

Chapter I

H.P. FUEL PUMPS TYPE A.260 Y. Mk. 5

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INTRODUCTION

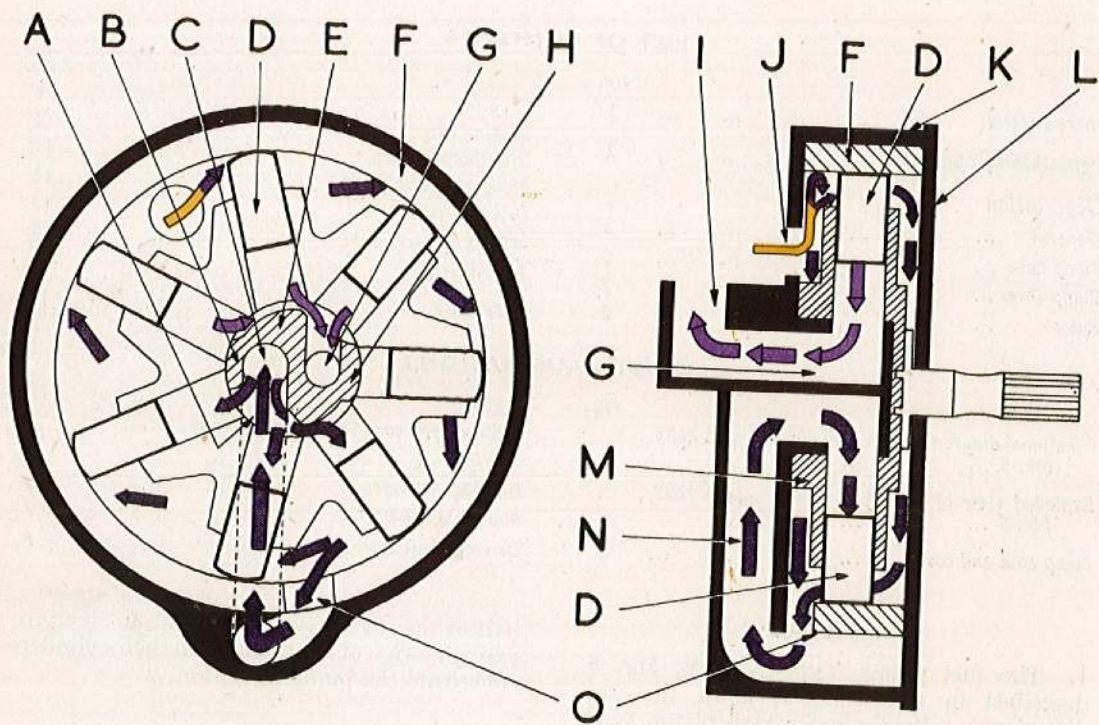
1. The fuel pump, Type A.260Y, Mk. 5, described in this chapter, is of the uni-directional, self-priming, rotary piston type, and is designed to be driven from an engine accessory drive. The delivery at 3,500 r.p.m. is 10 g.p.m. at a pressure of 1,000 lb. per sq. in. The gross weight of the pump is 11 lb. Pumps of this type are fitted to Goblin Mk. 2 aero-engines.

PRINCIPLE OF OPERATION

2. Referring to the functional diagram, fig. 1, the pump comprises an outer case (K) which contains the bearing ring (F) and supports the ported valve element (E) around which rotates the cylinder block (M). Bolted to the case is the cover (L) which supports the driving members. The cylinder block or rotor has seven radial cylinders, in each of which slides a plunger (D). As the rotor revolves, the plungers are thrown outwards by centrifugal force until they bear against the inner periphery of the bearing ring. Owing to the eccentric position of the valve shank, the plungers are forced inwards for one half revolution of the rotor and are then allowed to move outwards for the other

half of the revolution. The resultant reciprocating motion of the plungers in their cylinders constitute the pumping action.

3. Fuel enters the body of the pump via the inlet connection (J) in the case and is set in motion by the revolving rotor. Centrifugal force carries the fluid outwards and thence via the slot in the bearing ring (O) and the duct in the casing (N) to the suction port of the valve. The fuel on entering the suction port passes along the axial drilling (C) and emerges in the arcuate port (A) which coincides with the plane of rotation of the cylinders on the suction side. In this way, as the fuel is already under pressure, positive charging of the cylinders on the suction stroke is ensured. As each cylinder comes into communication with the suction arcuate port, the corresponding plunger is at the inner end of its stroke (fig. 1). As the rotor revolves around the valve, centrifugal force throws the plunger outwards, thus permitting fuel to enter the cylinder, which becomes fully charged with fuel when the end of the suction stroke is reached. The fuel is carried in the cylinder over the valve land (B) which separates the suction and delivery ports.



- A. ARCUATE PORT
- B. VALVE LAND
- C. AXIAL DRILLING
- D. PLUNGER
- E. DISTRIBUTING VALVE
- F. BEARING RING
- G. DELIVERY PORT
- H. VALVE LAND

- I. DELIVERY CONNECTION
- J. INLET CONNECTION
- K. OUTER CASING
- L. COVER
- M. CYLINDER BLOCK OR ROTOR
- N. CASING DUCT
- O. BEARING RING

Fig. 1. Functional diagram of H.P. fuel pump, type A.260Y, Mk. 5

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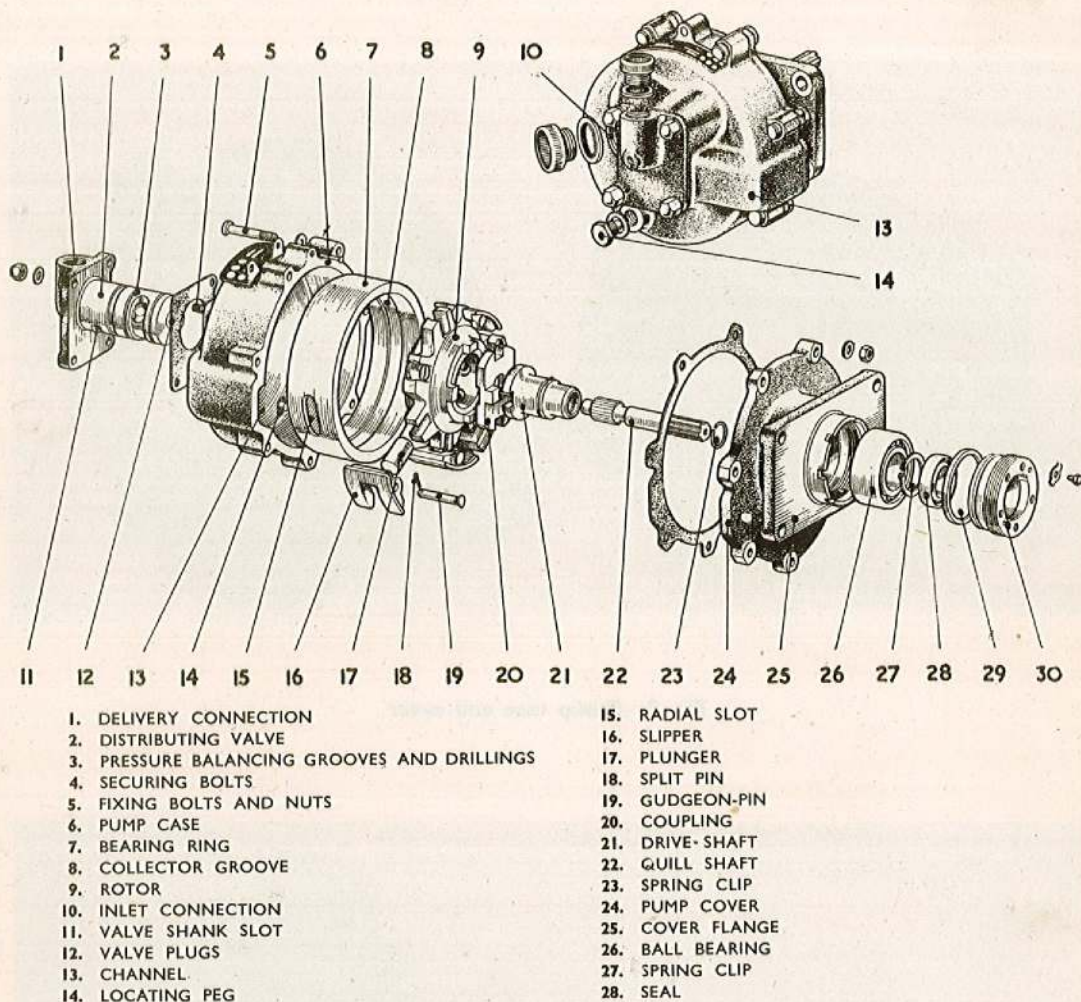


Fig. 2. Exploded view of H.P. fuel pump, type A.260Y, Mk. 5

This stage completes the suction cycle for one plunger and the delivery cycle of that piston then commences.

4. The cylinder crosses the valve land (B) and the plunger, guided by the bearing ring (F) which is eccentric to the valve, is forced inwards and thus expels the fuel from the cylinder into the delivery port (G), thence to the delivery connection (I). The valve lands (B) and (H) which separate the suction and delivery ports are slightly longer than the diameter of the plunger and thus form a seal, preventing the escape of fuel from the delivery side to the suction side of the pump. The cycle of operations described is repeated for each cylinder on each revolution of the rotor.

DESCRIPTION

General

5. The bearing ring, plunger assemblies, and the rotor, are housed in the main case. The distributing valve, which has the delivery connection screwed in its head, is bolted to the case end wall and its shank projects into the main case to form a spindle for the rotor. The drive shaft runs in a ball bearing mounted in the cover, and rotates the rotor by means of an "Oldham" type coupling. The inlet connection is screwed into the port in the pump body. An "exploded" view of the pump is given in fig. 2 to which the following item numbers refer.

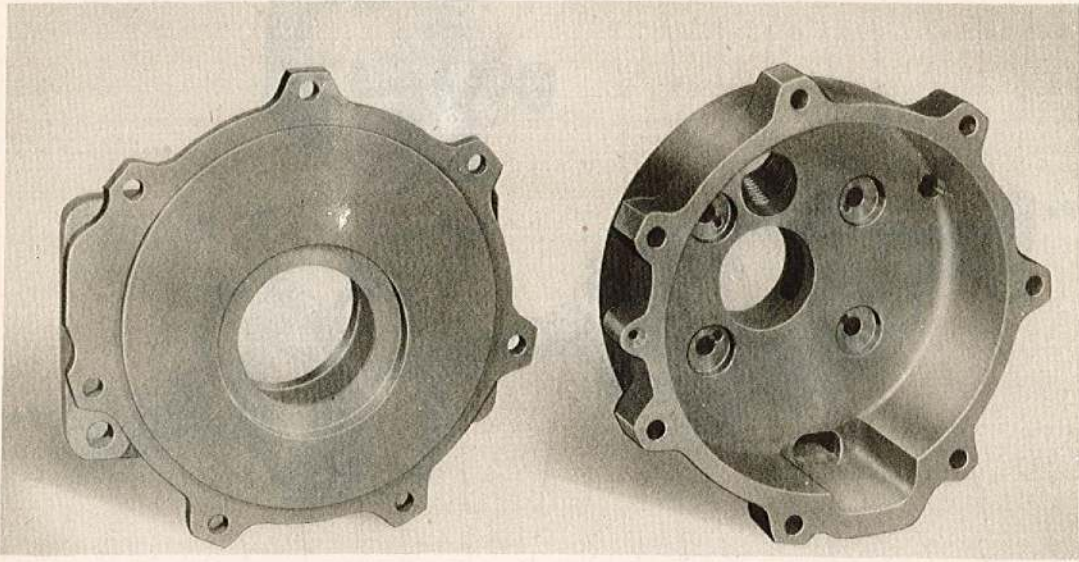


Fig. 3. - Pump case and cover

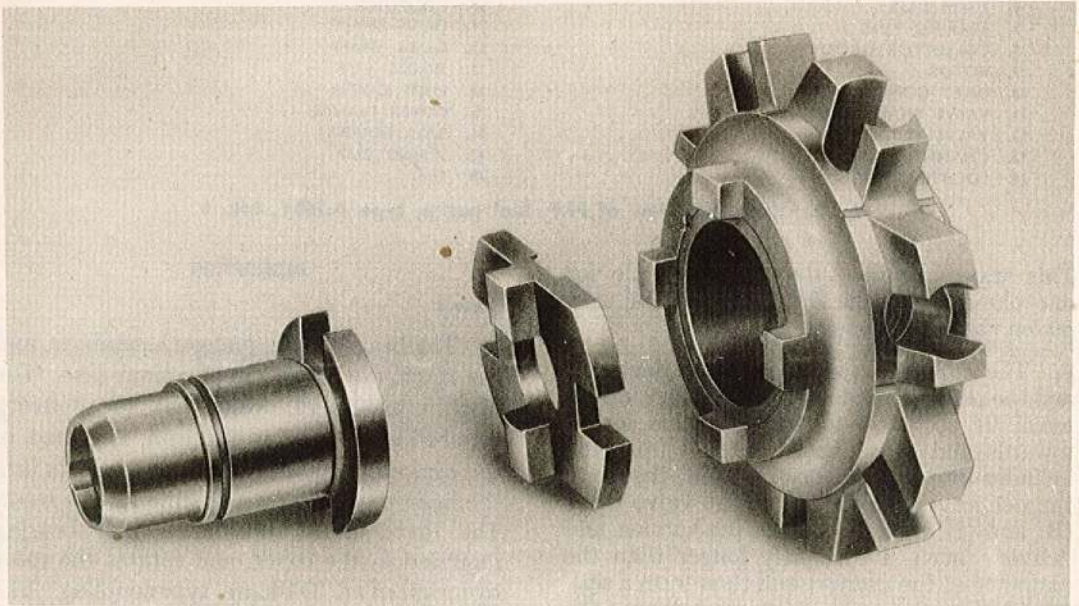


Fig. 4. Oldham type coupling and pump rotor

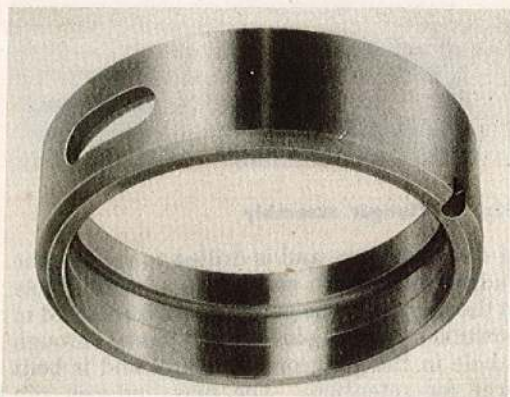
ADMIRALTY
AIR MINISTRY

Fig. 5. Bearing ring

Pump case

6. The pump case (6) as shown in fig. 3 is a pan-shaped light alloy casting which houses the valve, rotor assembly and bearing ring. A channel (13) cast in the case wall is located to allow fuel under the centrifugal action of the rotating rotor to communicate with the suction port drilling of the distributing valve. The outer face of the case is formed into a rectangular boss on which the valve is located by four studs (4). Adjacent to the rectangular boss a second boss is drilled through the case and is tapped to form the inlet connection (10). Seven holes in the flange of the case receive the bolts for securing the cover to the case.

Pump cover

7. The pump cover (24) which is a light alloy casting (fig. 3) is a spigoted member which closes the end of the main casing and contains the driving shaft, together with its bearing (26) and seal (28). The end of the cover is flanged and spigoted (25) for mounting to the engine gear box. The cover is located to the case by a spigot and is secured to the pump case by seven bolts and nuts (5).

Rotor

8. The rotor (9) shown in fig. 4 is manufactured from a centricast nickel iron casting, and is a star-shaped member having seven equally spaced arms, each arm being bored to receive its corresponding plunger. The trailing horn of each arm, which withstands the drag load of the slipper, is buttressed for increased strength. The centre bore, which rotates on the valve member, has a phosphor bronze bush, the bearing surface of which is

lead indium plated. The purpose of this soft surface is to absorb small hard particles which may be carried into the pump with the fuel, and so prevent seizure or damage to the valve with consequent adverse effect on the performance. In aggravated cases the soft coating may be partially or completely disrupted by foreign particles; although this will result in some reduction in performance, sufficient fuel will continue to be supplied for all but maximum engine conditions. Thus the combination of buttressed horns with the lead indium plated bore renders the pump virtually indestructible under operating conditions.

Coupling

9. The "Oldham" type coupling (20) shown in fig. 4 is a steel disc-shaped member, having two diametrically opposed integral dogs to engage with the slots of the drive shaft. At right angles to these dogs are two slots to receive the dogs on the rotor.

Bearing ring

10. The bearing ring (7) shown in fig. 5 consists of a hardened and ground steel ring located around the inner wall of the case into which it is housed. The ring is eccentrically situated relative to the distributing valve shank. Within the inner periphery of the ring is a collector groove (8) which connects with a radial slot passing through the ring (15). To prevent rotation of the ring within the case, a peg (14) which is screwed through the case, locates the ring in the required position.

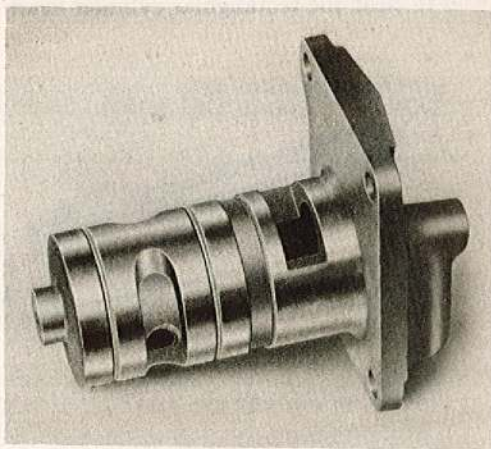


Fig. 6. Distributing valve

FUEL SYSTEM COMPONENTS (GENERAL) FOR GAS-TURBINE ENGINES

This is Amendment List No. 20 to Air Publication 4282, Volume I Section 2, Chapter 1. Remove and dispose of the existing leaf bearing para. 6 to para. 13 and substitute this leaf bearing para. 6 to para. 13. Record the incorporation of this A.L. in the Amendment Record Sheet.

ENGINEER

R E S T R I C T E D

Distributing valve

11. The valve element (2) shown in fig. 6 is manufactured from a nitralloy steel forging; it is cylindrical in shape and has an integral rectangular flange at one end in which four holes are drilled in the corners for fixing purposes. The flanged end of the valve is formed as a housing into which the delivery connection (1) is screwed. Axial delivery and inlet ports are drilled to intersect the delivery and inlet connections respectively. These axial delivery and inlet ports, after machining, are sealed at one end by plugs (12) which are silver soldered into position. A slot (11) machined in the valve shank near the flanged end allows the passage of fuel from the duct in the case to the inlet port of the valve. An arcuate port, in communication with the inlet port via a radial drilling, allows fuel to pass from the inlet port to the rotor cylinders. Similarly a second arcuate port, communicating with the delivery port, permits fuel under pressure to pass from the cylinders in the rotor to the $\frac{3}{8}$ in. B.S.P. delivery connection. To prevent uneven wear between the valve and rotor bore, pressure balancing grooves and drillings (3) are provided in the valve's circumference.

Plunger assembly

12. The plunger assembly, illustrated in fig. 7, comprises a nitralloy steel plunger (17), a phosphor bronze slipper (16), a hardened steel gudgeon-pin (19) and a split pin (18). The slipper has an arcuate lead indium plated surface which runs on the inner surface of the bearing ring. Each slipper is slotted to clear the rectangular cylinder head

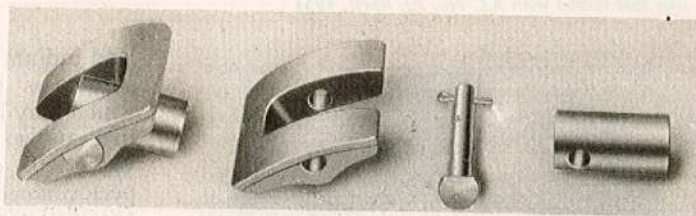


Fig. 7. Plunger assembly

of the rotor arm, and is drilled to receive the gudgeon-pin which engages in a bearing hole in the plunger. The gudgeon-pin is retained in position by a split pin; this pin passes through a hole in the gudgeon-pin shank and is bent over for retention. The new gudgeon pin with one flat on the side of the head and the shorter split pin shown in fig. 7 was introduced by Dowty Mod. FPD/30.

Drive shaft

13. The complete shaft (fig. 8) which is manufactured from steel to specification S.11 is in two parts; the drive shaft (21) and the quill shaft (22).

The drive shaft, incorporating the coupling dogs, is mounted in a double row ball race type R. & M.L.D.T./25K in the pump cover. Internal serrations machined in this shaft mate with the quill shaft by means of which connection to the engine drive is made. A spring clip (27) sprung into a groove on the drive shaft locates against the face of the inner race of the ball bearing thus securing the drive shaft in position. The outer race of the ball race is a shrunk fit in its bore of the cover casing; this method of fitting secures it rigidly in position in the cover. A second spring clip (23) retains the quill shaft in position in the drive shaft.

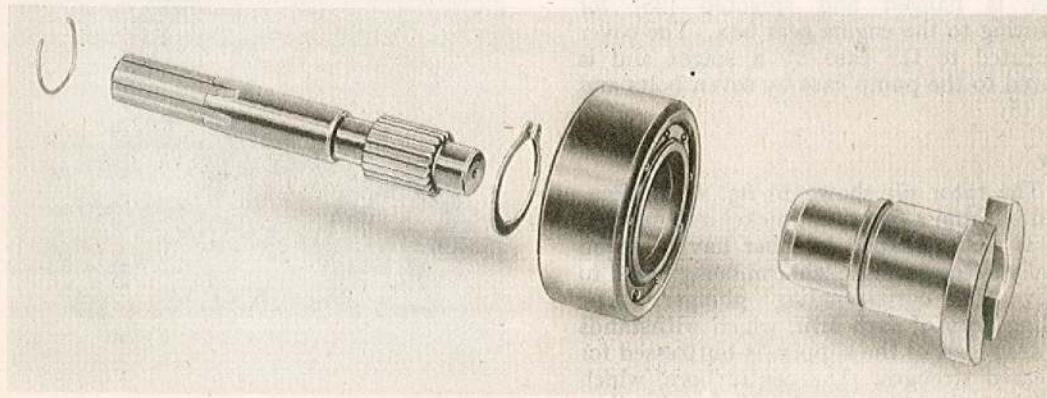


Fig. 8. Driving shaft assembly

R E S T R I C T E D

Sealing

14. To prevent leakage of fluid around the drive shaft, a seal (28) of the patent spring-loaded type is employed. This seal comprises a steel outer casing into which a two-lipped rubber ring is bonded; each of the "lips" is surrounded by a steel coiled spring. These springs ensure positive bearing of the rubber lips on the drive shaft.

INSTALLATION

15. Four bolts and nuts secure the pump flange to an adapter which is bolted to the engine casing. This adapter converts the four-hole type mounting on the pump cover to a standard RDE.14/33 mounting flange. Before fitting the pump it is essential to see that the faces of the engine, adapter, and pump are clean and undamaged. After cleaning, smear the jointing faces with jointing compound and assemble the adapter into position. Align the splined drive of the engine to the splined shaft of the pump, push the pump home into position and secure with nuts, plain and spring washers. If difficulty is experienced in aligning the splined drive, turn the impeller by hand, which in turn will rotate the pump drive shaft and allow the splines to be mated.

16. Before the installation can be completed the fuel system must be primed, which is carried out as follows:—Unscrew the outlet pipe union from the L.P. fuel filter to the engine pump, close the H.P. fuel cock and open the L.P. cock. When fuel is discharging full bore from the union, re-connect the pipe. The fuel system will then be primed as far as the pump. After installation the whole system as far as the fuel manifold should be primed by making a false start, i.e. remove and earth the leads from the igniter plugs. This will obviate the danger of starting the engine with an incorrect fuel supply. Before attempting a true start make sure that all fuel has drained away from the combustion chambers.

SERVICING

17. Servicing of the pump after installation, other than a periodic check of the nuts and unions for tightness, is not permissible. In the event of the pump being defective it must be removed, all parts suitably blanked and the pump returned to the Repair Unit for rectification.

Note . . .

Whenever the fuel line between the tank and the pump is broken, e.g., when checking pipes and filters for cleanliness, the fuel system must be primed as described in para. 16.



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