 per cent manganese showed that the welded joints had tensile strength properties equal to those of the parent material, even at liquid-nitrogen temperature (−320 deg. F.). Tests of argon-arc welds in several types of high-strength, heat-treatable aluminium alloys, in plates 1½ inch thick showed that sound welds can be made with some of the available filler metal alloys. In certain cases, these welds have tensile strengths approaching those of the heat-treated parent material, but it is indicated that additional work will be required to produce weld metals with satisfactory ductility and response to heat treatment. This may depend on improved welding technique or on the development of better filler metals. The influence of the welding heat on the properties of the heat-treated aluminium-alloy plates, in regions remote from the weld area, is also discussed.—*C. B. Voldrich, The Welding Journal (New York), Vol. 28, June 1949, pp. 275-s-288-s.*

Tape Soldering

A new self-soldering tape has been developed in the United States which is said to eliminate the need for a soldering or torch equipment. The tape is a ribbon of lead-tin solder attached to a ribbon of vinyl plastic in which heating material is dispersed. When ignited, the vinyl ribbon provides a safe and efficient medium for melting the solder, causing it to flow directly into the joint. The surfaces to be soldered are cleaned with steel wool and coated with a thin layer of soldering paste. A strip of the tape is cut to a length sufficient for the job in hand; the metallic face of the tape is positioned over and adjacent to the surfaces to be soldered so that the plastic-fuel ribbon will be uppermost, permitting easy ignition and allowing the metal ribbon to flow into the required joint. One end of the fuel ribbon is fluffed to facilitate ignition, and lit. The ash after the fuel ribbon has burned is removed with a clean rag, and the soldered joint may be buffed with steel wool prior to inspection.—*Petroleum, Vol. 12, July 1949, p. 180.*

Pearlitic Structure Effect on Brittle Transition Temperature

It has often been observed that steel plates rolled from the same heat of ingot may possess different impact properties. Since there is no appreciable variation in the chemistry of such steel, it is usually assumed that the micro-structure is responsible for the variations in the mechanical properties. A plain, low-carbon steel plate was selected for tests to determine the effects of fineness of pearlite and grain size on the transition temperature of a specimen with a given geometry. It was found that the material with the small grain structure and with the finest pearlite spacing had the lowest transition temperature. The order and magnitude of the lowering of the transition temperature is proceeding from coarse to fine pearlite appeared to be about the same as that found in proceeding from the large to the small grains from this particular steel.—*N. Grossman, The Welding Journal (New York), Vol. 28, June 1949, pp. 265-s-269-s.*

Final Report of the Weld Stress Committee

In this report the Chairman of the Committee states that as a result of the work done by the Weld Stress Committee, by corresponding government agencies and by private individuals, the following general conclusions seem warranted at this time: (1) Stress corrosion specimens and the relaxation of weldments by machining indicate residual stress systems of considerable magnitude in welded structures. The relaxation of weld stresses by machining and its effect on stress corrosion can be demonstrated in the laboratory. (2) The detrimental effect as originally attributed to residual stresses in the useful life of a structure has not been established, although it is generally conceded that reaction stresses may progress a crack once initiated regardless of the cause—sometimes this elastic stored energy in a large structure may propagate a crack with explosive violence. (3) Stress relieving treatments, particularly thermal, have been proved to be beneficial in so far as the quality of a welded joint is concerned, and are still considered a necessity in many structures, as, for example, pressure vessels, machinery parts and the like. The beneficial effects are not primarily due to reduction of residual stresses, but rather to improvement of metallurgical structure, dimensional stability in machining operations and reduction in stress corrosion potentialities. (4) Preheating, peening, local stress relief and general stress relief, sequence of welding and similar devices, are known to be advantageous in preventing cracking on cooling, in minimizing and controlling distortion and in bringing about more desirable redistribution of stresses. (5) High concentrated stresses are always coincident with failure of a structure. They are usually multi-axial in nature and hence the great majority of investigations should be turned to the problem of plastic flow and fracture of metals under conditions that produce the gamut of failures from shear to cleavage. (6) It has been established by many investigators that design and workmanship which result in stress raisers and obstructions to the ductile behaviour of metals are the most important elements in failure. (7) Next to design and workmanship, it is agreed that the notch sensitivity of steel at low temperatures is the most important consideration that must be taken into account in rigid welded monolithic field erected structures. (8) A concept of the inter-relation of rate of loading, temperature and degree of constraint for any particular steel and under any given set of conditions is now available. The importance of transition temperature of steel has been emphasized. (9) The desirability of avoiding metallurgical damage to steel during the fabricating process is generally conceded. (10) Many believe that the problems of stress corrosion and strain ageing are closely inter-related and are materially affected by the quality of steel, methods and procedure of welding. (11) Fracture where localized stresses are high will not take place if sufficient plastic flow can occur to sculpture the abrupt change of contour and strengthen the critical metal by work hardening.—*E. Chapman, The Welding Journal (New York), Vol. 28, June 1949, pp. 271-s-274-s.*

Solid Fuel Burning Gas Turbine

In Fig. 3 the gas turbine (1) of the plant is driven by gases supplied through the piping (2) from a pressure combustion unit (3) arranged for the combustion of coal in granular form. The combustion unit (3) includes a primary cylindrical whirl chamber (4) and a secondary cylindrical whirl chamber (5) for tempering the combustion gases from the primary chamber. Both chambers are surrounded by a cylindrical pressure casing (6). Near the top of the primary whirl chamber (4) tangentially arranged inlet ports (7) and (8) are provided for the introduction of granular coal with primary air and secondary air respectively. The walls (17) and (23) of the primary and secondary whirl chambers respectively are lined with refractory, and fluid cooled by means of a cylindrical row of tubes (24) which extend from an annular inlet-header (25) below the cylindrical wall (23) of the secondary whirl chamber to an intermediate annular header (26) placed above the cylindrical wall of the primary whirl chamber. Two cylindrical rows of tubes (27) in the annular space (28) connect the intermediate header (26) to an outer header (29) located in the annular space (28) outside the wall (23) and above the header (25). Above the level of the bottom of the primary whirl chamber the tubes (27) are provided with extended surface elements in the form of ribs. From the outlet header (29) a connexion leads to the inlet side of a pump (41), the outlet of the pump being connected to the inlet header (25). The cooling fluid consists of water under pressure, or a fluid having a high boiling point. In the upper part of the secondary whirl chamber (5) above the level of the header (29), some of the tubes (24) in the wall (23) are bent in order to provide a circular series of ports (42) formed to give a whirling motion in the primary whirl chamber. The ports (42) serve for the introduction of tempering air, which is delivered through the duct (43). The lowermost part of the secondary whirl chamber is formed as a hopper (50) for the collection of solidified ash and a valve (51) is provided for the discharge of the ash into a suitable receptacle. Above the hopper (50) a gas outlet duct (55) extends laterally from within the secondary whirl chamber to the outside of the pressure casing for passing combustion gases into the duct leading to the gas

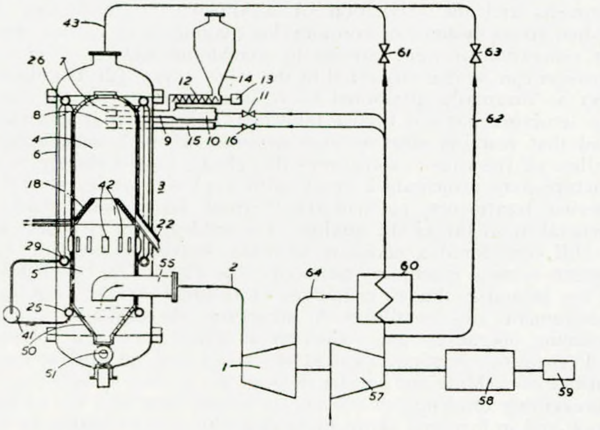


Fig. 3.

turbine (1). The gas turbine is mechanically coupled to an air compressor (57), an electrical generator (58), and a starting motor (59). The air compressor supplies air under pressure, which, after heating in a regenerator (60), is distributed as primary air. An air duct (62) provided with the control valve (63) leads pressure air from the compressor to the tempering air duct (43) without passing through the regenerator (60) or the control valve (61). A gas duct (64) conveys gases from the exhaust of the turbine to the regenerator. The gas turbine plant described is suitable for operation with an ash-containing coal, this coal being reduced to proper size by crushing it in a hammer-mill-type coal-crusher to a granular product. In the case of bituminous coal, for instance, the product will consist of particles all substantially less than $\frac{1}{8}$ inch in size and will have a minimum amount of fines, no more than 10 per cent, passing through a number 200 mesh screen. The operating conditions will be so adjusted that on the cylindrical whirl chamber wall (17) an adherent molten ash film is formed which provides a sticky surface by which fuel granules thrown upon it are retained and burnt out under the action of the whirling gases sweeping over the surface. The ash contained in the molten film flows downward by gravity until it is trapped by the wall (18).—*Brit. Pat. No. 616,864, issued to Babcock and Wilcox Ltd., C. H. Davy and T. B. Webb. Complete Specification accepted 27th January 1949. Engineering and Boiler House Review, Vol. 64, June 1949, p. 199.*

Gas Turbine Power Plants

It is the author's opinion that in addition to the normal, continuing improvement of the various cycles and plants thus far designed and fabricated for marine gas turbine plant, several noteworthy paths of still further development are open in adapting the gas turbine to marine propulsion. One path requiring further investigation is that in which the marine plant utilizes Lysholm rotary, positive displacement compressors. The advantage of use of such compressors over the other types available is the principal one that this type compressor offers stable, high efficiency operation over almost any range of loads. The Lysholm compressor is capable of having discharge control independent of compression ratio. This feature, which results in high part-load efficiency is most desirable for marine plants. At present, only one plant, the Elliott Co. plant, makes use of this type compressor. Their application of it has been very successful and the only disadvantage found in its use, was the fact that it was excessively noisy. This factor and the further application of such a compressor to gas turbine plants with the requirements peculiar to marine plants demands further exploration. Another path of investigation open to marine engineers is in the application of the closed-cycle to marine propulsion plants. The advantages of higher full and part-load efficiences of this cycle over the open-cycle, in addition to reduction in size and weight of the components of the plant offer attractive possibilities. It is true that the closed-cycle plant is more complex than the open-cycle one, but even this complexity appears to be less than that of a shipboard steam turbine plant installation. The requirement of cooling water supply for precoolers and intercoolers in the closed-cycle plant is of no importance for a marine installation, since a supply of cooling water is always plentiful, and during ahead operation, little pumping power is required for circulation of this water. The waste heat available from the air heaters of a closed-cycle plant could be utilized in a waste heat boiler to generate steam for heating, operation of evaporators, cooking and the many other needs for steam or a source of heat required in a marine plant. Still another development path open to marine engineers is the application of "wet compression" to a marine gas turbine plant. This process refers to the effect produced by compressing a mixture of finely divided liquid water suspended in the air supplied to the compressor, which is an effect similar to intercooling but is better in that no heat is removed from the cycle. The heat of compression of the air is absorbed as latent heat in the water, which is evaporated. At low compression ratios such as are now used in gas turbine cycles, the amount of water required is in the same order of magnitude as the weight of fuel used in the cycle, or 2 to 3 per cent of the weight of air. This process reduces the work of compression and returns the heat removed from the air to the working fluid in the form of steam. This brings about, for a given size of compressor, an increase in the net power output from the cycle of as much as 20 to 30 per cent. Although no gas turbines designed for wet compression have been built as yet, tests have been run on a gas turbine designed for conventional compression operating with wet compression. The limited test results have borne out all of the above results based on calculations. The problem of a supply of pure water in such a process should not vex marine designers since all marine plants require evaporators for production of drinking water, and this small source of additional water requirement could be easily handled in the same apparatus. Present practice is to produce both drinking and boiler water by the same set of evaporators, merely decreasing the feed rate of the salt water to obtain the additional purity of feedwater over drinking water.—*S. Comassar, Journal of the American Society of Naval Engineers, Vol. 61, May 1949, pp. 347-364.*

Corrosion Prevention for Metals

A powerful corrosion inhibitor has recently been introduced for preventing corrosion of iron and steel and other metals, between manufacturing steps, in packages for shipment and during storage. It is a synthetic chemical with unique properties that make possible an entirely new method of corrosion-preventive packaging. The compound is a white crystalline stable organic compound which very slowly sublimes or vaporizes. The vapour, which is odourless, non-toxic and non-injurious to the skin, completely surrounds any article in an enclosed space and prevents corrosion. Direct contact of the substance with the metal is not necessary. It acts by forming an invisible, thin, protective film on the surface of the metal and this film is maintained as long as the inhibitor is present in the atmosphere. The new product may be applied in powder form or in solution in water or alcohol, but the most convenient and economic method is the use of coated wrapping materials. The inhibitor is claimed to be outstanding for corrosion protection of ferrous metals and for such metals as aluminium, duralumin, cast iron and chromium plate.—*Petroleum, Vol. 12, July 1949, p. 180.*

Fly-ash Erosion in Gas Turbines

One of the chief difficulties anticipated in the use of pulverized coal as a fuel for the gas turbine is the possibility of serious erosion of turbine blades and other metal parts by the suspension of fly ash in hot combustion gases. The erosion of metals through the impingement of solid particles suspended in a rapidly moving gas stream is an extremely complicated process which at present cannot be described in exact terms. The high operating temperature of gas-turbine blades introduces special problems in connexion with erosion by solid particles. The oxide film which is formed on metal surfaces at high temperatures may well be more brittle and more susceptible to erosion damage than the underlying metal. If this surface film is removed by erosion, exposing more metal to oxidation, then the repetition of this process might lead to a very rapid loss of metal. In addition, the heterogeneous nature of some turbine alloys complicates the situation because the relatively minute particles of fly ash may show a preferential attack on some constituents of the metal structure, resulting in the weakening of stressed parts. In studying the erosion of turbine blades by fly ash at high temperatures, it is thus necessary to investigate possible structural changes and localized damage, as well as the overall loss in metal weight. The authors report that the chief features of all erosion tests at high temperature (800 deg. F. to 1,350 deg. F.) was the formation of hard tenacious coatings or deposits on the specimens. The exact amount and nature of the deposits varied widely according to the fly ash used and the conditions of impingement. In many cases it was found that both deposit formation and erosion took place on different parts of the same specimen, so that the net result varied from a considerable loss of weight of the erosion test specimen under some conditions to rapid weight gains under other conditions. In general, it was found that deposit formation was associated with the impingement of relatively fine ash particles, smaller than about 10 microns diameter, while coarser particles tended to remove any deposits present on the specimen face and to produce erosion of the metal. The deposits produced at high temperature consisted of a hard ceramic-like material ranging in colour from a light tan, through various shades of reddish brown, to a dark-red almost black colour. Most of the deposits adhered so strongly to the metal surface that they could be removed only with difficulty by using a sharp knife-blade. The general appearance and properties of the high-temperature deposits suggested that the fly-ash particles actually were sintered together, even at temperatures as low as 800 deg. F. It appears that the sintering of the fly ash in the deposits must be helped by the pressures developed during impingement as well as by the selective concentration in the deposit of the more plastic constituents of the fly ash.—*M. A. Fisher and E. F. Davis, Mechanical Engineering (New York), Vol. 71, June 1949, pp. 481-487.*

Lysholm Marine Gas Turbine

In Fig. 2 is illustrated a marine gas turbine installation comprising two units (1, 2) in series. The high-pressure turbine (1) drives a centrifugal compressor (3), and the low pressure unit (2) is coupled to a displacement compressor (4), from which air is supplied to a primary combustion chamber (9) delivering gas to the h.p. turbine (1). The exhaust gases from the h.p. turbine pass into a second combustion (11) and thence to the l.p. turbine (2). Before the gases are discharged to the atmosphere they pass through a heat exchanger (12), thus raising the temperature of the air supplied to the primary combustion chamber (9). The l.p. turbine (2) drives the propeller (14)

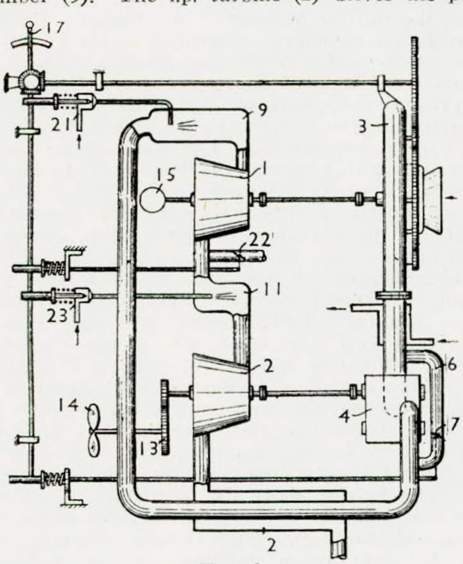


FIG. 2.

through gearing (13). A starting motor (15) is arranged on the shaft of the h.p. turbine (1). The outlet area of the centrifugal compressor (3) is gradually decreased as the load is lowered, and eventually the displacement compressor (4) is placed out of operation by opening the valve (7) and the by-pass conduit (6). At high loads both fuel valves (21, 23) are open and the valves (7, 22) are closed. The centrifugal compressor (3) is provided with adjustable outlet guide vanes moved by gearing from a shaft controlled by a lever (17), which also regulates the fuel supply to the combustion chambers.—*(Brit. Pat. No. 613,292. A. Lysholm, Stockholm). The Motor Ship, Vol. 30, July 1949, p. 159.*

Operating System of Elliott Gas Turbine

In Fig. 5 is illustrated a gas turbine intended to operate throughout the load range at practically constant admission temperature with a flat efficiency curve under varying load. The plant includes two rotary displacement Lysholm compressors. The low-pressure machine (1) has a rotor (3) driven by the high-pressure turbine (6), and the outlet (7) communicates with the high-pressure machine (9) driven by a low-pressure turbine (12). The outlet of the h.p. compressor communicates with a heat exchanger (16) having an outlet leading to the burner (19) of the combustion chamber (18). Oil is supplied to the burner from a multi-cylinder Diesel injection pump (21). The pump cylinders inject oil at a frequency designed to give a continuous

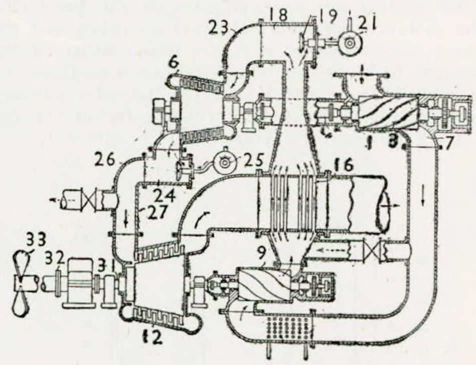
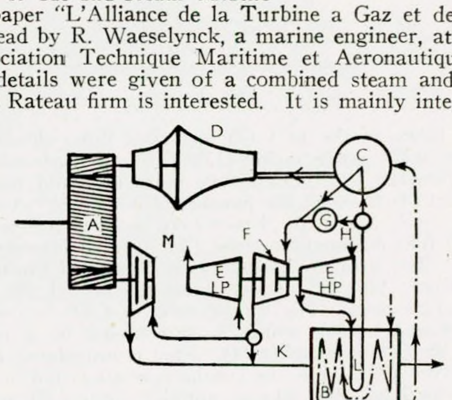


FIG. 5.

flame in the combustion chamber, and the gas is conveyed to the h.p. turbine (6) through a pipe (23). The outlet of this turbine is connected to a second combustion chamber (24) with a fuel pump (25) and a burner (26). The outlet (27) of the chamber communicates with the inlet of the l.p. turbine (12). The end of the l.p. turbine (12) has a driving shaft (31) and a coupling (32) for the propeller (33). The airflow in the cycle varies directly with the load, for the reason that the low-pressure compressor is not driven by the l.p. turbine but by an h.p. turbine that serves no other purpose. All the air from the l.p. compressor must pass through the h.p. machine.—*(Brit. Pat. No. 612,817, Elliott Co., Pennsylvania, U.S.A.). The Motor Ship, Vol. 30, July 1949, p. 159.*

Combination of Gas and Steam Turbine

In the paper "L'Alliance de la Turbine a Gaz et de la Machine a Vapeur" read by R. Waeselynck, a marine engineer, at the meeting of the Association Technique Maritime et Aeronautique, in Paris, last month, details were given of a combined steam and gas turbine in which the Rateau firm is interested. It is mainly intended for the



Proposed gas-steam turbine marine installation

propulsion of high-powered ships, such as cruisers, enabling economies to be effected at cruising as well as maximum speeds. At reduced speed the gas turbine would be in operation and the steam turbine shut down. The diagram shows the suggested arrangement of combined gas-steam turbine installation, with a reduction-gear drive to the propeller.—*The Motor Ship, Vol. 30, July 1949, p. 139.*

Heater for Gas Turbine Plant

This invention relates to a gas heater which is particularly suitable for employment in gas turbine plants, in which the gases to be heated must attain a very high temperature. In consequence of the temperature drop accompanying the process of heat transmission, differences occur in the thermal expansion of the various structural parts, and it is an object of this invention to provide compensation for such differences in expansion. The heat-exchange surfaces of the gas heater shown diagrammatically in Fig. 1, are constituted by two vertically arranged tube nests (1) and (2) which are connected in series by means of a conduit (3) formed as a U-bend. In the first instance the heating gases flow through the tubes of the nest (1) and then pass through the U-bend into the tubes of the nest (2), while pressure-resisting jackets (4) and (5) surround the nests and are connected to each other by a U-bend (6) which is of rigid construction. On the other hand the conduit (3) connecting the tube nests is of flexible construction and is arranged within the rigid bend (6) in such a way that it is free to move in every direction. The pressure jackets are supported by feet (7) and (8), the feet (7) being fixed by bolts (9) to the floor (10), whilst the feet (8) can slide over the floor as required by the contraction or expansion of the bend (6), with the result that the distance between the nests of tubes and the pressure jackets will vary in accordance with the temperature of the rigid U-bend (6). The gas to be heated—for example air—flows from a pipe (11) into the inlet (12) of the jacket (5), initially passing upwards through the space (14) between the pressure jacket (5) and an inner guide jacket (13) until at the point (15) it enters the spaces (16)

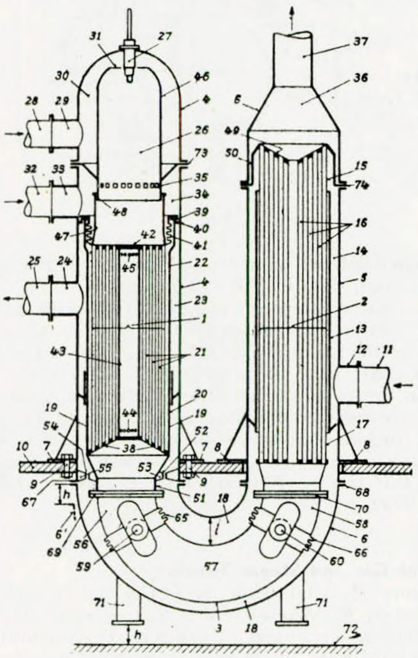


FIG 1.

between the tubes of the nest (2) and then flows downwards along the tubes within the guide jacket (13). The gas then issues from the spaces (16) between the tubes at the point (17) and passes into the pressure jacket (4) through the passage (18) formed between the conduit (3) and the U-bend (6). From here the gas passes through the openings (22) into the annular space (23) formed between the jackets (4) and (20). The pressure jacket (4) is connected through an outlet (24) to a delivery pipe (25) which leads the heated gas to the place where it is to be used. The top of tube nest (1) is connected to a combustion chamber (26), which is surrounded by a pressure-tight extension of the pressure jacket (4). Fuel is introduced and atomized through a burner (27), while the combustion air is fed in from a pipe (28) through an inlet (29), into an annular space (30) and enters the combustion chamber (26) at the point (31). The secondary air, required to perfect combustion, is fed into an annular space (34) from a pipe (32), through an inlet (33) and passes through openings (35) into the flame zone of the combustion chamber (26). The products of combustion then flow down through the tube nest (1) into the conduit (3) and thence up through the tubes of the tube nest (2) into a collecting space (36) and an exhaust gas pipe (37). In order to cool the tube-end (42), which is subjected to considerable heating by the flame in the combustion space (26), a tube (43) of larger diameter is fitted in the centre of the tube nest (1) and is provided with openings (44) and (45) in its lower and upper ends respectively. By this arrangement a portion of the gas flowing in through the openings (19) is allowed to pass through the openings (44) into the tube (43) and leave it again by the exit (45) without becoming heated to any appreciable extent, before flowing along the tube-end (42) towards the outlet openings (22) and thereby effecting the cooling of the tube-end and of the uper parts of the tubes.—*Brit. Pat. No. 619,158, issued to Sulzer Frères Société Anonyme. Complete Specification accepted 4th March 1949. Engineering and Boiler House Review, Vol. 64, July 1949, p. 231.*

Separately Fired Superheaters

In the reconditioned Orient liner *Otranto,* which is fitted with both double-ended and single-ended cylindrical boilers, it was desired to improve the arrangements for superheating the steam. For this purpose two independently-fired Melesco superheaters were installed, and during the liner's refit the furnace volume of these units has been increased. Each unit is designed to pass 70,000lb. of steam per hour and to raise the temperature to 675 deg. F. Two oil fuel burners are fitted to each unit and the increased cubic volume will enable more oil to be burnt cleanly per unit than was possible with the smaller furnaces. A feature of the design of these superheaters is the re-circulation of the gases from the uptake down the back furnaces through the front wall ports. This relatively cool gas being directed to the brickwork of the furnace sides assists in preserving the refractories. The superheater elements are made with forged return bends, and, due to their length, are provided with intermediate joints. These joints are of the metal-to-metal ball type, and these elements are arranged in such a way as to ensure a continuous gas traverse over the whole of the available surface. This arrangement allows the final stream temperature to be regulated within very narrow limits, as it is directly a factor of the quantity of oil used in the independent furnaces.—*The Journal of Commerce (Shipbuilding and Engineering Edition), No. 37,877, 21st July 1949, p. 6.*

Fredriksstad Steam Motor

The Fredriksstad steam motor is a double-compound marine steam engine, working on superheated steam of about 220lb. per sq. in. pressure and about 600 deg. F. It is designed on the Woolf principle, and each of the four pistons acts upon its own crank. The cylinder block is built up of two equal units, each consisting of one h.p. and one l.p. cylinder, with a common piston slide valve. The functions of this valve are only to control the admission of steam to and exhaust from the h.p. cylinder. When the piston valve opens for exhaust from the h.p., the steam passes directly into the l.p. cylinder and then expands simultaneously in both cylinders. This is made possible by the opposition of the cranks. The halves of the engine work at right angles; the disposition of the four cranks being at about 90 deg., the turning moment of the engine is very even. The exhaust from the l.p. cylinder is controlled by the l.p. piston itself at the end of its stroke and is discharged through ports in the cylinder wall. The sectional area of the ports is ample, and there is no measurable pressure-drop between the cylinder and the condenser. In engines having slide or poppet exhaust valves the pressure-drop is usually found to be considerable. The steam motor can utilize and is designed to work with a vacuum of 95 per cent. In the l.p. cylinders the compression covers 80 to 90 per cent of the stroke, as a result of the working of the uniflow principle. On account of the low initial pressure the final compression pressure is always lower than that of the admitted steam, but high enough to counteract the inertia of the reciprocating parts. In the steam motor a drop of the vacuum is automatically rendered harmless by means of a patented bleeding arrangement. The l.p. cylinder covers are made hollow, and the spaces thus formed serve as receivers for l.p. steam which is admitted through unloaded, low-lift, non-return valves. The cavities of the l.p. cylinder covers are always charged with steam at a pressure corresponding to the maximum pressure in the cylinders (some 50 to 60lb. per sq. in.). The valves close automatically when the pressure in the cylinder, owing to the expansion, drops below the pressure in the covers. Should a very poor vacuum cause the steam pressure in the l.p. cylinder to rise above the normal limit, the steam spaces in the covers will immediately, through the non-return valves, be in communication with the compression volume, effecting a considerable reduction in the compression pressure. Steam at about constant pressure, which already has done useful work in the h.p. cylinders, is always enclosed in the l.p. covers. These steam spaces to some extent replace the receivers in ordinary steam engines (receivers are not embodied in the Woolf design) and may be utilized for bleeding steam for feed-water heating, accommodation heating, sealing of rod packings and heating of cylinder oil. The heated l.p. cylinder covers have an advantageous effect also on the economy of the engine, the cylinder condensation being reduced considerably. In fact, the superheat of the working steam is retained well into the l.p. expansion period. High vacuum is obtained by means of a regenerative condenser, where, even at varying loads, no perceptible undercooling of the condensate takes place. The steam consumption of the main engine alone has been found to be 9·25lb. per i.h.p. per hour and 9·8lb. per i.h.p. per hour when the consumption of the propulsive auxiliaries, i.e. the air ejector, the condensate, feed and circulating pumps and the fan engine, are included.—*Lloyd's List and Shipping Gazette (Shipbuilding and Engineering Section), No. 41,997, 21st July 1949, p. 11.*

Making and Breaking Press and Shrink Fits

The complications incurred in the production of the temperature required for making or breaking shrink fits have in the past proved an obstacle to a more general employment of this type of fit in power transmissions. It is claimed that these difficulties are now eliminated by the invention of the pressure oil method by E. Brett of the SKF Co. This method employs the principle of injecting oil at high pressure between the surfaces contacting each other in shrink or press fit and thus reducing the friction between these surfaces to a fraction of its normal value. When applying this method to the placing or removing of large couplings, as, for instance, of propeller shafting, special hydraulic means for making the press fit proper are also provided. The combined method is indicated in Fig. 15, which shows the application of a split flange containing a number of peripherally arranged pressure oil plungers, operated jointly and concurrently by means of a hand pump, for forcing the coupling sleeve into place. The two hand pumps for forcing the pressure oil between the contacting surfaces of the coupling are also shown. Once the joint is made the oil is allowed to drain off, thus establishing the press fit proper; while the split flange containing the forcing plungers is removed.—*E. Wilhjelm, Ingeniøren, Vol. 29, 16th July 1949, pp. 585-590.*

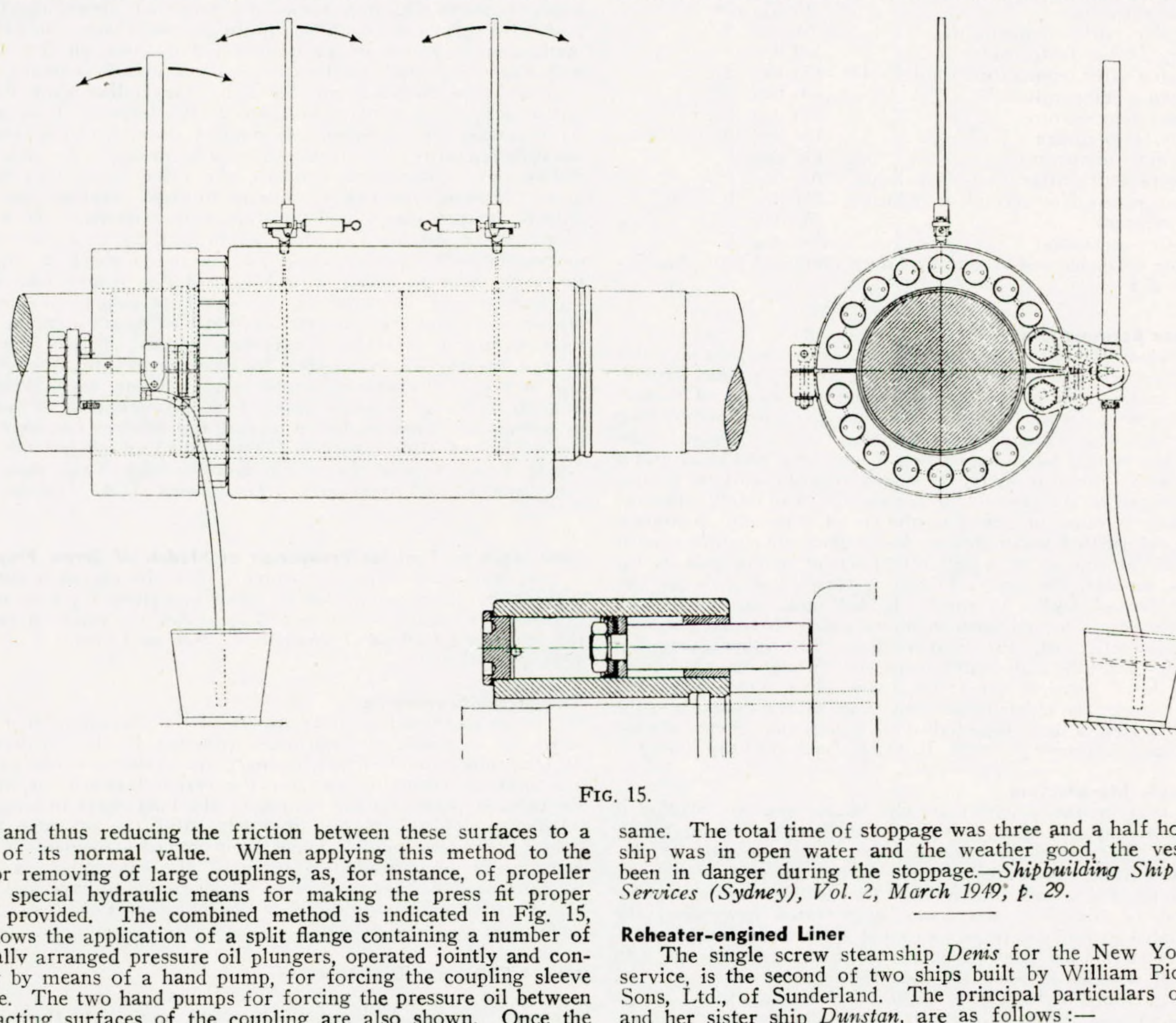


FIG. 15.

A 6,000 h.p. Combination Installation

The Readhead-built-and-engined *Armanistan,* recently delivered to Frank Strick and Co. is one of the highest powered single-screw steamships with reciprocating machinery and Bauer-Wach exhaust turbine to be built for many years. The total power is 6,000 h.p. at 92 r.p.m. and the low-pressure cylinder is 81 inch in diameter. Her four Scotch boilers have White oil-burning equipment and Melesco smoke-tube superheaters delivering the steam at 600 deg. F. The large Wallsend Slipway-built exhaust turbine develops 1,500 s.h.p. at 2,500 r.p.m.—*The Marine Engineer and Naval Architect, Annual Steam Number, 1949, p. 257.*

Engine Breakdown at Sea

When a certain steamer was on a voyage from Fremantle to Newcastle, N.S.W, the main engines gradually slowed down and finally stopped. The safety valves on boilers lifted, and it was noticed that the pressure gauge for h.p. steam chest had gradually fallen to zero. On opening the h.p. cylinder and valve chest drains, practically no steam issued. The main stop valves on both boilers were shut, and cover taken off h.p. valve chest, where valve and spindle were found in good order. The engine stop valve cover was opened, and the valve seat was found to be loose and the set screws holding the seat flange in place broken. The broken set screws were drilled out, holes retapped and seat coated on outside with jointing putty and replaced. The cause of the seat becoming loose is considered to be due to the valve, which is of the screw lift type, rattling on spindle and wings of valve striking side of seat, having a hammering action on same. The total time of stoppage was three and a half hours. As the ship was in open water and the weather good, the vessel had not been in danger during the stoppage.—*Shipbuilding Ship Repair and Services (Sydney), Vol. 2, March 1949, p. 29.*

Reheater-engined Liner

The single screw steamship *Denis* for the New York to Brazil service, is the second of two ships built by William Pickersgill and Sons, Ltd., of Sunderland. The principal particulars of the *Denis* and her sister ship *Dunstan,* are as follows:—

Length overall ...	357ft. 9in.
Length between perpendiculars ...	335ft. 0in.
Breadth moulded ...	50ft. 6in.
Depth moulded to upper deck ...	22ft. 0in.
Depth moulded to shelter deck ...	31ft. 0in.
Draught on summer loadline ...	20ft. 11in.
Corresponding deadweight capacity ...	4,915 tons
Gross tonnage ...	2,990 tons
Service speed ...	11½ knots

The propelling machinery was installed by George Clark (1938) Ltd., Sunderland, and includes a superheated triple-expansion engine incorporating the North Eastern Marine Engineering Co.'s reheat system.

The main engine has cylinders 21½ inch, 34 inch and 62 inch in diameter with a stroke of 39 inch. Cam-operated valves are fitted to the h.p. and m.p. cylinders. It is designed to develop 2,250 i.h.p. on trial at 97 r.p.m. and 1,950 i.h.p. at 92 r.p.m. in service. The two cylindrical multi-tubular boilers are 15ft. 9in. in external diameter and 11ft. 0in. long, with a combined total heating surface of 5,304 sq. ft. They are designed to supply superheated steam at a pressure of 220lb. per sq. in. and are fitted with Nemenco superheaters in the wing combustion chambers only; these give a maximum steam temperature of about 750 deg. F. at the superheater outlet. The performance figures obtained during the trial were as follows:—

r.p.m. ...	102·8
i.h.p. ...	2,079
m.i.p. referred to l.p. piston ...	34·01b. per sq. in.
Boiler steam pressure ...	218lb. per sq. in.
Engine stop valve pressure ...	203lb. per sq. in.
Condenser vacuum ...	26·0in. Hg.
Barometer ...	29·70in. Hg.
h.p. chest pressure (engine throttled) ...	164lb. per sq. in.
m.p. chest pressure ...	61lb. per sq. in.
l.p. chest pressure ...	10·0lb. per sq. in.
Superheater outlet temperature ...	761 deg. F.
Auxiliary steam temperature ...	440 deg. F.
Engine stop valve temperature (boiler side)	533 deg. F.
h.p. exhaust temperature ...	430 deg. F.
m.p. chest temperature ...	580 deg. F.
l.p. chest temperature ...	352 deg. F.
Feed at filter temperature ...	102 deg. F.
Feed temperature after first-stage heater	206 deg. F.
Feed temperature after second-stage heater	274 deg. F.
Air at furnaces ...	220 deg. F.
Gases after air heater ...	366 deg. F.

—*The Marine Engineer and Naval Architect, Annual Steam Number 1949, pp. 269-275.*

Marine Water Refining Unit

In the Refinite M-10 unit produced by an American firm of water treatment engineers raw water from any of the ship's tanks, including the skin tanks, is caused to flow to the unit by means of a small pump. The incoming water is highly chlorinated to ensure destruction of all bacteria. The strength of chlorination is 5 to 8 ppm. The practice of chlorinating all water passing through the unit is advisable because it assures complete safety of supply regardless of the source of the raw water or the possible contamination that might unknowingly take place in tanks or piping on the vessel, especially in tropical zones. The chlorinated water flow is so designed that ample time is given for the chlorine to have full killing effect on bacteria as the water passes through the unit. This is accomplished with the use of a special baffled tank. From the baffled tank, the water, still heavily chlorinated, is passed through filters which clear the water of all foreign deposits, grit, dirt, rust particles and other suspended matter. From the filters all water is passed through an absorption filter. This filter removes from the water all foreign tastes and odours, the taste of the chlorine, and any discoloration present in the water. This water is then passed through a softener filter.—*Marine Engineering and Shipping Review, Vol. 54, June 1949, pp. 54-55.*

Turbine Nozzle Manufacture

Almost every modern marine turbine having reaction blading is preceded by an impulse wheel in the h.p. section; moreover, astern power blading, for reasons of space alone, is very frequently entirely of the impulse type. In every instance where impulse wheels are incorporated, nozzles to control and direct the steam on to the impulse blading must be provided, and many and varied have been the methods adopted to produce these somewhat awkwardly shaped units. During the war, special steel blading was used, cast integral with bronze carrier sections which were then bedded on to the cast steel nozzle boxes provided on the casing castings. Although these castings served their purpose, being subjected to the highest steam temperature as well as a very high velocity, they were prone to serious distortion; moreover, owing to the blades being continuously in contact with high velocity steam, they were liable to a certain amount of erosion, which, however, did not proceed very far. Later, various other methods of milling out the profile of these nozzles have been introduced with a view to building up groups of nozzles according to requirements. Using this method of manufacture, nozzle profiles were machined out from solid alloy steel forgings, the steam passages being finished by hand. They were subsequently gauged and checked to ensure that the angles and areas were correctly made in accordance with design, then a segmental cover plate, also made from alloy steel, was fitted over the profiles and a special form of clamping ring in segmental form was secured by fixing studs in the casing. Each of these studs was fitted with cap nuts. In the latest form, each nozzle profile is machined out as an irregular steel box. When all the material that it is possible to remove by machining has been taken off, these units are finished by hand; they are then gauged and fitted together and welded at the sides to form a segmental group, consisting of eight, ten or a dozen nozzles, as may be required. Although nozzle groups built up in this way may be considered expensive their correct profile is assured and they have the additional advantage of robust construction, being cut from solid forged blocks of alloy steel suitable for high temperature work.—*The Journal of Commerce (Shipbuilding and Engineering Edition), No. 37859, June 1949, p. 6.*

U.S. Navy Research

At a recent meeting of the Northern California Section of the Society of Automotive Engineers, Lt.-Com'r A. E. Brandin, U.S.N.R., explained the way in which the United States Navy is carrying on a programme of continued research in a wide range of scientific and engineering fields. With various branch offices reporting to the Office of Naval Research in Washington, D.C., the Navy has entered into many contracts with universities and industrial laboratories to further research projects in chemistry, medicine, electronics, nuclear physics, mathematics, geophysics, propulsion and missiles, physics, mechanics and materials, fluid mechanics, and subsurface warfare, he said. Contracts are initiated with the U.S. Navy either upon the Navy's initiative or from a suggestion outside the service. They are essentially partnership agreements to conduct research in the sense understood by scientists—the creation of new knowledge. Because scientists dislike tight government controls, the officer said, they have been given abundant freedom to initiate projects, explore new avenues, publish their findings, and to train new scientists. If a scientist makes a suggestion of a proposed project, he is asked to write a description, tell what he would propose to do about it, what results he would hope to attain, how long will the project take and what facilities would be required, personnel necessary to conduct the investigation, and give financial estimates of salaries, capital expenditures, expendible, travel, and overhead charges. This is first reviewed by the branch office, and then by headquarters in Washington. If the proposal is approved a contract is drawn up. When World War II ended all wartime research activities tended to become disorganized and scientists began leaving the services for their old jobs. By the end of 1946, however, Congress had established the Office of Naval Research, and the programme to keep Navy research alive was launched, he recounted.—*SAE Journal, Vol. 57, July 1949, pp. 86-87.*

New Machine Tool for Production of Models of Screw Propellers

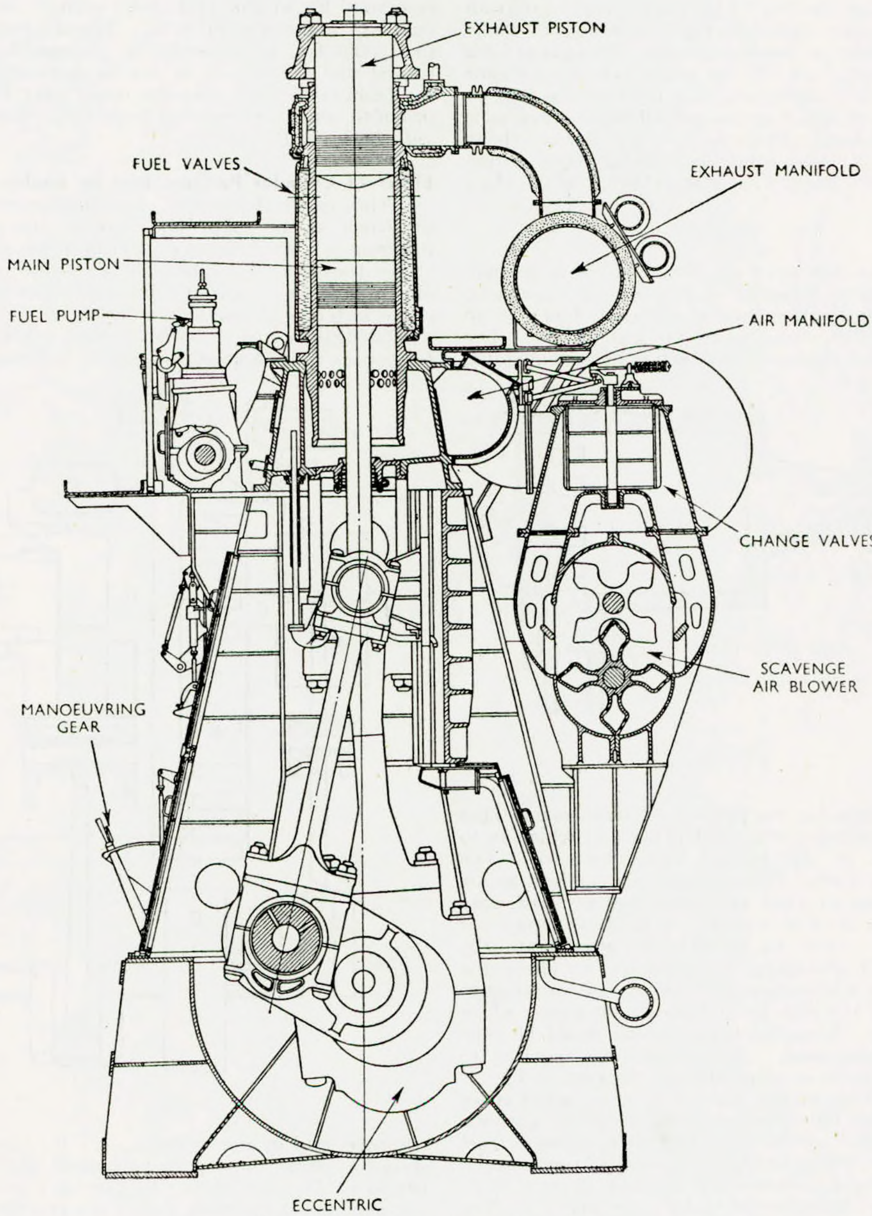
At the Paris tank a machine tool is in use since 1947 which permits the direct production of screw propellers for tank tests from drawings of sections. The article describes the essential features of the machine.—*Bulletin Technique du Bureau Veritas, Vol. 31, July 1949, pp. 147-149.*

Two-stroke Scavenging

In an examination of the inertia of the scavenging and induction processes in two-cycle machines, reported by E. Neidermayer in Maschinenbau and Wärmewirtschaft, the author considers that there are three governing factors for the period between the opening of the exhaust ports and the closing of the inlet ports in loop-scavenge oil-engines. They are the air-supply ratio, the scavenge ratio, and the air utilization factor. These are examined mathematically at some length, and an indication is given of the calculation of the three parameters of a scavenge system for an engine to have high charging and high scavenging ratios.—*Gas and Oil Power, Vol. 44, July 1949, p. 187.*

New 4,500 b.h.p. Diesel Engine

At the Greenock Works of John G. Kincaid and Co., who are sub-licencees for the building of Harland and Wolff-Burmeister and Wain Diesel engines, the first two-stroke single-acting crosshead engine of the eccentric-type opposed-piston design was recently tested. This engine is being installed in the motor vessel *Braeside* constructed by Barclay Curle and Co. for Burns, Philp and Co., Sidney. The engine has six cylinders 620 mm. in diameter, the main piston stroke being 1,400 mm. and that of the exhaust piston 470 mm. The maximum continuous service rating is 4,500 b.h.p. at 115 r.p.m., the mean indicated pressure being 6·5 kg. per sq. cm. The bedplate is of welded steel construction and is relatively deep, being bolted direct to the tank top. The A frames, mounted on top of the bedplate, are also of welded steel construction, and these, in turn, support the scavenge belt. In this engine the scavenge belt is of cast iron, being



End sectional elevation of engine

made in two sections, one forward and one aft of the engine centre line. The fuel pumps, with their camshaft, are mounted on the top of the A-frames at the front of the engine. At the back, the guides for the main and exhaust piston running gear are bolted to projecting facings on the frames, thus providing substantial bracing for the entire entablature. The cylinders, each of which is a separate unit, are bolted by flanges to the top of the scavenge belt. The chain casing is arranged at the mid-length of the engine, between each group of three cylinders. The crankshaft is of the fully built type, the webs being of cast steel. Integrally cast with each crankweb is an eccentric for operating the exhaust-piston gear. The maker's latest type of main bearings are fitted into housings in the bedplate cross girders, the cast-steel bearing shells being lined with white metal. The bottom halves of the bearings can be turned out with the crankshaft in position. The crankshaft is well balanced. The main piston running gear is of normal construction for a crosshead type of engine. The pistons have bodies of special cast iron, with chrome molybdenum cast-steel heads. The heads are screwed into the bodies and are suitably locked. The exhaust piston construction is similar to that of the main piston. Each pair of eccentrics is coupled by eccentric straps and rods and four steel side rods to the cast-steel yoke of the exhaust piston, by which means the exhaust pistons are driven by, and in turn transmit power through, the eccentrics on the crankshaft. As the main and exhaust piston loads are at all times equal and opposite, the vertical forces caused by the gas pressure are balanced within the engine running gear. The cylinders are of vanadium cast iron, cast in one piece, and are water jacketed above the flange by which each cylinder is bolted to the scavenge belt. Two sets of ports are arranged in each cylinder, one set near the bottom for the admission of scavenging air and one set near the top for the discharge of the exhaust gases. The scavenge ports are opened and closed by the main piston when it approaches the bottom of its working stroke, while the exhaust ports are opened and closed by the exhaust piston as it nears the top of its stroke. As both sets of ports open and close almost simultaneously, the scavenge air has a clear blow-through, thereby ensuring that a fresh charge of air is available for each compression stroke. Two fuel valves, one starting valve and one safety valve are arranged on the same plane around each cylinder, abreast of the combustion space. Scavenge air is supplied by two positive rotary blowers, mounted on the back of the engine and each driven by Renold triplex chains from the crankshaft. The air is directed by means of a change valve to the scavenge manifold, thence to the scavenging air belts and the cylinders. The fuel pumps, which are independent units, are operated by a camshaft which is also driven by chain from the crankshaft. The pump plungers are of the normal scroll type, of case-hardened steel, and are connected through link-and-rod mechanism to the governor and control gear. The main and exhaust pistons are cooled by oil, taken from the main lubrication system. The warm return oil from the pistons is led through piping direct to the double-bottom tanks under the engine. The engine is force-lubricated throughout, the oil for the moving parts being led to the main bearings, thence through holes in the crankshaft and connecting rods to the bottom and top end bearings, etc. Mechanical sight-feed lubricators are used for supplying oil to the cylinders. The cylinders and exhaust belts are cooled by fresh water. A force-lubricated double-collar thrust block is incorporated in the bedplate.—*The Motor Ship, Vol. 30, July 1949, pp 126-128.*

Total Injection Engine

A paper by G. Brown published in the Memoirs de la Société des ingenieurs civiles de France contains a number of interesting proposals to raise compression-ignition engine efficiency from 50 to 60 per cent in order to meet the challenge of the gas turbine. The various designs proposed to rest upon the introduction of a recuperator

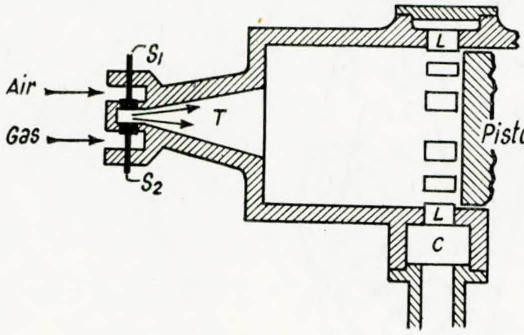


FIG. 1

in the compression-ignition cycle for the purpose of transferring heat from the expanded exhaust gases to the combustion air, which is to be isothermally compressed to the highest cycle pressure. The inventor argues that in the orthodox Diesel engine the combustion air is introduced into the cylinder at very moderate pressure and once it is contained in the cylinder it is obviously impossible to carry out isothermal compression. In order to be able to incorporate the recuperative principle it will therefore be necessary to effect the isothermal compression of the combustion air to its maximum pressure and its subsequent heating by the heat from the exhaust gases before it is admitted to the cylinder. A similar arrangement would be used in cases where gaseous fuel is used. The engine type required to carry out the total injection cycle is schematically outlined in Fig. 1. Here the combustion chamber is mainly formed by the conical space or passage T connecting with the cylinder cavity. At the extreme end of this passage combustion air and, in this case, gaseous fuel are injected through the valve-controlled inlets S_1 and S_2 respectively. These inlets communicate with pressure tanks (not shown) containing air and combustible respectively under pressure *P*. The exhaust gases are discharged through piston-controlled ports L into the exhaust manifold. The operating principle is as follows. The valves S_1 and S_2 are opened as the piston approaches t.d.c. causing the admission of air and combustible gas into the space T. The combustion of the resultant mixture takes place at a pressure slightly below the pressure *P*. Injection and combustion continue during the first part of the expansion stroke until the valves S_1 and S_2 are closed. Expansion continues until the ports L are uncovered by the piston. No provision is made for scavenging; at the end of the exhaust period, when the piston has closed the ports L, the cylinder space will therefore still remain filled with spent gases which are then compressed during the compression stroke. A new injection cycle follows, and so on. The diagrammatic representation of a simple expansion engine employing the total injection cycle with recuperation is given in Fig. 2. It is assumed that in this case the pressure *P* is of the order of not more than 30 atmos. The total injection type engine M is coupled to an electric generator D and a charging compressor G. The engine is assumed to be operated on liquid fuel. The compressor shown is of the two-stage type, but actually three or four stages will be required in order to reach 30 to 40 atmos. pressure. The compressor is charged at slightly super-atmospheric pressure by the fan V. The delivery side of the compressor is connected with the receiver R from whence air at the pressure *P* is supplied via the heat exchanger E to the admission valve S_1. The heat exchanger is passed by the spent gases discharged through the port C of the engine. The fuel is supplied from the reservoir R^1 to the fuel close control of the air temperature, an auxiliary admission valve S_2. The air temperature must not be less than 500 deg. C. in order to safeguard ignition and it must not exceed 650 deg. C. so as not to damage the inlet valve. In order to obtain oil burner B in the upper part E^1 of the heat exchanger is provided with a thermostatic control.—*Gas and Oil Power, Vol. 44, July 1949, pp. 185-187.*

Effect of Cylinder Pressure Rise on Engine Vibrations

This paper shows that it is fundamentally impossible to express the effect of the particular shape of the pressure-time curve on the response of the vibrating system in terms of one single time derivative of the pressure-time curve, for the same reason that it is fundamentally impossible to express the particular shape of the pressure-time curve in terms of one single derivative. It appears that some fundamental features of a force-excited simple harmonic oscillator may be successfully applied to engine vibrations originating from the

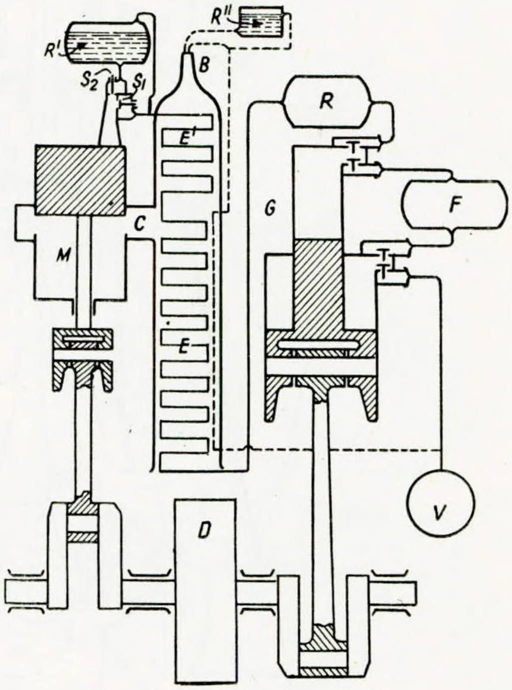


FIG. 2

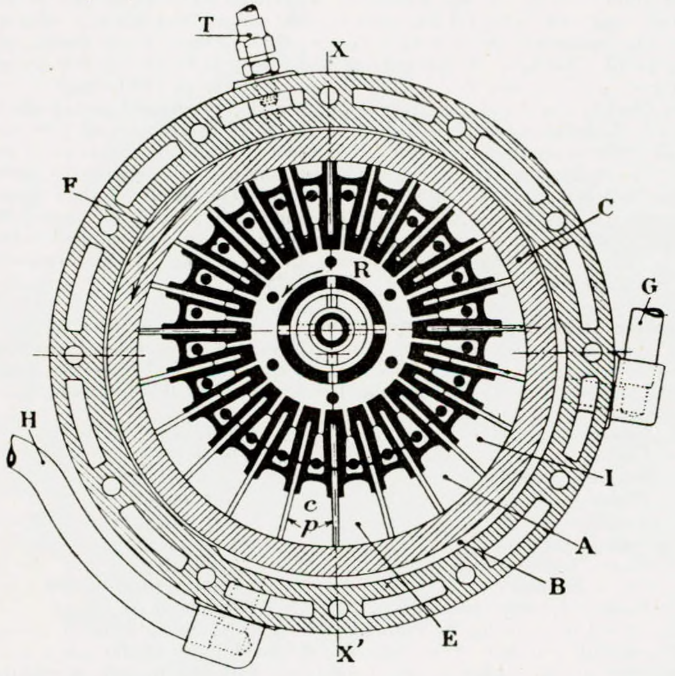
pressure rise in the cylinder. If the applied force is periodic and shows a rather short period of rapid rise compared with the natural period of the oscillator, vibrations are generated each time the rapid rise sets in. If damping forces are present, of the order of magnitude as occurring in actual cases of engine vibrations, the analysis can be appreciably simplified by considering only one single period. The actual vibration problem may then be approximated by studying the transient vibrations of an oscillator excited by a force that shows a rapid rise during a certain time. From the analysis of this simplified problem it is concluded that in analysing pressure-time curves of internal-combustion engines for their effect on engine vibrations, the following must first be determined: The ratio between the period of rapid pressure rise and the natural period of the vibratory system; further, the maximum pressure rise during the former period over and above the compression pressure. Only if this ratio exceeds a value of 0·25, roughly, is it worth while to analyse the shape of the pressure-time curve more closely for its effect on the response of the vibratory system. It must be kept in mind, however, that the effect of the shape of the pressure-time curve still is a minor one if compared with the effect of the duration of the period of rapid pressure rise. To judge pressure-time curves on their vibration-exciting features, only a rough measure can be given, which then must be in terms of the following—the ratio between the period of rapid pressure rise and the natural period; the total pressure rise in this period; and in some cases also in terms of the rate of pressure drop beyond its maximum value. Applications to some cases found in literature show that the theoretical features derived for a harmonic oscillator are satisfactorily applicable to actual vibratory systems.—*Paper by J. O. Hinge, read at the 1949 ASME Oil and Gas Power Conference, Paper No. 49-OGP-3.*

Vibrations in Valve Mechanisms

At the no-follow speed for a valve mechanism the roller will leave the cam. This speed may be determined by calculation or by experiment. The calculation considers the lift-curve acceleration, the weights of the moving parts, and the valve-spring characteristics. The experiment is based on the noise when the roller comes back to the cam. Unfortunately there is often considerable disagreement between the values for the no-follow speed determined by these two methods. This difference may be explained by vibrations in the valve mechanism. Even when the roller stays on the cam, these vibrations are detrimental. They will increase the pressure between roller and cam thus increasing the possibility of pitting. It is important, therefore, to keep the vibrations in a valve mechanism at a minimum. The discrepancy between the no-follow speed of a valve mechanism as determined by calculation and by experiment is explained by vibrations in the valve spring and in the push rod. Abruptly changing lift-curve acceleration will cause severe push-rod vibration, while uniformly changing acceleration is beneficial. The ramp causes additional complications. A complete set of the calculations necessary to design a lift curve is given.—*Paper by T. Warming, read at the 1949 ASME Oil and Gas Power Conference, Paper No. 49—OGP-2.*

Rotary Internal Combustion Engine

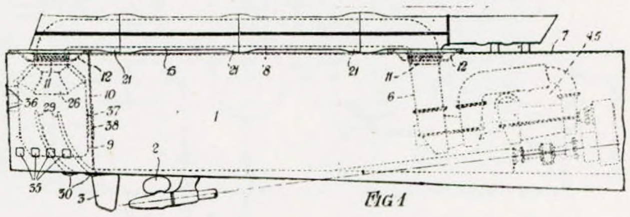
Numerous types of rotary internal combustion engines have been prepared in the past, but none has so far found large-scale application in practice. According to the author, the main shortcoming of previous types was the friction prevailing between the rotor vanes and the stationary casing wall. In the proposed new design which is shown in the accompanying sectional illustration, a revolving cylinder C is placed in the stationary housing of the unit. The rotor R is seen to be equipped with radial vanes P. During one revolution of the rotor each rotor cell goes through a complete cycle comprising

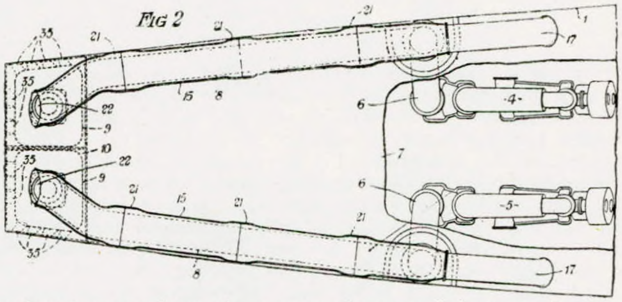


scavenging at A, compression from A to X with fuel being injected at I, combustion and expansion from X to X^1 and exhaust at E. Scavenging is effected by ejector action produced by the exhaust gases. The motor shown in the engraving has twenty-four rotor cells and operates on the two-stroke cycle system. Its performance is therefore equivalent to that of a twenty-four cylinder engine. Ignition is transmitted continuously at the point of maximum compression from one cell to the following (from the cell at the left of X to that approaching X from the right). A lateral crossover connexion is provided for this purpose. Starting is effected by spark plug or hot bulb. No special timed fuel injection pump is required, as injection is continuous. The article describes in some detail the various component parts of the engine. It is expected that a unit comprising a cylinder of 75 to 80 mm. width rotating at 3,000 r.p.m. will have an output of 150 h.p. Three prototypes are stated to be under construction, namely, a compressor with forty-eight cells, a constant pressure turbine with forty-eight cells, and an explosion turbine with thirty-six cells.—*R. Planche, Génie Civil, Vol. 126, 1st June 1949, pp. 206-208.*

Silencing and Disposal of Exhaust Gases

The main object of this invention—improvements relating to the silencing and disposal of exhaust gases from internal combustion power plant of marine craft—is to provide a means whereby relatively large quantities of gases can be dealt with effectively when they possess high velocity and temperature characteristics. These conditions are met with in the use of gas and internal combustion turbines for the propulsion of high-speed motor boats and the like and particularly in the case of the fast high-powered craft used for naval purposes. For the latter it is most important that the escape of the exhaust gases should not be unduly noisy and that the possibility of flaming at the exhaust exits should be avoided. In Figs. 1 and 2 the hull of the craft is marked (1), and (2) and (3) respectively represent the propeller or propellers and the rudder. Two internal combustion turbine arrangements marked (4) and (5) are shown disposed in the engine room, one at either side of the centreline of the hull.

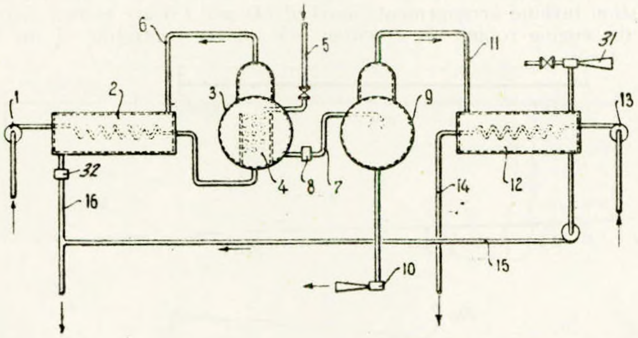




The exhaust gases from the power plant are led upwardly through pipes (6) to pass through the deck (7) of the craft and are then conducted by pipes (8) running above the deck to pass eventually through the deck aft to enter the top of a pair of exhaust chambers (9) in the aft peak (10). Expansion joints (11) are fitted where the piping leads through the deck. Seals are provided where the expansion joints meet the deck, to prevent entry of the weather in the engine room and the aft peak. The exhaust piping (8) along the deck is also fitted, where desirable, with expansion joints of the bellows type. This piping preferably is air-jacketed at (15) and the jacket piping has expansion joints. The piping (6) below deck at the lower plant may also be air-jacketed or lagged. Each air duct (15) round the exhaust piping above deck is open ended and at the forward end is provided with an air feed scoop (17). At the point where the exhaust gases enter the exhaust chamber, a guide baffle in the form of a hollow truncated cone (26) is fitted. These guide baffles serve to spread the gases in order to fill out the chambers relatively uniformly. Water is sprayed into the gases by means of tubes (29) which are fed with water by scoops (30) on the bottom of the hull. The purpose of the water jets is to cool and dampen the gases, and they also assist in silencing them. In the upper part of the exhaust chambers a water jacket is provided which is supplied with water under pressure from a pump driven by the power plant and the tapering part of the exhaust chamber is perforated so that the water may be sprayed into the exhaust gases in order to cool and dampen them when the craft is stationary. The final disposal of the exhaust gases, under running conditions of the craft, is through a series of nozzle-like outlets (35) having orifices of suitable area and situated along the transom and/or sides of the hull below the waterline. When the boat is at rest and the turbines idling, the exhaust chambers (9) would be flooded to the water-line of the craft; this is prevented by the provision of a pair of spring-loaded flap valves (36). It will be realized that an aid to propulsion can be anticipated by virtue of the "jet" effect resulting from the release of gases at high velocity in the rearwards or aft direction above or below water.—*Brit. Pat. No. 622,414, issued to P. Du Cane, O.B.E., R.N.(ret) and Vosper, Ltd., Complete Specification accepted 2nd May 1949. The Shipping World, Vol. 121, 20th July 1949, p. 88.*

Sea-water Evaporation Plant

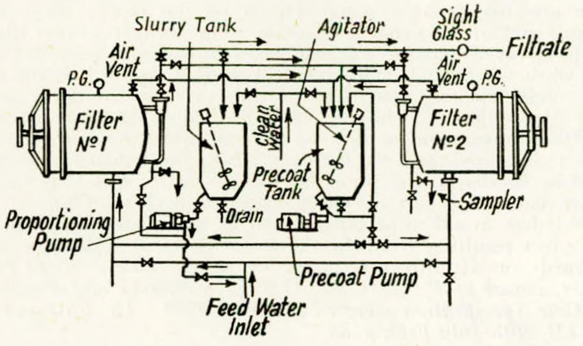
This invention provides a process for evaporating liquids continuously with an economical consumption of heat. According to the invention the liquid to be treated is first passed through a preheater and then through a first evaporation stage wherein heat and pressure are applied to the liquid so as to effect a partial evaporation. The vapours generated in the first evaporation stage are returned to the preheater for preheating the liquid to be treated. The liquid withdrawn from the first evaporation stage is subjected in a single second stage to flash evaporation at reduced working pressure without the application of further external heat, so as to have the liquid evaporated exclusively by self-expansion and thereby cooled down to, or nearly to, the temperature of the fresh liquid to be preheated. The diagram shows a plant serving for evaporating sea-water for obtaining distilled water on board ship. The salt-water to be evaporated is sup-



plied by the sea-water pump (1) and is forced through the preheater (2) to the first evaporator (3) in which the liquid is subjected to a limited evaporation and which is provided with a nest of tubes (4) to which heating steam is supplied by conduit (5). The vapour generated in the evaporator (3) by means of conduit (6) is conveyed to the preheater and therefore serves for heating the seawater to be evaporated. The vapour has, for instance, a temperature of about 115 deg. C. and is then adapted to preheat the seawater, the initial temperature of which is about 30 deg. C. up to 110 deg. C. The partially concentrated liquid flows through the conduit (7) into the flash evaporator (9) in which a reduced pressure is maintained. The conduit (7) contains a throttle valve (8) controlled by a float under the influence of the liquid level in the evaporator (3). Owing to the difference in pressures before and behind the valve (8), the liquid is partly converted into vapour in the evaporator (9), so that the liquid is cooled down to, for instance, 40 deg. C. and is then withdrawn overboard by the pump (10). The vapour generated in the evaporator (9) flows through the conduit (11) to a condenser (12), to which cooling water is supplied by pump (13) and this water leaves the condenser by conduit (14). Pipe (16) is provided with a steam trap (32). The condensate formed in the condenser (12) through the pipe (15) joins the condensate withdrawn from the preheater (2) by pipe (16) in order to be employed as fresh water for feeding boilers and other purposes.—*Brit. Pat. No. 621,967, issued to Werkspoor N.V., Amsterdam. Complete Specification accepted 25th April 1949. The Shipping World, Vol. 121, 27th July 1949, p. 112.*

Elimination of Oil from Boiler Feed Water

The trend towards higher working pressures has caused the increasing use of the water-tube boiler with triple-expansion engines and the greater popularity of the uniflow engine for marine propulsion. But uniflow engine condensate has a much higher emulsified oil content



than that from the common multi-expansion marine steam engine. In marine practice today, the elimination of oil from boiler feed water is almost entirely effected by the use of filters, the media and construction of which vary considerably. The most common type in use is the terry-cloth cartridge filter comprising a number of perforated cylinders or cartridges wound in cloth. Where special care is required in the removal of oil, for instance with an engine using superheated steam, several absorbent type filter stages preceded by a baffle settling chamber are employed. These filters are quite effective in the removal of any emulsified oil in the condensate, though their performance is very satisfactory with the removal of free oil and grease. With the introduction of the uniflow engine to the marine field, however, it was necessary to seek new means for the filtering of the highly emulsified condensate encountered. In land practice extensive and successful use had been made and is still being made of the principle of chemical coagulation. The application of this method to a marine installation was accordingly considered, and the first marine installations using uniflow engines employed sand filters with alum and soda ash floc. Investigations conducted by the U.S. Maritime Commission into suitable filter to be used in conjunction with uniflow engines led to the development of the diatomaceous earth leaf-type filter, which, according to the accompanying sketch, comprises the following salient parts: filter unit, mixing tank, precoat tank, precoat pump and proportioning pump. The filter unit consists of a cylindrical tank placed horizontally with a number of filter leaves suspended vertically inside. Each leaf consists of two fine mesh screens sandwiching a heavier mesh screen which acts as a spacer for draining the liquid to discharge eyes attached to the leaf frame. When several leaves are placed together, these eyes form a tubular channel which is connected to a discharge manifold. The oil contaminated condensate enters the filter container through the top, bottom, or both, depending on the filter capacity, then passes through the filter screens to the discharge manifold. The first step in the filter operation is to fill the system with water, then place a mixture of diatomaceous earth and asbestos fibre, 1·6oz. respectively, per sq. ft. of filter area, in the mixing tank, there to be thoroughly mixed by means of the agitator. This mixture is then pumped directly into the filter by means of the precoat pump and continuously re-circulated until all the material is deposited on the filter leafs. Actual filtration may then proceed, and if the oil content is high, filter aid is added to the condensate by the proportioning pump in the proportion 10lb. filter aid per gallon of oil to be removed. The filter aid then forms a cake on the leaves and gradually builds up a back pressure; the cycle is concluded when this pressure reaches a pre-determined value. —*G. S. E. Emmerson, The Marine Engineer and Naval Architect, Annual Steam Number, 1949, pp. 251-257.*

Turbine Steamship *Presidente Peron*

The twin-screw passenger and refrigerated cargo liner *Presidente Peron*, which was built by Vickers-Armstrongs, Ltd., for the Instituto Argentino de Promocion del Intercambio has the following leading particulars :—

Length overall	529ft. 6in.
Length b.p.	495 feet
Breadth moulded	71 feet
Depth moulded to B deck	47ft. 6in.
Draught	27ft. 6in.
Speed on trials	19 knots
Power (maximum)	14,500 s.h.p.
Gross tonnage	14,500 approximately
Insulated cargo capacity	315,000 cu. ft.

The vessel is propelled by twin screws, each driven by a set of geared turbines of Parsons type, capable of developing 13,500 s.h.p. continuously at sea, under service conditions, with the propellers making 130 r.p.m., and a maximum output of 14,500 s.h.p. The astern turbines are capable of developing not less than 9,000 s.h.p. Steam is supplied to the turbines at 470lb. per sq. in. gauge, and at a temperature of 750 to 800 deg. F. Each set of gearing is of the double reduction articulated type and comprises two first reduction gears, one for the high pressure turbine, and one for the low pressure turbine driving secondary reduction pinions on the main wheel. Each first reduction gear is enclosed in a separate casing bolted to the second reduction gear case. The h.p. turbines are of the all-impulse type, with impulse wheels forged solid with the rotor shaft. The l.p. ahead turbine is of the single-flow all-reaction type, having seventeen rows of segmental blading in the cylinder and twelve rows of segmental with five rows of integral blading on the solid forged steel rotor. An astern 3-row impulse wheel is incorporated in each l.p. ahead turbine casing, and is forged solid with the rotor. All impulse blading is of chromium iron. The reaction blading is of monel metal for segmentally fitted blades, and of chromium iron for the individually fitted blades. Each turbine is connected to the gearing by a flexible coupling of the claw type, and secondary pinions are driven through quill drive couplings from the primary gears. The primary gears for the h.p. and l.p. turbines are enclosed in fabricated steel gear cases and consist of nickel steel pinions, with cast iron first reduction wheels having forged steel rims shrunk on. Main gear wheels are of cast iron with forged steel rims shrunk on, the secondary pinions of nickel steel, quill driving shaft of forged steel, all enclosed in a fabricated steel gear case and arranged for the efficient lubrication of all gear wheels and bearings. The h.p. turbines run at 5,564 r.p.m. and the l.p. turbines at 3,213 r.p.m., while the gear ratio is such that with these turbine speeds the propellers run at 130 r.p.m. when the turbines are developing a total of 13,500 s.h.p. Aspinall's cut out governors are fitted to all turbines. Steam is supplied by two water-tube boilers of Foster Wheeler's controlled superheat design, arranged to give a superheat control from 800 deg. F. down to about 600 deg. F. when manœuvring. The steam pressure at the superheater outlet is 500lb. per sq. in. There is one auxiliary boiler for harbour use of the Foster Wheeler single furnace D design.—*The Shipping World, Vol. 121, 27th July 1949, pp. 104-106.*

Nailable Steel Deck

The automobile carrying Great Lakes freighter *George W. Mead* is equipped with a new deck formed of nailable steel flood channels welded to a structural steel framework built up from the ship's main deck. It measures 269 feet long by 49 feet wide and represents the first marine application of the nailable steel channels developed by an American firm of steel makers. The nailable steel floor channels

Cross section of nailable steel flooring

are formed with curved edges and are installed with a space between every channel. Nails driven into these grooves are bent and gripped by the curved channel edges. Thus wood blocks can be nailed to the deck for holding freight in place. Because of its channel construction the superdeck has exceptional structural strength and a level, even surface.—*Marine Engineering and Shipping Review. Vol. 54, July 1949, p. 82.*

New Italian Passenger Liner

The motor passenger and cargo liner *Esperia* was recently completed at the Monfalcone yard of the Cant. Riuniti dell'Adriatico for the Adriatica Soc. Anon. di Navigazione, of Venice. She has been constructed to the regulations of the Registro Italiano Navale, Class 100 A.1.1., also in accordance with the rules of Lloyd's Register of Shipping. Welding has entered substantially into the building of the new ship The main details are:—

Length on the water line...	141 m.
Length b.p. ...	136 m.
Moulded beam	19·2 m.
Depth to main deck	11·80 m.
Mean draught when fully laden ...	6·62 m.
Full-load displacement	10,265 tons
Deadweight capacity	2,800 tons
Gross register	9,314·13 tons
Net register ...	5,368·20 tons

The vessel, which has a design speed of 21 knots, is designed for Mediterranean service as well as for transatlantic trading. Two C.R.A.-Sulzer engines are installed in the main engine-room. Each of these has ten cylinders with a diameter of 720 mm. and a piston stroke of 1,250 mm. They are designed for 6,500 b.h.p. each at 125 r.p.m., and on trials the maximum total output obtained was 16,150 b.h.p. at 133·9 r.p.m. The specific consumption was stated to be 160 gr., which is equivalent to 0·355lb. per b.h.p. hr. For the supply of current there are five Diesel generating sets, each comprising a C.R.A. Diesel engine with a cylinder diameter of 330 mm. and a piston stroke of 400 mm. coupled to a 225 kW. direct-current dynamo. In addition, there is an emergency set comprising a high-speed Fiat four-stroke engine driving a dynamo and an air compressor. The speed attained was stated to be 22·6 knots. In normal service, it is anticipated that about 50 to 55 tons of fuel will be consumed daily, and it is intended to use a mixture of Diesel oil with boiler oil.—*The Motor Ship, Vol. 30, July 1949, pp. 143-146.*

New Research Trawler

A new research trawler, capable of catching and quick-freezing at sea as visualized in the White Paper "Industry and Employment in Scotland", will be built probably in Aberdeen and will be the most modern vessel of its type in existence. No formal plans have yet been announced but it is understood that the experts at Torry Research Station have been in consultation with naval architects, builders and consultants in various fields as to the possible scope and type of such a unit. It will probably be Diesel-electrically propelled and will be the first fishing vessel to use this system. Her main function will be to carry out research work on the handling and stowage of fish and on quick-freezing at sea. Also incorporated will be a laboratory where scientific work can be carried on during actual catching operations. The Torry Research Station has been leading up to such a development for years and has a converted drifter at work for scientific purposes. All the quick-freezing has been done ashore, however, and there has been an obvious need, for years, for the development of suitable vessels, specially built, to carry out research on quick-freezing at sea which Torry has advocated as one method of facilitating the development of the industry.—*Modern Refrigeration, Vol. 52, June 1949, p. 148.*

Cargo and Passenger Steamer *Jason*

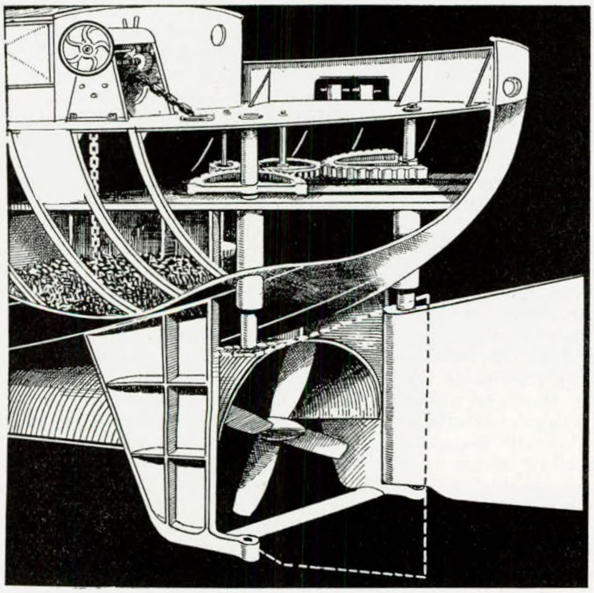
The cargo and passenger steamer *Jason*, which was recently launched from the Wallsend yard of Swan, Hunter and Wigham Richardson, Ltd., is 485 feet b.p. by 69 feet moulded by 38ft. 6in. moulded; 11,500 tons deadweight on 30ft. 9in. draught (moulded); 11,500 tons gross; estimated speed in service, 18 knots. Built for the China Mutual Steam Navigation Co., Ltd. (Alfred Holt and Company, Managers), Liverpool. The raked stem is of rounded construction and the stern is of cruiser type. The vessel has two masts, an elliptical funnel, and a stream-lined rudder of non-balanced type, with horizontal coupling. Steam fire-extinguishing equipment protects all the cargo compartments. The refrigerating machinery is installed at the fore end of the main machinery space. The propelling machinery, constructed by the Wallsend Slipway and Engineering Co., Ltd., consists of a set of three-casing double-reduction geared turbines developing 14,000 s.h.p. at 106 r.p.m. in service, steam being supplied at a pressure of 525 lb. per sq. in. and at a total temperature of 850 deg. F. The gearing, which is of the double-helical type, comprises a main wheel engaging with three pinions—one driven by each turbine. The astern turbines are designed to develop 65 per cent of the ahead power. The main gear wheel has a cast-iron centre, with a shrunk forged-steel rim. All bearings have forced lubrication. The main steam-generating installation consists of two Foster Wheeler controlled-superheat boilers, fitted with economizers, superheaters and tubular air heaters. The main boilers burn oil only, on the Wallsend-Howden pressure system, under balanced draught. The forced and induced-draught fans, which were made by James Howden and Co., Ltd., are electrically driven. The total generating surface of the two boilers is 24,000 sq. ft. These boilers supply steam for the main turbines, turbo-generator, air ejectors, turbo feed pumps and auxiliary boiler-feed pumps. A steam generator, taking high-pressure saturated steam from the main boilers, supplies steam for auxiliary purposes at sea; while, for harbour duty, there is a Cochran oil-burning vertical boiler, the working pressure of both units being 100lb. per sq. in.—*The Shipbuilder and Marine Engine-Builder, Vol. 56, July 1949, p. 547.*

Galley Construction and Sanitation

When considering the sanitary construction of a ship's galley, allied spaces such as the pantry, scullery, bake shop, butcher shop, domestic refrigeration, and dry stores should be included. This is deemed advisable as all these spaces are utilized in the storage, preparation and serving of food. Gastro-intestinal disturbances may originate either in the potable water system or the galley spaces. Contamination which finds its way to the dinner table can most likely be traced to the galley. Because of this, it is extremely important that every reasonable precaution be taken, during the design and construction stages of a vessel's development, to assure the incorporation of all necessary sanitary features for the protection of the health of those who will partake of food processed in the galley. The galley and its allied spaces should be enclosed in an area the boundaries of which are conducive to sanitary conditions. The bulkheads and deckheads should be of smooth, hard-surfaced, light-coloured material. Decks should be of impervious material and constructed to provide adequate drainage. Piping of all kinds, particularly that for all non-potable liquids, should be eliminated from galley spaces. When it becomes necessary to pass pipes carrying sewage through these areas, they should be made of extra heavy steel or wrought iron, have welded joints, and be tested hydrostatically for leakage at the maximum head obtainable in the line. No rodding or clean-out plugs should be placed in any overhead line in the galley because these plugs could develop leaks and drip on food below. Leakage through gaskets in flanged joints or defective screw joints in galley spaces, could be the source of serious food contamination. Only potable water should be piped into the galley. However, if it becomes necessary to pipe wash water into this area because of inadequate potable water-storage facilities the service outlets should be not more than 18 inches above the deck and should be clearly labelled "For Deck Washing Only". Dish-washing facilities should consist of at least a two-compartment sink and preferably a unit of three compartments. The bactericidal vat should have a depth adequate to permit complete immersion of the largest dishes. It is recommended that all utensils be subjected to a bactericidal treatment after first being washed in hot soapy water. If bactericidal treatment is to be accomplished by immersion in hot water, it should be done in a vat in which the temperature of the water is at least 170 deg. F. to be effective.—*E. D. Shirck, Marine Engineering and Shipping Review, Vol. 54, June 1949, pp. 51-55.*

New Type of Stern for River Tanker

A motor-driven river tanker now building at a Dutch yard is fitted with a novel type of stern which makes it possible to turn craft of this type in their own length. This feature counters a difficulty which has arisen, particularly in Holland and other countries with extensive inland waterways, during the introduction of self-propelled craft. It was found that the vessels steered with difficulty in busy waterways and that in many cases it was found necessary to employ a tug to get them away from the quay. Moreover, the turning circle is considerable when approaching or leaving harbours and docks and often shore staff are needed to moor or cast off. Additional difficulties are also encountered when the vessel is light, as the propeller does not get sufficient water for efficient operation. This condition is aggravated in strong winds. With an unprotected propeller damage from stones or other obstacles are of frequent occurrence in narrow waterways, especially when carrying a full load. The invention basically consists of the adoption of balanced rudders and skegs of aerofoil section as shown in the perspective diagram. The rudders are seen to be hand-operated by a simple mechanism of rods and gearing. It is claimed that craft fitted with this patent stern can be turned without communication with the shore and against the current. A vessel of this character will also turn on its own axis without forward movement. A tunnel built between the skegs serves a dual purpose, directing water into the propeller and protecting it from damage. The lines of the stern are modified to ensure an easy flow to the propeller and both propulsive efficiency and manœuvrability have been improved. Above the water line it has been found possible to design a fuller stern which gives better placing for the after windlass and chain lockers. Although designed primarily for river craft this patented stern can also be used for seagoing ships. The first vessel was built on this patent principle in 1938-39 and a second was delivered in April 1940. A number of craft have since been built and all are operating in service satisfactorily. The inventor states that no alterations were necessary even on the earlier experimental ships.—*Shipbuilding and Shipping Record, Vol. 74, 14th July 1949, pp. 45-46.*



Diagrammatic outline of the de Haan stern

Greases

Greases are essentially mixtures of oils and soap in which may be incorporated special additives and other materials. They are not, however, simple mixtures. On the contrary, they are exceedingly complex, multiple-phase systems of which little of the true physico--chemical nature is even yet known. The problem facing the research technologist is not, therefore, simple or easy of solution. Very careful consideration must be given to the ingredients which must be used to make a product having the desired characteristics, as well as to the methods to be used in combining these ingredients. Greases contain four fundamental types of ingredients: fats or fatty materials, a base (alkaline material) which is added to bring about the saponification of the fat, oily material (usually a petroleum oil) and finally, additives and other special characteristics. The grease technologist in approaching the problem of preparing a new grease must consider each of these types of materials in order to select ingredients which will impart the desired characteristics to the finished product. The soap phase of the grease which is to be prepared is composed of a fatty material which is chemically reacted (saponified) with an alkaline material. The effect of the fat and the base (alkali) must, therefore, be considered individually. Fatty materials may be classified in several different ways. For the purpose of grease making, however, they may be classified as natural fats (glycerides), fatty acids, distilled fatty acids, modified fats and fatty acids, and synthetic fatty materials. Each of these classifications is in itself extremely broad. Natural fats may be classified broadly as animal, vegetable, and marine fats. Animal fats may be classified by origin, i.e., horse oil, beef tallow, hog fat, etc. Each of these fats has definite characteristics. Having chosen a suitable fat or blend of fats for the application in question, the grease technologist must next choose a proper saponifying agent. Many materials are available for this purpose, although those most commonly used are the oxides or hydroxides of sodium, calcium, aluminium, lithium, or mixtures of these materials. To obtain special characteristics, however, barium, strontium, magnesium, lead, potassium, copper, and a number of organic bases may be used alone or in combination with any of the forementioned types. After a suitable fatty material and alkaline material have been chosen, the grease research chemist must next turn his attention to the oil to be used. No set rules can be laid down for the choice of the proper oil. In general, however, the choice is based on the type of service for which the grease is to be used. For slow moving bearings under heavy loads, high viscosity oils are used; for high speed bearings under light loads, low viscosity oils are used. For bearings operating over long periods of time without relubrication, oils of high refinement and oxidation stability must be used; for bearings where leakage is high and relubrication is frequent, more economcal oils of lesser refinement and lower oxidation-stability may be used. For bearings operating under high temperature conditions, oils of high flash point and high distillation range to lessen fire hazard and prevent evaporation losses may be necessary; pour point and viscosity index may be of little consequence. Having chosen the basic fundamental units of soap and oil for his grease, the research chemist must then choose the modifying agents which he wishes to incorporate in his grease to produce special properties. The additive (or additives) used must be chosen, of course, on the basis of the intended service. The character of the grease may be quite changed by the proper use of additives; a calcium soap grease which would have a typical buttery texture without additives may be changed to a tacky, stringy, product by the incorporation of proper materials. Needless to say, the choice is one of great importance. Decision as to the use of fillers must also be carefully made—graphite, metallic dusts, fibre, etc.—which although not commonly used, do fulfil a specific need for special purposes.—*Lubrication, Vol. 4, June 1949, pp. 133-144.*

Coastal Vessels for South Africa, Australia and India

In this article the author discusses prevailing tendencies in the design of vessels for coastal services. Referring to the aspect of propulsion plant design, the author points out that it will be interesting to see whether the direct-coupled engine will eventually give place to a pair of high-speed vee-type two-cycle units, geared to the shaft, and with control from the navigating bridge. The first coastal ship of this kind to be built in European waters is a Dutch ship, the *Dorinda,* built at Waterhuizen in the Groningen district, and her speed in service, fully loaded, with the two engines in operation, is 9½ knots, and seven knots with one. The engines turn at 1,800 r.p.m. and are of 290 b.h.p. output. The reduction gear is 5 to 1, so that the screw turns at 360 r.p.m. The ship is of raised quarter-deck design, with machinery and accommodation aft, and has a deadweight of 325 tons. Her fuel tanks carry 24 tons, but for long voyages there is space for another 28 tons in the reserve tanks. The argument put forward by the makers of these engines is that their high speed means light weight, even when the gearing and control equipment are taken into account.—*A. C. Hardy, The Journal of Commerce (Shipbuilding and Engineering Edition), No. 37,871, 14th July 1949, p. 5.*

Spray Strips for Power Boats

Spray strips, used to deflect water from the topsides of the hull of a boat, are particularly advantageous on hard-chine designs and are occasionally beneficial on round-bottom designs according to a report issued by the Experimental Towing Tank of Stevens Institute of Technology on tests made on various power-boat designs. At low speed spray strips may increase hull resistance; but at speed-length ratios of 3 and higher, they usually are found to be very effective in restricting the bow wave, improving the running trim, and causing a pronounced saving in effective horsepower. In certain test cases the maximum saving in effective horsepower has run as high as 34 per cent at top speed. Observations of diving stability and turning tests of power boats have indicated a definite advantage in using spray strips. By deflecting sharply, the water coming up forward on the sides of a fast-running boat, spray strips greatly reduce wetting of the topsides by a large, and sometimes intolerable, bow wave. These appendages also resist a downward suction of the bow, and usually give a positive lift which increases the running trim. The boat speed for a given horsepower is raised and a drier, safer boat is ensured. The greatest gain from spray strips arises from their action up forward on the hull. They should start well forward on the boat. On hard-chine designs they should extend at least a little farther aft than where the chine enters the water. For most designs it helps to run the spray strips all the way back to the transom. As to vertical location, the spray strips on V-bottom hulls should be fastened at the chine, the report brings out. For round-bottom designs, this location is more difficult to determine since careful consideration must be given to the particular hull form, load waterline, and wave formation.—*Marine Engineering and Shipping Review, Vol. 54, June 1949, pp. 56-57.*

Air Lubrication and Resistance

In the introduction to a paper discussing reduction in resistance by air lubrication, by Hans Edstrand and Ragnar Rödström, which has been issued by the Swedish State experimental tank, the authors state that the idea of air lubrication is, in itself, an old one, and a number of researches have been conducted on the problem. D. W. Taylor in "Speed and Power of Ships", describes experiments with air-lubricated models which were carried on at Washington. Tests were made both with a ship model where air was pumped out through five holes near the bow, and with a friction plane, where the air was forced out through vertical slits at the fore end. The results of these experiments indicated that no decrease in resistance might be expected from such "air lubrication". These investigations were carried out in the one case with a model of normal form and with a friction plane, but it was thought by the authors that different results might be obtained were air cushions introduced under the bottoms of flat barges to be operated in protected inland waterways. Accordingly, experiments were made on the model of a barge 65 metres in length, 8 metres in beam and 1·75 metres in draught (approximately 213×26×5½ feet). The results showed that a reduction of approximately one-fourth of the resistance might be obtained by having an air cushion under the bottom. This result should induce further research in connexion with barge design.—*Shipbuilding and Shipping Record, Vol. 74, 21st July 1949, p. 67.*

Prevention of Rolling at Sea

A stabilization system, designed to reduce the rolling motion of ships by 80 per cent, is to be tested by the U.S. Navy. The apparatus has been installed in the large naval minesweeper *Peregrine,* which will test it out in rough weather at sea off the coast of Virginia. This new system has been under study for a number of years, but only recently has it been perfected, and in warships it is claimed it would improve the accuracy of guns by giving them a more stable firing platform. The U.S. Navy Department states that, operating on a counter-balance principle, this stabilizing system consists of two pairs of large tanks mounted on opposite sides of the ship. The bottoms of the tanks, each of which is half-filled with ballast water, are connected athwartships by transfer ducts. Powerful, electronically-controlled impellers automatically pump water back and forth at a rapid rate to counter-balance the ship's rolling motion. In principle, the motion of the ship is corrected just as it commences. The electronic equipment detects the roll at a very early stage, immediately producing a signal to activate the pumping equipment. The movement of the water from one tank to the other is accomplished with two large variable-pitch propellers in the transfer ducts near the bottom of the tanks. U.S. Naval engineers believe that the activated tanks' stabilizing system can be installed in a new vessel at a cost in weight of approximately one per cent of the ship's displacement. They estimate that the system would increase the monetary cost by only about three per cent, and would require only about two per cent of the ship's propulsive power. The advantages mentioned in connexion with the system include the fact that the stabilizing action, both under way and at anchor, would facilitate discharge of cargo in open seaways. Moreover, the whole installation is relatively inexpensive, weighs less, and requires less space than certain other stabilizing systems, and does not present the problems involved in fast-rotating stabilizers.—*The Journal of Commerce (Shipbuilding Engineering Edition), No. 37,883, 28th July 1949, p. 2.*

New Icelandic Trawler

The new Icelandic motor trawler *Jorundur,* designed and built by Brooke Marine, Ltd., of Lowestoft, for Mr. G. Jorundsson, of Iceland, has recently completed successful trials. This vessel, it is claimed, is the largest of her type to be built on the East Coast. A notable feature is the extent to which non-corrosive aluminium alloys have been adopted. The main particulars of the vessel are as follows:

Length	167 feet
Length b.p.	150 feet
Breadth moulded	28 feet
Depth moulded	15 feet
Depth moulded at raised quarterdecks	16 feet
Fish-hold capacity	12,000 cu. ft. or 4,500 kits of fish
Meal-hold capacity	2,500 cu. ft.
Liver oil capacity	20 tons
Fuel oil capacity	100 tons

The double bottom tank structure, oiltight and watertight bulkheads, engine seatings and deck casings are of welded construction. The bridge structure, including the funnel, is of aluminium alloy, the alloy being Noral 65 ST., and 51 SQ., approved by Lloyds. The vessel carries a total of 100 tons of Diesel fuel in cross bunkers and double bottom tanks aft, and 23 tons of fresh water in double bottom tanks forward. 4½ tons of lubricating oil are also carried in double bottom tanks aft. The propelling engine is a Mirrlees HFRBT8 8-cylinder turbo-charged Diesel of the direct-air reversing type, developing 950 s.h.p. (continuous) at 300 r.p.m. The drive to the propeller shaft is taken up through a Bibby flexible coupling and a SLM combined oil-operated reduction gear with isolating clutch, manufactured by Modern Wheel Drive, Ltd. A Clarkson composite oil fired exhaust gas boiler utilizes the waste gases from the main engine to provide steam for shipboard requirements. The boiler has a total maximum evaporation of 1,650 lb. per hour at 75lb. per sq. in.—*The Shipping World, Vol. 121, 20th July 1949, pp. 82, 84.*

Turbine Steamship *Maid of Orleans*

The new twin-screw cross-channel passenger steamer *Maid of Orleans,* built by William Denny and Brothers, Ltd., recently entered service of the Folkestone-Boulogne cross-Channel service. The design of the vessel is on modern lines with raked and rounded stem, cruiser stern and of streamlined appearance. The vessel has two continuous decks with a boat deck amidships, a bridge deck and navigating bridge above. In addition there is a lower deck forward and aft. The principal dimensions of the *Maid of Orleans* are as follows:—

Length overall	341 feet
Breadth moulded	50 feet
Depth moulded to main deck	18 feet
Draught loaded	12ft. 6in.
Gross tonnage	3,777 tons
Net tonnage	1,670 tons
Total power developed	11,000 s.h.p.
Speed on trials	22 knots

This is the first vessel built for the short-sea route to be fitted with the Denny-Brown stabilizer. A further feature of interest is the coned top of the inner funnel which was designed by the Thermotank Co. after experiments to avoid soot and dirt from the funnel top, falling on deck The effect of the coned top is to increase the velocity with which the gases are ejected from the funnel, thus forcing them sufficiently high to avoid the area of low pressure which naturally formed immediately abaft the funnel top. The main machinery consists of two sets of Parsons geared turbines manufactured by William Denny and Bros., Ltd., the combined output being 11,000 s.h.p. at 275 r.p.m. Each unit consists of a h.p. ahead turbine of impulse reaction type and a l.p. ahead turbine of all-reaction type. A h.p. astern turbine of all-impulse type is incorporated with the h.p. ahead turbine and a l.p. astern turbine of impulse-reaction type is incorporated with the l.p. ahead turbine. The astern power is sufficient to give 85 per cent of the ahead going revolutions. The turbines drive the main shafting through single-reduction gearing of double-helical, involute, all-addendum type. A single-collar Michell thrust block of line contact is incorporated in each gear case. The main shafting is supported in Cooper split roller bearings. Steam for main and auxiliary machinery is supplied by two Foster Wheeler "D" type boilers at 250lb. per sq. in. pressure with a temperature of 500 deg. F. at superheater outlets.—*The Shipping World, Vol. 121, 6th July 1949, pp. 21-23.*

Integrated Tow

As reported by E. Westphal, a type of integrated tow developed in Germany during war-time for river transport of coal consisted of tubular barge units as shown in Fig. 1, where the dimensions of such a unit are also indicated. The width of the hatch is 1·8 m. (6 feet). All-welded construction was employed, the hull plating and bulkheads

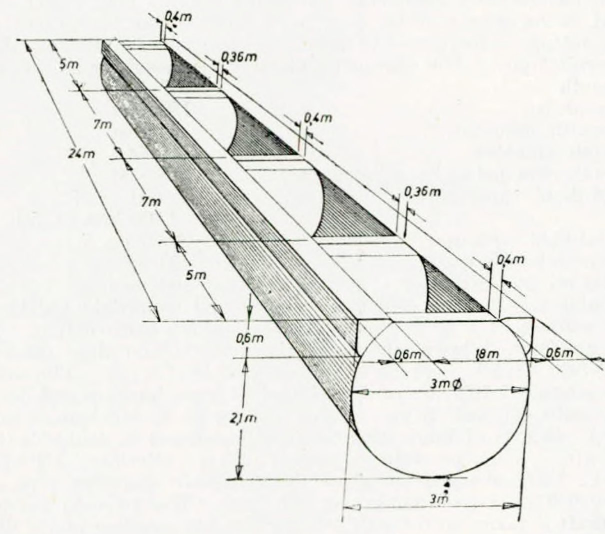


FIG. 1.

being made of 7 mm. thick plate. Maximum deadweight is 130 tons per barge, but at present the deadweight is reduced to 101 tons in order not to exceed the maximum draught of 2 m. permitted on the Mitteland-Kanal. An integrated tow of this type consists of eight rows of barges tied end to end, each row comprising three barges side by side. The tow is powered by push and pull tugs; the pulling tug, which constitutes the bow portion, is propelled by two 150 h.p. Diesels driving two screws in Kort nozzles through a bevel geared drive. The stern unit is powered by two 125 h.p. Diesel engines coupled by reversing-reducing gears with two screws in Kort nozzles. Experience has shown that this power is in excess of actual requirements. The first integrated tow of this type was placed in service in 1943.—*Hansa, Vol. 2, 11th June 1949, pp. 580-581.*

Ricardo Fuel Injection Nozzle

A fuel injection nozzle in the closed and open positions is shown in Fig. 4, and the accompanying curves indicate the characteristics of two different nozzles. When the needle valve (F) is on its seat there is formed, around the pintle (G) and beyond the valve, an annular chamber (H). Communicating with this chamber is a passage (J) at one side of the central delivery orifice (C). Fuel under pressure is supplied to the chamber (D) and the valve (F) leaves its seat and allows fuel to enter the chamber (H). At each delivery stroke of the fuel pump, provided the central orifice (C) remains closed by the pintle, the discharge of fuel will occur only through the subsidiary passage (J). At low rates of fuel delivery the resistance to flow of the passage (J) is insufficient to cause the fuel pressure to build up in the chamber (D) and open the main orifice (C). When the delivery rate is high, the resistance occurring in the passage (J) causes a rapid build-up of pressure in the chamber (D) and the valve is lifted from its seat. In the upper set of curves (I) shows the total quantity delivered by the pump at various speeds, while (II) shows the quantity delivered through the main orifice (C) per stroke. Curve

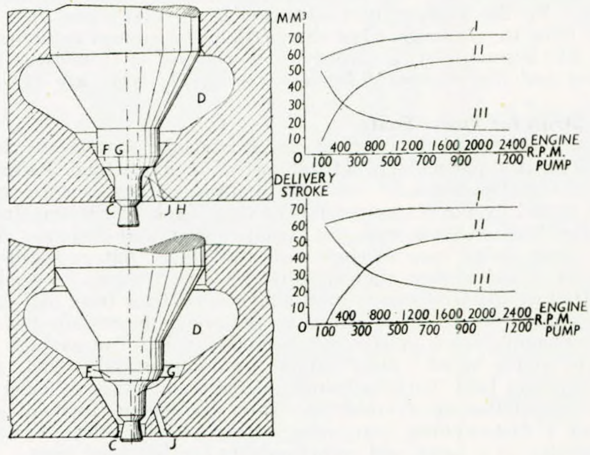


FIG. 4.

(III) shows the amount delivered through the auxiliary passage (J) per stroke. The characteristic is such that at low rates of supply the quantity of fuel discharged through a plain single passage (J) may be 6·5 times the quantity discharged by way of the pintle controlled passage (C). In the case of the lower set of curves, (I) shows the total delivery, (II) the part which takes place through the main passage (C) and (III) the delivery through the auxiliary passage (J). At the higher rate of fuel supply the flow through the pintle orifice (C) is three times that through the hole (J). The layout depicted and described is that adopted in the C.A.V.-Ricardo Pintaux nozzle now used to facilitate cold starting of engines.—*Patent No. 617,795, issued to H. R. Ricardo, G. A. Holt, K. Brook and C.A.V. Ltd. The Oil Engine and Gas Turbine, Vol. 17, July 1949, p. 106.*

New System of Tank Cleaning

At a demonstration recently held in the Royal Albert Dock, London, the methods were shown by which the tank cleaning barge *Interknit* will remove gases or oil sludge from the fuel or double bottom tanks of ships. The problems encountered in gas-freeing oil tanks, and the difficulties under which oil or residue must be removed from oil tanks such as the double bottoms and settling tanks, are well known. With special equipment on the *Interknit* it is claimed that much of the manual labour can be avoided and the tank cleaning carried out without affecting the general cleanliness of the ship, by withdrawing the oil, heavy sludge or residue through a specially constructed nozzle and through a flexible metallic hose, using a high vacuum. Such a vacuum also clears the gases from confined corners of the tanks. Steam from the boiler of the *Interknit* is used for driving two vacuum pumps capable of moving more than 2,500 cu. ft. of air per min. These pumps create a vacuum in the cylindrical tanks arranged on the deck of the vessel. From these tanks, a 4-inch flexible metallic hose fitted with a specially designed nozzle is led to the tank to be cleaned. This nozzle (patent applied for) is constructed to admit varying amounts of air behind the main aperture of the nozzle. When adjusted in the working position, this inrush of air breaks up the heavy sludge into globules or particles which can then be lifted by the airstream and conveyed to the vacuum tanks. The vacuum created is sufficiently high to enable small solids to be picked up and sucked through the flexible hose. When the spoil is in the vacuum tanks, the vacuum is then broken and the contents dropped into special sludge tanks constructed within the hull of the vessel. Within these tanks is incorporated an extensive range of heating coils and the spoil can then be heated as necessary and pumped to the Victor separator on the foredeck, where the oil and water are separated. From the separator, the water is discharged into the hopper tank in the fore end of the vessel, from which it can be later transferred by the *Interknit*'s pumps. The reclaimed oil is deposited in the reclaimed oil tanks constructed in the double bottom.—*The Shipping World, 121, 6th July 1949, p. 27.*