Marine Engineering and Shipbuilding Abstracts

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* Patent Specification

Motor Tanker for East Asiatic Company

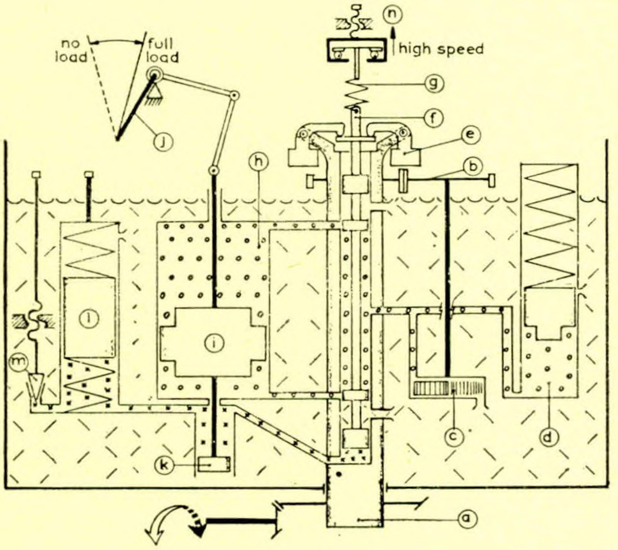
The first of a series of oil tankers ordered from A/S Nakskov Skibsvaerft, Denmark, by the East Asiatic Co., Ltd., Copenhagen, has entered service. This vessel, the *Annam,* 18,500 tons d.w., is of considerable interest in view of the fact that she is believed to be the first ship to be built in Denmark with the assistance of an electronic computer. The *Annam* is powered by a turbocharged B. and W. Diesel engine giving her a service speed of about 15 knots. Considerable use is made of the waste heat from the main engines, and under normal service conditions the steam obtained from the waste heat in the exhaust gases is used for driving a 350-kVA turbo-alternator. The heat from the fresh water cooling system is used in a fresh water generator. The principal particulars of the *Annam* are as follows:—

Length o.a. ...	559ft. 10in.
Length b.p. ...	535ft. 4½in.
Breadth, moulded ...	72ft. 4in.
Depth, moulded ...	39ft. 3in.
Draught ...	30ft. 0in.
Deadweight ...	18,500 tons
Gross tonnage ...	12,500 tons
Machinery output ...	10,000 b.h.p.
Service speed ...	16 knots

The *Annam* has been built without sheer from the forecastle to the poop and, apart from the bilge strake, sheer strake and stringer angle is of welded construction. The framing in the fore part and after part, i.e. away from the cargo tanks, is riveted. Oil cargo is carried in nine centre tanks and 12 side tanks having a total capacity of 895,000 cu. ft. A dry cargo hold having a capacity of 29,300 cu. ft. (grain) is arranged in the forecastle. The cargo oil is handled by four vertical Carruthers' pumps, each of 500 tons per hour capacity. There are also two vertical stripping pumps, each of 100 tons per hour capacity, also supplied by J. H. Carruthers and Co., Ltd. These pumps are arranged in two pump rooms, one between Nos. 3 and 4 centre tanks and the other between Nos. 6 and 7 centre tanks. The forward pump room contains two steam-driven 80 tons per hour duplex pumps, one for bilge and ballast duties and one for oil fuel transfer. Both have been supplied by Dawson and Downie, Ltd. The pump rooms are ventilated by means of steam turbine driven fans. For gas freeing the tanks, Meco steam driven fans are used. The oil cargo tank heating coils are of Alacoil 2-in. piping supplied by Steels Engineering Installations, Ltd. The *Annam* is powered by an eight-cylinder B. and W. Diesel engine, type 74-VTBF-160, fitted with two turbochargers of B. and W. design. The engine has a rated output of 10,000 b.h.p. at 115 r.p.m. and a m.i.p. of 8 kg. per sq. cm. Arrangements have been made for the engine to operate on heavy fuel. The speed on trials was estimated to be about 16 knots with an engine output of about 8,400 b.h.p., which corresponds to about 85 per cent of the maximum power. Heat is recovered from the fresh water cooling system by means of a 36-tons per hour Atlas fresh water generator. Recovery of the waste heat in the exhaust gases is effected by means of a Spanner down-flow exhaust gas boiler having a capacity of 3½ tons of saturated steam per hour at a working pressure of 12 kg. per sq. cm. with the engine running at 80 per cent load. Under normal service conditions, steam from the Spanner boiler is sufficient to operate a 350-kVA turbogenerator of Atlas make. The steam supply is automatically controlled by an electric motor driven valve in direct line with the turbocharger outlets and the Spanner boiler and exhaust outlet. When the vessel is at sea the load on the generators is reduced considerably by using the hydraulically driven salt water and fresh water cooling pumps. In the *Annam,* the cooling water and lubricating oil pumps are hydraulically driven from the main engine propeller shaft by means of an IMO pump supplying oil at 12 kg. per sq. cm. to an IMO motor. The discharge side of the IMO motor is directly connected with the main engine lubricating and cooling oil system. Standby electric motor driven pumps for the above-mentioned duties have been installed for manœuvring and slow running. One advantage of this system is that the main engine, under normal service conditions at sea, is independent of the usual electrically driven or steam driven lubricating oil, fresh water and salt water cooling pumps.—*The Shipping World, 10th December 1958; Vol. 139, pp. 511-514.*

Hydraulic Governor

The Curtiss-Wright governor has been successful in power generation, marine propulsion and compressor applications, as well as turbines. The hollow shaft which is shown in the accompanying diagram is driven by the engine. This shaft carries a yoke with two flyweights at the top. Through gears it drives the oil pressure pump. The pilot valve is inserted in the shaft. The flyweights are arranged so that as they move outward, they move the pilot valve downward against the tension of the speeder spring. In neutral, the two lands of the pilot valve cover the upper and lower canals to the power cylinder. This piston rod is connected to a crank on the terminal shaft which is attached to the fuel linkage. If the load is thrown off, the engine tends to increase speed so the flyweights move out and move the pilot valve down. This action lets oil under pressure go to the underside of the power piston, forcing it upwards and decreasing fuel. Then the balance system takes over. As the power piston moves up-



wards, the balance piston displaces oil in the balance system; the proportioner piston, floating between two loaded springs, is pushed upwards against the proportioner spring until it compresses it to a force equal to the offspeed force of the pilot valve downward. Consequently the pilot valve is pushed up and closes the two canals to the power cylinder. When the pilot valve is back at centre, the power piston is stopped at a decreased fuel position and the proportioner piston is above its neutral centre position. The proportioner piston moves back to the centre as the compensating oil bleeds off through the needle hole. This acts to hold an upward pressure on the pilot valve to keep it from opening again as the engine comes back to speed. The needle valve must be adjusted in such a way that the oil stored by the proportioner piston bleeds back to sump at the same rate with which the engine is capable of coming back to speed. The proportioner is then recentred; thus, whenever the power piston moves, the compensation system exerts pressure or suction on the controlling element (pilot valve) to reposition it and wait for the engine to respond. —*Holland Shipbuilding, November 1958; Vol. 7, pp. 62-63.*

Self-discharging Super Collier

One of the most interesting ships to enter service during last year was the super collier *Consolidation Coal,* which was named and carried out trials on the same day early in October. The first of her type to be built, this self-discharging collier carries 24,000 tons of coal, twice the cargo capacity of the conventional collier. Her unique conveyor system can unload coal at the rate of 3,600 tons per hour. For maximum flexibility, there are two discharge rates, a low speed up to 1,800 tons per hour, and high speed up to 3,600 tons per hour. Of the single-screw, flush deck type with fo'c'sle, the ship has a raked stem and cruiser stern. The principal particulars are: —

Length overall	635ft. 0in.
Length b.p.	610ft. 0in.
Breadth moulded	75ft. 0in.
Depth moulded to upper deck	47ft. 0in.
Draught	32ft. 6in.
Cargo capacity	1,000,000 cu. ft.
Service speed	15 knots

The eight specially designed holds of the super collier are loaded through conventional hatches on the upper deck. Discharge is entirely by means of her built-in automatic equipment. The 24,000 tons of coal she carries run by gravity through 159 hoppers at the bottom of the holds. The hoppers have 36-in. × 52-in. hydraulically operated gates, which are opened to allow the coal to feed on to three horizontal conveyor belts. These belts, 42in. wide and 435ft. long, run under all the holds, forward to two elevators. Each belt has a capacity of 1,200 tons of coal per hour. Coal from the horizontal belt conveyors is fed into the buckets of two 84-ft. elevators, each of which has a capacity of 1,800 tons per hour. These inclined twin elevators carry the coal up to the deck level where it is transferred to the conveyor belt of the boom. Pivoted at the spar deck, the 250-ft. long boom can swing through a horizontal arc of 89 degrees on either side of the ship and can be raised to permit piling coal 60ft. high. The boom can discharge into a hopper or sweep in a series of arcs to stockpile coal on a ground storage area. The super collier can also discharge into a barge moored alongside. Push button operations allow complete and instantaneous control over all self-loading mechanism. The communications system includes special intercom arrangements to all sections of the ship. One of the ship's most valuable features is a dust free discharge system that allows high speed discharge of dry coal without air pollution. This is accomplished by the application of detergent spray at the boom tip, ending the dust nuisance of conventional discharge operations.—*Shipbuilding and Shipping Record, December 1958; Vol. 12, pp. 799-800.*

Flange-spreading Tool

The flange-spreading tool designed and manufactured by the Borer Engineering Company, of Croydon, Surrey, for the oil industry, is now being applied to other industries which use bolted type flanges for joining pipes, and is in great demand where the breaking of pipe flanges is required. The tool, illustrated in Fig. 7, replaces wedges in the opening of bolted type pipe flanges and is a quicker and safer method of operation. It is claimed that with the flange spreader, the quicker breaking of joints saves the valuable time of skilled workmen and is safer than using wedges or chisels, as there is no danger of flying parts during the removal period. As the leverage is under control, no damage is caused to the faces of the flanges, which can also be held apart to enable workmen to clean or prepare the joints. The tool can be used in confined spaces and it is further claimed that there is no danger of explosions or fire due to sparks. The operation of the flange spreader is simple. After removing all the bolts and nuts, the pin of the

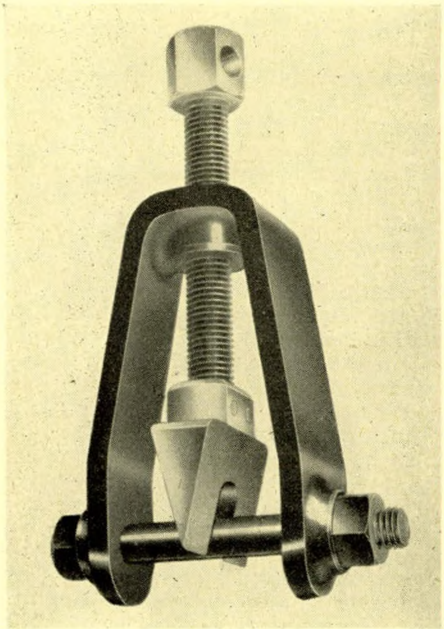


FIG. 7—*Flange-spreading tool*

spreader is inserted in the bolt hole and then the wedge is inserted between the flanges by tightening the drive screw. The prototypes, tested on oil pipe lines, were used in pairs mounted diametrically.—*The Shipbuilder and Marine Engine-Builder, November 1958; Vol. 65, p. 646.*

Refuelling Nuclear Ships

Present shipboard reactors are top unloaded. This indeed is a satisfactory and safe method for defuelling. An even safer way—and much less time consuming—is the method of *bottom* unloading. In other words, the spent fuel elements are pushed out through the bottom of the reactor through a water chute, where they drop into a water canal under the reactor. This practice is used very successfully at the Materials Testing Reactor, Idaho Falls. Possibly this method could be adapted to shipboard reactors. If so, the defuelling procedure might go something like the following: The nuclear ship would moor into a graving dock, and the water would be pumped out in normal dry docking procedures. Adequately below the dock, there would be a spent fuel transfer canal (see Fig. 6). From this canal, a hydraulically operated caisson (with appropriate water locks and guide surfaces to keep the fuel elements upright) would rise up through the graving dock floor. Simultaneously, a hydraulically operated defuelling port in the ship's bottom would open up. The graving dock caisson would then attach to a defuelling adaptor permanently designed as part of the mounting structure of the reactor shell. Then the bottom of the reactor shell would open up making a complete U-tube water head between the water level in the reactor and that in cooling pits alongside of the graving dock. It would then be a matter of remotely unlocking the spent fuel elements (by integral mechanisms in the reactor shell design) and letting them sink slowly to the canal floor. From here, they would be underwater transferred to designated cooling storage spaces, where they would remain until all chance of melt down was gone. Concurrent with the defuelling operation above, regular ship's bottom cleaning and painting, overhaul of fittings and discharges, and tail shaft and propeller inspections could be carried on. Concurrently, also, new fuel elements could be reloaded through the reactor's top. Thus, the complete cycle of nuclear refuelling—including normal drydocking work—could be performed in a day or two—or three at most.—*H. F. Crouch, Journal, American Society of Naval Engineers, November 1958; Vol. 70, pp. 675-681.*

Superstructure Vibration Excited by Exhaust Pulsation

A vibration specialist from Det Norske Veritas was invited recently to make a round voyage from Rotterdam to Hampton Roads (U.S.A.) and back to a north European port in order to undertake an exhaustive examination of ship vibration with the ship in ballast and laden. This investigation was part of a wide series of vibration studies on hull, structural components and machinery and an analysis of noise undertaken by the Norske Veritas research department. The vessel was a 15,000-ton cargo motorship with a seven-cylinder single-acting two-stroke main engine of 6,300 b.h.p. at 115 r.p.m. Preliminary vibration measurements undertaken while the ship was in port showed that the auxiliary engines could be eliminated as the source of the troublesome vibrations. During the trip to Hampton Roads, the ship sailed in ballast and the draught was insufficient to immerse the propeller fully. In such cases, and especially in bad weather, it is expected that vibrations will occur in different parts of the vessel owing to the fact that the

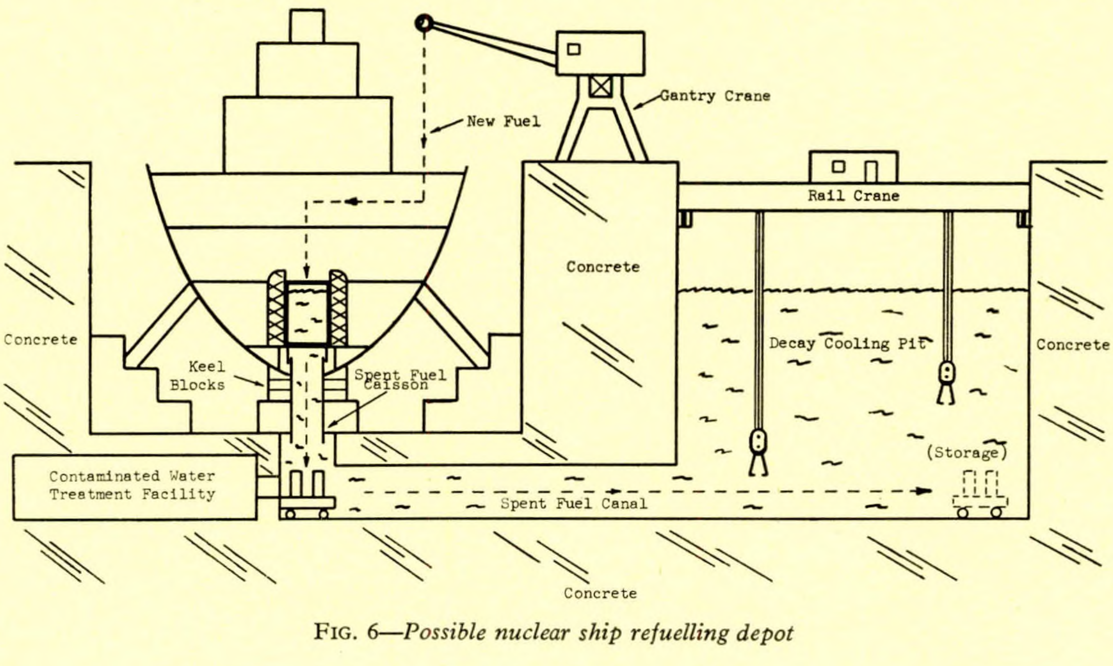
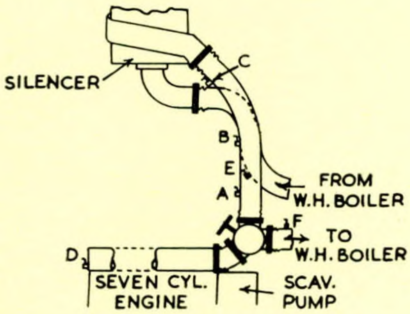


FIG. 6—*Possible nuclear ship refuelling depot*

blades rise out of the water. In this case there would be vibrations of the 4th order of the engine speed as the propeller was four-bladed. In bad weather both ship and machinery were subject to severe stresses. After a hard "slam" at 2 knots it was possible to feel the periodic vibrations at the ship's natural oscillation for vertical hull vibrations continuing for a long time. Slamming of this kind was also recorded on the vibrograph during the measurement and investigation of vibration conditions on board. Much of this investigation consisted of measuring the variation in pressure at different points of the exhaust pipe between the engine and the silencer, mechanical vibrations of the actual pipe and their propagation through the suspension points to various points of the superstructure,



Sketch of exhaust system and measuring points

particularly at points where there seemed to be resonance with the impressed impulses. Diagrams which were plotted showed that the pressure variation in the exhaust pipe is of composite form, with components of the 7th order of the speed of rotation, but mainly of the 10th and 11th order, with phase displacement. Mechanical vibrations corresponding to the higher order pressure variations in the exhaust gas were also found in the actual exhaust pipe. Measurments carried out on opposite sides of an elastic suspension point for the exhaust pipe showed that this vibration damper effected a reduction in the vibration amplitude in the ratio of 6 to 1. These smaller remanent impulses were nevertheless of sufficient magnitude to propagate further, mainly in the superstructure and other parts which had a natural frequency corresponding with the impressed vibration periodicity. These vibrations were amplified, according to the damping present. According to Reiher and Meister's curve of human sensitivity to vibration, the amplitude was of the order of magnitude "uncomfortable" at a point in one of the saloons. On the basis of analyses of the results of measurements of pressure variations and with simplified conditions the natural frequency for pressure vibrations in the exhaust pipe was calculated and found to be in the vicinity of the vibrations of the 11th order measured. The natural frequency for mechanical vibration of the pipe was found by calculation to be above the measured periodicity. Arising out of the investigations, certain modifications were recommended for the suspension of the exhaust pipe in order to isolate the vibration impulses from the ship's structure.—*J. W. Pettersen, Veritas No. 13; The Marine Engineer and Naval Architect, December 1958; Vol. 81, pp. 538-539.*

Coastal Supertanker

The *Atlantic Enterprise,* the fifth supertanker to join the fleet of the Atlantic Refining Company, is nominally a standard 30,000-ton deadweight vessel of the type built by the Sun Shipbuilding and Dry Dock Company, Chester, Pa. She was actually built for the Philadelphia Northern Steamship Company of Wilmington, Delaware, and some modifications were made to the standard Sun specifications to make her more suitable for long term charter and operation by the Atlantic Refining Company on their coastwise run with refined oils from their Port Arthur refinery to U.S. North Atlantic coast terminals. The principal dimensions and particulars are as follows:—

Length overall	641ft. 0in.
Length between perpendiculars	615ft. 0in.
Moulded breadth	84ft. 0in.
Moulded depth	45ft. 0in.
Moulded draught	34ft. 0in.
Summer deadweight ...	30,308 tons
Normal power/r.p.m. ...	13,500/100
Maximum power/r.p.m. ...	14,850/103·5
Normal sea speed	16·5 knots.
Normal bunker capacity ...	22,000 bbls.

The *Atlantic Enterprise* has a raked stem with bulbous bow, a cruiser stern, single continuous deck and three island structures. The cargo piping system is laid out for handling separate grades of cargo and the four pumps, under ideal conditions, will discharge a full cargo of several grades of refined products in about 12 to 14 hours. The pumps are driven at 1,750 r.p.m. by 500 h.p. at 4,850 r.p.m. steam turbines taking steam at 525 deg. F. and exhausting at 10lb. per sq. in. Each pump will discharge about 5,700 barrels per hr. against 125lb. per sq. in. pressure and about 8,500 barrels per hr. against 85lb. per sq. in. pressure. Four duplex steam driven stripping pumps are fitted for tank drainage with a capacity of 700 bbls. per hr. each. The main propulsion plant is of Westinghouse supply and consists of a two-casing cross-compound double-reduction geared steam turbine designed to develop 13,500 s.h.p. at 100 r.p.m. for 16·5 knots. The steam supply is 585lb. per sq. in. (gauge) and 825 deg. F. temperature and the exhaust is at 28¼-in. vacuum. Two Babcock and Wilcox two-drum boilers each generate 52,500lb. of steam per hr. at 600lb. per sq. in. (gauge) and 535 deg. F. temperature, plus 3,100lb. per hr. of desuperheated steam when supplied with feed water at 240 deg. F. temperature. The boiler efficiency is about 87·5 per cent, with fuel having a calorific value of 18,500 B.t.u. per lb. The propeller is of built-up four-bladed type and follows practice established many years ago. The economy realized in less costly repairs and maintenance on built-up propeller was considered to outweigh the small loss in propulsive efficiency. Two spare blades are carried instead of a complete spare propeller. A steam-driven capstan has been fitted forward on the forecastle, abaft the hatch, to the dry cargo hold, to permit easier and quicker handling of the breast lines and to provide a means of power handling lines on the forecastle in the event of windlass failure. Mooring bitts have been fitted on either side of the vessel at the break of the poop deck.—*The Marine Engineer and Naval Architect, December 1958; Vol. 81, pp. 510-511.*

Windscale Advanced Gas Cooled Reactor

The United Kingdom Atomic Energy Authority has placed contracts in connexion with the small reactor at Windscale. This is the one which offers a possibility of economic application to marine propulsion. The reactor vessel has been placed with Whessoe, Ltd., turbo-alternator and associated equipment with English Electric, Ltd., heat exchangers with International Combustion, Ltd., containment building with Babcock and Wilcox, Ltd., dump condenser with Hick Hargreaves, Ltd., feed pumps with Mather and Platt, Ltd., and building and civil work with Whatlings, Ltd. Ewbank and Partners, Ltd., are the consultants for the turbo-alternators and that part of the steam plant within the turbine hall. This reactor will be a further development of the Calder Hall type of gas cooled graphite moderated power reactor system. By using ceramic fuel in the form of uranium oxide, and beryllium for the cans, it should be possible to operate at considerably higher temperatures, giving an increase in efficiency compared with Calder. The pressure vessel containing the core and moderator is a vertical cylinder 53ft. 6in. high and approximately 21ft. diameter, with hemispherical top and bottom heads, and is to be constructed from very thick notch ductile steel plate. A large number of closely pitched charge tubes and control rod stand pipes for refuelling and controlling the reactor are arranged in the upper header. Support of the heavy core and graphite moderator and the shielding material is complicated because the internal baffles are arranged so that the relatively cool inlet gas sweeps the entire pressure vessel shell. The hot gas is collected from the reactor channels and passes out of the reactor through an inner concentric duct which prevents it from contact at any point with the vessel shell. The English Electric turbine will run at 3,000 r.p.m. and will be of two-cylinder impulse reaction type rated at 33,000 kW and operating with steam at 650lb. per sq. in. (gauge) and a temperature of 850 deg. F.—*The Marine Engineer and Naval Architect, December 1958; Vol. 81, p. 522.*

Twin-screw Turbine Steam Ship *Pendennis Castle*

The twin-screw turbine steamship *Pendennis Castle* replaces the *Arundel Castle*. The principal particulars of the *Pendennis* Castle are as follows: —

Length overall	764ft. 0in.
Length b.p.	716ft. 0in.
Breadth moulded	83ft. 6in.
Depth moulded	48ft. 0in.
Load draught	32ft. 0in.
Displacement at load draught	37,200 tons
Deadweight capacity ...	16,700 tons
Gross tonnage	28,582 tons
Net tonnage (about) ...	17,000 tons
Complement:	
First class	197
Tourist (maximum) ...	539
	736
Crew	419
	1,155
Cargo capacity	613,470 cu. ft.
Insulated space	346,000 cu. ft.
Fuel capacity	4,392 tons
Fresh water capacity ...	3,314 tons
Horse power (about) ...	42,000 s.h.p.
Service speed	22½ knots

The propelling machinery made by the builders consists of compound, double reduction geared turbines driving twin propeller shafts, designed in accordance with the latest and best practice, and capable of giving about 10 per cent in excess of the normal designed power. The h.p. ahead turbines are of the all-impulse design and the l.p. ahead turbine is of double flow, mixed impulse reaction type, with double casing construction. The h.p. astern and the l.p. astern turbines are both of impulse type. The turbines are arranged round the main gear so that simplicity of overhaul and ease of access to all parts will be ensured. The l.p. turbines exhaust into underslung condensers of the latest Weir regenerative type constructed by Harland and Wolff, Ltd. The propellers are of nikalium, four-bladed solid with the boss, made to the builders' latest design. Thrust blocks of the Michell type are bolted to seats built on the tank top and arranged in the engine room just aft of the main gear cases. There are three oil fired watertube boilers of the two-drum integral furnace type with superheat control designed by Babcock and Wilcox, Ltd., and manufactured by Harland and Wolff, Ltd. The working pressure is 600lb. per sq. in. at the superheater outlet with a total temperature of 850 deg. F. One motor driven regenerative air preheater by Howden-Ljungstrom and a Babcock and Wilcox stud tube economizer are incorporated in each boiler. The boilers are arranged for forced and induced draught. The auxiliary machinery is electrically driven, with the exception of the air ejectors, main turbofeed pumps and the auxiliary feed pumps which are steam driven. There are two Allen turbogenerators and three Diesel generators for supplying electric power arranged in a separate compartment forward of the boiler room. The turbogenerators are geared double reduction and have each an output of 1,500 kW, 225 volts d.c. and are self-contained with underslung condenser and attendant pumps. The Diesel generators are of H. and W. design and manufacture, the engines being four-stroke turbocharged, each having a capacity of 1,000 kW.—*The Shipping World, 7th January 1959; Vol. 140, pp. 9-13.*

10,010-ton 15-knot Open Shelterdecker

The open shelterdecker *Jedmoor* was delivered by Hawthorn, Leslie (Shipbuilders), Ltd., from their Hebburn-on-Tyne yard to the order of the Moor Line, Ltd. With a deadweight capacity of 10,010 tons on a draught of 26ft. 4in., the new vessel has the following characteristics: —

Length, b.p.	435ft. 0in.
Breadth, moulded	60ft. 6in.
Depth, moulded to freeboard deck	29ft. 9in.
Deadweight capacity ...	10,010 tons
Corresponding draught ...	26ft. 4in.
Gross register	5,980 tons
Net register	3,000 tons
MACHINERY	
Make	Hawthorn-Doxford
R.P.M.	115
No. of cylinders	5
Bore	670 mm.
Combined piston stroke ...	2,320 mm.
Service speed	15 knots

Of the open shelterdecker type, with divisional bulkheads in the shelter 'tweendecks and built under the special survey of Lloyd's Register of Shipping to comply with their requirements for class ✠ 100 A1, the hull is divided into three cargo holds forward of the machinery space with two abaft, while immediately forward of the engine room is a deep tank with a centre line bulkhead and suitable for water ballast or dry cargo. All cargo holds and 'tweendeck spaces are fitted out for grain shipments. The vessel is equipped with a Simplex balanced type rudder, electro-hydraulic steering gear, an electric windlass, and 10 cargo winches, also electric, as is the warping winch. All winches have remote control, and they serve 10 derricks with lifting capacities of from five to ten tons, with one for 30-ton lifts at No. 2 hatch. A CO_2 fire detecting and extinguishing system is installed throughout all cargo spaces. The Doxford-type main engine, built by Hawthorn, Leslie (Engineers), Ltd., has five cylinders, with a bore of 670 mm. and a combined piston stroke of 2,320 mm. At 115 r.p.m., the service output is 5,500 b.h.p., and the estimated daily fuel oil consumption is 21½ tons. The engine, which drives a nikalium propeller, has two lever driven scavenging air pumps and has the lower pistons cooled by lubricating oil. It is fully equipped for operation on boiler oil.—*The Motor Ship, December 1958; Vol. 39, pp. 416-417.*

Motorships for Singapore-Indonesia Trade

Two sister ships—the *Giang Ann* and *Giang Lee*—have recently been completed by the Hong Kong and Whampoa Dock Co., Ltd., of Hong Kong, for the Heap Eng Moh Steamship Company of Singapore. These vessels have been designed by Messrs. Richie and Bisset, naval architects and consulting engineers of Singapore, to suit the owners' special requirements for trading between the Indonesian Islands and Singapore. It was specified that the registered net tonnage must not exceed 99·9. The principal dimensions and other leading characteristics of the vessels are: —

Length overall	168ft. 0in.
Breadth moulded	31ft. 6in.
Depth to main deck	10ft. 2in.
Depth to shelterdeck	18ft. 4in.
Draught	10ft. 0in.
Corresponding deadweight, tons	500
B.H.P.	530
Corresponding r.p.m.	660
Speed, knots	10½

They are of the open shelterdeck type, with the navigating bridge and rooms for the captain and radio operator placed forward. The engine room and cabins for the remainder of the crew are located aft. In view of the fact that arrangements are made for carrying deck passengers, the shelter and main decks are completely covered with teak. Cargo is loaded through two hatchways, which are served by two 5-ton and two 3-ton derricks. At the shelterdeck level, special aluminium hatch covers, constructed by the shipbuilders, are fitted. For operating the derricks there are two electrically driven 5-ton winches. There is also an electrically driven windlass and hand hydraulic steering gear. For a ship of this type, the engine room equipment is particularly comprehensive. The main propelling machinery consists of a National, type-R4AUM7, turbocharged Diesel engine, capable of developing 530 b.h.p. at 660 r.p.m. in tropical conditions. A sea water cooled after-cooler is arranged in the blower discharge. The drive is taken through an MWD reverse reduction gearbox.—*The Shipbuilder and Marine Engine-Builder, November 1958; Vol. 65, p. 636.*

Highest Power Doxford Engine

A Scott-Doxford turbocharged engine capable of developing 9,000 b.h.p. at 118/119 r.p.m., and which has in fact developed 9,500 b.h.p. on the test bed, has recently been completed by Scotts' Shipbuilding and Engineering Co., Ltd., of Greenock. This is the highest powered Doxford type engine yet to be built, and the overall length of the bedplate is no greater than for the normally aspirated engine having the same number and size of cylinders. The rated power is 32 per cent more than for the same size of normally aspirated engine, and the h.p. per ton weight is 20 per cent more than for a normally aspirated Doxford engine. It is claimed that the bearing pressures and stresses on running parts are no greater than have proved satisfactory on the normally aspirated standard engines. The principal details of the engine are:—

Number of cylinders...	6
Bore of cylinders, mm.	670
Total stroke, mm.	2,320
Rated b.h.p.	9,000
R.P.M.	118/119
Brake mean pressure, lb. per sq. in.	100
Indicated mean pressure, lb. per sq. in.	111
Maximum combustion pressure, lb. per sq. in.	800
Number of exhaust turbochargers ...	2
Type of exhaust turbochargers ...	Napier MS500Z
Number of lever driven scavenge pumps	3
Bore of lever driven scavenge pumps, mm.	1,460
Stroke of lever driven scavenge pumps, mm.	563

The engine is an improved, more highly rated version of the prototype engine of the same dimensions, which has been operating on heavy marine fuel very successfully, both mechanically and economically, in the *Egori*, since that ship was handed over in February 1957. Smaller turbochargers running at higher speed are fitted, and these discharge the air through Serck coolers and Serck moisture separators into the scavenge pump receiver. The scavenge pumps have been further reduced in size and are retained because they facilitate starting and manœuvring, ensure an ample supply of air at all speeds with good combustion, are able to respond to increased resistance if the condition of the engine and exhaust boiler is allowed to deteriorate in service, help to maintain efficiency when ship resistance increases, minimize the risk of fires in the entablature, and permit running in emergency up to 85 per cent of full engine speed without detriment if the turbochargers are out of action. In principle, the latest improvements which are being generally adopted on Doxford type engines are incorporated, including the diaphragm isolating the lower cylinder from the crankcase, oil cooled lower pistons, the timing valve injection system and rotary distributor, air-starting system, but there are numerous differences in detail. A special Scotts' design of weldless forged steel liner reinforcing jacket, and attached valve housings, enable the heat stresses and higher combustion pressures to be borne with greater safety. To suit the increased flow of air and gas, the exhaust and scavenge ports have been redesigned. The builders' special fuel injection system for engines operating on heavy marine fuel is fitted, some features of which are low pressure losses due to large bore pipes and filters, ready means of isolating any pressure pipe which may fail, safer running under manœuvring conditions, prepressure supply pump and ready means of circulating fuel. The timing valves can be adjusted individually for output without stopping the engine. To comply with the requirements of the American Bureau of Shipping, the number of crankcase relief valves is about twice that usually fitted.—*The Shipbuilder and Marine Engine-Builder, January 1959; Vol. 66, pp. 40-42.*

Shot Blast Machine

Details have been released of a set of equipment which was developed specially for the British Admiralty. The equipment combines a Simon hydraulic platform with a Vacu-Blast Senior shot blasting machine. The purpose of the equipment is to enable an operator to clean or descale the curved hull of a ship without the necessity for large amounts of scaffolding construction and without frequent changes of perch on the part of the operator. The new system takes advantage of the long reach of these hydraulic platforms, and of the continuous, dust free operation of the blast equipment. It achieves a hull cleaning rate of between 100 and 300 sq. ft. per hr., dependent on the surface being treated and the type of finish required. By a system of special joints, the platforms enable an operator in the working cage to position himself close to the most inaccessible places on a ship's side, and because of the long reach of the platform's boom, the lorry on which the machine is mounted need only be moved very few times in order to cover the hull from bow to stern. The model used by the Admiralty reached almost 27ft. horizontally from its mounting, and 35ft. vertically. A traversing gear was designed for the Admiralty by Simons Engineering which moves the nozzles of the shot blast guns automatically over the surface of the hull once the cage is positioned. The area which can be covered each time is about 5ft. wide and 2ft. 8in. deep. The cage is then repositioned to the adjacent area, until the full reach of the platform from one lorry position has been utilized. The Vacu-Blast "Senior" machine is adapted for this installation to feed two closed circuit shot blast guns. They are independently spring mounted on two arms on the automatically traversing carriage. The abrasive blast and recovery hoses from the guns are taken down the boom of the platform to the generator reclaimer unit and the dust collector unit. The generator reclaimer separates the used abrasive from the cleanings, air washes it, sieves it and returns it *via* the dump valves to the pressure feed hopper where it is fed once more to the guns.—*Shipbuilding Equipment, January 1959; Vol. 1, p. 9.*

Compressed Air On Board Ship

On ocean going ships the compressor plant usually incorporates two electric motor-driven compressor units, each with a capacity of 140 to 175 cu. ft. per min. free air delivery at 350lb. per sq. in., and each supplying an air receiver of from 350 to 400 cu. ft. storage capacity. Pneumatically operated motors and equipment are generally designed to operate at a working pressure of 85 to 100lb. per sq. in. The quantity of compressed air therefore which is stored in the receivers considerably exceeds the anticipated demand. Consequently, if a ship is in dock or harbour there is a ready supply of compressed air obtainable, eliminating the need for starting up the compressor plant. Among the advantages of using pneumatic equipment can be mentioned the following:—(*a*) It is simple in design, reliable, and can be operated by unskilled labour. (*b*) Low weight, in relation to free air delivery capacity, makes it possible to use portable motors, thus eliminating the necessity of incorporating a motor in each single unit. This results in a saving of costs both for installation and maintenance, for example, lifeboat davits and derrick topping winches. (*c*) The need for special equipment to control speed and output, as well as reversing the direction of rotation, is eliminated as control of these operations is effected through the throttle valve. (*d*) The accident risk is reduced to a minimum as overloading will not damage the motor, and the risk of sparks, overheating or short-circuiting is eliminated—factors which are of the utmost importance when operating on tankers. Steam can, of course, be considered as a source of power since tankers would be equipped for this. At the same time, however, it should be remembered that compressed air does not require return pipelines or expensive insulation. Compressed air can also be exhausted from the machine since it does not reduce visibility, but acts on the other hand as a source of ventilation. A 1-h.p. air motor has a consumption of 27 cu. ft. per min. of air and can therefore operate continuously for approximately 3½ hours with an air receiver of the above mentioned size and a maximum pressure of 350lb. per sq. in. Three types of air driven motors exist and these are the piston type motor, the vane type and the turbine type. The piston type motor is still used today for lifting and winching though it has changed considerably in design, and is now made as a four, five or six-cylinder radial piston type unit. As the motor may be started under load it allows full speed control from minimum to maximum r.p.m. A vane type motor has an eccentric rotor, carried in ball bearings, and the energy is converted in the space formed by vanes sliding in grooves in the rotor and between the end washers. The vanes are usually four in number and operate in a similar way to those of the piston type motor. Due to the excellent balancing of the vane type motor, extremely high speeds are obtainable, resulting in low weight and small sizes. The third type, the turbine, has the simplest design of the three since it can be said to consist of only one part, the bladed turbine rotor. It is used for high speed equipment where very fine speed control is not required, e.g. floodlights. Its starting torque is low and consequently this type cannot be used in air hoists or similar equipment.—*S. Oden, The Shipping World, 3rd December 1958; Vol. 139, pp. 491-492.*

Securing Valves

Under conditions of vibration a valve normally will not open or close by itself because of the friction between the packing and the valve stem. In certain critical locations however, it may be desirable to make sure that a valve does not turn of itself. A positive device may be installed. An example of such an application would be the lubricating oil crossover line valve between two main propulsion units in the same machinery space, where a partially opened valve could result in the slow transfer of lubricating oil casualty in the one unit. To prevent

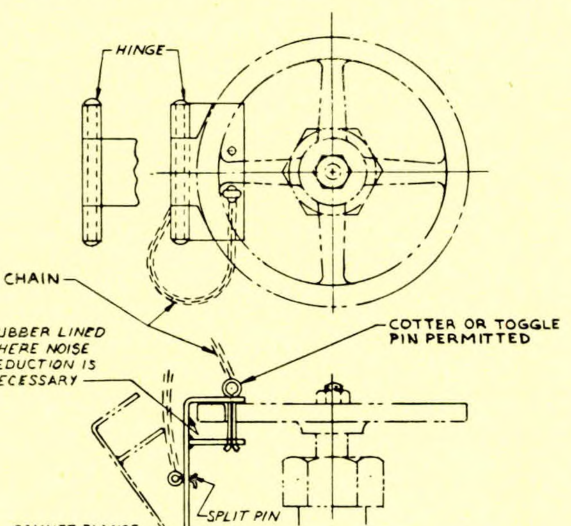


FIG. 1—*Positive mechanical device for securing a valve*

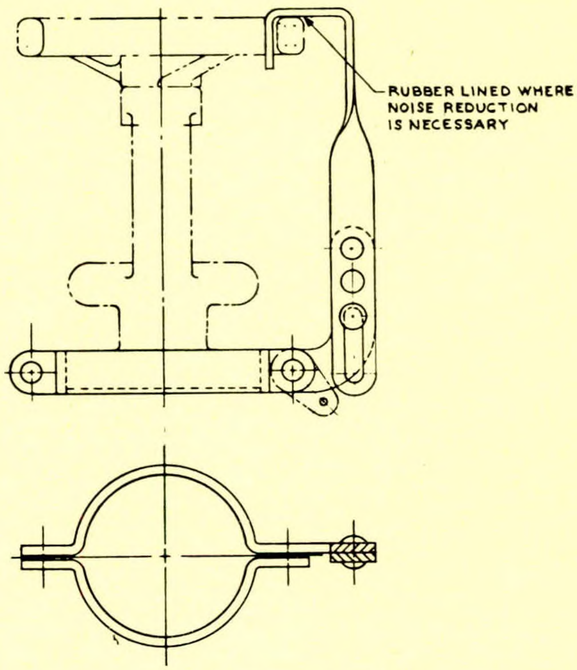


FIG. 2—*Alternate method*

a possible casualty, the use of a simple positive mechanical device as illustrated in the accompanying sketches (Figs. 1 and 2) may be desirable. The manufacture and installation of such a device is within the capabilities of the ship's force and may be used where positive positioning of a valve is considered necessary.—*Bureau of Ships Journal, November 1958; Vol. 7, p. 26.*

Direct Bridge Control of Ships' Engines

Direct bridge control of ships' engines has been in operation in the United States of America, as well as several other countries, for some time. In order to obtain the maximum benefit from such a system, of course, two or more operational positions are required on the bridge or superstructure. The tug *Flying Dipper,* owned by the Clyde Shipping Co., Ltd., of Glasgow, and powered by a British Polar Diesel engine, is the first vessel to work in United Kingdom waters using a full application of pneumatic control equipment, and she has four operational positions on the bridge. The vessel can also be controlled direct from the engine room. Single lever control is provided at the four bridge positions and the interlock features of the controls prevent any mishandling of the engines. Westinghouse type-2A2A Controlair valves are installed at all these single lever control points. Selection of direction is made in the first movement from the neutral position and effected by passing an air signal down the ahead or astern signal line, as required. This operates a three-position cylinder mounted on the gearbox, and a pneumatic interlock connects the throttle signal line from the Controlair valve to the control port of a Pneudyne positioner mounted on the main engine. This unit is of the servo pattern and provides accurate positioning of the engine throttle in response to the signal given from the bridge. By means of a time delay feature, the engine may be opened up at a maximum predetermined speed. A pneumatic time delay unit is built into the gearbox control system to ensure that when going from ahead to astern, or *vice versa,* there is a short pause in the neutral position before the new drive position is selected. To change from one control position on the bridge to another is simple. The only action required is to depress the changeover button at the new position until the air supply is registered on the air pressure gauge, mounted locally. Full control is then available at the new position. To change control between the engine room and any bridge position, the engineer operates his locally mounted Rotair valve. While the *Flying Dipper* is fitted with special control desks incorporating the pneumatic valves, it is claimed that the equipment is suitable for operation by a conventional ship's telegraph head. Whaling ships, Great Lakes ore carriers, spirit tankers, bulk sugar carriers, a Canadian Shell tanker and Admiralty frigates and tugs are among the ships fitted, or being fitted, with pneumatic control equipment.—*The Shipbuilder and Marine Engine-Builder, November 1958; Vol. 65, p. 630.*

Influence of Ship Form on Pitch and Heave Amplitudes

The results of pitch and heave amplitude measurements are presented for five different models which were tested in regular waves representing head seas conditions. The data are given in the form of curves, at constant Froude numbers, of non-dimensional motion parameters plotted against the ratio of the natural period to the period of encounter (tuning factor). It is shown that the motion results can be related, through empirical curves, to certain basic hull parameters which are developed and discussed in the report. Thus, the experimental data can be used to predict the motion amplitudes of various hull forms which have characteristics similar to those of the five models used in this investigation.—*G. P. Stefun, David Taylor Model Basin, Report No. 1,235, 1958.*

Sea Behaviour of *Mariner* Class Ship with Bow Fins

The results of model tests performed to determine the feasibility of reducing the pitching motion of the *Mariner* type ship by means of fixed anti-pitching fins at the bows are presented. A 20-ft. self-propelled model representing the final design of the *Mariner* type ship was tested in waves with four anti-pitching fin configurations. Data are presented for both model and ship and are summarized in dimensionless form. The data are also used to compute the effect of the fins on the vertical motion and acceleration along the length of the ship. The results of the model tests indicate the feasibility of reducing the amplitude of pitch of the *Mariner* by means of anti-pitching fins installed at the bow of the ship. The numerical value of the full-scale pitch reduction, however, may be influenced by scale effects. The tests at the lighter load conditions, corresponding to 15,870 tons and mean draught of 23ft. with 4-ft. trim by the stern, showed small differences of pitch and heave amplitudes compared with the results of the tests at the heavier load condition. The general behaviour of the model in the regular tank waves was, however, much worse in the lighter condition. Fore-foot emergence and slamming occurred frequently. This can be attributed to the shallow draught of 21ft. forward, and possibly unfavourable phase relationship between the heaving and pitching motions. The effect of forward speed and wave length on pitch reduction is noteworthy. The damping contributed by the fins attains its maximum effectiveness in reducing the amplitude of pitch when the ship operates in the near-synchronous range. At very low and very high frequencies of oscillation (that is, at frequencies of encounter with the waves far removed from the natural frequency of the ship in pitch) the effects of added damping are generally small. The fins have little effect on the phase lag of heave after pitch. The small changes of the phase-lag values, however, assume importance in defining the point of minimum motion and also the vertical motion of any point along the length of the ship.—*U. A. Pournaras, David Taylor Model Basin, Report No. 1,084, October 1958.*

Flat Plated Grillages Under Concentrated Loads

The present position regarding flat grillage theory is briefly reviewed, and a distinct lack of experimental data for singly-plated grillages of welded steel construction, as used in naval structures, is observed. This paper describes tests under controlled conditions on three simple full-scale grillages. Concentrated loads are applied over the grillage beams, so that the results are particularly applicable to the decks of ships and bridges, but it is expected that the conclusions would hold for uniform or hydrostatic pressure loading. The results for the elastic range are discussed in terms of an effective breadth of plating. Using this concept, the beam moments of inertia are calculated to include a wide flange contributed by the plating, and the grillage analysis is then carried out as for unplated grillages, a considerable simplification. It is found that, for practical grillages of the type tested, the effective breadth of plating should be taken equal to half the beam spacing, rather than the complete spacing as indicated by some theoretical work. Using this rule, very satisfactory agreement is obtained between the measured and calculated deflexions and stresses. Tests beyond the elastic range show that there is considerable further strength due to bending action and to membrane stretching ("shape hardening"). Where the bending collapse mechanism does not introduce any membrane action, the observed collapse load agrees well with predictions using existing theories for the collapse of unplated grillages. In one of the grillages, membrane stretching was observed beyond a permanent set of about 1/100 of the width of the grillage. This membrane stretching would almost always be present in ship grillages, and it is an interesting problem not so far investigated theoretically. However, it is considered to be of less practical importance than a knowledge of the behaviour in the elastic range, and particularly the maximum load which can be applied without measurable permanent distortion of the beams.—*Paper by J. C. Clarkson, submitted to the Institution of Naval Architects for written discussion, 1958.*

Engine Noise Investigation

The demand for higher operating speed and power, combined with light weight construction, has resulted in a considerable increase in the noise level of modern naval Diesel engines. To safeguard the health of crews and to ensure that orders can be heard and understood, the Admiralty Engineering Laboratory at West Drayton, Middlesex, is devoting considerable attention to the design of efficient silencer systems. Since trials and tests of actual Diesel engines would be expensive, slow and very noisy, special laboratory techniques have been developed. One method which has given excellent results involves the use of an unusual means of noise simulation. Instead of attempting to reproduce the noise frequency spectrum of a given engine, "white" noise (of equal loudness at all frequencies) is fed into an experimental silencer, whose "exhaust" terminates in an anechoic chamber. A microphone in the chamber feeds an a.f. analyser by means of which the output noise spectrum is plotted. The extent and characteristics of the attenuation given by the model under test can thus be established, in comparison with a datum spectrum obtained by replacing the silencer with a straight pipe.—*British Communications and Electronics, December 1958; Vol. 5, p. 954.*

Thermal Stresses in s.s. *Boulder Victory*

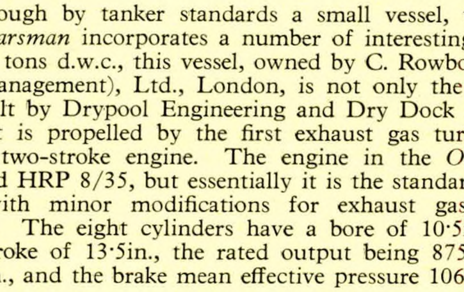
The lack of comprehensive experimental measurements of thermal stresses induced in a ship's hull structure by diurnal temperature changes promoted the present study. Its essential purpose is to provide reliable prototype measurements of thermal stress patterns around a complete transverse section. These results are compared with stresses computed by the theory of simple beams under arbitrary temperature distributions across their section. The research was conducted under direct sponsorship of the Society of Naval Architects and Marine Engineers at the Maritime Reserve Shipyard in Richmond, California. The s.s. *Boulder Victory* was supplied as the test vessel by the Maritime Administration. The ship was instrumented during June and July 1957, and tests run during August. Various temperature conditions were observed and corresponding strain measurements taken. The results are consistent and give a reliable picture of thermal-stress conditions in the ship. They also verify the prediction of thermal stresses afforded by the simple beam theory.—*J. L. Meriam,* et al., *Journal of Ship Research, October 1958; Vol. 2, pp. 55-71.*

Longitudinal Motions of Hydrofoil Craft

As interest in hydrofoil supported craft has grown, particularly in the last decade, there has arisen a need to predict the characteristics of hydrofoils and of hydrofoil craft. One of the problems which has been considered extensively but which still poses considerable difficulty is the dynamic response of a hydrofoil craft in waves. Some theoretical work has been done by several investigators, and one systematic experimental programme has been reported. However, until now the only direct comparison between theoretical and experimental results has indicated wide discrepancies between the two. The present report shows how modifications to the available theory result in realistic predictions for the most important group of experiments reported. Only one particular configuration is considered. The craft to be studied has two identical foils placed at equal distances fore and aft of the craft's centre of gravity. The foils are of the dihedral, or area-stabilized, type. The section profiles are assumed to be constant across the span and the foils are assumed to have no twist. This configuration closely approximates to several practical designs which have been built in the last two decades. It is shown that the net effect of unsteadiness on the amplitudes of heave and pitch motions is generally quite small, although the forces on the foils are reduced by as much as 40 per cent in some head seas conditions. The transient responses of the craft are calculated. Linear and non-linear, quasi-steady solutions are discussed—also linear, unsteady solutions. It is found here that the most important components of the transient solutions are only slightly affected by either non-linearities or unsteadiness. Next, the effects of downwash are considered. It is shown that the unsteady vorticity shed by the forward foil has negligible effect on the after foil.—*T. F. Ogilvie, David Taylor Model Basin, Report No. 1,138, 1958.*

1,100-ton Tanker

Although by tanker standards a small vessel, the motor tanker *Oarsman* incorporates a number of interesting features. Of 1,100 tons d.w.c., this vessel, owned by C. Rowbotham and Sons (Management), Ltd., London, is not only the first ship to be built by Drypool Engineering and Dry Dock Co., Ltd., Hull, but is propelled by the first exhaust gas turbocharged Crossley two-stroke engine. The engine in the *Oarsman* is designated HRP 8/35, but essentially it is the standard HRN 8 engine with minor modifications for exhaust gas pressure charging. The eight cylinders have a bore of 10·5in., and a piston stroke of 13·5in., the rated output being 875 b.h.p. at 350 r.p.m., and the brake mean effective pressure 106lb. per sq.



Performance of the turbocharged Crossley HRP8/35 engine based on propeller law

in. (83lb. per sq. in. when normally aspirated). The non-turbocharged HRN engine at its maximum rated speed of 600 r.p.m. gives 1,065 b.h.p., so that the turbocharged (HRP) version would give up to about 1,600 b.h.p. This engine is also built with 16 cylinders in vee-form so that ultimately 3,200 b.h.p. could be obtainable. The new turbocharged HRP engine has been developed by Crossley Brothers in collaboration with the turboblower division of the Brush Group. The turbocharger is a Brush type MB.32/D unit which compresses the air and delivers it to the scavenge pump operating in series. An after cooler is fitted to cool the air before admittance to the cylinders. This blower is designed for a maximum speed of 12,200 r.p.m. and a maximum temperature of 1,200 deg. F. It is emphasized that the exhaust pulse pressure charging system—a feature of Crossley engines—is retained to aid in obtaining a dense charge of clean air in the cylinders at the beginning of compression. The scavenge pump is a reciprocating double acting unit with three pistons arranged in tiers. Although the standard engine has been only slightly modified for 28 per cent turbocharging—for example, the crankshaft is unchanged—some minor alterations have been made to the cylinder heads and studs because of the enhanced stress. As a result of the increased density of air charge higher maximum cylinder pressures are encountered than has been the case with the normally aspirated engine, but this is classed as a relatively small increase. Therefore, the main characteristics of the engine in its present restricted form of turbocharging, which will subsequently give a 50 per cent power boost, are:—

CROSSLEY TYPE HRP. 8/35

Cylinder bore	10·5in.
Piston stroke	13·5in.
Number of cylinders ...	8
Rated output	875 b.h.p.
Corresponding r.p.m. ...	350
B.M.E.P.	106lb. per sq. in.
M.I.P.	136lb. per sq. in.
Maximum combustion pressure	1,200lb. per sq. in. gauge
Charging air pressure ...	7·2lb. per sq. in. gauge
Exhaust temperature at turboblower	750 deg. F.
Exhaust pressure at turboblower	5·1lb. per sq. in. gauge
Air temperature before scavenge pump ...	135 deg. F.
Air pressure before scavenge pump	4·3lb. per sq. in. gauge
Air temperature after scavenge pump ...	160 deg. F.
Air pressure after scavenge pump	7·4lb. per sq. in. gauge
Air temperature before cooler	160 deg. F.
Air pressure before cooler	7·4lb. per sq. in. gauge
Air temperature after cooler	117 deg. F.
Air pressure after cooler	7·2lb. per sq. in. gauge
Bore of scavenge pump	20·5in.
Stroke of scavenge pump	8·25in.
Blower r.p.m.	9,500
Exhaust temperature after blower	690 deg. F.
Exhaust pressure after blower	0·75lb. per sq. in. gauge

The dry weight of the engine, complete with pumps, etc., is 22 tons, equal to 56·3lb. per b.h.p., but for an engine with the percentage boost increased to 50 per cent, giving a power of 1,600 b.h.p. at 600 r.p.m., the weight per b.h.p. will be reduced to 31lb. As the accompanying performance curves show, the fuel consumption, on marine Diesel oil, is 0·37 lb. per b.h.p.-hr. which corresponds approximately to that of the normally aspirated unit. At the forward end of the engine are the direct acting rotary water pumps, chain driven off the crankshaft.—*The Motor Ship, February 1959; Vol. 39, pp. 534-536.*

Corrosion-resistant Experimental Steels for Marine Use

Six steels having various combinations of nickel, copper and phosphorous were tested in sea water for exposure periods of one, two and five years, and a comparison made with the corrosion resistance of structural carbon steel. The test specimens measured 20ft. in length and were placed in the sea water so that their tops extended above the splash zone while the bottoms were in the mud. Decreases in thickness were calculated at 20 different levels for each of the Ni-Cu-P steels. It was found that these steels as a class were much more corrosion resistant than the sheet piling steel to the conditions existing in and above high tide. The superiority was even greater when the steels were exposed to the atmosphere 80ft. from shore. The five-year exposure tests showed that steel containing 0·5 per cent Ni, 0·5 per cent Cu and 0·12 per cent P had the greatest resistance of the steels tested. The attack below low tide was essentially independent of the composition of the steel. Pitting attack was very local and thus severe. In atmospheric tests made 80ft. from the shore, the most resistant Ni-Cu-P steel had a weight loss only 5 per cent that of sheet piling steel.—*C. P. Larrabee, Corrosion, November 1958; Vol. 14, pp. 21-24.*

Cargo Motorship for Paris-London Service

The cargo motorship *President E. Chalas,* built at Sheepswerf "De Dollard", Landsmeer, for the Compagnie Maritime de la Seine, Paris, has entered the service of her owners. The ship is of the raised-quarterdeck type, and has been constructed for the carriage of general cargo. She is intended for the owners' service between London and Paris. The leading characteristics are as follows:—

Length overall	175ft. 10¼in.
Length b.p.	165ft. 8¼in.
Breadth	25ft. 1⅛in.
Depth to main deck ...	14ft. 9⅛in.
Depth to r.q. deck	18ft. 0½in.
Draught	11ft. 5in.
Deadweight	650 metric tons
Gross tonnage	480·76 R.T.
Net tonnage	263·19 R.T.

The *President E. Chalas* has been constructed in accordance with the rules of Bureau Veritas. The engine room is placed aft, and there are two cargo holds, separated by a watertight bulkhead. A double bottom is fitted to the hull, and arranged for the carriage of water ballast and fuel oil. The fore and after peaks are arranged for water ballast. Cargo is handled by two derricks, suitable for 2-ton loads. They are attached by two collapsible masts placed at the fore and after ends of the cargo section. These derricks are served by two Hatlapa electric cargo winches of the "Ladoga 2,000 E" type, with a hoisting speed of 0·35-0·7 m./sec. They are fitted with a built-in d.c. motor of 12 h.p. at 1,250 r.p.m. The Hatlapa windlass is of the Ankona III-E type with a hoisting speed of 10 m./min. It is fitted with a built-in electric motor of 12 h.p. at 1,350 r.p.m. The hand operated capstan of the same make has a pull of 1,500 kg. The main propelling machinery consists of a Werkspoor TMAF 278 Diesel engine, of 540 h.p. at 350 r.p.m., coupled to a "Brevo" reverse gear. The engine drives a four-bladed Lips Lima-bronze screw with a diameter of 1,780 mm. The engine gives the ship a speed of 11·5 knots.—*Holland Shipbuilding, November 1958; Vol. 7, pp. 31, 54.*

Chemical Cleaning of Low Pressure Distilling Units

One major problem in the operation of a sea water distilling unit is the build-up of scale on the heating surfaces of the evaporator, and to some degree in other parts of the unit. When untreated sea water is fed into the system the scale usually consists of from 80 to 90 per cent calcium carbonate. Generally the remainder is a mixture of calcium sulphate, magnesium hydroxide, metal oxides, silica, and miscellaneous deposits. Other deposits, such as phosphate sludges, may predominate when treated sea water is fed into the system. Silicates or calcium sulphate may be the major constituents when shore water is used. The rate of build-up and the composition of the deposits depend on such factors as the temperature, the density of the brine, and the rate of circulation of the brine over the evaporator heating surface. Proper feed treatment in the submerged tube and vertical basket types will reduce these deposits. Experience shows that chemical cleaning is faster, more economical, more effective, and less detrimental to distilling unit parts than mechanical cleaning. The method consists of circulating a heated dilute acid solution through the salt water (feed and brine) circuits by means of the brine overboard or a special acid resistant pump, depending upon the acid used. It is not necessary to dismantle the unit. Cleaning with acid, when done according to instructions, will cause a slight, but acceptable, solution of metal parts, and will also have some slight effect on gasket materials. The low level acid attack should not reduce the life of the distilling unit significantly, provided chemical cleaning is used only when necessary and in the recommended manner. Chemical cleaning is not the answer to all distilling unit problems or a substitute for all other types of care. These are pitfalls to be guarded against in a general adoption of such cleaning. It would not do to neglect the current distilling unit feed water treatment, or proper operating procedures, in the expectation that chemical cleaning would remove heavy scale. The July 1958 edition of Chemical Cleaning of Low Pressure Distilling Units (NavShips 250-551-2) establishes an approved method of descaling low pressure submerged tube type, vertical basket type, or flash type distilling units with either hydrochloric or sulphamic acid. With the method described, either reagent being used, the plants may be cleaned by circulating dilute acid solutions through the system without dismantling the units. Use this method of cleaning whenever possible, in preference to dismantling the units for mechanical descaling or acid dipping.—*Bureau of Ships Journal, December 1958; Vol. 7, pp. 23-24.*

Removing Superheater Tubes

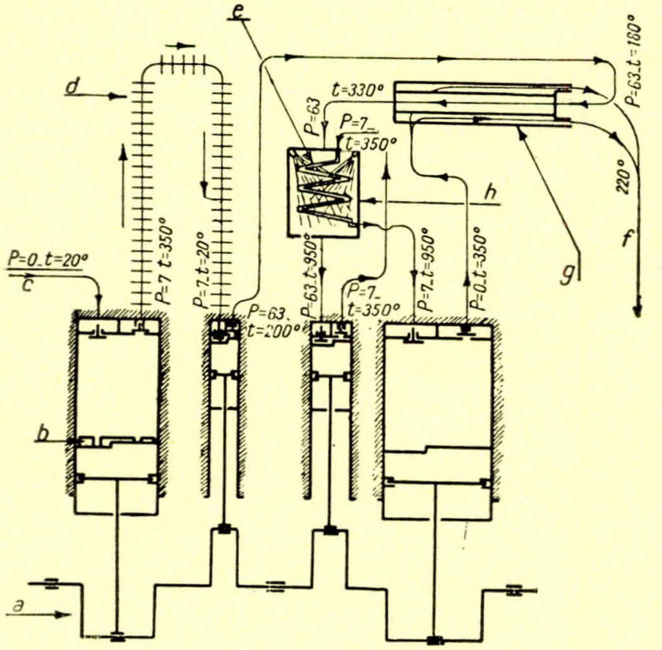
Routine inspection of the boilers during a ship's regular overhaul revealed cracks in the superheater headers of all boilers. All headers were replaced and one was sent for examination. The header material was a chromium-molybdenum steel, containing approximately 5 per cent chromium and ½ per cent molybdenum. The Station reported that the failure was due to thermal cracking, evidently caused by application of heat during removal of superheater tubes. This material is susceptible to air hardening, and the cracks were located in the hardened area of the tube hole ligaments. Chapter 51-154 of the U.S. Bureau of Ships Manual describes several methods for removing defective boiler tubes from tube sheets. One method suggests laying two beads of weld in the tube to help shrink the tube, after which it can be more readily driven out. This method must *not* be used for removing superheater tubes when the superheater header is fabricated from 4-6 per cent and ½ per cent molybdenum material. Heating of the header or tubes with a torch to facilitate tube removal should not be permitted under any circumstances. Care must also be taken in cutting off superheater tubes with a torch to make sure that the torch is not used near the header.—*Bureau of Ships Journal, December 1958; Vol. 7, p. 20.*

Corrosion Voltmeter

Since corrosion is basically an electro-chemical action, by measuring the electric potential between the structure and its environment it is possible to obtain an accurate estimate of the location and extent of corrosive action taking place. This can be done by use of a corrosion voltmeter which has been developed by an instruments company in conjunction with a firm specializing in cathodic protection. In order to obtain absolute values of the small electric potentials involved it is necessary to avoid the introduction of any instrument that takes current from the circuit for its operation. Thus an ordinary voltmeter would, in many circumstances, be unsuitable. The corrosion voltmeter incorporates a potentiometer that in effect feeds to the circuit an equal and opposite E.M.F. to the corrosion voltage and the measurement is made of this opposing voltage, thus taking no current from the circuit. The instrument incorporates a high resistance "Unipivot" voltmeter having ranges of 1·2 and 5 volts, together with a potentiometer which is connected in series with the "corrosion" voltage to be measured and adjusted until the voltmeter reading is reduced to zero. This potentiometer "backing off" voltage is then measured on the voltmeter and represents the equivalent of the E.M.F. developed between the structure and the soil. With care, satisfactory measurements may be made in circuits up to 1 megohm resistance.—*Corrosion Technology, October 1958; Vol. 5, p. 333.*

Four-cylinder External Combustion Engine

The firm of Réné Planche et Cie have built a four-cylinder external combustion engine. In developing this prime mover the inventors have endeavoured to overcome certain shortcomings, principally thermal ones, inherent in the classical four-cycle internal combustion motor: The need for a clearance volume leading to lowering of the efficiency; compression and expansion in the same cylinder, which results in the gases, after the explosion, being at a very much higher temperature than after compression. These are of much greater volume and should be expanded in an equally large capacity. At the time of admission the cylinder is never fully charged and after the explosion the expansion of the gases of combustion is never complete. Referring to the accompanying diagram, the two cylinders on the left serve as air compressors in series, the first one delivering air at 8 kg./cm.² abs. and the second one at 64 kg./cm. abs. Between these two stages the air passes through a cooler. On leaving the second cylinder, the air passes through a heat exchanger warmed by the air leaving the second expansion cylinder, is then led into an external reheating chamber (combustion chamber) where it is raised to about 950 deg. C. On leaving this chamber the air is led to the first expansion cylinder where it expands from 64 to 8 kg./cm.² abs., producing, in so doing, a much greater amount of work than that required for its corresponding compression in the same interval. This is because the air, in expanding, being much hotter than after compression, would, if free, occupy a very much greater volume. The air leaving this first expansion is partially cooled, in doing work, to 350 deg. C. and is returned



Cycle diagram of the hot air engine, with compressor cylinders on the left and expansion cylinders on the right. E is the intercooler, V is the combustion chambers, G the heat exchanger and H the combustion chamber with its inner and outer gas passes

to the combustion chamber which it traverses by means of an internal pipe coil, being reheated to 900 deg. C. It then passes into the second expansion cylinder in which it expands down to atmospheric pressure, performing further work. As in the first expansion the work is greater than that required for the corresponding compression. The exhaust is still hot and leaves the system through the "hot pass" of the heat exchanger, previously mentioned, where it gives up some of its heat to the h.p. compressed air. From this description the need for a carburettor or ignition is obviated and a lower grade of fuel than petrol, gas oil, kerosene or fuel oil can be used. The cooler and the heat exchangers have no moving parts and are therefore relatively free from breakdowns. The two expansion cylinders are the only elements subject to high temperatures and even so they work under rather better conditions than in an orthodox internal combustion engine. The engine can be started by an ordinary battery powered starter motor and the first-stage pressure can be limited to 3 to 4 kg./cm.² when starting. According to performance figures given by the makers, a 50-h.p. engine has a thermal efficiency of 37·7 per cent.—*Gas and Oil Power, February 1959; Vol. 54, pp. 57-58.*

Dissolved Oxygen Recorder

Corrosion of boiler tubes and allied components will take place wherever liquid or moisture is in contact with the metal to form an oxide layer under the influence of oxygen present in solution in the liquid. For the very low oxygen concentrations normally present in feedwater, various methods of measurement have been tried using chemical and physical processes. The former demands the services of a competent chemist and, due to the various reactions, considerable time elapses before the oxygen content is determined in any given sample. Physical methods have been found to be sluggish to respond to oxygen changes and subject to interference by chemicals in the feed system. Several years of experimental work by a company which has just produced a new dissolved oxygen recorder have shown that the most accurate determinations of small quantities of oxygen can be made by electrochemical means. It has been found that by using such a method an accurate record is obtained which will be free from drift, independent of chemical interference, and to have a rapid response to oxygen changes. The indicating and recording unit on the new recorder, together with the controls for calibration, are housed in a cast alloy case having a glass panelled door. The front of the case opens to permit changing charts, routine servicing and adjustments to be made. The hydraulic equipment is housed in a similar case and consists of cooling arrangements, filter, pressure reducing valves, sodium chloride saturator, and calibration and measuring cells.—*Corrosion Technology, October 1958; Vol. 5, p. 335.*

Model Experiments on Ship Strength and Slamming in Regular Waves

This paper presents the results of experiments on the effect of ship form upon the hydrodynamic loads and hull strength in waves from the slamming point of view. A series of self-propelled tests was carried out at the Mejiro Experimental Towing Tank in Tokyo on two brass models of merchant ships in various wave lengths, wave heights, and at various ship draughts in regular waves. The one had U and the other V sections forward, with identical principal dimensions. In the experiments, the pressures induced by waves, the impulsive pressures at the instant of ship slamming, and the hull stresses were measured in the tests. On the basis of the experimental results, comparative evaluation is discussed between the U and V-form ships from the slamming point of view.—*Paper by K. Ochi, read at the Annual Meeting of the Society of Naval Architects and Marine Engineers on 13th November 1958.*

Double Propeller for a 24-metre Cutter

The double propeller is a special case of the tandem propeller, the two sets of blades being rigidly attached to the same shaft. In trials carried out with a 79-ft. fishing cutter, performance data were obtained for a two-blade double propeller, a three-blade double propeller, and two similar three-blade single propellers. One of the latter was of cast steel, while all the rest were of welded sheet steel construction. The craft was propelled by a Diesel engine rated for 200 h.p. at 350 r.p.m. Torque and r.p.m. were measured over a range of free running ship speeds for each propeller tested, and the bollard pull characteristics were also established. The results are presented in curves and diagrams, and discussed. The three-bladed double propeller gave the best performance. At the same ship speed this propeller absorbed about 8 per cent less power than either of the single propellers, despite less favourable wind conditions. This propeller had a diameter of 4·27ft. (both discs), with an area ratio of 0·70 and pitch diameter ratios of 0·63 forward and 0·73 aft. The bollard pull at rated torque was increased by 36 per cent, the specific pull rising from 26·2 to 35·5lb./s.h.p. The results from the two-bladed double propeller (4·59ft. diameter) were not so good, though still better than those from the single propellers; this is attributed to inadequate clearance between the trailing edges of the after blade pair and the rudder. The single propellers gave practically equivalent performances, though the welded one was slightly superior. An attempt is made to provide a theoretical explanation for the observed improvement. An important parameter is the k-factor, this being that fraction of the additional inflow velocity at infinite distance which is actually effective at the after disc. The relations between k-factor and the thrust and torque coefficients are studied, and it is shown that for a given k-factor there is an optimum pitch diameter ratio for the after blades. This work is the initial stage of a research programme, which will include further trials and tank tests under various conditions.—*H. Schiefer, Schiffbautechnik, September 1958; Vol. 8, p. 459. Journal, The British Shipbuilding Research Association, November 1958; Vol. 13, Abstract No. 14,663.*

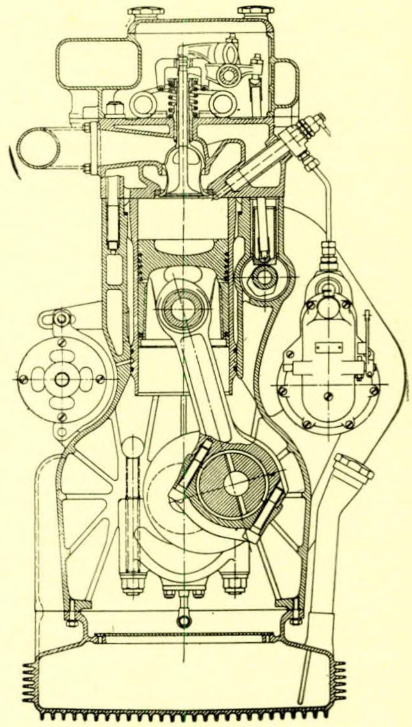


FIG. 2—*Transverse section through a Buchi telescope valve high speed Diesel engine*

Buchi Telescope-valve System on Four-cycle Diesel Engines

The telescope valve engine is an improved four-stroke cycle internal combustion engine, built with or without pressure charging, preferably combined with scavenging to sweep out the exhaust gases from and to cool the combustion space. A swirl is generated in this space for a simple and perfect fuel distribution and combustion. Such an engine design may be adopted for internal combustion engines of any size and use, and of any cylinder arrangement. The telescope valve system and its special design of the cylinder head, combustion chambers, valves, fuel injection system and valve control mechanism are also favourable for other than Diesel engines, such as gas, gasoline or heavy fuel engines. Two valves are provided, one coaxially arranged within the other; one of them serving for admitting the charge and the other for discharging the exhaust gases. This system, the so-called telescope or concentric valve system, by means of its concentric valves in conjunction with the form of the upper part of the piston closing the combustion chamber, in its outer dead centre position gives the combustion chamber the shape of a relatively deep disc while the valves are closed. To obtain ample flow areas relatively adjacent to the valve openings or seats, a corresponding form of the combustion space is chosen in the cylinder head and/or in the piston top. Thus, a circumferential wall is formed around the combustion chamber which conducts the intake air flowing from the inlet valve opening to that of the exhaust valve. Furthermore, the combustion chamber and the cylinder head on its inner side may be so shaped that when the piston is in T.D.C. position and both valves are open, the inner valve disc extends to a corresponding complementary portion of the piston head and an annular passage is formed between the valve disc and the adjacent walls. The valves and its discs are so shaped that the charge entering through one of the valves is led to the other valve by flowing around the outer valve disc, thereby sweeping through the whole combustion chamber. The valve bodies, the inner wall of the combustion chamber and the surface of the piston head may be given such a shape that, with both valves open, passages of smooth configuration for the scavenging air are formed which provide approximately constant stream areas. The seat of the inner valve may be recessed so deeply into the outer valve body, and the part of the inner valve body projecting into the combustion chamber is rounded to such an extent, that the scavenging air is deviated gradually and regularly from one valve opening to the other. The surface of the piston head may be advantageously so shaped as to surround, in the T.D.C. position, the surface of the projection on the exhaust valve disc in the open position of this disc. The charge either can be admitted around the outer valve and discharged through the inner annular space between the two valves or *vice versa.* Moreover, to the entering charge may be imparted advantageously a rotatory movement about the valve axis, by means of tangential or spiral entrance-surface portions or separate guide surfaces. Alternatively, for effecting this whirling movement the connecting ribs between the stem and the sleeve of the outer valve can be utilized, which may be provided with helical surfaces. Because of this design, the insides of the cylinder head and of the piston top surrounding the combustion space are absolutely symmetrical to the cylinder axis and have a minimum of relatively plain and regular surfaces. For a sufficient opening of both valves, even during the scavenging period, no cuts or the like are necessary in the piston head or in the cylinder liner for these valves when the piston is near or in its T.D.C. position. The fuel injector or injectors are located in such a manner that the injected fuel arrives uniformly distributed in the combustion space. The fuel injection device or devices inject the fuel in a direction which is transverse and, if necessary, also oblique to the cylinder axis.—*A. J. Buchi: paper contributed to the Oil and Gas Power Division Conference, 1958, of the American Society of Mechanical Engineers, Gas and Oil Power, December 1958; Vol. 53, pp. 325-328.*

High Torque Merchant Ship Gearing

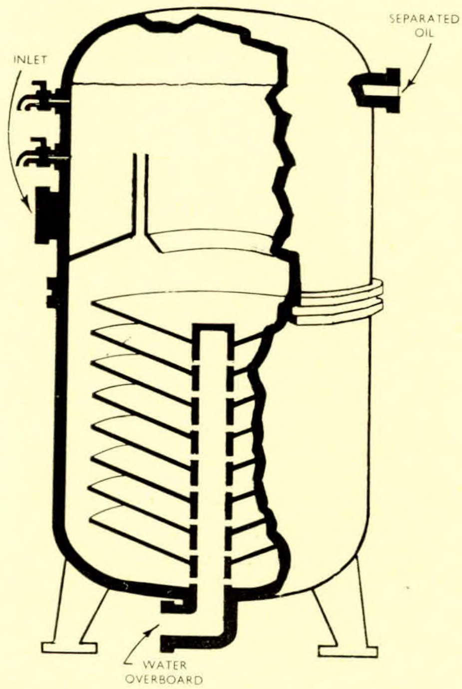
The current trend in large tanker machinery is towards successively higher torques on the propeller shaft as deadweight is increased. Retaining the two-turbine single-screw arrangement generally preferred for reasons concerning cost and efficiency, for tankers larger than about 65,000 tons deadweight, gearing of a type somewhat different from current practice may be desirable. In this paper proposals for machinery developing 26,500 h.p. at 109 r.p.m. are taken as examples, and it is concluded that the use of hardened and ground gearing for the first-reduction units can show to advantage, preferably in conjunction with dual-tandem drive. Although the design problems and solutions suggested in this paper have been based on tanker type machinery, the principles involved are no less valid for other vessels, particularly passenger liners of high power. During the past ten years a considerable amount of work has been done on surface hardening of gears for marine use. In this paper are recorded details of this work with particular reference to the type of equipment found suitable, operation and procedure determined by experience and selection of the most appropriate steel based on consideration of the practical aspects of heat treatment taken in conjunction with fatigue properties. Some particulars are also given of alternative processes, notably induction hardening and nitriding.—*Paper by J. R. G. Braddyll and M. C. Oldham, read at a meeting of the North East Coast Institution of Engineers and Shipbuilders on 9th January 1959.*

Boom for Containing Oil Spills

The hazards and expense caused by oil spills are a problem to Port Control Authorities (military and civil) as well as to the vessels concerned. The Port Control Office, San Francisco, has adopted an effective method of minimizing the area of a spill, reducing the resultant hazards, and lessening the overall cost of cleaning and disposing of oil spills. Study of oil spills occurring at the Naval Station, Treasure Island, revealed that the primary factor in controlling hazards, area of spread, and commercial clean-up costs was the speed with which the oil was contained after a spill. The minimum for a commercial contractor to arrive on the scene of a spill was 1 hr.; the maximum was 3 hr. As a result of the study, the Port Control Office improvized a portable oil-containing boom approximately 6½in. in circumference and consisting of six 50-ft. lengths for a total of 300ft. The boom was fabricated by naval personnel in the Ships Department, Treasure Island. Materials used were 6-in. foam glass fishing floats (2in. wide), a nine-thread line passed through a centre hole of the floats, and three 8-oz. washers (total 24oz.) for spacers between floats. The floats were strung on the nine-thread line, and three 8-oz. washers were placed between every third and fourth float to give flexibility to the boom and provide enough weight to keep it from surging on top of the water and letting oil escape. If water action in a particular area is severe, a 6-in. canvas apron, weighted on the bottom side of the boom, can be used as further assurance against escaping oil. The 50-ft. sections of fabricated floats, washers, and nine-thread line are encased in water-repellent canvas. An 18-in. sleeve is left at each end with enough line to secure the sections together. This covering contributes to flexibility and ease of handling, and it prevents open gaps in the boom. The boom is then wound around a reel (the size depending on the length of the boom) that is mounted on a trailer or other means of providing mobile service. If available, a small boat would be ideal. By encircling the contaminated area with the boom, the Port Control Office has been able to contain spilled oil within 10 minutes of notification. Although there are various ways to dispose of oil after it is contained, the Port Control Office uses a chemical known as Tricon Oil Spill Eradicator. The chemical is sprayed over the oil and then agitated with a steady, fast stream of salt water from a fire hose to facilitate quicker blending of the chemical with the oil for faster diffusion. The chemical emulsifies oil so thoroughly that there is little possibility of any oil adhering to pier pilings or ship sides. The emulsified oil is dispersed by tidal and water action.—*J. W. Otis, Bureau of Ships Journal, November 1958; Vol. 7, pp. 36-37.*

A New Design of Oily Water Separator

The importance of having an efficient means of separating oil from bilge and ballast water on board nearly all types of vessels is fully appreciated by shipowners and seagoing personnel. The Simplex-Turbulo Marine Co., Ltd., has recently introduced the Turbulo separating tank with a capacity range



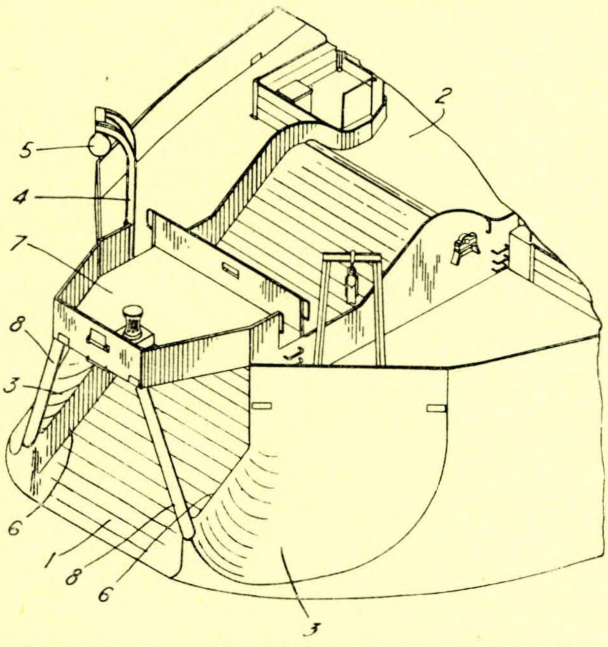
The Turbulo oily water separator in outline

of from 10 to 250 tons per hr. Oily bilge and ballast water enters the upper part of the separator where there is a coarse separating chamber and the mixture is roughly cleaned before passing down into a fine separating chamber directly below. The oil to be separated gathers on the underside of dished circular plates forming globules which rise from the outer edges of the plates and are caught by the main plate dividing the rough and fine separating chambers. This oil is led off through tubes into the oil collecting chamber and thence from the separator to the oil collecting tank. Surplus air which gathers in the top of the tank is automatically discharged. The separator, which can be supplied with either hand or fully automatic electronic control, has received approval from the Ministry of Transport and Civil Aviation.—*The Motor Ship, February 1959; Vol. 39, p. 541.*

Patent Specifications

Trawler

The invention consists in a trawling vessel of which the stern comprises a central inclined chute, for hauling in a net, having on each side near to its lower end a separate surface inclined to the vertical and preferably concave, over which an otter can be hauled in. The chute and the aforementioned surfaces extend abaft the propeller of the vessel, and to or below water level. The lower end of the chute is constructed to allow escape of water transversely at its sides. As shown in the drawing the flat chute (1) runs up to the level of the deck (2). The base edge of this chute (1) extends below water level and aft of the propeller (not shown). On each side of the chute (1) the hull is formed with a surface (3) inclined to the vertical and preferably concave. This surface also extends substantially to or below water level and beyond the propeller. These surfaces (3) are adapted to receive and facilitate movement of the otters which are hauled in at the same time as the net. The danger of the otters fouling the



propeller is therefore minimized or eliminated. On the deck over each surface (3) a davit structure (4) supports a pulley mechanism (5) over which runs the otter cable. The chute (1) is separated at its lower end from the surfaces (3) by partitions which define the chute channel transversed by the net. It is an important feature of the invention that these partitions shall offer little obstruction to the escape of water sideways from the chute. The partitions may be in the form of closed walls (6) standing at a comparatively small height above the chute surface; they are preferably perpendicular, but may be outwardly inclined. Also, they may be formed of grilles to allow passage of water. Any mass of water impinging on the chute can readily escape over the walls (6) (and through them if they are apertured) and is less likely therefore to jam or damage a catch being hauled up the chute.—*British Patent No. 810,344 issued to Sir Charles Dennistoun, Bart, C.M.G. Complete specification published 11th March 1959.*

Gravity Davits

This invention relates to gravity davits in which the winch is operated by an electric motor. According to this invention, provision is made for bringing in the davits under power in two stages which are determined by the operation of two limit switches in turn and one considerably in advance of the other. In Fig. 1 the successively operated limit switches (10 and 11) are used in conjunction with contactor type starter gear to determine the two power stages and change of winding-in speed automatically and independently of any action on the part of the operator. In this arrangement, in which 12 is the full speed contactor, 13 is the line contactor, 14 is the usual stop button switch and 15 is the start/run button switch,

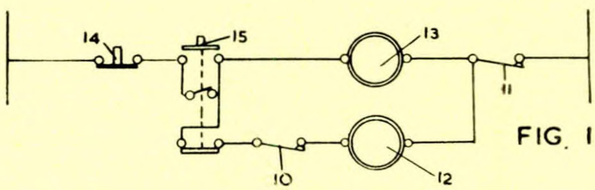


FIG. 1.

the first or advance limit switch (10) is opened by the incoming davit arm so as to de-energize the full speed contactor (12) which functions to reduce the winding-in speed in one of various ways, depending on the type of driving motor employed. For example, the contactor (12) may function to reinsert resistance in the armature circuit of a d.c. motor to reduce the voltage applied to the armature and thereby reduce the speed, or it may reinsert resistance in the rotor circuit of an a.c. motor so as to increase the slip and thereby reduce motor speed. If an a.c. driving motor of the two-speed squirrel cage type is employed, the contactor (12) may function to change over to the alternative field winding which gives a greater number of magnetic poles and consequently a reduced motor speed. Thus, opening of the first or advance limit switch (10) initiates the final stage of the inboard movement of the davit at low power and speed up to the second limit switch (11) which determines the second stage at the stowed position. Thus the whole of the inboard movement is effected under power with complete safety and avoiding any necessity for winding by hand.—*British Patent No. 808,869 issued to Samuel Taylor and Sons (Brierley Hill), Ltd., and A. P. Smith. Complete specification published 11th February 1959.*

Handling and Stowing Containers in Cargo Ships

This invention relates to a cargo ship with means for stowing containers in a number of fixed decks which are arranged one above the other and divide the hold horizontally, being connected to one another and with a continuous upper deck by at least one lift. The object of the invention is to provide means by which the containers can be stowed on the individual decks so as to make full use of the deck surface in a continuous and therefore time saving operation. In Figs. 1, 2 and 3 the containers (1) which travel from the pier over a loading bridge (10) on to the upper deck (7), are moved into the lift (2) which brings them to the individual decks (3 to 7). There the containers (1) are moved on to the roller systems (8), which are covered with the plates (9) and are rolled along these in the longitudinal direction of the ship adjacent to the required place. Here they are moved transversely to the direction of the roller system to the place where they are to be stowed and are there anchored. The individual cover plates (9) with the containers (1) standing on them remain on the roller system when the transverse rows are filled. *—British Patent No. 806,098, issued to A. G. Weser. Complete specification published 17th December 1958.*

Fig. 1.

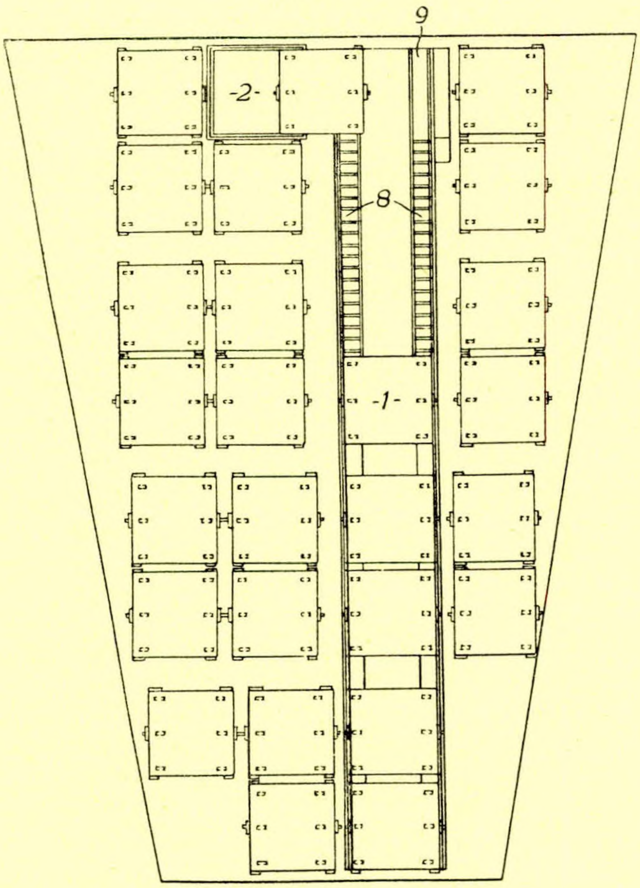


Fig. 2.

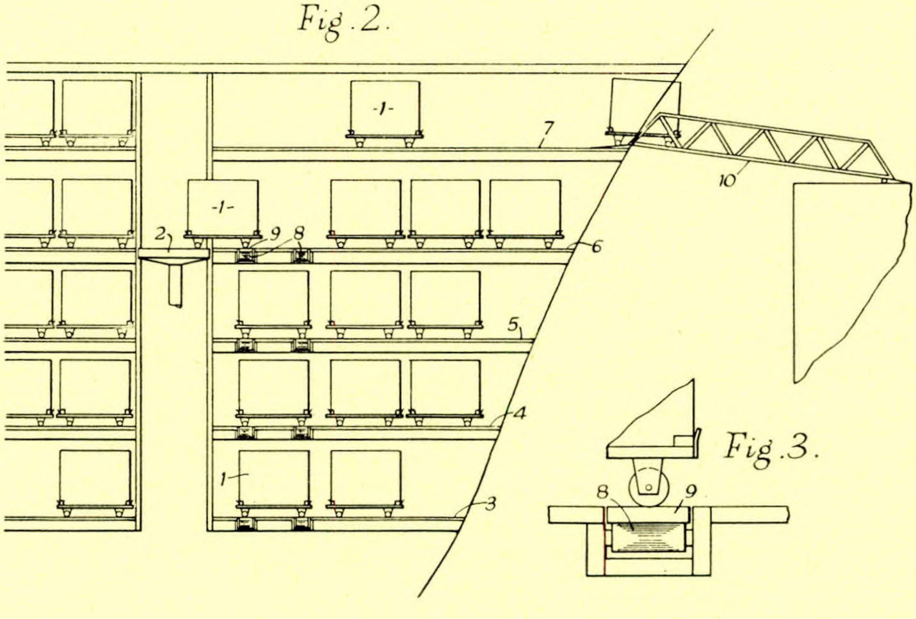


Fig. 3.

Storing Cargoes in Ships' Holds

This invention relates to means for storing cargoes in ships' holds and is concerned more particularly with the storage of that type of cargo which comprises a number of bodies of appreciable bulk; that is, bodies which have an

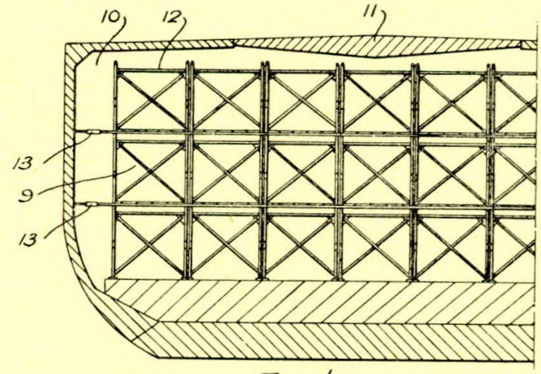


Fig. 1

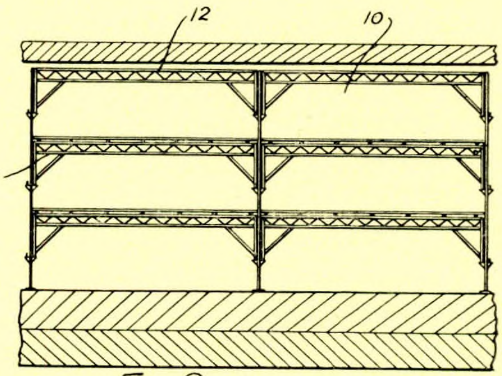


Fig. 2

overall vertical dimension, when stowed, of at least 3ft. and overall dimensions in the horizontal direction of at least 2ft. by 2ft. and which cannot without risk of damage be stacked one on top of the other. Typical examples are motor cars and small aircraft. In Figs. 1 and 2 the hold (10) of a ship having a hatch cover (11) is provided with means (9) for storing cargo. The structure comprising means (9) is provided at each side with one or more adjustable jacks (13) by means of which the structure (9) can be held securely in a position between the sides of the ship. Three layers of cargo receiving spaces are provided and the uppermost level (12) is provided for stiffening purposes, and if desired stowage of small pieces of cargo.—*British Patent No. 807,032 issued to Kwikform, Ltd. Complete specification published 7th January 1959.*

Ballast Tank

This invention relates to a ballast tank constructed so as to be variable in volume. The walls are of flexible sheet material, and the tank is connected at one of its surfaces to a water ballast chest attached to the ship's structure. The tank may be of any required profile, and when not used for ballasting is kept in a collapsed condition, thereby occupying a con-

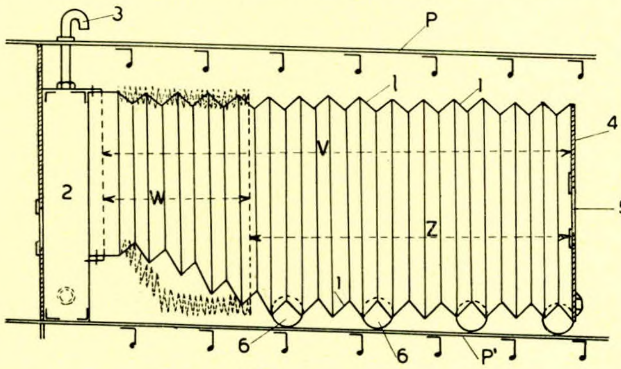


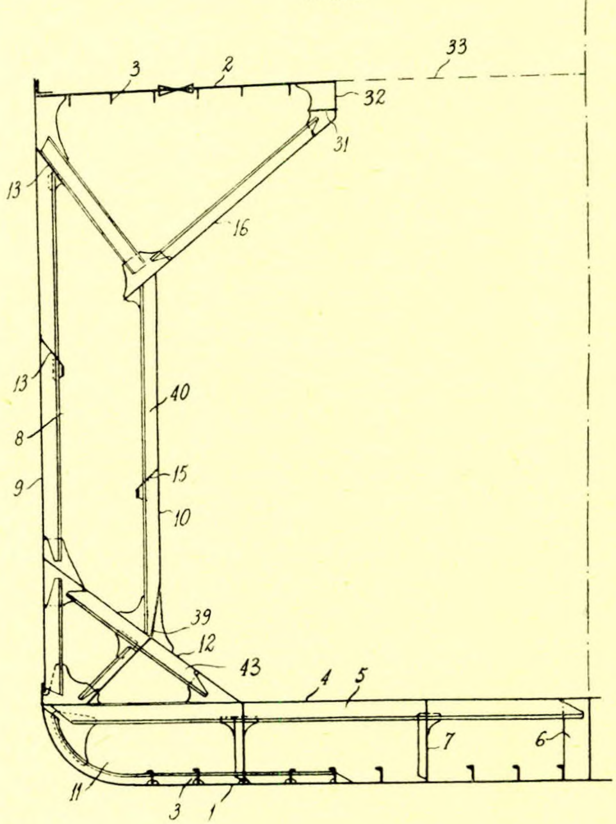
FIG. 1

siderably smaller space. The ballast tank shown in Fig. 1 is fitted between decks P and P^1 and is constituted by a bellows-like flexible hollow member (1) of flexible liquid-impervious sheet material, the walls preferably being plaited or corrugated. The hollow member (1) is connected to a watertight chest (2) having water ballast supply piping (3) and such other fittings (not shown) as air escape piping, sounding devices, etc. At its other end, the hollow member (1) is closed by a metallic wall (4), which may have a manhole (5). In order to facilitate the spreading out of the member (1), effected by the thrust of the water flowing into the tank, member (1) is provided with rollers (6). Collapsing of the empty member (1) is effected with blocks, ropes and tackle.—*British Patent No. 809,695 issued to L. Vecchi. Complete specification published 4th March 1959.*

Ship's Hull

A ship's hull according to the invention comprises a double bottom forming ballast tanks, the tops of the ballast tanks on which the cargo rests being supported and stiffened by transverse beams which are fastened to the structure of the sides of the hull so as to transmit part of the weight of the cargo to the longitudinal bulkheads. As shown in Fig. 2, referring to a tanker, the bottom plating (1) and the deck

FIG.2



plating (2) are stiffened by longitudinal members (3) constructed and arranged to withstand part of the general stresses imposed on the ship's girder structure as well as the local stresses due to water ballast and heavy sea. The hold floor (4) defining the top of the ballast tank directly supports the cargo upon it and is stiffened by transverse beams (5) secured to the central keelson (6) and partly supported by side keelsons (7). Selected beams (5), e.g. every other beam, are laterally extended through side ballast tanks as far as the ship's side (9), to which they are connected. The beams (5) will therefore transmit the weight of the cargo in part to the ship's bottom plating (1), in part to the ship's sides (9), and in part to longitudinal bulkheads (10) of side tanks (8), since the beams (5) are also secured to reinforcements (43) of such longitudinal bulkheads. Accordingly, the transverse beams (5) of the hold floor (4) or ballast tank top are essentially designed and constructed to withstand the local stresses due to cargo loading, and owing to their arrangement they are not subjected to the longitudinal stresses to which the ship's girder structure is subject, due to motion of the ship in the sea.—*British Patent No. 808,240 issued to V. Albiach. Complete specification published 28th January 1959.*