

Chapter II

HIGH PRESSURE FUEL PUMPS, TYPE GD SERIES

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Introduction

1. The GD series of fuel pumps are of the positive displacement, variable stroke, multi-plunger type. Fuel delivery is regulated by an overspeed governor and a pressure control valve.

2. Some units are fitted with a solenoid isolating-valve which is in communication with the servo system. This type of valve is described in Chapter 3.

3. The pump is capable of fuel flows of 1,300 G.P.H. at normal rated speeds and delivery pressures; the dry weight of the unit is approximately 21 lb.

4. The letters G.D. are type symbols, the letter D is the dimensional classification of the plungers and therefore an indication of the pump capacity. The number following the type symbols indicates a particular model of the series, and the installation and calibration details are identified by a suffix number and letter, e.g. on a unit designated G.D. 5/6C, the type is 5, installation number 6 and calibration code C.

5. Installation differences include connections for fuel control units or gauge recording points, etc.

6. The GD 10 type of pump differs from the others in the series in that it has silver

cylinder-liners instead of phosphor-bronze. Also, the overspeed governor is inoperative, as in this instance a hydro-mechanical governor is employed.

Description (fig. 2 and 3)

7. The body casting houses a rotor (19) supported on carbon bearings (17 and 24). Seven inclined cylinders accommodating hardened steel plungers (18) are formed in the rotor. The ends of the plungers which protrude from their cylinders are ball-shaped to fit socketed slipper heads (20) engaging with an appropriately shaped, polished camplate (21), which pivots on trunnions. The angle of inclination of this camplate can be varied by a servo piston (8) from zero to maximum plunger stroke.

8. An auxiliary camplate (1) drilled to take the slipper shanks, supports the slipper in position against the camplate face. At its centre it runs upon a hemispherical bush or thrust bearing (23) which is spring-loaded upon the stem of the rotor to absorb slight fore and aft play. The auxiliary camplate assists the inlet stroke of the plungers, whilst its spring-loaded thrust ball eliminates chatter.

9. From the hollow interior of each plunger, a small central hole is drilled through the ball-shaped head to afford passage for a

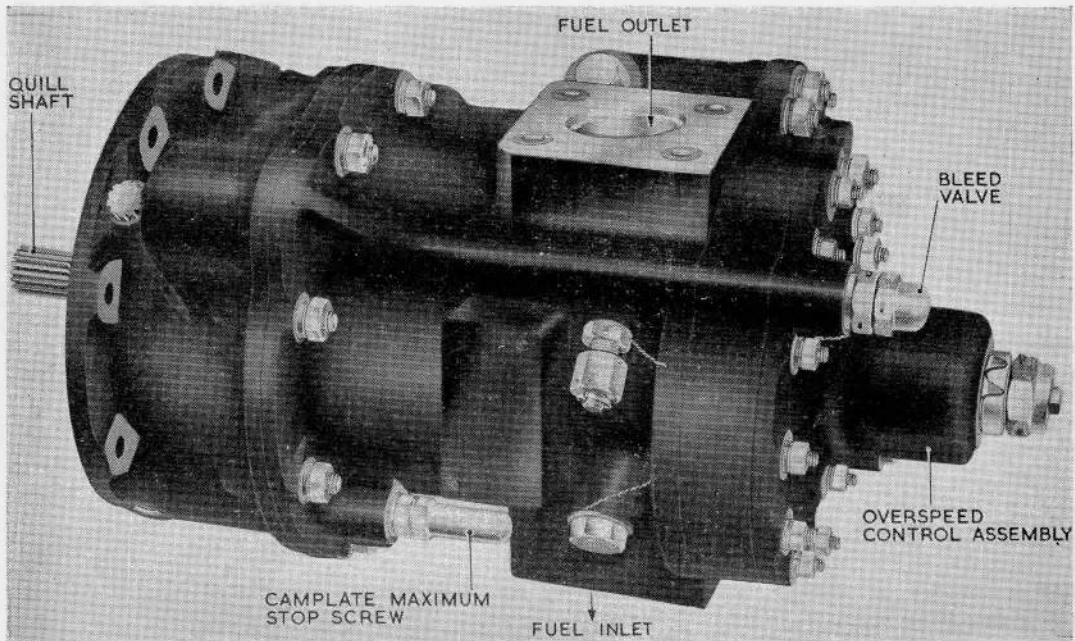


Fig. 1. GD Series fuel pump

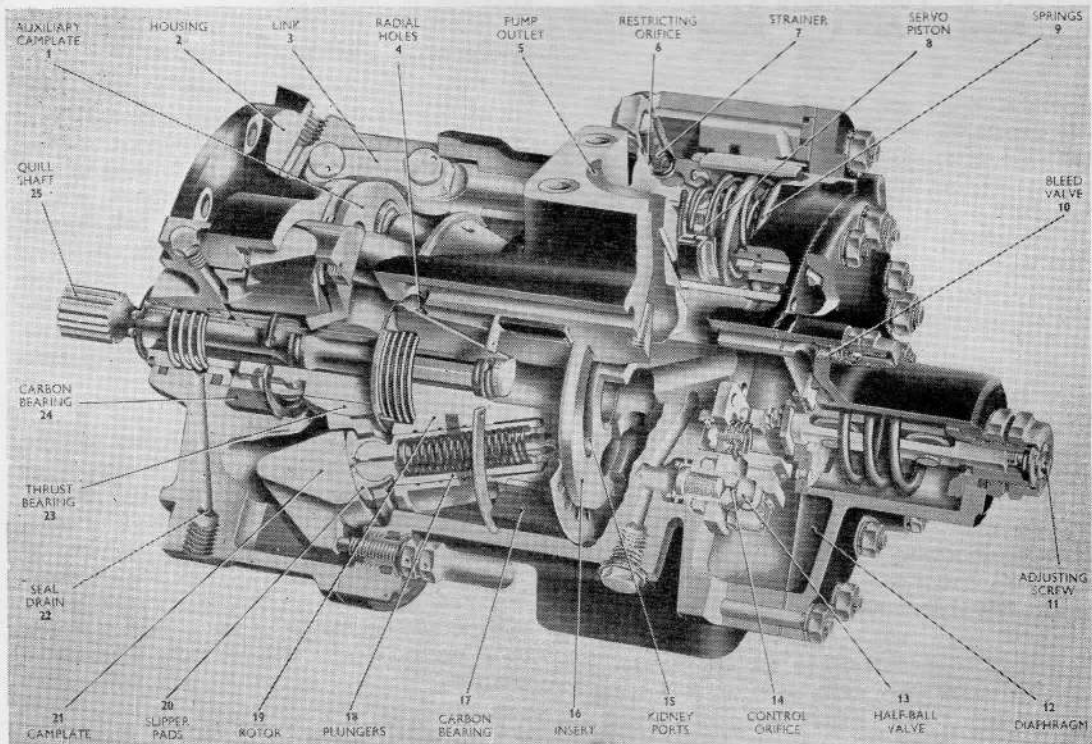


Fig. 2. Cut-away view of fuel pump

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cooling film of fuel to the underside of the slipper. A very fine central hole in the slipper admits this graduated leakage to the bearing surface between the slipper and camplate, thus providing adequate cooling and lubrication.

10. The plunger bores in the rotor are stepped in diameter, the inner ends terminating as seven ports in the flat face of the rotor which engages with a hardened insert (16), in which are cut kidney-shaped inlet and delivery ports (15).

11. A pressure tight seal is made by the rotor being pressed against the insert by the force exerted by the seven plunger return springs and the fluid pressure acting upon the annulus formed by the stepped portions of the plunger bores. At normal pressures the fluid force is the predominant one and gives a sealing force roughly proportional to the fluid pressure handled.

12. In the inlet stroke fuel enters the unit through port (28) the outward force being provided by both the return spring and by centrifugal force acting along the inclined axis of the piston.

13. The pump drive is formed by the outer end of the rotor shaft which engages with the outer end of the engine wheelcase drive.

Operation

14. Under normal operation the fuel is supplied to the inlet port at a boosted pressure of up to 15 lb. per sq. in. It then passes through a strainer to the kidney-shaped fuel port.

15. With the rotation of the pump through the quill shaft (25), the inlet stroke of the plungers is provided by their outward movement due to centrifugal force acting along their inclined axis together with the loading of the plunger return springs. The pump therefore is capable of satisfactory operation under an inlet depression but this is not desirable for long periods of running when the life of the pump is an important consideration.

16. Further rotation of the pump rotor with the plungers in contact with the inclined camplate face will reverse the motion of the plungers which will thus complete one inlet and one delivery stroke for the complete rotation of the rotor.

Pump stroke control

17. Control of the pump is effected by means of a servo or relay-operated system illustrated in fig. 3. It comprises a piston (8) operating in a cylinder against the loading of a pair of helical springs (9). The piston rod is connected to the camplate by means of a link (3) and the springs are arranged to move the camplate into the position corresponding to maximum delivery. High pressure fuel from the delivery side of the pump is supplied to the underside of the control piston and via the restricting orifice (6) to the chamber above the piston.

18. Movement of the piston is controlled by one or more control orifices, which are responsive to measured conditions defining engine requirements. When all control orifices are closed, the pressure on each side of the piston equalise by way of the restricting orifice. The spring force, assisted by the fluid pressure upon the extra area above the piston head now moves the piston to produce maximum plunger stroke, and thereby, maximum pump output. The opening of any control orifice allows fluid to escape from the chamber above the piston and the piston is moved against the spring loading to reduce pump delivery. During steady uniform running, the control orifices are just open, permitting a total leakage at the same rate as the pressure is made up through the restricting orifice, so that the servo control piston remains stationary to maintain a constant pump output.

Maximum pressure control

19. One of the control orifices is contained in the pump itself. It functions as the relief valve and as part of the overspeed governor mechanism.

20. When operating as the relief valve, delivery line pressure in excess of a pre-determined maximum, caused by a line blockage or the inadvertent closing of a cock, will lift the half-ball (or plate valve (13)) from the orifice seat, opening the control orifice to effect a diminution of both pump output and pressure.

Maximum speed control

21. To form an overspeed governor the orifice is arranged to be controlled by a force dependent upon the rotational speed of the

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pump. A series of radial drillings (4) in the rotor body create a centrifugal pressure in the pump casing and this pressure is directed through ducts in the pump casing to exert a force upon a flexible diaphragm (12), loaded by a spring assembly adjustable by means of a screw (11). A hardened stud in the centre of the diaphragm is arranged to rest upon the end of a spring-loaded rocker lever (27), mounted upon two pairs of cross-torsional springs, and carrying at the other extremity the half-ball which is the sealing member of the control orifice.

22. As soon as the pre-determined maximum speed is attained, the diaphragm is moved by the increased pressure in chamber (12) against the rocker lever to open the control orifice. Leakage of fuel at servo pressure now occurs from the chamber above the control piston and the piston moves to reduce the pump stroke, thus preventing any further increase in speed.

Installation

23. The cleanliness of the fuel is most important and adequate filtering should be provided, particularly in the suction line to the pump.

24. The fuel ports are situated on opposite sides of the pump body and are clearly marked INLET and OUTLET.

25. Installation details vary according to engine requirements, specific information being given in the relevant engine Air Publication. The direction of rotation of the drive shaft is clockwise when viewed from the end of the shaft.

Inhibiting

26. The pump must be inhibited in accordance with the instructions contained in A.P.4471A.

27. Fit packing gaskets over the fuel ports, attach the specially shaped blanking plates and secure them with slave washers and nuts. Screw dust caps on the exposed connections and carefully pack the units in a suitable container.

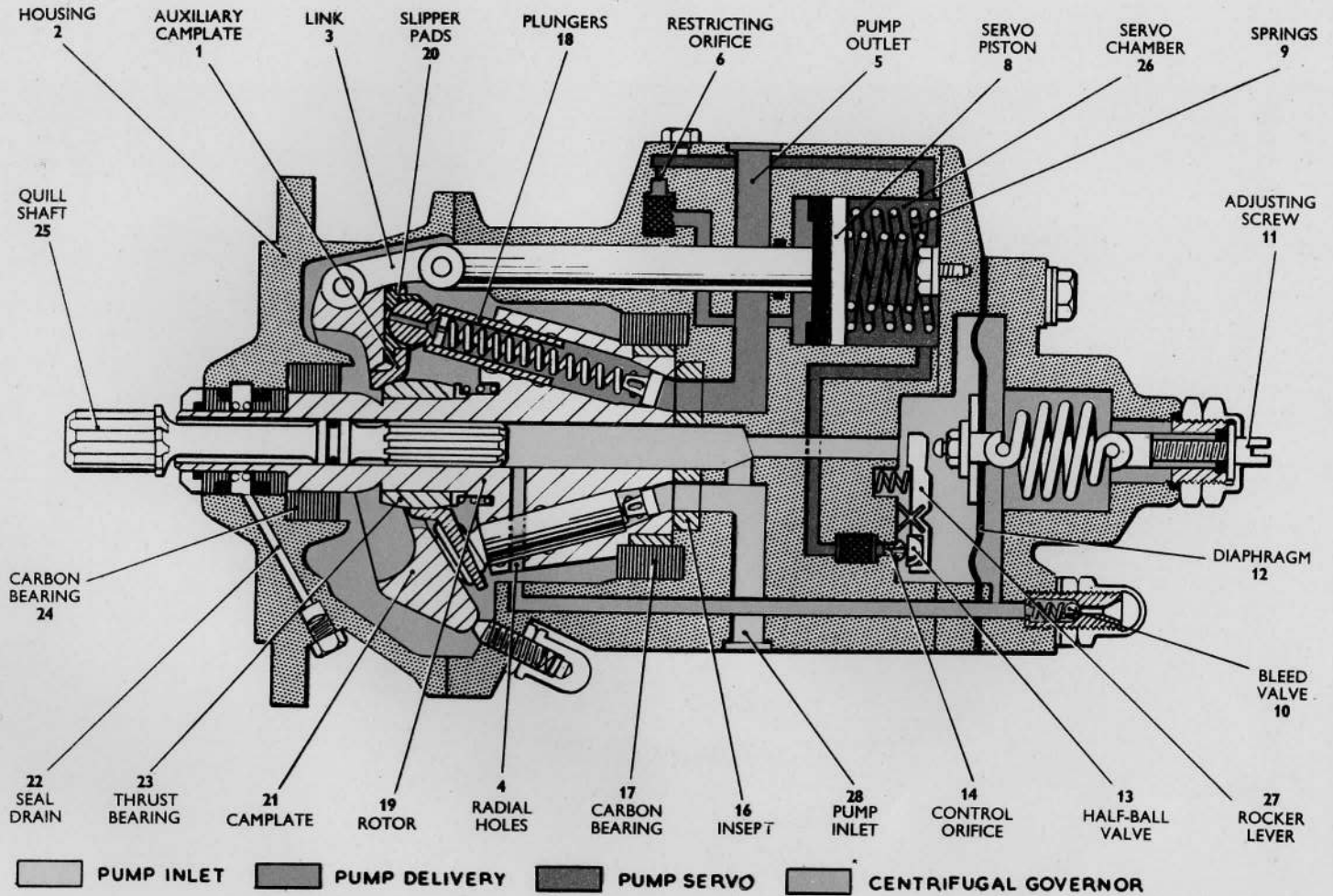
Servicing

28. An air bleed valve (10) is provided on the diaphragm cover and use of this, together with the setting of the governor adjusting screw is the only routine servicing permitted.

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Fig. 3 Functional diagram



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