Motor T.S/S. Arnus

General description of 1122 Type SH&WR Diesel Engine

Reprinted from THE MOTOR SHIP October, 1922.

THE NEPTUNE :: MARINE :: OIL ENGINE.

SWAN, HUNTER & WIGHAM RICHARDSON,

NEPTUNE WORKS,

NEWCASTLE-ON-TYNE, ENGLAND.

Reprinted from THE MOTOR SHIP *October, 1922.*

THE NEPTUNE MARINE OIL ENGINE.

TRIALS OF THE 1,400 I.H.P. NEPTUNE TWO-CYCLE SET WITH SCAVENGING PUMPS BELOW WORKING CYLINDERS. A NOVEL CYLINDER COVER.

BEFORE the war Diesel engines were built by Messrs. Swan, Hunter and Wigham Richardson, under licence from the Atlas Diesel Co., Stockholm, but the type which is now being manufactured by the former concern offers several points of difference from the original design, and may reasonably be said to be a new engine, so far as any Diesel motor can be considered new. The first of the post-war Neptune engines to be built ran trials during the course of the last month at the Neptune Works, where we had an opportunity of inspecting it and noting its operation while it was being tested.

The new engine is the first of two sets being built for installation in the motor tanker "Arnus," and is designed to develop about 1,400 i.h.p. in six cylinders at 125 r.p.m., the equivalent brake power being probably in the neighbourhood of 1,050. The cylinder bore and stroke are 17 ins. and 35 ins. respectively.

A Novel Cylinder Cover.

The Neptune engine is a two-cycle type, and its main peculiarity, so far as principle of operation is concerned, lies in the provision of a scavenging cylinder below each working cylinder and their employment as starting motors. This is a well-known system and has for years been used by the Swedish originators of the idea. It has the advantage of limiting the number of valves in each cylinder cover to that required for the fuel (apart from the automatic escape valve), and avoids the necessity for admitting cold starting air to the combustion cylinders when manœuvring.

Before, however, dealing with this part of the design, reference may be made to a very novel feature which has just been adopted for the first time. This refers to the construction of the cylinder cover, and can be examined in detail in Figs. 1, 4 and 7. The cylinders are supported in pairs by three cast-iron columns at the top, arranged to carry the crosshead guide plates, and three at the back, which are bolted to the front columns. In addition there are continuous through bolts connecting the working cylinders to the bedplate—three at the back and three at the front for each pair of cylinders, as indicated in Fig. 7. These do not pass through to the top of the covers, but merely to the top of the cylinders.

There are two separate cylinder covers. The main cover is not arranged to take the fuel valve direct, but is provided with a loose liner, as shown in Fig. 4, with one central hole. On the top of the main cover is bolted the small cover, into which the fuel valve is fitted, the general arrangement being clearly shown in Fig. 4. The small cover is provided with rings where it fits into the cylinder cover liner, and the latter is thus perfectly free to expand. At the bottom the liner is shaped to the form of the piston, which, incidentally, is symmetrical.

The main cylinder liner is separate and is also free to expand, the method of attachment being indicated in Fig. 4. It will be seen that with this construction the small liner at the top encompasses the zone of greatest heat, and it is thought that with such an arrangement the possibilities of troubles developing through heat stresses are reduced to a minimum; in any event the replacement of one of a small cover is a much less important item than that of the ordinary large Diesel engine cover. This method allows of very effective cooling of the upper liner, but the main cylinder cover has, naturally, not to be water-cooled beyond the section indicated. Such a system of designing the cylinder and cover would appear to allow of engines of large cylinder diameter being built without much risk of trouble being caused by excessive heat stresses, at any rate so far as the cover is concerned.

In addition to the fuel valve there is a horizontal escape valve indicated in Figs. 4 and 7—one for each cylinder. A small horizontal spindle is carried at the back of the cylinders (Fig. 7) on which are cams actuating short levers, by which the escape valves are opened. This spindle is operated from a lever at the control platform, so that all the escape valves may be opened. The cams are set differently, so that the first three, and finally six, escape valves are allowed to open.

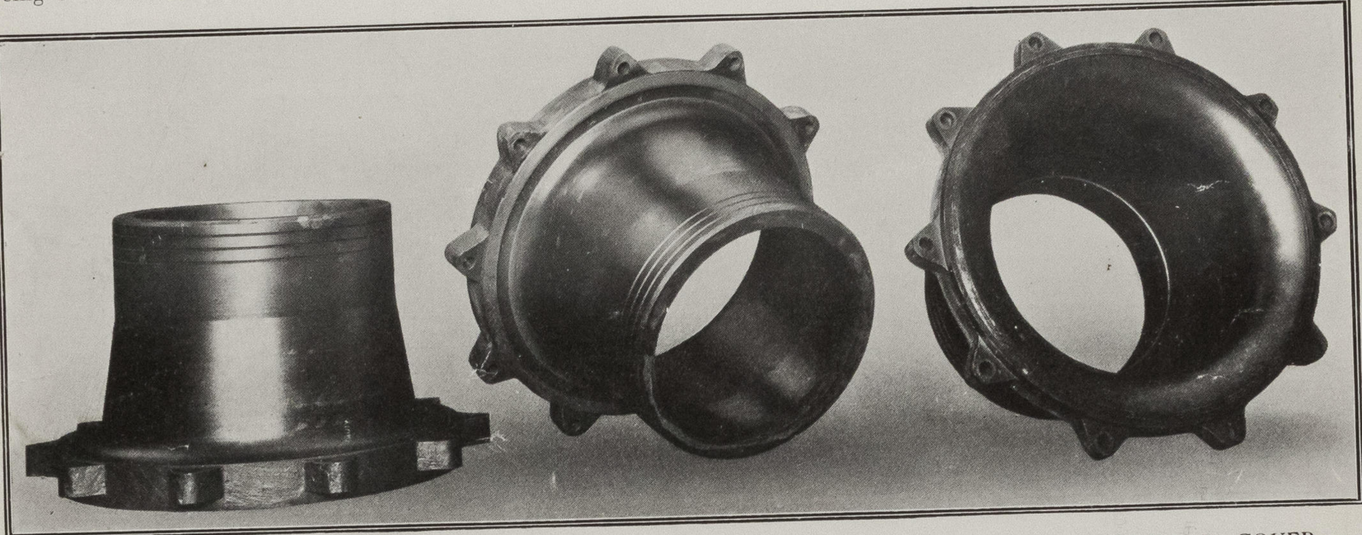
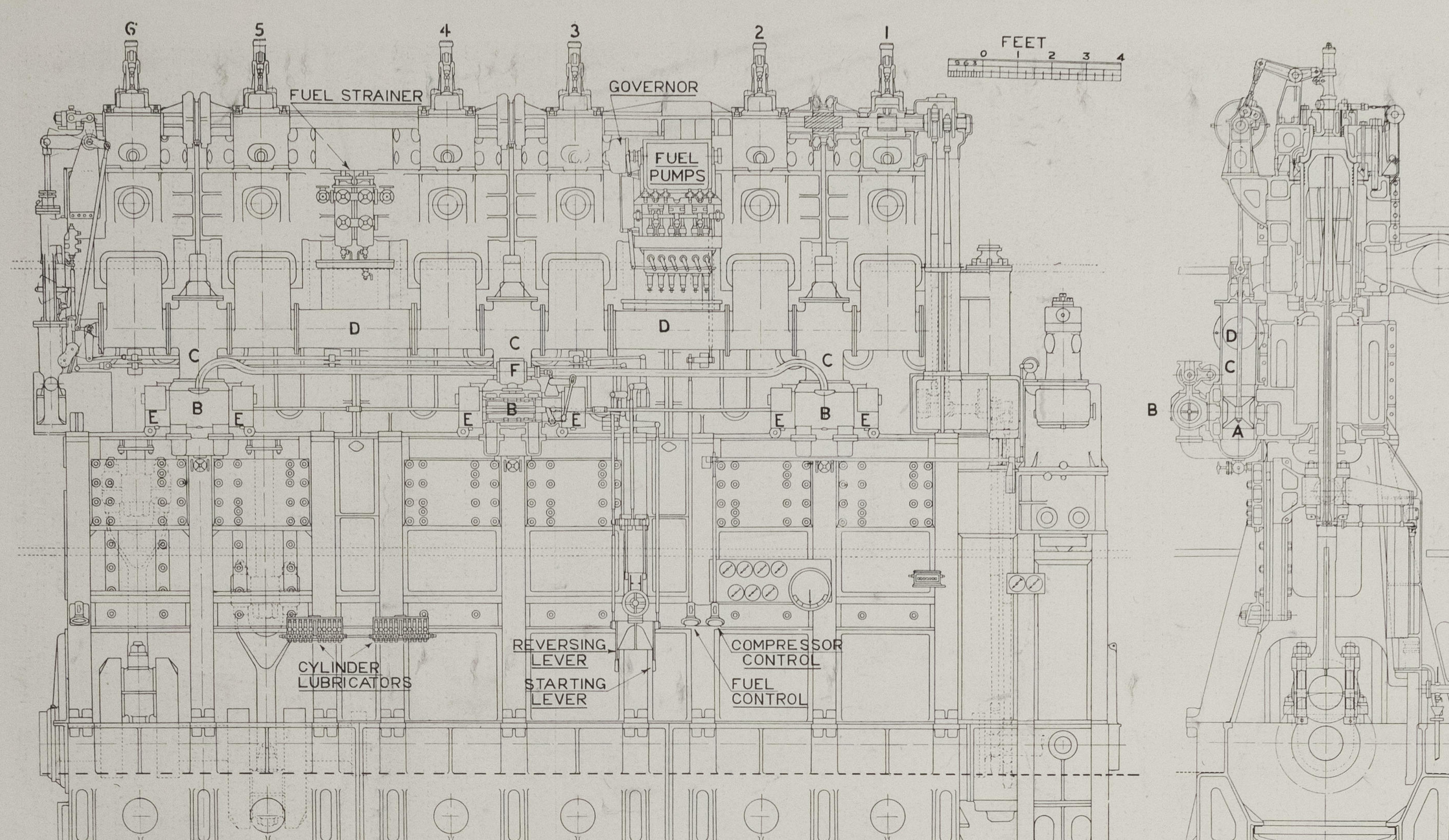


FIG. 1.—THREE VIEWS OF THE CYLINDER COVER LINER. THERE IS A SMALL CENTRAL CYLINDER COVER BOLTED TO THE MAIN CYLINDER COVER.

Scavenging and Air-starting System.

We may now deal with the system of scavenging and the employment of scavenging cylinders for starting purposes. The scavenging pumps below the working cylinders are slightly larger in diameter than the latter, and deliver the air at a pressure of about 1½ lb. per sq. in. into the receiver (C, Fig. 4). The arrangement is such that when the piston valve (A)—there is one of these valves for each pair of cylinders (operated from the camshaft by eccentrics)—is below the central position, air from the atmosphere passes through the bottom row of ports into No. 1, 3 or 5 scavenging cylinder. At the same time the top row of ports is open and allow No. 2, 4 or 6 scavenging cylinder to discharge scavenging air into



FIGS. 3 AND 4.—FRONT AND SECTIONAL SIDE ELEVATIONS, SHOWING CYLINDER AND PISTON CONSTRUCTION WITH SCAVENGING PUMPS BELOW THE WORKING CYLINDERS. BORE, 17 ins.; STROKE, 35 ins.; SPEED, 125 r.p.m.

1,400 I.H.P. NEPTUNE TWO-STROKE DIESEL ENGINE.

Built by Swan, Hunter and Wigham Richardson.

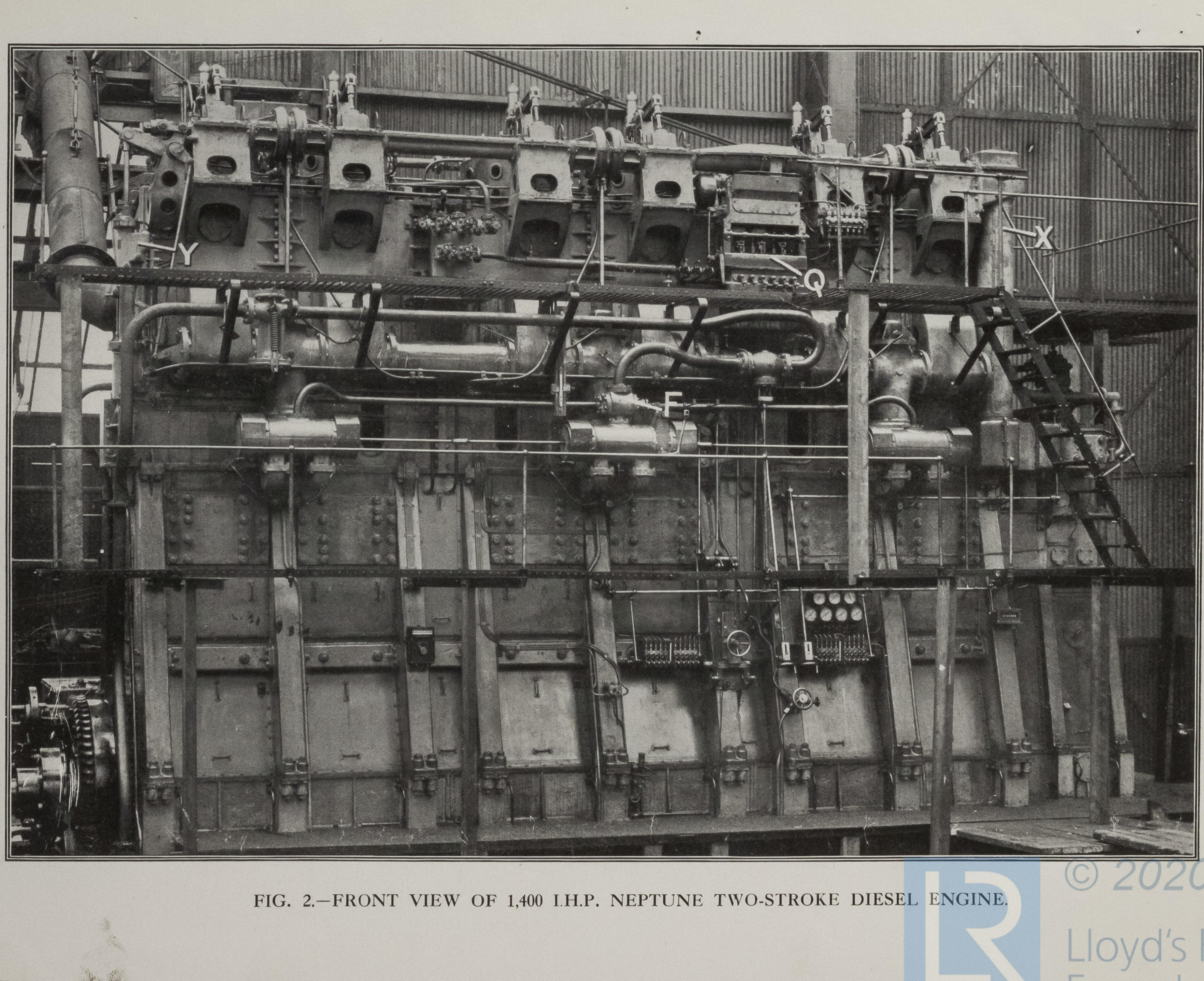


FIG. 2.—FRONT VIEW OF 1,400 I.H.P. NEPTUNE TWO-STROKE DIESEL ENGINE.

the receiver (C, Figs. 3 and 4). When the piston valve (A) is above the central position, No. 2, 4 or 6 scavenging cylinder is taking in air through the top port, and No. 1, 3 or 5 scavenging cylinder is discharging into the receiver (C) through the bottom port. This applies to each pair of cylinders controlled by the individual valves (A). It should be noted that, when reversing, these piston valves (A) are automatically set in the right position, since the eccentric, driven off the camshaft above, is turned through 180 degrees. There is a horizontal pipe (D) connecting the vertical receivers (C), and through this the scavenging air passes to the cylinders in the manner described above. Atmospheric air is admitted to the change-over valves (B, Figs. 3 and 4) through the inlet ports (E, E).

For starting purposes compressed air is admitted through the compressed-air valve (F). The change-over valves (B) are placed in the desired position by means of a lever worked from the starting platform. In order to diminish back pressure or exhaust resistance when starting with compressed air, the change-over valve (B) is arranged so that most of the air is exhausted through the ordinary air intake pipes (E, E). The scavenging system will be further referred to when dealing with the method of reversing.

It need hardly be remarked that with such a design the valve mechanism and the cam gear on the top of the engine are considerably simplified—a fact well indicated in Fig. 7, showing a top view of the engine. The method of driving the camshaft is interesting. By means of two eccentrics on the crankshaft a horizontal spindle about half-way up the engine is operated, and from this two connecting rods take the drive to the camshaft, the whole being totally enclosed in the casing (X, Fig. 2). This system allows of ready and accurate adjustment. The camshaft is also totally enclosed, apart from the section where the drive for the eccentrics operating the piston valves is taken.

For each fuel valve there are virtually four cams, although it should be noted that, when moving the camshaft fore and aft on reversing, it is not necessary to lift the valve levers. Two of the cams are for ahead and astern operation, while the other two are for slow running, either ahead or astern, the lift of the valves being reduced. The McTaggart-Scott servo motor, which, through a bell-crank lever, causes the fore-and-aft movement of the camshaft, is seen at Y in Fig. 2 at the after-end of the engine.

Reversing System.

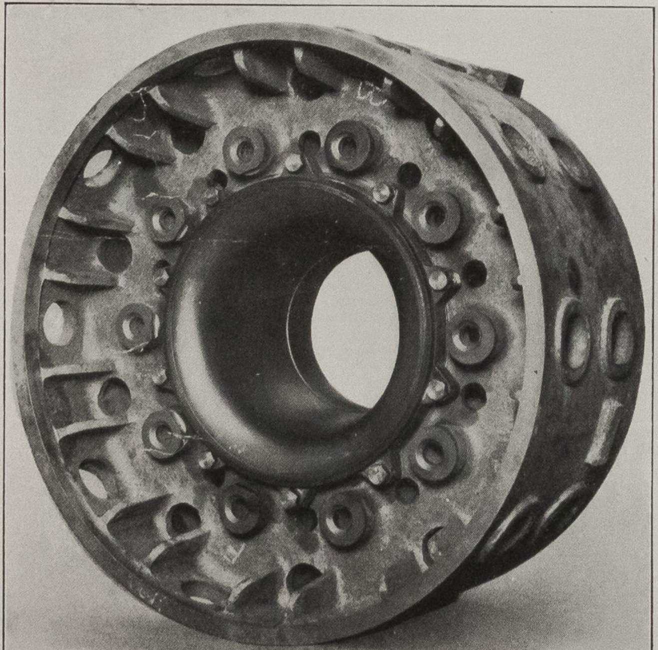
The reversing and manœuvring system will be readily understood from the description which has already been given, together with an examination of Fig. 6, showing the starting platform. The lever (H) on the left, which is barely visible, is the reversing lever, while that on the right (G) is the starting lever. When H is in the position shown the cam gear is set for ahead running, but if it be moved to the forward position the servo motor is actuated by means of the rod (K) and a horizontal spindle. This causes compressed air to enter the air cylinder of the servo motor, and the camshaft is then moved fore and aft, bringing the astern cams under the fuel valve lever rollers. When the camshaft has moved to the right position, it is indicated on the indicator above the starting levers. The handwheel (L) is merely for locking the levers in position. It will be noted that on the indicator there are two positions for ahead and astern in addition to the stop position in the middle. The second stage is when the engine is to run at low speed, in which case the half-cams referred to previously are below the valve levers, thus reducing the lift of the fuel valves.

To start up the engine the lever (H) is moved forward. Through the lever system (M, N, Fig. 6) the change-over valves (B) are moved, so that the connection with the atmospheric air is cut off and the scavenging cylinders may receive compressed air from the starting air reservoir through the valve (F, Figs. 2 and 3). This valve is opened by the movement of the lever (H), so that, immediately it is moved forward, compressed air enters the scavenging cylinders. After the engine has made a few revolutions, the starting lever is pushed back to its normal position, and the speed of the motor is controlled by means of the wheel (P, Fig. 6). This varies the period of opening of the suction valves of the fuel pumps, which are driven from the camshaft through spur gearing and are seen in Fig. 2 at Q. They are so arranged that they are out of action during the operation of reversing, and remain so until the engine is rotating in the desired direction, when they are automatically brought into action again, thus avoiding delivery of the fuel to the cylinder during this operation.

In addition to the hand control, the suction valves of the fuel pumps are subject to the action of a centrifugal governor, driven from the camshaft, and indicated in the illustrations. A near view of these pumps is given in Fig. 8, and the delivery pipe to the left is steam jacketed. As during the trials the engine was run practically the whole time on fuel oil as used under boilers, the specific gravity being .94, this arrangement is advantageous.

Cooling and Lubricating Systems.

The now common practice of driving the auxiliaries separately is adopted, apart from the air-injection compressor, which is of the three-stage type, built by



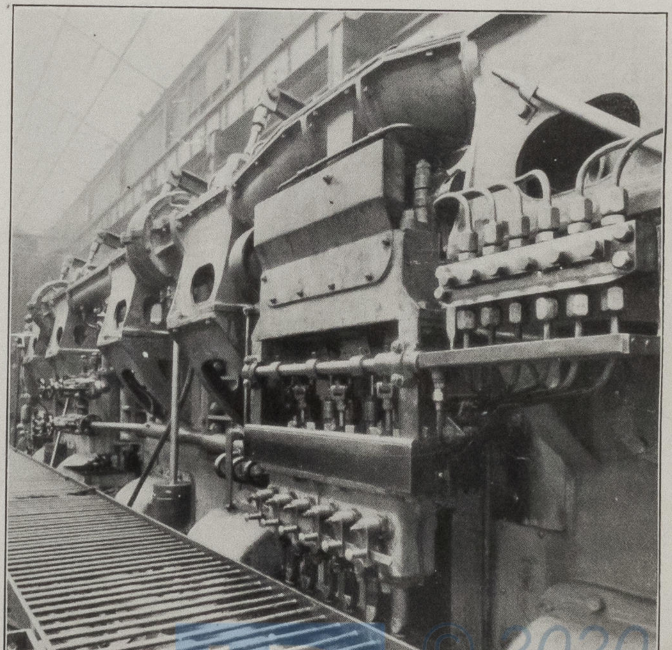


Fig. 5 (left).—View, looking into the combustion space of the cylinder cover, showing the loose liner. The bosses for the circulation of the water around the liner can be seen. Fig. 8 (right).—Near view of fuel pumps.

Donkey Boilers made at WALKER By whom made SWAN. HUNTER. W. RICHARDSON Boiler No. 1122 When made 192

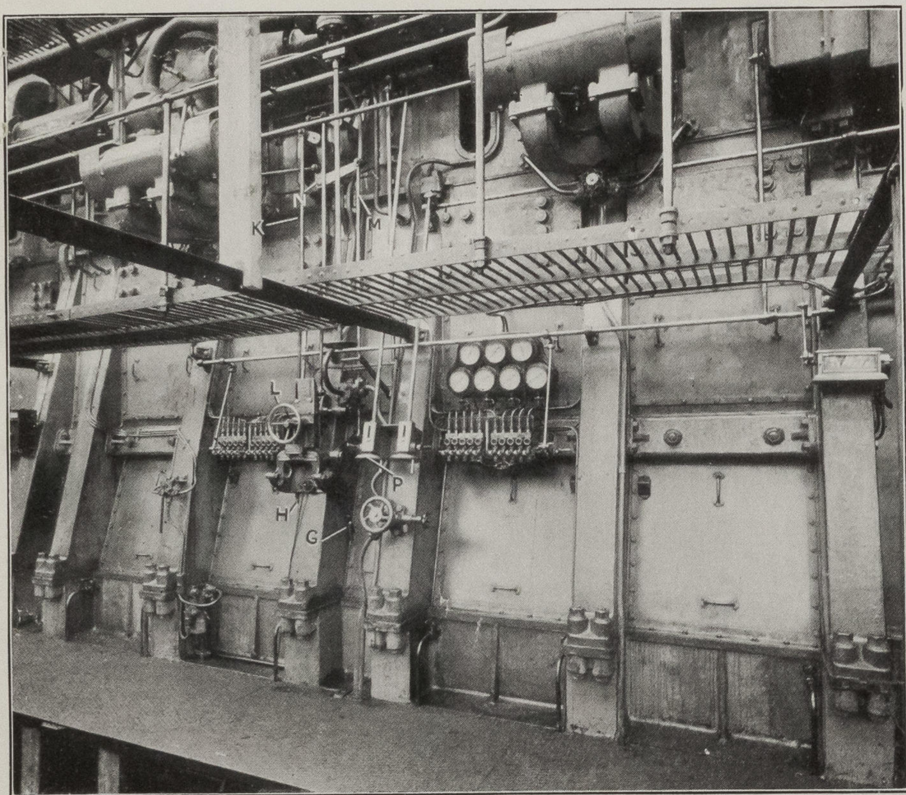


Fig. 6.—Near view, showing control station.

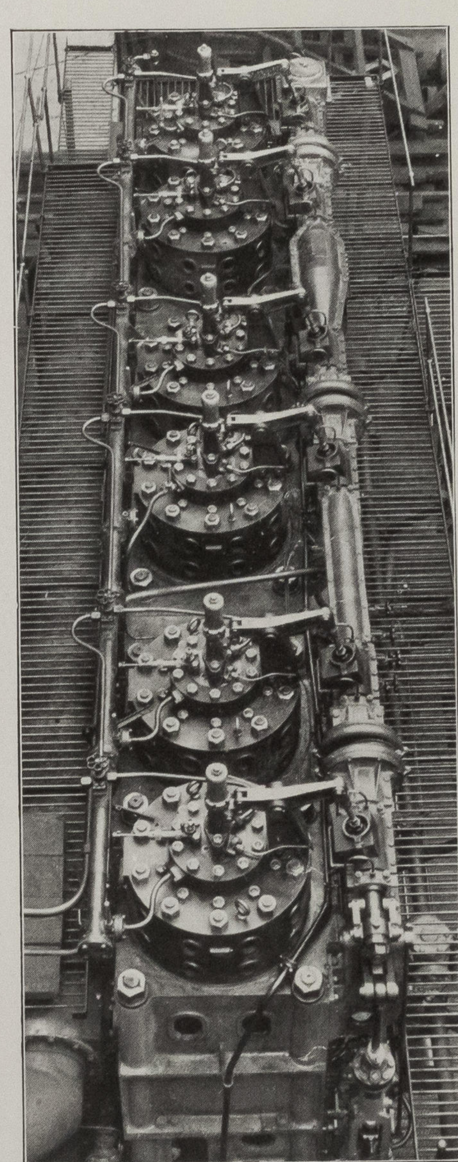


Fig. 7.—Top of the engine, showing the small cylinder covers.

Swan, Hunter and Wigham Richardson. It is driven off the end of the crankshaft. The high-pressure cylinder is fitted with a loose liner, while the other cylinder liners are cast with their water jackets. The intercoolers are of the vertical tube type and are located at the forward end of the engine, being fitted with separators on each stage. A set of sight-feed lubricators, driven from the camshaft driving gear, is provided for lubricating the working and compressor cylinders. Sea-water is utilized for cooling pistons and cylinders. As seen in Fig. 4, the cooling water for the pistons enters and leaves through the hollow piston rods and telescopic tubes; air vessels are provided at the back for each individual piston in order to avoid water hammer.

The working pistons are shaped symmetrically, which is a new feature for the Neptune engine, and this design, together with the arrangement of scavenging ports, is the result of very prolonged tests which have been carried out at the Neptune Works. There are four scavenging ports in each cylinder liner, the exhaust ports being opposite, and it is believed that, as a result of the experimental work carried out, a very effective system of scavenging has now been devised. Other manufacturers of two-cycle engines of the single-piston type have tended towards the employment of controlled scavenging, but in this motor the designers have certainly the advantage of simplicity, and it will be interesting to note whether any loss in efficiency results, due to imperfect combustion.

During our visit the engine ran very smoothly and silently, while reversing was effected with the usual ease. It was then working on fuel oil, and the exhaust was practically invisible, while the general operation of the plant created a favourable impression. It may be added that the total weight of the engine as illustrated is in the neighbourhood of 130 tons.

Temple Press Ltd., 7-15, Rosebery Avenue, E.C.1.