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* Patent Specification

Stork Feedwater Deaerator

The principal characteristics of the Stork deaerator are the following: 1. The deaerator is equipped with an automatically operated sprayer, which finely distributes the water in the form of a cone with obtuse top angle. This sprayer is located at one end of the reservoir, while the outlet for the feedwater is at the other end. 2. The non-condensable gases are discharged in the immediate vicinity of the central spraying device. Practically no steam escapes *via* this outlet. 3. The deaeration reservoir is divided by a vertical partition about one-third down the length of the apparatus. The partition extends to about half a metre (1½ft.) above the deaerator bottom, thus below the water level. 4. There is a connecting pipe between the compartment on the outlet side and the underside of the sprayer. Through this pipe the non-condensable gases together with the water vapour from that compartment are conducted to just under the water screen. In effect they are drawn to that point, because there is a cold zone above the screen. This construction ensures a very low content of non-condensable gases in the part where the outlet is located, so that the chance of the gases which have been driven off falling back into the water is very small. This has a favourable effect on the deaeration process. The automatic sprayer ensures effective distribution of the water under any load, which promotes deaeration. Another feature of this sprayer is that with changing load the space between the water screen and the top of the deaeration vessel remains constant. The most recent development of the Stork deaerator relates to the supply of the heating steam. Until recently steam was supplied only below the water level with the aid of a manifold with Ruth nozzles, but also by means of a charging pipe with baffles, which at the same time promote circulation of the water. With the new patented construction of the Stork deaerator the heating steam is not introduced below the water level, but just above it. The steam is discharged into a pipe which is open at one end and extends across the entire width of the vessel. On its way to this discharge pipe the superheated steam passes through a bundle of heating tubes on the bottom of the vessel, where it heats the water, so that the gases are driven off and the steam saturated. —*VMF Review, February 1959; No. 9, pp. 403-406.*

Air Curtain Unit

The escape of cold air from a refrigerated compartment when the door is left open is a serious problem now being overcome by the Miniveil Mark IX air curtain unit. It has already been used satisfactorily in the Ellerman Lines ship *City of Port Elizabeth* and the British India Company's *Uganda, Kenya* and new *Bulimba.* One of the difficulties to be overcome on shipboard is the limited headroom available and various obstructions met with in a ship, and this has led to the development of a very compact unit with high efficiency and low cost. The Miniveil is so sited over the door that risk of damage to it is eliminated and maintenance is required only on the fan motor and starter. The Miniveil is essentially a device for passing a stream of air over the face of a door opening. As this air stream has considerable velocity, it entrains the air in its immediate vicinity and carries it down to the ground. Warm air carried by convection currents towards the cold store is collected by the air veil stream and prevented from reaching the doorway. The air flow is started up, as soon as the door is moved, by the closing of the contact of an auxiliary switch on the door frame, and remains in operation until the door is closed.—*Shipbuilding and Shipping Record, 7th May 1959; Vol 93, p. 609.*

Operation of Department of Transport Icebreakers in Canada

This paper deals with experiences of the Canadian Department of Transport in operating a fleet of icebreakers over a period of twenty-five years. The paper is concerned mostly with information obtained from the operation of icebreakers under Canadian conditions. The Canadian Arctic consists mainly of islands and inlets which stretch over an area of

2,000 miles north and south and a little more east and west. A large part of the area is eternally icebound and cannot be reached by ships at all, but by far the largest part of the arctic is accessible to icebreakers in season. The geographical set-up brings tremendous ice pressure concentrations owing to the shape of the land and the effect of wind and ice in the large areas of open water in the ocean. The ice itself presents greater difficulty than the ice farther south because new ice very often simply forms a matrix for heavy oil arctic ice which is heavy enough to do serious damage to underwater plating of ships. In order to carry out operations in the north successfully, the ships also require to be fitted with helicopters.—*Paper by A. Watson, read at the Spring Meeting of the Society of Naval Architects and Marine Engineers, 12th-13th June 1959.*

Stability and Control of H.M.C.S. *Labrador*

H.M.C.S. *Labrador* is an icebreaker fitted with fin-type stabilizers. This paper deals with the consideration given to the problem of the inherent rolling of icebreakers before making the decision to fit these stabilizers. The stabilizer gear fitted in the *Labrador* is described, together with adjustments which can be made to meet particular sea conditions. Results of trials carried out are given and discussed. The trial results indicate that the stabilizers effectively reduce rolling and have little effect on speed at the higher speeds. From the turning trials results it is evident that the stabilizer fins have little effect on manœuvrability. Control of icebreakers is discussed and the paper concludes with a summary of the sea experience in H.M.C.S. *Labrador*.—*Paper by F. W. Matthews, read at the Spring Meeting of the Society of Naval Architects and Marine Engineers, 12th-13th June 1959.*

Design and Construction of Icebreakers

Underlying considerations governing the design of present day icebreaking vessels of Canada, and the resulting influence on design and construction details, are treated in this paper. With approximately three-quarters of a century of icebreaking experience forced on them by yearly problems of the St. Lawrence River and more recently with the opening up of the arctic, Canadians have gained much experience in the operation of icebreakers. This backlog of experience is, quite naturally, expressed in the design of the contemporary icebreaking vessels. The author traces briefly the historical problems centred mainly in the St. Lawrence River valley and outlines the role of the icebreaker in the attack on this problem. A brief background of the growth of Arctic operations is presented and attention is drawn to the different kinds of operation required in the arctic as compared with the River St. Lawrence service. With the background established, the author discusses many details which must be considered in preparing the design of the icebreaking vessel, such as the choice of principal dimensions, hull form, stability, power, hull strength, choice of machinery, subdivision and other features. Various aspects of construction are discussed and the elements of present practice are brought out.—*Paper by J. Gorman German, read at the Spring Meeting of the Society of Naval Architects and Marine Engineers, 12th-13th June 1959.*

Proportions and Form of Icebreakers

The opening of the St. Lawrence Seaway adds new emphasis to the important service which will be performed by icebreakers in the future. More of these ships will be built, so it is timely to review the design criteria which have been used and to search for possible improvements. As is well known, the design of icebreakers depends mostly on experience although some analysis has been attempted. In preparing the paper on proportions and form, a large number of reports have been reviewed in order to determine areas wherein the existing ships could be improved. The most important feature in which conventional design could be improved is in the length/beam ratio. There appears to be opportunity for substantial improvement on conventional design in so far as the transverse sections in the forebody are concerned. A number of other characteristics of the form are discussed in the paper and directions of improvement are suggested. The goal is to make such innovations in the icebreaker lines as will increase the icebreaking force, improve controllability of the ship, improve seaworthiness, reduce propeller and rudder damage and at the same time make the ship easier and cheaper to build.—*Paper by L. W. Ferris, read at the Spring Meeting of the Society of Naval Architects and Marine Engineers, 12th-13th June 1959.*

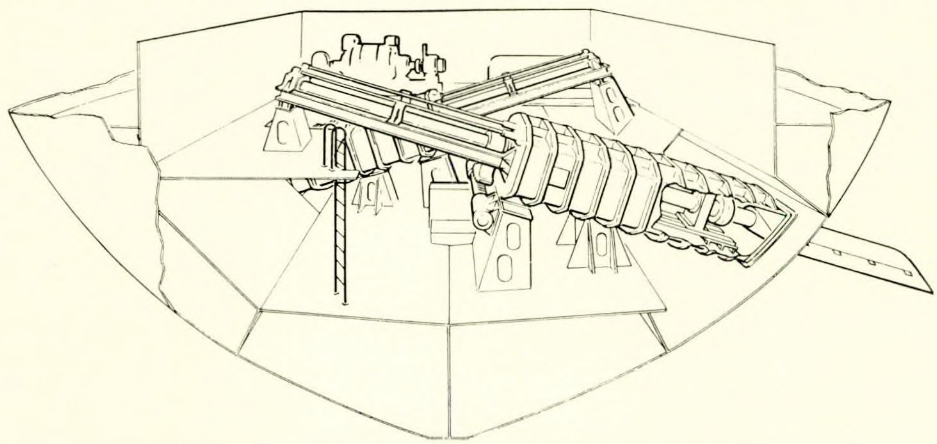


FIG. 2—*Arrangement of stabilizer in hull of the* Labrador

Application of Nuclear Power to Icebreakers

The application of nuclear power for propulsion of icebreakers is not visualized simply as substituting one means of power for another of the same output. Nuclear power provides a method of propulsion that will greatly improve the operating capabilities of the icebreaker as compared to present Diesel-electric designs. Icebreaker operations have been confined mostly to missions during approximately 3 months of the summer seasons at the respective polar regions. This restriction on the period of operations is due largely to the capability of the present icebreakers to enter these areas only when the ice fields are receding and ice is decaying and present the least resistance. The present designs provide for this icebreaking capability and although the fuel capacity is marginal, enough is provided for minimal heating and auxiliary uses if the vessel is beset in the ice and forced to remain for the winter period. When the period of operation is extended or conditions are unusually severe, increased capabilities are indicated. During the 1955 supply for the Dew line the early closing in of the ice fields north of Point Barrow was more than the accompanying icebreakers could handle and only a fortunate shift of wind which carried the floes offshore permitted the large convoy of supply vessels to escape, but not without considerable structural damage. For several past winters different ships of the Wind class have been assigned limited hydrographic survey work in the Alaskan area. Reports indicate that on some occasions, the conditions practically prevent advance. On one occasion *Northwind* reported being able to make only 2 miles headway in a 12-hr. period and actually only one mile in the desired direction. Under these conditions fuel consumed per mile is an astronomical figure and there are no fuel stations to replenish tanks. The use of nuclear energy would permit the installation of increased power to improve icebreaking capability and at the same time would permit this power to be used over prolonged periods of operation. Furthermore, if the nuclear icebreaker were beset for the winter there would be no problem of fuel shortage to force drastic reductions in heating and other auxiliary functions, and the vessel could become fully operational as soon as ice conditions permitted. The paper describes the feasibility study for a 30,000 s.h.p. nuclear icebreaker, and comparison is made with the Diesel electric powered *Glacier* and the nuclear powered *Lenin*.—*Paper by S. W. Lank and O. H. Oakley, read at the Spring Meeting of the Society of Naval Architects and Marine Engineers, 12th-13th June 1959.*

Modern Trends in High Speed Diesel Engines

The most efficient way of obtaining increased power is to pressure charge the engine; for a small increase in weight and no increase in speed, a 25 to 50 per cent increase in power becomes available. The ability of a compression ignition engine to develop power depends largely on the density of the charging air and on the effectiveness of the scavenging. The function of the pressurizer is to increase the density of the air within the manifold so as to provide the combustion space with additional oxygen. By correct timing, the available pressure differential can be used to obtain more complete scavenging. Consequently, with the clearance space properly scavenged and with cleaner air and more oxygen in the combustion space, more fuel can be economically burnt. When size and weight are important factors, pressure charging offers the simple and most effective means of increasing the power output of an engine. The characteristics of the positive displacement type of blower, with its ability to deliver air in almost direct proportion to its speed, makes it admirably suitable for its application to engines requiring high torque at low speeds and extra power at high speeds. The net gain in power after allowing for the extra horse power to drive the pressurizer is in the region of 25 per cent. The method results in an increase in specific fuel consumption. Where a turboblower is used it is driven by the exhaust gases and on the same spindle an impeller is carried which induces a pressure higher than atmospheric in the induction manifold. At low engine speeds the exhaust turbine is not so efficient because of the low volume of the exhaust gases. At about half maximum engine power it is still not giving the same net gain in horse power as a positive displacement blower, but it is giving a better fuel consumption. Some of the energy otherwise dissipated by the exhaust gases is utilized, and therefore the increased horse power is obtained without any additional work. The specific fuel consumption of the engine is better than a normally aspirated engine or an engine with a positive displacement blower. If the engine is taken to near its maximum b.h.p., the turboblower reaches its most efficient stage and with a low specific fuel consumption and a net increase in horse power of nearly 50 per cent, it is definitely a great advantage to the engine manufacturer and the user of equipment requiring a high power output. Time and research have proved that bearing loads need not be increased by pressure charging, and on the contrary, smoother expansion takes place over a longer crank angle. Ignition commences 5 degrees before and is completed 6 degrees after t.d.c. The pressure rise is rapid and the curve slightly irregular and fairly peaked at maximum pressure. Power is lost if the injection is timed incorrectly, or if the injectors are falling off in efficiency. Numerous other factors also affect the curve, but with better scavenging of the cylinder there is a larger margin and a supercharged engine generally will not show such a rapid fall-off in efficiency at high crankshaft speeds as a normally aspirated engine. In the same engine after pressure charging ignition commences earlier through better mixing of the fuel with the air. Combustion is completed at about 12 degrees after t.d.c., giving a burning period of 20 degrees as against 11 degrees in the normally aspirated engine. The combustion process is therefore smoother, the pressure does not rise so rapidly and the curve begins to show a flat top, that is, nearing the ideal. The maximum pressure has been lowered, which improves the life of the bearings, and besides the higher weight of air for combustion, the burnt gases from the previous cycle have been efficiently scavenged.—*L. D. E. Brodie, Diesel Engineers and Users Association, April 1959; Report S263, pp. 36-43.*

Tapered Land and Pivoted Shoe Thrust Bearings for Large Steam Turbines

The tapered land bearing consists basically of a circular thrust plate, split in two halves, which is rigidly supported to carry the thrust load. The babbitt bearing race is divided into lands by radial oil feed grooves. The surface of each land is machined with a compound taper, which slopes in the direction of rotation from the leading to the trailing edge and, to a lesser degree, from the inner to the outer radius at the leading edge of the land. The lubricating oil, which is admitted under pressure to the radial oil feed grooves, thus forms a wedge shaped oil film, due to the rotating thrust collar. Since the surface of the lands is fixed, any compensation for misalignment must be accomplished by the supporting housing, and common practice is to mount this member on a ball seat. It is recognized that self-alignment with a ball seat type mounting inherently involves some degree of friction, which, if excessive, could prevent proper alignment of the bearing face, thus reducing the potential capacity of the thrust bearing. Factory tests, as well as actual operating experience, however, indicate that a properly fitted ball seat will permit the thrust bearing to align satisfactorily. The pivoted shoe bearing contains segmental shoes which are free to pivot in any direction on pivot points centrally located on the back of each shoe. Oil is fed into the bearing around the inner radius of the shoes, and the hydrodynamic action of the lubricant tends to tilt the shoes to form the proper oil film shape. Proper alignment is maintained through a system of equalizing plates which supports the shoes within a rigid base ring assembly. This construction equalizes the load over the various shoes and also compensates for any dishing of the thrust collar resulting from load or temperature gradient. Two of the largest thrust bearings tested at 3,600 r.p.m. were a 270-sq. in. tapered land bearing and a 254-sq. in. pivoted shoe bearing. Both of these two types of bearings in this size already had been installed in several large steam turbines and were operating satisfactorily. For test purposes, each bearing was supported in the testing machine in a manner nearly identical with the actual turbine assembly. During actual testing the bearing was loaded gradually in uniform increments, and thermocouples recorded bearing metal and oil discharge temperatures. The test results indicate that the maximum load carrying capacity of the 270-sq. in. tapered land thrust bearing at 3,600 r.p.m. is in excess of 1,000lb. per sq. in. The tests results for the 254-sq. in. pivoted shoe bearing at 3,600 r.p.m. indicate maximum capacity to be not over 712lb. per sq. in., and the effort thus far expended to improve this load capacity has had no appreciable effect. The measured metal temperatures and horse power loss are approximately equivalent for both types of bearings at the same unit load. Both types of bearings suffer from the effects of thermal distortion, although the compensating aspects of the oil film pressure tend to reduce this effect on tapered land thrust bearings. Increased bearing area and higher runner velocity have not affected significantly the high load capacity of the tapered land bearing.—*R. E. Brandon and H. C. Bahr, ASME Transactions, Series A, April 1959; pp. 208-214.*

Radio Sextant

A new radio sextant with which weak radio waves from the moon are used to establish a navigational fix was recently installed aboard the U.S. Navy's experimental ship *Compass Island*. The new sextant is considered a major break through in navigational systems. The radio sextant functions as a precise compass, furnishing the direction of North with more than 10 times the accuracy of previous marine compasses. The radio sextant has a 5-ft. parabolic dish antenna with which the moon signals are picked up. The sextant receiver used in the system is said to be the most sensitive receiver of its type ever built. The receiver "recognizes" the slightest changes in the signals from the moon and thereby follows the path of the moon across the sky. After the sextant is installed in ships, special precautions will have to be taken to make sure of the maintenance of constant variables, such as temperature and stability. A special pitch-and-roll platform has been designed to stabilize the instrument in heavy seas.—*Bureau of Ships Journal, June 1959; Vol. 8, p. 25.*

Japanese Refrigerated Factory Ships

Salmon and trout fishing in the Northern Pacific Ocean and whale catching in the Antarctic Ocean are especially important to Japan. The refrigerated factory ship plays a central role in these types of fishing. Many modern refrigerated factory ships have been built in Japan since World War II, installed with the latest equipment and machinery. Fig. 1 shows the general arrangement of the *Miyazima Maru,* as typical of these vessels. In all the refrigerating machines, NH_3 refrigeration is used, and indirect brine cooling is employed for the cooling system. Almost all the Japanese refrigerated factory ships employ the shelf-freezer system, in which brine is circulated.—*Paper by Shigeru Sato, presented at the 2nd World Fishing Boat Congress, Rome, 5th-10th April 1959.*

Flow Pattern in Diesel Nozzle Spray Holes

The paper presents a study of the flow in spray holes of 0·2 to 2·5-mm. diameter and shows how the changes in cavitation pattern affect the apearance of the jet. The influence of the cavitation number, Reynolds number, the upstream edge sharpness, and the length/diameter ratio is investigated. A cavity first formed near the upstream corner, but soon caused the jet to leave the wall altogether so that only the upstream corner had any effect on the flow. Under non-cavitating conditions the emerging jet had a ruffled appearance, but under conditions when the jet had left the wall, it emerged smooth and glass like. The glass like stage could only be obtained with very accurately made spray holes, and any disturbance upstream, such as occurs in actual Diesel nozzles, caused the jet to appear ruffled at all times. The discharge coefficient was found to vary with Reynolds number and cavitation number and a contour map covering Reynolds number of 1,000 to 20,000 and cavitation number of 0·2 to 100 is presented.—*Paper by W. Bergwerk, submitted to the Institution of Mechanical Engineers for written discussion, 1959.*

Propulsion without Smoke

A tentative design for a gas turbine working on a semi-closed circuit is described. The gases expelled from the turbine pass through two heat exchangers and enter the exhaust chamber, which is situated at the ship's side below the waterline. The lower end of the chamber is open to the water, so that the gases in the chamber are under a pressure which will be a function of their depth below the waterline. The chamber is fitted with a cooler through which sea water flows by virtue of the ship's motion; a pump is fitted to ensure the flow when the ship is not under way. From the top of the chamber gas is drawn into a gas compressor, from which it is forced through one of the heat exchangers to an annular space

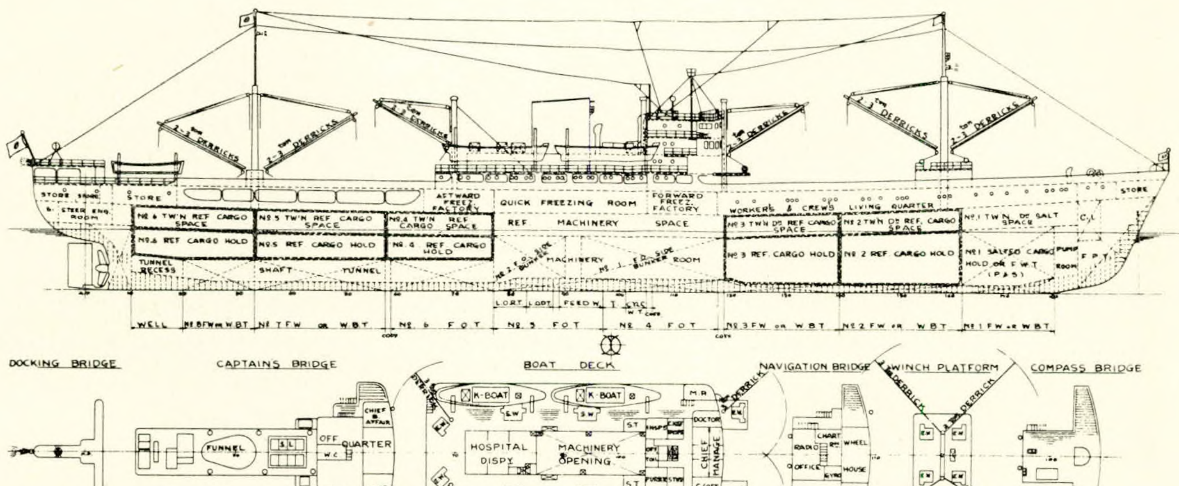


FIG. 1—*General arrangement of refrigerated factory ship* Miyazima Maru: *principal dimensions 459ft. 2in. x 62ft. 3in. x 44ft. 3in. (140 m. x 19 m. x 13·5 m.)*

in the combustion chamber; at the same time, air is drawn from outside the circuit into an air compressor, from which it is forced through the same heat exchanger to the centre of the combustion chamber, where it mixes with the fuel and is ignited. The expanding gases, which include the recirculating gas which has been through the gas compressor, drive the turbine in the normal way, and then pass through the heat exchangers to the exhaust chamber. From the exhaust chamber, gas is drawn into the gas compressor as stated above, and gas surplus to the cycle is vented into the water. No funnel is therefore necessary, and the air intake is small as compared with that of the open circuit gas turbine. It may be necessary to use a high grade fuel. The application of this system to installations with electrical transmission and with gear transmission to the propeller, and the associated safety devices and starting appliances, are described. The application of the system to submarines is also discussed.—*P. Tulane, Nouveautes Techniques Maritimes, 1959; pp. 153-157. Journal, The British Shipbuilding Research Association, May 1959; Vol. 14, Abstract No. 15,325.*

Propulsion Systems for Motor Trawlers

Difficulties in trawler design arise because of the two different requirements, high sailing speed and high trawling power. The paper describes how trawling power decreases in the case of a normal trawler, and how this loss can be avoided by the use of a multiple-speed gear, a controllable pitch propeller or a propeller nozzle. To obtain a high sailing speed, the propeller must be designed to deliver maximum torque at the nominal (100 per cent) r.p.m. of the engine. But the propeller also requires maximum torque when trawling, and as the engine cannot maintain this torque at a reduced speed of the ship its r.p.m. and power drop. A vessel with a propeller of 11·8ft. (3·6 m.) diameter was tested at a trawling speed of 3·5 knots under several different head wind forces. When the same vessel was tested in the sailing condition at 14·5 knots its engine developed 1,025 s.h.p. at 118 propeller r.p.m. and a measured propeller torque of 45,000lb./ft. (66,220 kg./m.). This torque could be obtained without overloading the engine when trawling. The tests show that, while trawling, the maximum effective power on the engine is limited to 720 s.h.p. The loss of about 300 h.p. when trawling can be avoided if a multiple speed gear or a controllable pitch propeller is used, or a Diesel electric drive. The multiple speed equipment consists of a reversible reduction gear of normal oil pressure as used for many decades aboard fishing boats. The only difference is that, instead of a single speed reduction for ahead, there are two, one for sailing and another for trawling. Full engine power can be used at any time with these. Changing from one speed to the other and to "astern" is done in seconds with oil pressure laminated disc clutches. The gear can be used with non-reversible main propulsion Diesels by de-clutching and allowing the engine to run. As there is no direct connexion between propeller and engine, the propeller can be stopped automatically by a brake. The advantages of this design have been proved in practice. Five trawlers obtained optimum catches around Boulogne-sur-Mer by using multiple speed reversible gears. The captains state that catches were less when they did not use the trawling speed gear. Similar performances can be obtained with controllable pitch propellers. The multiple speed gear gives full power when trawling by adjusting the propeller speed, while the controllable pitch propeller changes its pitch when trawling, maintaining a constant propeller speed. In both cases it is possible to operate the engine when trawling under full power at the nominal engine speed. However, to improve the efficiency of a controllable pitch propeller under various load conditions, it is necessary to change not only the pitch but also the r.p.m. To obtain good thrust results, a controllable pitch propeller must have a large diameter, as is shown in Fig. 1, and a comparatively low propeller r.p.m., and this requires a gear to reduce the engine r.p.m. A large controllable pitch propeller, say 11·8ft. (3·6 m.) diameter, combined with a reduction gear is, however, very expensive and complicated, so that a careful study should be made as to whether or not a multiple speed gear with a fixed propeller is more economical.—*Paper by F. Süberkrüb, read at the 2nd World Fishing Boat Congress, Rome, 5th-10th April 1959.*

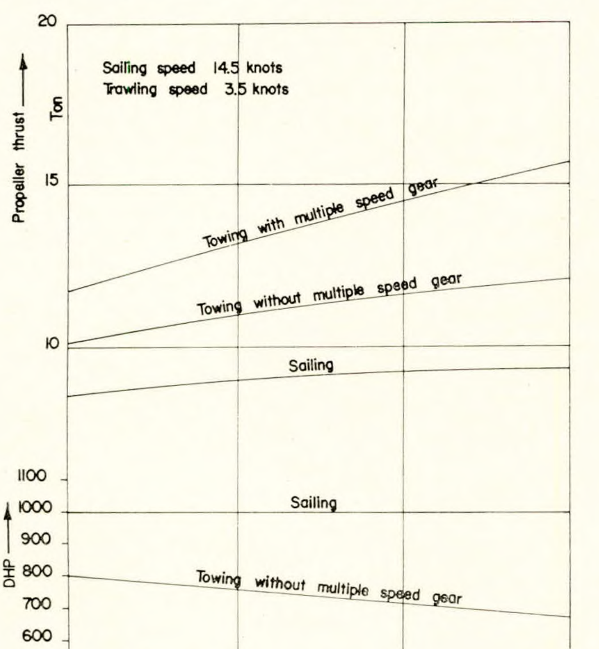


FIG. 1—*Propeller thrust and d.h.p.* versus *propeller diameter*

Governing of Compression-ignition Oil Engines

In this paper is discussed the application of some of the concepts of modern control theory to the problem of the governing of compression ignition engines. A physical description of the problem is given, illustrated by measurements made on governors and engines, including some to show the effect of the finite-time intervals between successive firing strokes, and other non-linearities such as Coulomb friction. In Appendix I is discussed the setting up of the equation of motion of mechanical systems, and their solutions using vector methods and the inverse locus to find the stability and also the transient responses of the system. While none of the theory will be novel to control engineers, part of its presentation may be. Some experimental data obtained on medium-size engines are included, together with comments on their use and some details on the investigation of unstable engine governor systems. A large saving in test bed time is reported.—*Paper by D. B. Welbourn, D. K. Roberts and R. A. Fuller, submitted to the Institution of Mechanical Engineers for written discussion, 1959.*

Pressure Vessel Design

To form rules for the design of pressure equipment, the Bureau of Ships is sponsoring research in co-operation with the Atomic Energy Commission and the Pressure Vessel Research Committee of the Welding Research Council. The Bureau has issued some of the data on fatigue loading already acquired, even though research is in the early stages. In spite of the wide scale use of boilers and other pressure vessels for more than a hundred years, many of the design and fabrication rules have little rational basis. The advent of nuclear power with its emphasis on structural reliability and tightness of the primary circuit and the requirements of other equipment in the petroleum and chemical processing industries are forcing complete reappraisal of pressure vessel construction codes. One of the principal items being considered is design for cyclic (fatigue) loading, due to variations in pressure or temperature in normal service (as differentiated from the start-up and shut-down). As a matter of example, a conventional boiler operates at essentially constant pressure throughout its range of operation—perhaps a maximum of 10 to 15 per cent variation. However, the secondary side of a high pressure, water cooled nuclear plant operates with an approximate 50 per cent variation; a catapult steam receiver can go through an 80 to 90 per cent variation in going from heavy to light plane launches and return; and a submarine condenser head can be subjected to 100 per cent variation when a submarine dives to design depth. It should, therefore, be recognized that the pressure loads on conventional boilers (and most pressure vessel equipment) are essentially static loads, and that the rules established for such equipment through service experience are not necessarily adequate for equipment subjected to variable or fatigue loading.—*J. L. Mershon, Bureau of Ships Journal, June 1959; Vol. 8, pp. 38-39.*

Unusual Displacement Hull Forms for Higher Speeds

A sharp increase in the wave resistance has limited speeds of full bodied surface vessels to a practical maximum which has sometimes been called the "wave barrier". Two approaches towards increasing the top speed of displacement type surface ships are investigated herein. The first approach is that of keeping Froude number constant and increasing length. The second approach, involving operation at high Froude numbers, is emphasized. This involves a study of minimum wave resistance at Froude numbers greater than 0·35. Principles for minimizing wave resistance are proposed. The wave resistance of certain elementary shapes is reviewed, and several forms likely to have a minimum wave resistance are discussed with reference to the principles proposed, and with reference to operation in rough seas. Heavy displacement type hull forms exist which "break the wave barrier" reaching Froude numbers greater than 0·9 (speed/length ratios greater than 3·0), thus multiplying their speed capabilities. The form characteristics which make for a higher speed may, within limits, also make for a maximum propulsive efficiency and a minimum motion in a seaway. The concept of increasing depth instead of increasing length in order to increase speed and seaworthiness is also briefly investigated.—*H. Boericke, International Shipbuilding Progress, June 1959; Vol. 6, pp. 249-264.*

Abnormal Brush Wear in D.C. Machines

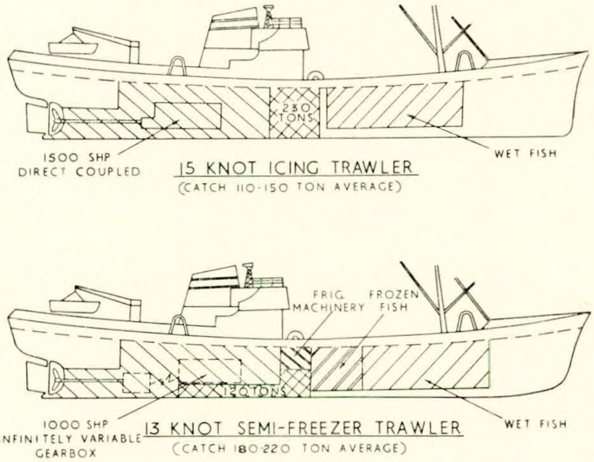
The use of silicone insulating materials in enclosed direct current motors and generators will produce abnormal brush wear. The mechanics of silicone effect on brush wear is not completely understood. However, it appears that when even minute amounts of silicone vapour are absorbed in the carbon brushes, the silicone is converted by the arcing under the brush face to a sandlike, abrasive material. Another theory is that the water resistant properties of silicone prevent the water vapour in the air from reaching the brush contact surface, which is necessary for forming the proper commutator film. Whatever the reason, it is known that *any amount* of any type of silicone varnish, compound, rubber, grease, laminate, or binder will cause abnormal brush wear, and must be avoided in *enclosed* d.c. machines or *enclosed* a.c. machines having collector rings within the machine enclosure. The Bureau of Ships, silicone materials suppliers, motor and generator manufacturers, and brush manufacturers have been trying to solve the silicone brush wear problem for many years. The only success to date has been the development of brushes that have a greatly reduced wear rate in silicone vapour, but that still have a higher wear rate than normal brushes in non-silicone atmospheres. Silicone materials may, however, be successfully used in parts of well-ventilated open d.c. motors and generators in which the incoming air passes over the commutator before entering the windings.—*Bureau of Ships Journal, July 1959; Vol. 8, p. 25.*

Reinforced Plastic Ventilation System

A reinforced plastic battery exhaust ventilation system has recently been fabricated and installed on the U.S.S. *Perch.* The system consists of all forward and after battery exhaust ventilation from the deck spool of the battery well to the battery exhaust fans and from the fans to the main exhaust line. It is composed of complex irregular sizes and shapes including rectangular, rounds, flat oval offsets, 90-deg. elbows, venturi tubes, and transitional round to rectangular T-shaped damper fittings. The entire system is made of fibrous glass cloth laminated with polyester resin. The finished plastic product was made by the following procedure: A sheet metal mould was made to the required shape by conventional sheet metal fabricating procedures. All parts against which plastic were to be applied had a smooth finish to ensure a smooth, close texture on the surface of the plastic article. The mould was also designed so that the plastic article could be easily removed after completion. The completed mould was waxed with a special paste wax and given three coats of release material to prevent adhesion of the plastic to the mould. A get coat of polyester resin, properly mixed with a catalyst, was then applied. Colour can be added to the polyester resin for decorative effect. Over the primary coat, layers of fibrous glass cloth were laminated with polyester resin to produce the end product. The number of laminations and the type and viscosity of resin used depends on the thickness and specific qualities wanted in the finished article. After lamination, the product was air cured for 6 to 8 hours at a temperature of approximately 70 degrees. Portable heat lamps or an electric oven could be used for fast curing. After the article had cured, it was removed from the mould and trimmed and finished with the same tools and mechanical equipment used for sheet metal.—*Bureau of Ships Journal, July 1959; Vol. 8, pp. 38-39.*

Propulsion and Processing Machinery for Deep Sea Trawlers

In order to get as much fish as possible into a ship of a given length, the engine room must be kept as short as possible. Thus, when freezing is considered, certain types of machinery have an economic advantage. These include Diesel electric with high speed engines of V-construction and a single large Diesel driving both winch and a controllable pitch propeller. The figure shows in diagrammatic form two motor trawlers, each of 185ft. b.p. The upper diagram represents the very fast motor trawler popular in the United Kingdom at present.



The average vessel of the British distant water fleet spends about 140 days on the fishing grounds in a year and on this basis the fast vessel will spend about 160 days on the grounds in a year, none of its fish being staler when landed. The lower diagram is a part-freezing trawler with constant power machinery and of the same overall dimensions and about the same capital cost. It would spend 180 days in a year on the fishing grounds and in running to and from the grounds would burn little more than half as much fuel in a year as the faster ship. In the hands of an average skipper it would produce in a year an amount of edible fish not far short of the most successful vessels at present, and of higher average quality.

Preliminary calculations indicate that for the reasons just given this type of vessel will compare favourably in economics of operation with the average orthodox trawler. Proper design studies and estimates are being undertaken. These already indicate that the speed of the design has been underestimated; it may be possible to achieve 13½ knots. There is no reason why this type of vessel should not develop gradually in size, in which case a higher proportion of the catch would be frozen. This line of development could in time merge with the large factory trawler.—*Paper by G. C. Eddie, read at the 2nd World Fishing Boat Congress, Rome, 5th-10th April 1959.*

Stern Trawlers

A gas turbine, with Pescara free piston gasifiers, a type becoming now increasingly popular, was installed in the *Sagitta*. Although its specific fuel consumption is higher than that of Diesels, a cheaper oil of lower quality (a somewhat improved Bunker C oil) is used. This results in considerable savings in the fuel bill. As there are few moving parts to wear away, and these are comparatively cheap and easy to renew, it is hoped that maintenance costs will be very low. The two gasifiers are of standard design with maximum 1,000 h.p. each at the turbine coupling, giving ample reserve of power for bad weather. The total plant is normally run with about 1,500 h.p., which is sufficient for a speed of about 14 knots. The plant can also run with one gasifier only, this giving the necessary reserve. The turbine itself is a very safe engine, and has a controllable pitch, non-reversible propeller. A generator for the ship's mains, as well as for the pumps for the hydraulic winch drive, is driven from the intermediate shaft of the articulated double-reduction gear. For harbour duties, these pumps are driven from the generator which works as a motor, the power coming from two Diesel generator harbour sets. The *Sagitta* had teething troubles with the gas turbine and the hydraulic winch drive. The gas turbine troubles were of a minor nature (choice of the correct lubricating oil, governor trouble, etc.). These have been more or less overcome. The hydraulic components of the winch drive were the doubled-up version of a successful unit used on drifter trawlers, but one plus one did not turn out to be two, as so often happens in practice. The main failure was a too low gear ratio between motor and winch, so that the system always worked with the

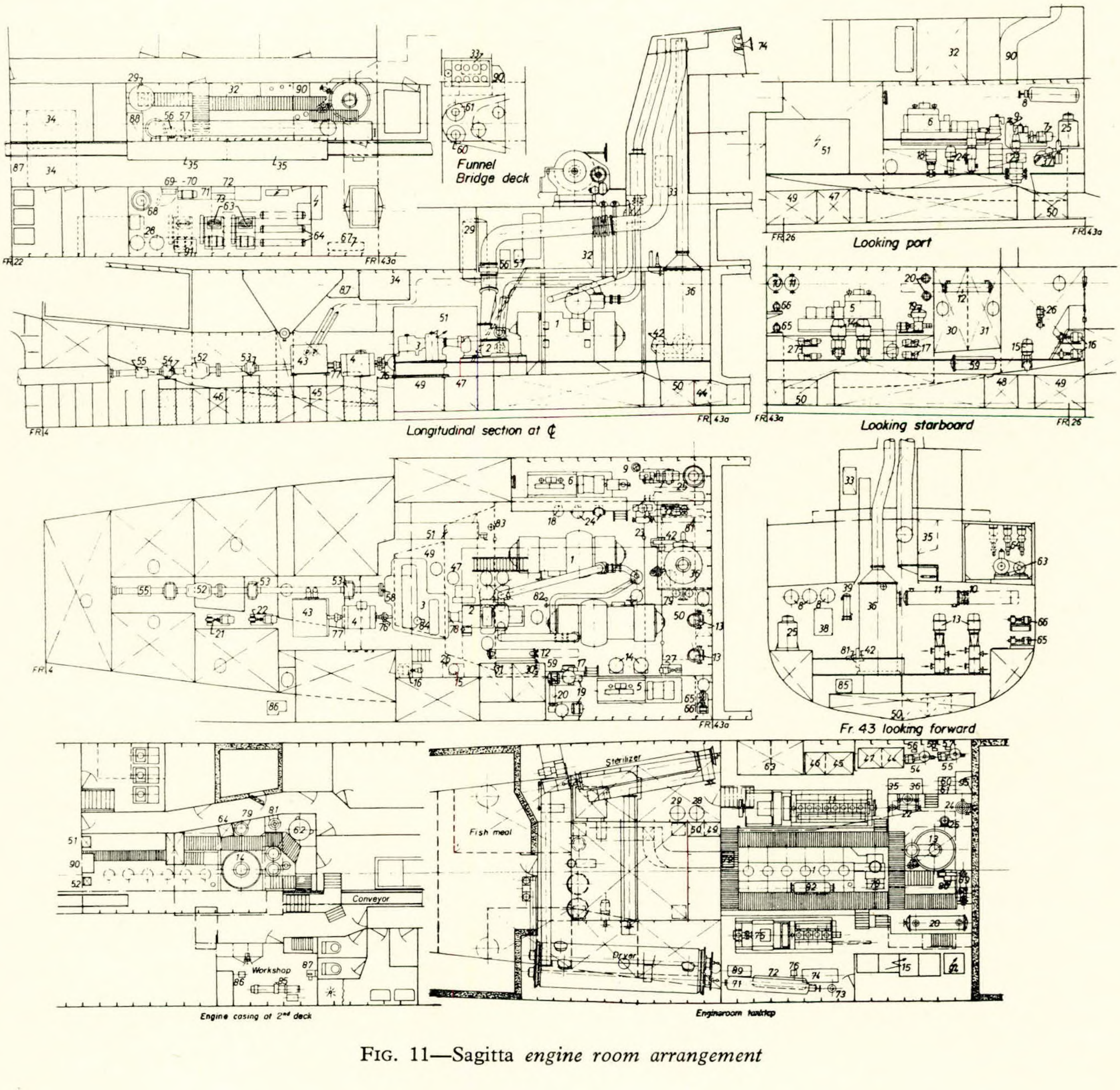


FIG. 11—Sagitta *engine room arrangement*

maximum pressure and minimum oil flow, opposite to what was required. There was also governor trouble (in operating the clutches the revolutions could not be reduced enough and the winch started too quickly), and a broken ball bearing, which was only bad luck and could have happened to any drive. But it was possible to carry on work with the other unit. After putting in two gear wheels of a more suitable gear ratio, the oil pressure went down and the winch worked more quickly and smoothly. During this repair, some slack in the connexion between the control wheel on the winch and the governor was detected and corrected. Since that time no other trouble of importance has occurred.—*Paper by H. Heinsohn, read at the 2nd World Fishing Boat Congress, Rome, 5th-10th April 1959.*

Advanced Hull and Propeller Design for Fishing Boat

Tank tests of recent fishing boat designs reveal considerable scope for improvement in hull form and propulsive efficiency. A model of a 75-ft. (22·86 m.), 100-ton, 10-knot "fishing boat of the near future" was designed from a hydrodynamic point of view, incorporating a bulbous bow, 2-bladed propeller, and a steerable nozzle which replaces the rudder. Tank tests of this model show exceptionally low resistance, exceptionally high propulsive efficiency, and a high efficiency when trawling. The power required at 10 knots is only 105 b.h.p. compared with 250 b.h.p. for the average recent Canadian fishing vessel of the same size and speed. The results are expanded to all sizes for ready comparison with existing vessels.—*Paper by J. T. Tothill, presented at the 2nd World Fishing Boat Congress, Rome, 5th-10th April 1959.*

Review of B.S.R.A. Trawler Research

The paper reviews the research progress of the British Shipbuilding Research Association in so far as trawlers are concerned. It is in three main sections: icing experiments, methodical series resistance experiments, and vibration research.

Icing experiments on a trawler model. "Trawler-icing" came to the fore in 1955 with the loss of two trawlers in Arctic waters and the Association initiated an investigation to throw light on the problem. This took the form of icing experiments on a small scale model in a climatic chamber from which the weight and distribution of ice accretion was determined for various attitudes to the wind and different rigging arrangements. The loss of stability due to the added ice was also determined. The tests have shown the importance of removing as far as possible ice-catching details such as shrouds and ratlines and cleaning up the rigging generally. This has been underlined by the better performance of the tripod mast arrangement compared with conventional rigging.

Methodical series of resistance experiments on trawler models. The object has been to provide design data to cover a practical range of proportions and fullness including systematic variation of mid-section area coefficient, beam draught ratio, length displacement ratio and other geometrical features. The basic models represented to scale a 150-ft. (45·7 m.) trawler of 847 tons displacement with a service speed of about 12 knots. Throughout the work the results have been compared on a basis of constant displacement. The mid-section variations showed the beneficial effect on resistance of reducing the prismatic coefficient by fining the ends and filling out the midship section. At speeds below 11 knots there was a significant increase in resistance as the beam draught ratio was increased. An interesting and important feature, however, was that in the neighbourhood of the service speed of 12 knots the resistance appeared to be insensitive to changes in this ratio. The length displacement ratio group showed very clearly the advantage to be gained by lengthening the form while maintaining the other geometrical features. Tests in which the block coefficient was systematically varied showed that, at constant displacement, the resistance progressively increased with block coefficient.

Vibration research. Experience seems to show that trawlers have not been troubled with vibration problems to the same extent as other classes of seagoing ships, but with the present trend for higher speeds and powers the matter is now assuming increasing importance. For this reason the Association has been giving more attention recently to the vibration characteristics of trawlers. One of the main problems is to avoid resonant conditions, that is, to ensure that the natural frequencies of the hull do not coincide with those of pulsating forces emanating from the propelling machinery and usually related in some way to the r.p.m. The first requirement is therefore to determine in the design stages these natural hull frequencies, but experience shows that, from first principles, this is a very tedious matter and sometimes quite impracticable. Moreover, the detailed information required is not generally available. Efforts have therefore been made to improve and simplify methods of estimating critical frequencies and at the same time to relate the amplitude to the exciting forces. This is being effected by determining experimentally the natural frequencies for a range of ship sizes and then correlating these in terms of simple parameters involving only factors known in the design stages. At first, measurements were made during trials, using the propeller machinery as the means of excitation. This work has now been supplemented by controlled tests using a vibration exciter specially designed for the purpose, which enables more comprehensive data to be obtained. Some typical results are presented in the paper and an indication given of the manner in which they are being correlated.—*Paper by H. Lackenby, presented at the 2nd World Fishing Boat Congress, Rome, 5th-10th April 1959.*

Steam versus Diesel

A comparison indicates the advantages of Diesel over steam as regards fuel economy, power for fishing, acceleration, fish room capacity and constant draught and trim. A maintenance schedule is given for the main engine. Teething troubles experienced are discussed, such as removal of piston castellations to avoid uneven liner wear, use of detergent lubricating oil and increased lubricating oil temperatures to reduce carbon deposition, correct lubricating oil filter usage and regular checking of oil samples, and of small accessories. Wear figures are given. The turbocharger system is referred to, including air supplies and some troubles with erosion of the gas outlet casing. The type of fuel oil is defined and a fuel consumption curve is given. The importance of satisfactory engine alignment is emphasized and the recommended installation procedure detailed. There are no barred speed ranges and a description is given of the torsional investigation. The anticipated loss in propeller efficiency in changing from a steam engine running at 120 r.p.m. to a Diesel at 230 r.p.m. has been reduced by the use of modern bronze propellers. Details of these are given, together with curves of efficiency, etc. The importance of power balance between the winch motor and Diesel is stressed. Troubles on earlier vessels with carbonization of pistons, etc., and armature difficulties are described. Reference is made to maintenance procedure, lubricating oil and alarm systems. The two general service sets, each driving a generator, pump and compressor, are described, as well as some difficulties with the lubrication of the compressor big end bearing and suggestions made about starting, and also about driving the pump and compressor electrically. Reference is made to steam boiler heating, which has been superseded by small oil fired hot water circulation boilers.—*Paper by G. Hopwood and N. W. N. Mewse, read at the 2nd World Fishing Boat Congress, Rome, 5th-10th April 1959.*

Propulsion Engines for Fishing Boats

The designs of two and four-stroke Diesel engines are compared, giving their advantages and disadvantages, and indicating that a two-stroke engine may give 60 to 70 per cent more power than a four-stroke engine of the same cylinder volume. Scavenging is found to be simpler with a four-stroke Diesel, and homogeneous material can more easily be used for this type of engine. Supercharging of the four-stroke Diesel is discussed, and it is stated that 60 to 100 per cent more power can be obtained thereby. The high pressure supercharged four-stroke engine is a good substitute for the fully scavenged two-stroke Diesel engine. Various types of Diesel engines are reviewed, giving their advantages and disadvantages. A short note is given about Diesel electric propulsion on some recent trawlers. In the author's opinion, future development may lead to a supercharged two-stroke crosshead engine, which will displace the supercharged four-stroke.—*Paper by I. B. Stokke, read at the 2nd World Fishing Boat Congress, Rome, 5th-10th April 1959.*

Trawler of Unorthodox Design

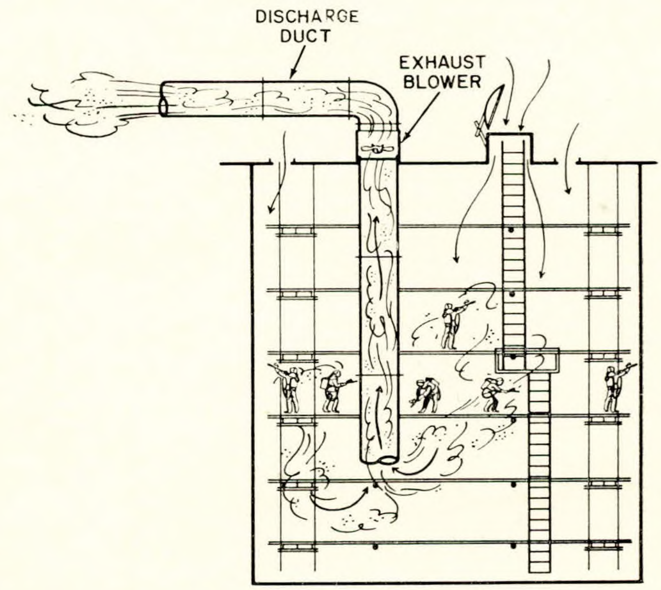
The recent practice in trawler design is to use fine entrance angles and small water plane coefficients. This, however, results in lack of stability and expensive work for the fore body. A new type of hull with double chines has been developed, and it has proved to have a good performance. The trial results of a 115-ft. (35 m.) vessel of the new type tallied closely with the predicted resistance obtained by model tests and the vessel was about 1 knot faster than an ordinary type of the same size and engine output. There is also a big advantage in the simple method of construction and subsequent low cost of building. The main merits could be summarized: (a) Cheaper, due to lower hull costs. (b) More economical to operate, due to the lower power required for equivalent service. (c) Cheaper because of smaller and lighter machinery, if required only for a given speed. (d) As efficient as the best normal ships in so far as concerns fish caught which are brought back without delay even in the worst weather. The paper also describes a practical way to introduce the type into underdeveloped areas, and mentions prospects for development, especially a smaller size under 100ft. (30 m.) with twin screws. —*Paper by E. C. B. Corlett and J. Venus, read at the 2nd World Fishing Boat Congress, Rome, 5th-10th April 1959.*

Glass Reinforced Plastic Hulls

The paper deals with plastic hulls and decks made from cold setting polyester resin reinforced with glass fibre "mat" laid up in a female mould. The chief advantage of plastic hulls are low initial cost and very low maintenance and repair costs. One hull costs no more than an equivalent wooden hull, but several hulls from the same mould are cheaper than wooden hulls. Maintenance costs are low because plastic hulls are unaffected by sea water; they cannot warp, rot, or split like wooden hulls. They are dry because they are homogeneous and therefore will not open at the seams or leak. They cannot rust or corrode and they are not subject to galvanic action like aluminium, nor can they be attacked by marine borers. They do not absorb water; therefore they cannot be contaminated by fish nor will they add to their own weight by water absorption when they are launched, like a wooden hull. Plastic hulls do not have to be painted. The colour is impregnated into the resin at the time of manufacture. The colour can be changed, however, if desired by sanding down and painting it with a suitable paint. Plastic hulls can be made fire resistant. They are stronger than wooden hulls of the same weight and have greater resistance to impact. They are resilient and do not dent under impact. If a plastic hull is damaged in a collision the damage will be local—that is to say, there are no planks to split. A first-aid repair can be carried out in a matter of hours and a full scale repair takes less than one-tenth of the time required to repair a wooden hull. Plastic is a natural insulator and therefore will not sweat internally like metal. The largest plastic hulls in the world are built under Lloyd's Register survey, with bulkheads, tanks and engine foundations installed while the hulls are still in their moulds.—*Paper by P. D. De Laszlo, presented at the 2nd World Fishing Boat Congress, Rome, 5th-10th April 1959.*

Techniques and Equipment for Tank Coating

The application of coatings to internal tank structure today has become one of the most promising methods of controlling corrosion in tanker cargo compartments. The development of more efficient shipyard coating procedures is of paramount importance to cut costs and time. An adequate volume and continuous supply of compressed air must be maintained at the sand blasting nozzles. A minimum pressure of 90lb. per sq. in. is required for proper blasting. The use of Diesel powered compressor units is recommended. An air receiver tank stabilizes fluctuating pressures and provides for removal of entrained moisture. Inadequate air pressure results in lower blasting rates (sq. ft. per man hr.), higher sand consumption, and increased sand removal costs. Requirements for tank scaffolding for this work are much more severe than for normal repair work. The scaffolding must be safely designed to support the maximum load of labourers and accumulated abrasives. Poor visibility conditions must be considered. Adequate working space must be provided commensurate with the prevailing ventilation and working conditions. Only a minimum of tank structure can be covered or shielded so that shifting of staging is avoided as much as possible. The scaffolding should be easy to install and remove. It should not restrict tank ventilation nor interfere with ventilation ducts, sand removal equipment, or the like. A suspended, cable-pipe-ladder-type scaffolding has, under most circumstances, been found best for tank coating applications. It has been adopted already by many shipyards carrying out this type of work today. The cable pipe scaffolding involves the use of "hanging ladders" made from wire cable and pipe. These are suspended from the deck head for support of wooden planks or grating sections used as staging. Grating sections are more desirable as they provide less restriction to ventilation and allow all abrasives and debris to fall through to the tank bottoms. Forced ventilation in tanks being blasted and coated is a necessity. Adequate air capacity and proper installation are of prime importance. Forced ventilation supplies fresh air for men in the tank, maintains adequate visibility while blasting, and maintains minimum explosive concentrations while applying solvent containing materials. The air should be exhausted from the lower portions of the tank, permitting fresh air to enter through Butterworth and tank hatch openings. This downward flow takes advantage of the natural settling of sand dust. Air removal is accomplished through ventilation ducts extending to within 10ft. of the tank bottom. An alternate procedure is to cut openings in the lower strakes of segregating bulkheads and exhausting through the adjacent tanks. Lighting requirements in tank compartments vary with the type of work being carried out. Common light strings and pan-reflector type floodlights are adequate for staging, sand removal and general cleaning purposes. However, more specialized lighting is required for blasting, inspection, painting and final



Ventilation by exhausting air from lower tank portions takes advantage of natural settling tendencies of sand dust cleaning operations. Both general flood and spot lighting are desirable during blasting operations. Floodlights fitted with protective lenses provide general lighting to the work area. Sealed beam, 150-watt spotlights, either hand held or attached to the blast nozzle, provide concentrated light on the blast area. Both the floodlights and spotlights should be used by inspectors checking the quality of blasting. They also are suitable for use during application of explosive materials. All other lighting equipment must be disconnected and removed from the tanks. Precautions must be taken to prevent the entry of water into tanks being blasted or coated. Considerable expense is involved in repairing the damage that can be done by rain or wash water during this critical period. Translucent polyethylene sheets have proved to be effective rain shelters. Water guards of 4-in. flat bar should be tack welded around Butterworth and ventilation duct openings to prevent deck drainage from entering the tanks and ruining fresh blasted surfaces.—*J. F. Koehler, Marine Engineering/Log, June 1959; Vol. 64, pp. 62-65.*

Locating Damaged Reduction Gear Teeth

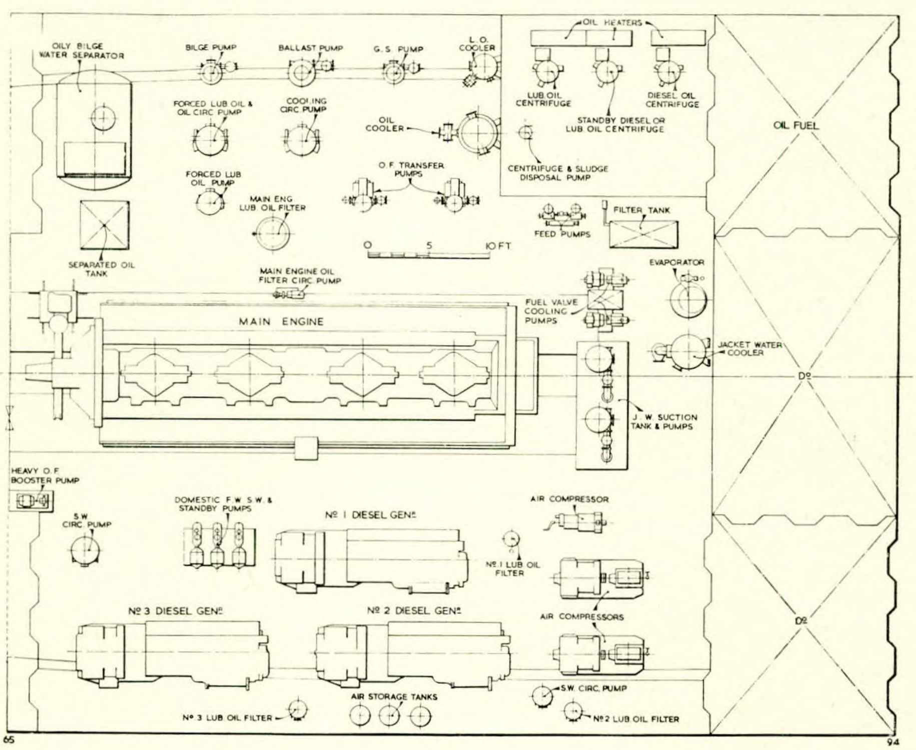
Damaged reduction gear teeth are located by use of the "Thump-O-Graph" method at the San Francisco Naval Shipyard. This method fixes the position of the damaged tooth in relation to a timing bump installed at a known position. Defective reduction gear teeth cause noise, but they are not easily located by visual inspection. On the main propulsion locked train type of double reduction gears found on most combat ships of the U.S. Navy, there are often as many as 1,500 gear teeth on 11 different gears rotating at various speeds. Large auxiliaries usually have either articulated or nested reduction gears with about 1,100 teeth on 7 different gears, also rotating at various speeds. Thumps from damaged gear teeth are often difficult to locate because of noise transmitted through the steel gear casings to other parts of the unit. After the noisy gear is found, tedious trial and error methods of inspection and correction are sometimes required to pinpoint the damaged tooth. Even slight damage may cause considerable noise and eventually result in failure of the teeth. The "Thump-O-Graph" method is based on the use of two vibration pick-ups feeding simultaneously through amplifiers into a two-channel recording oscillograph. One of the pick-ups is placed against the gear casing; it records on one channel of the oscillograph the vibration—or thump—resulting each time a damaged tooth on a gear meshes with the teeth of its mating gear. The other pick-up takes its excitation from a one-a-revolution timing bump that is artificially placed at a known position on the rotating gear element, under surveillance at a location where it will not damage the teeth. The vibration set up by this bump is recorded on the second channel of the oscillograph. Thus, the position of the thump caused by the damaged tooth is recorded on one channel of the oscillograph and the position of the once-a-revolution timing bump is recorded on the other channel. By simple subtraction of position difference, the location of the damaged tooth can be found in relation to the timing mark on the gear. Results have shown that damaged areas can usually be located by this method within a band width of two or three teeth.—*C. E. Alsop and C. G. Schrader, Bureau of Ships Journal, July 1959; Vol. 8, pp. 16-18.*

Cargo Motorship for Glasgow Owners

A recent addition to the fleet of H. Hogarth and Sons, Glasgow, is the cargo motorship *Baron Minto*, built at the yard of Sir James Laing and Sons, Sunderland. The vessel was built as a closed shelterdecker, but the tonnage well, hatch and openings have been so constructed that easy conversion to an open shelter deck type is possible with a minimum of modification. The principal particulars are:—

Length overall	449ft. 11½in.
Length b.p.	420ft. 4½in.
Breadth moulded	59ft. 6in.
Draught (summer)... ...	28ft. 6½in.
Gross tonnage	7,800 tons
Net tonnage	4,377 tons
Deadweight	11,550 tons
Speed on trial	14 knots

Built to the requirements of Lloyd's Register under special



Machinery arrangement in the Baron Minto survey, the vessel conforms to the latest requirements of the Ministry of Transport and Factories Act Regulations. The design is such that the vessel will be suitable to navigate the Manchester Ship Canal in the ballast arrival condition with the telescopic topmasts housed. The propelling machinery, built by Wm. Doxford and Sons (Engineers), Ltd., is of the latest diaphragm design, with oil cooled lower pistons and the new timing valve fuel injection system with C.A.V. injectors. The four cylinders each have a bore of 670 mm. and a combined stroke of 2,320 mm. The engine is designed to maintain in continuous service 4,400 b.h.p. at 112 r.p.m. The main piston speed is 850ft./min. and the maximum combustion pressure 640lb. per sq. in. It is a normally aspirated unit with two scavenging air pumps driven from Nos. 1 and 2 centre connecting rods. Although the engine is suitably arranged for operation on heavy oil, it is the owner's present intention to run it on Diesel oil. Provision has been made for the installation of suitable purifiers and heaters if the decision should be made later on to use boiler oil. On a flat at the forward end of the engine room is installed a Cochran vertical composite boiler 8ft. diameter by 20ft. 6in. high, having an oil fired heating surface of about 500 sq. ft. and an exhaust gas heating surface of about 890 sq. ft. It is designed for a working pressure of 100lb. per sq. in. and arranged to accept the exhaust gases from the main engine and also for simultaneous oil firing on the Wallsend low pressure air system.—*Shipbuilding and Shipping Record, 4th June 1958; Vol. 93, pp.725-728.*

Dutch Cargo Motor Liner

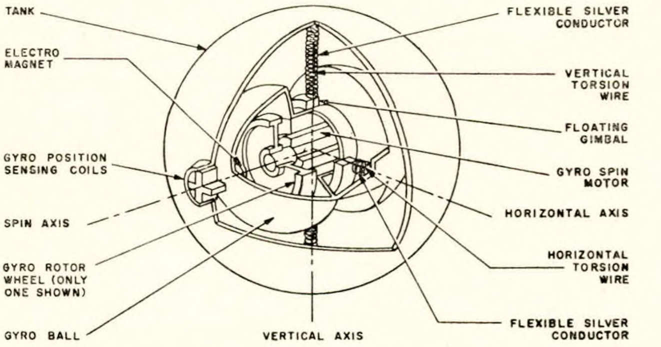
One of the latest additions to the fleet of the United Netherlands Navigation Company is the cargo motor vessel *Leiderkerk*, which has been built by N.V. Werf Gusto v.h. Firma A.F. Smulders, Schiedam. The ship is one of a series of three of which two have been constructed in Germany. The principal particulars of the vessel are as follows:

Length overall	479ft. 2½in.
Length b.p.	440ft.
Breadth moulded	66ft.
Draught (winter)	28ft. 3¾in.
Deadweight	11,510 metric tons
Draught (summer)	28ft. 10⅞in.
Deadweight	11,917 metric tons
Service speed	14·5 knots
Trial speed	14·7 knots

Constructed to the highest class of Bureau Veritas, the ship has five cargo holds, of which three are situated forward and two aft of the amidships deckhouse. The hatchways of the weatherdeck are covered by means of MacGregor hatch covers; those of the other decks are of the normal wooden type. The cargo handling gear includes one 120-ton heavy derrick, which is attached to the second mast, forward, and a 50-ton derrick attached to the third mast, aft. The 120-ton derrick serves No. 2 and the 50-ton derrick serves No. 4 hold. In addition to this heavy gear the cargo handling facilities include five 10-ton and eleven 3(5)-ton derricks. The main propulsion machinery of the ship consists of an eight-cylinder, two-stroke direct reversing Stork HOTLo Diesel engine, arranged for the use of heavy oil with a viscosity of maximum 3,000 sec. Redwood I at 100 deg. F. The engine is supercharged and has a maximum output of 6,500 h.p. at 132 r.p.m. Each of the cylinders has a bore of 630 mm. and a piston stroke of 1,350 mm. The cylinder liners are chrome hardened in accordance with the Porus Krome-Van der Horst process. The engine drives a Lips screw, giving the ship a service speed of about 14·5 knots.—*Holland Shipbuilding, May 1959; Vol. 8, pp. 46-48; p. 55.*

Gyro Compass

The British gyro compass manufacturing firm of S. G. Brown, Ltd., has introduced a novel design of gyro compass for marine use, far smaller than anything else previously available. The Arma Brown gyro can be used either as a North-seeking compass or as a directional gyro. Externally, the chief feature of the Arma Brown gyro compass is its small size. The complete self-contained unit can be contained within a cube about 10¼in. square, and weighs about 30lb. It can be mounted on a small bracket in the chart room or wheel house. The only additional equipment necessary is a motor/generator set, which is supplied separately. The compass will perform all the functions of a gyro compass, supplying information to operate all types of repeaters, automatic helmsman, and inputs to D/F and radar. It will also work with all existing installations of Brown auxiliaries. The compass is unaffected by vibration, rolling, or any of the effects of bad weather. This makes it suitable for installation in small vessels with lively motion at sea. The design of the compass is made possible



Cutaway diagram of sensitive element

by the suspension system employed. This is a type of fluid suspension in which the gyroscope itself is maintained in position by means of filaments. The gyro is encased in a hermetically sealed spherical housing, which in turn is completely immersed in a sealed tank containing a high density fluid. The gyro ball is immersed at neutral buoyancy in the tank, and this dispenses with the need for any form of bearings. Although suspension is established without the need for horizontal and vertical supports, this in itself is not sufficient. Some means of measuring the misalignment between the container and tank in both azimuth and tilt must be used. This is achieved by using electro-magnetic pick-offs set in the same plane as the gyro spin axis, the electro-magnets being within the gyro ball and the pick-off coils on the tank. The pick-offs immediately register any movement in tilt or azimuth, and since they form part of the azimuth and tilt servo (follow-up) loops, the gyro ball and tank will be "slaved" one to the other. The use of filaments satisfies the requirement to keep the gyro ball centred within its gimbal and the gimbal within the tank, but also—and of even more importance—provides the method of applying torque about the vertical and horizontal axes. Two flexible filaments known as horizontal torsion wires are fitted between the gimbal and the ball, and two flexible filaments known as vertical torsion wires between the gimbal and tank. Any measurable angular offset between the ball and the gimbal or between the tank and the gimbal will twist the torsion wires and produce torque about the horizontal and/or vertical axis. —*The Shipping World, 17th June 1959; Vol. 140, p. 598.*

Wetness Related to Freeboard and Flare

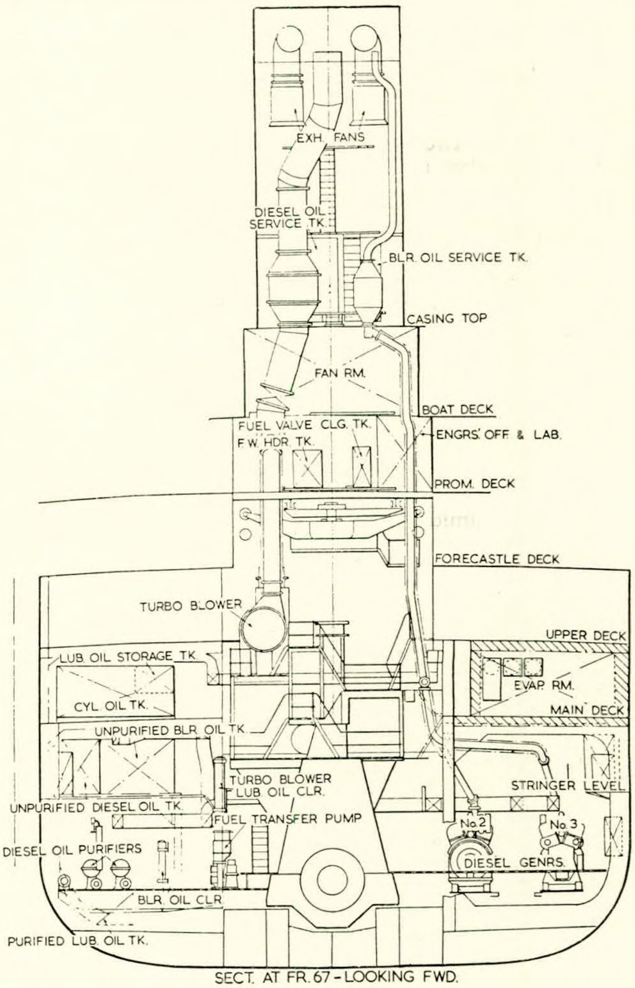
In this paper data obtained from investigations at the Admiralty Experiment Works in recent years are used to develop a method of comparing the wetness of ships in terms of certain characteristics of the ship and of the waves encountered. Three degrees of wetness, designated dry, wet, and very wet, corresponding to the dry, heavy spray, and green sea conditions in head seas are used to define the behaviour of a model in this respect. The results, plotted non-dimensionally, present a family of curves or "wetness contours" of which the main parameter is Froude number. It is shown that these wetness contours are common to models of fine form for which the coefficients of underwater form vary appreciably and that freeboard forward has a most important influence on the degree of wetness. The influence of variation of radius of gyration or longitudinal metacentric height is less marked and more difficult to take advantage of in design for practical reasons. The degree of wetness is associated with the probability of occurrence of waves of varying length and height in the North Atlantic, by a statistical method, to obtain another family of curves relating the annual incidence of wetness, as a percentage of a year, to the length of ship, for different freeboard coefficients and Froude numbers. Different families of curves, but of similar trend, apply to different ocean areas. The trend indicates that, for a specified annual incidence of wetness, the freeboard coefficient should increase up to a "critical" length of ship and decrease for ships of greater length. The effect of increased flare, obtained by incorporating a knuckle below the forecastle, is also treated as an "equivalent increase in freeboard" and shown to follow the same trend in influence on wetness. A tentative formula for assessing the equivalent freeboard of a knuckle of given position and shape, or *vice versa,* has been obtained from the limited data available. Suggestions are made for arriving at a single curve for a given ocean area, or as many curves as the oceans traversed by a vessel in service, as a standard, or standards, on which to base the assignment of freeboard in a new design with some guarantee of avoiding an undesirable degree of wetness.—*Paper by N. N. Newton, read at the Summer Meeting of the Institution of Naval Architects, 11th June 1959.*

$16\frac{1}{2}$-knot Motor Cargo Liner

The *Memnon* is the fourth of a class of six ships for the Blue Funnel Line, three of which—the *Menestheus, Menelaus* and *Machaon*—were built by the Caledon S.B. and E. Co., who have one more on order, while the *Memnon* has been constructed by Vickers-Armstrongs (Shipbuilders), Ltd., Walker-on-Tyne, who also have one more to build for these owners. All are propelled by Harland B. and W. type turbocharged two-stroke, opposed piston engines, each with an output of 8,500 b.h.p. at 115 r.p.m. Essentially, this M-series is a development of the six D-class ships, but nevertheless the latest vessels represent an entirely different class. Although the engines for each of the two types—D-class and M-class—are the same, the latter are rated for a higher output. The main characteristics of the two types of ships are as follows:—

	Demodocus	*Memnon*
Length o.a.	491ft. 5in.	494ft. 8in.
Length b.p.	452ft. 9in.	455ft. 0in.
Breadth, moulded ...	62ft. 0in.	65ft. 0in.
Depth, moulded to upper deck	35ft. 3in.	36ft. $0\frac{1}{2}$in.
Loaded draught ...	28ft. 5in.	28ft. $10\frac{1}{4}$in.
Corresponding deadweight, tons ...	9,100	9,770
Gross register, tons ...	7,960	8,500
Service speed, knots ...	16	$16\frac{1}{2}$
Machinery	8,000 b.h.p. at 112 r.p.m.	8,500 b.h.p. at 115 r.p.m.
M.I.P. lb. per sq. in. ...	95	103

Frame spacing throughout the greater part of the ship is 36in., and the framing is transverse except under the centre castle deck. All framing is riveted to the plates, the butts being welded. The longitudinals are riveted. The main engine is a Harland B. and W. type turbocharged unit, the six cylinders having a bore of 750 mm. and a combined piston stroke of 2,000 mm. (1,500 mm. for the lower piston and 500 mm. for the upper). Diesel oil will be used in the main engine only during manœuvring periods, boiler oil being consumed at all other times. Above the cylinder tops is mounted a new type of Carruthers engine room crane running fore and aft on rails, but also arranged for slewing. Constructed for 7-ton lifts, this crane has a jib which can be slewed in any direction, thus enabling it to reach to the farthest sides of the engine room casing. It is electrically operated for hoisting and for fore and aft travel, but hand operated for slewing. An unusual system of engine room ventilation has been adopted: four Davidson double-unit contra-flow 16,000 cu. ft./min. supply fans deliver air into a common chamber, or plenum, at the top of the engine room and abaft the engine casing room, where it is distributed at the various points throughout the machinery space by a series of ring mains. Circulation is completed by two exhaust fans at the top of the funnel. Instead of having two economizers for the auxiliary Diesel engine exhaust gas, as in the previous series, the *Memnon* has three of John Thompson manufacture, each to produce 250lb./hr. of steam, while the main engine economizer can produce 2,500lb./hr. at 120lb. per sq. in. These operate in conjunction with a John Thompson-LaMont single-header type watertube boiler situated near the top of the engine.



M.S. Memnon *engine room*

Entirely automatic in operation, this compact unit is designed to operate throughout on boiler oil and to work continuously (without cutting out) when producing from 3,500lb./hr. of steam down to 500lb./hr. Below 500lb./hr. output it cuts in and out automatically. There are two electrically driven fuel pumps, one an l.p. unit and the other h.p. When the boiler is not in use steam can be used for the various duties directly from the economizers. The *Memnon* is the first ship of the class to have the auxiliary boiler arranged for operation on boiler oil only.—*The Motor Ship, June 1959; Vol. 40, pp. 124-129.*

Russian Tanker

The Soviet oil tanker *Pekin* was launched from a Baltic shipyard in December 1958. This is the largest cargo ship of the Soviet merchant fleet. She is of the normal three-island type with forecastle, central superstructure, and poop; these erections are joined by a catwalk under which are laid pipe-lines and electrical cables. The principal particulars are as follows:

Length, o.a.	665·4ft.
Length, b.p.	616·8ft.
Breadth, maximum ...	84·6ft.
Depth, amidships ...	44·9ft.
Draught, summer load line ...	35·0ft.
Displacement at full load	39,770 tons
Deadweight	30,460 tons
Gross capacity of cargo tanks ...	1,420,000 cu. ft.
Speed (at draught of 34ft.)	18 knots (approximately)
Crew	57 persons

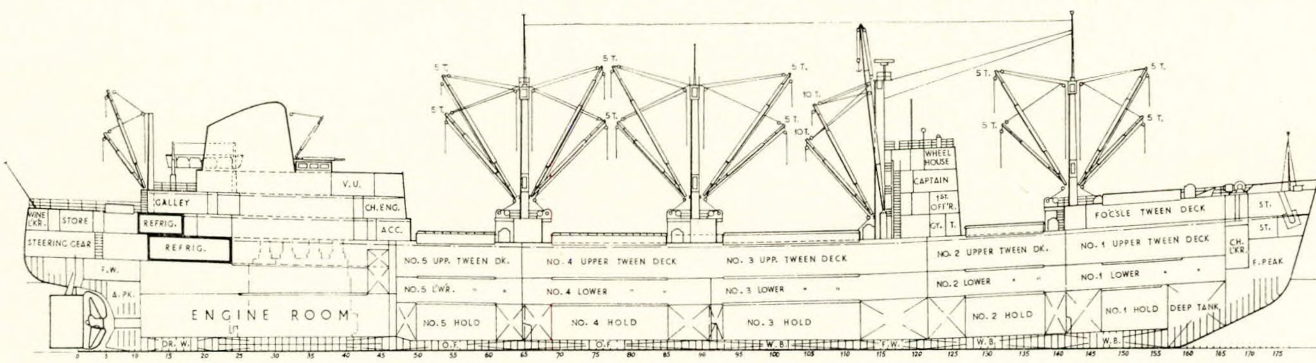
The tanker is intended for the transport of any grade of oil, and can carry up to three grades simultaneously, the maximum range being 10,500 miles. Thirty tanks are formed by two longitudinal and eleven transverse bulkheads. The hull is all welded except for the deck stringer angle and sheerstrake, and the crack arresting seams of the longitudinal bulkheads at the upper deck and at the turn of the bilge, which are riveted. The longitudinal framing system has been adopted for the deck, bottom, and sides in the region of the tanks and engine room; and the transverse system in the forward part of the vessel, aft of the engine room, and for the flats. Highly stressed hull components are made of high strength, low alloy steel. The vessel is propelled by a geared turbine installation with a nominal output of 19,000 h.p. at 110 propeller r.p.m. This comprises an h.p. and an l.p. turbine (two-casing arrangement), a two-pass condenser, and double-reduction gearing which incorporates a thrust bearing. There are three bleed points for regenerative feed water heating. Steam is supplied by two boilers, each with a nominal output of 34 tons of steam per hr. The pressure at the superheater outlet is 626lb./sq. in. (abs), and the temperature 880 deg. F. An automatic combustion control system is fitted. The diameter of the five-bladed propeller is 22·2ft. and the weight is 29·5 tons. Electric power is provided by three turbogenerators (one reserve), each with an output of 600 kW at 380 V, operating on superheated steam. The steering gear is of the electro-hydraulic type.—*N. L. Kuzmichev, Sudostroenie, 1959; Vol. 25, No. 3, pp. 1-6. Journal, The British Shipbuilding Research Association, May 1959; Vol. 14, Abstract No. 15,291.*

French Cargo Liner for Great Lakes Trade

The first of two cargo liners specially designed for regular service between France and the Great Lakes has been completed. This vessel, the *Chicago*, 7,500 tons d.w., was built by Chantiers et Ateliers de Provence, Port-de-Bouc. As will be noted from the accompanying drawings, the *Chicago* has her machinery arranged aft, and there is a specially long hold on the upper deck for the carriage of motor cars and lorries. The principal particulars of the *Chicago* are as follows:—

Length o.a.	450ft. 2in.
Length b.p.	423ft. 2½in.
Breadth, moulded	62ft. 5in.
Depth to upper deck ...	36ft. 5in.
Depth to main deck ...	25ft. 0in.
Draught	23ft. 8in.
Deadweight	7,500 tons
Service speed	13·5 knots
Machinery output ...	7,000 b.h.p.
Cargo capacity:	
Bale	466,683 cu. ft.
Refrigerated	17,655 cu. ft.

The *Chicago* has been built with three continuous decks and is divided into eight compartments by seven watertight bulkheads reaching to the upper deck, with the exception of the bulkhead between Nos. 3 and 4 holds which stops at the main deck. There are five cargo holds and these are all arranged forward of the engine room, apart from the refrigerated chambers which are aft. This arrangement enables more cargo to be carried than when the engine room is amidships and facilitates the loading and stowage of cargo. The *Chicago* has three bipod masts, two linked samson posts immediately abaft of the bridge structure, and two separate ones aft. The bipod masts carry twelve 5-ton derricks, the samson posts amidships carry a 30-ton heavy-lift derrick and two 10-ton derricks, and the after masts two 2-ton derricks for handling the refrigerated cargo. The operation of the derricks and the heavy-lift derrick is effected by means of 17 electric winches. The propelling machinery in the *Chicago* consists of a four-cylinder turbocharged Provence-Doxford engine type 70LBDS4 built by the Ateliers de Marseille des Chantiers de Provence. This engine has cylinders of 700-mm. bore and 2,320-mm. combined stroke, and develops 7,000 h.p. at 118 r.p.m. Two Brown Boveri turbochargers are fitted and it is believed that the engine is the first of its type to be built without scavenge pumps. It is designed to operate on heavy fuel of 3,500 secs. Redwood at 38 deg. C. A battery of Alfa-Laval type PX self-cleaning separator/purifiers has been installed. Steam for heating the fuel oil and for the various services on board is obtained from a Sulzer waste heat boiler fitted in the main engine exhaust gas line. When in port steam is supplied by a Foster Wheeler oil fired boiler built under licence by the Chantiers de Provence. This boiler is entirely automatic.—*The Shipping World, 17th June 1959; Vol. 140, pp. 593-594.*

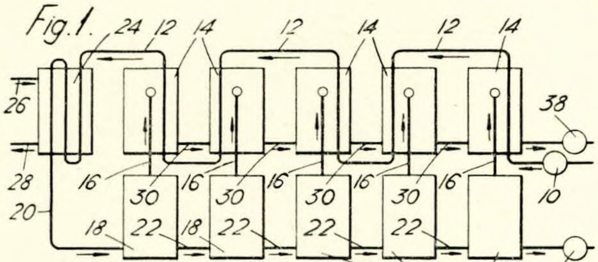


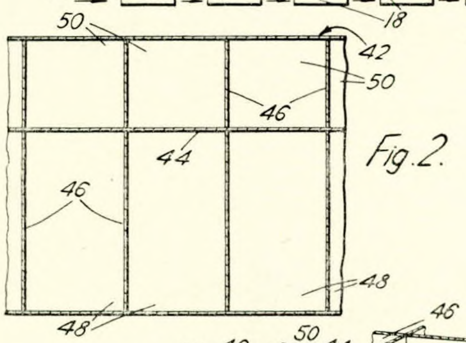
General arrangement of the cargo liner Chicago, *7,500 tons d.w., built by the Chantiers et Ateliers de Provence, Port-de-Bouc, for the Compagnie Générale Transatlantique*

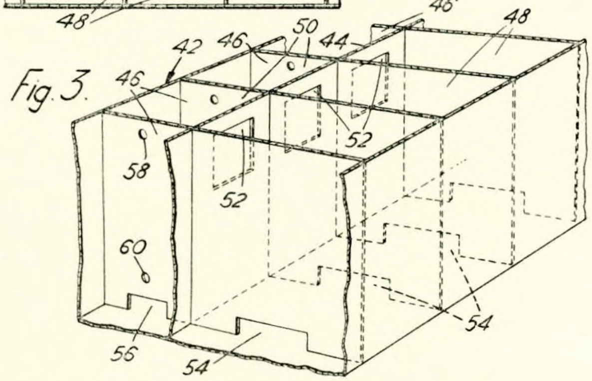
Patent Specifications

Flash Evaporator

In the flash evaporator arrangement shown in Fig. 1 the liquid to be evaporated is pumped by a circulating pump (10) along the tubes (12) through a series of heaters (14) in which it is gradually brought to a higher temperature by the latent heat of condensation of vapour which is passed into heaters (14) through passages (16) from a series of flash chambers (18) supplied with heated liquid from the heaters through the tubes (20 and 22). Before being passed into the flash chambers (18), the liquid is heated further in a heater (24) which is supplied with live steam through the tubes 26 and 28. Distillate which condenses in the heaters (14) is removed through the communicating passages (30) by a distillate pump (38), and the liquid in the flash chambers (18) which is not evaporated is similarly removed through the communicating passages (22) by the pump (40). According to the invention, the heaters (14)







and the flash chambers (18) are located side by side in a rectangular vessel, part of which is shown at 42 in Figs. 2 and 3. This vessel is divided into separate compartments by a longitudinally-extending vertical partition wall (44) and a number of transversely-extending vertical partition walls (46). The compartments (48) formed on one side of the wall (44) serve as flash chambers while the compartments (50) formed on the other side of the partition wall serve as heaters. Those walls which have a pressure drop across them in operation of the evaporator can be of part-cylindrical shape if convenient. The flash chambers (48) and the heaters (50) shown in Figs. 2 and 3 operate in the same way as the flash chambers (18) and the heaters (14) shown diagrammatically in Fig. 1.—*British Patent No. 815,796 issued to Richardsons, Westgarth and Co., Ltd. Complete specification published 1st July 1959.*

Suspension of Heating Coils in Cargo Tanks

In tankers the tank heating coils are exposed to damage of both a chemical and mechanical nature. In view of the danger of corrosion, cast iron pipes are to be preferred. With such pipes, however, the risk of mechanical damage is more serious, as cast iron parts are more liable to damage from blows and bending actions than for instance a seamless steel tube. Owing to the periodical heating, to which the coils are exposed, great variations in their length will occur, and during the voyage the different parts in the lower part of the ship will move to a certain extent in relation to each other. Great attention must therefore be paid to the mounting of the coils, in order that they may not be rigidly secured to the bottom structure of the ship. The invention is concerned with coils which are composed of pipe parts provided with end

Fig. 1

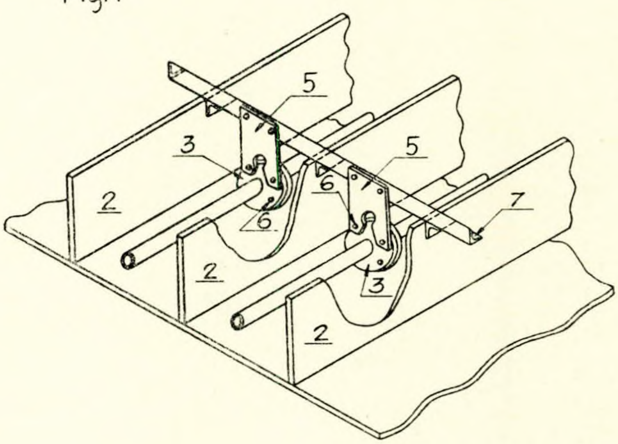
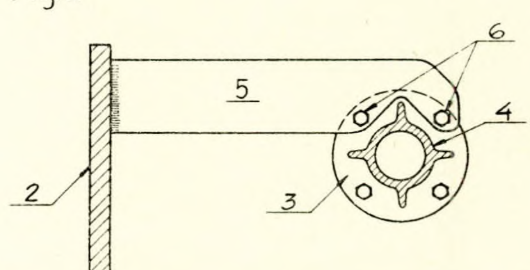


Fig. 2

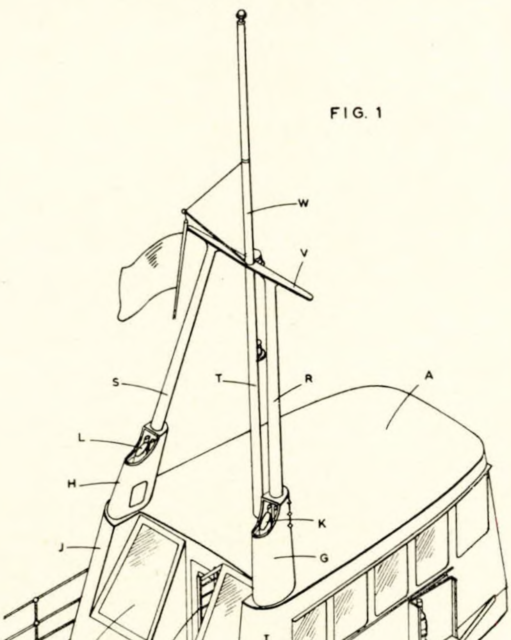


flanges whereby straight runs of the pipe parts are connected end to end. The invention is mainly characterized in that such coils are supported by the longitudinal frames of the ship by means of suspension members in the form of plates. These plates are arranged with their faces at right angles to the longitudinal axis of the pipe parts and are connected to them by means of bolts, forming part of the flange connexions. The thickness and the free length of the plates are so selected that the members will be resilient and thus allow a movement of the pipe parts parallel to the longitudinal frames. Fig. 1 shows the lower part of a cargo tank in which the suspension members are attached to an angle bar, which is supported on the frames, while Fig. 2 shows a cross section close to a longitudinal frame, where the suspension members are welded directly to the sides of the frames.—*British Patent No. 815,888 issued to Aktiebolaget Götaverken. Complete specification published 1st July 1959.*

Deck Arrangement for Tugs

This arrangement relates to deck arrangements of tugs and similar small vessels and has for its object to enable the need for excellent all round visibility to be achieved. The invention is particularly applicable both to Diesel tugs and steam tugs, and in the case of Diesel tugs provides for silencers installed in the engine room rather than in the funnel. Funnels are dispensed with and exhausts or uptakes are led through the aftermost corners of an enlarged wheelhouse. The wheelhouse is so constructed that there is a clear view aft through large windows and doors on the centre line. The continuation of the wheelhouse trunks forms the after legs of a tripod mast. The effluent leaves the mast through suitable apertures at a suitable level in a sternwards direction. The wheelhouse is so constructed that complete all-round visibility is obtained, and the after side of the wheelhouse may be entirely, or in part, all glass with metal or wood framings. Figs. 1 and 2 show the proposed form of wheelhouse and deck arrangement which is applicable both to Diesel tugs and steam tugs. Funnels are dispensed with, and the exhausts or uptakes are led through the aftermost corners of an enlarged wheelhouse having a roof or top deck (A). B is the main deck of the tug, and C an entrance door from the main deck to the wheelhouse. There are side windows (E) which, together with those on the port side and ahead, afford substantial all-round visibility. G and H represent metal trunks or fairings projecting upwardly from the aftermost corners (I and J) of the top deck (A), and these trunks or fairings house exhaust outlets (K and L) where the ship is internal combustion engine driven, or uptakes in the case of steam tugs.—*British Patent No. 816,403 issued to Burness, Corlett and Partners Ltd., E. C. B. Corlett and the Manchester Ship Canal Company. Complete specification published 15th July 1959.*

FIG. 1



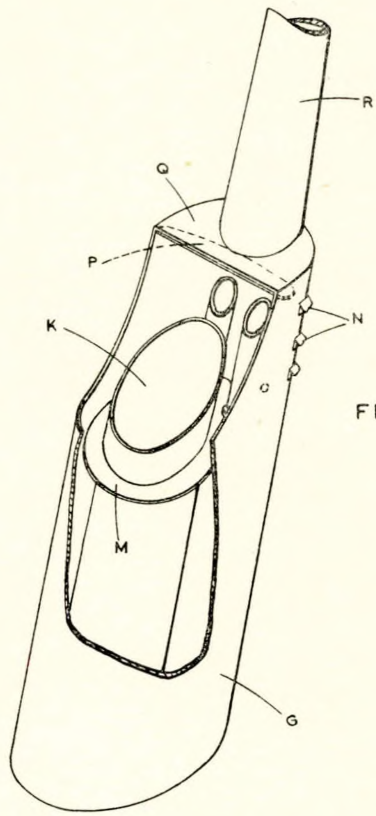
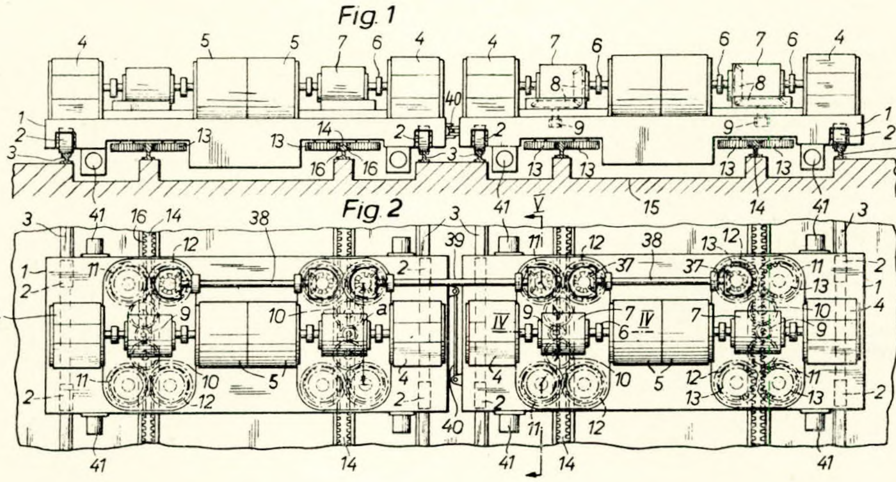


FIG. 2

Ship's Stabilizer

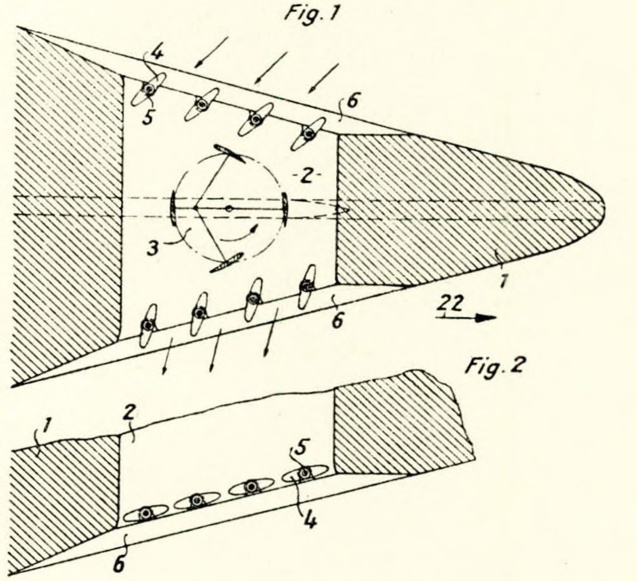
This invention concerns a stabilizer which is intended to produce very great stabilizing effects. For this purpose two travelling trucks are used which are arranged one behind the other in longitudinal direction of the ship, and side by side in the direction of travel respectively, so that the free travelling path provided between the ship sides will by no means be shortened by adding a second truck. Mounted on each of the two travelling trucks are two drive units; they are also arranged one behind the other in longitudinal direction of the ship. Referring to Figs. 1 and 2, the single truck chassis (1) is supported on four spring mounted travelling wheels (2), which are able to roll on rails (3) extending in transverse direction of the ship. Each drive unit comprises two coaxial electromotors (4 and 5) mounted on the truck (1). The casing of the inner motor (5) is combined with the casing of the motor (5) of the second drive unit. By means of couplings (6) the motors are operatively connected to an equalizing gear (7) and the latter is connected by intermediary or bevel gearing (8) to a pinion (9). Engaging this pinion are two gears (10) of two-gear transmission trains (10, 11, 12) which are situated symmetrically to the longitudinal centre plane of the travelling truck. The gears (11 and 12) are connected each to a driving gear wheel (13) having a vertical axis. The gear wheels (13) are meshing in



pairs at two contact points transversely spaced by a distance "a", with a toothed rack (14), which is mounted in the ship body (15) at right angles to the longitudinal direction of same. The rack illustrated is provided with teeth (16) at either side of its head portion.—*British Patent No. 817,434 issued to Schweizerische Lokomotiv und Maschinenfabrik. Complete specification published 29th July 1959.*

Bow Propeller Duct

This invention relates to apparatus for closing transverse ducts in ships' hulls having propulsive means arranged in these transverse ducts. A known arrangement in ships is the provision of special propellers which are not continuously used and which are intended as steering means. One proposal in this connexion, for instance, is the provision of a moving vane type propeller, especially a high speed cycloid propeller. This type of propeller offers the special facility of permitting the whole of its race to be projected into any desired direction merely by the displacement of the control centre of the rod linkage which controls the vane oscillation. Fig. 1 shows the hull (1) of a ship with a transverse duct (2) and a moving vane type propeller (3) located in the duct. The ends of the transverse duct (2) can be closed by several flaps (4) in the manner shown in Fig. 2. Conveniently, the flaps are arranged to leave gaps between them when they are closed to avoid seaweed or the like from collecting and preventing the flaps from becoming properly closed. The flaps (4) are rigidly affixed to hinges (5) rotatably mounted in the ship's hull, and operated by a servo motor not specially shown. To protect the moving vane propeller (3) from damage by floating debris such as ice and pieces of timber, bars (6) are arranged to extend across the open ends of the transverse duct. Since the flaps (4), when they are open, have a supplementary rudder effect, their positions at either end of the duct is not always the same, as is illustrated in Fig. 1, and their angles of deflexion may differ according to the rudder effect it is desired to produce. In the illustrated form of construction the hinges (5) of the flaps (4) are arranged behind the bars (6) in such a way that when fully



open the flap edges will just be located in the plane of the outer skin of the hull.—*British Patent No. 817,608 issued to J. W. Voith, G.m.b.H. Complete specification published 6th August 1959.*