

## FUEL SYSTEM

### Fuel Filters

The fuel filter is of the paper element type, and no attempt should be made to clean the element. It should be renewed when periodical maintenance is being carried out.

The filters fitted to earlier engines have a separate element positioned inside a bowl whereas filters fitted to later engines have an encapsulated element held between the filter head and the filter base.

The period for changing the element will largely depend upon the quality and condition of the fuel available. Under normal conditions the element should be renewed in accordance with the recommendations stated in the current service schedule.

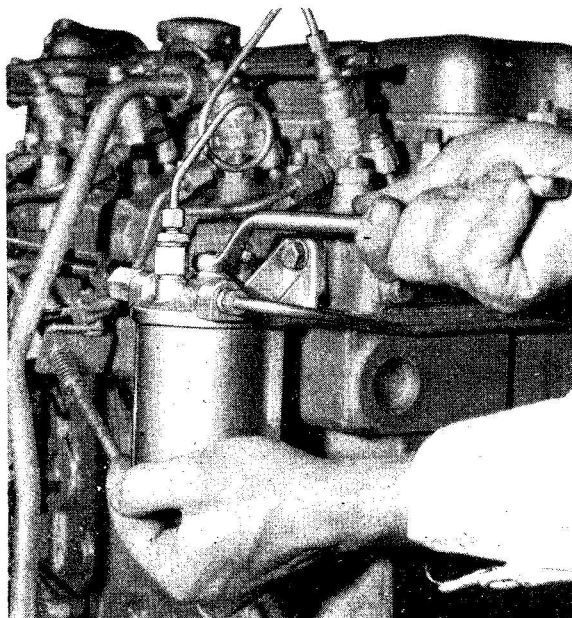


Fig. 1

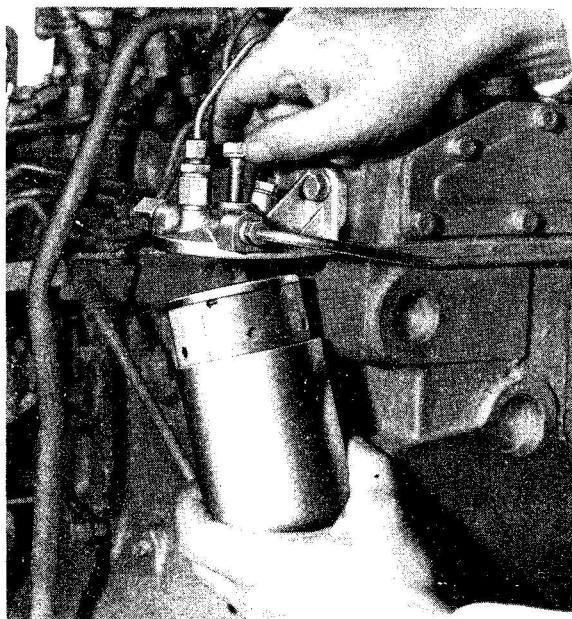


Fig. 2

### To Renew Earlier Type Filter Element

1. Remove filter bowl as in Figs. 1 and 2.
2. Discard the dirty element. Remove the lower element sealing washer, seal seating and spring from the bowl.
3. Clean the inside of the bowl and centre tube.
4. Fit the spring and seal seating to the bowl. Examine the lower seal, renew if necessary and refit to the bowl. Place the new element in position in the bowl.
5. Ensure that the element and bowl seals are in good condition. If not, fit new seals.
6. Refit the bowl to the top cover.
7. Vent the fuel system.

### To Renew Later Type Filter Element

1. Thoroughly clean the exterior of the filter assembly.
2. Holding the filter base, unscrew the setscrew in the centre of the filter head and lower the base and filter element (Fig. 3). Discard the filter element.

3. Thoroughly clean the filter head and base.
4. Inspect the sealing rings and renew if damaged in any way.
5. Place the base squarely on the bottom of the new filter element and offer up the element squarely to the filter head so that the top rim of the element locates centrally against the sealing ring in the filter head.
6. Hold in this position whilst the securing set-screw is located and screwed home.
7. Bleed the fuel system as detailed on Page 10.

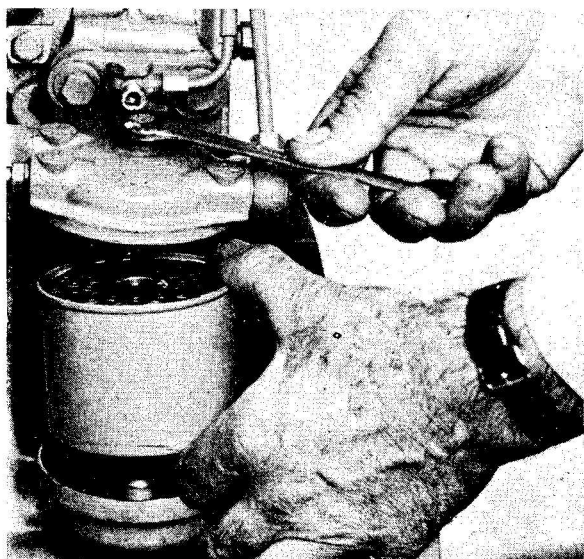


Fig. 3

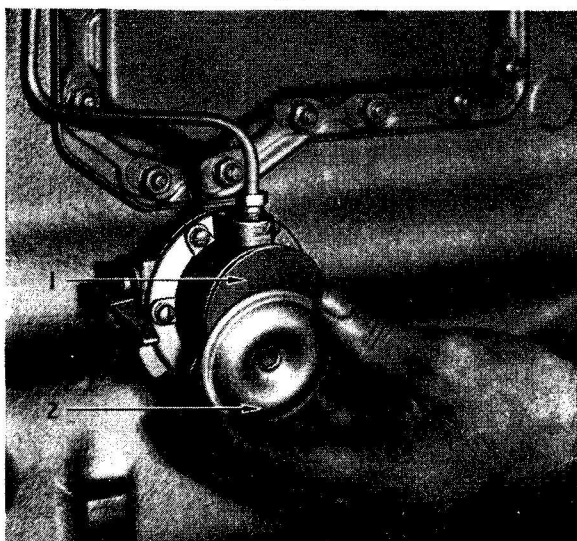


Fig. 4

#### Fuel Lift Pump

##### Testing the Pump in Position

1. Disconnect the outlet pipe (lift pump to filter) leaving a free outlet from the pump.
2. Rotate the engine. There should be a spurt of fuel from the outlet port once every two revolutions.

##### Pressure Checking of Fuel Lift Pump in Position

Fit a 0-0,7 kgf/cm<sup>2</sup> (0-10 lbf/in<sup>2</sup>) pressure gauge to the outlet of the pump. Ensure that there are no leaks at the connections between pump and gauge. Crank the engine for 10 seconds and note the maximum pressure on gauge. If the pressure recorded is less than 75% of the minimum production static pressure shown below, then rectify the pump. Also observe the rate at which the pressure drops to half the maximum figure obtained when cranking has ceased. If less than 30 seconds, rectify the pump.

	Minimum Production Static Pressure		Min. Test Pressure (75% of Min. Production Pressure)	
	kg/cm <sup>2</sup>	lbf/in <sup>2</sup>	kgf/cm <sup>2</sup>	lbf/in <sup>2</sup>
4 bolt type	0,42	6	0,31	4,5
2 bolt type	0,19	2.5	0,14	2

##### To Clean the Pump Chamber

1. Remove the fuel lift pump cover and pulsator diaphragm (Fig. 4).
2. Clean the sediment chamber and check the diaphragm for condition.
3. Refit the diaphragm and cover. Tighten the securing screw just sufficiently to make a tight sealing joint.
4. Vent the fuel system.

## ENGINE REMOVE AND REFIT

### ENGINE REMOVE AND REFIT

#### To Remove

Disconnect battery.

Release clips and remove rear engine cover.

Remove radiator (Refer to Sub-section C200).

Remove engine cover front section.

Remove air cleaner assembly and intake hose.

Disconnect 'Lucar' at 'Thermostart'.

Unscrew union of fuel line at 'Thermostart'.

Remove the bolt and three nuts and lift off intake elbow.

Disconnect electrical plug and earth lead of the auto-stop control and displace the harness.

Remove throttle cable return spring, disconnect cable clevis at injection pump, release cable adjuster and displace cable.

Disconnect heater hoses.

Remove headlamp surrounds, disconnecting flashing indicator harness plugs as they are revealed.

Loosen screw of bonnet release cable, release outer cable clip and displace cable.

Remove bonnet closing platform.

Remove bumper irons and detach bumper assembly.

Remove cab front lower cross member.

Remove fuel pipe from fuel lift pump and return to tank line at fuel filter.

Detach top brackets from front chassis cross member.

Disconnect alternator harness plug and wire to temperature sender unit and displace harness.

Remove bolts to release towing eyes and front chassis cross member and remove cross member.

Disconnect two 'Lucar' connectors at starter solenoid, feed cable to starter motor, low oil pressure switch connection and displace harness.

Unscrew exhaust outlet union, release pipe clip at bell housing and displace pipe (vacuum/hydraulic brakes).

Unscrew unions of outlet pipe at compressor and governor control valve and displace pipe (air/hydraulic brakes).

Remove bolts, release 'Dzus' fasteners and remove rear undertray.

Remove nuts and bolts from exhaust down pipe to manifold joint and steady bracket, slacken clip at nose of silencer, remove down pipe and recover sealing ring.

Release and displace clutch slave cylinder from bell housing.

Remove R/H rear insulation panel.

Unscrew nuts from bell housing to flywheel housing studs.

**Note:** One nut cannot be removed until the engine is partially withdrawn.

Remove rear bolts from front engine mounting support to chassis side member brackets.

Unscrew gland nut and remove dip stick tube assembly.

Release hose clip, remove steady bracket nut and detach oil filler assembly.

Using a trolley jack and wooden block, support the engine midway along the sump i.e. just behind the well of the sump.

Use an engine crane with a suitable attachment to help support and steady the engine using the front lifting eye.

Support the rear of the gearbox using any suitable and safe method.

Remove the remaining bolts from the front engine mounting support brackets and detach one of them completely by removing the lower nut from the flexible engine mounting.

Carefully part the engine from gearbox at flywheel housing to bell housing joint and remove the last nut.

Moving the trolley jack and engine crane simultaneously, withdraw the engine unit from the vehicle.

### **To Refit**

Refitting is a reversal of the removal instructions.

If it is necessary to turn the gearbox primary shaft chock front wheels, raise one rear wheel, engage top gear, release handbrake and turn wheel in normal direction of rotation.

**Note:** If the vehicle is fitted with air/hydraulic brakes and the system is exhausted, wind-off the spring brake actuator or replenish the system using an air line.



**To Remove the Pump**

Lift pumps which are in a upright position (with the top cover uppermost) are fitted to later engines. These are secured with four studs, nuts and spring washers and two keeper plates fitted vertically between the washers and the outside face of the pump mounting flange.

1. Disconnect the pipes.
2. Remove the pump and joint.

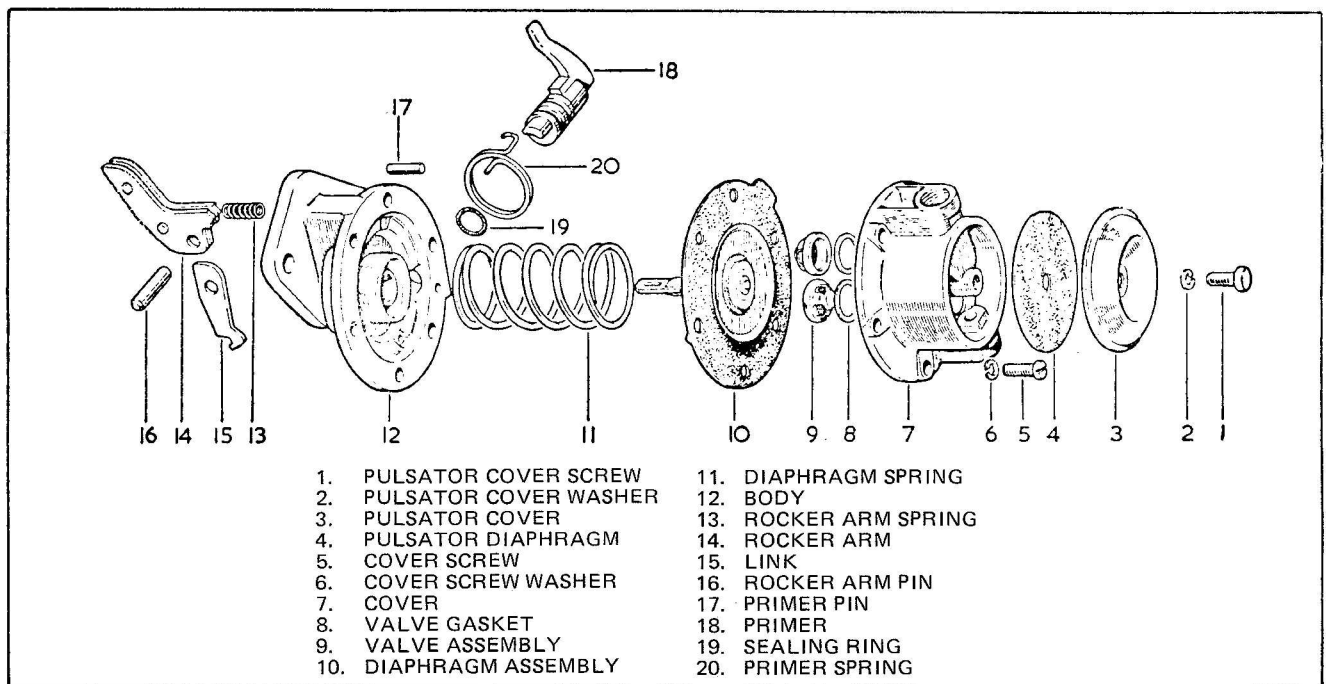
**To Dismantle the Pump (Fig. 5)**

1. Before dismantling, make a file mark across the two flanges for guidance in re-assembly.
2. Separate the two halves of the pump.
3. Remove the diaphragm by unhooking it from the rocker arm link. The diaphragm spring can now be withdrawn.
4. Drive out the rocker arm pivot pin and withdraw the rocker arm, spring and link.

5. Dismantle the priming lever by removing the lever retaining pin.
6. Remove the valves by levering from their locations. Remove the valve gaskets.
7. Remove the pump cover and pulsator diaphragm.

**Inspection of Parts**

1. Check the diaphragm for hardening or cracking and examine the pull rod for wear at the point where it connects with the rocker lever link. A stem seal fitted over the diaphragm shaft may be found on some applications and should be renewed if worn.
2. The diaphragm spring should be renewed if corroded or distorted. Ensure the new spring has the same (green) colour identification.
3. The valves should be replaced. The two valves are identical and may be used for inlet or outlet (Fig. 5).

**Fig. 5**

4. Examine the rocker, arm, link, spring and pin for wear.
5. Check the pulsator diaphragm for condition.
6. Examine the flanges of the two pump halves for distortion. If necessary lightly finish to restore flatness.

#### **To Re-Assemble the Pump**

1. Fit the new valve gaskets and valves to the body. The inlet valve must be fitted so that it can open to admit fuel. The outlet valve must be fitted in the reverse position to the inlet valve. Valves are retained by retaining plate or alternatively by staking in six places with a suitable punch.
2. Fit the pulsator diaphragm and cover.
3. Insert the rocker arm pin through its hole in the body, at the same time engaging the link and the rocker arm. Tap the rocker arm pin in until it is flush with the pump body. Stake the casting in three places each side to retain the pin.
4. Place the diaphragm spring in position.
5. Place the diaphragm assembly over the spring, the pull rod being downwards, and centre the upper end of the spring in the lower diaphragm protector washer.
6. Press downward on the diaphragm and make sure that the downward tag on the lower diaphragm protecting washer is on the priming lever side of the body. This tag is required to be in the hole of the body ready for fitment of the priming lever. Engage the diaphragm pull rod with the link and at the same time match up the holes in the diaphragm.
7. Push the rocker arm towards the pump until the diaphragm is level with the body flanges. Place the upper half of the pump into position as shown by the file mark on the flanges.

Install the screws and washers and tighten only until the heads just engage the washer. Release the rocker arm and push on the spaded end of the rod so as to hold the diaphragm at the top of the stroke, and while so held tighten the securing screws diagonally.

**Note:** The edges of the diaphragm should now be flush with its two clamping flanges. Any appreciable protrusion of the diaphragm indicates incorrect fitting.

8. Fit primer to side of body and retain with the pin. Clip on priming lever spring.
9. Test the pump to ensure that it is working correctly.

#### **To Refit the Pump**

1. Refit the pump to the cylinder block.
2. Reconnect the fuel line and vent the system of air as detailed in this section.

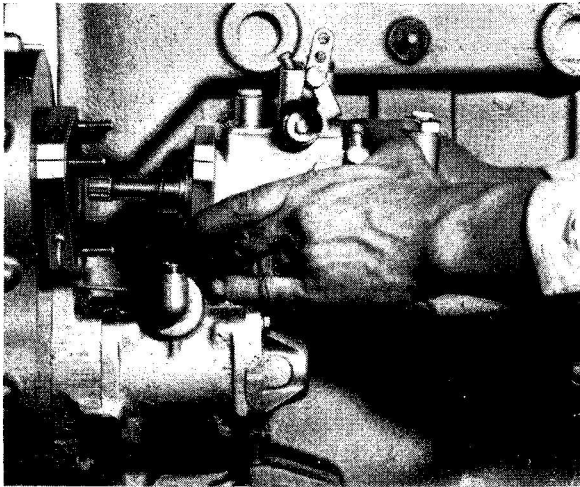
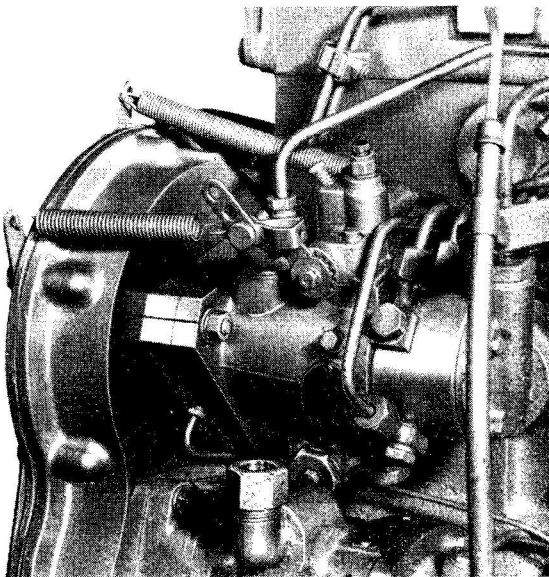
#### **Fuel Injection Pump**

##### **Description**

The fuel injection pump is of the D.P.A. distributor type. It is a precision built unit incorporating a simple hydraulic governor or one of the mechanical flyweight type.

The pump is flange mounted and is driven from the engine timing case.

**IMPORTANT NOTE:** Unless the necessary equipment and experienced personnel are available, dismantling of the fuel pump should not be attempted.

**Fuel System****Fig. 6****Fig. 7****To Remove the Fuel Pump  
(Hydraulic Governor)**

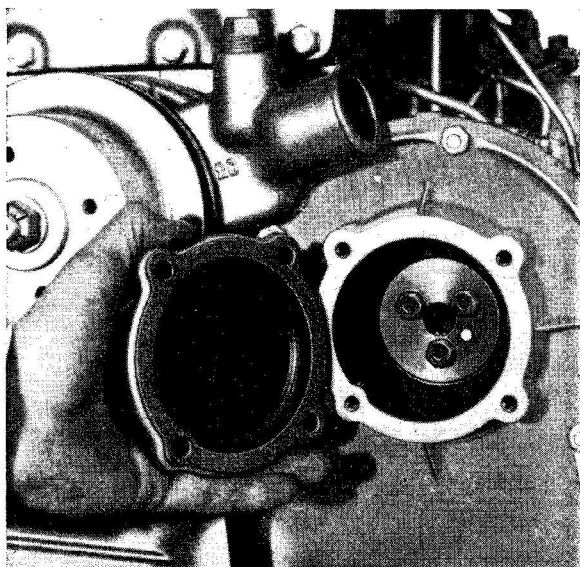
1. Remove the high and low pressure pipes from the fuel pump.
2. Disconnect the stop and throttle controls and remove the return springs.
3. Remove the fuel pump (Fig. 6).

**To Refit the Fuel Pump  
(Hydraulic Governor)**

1. Replace the fuel pump ensuring that the master spline on its quill shaft will enter the female spline in the driving plate.
2. Position the fuel pump so that the scribed line on the fuel pump flange aligns with the mark on the fuel pump gear adaptor (Fig. 7). Secure the pump to the timing case. To check accuracy of mark on fuel pump adaptor plate, this may be ascertained in accordance with instructions for marking new adaptor plates given in A415.
3. Refit the high and low pressure pipes to the fuel pipe.
4. Re-connect the throttle and stop lever controls and attach the return springs.
5. Vent the air from the fuel system as described in this section.
6. Adjust the maximum and idling speeds.

**To Remove the Fuel Pump  
(Mechanical Governor)**

1. Remove the high and low pressure pipes from the fuel pump.
2. Disconnect the stop and throttle controls and remove return springs.
3. Remove the timing case front cover inspection plate (Fig. 8).
4. Remove the three setscrews which secure the fuel pump gear to the fuel pump.
5. Remove the fuel pump from the timing case ensuring that when the fuel pump gear leaves the shaft it stays in mesh with the idler gear otherwise the fuel pump timing will be affected.

**Fig. 8****To Refit the Fuel Pump  
(Mechanical Governor)**

1. Replace the fuel pump ensuring that the slot in the pump hub is aligned with the dowel in the gear.
2. Position the pump so that the scribed line on the pump flange aligns with the mark on the timing case (Fig. 9). Secure the pump to the timing case. To check accuracy of mark on rear of timing case, this may be ascertained in accordance with the instructions for marking a new timing case given in A415.
3. Secure the driving gear to the fuel pump shaft with the three setscrews and spring washers, ensuring the dowel is properly located in its slot (Fig. 9).
4. Fit the timing case inspection cover.
5. Refit the low and high pressure pipes to the fuel pump.
6. Re-connect the throttle and stop lever controls and attach the return springs.
7. Vent the air from the fuel system.
8. Adjust the maximum and idling speeds.

**Fuel Pump Gear**

For details of fitting a new fuel pump gear, see A415.

**To Re-set the Fuel Pump Timing**

On the fuel pump rotor inside the fuel pump are a number of scribed lines, each one bearing an individual letter. A timing circlip is positioned inside the pump and has to be set so that when the appropriate scribed line on the fuel pump rotor aligns with the scribed line on the circlip it denotes commencement of injection (static timing).

**Note:** On later engines the scribed line on the circlip has been deleted. On these engines the scribed line on the rotor should be aligned with the end of the circlip which has the straight edge, A415, Fig. 12.

To set the timing circlip, it is necessary to remove the pump from the engine and fix the position of the circlip by connecting No. 1 cylinder outlet connection (marked "W") to an atomiser tester and pump up to 30 atm (31 kgf/cm<sup>2</sup> or 440 lbf/in<sup>2</sup>). Turn the pump by hand in the normal direction of rotation until it "locks up". The squared end of the circlip should now be adjusted until it lines up with the letter "A" for hydraulic pumps or the letter "C" for mechanical pumps, on the pump rotor.

To re-set the fuel timing the following procedure should be adopted:—

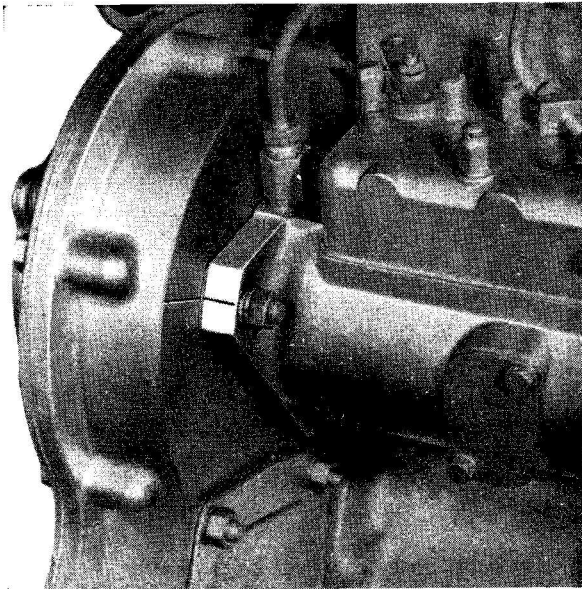
**(a) Hydraulically Governed Pump**

Ensure that the fuel pump circlip is correctly positioned as described previously.

1. Ensure that the fuel pump is correctly fitted with the scribed line on the mounting flange aligning with the mark on the fuel pump gear carrier (Fig. 7).

**Fuel System**

2. Position the crankshaft so that No. 1 piston is at T.D.C. on compression stroke.
3. Remove the collets, spring cap and spring from the inlet valve of No. 1 cylinder and allow the valve to rest on the top of the piston.
4. With the aid of a clock gauge in contact with the end of the valve now resting on the No. 1 piston it will be necessary to position the crankshaft at the static timing position.
5. Remove the inspection plate on the fuel pump enabling the rotor to be seen.

**Fig. 9**

6. With No. 1 piston at the static timing point on its compression stroke, the scribed line on the fuel pump rotor marked "A" should align with the scribed line or straight edge on the circlip, see A415. If it does not, release the fuel pump drive plate securing setscrews and turn the drive plate on the slotted holes, the required amount to bring them into alignment. Access to the drive plate is gained by removing the timing case front cover inspection plate (Fig. 8).
7. When the fuel pump timing is correct, obliterate the mark on the fuel pump drive gear and re-mark the gear to correspond with the mark on the fuel pump drive plate.

8. Refit the spring, spring cap and collets to No. 1 inlet valve and refit the pump inspection plate and timing case inspection plate. Re-seal the inspection plate.

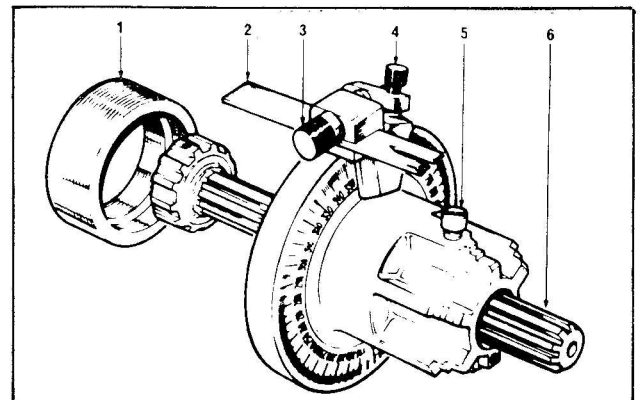
**(b) Mechanically Governed Pumps**

The procedure for re-setting the fuel pump timing on mechanically governed engines is similar to that used for hydraulically governed engines with the exception of the method of pump adjustment.

As there is no adjustable fuel pump drive plate on a mechanically governed engine, the adjustment is carried out by slackening the nuts on the pump mounting flange and rotating the pump body until the scribed line on the rotor, marked with the letter "C" aligns with the scribed line or straight edge of the circlip.

**To Check Marking Angle of Fuel Injection Pump using Tool MS.67B**

1. Release screw (5, Fig. 10) and remove splined shaft (6). If pump has a slotted hub, the splined shaft should be retained with the small splined diameter to the rear to locate in the centre of the hub.
2. Ensure that slotted pointer (2) is positioned with slot to rear of tool and chamfered sides of slot outwards. At this stage, slotted end of pointer should be kept well back towards body of tool. Ensure that the flat in the washer fitted behind the pointer securing screw (3) is located over side of pointer.

**Fig. 10**

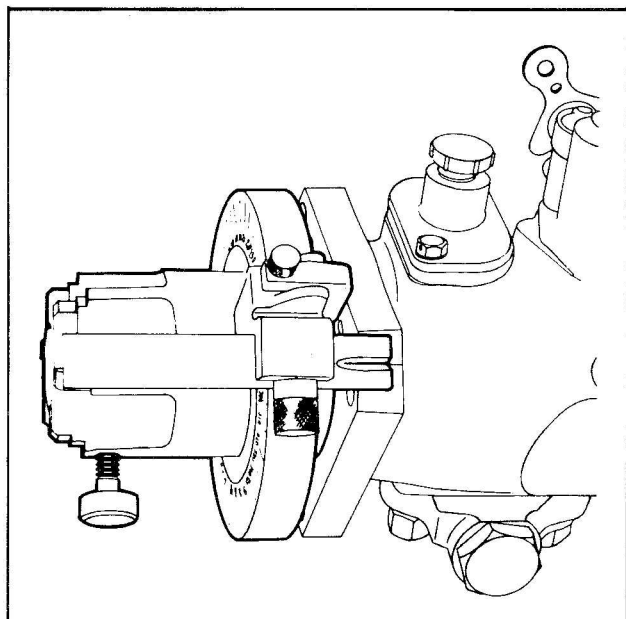


Fig. 11

3. Release bracket screw (4) and set bracket so that the chamfered edge is in line with the relevant marking angle.
4. Position timing tool on pump drive shaft with master splines engaged and tool locating on spigot (see Fig. 11). With dowel drive pumps, locate splined shaft in hub, slide tool towards pump to rest on end of hub and lock shaft in tool (see Fig. 12).
5. Connect No. 1 outlet of pump body to an atomiser test rig and pump up to 30 atmospheres (31 kgf/cm<sup>2</sup> — 440 lbf/in<sup>2</sup>). If pressuring valve is fitted this must be removed.
6. Turn pump in normal direction of rotation as shown on pump nameplate, until it locks.
7. In this position, slide pointer forward until it is halfway over pump flange and check that timing mark is central to slot in pointer.

#### Maximum Speed Setting

**IMPORTANT NOTE:** The maximum speed screw seal of the original fuel pump must not be broken or tampered with in any way unless factory authority is first obtained. Failure to do so may result in the guarantee becoming void.

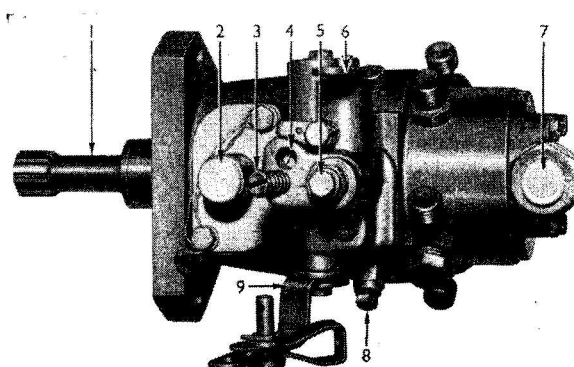
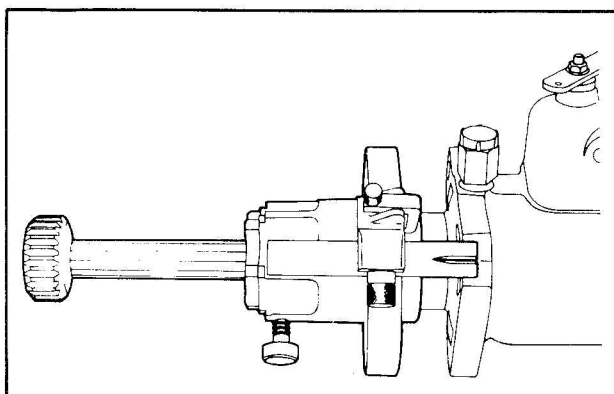


Fig. 13

- |                        |                        |
|------------------------|------------------------|
| 1. DRIVE SHAFT         | 5. BLEED SCREW         |
| 2. FUEL OUTLET         | 6. STOP LEVER          |
| 3. IDLING SCREW        | 7. FUEL INLET          |
| 4. MAXIMUM SPEED SCREW | 8. BLEED SCREW         |
|                        | 9. SPEED CONTROL LEVER |

When fitting a replacement fuel pump, or in the event of the maximum speed screw having been moved, the maximum no load speed must be checked and re-set as necessary.

The maximum no load speed will vary according to application. For details, reference should be made to the code number stamped on the fuel pump data plate. The last four numbers in the code indicate the speed required, and in the case of the following example, this would be 3130 rev/min.

**Code Example:— AS62/800/0/3130**

**Note:** If the fuel pump data plate is damaged or defaced so as to make it impossible to read the code, or if the code is not stamped on the plate, you are advised to contact your nearest Perkins Distributor or C.A.V. dealer, or alternatively, Service Department, Perkins Engines Limited, Peterborough, to obtain the correct setting.

**IMPORTANT:** Under no circumstances should the engine be allowed to operate at a higher speed than specified or severe damage to the engine may result.



## Fuel System

**Idling Speed Setting**

The engine idling speed is adjusted by the idling screw. With the engine warm, turn the screw clockwise to increase the engine speed and anti-clockwise to decrease.

The idling speed will vary according to application. For details apply to the nearest Perkins Distributor or C.A.V. Dealer, alternatively Service Department, Perkins Engines Limited, Peterborough.

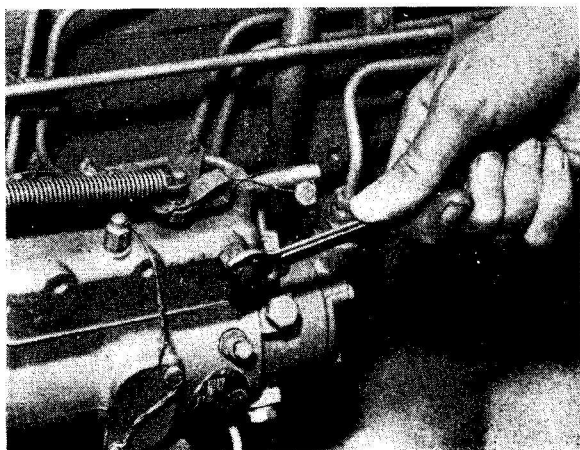


Fig. 14

1. Slacken the air vent valve on the front side of the governor control cover (mechanical governor, Fig. 14) or on the top of the control gear housing (hydraulic governor, Fig. 13).
2. Slacken the vent valve fitted on one of the two hydraulic head locking screws (Fig. 15).
3. Where applicable, unscrew, by two or three turns, the vent plug on the top of the filter cover.
4. Operate the priming lever on the fuel feed pump (Fig. 17) and when fuel, free from air bubbles, issues from each venting point, tighten the screws in the following order:—

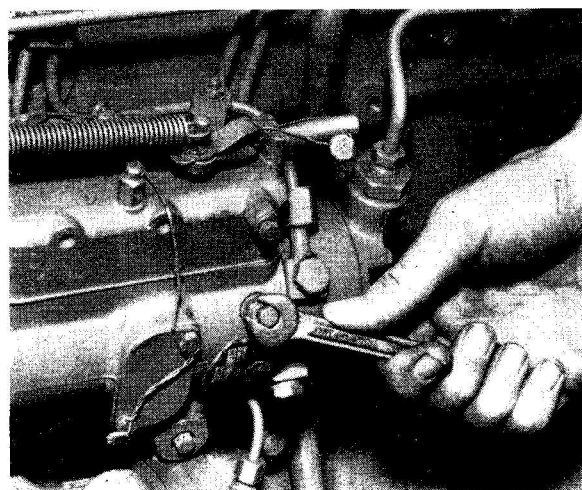


Fig. 15

**Priming the Fuel System**

The air must be vented from the fuel system whenever any part of the system between the fuel tank and injection pump has been disconnected for any reason, or when the system has been emptied of fuel.

No attempt must be made to start the engine until the injection pump has been filled and primed as serious damage can be caused to the pump due to lack of lubrication.

Later filter elements are self venting and do not have a vent plug fitted on the top of the filter cover.

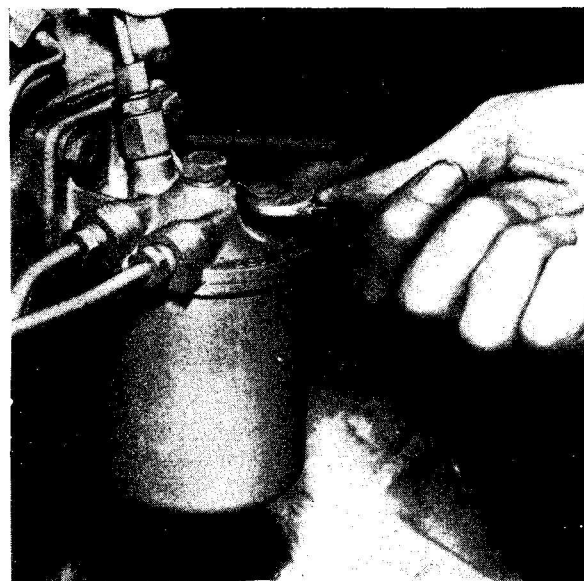


Fig. 16

## Fuel System

Tighten securing nuts evenly to 16 Nm (12 lbf ft).

Atomisers should be taken out for examination at regular intervals.

Refer to the Service Schedule.

The first symptoms of atomiser troubles usually fall in one or more of the following headings:—

1. Misfiring
2. Knocking in one (or more) cylinders
3. Engine overheating
4. Loss of power
5. Smoky exhaust (black)
6. Increased fuel consumption.

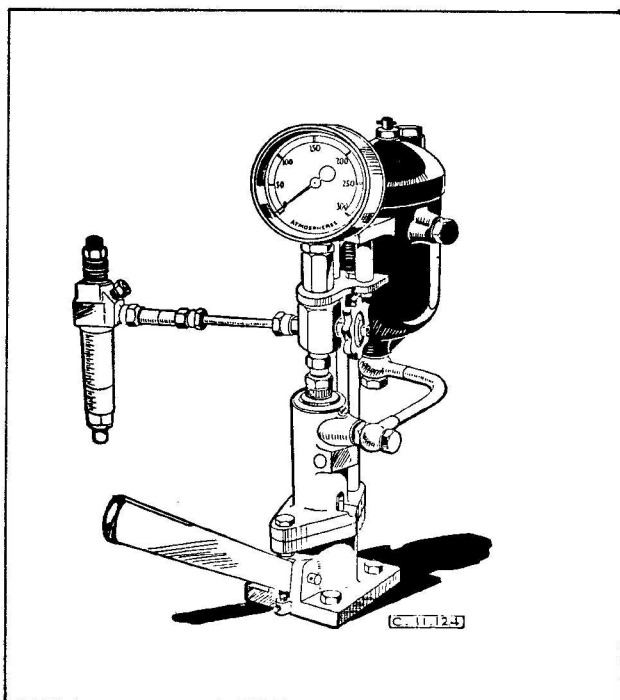


Fig. 19

The particular faulty atomiser or atomisers may be determined by releasing the pipe union nut on each atomiser in turn, with the engine running at a fast "tick-over". If after slackening a pipe union nut the engine revolutions remain constant, this denotes a faulty atomiser. The complete unit should be withdrawn from the cylinder head and inverted, atomiser nozzle outwards and the unions retightened. After slackening the unions of the other atomiser pipes (to avoid the possibility of the engine starting), the engine should be turned until the nozzle sprays into the air, when it will be seen if the spray is in order. If the spray is unudly "wet" or "streaky" or obviously to one side, or the nozzle "dribbles" it may only be necessary to probe the nozzle holes to remove carbon.

**Note:** Care should be exercised to prevent the hands or face from coming into contact with the spray, as the working pressure will cause the fuel oil to penetrate the skin.

NO ATTEMPT SHOULD BE MADE TO ADJUST THE INJECTION PRESSURE WITHOUT A PROPER TESTING PUMP AND PRESSURE GAUGE (Fig. 19). IT IS QUITE IMPOSSIBLE TO ADJUST THE SETTING OF ATOMISERS WITH ANY DEGREE OF ACCURACY WITHOUT PROPER EQUIPMENT.

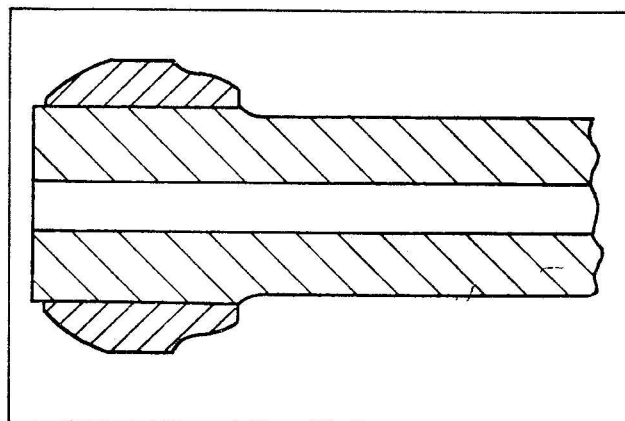


Fig. 20

A perfect atomiser, when tested by pumping fuel through it in the open air gives a short "pinging" sound as the fuel emerges from the holes. After the atomiser has been in service for some time, the "pinging" changes to a crackling sound. It is not until the atomiser sounds "dead" that its condition is likely to affect the running of the engine.

**Atomiser Identification**

Atomiser identification codes as given in 'Data' were originally stamped on a tab washer fitted under the spring cap locknut.

Currently, the atomiser code is stamped on the atomiser body.

No two of the pressure pipes, from the fuel pump to the atomisers are alike.

High pressure fuel pipe nuts should be tightened to 20 Nm (15 lbf ft).

If the union nuts have been over-tightened there is a risk that the olives will have cracked or been unduly compressed, when leakage will result.

The working pressure which these joints must sustain is several thousand pounds per square inch.

**Fuel Pipes**

For standardisation purposes, high pressure fuel pipe assemblies are now supplied with olives fitted as shown in Fig. 20. The earlier type pipe assemblies with olives fitted in the reversed position are still satisfactory.

If the union is tightened excessively the olive may collapse and split. The same danger exists if the pipe is not square to and central with the union.

When changing an atomiser always remove the pipe entirely.