

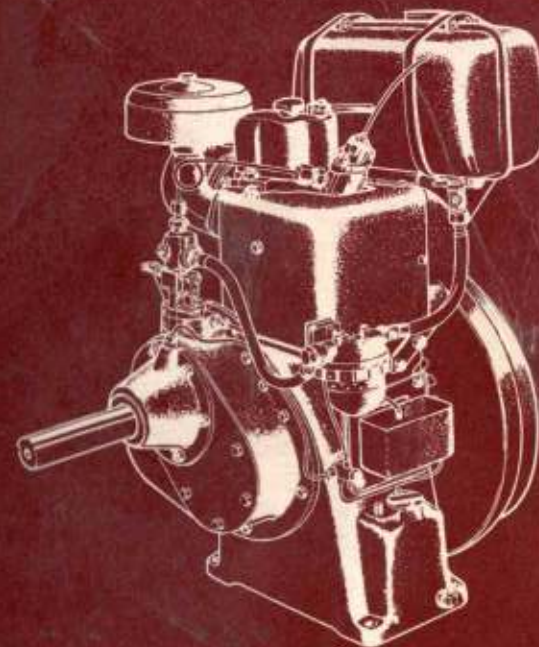


**PETTERS LIMITED**  
STAINES, ENGLAND

PHONE-STAINES 1122. TELEGRAMS AND CABLES-DIESEL STAINES  
A MEMBER OF THE HAWKER SIDDELEY GROUP

# **PETTER**

## **DIESEL ENGINES**



**PAZ 1**

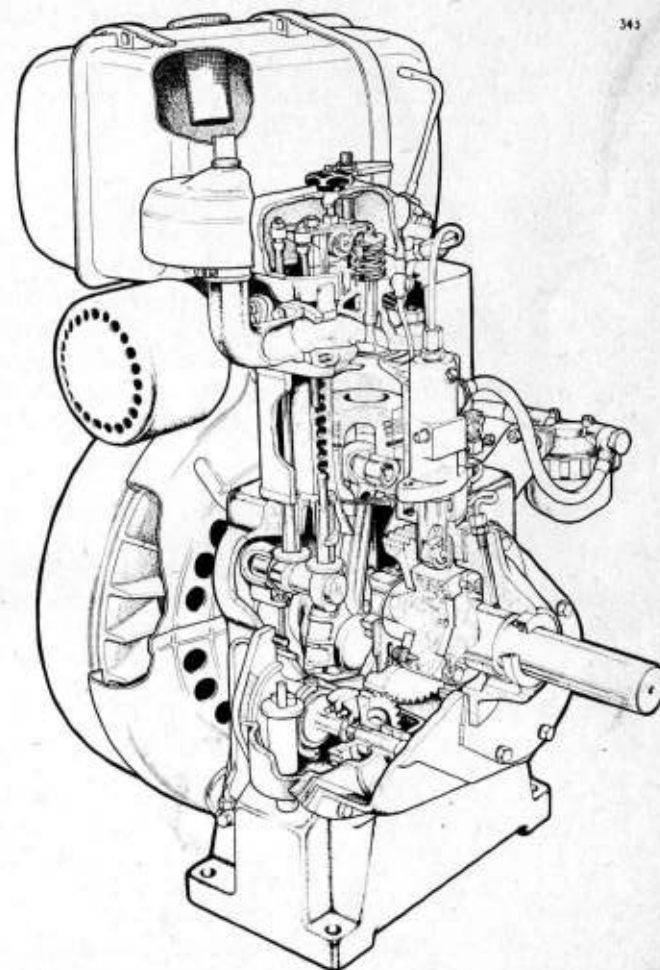
**OPERATORS**  
**HANDBOOK**

PUBLICATION No. 2086/7

# Petter Diesel Engines

## TYPE PAZI

343



*This book will help the user to get the best results from the engine. No engine will run without care, but it will give good service if given the attention described in this book.*



## **Please remember . . .**

**... an engine needs fuel—**

Keep fuel, tank, filter and piping clean.

**... an engine needs lubricating oil—**

Use the correct grade of oil. Keep oil levels topped up.

**... an engine needs air—**

Keep air cleaner clean. Keep air inlet manifold and entire exhaust system free of carbon and any other restriction.

Keep fan air intake unrestricted.

After approximately 20 hours initial running-in of a new or overhauled engine, the following points should receive attention:

- (a) Tighten cylinder head nuts
- (b) Check valve rocker clearance
- (c) Drain lubricating oil from sump and refill with clean oil
- (d) Check fuel filter
- (e) Check all nuts and bolts for tightness
- (f) Check clutch adjustment

Requests for spares and service should be directed to

Hawker Siddeley (Hamble) Ltd.  
Petter Armstrong Service Division,  
Hamble, Southampton

Hamble 2061

or your nearest Service Depot at:  
Hawker Siddeley (Hamble) Ltd.  
Petter Armstrong Service Division,  
15-17 Haddon Street, Aberdeen

Aberdeen 21217

Hawker Siddeley (Hamble) Ltd.  
Petter Armstrong Service Division,  
Walker Square, Cowal Street,  
Maryhill, Glasgow

Maryhill 2265

Hawker Siddeley (Hamble) Ltd.  
Petter Armstrong Service Division,  
Limewood Road., Seacroft, Leeds, 14

Leeds 20965

Hawker Siddeley (Hamble) Ltd.  
Petter Armstrong Service Division,  
Cliff Works, Burton-on-the-Wolds,  
Loughborough, Leics

Wymeswold 333

Hawker Siddeley (Hamble) Ltd.  
Petter Armstrong Service Division,  
Bridge Works, Staines, Middx.

Staines 51333

Bore	...	...	...	...	3 in. (76.2 mm)
Stroke	...	...	...	...	3 in. (76.2 mm)
Power and speed (B.S. rating)	...	...	...	...	1.5 b.h.p. @ 1000 rev/min 2.5 b.h.p. @ 1500 rev/min 3 b.h.p. @ 1800 rev/min
Cubic capacity	...	...	...	...	348 cu. cm (21.2 cu. in.)
Compression ratio	...	...	...	...	19.5:1
Lubricating oil pressure	...	...	...	...	12 lb/sq. in. (0.84 kg/sq. cm)
Compression pressure	...	...	...	...	735 lb/sq. in. (51.68 kg/sq. cm)
Fuel injection release pressure	...	...	...	...	1000 to 1199 rev/min 2137/2363 lb/sq. in. (150.2/165.9 kg/sq. cm) 1200 to 1800 rev/min 2850/3150 lb/sq. in. (200/221 kg/sq. cm)
Fuel injection timing (by spill)	...	...	...	...	23° before T.D.C. 1000 to 1299 rev/min 26° before T.D.C. 1300 to 1800 rev/min
Inlet valve opens	...	...	...	...	6° before T.D.C.
Inlet valve closes	...	...	...	...	30° after B.D.C.
Exhaust valve opens	...	...	...	...	29° before B.D.C.
Exhaust valve closes	...	...	...	...	7° after T.D.C.
Fuel tank capacity (engine mounted)	...	...	...	...	1½ gal (6.8 litres)
Oil capacity	...	...	...	...	6¾ pints (3.8 litres)
Lubricating oil	...	...	...	...	See approved list
Fuel oil	...	...	...	...	A high grade light distillate diesel fuel in accordance with B.S. Specification No. 2869:1957 Class A

Camshaft end float	...	...	...	0.006/0.012 in. (0.15/0.3 mm)
Crankshaft end float (new)	...	...	...	0.006/0.016 in. (0.15/0.4 mm)
Crankpin ovality (not to exceed)	...	...	...	0.003 in. (0.08 mm)
Cylinder bore (new)	...	...	...	2.9995/3.0005 in. (76.187/76.213 mm)
Piston ring gap (new)	...	...	...	0.009/0.014 in. (0.23/0.35 mm)
Piston ring gap (not to exceed)	...	...	...	0.06 in. (1.5 mm)
Exhaust valve lift by decompressor (max)	...	...	...	0.02 in. (0.508 mm)
Bumping clearance	...	...	...	0.035/0.040 in. (0.887/1.016 mm)
Valve rocker clearance (cold)	...	...	...	0.010 in. (0.25 mm)
Main bearing clearance (new)	...	...	...	0.002/0.0042 in. (0.05/0.107 mm)
Large end bearing clearance (new)	...	...	...	0.002/0.0042 in. (0.05/0.107 mm)
Pulley sizes:				
All marks	...	...	...	5 in. diameter x 4½ in. face
Marks I, II, III, IV	...	...	...	5 in. diameter x 7 in. face
Cylinder rebore diameters:				
Amount oversize	Bore diameter			
0.020 in. (0.508 mm)	3.0195/3.0205 in. (76.7/76.72 mm)			
0.040 in. (1.016 mm)	3.0395/3.0405 in. (76.3/76.33 mm)			
Crankshaft regrinding diameters:				
Amount undersize	Main journal diameter	Crankpin diameter		
0.010 in.	1.737/1.7362 in.	1.740/1.739 in.		
(0.254 mm)	(44.12/44.009 mm)	(44.20/44.17 mm)		
0.020 in.	1.727/1.7262 in.	1.730/1.729 in.		
(0.508 mm)	(43.86/43.84 mm)	(43.94/43.81 mm)		
0.030 in.	1.717/1.7162 in.	1.720/1.719 in.		
(0.762 mm)	(43.61/43.59 mm)	(43.69/43.66 mm)		
0.040 in.	1.707/1.7062 in.	1.710/1.709 in.		
(1.016 mm)	(43.36/43.34 mm)	(43.43/43.41 mm)		

## APPROVED LUBRICANTS

Supplier	Winter	Summer	Tropical
Shell Group of Companies	Rotella Oil 10W	Rotella Oil 20/20W	Rotella Oil 30
	Rotella Oil 10W/30	Rotella Oil 10W/30	Rotella Oil 10W/30
	Talona Oil 10W	Talona Oil 20	Talona Oil 30
Mobil Oil Co. Ltd. and Associate Companies	Mobiloil Special	Mobiloil Special	Mobiloil Special
	Delvac Special	Mobiland Diesel 20 Tractor Oil	Delvac Special
	Mobiland Diesel 10 Tractor Oil	Delvac Special	Mobil DTE Oil No. 3D
Power Pet. Co. Ltd. (U.K.) B.P. Companies (Overseas)	Energol Diesel D-SAE 10W	Mobil DTE Oil No. 2D	Energol Diesel D-SAE30
	Energol Visco Static	Energol Diesel D-SAE 20W	Energol Visco Static
	Energol Diesel D	Energol Diesel D	Energol Diesel D
Esso Marketers	Esolube HD 10	Energol Diesel D	Esolube HD 30
	Esor HD 10W	Esolube HD 20	Esor HD 30
		Esor HD20	Tromar HD 30
Caltex/Texas Co. Regent Oil Co. Ltd.	Calrex RPM Delo Special SAE 10W	Calrex RPM Delo Special SAE 20W	Calrex RPM Delo Special SAE 30
	Texaco Urso Oil Heavy Duty SAE10W	Texaco Urso Oil Heavy Duty SAE20W	Texaco Urso Oil Heavy Duty SAE30
	Havoline Special 10W/30	Havoline Special 10W/30	Havoline Special 10W/30
Gulf Oil Group of Companies	Brit-Gulf 10W-HD	Brit-Gulf 20/20W-HD	Brit-Gulf 30-HD
	Gulflube Motor Oil HD 30	Gulflube Motor Oil HD 20/20W	Gulflube Motor Oil HD 30
			Gulf Veritas V9 HD

## TROUBLE LOCATING CHART

Trouble	Reason	Causes	Suggested Remedy
Engine will not start	Fuel supply failure Check by turning engine and listen for the characteristic squeak in the injector	No fuel in tank Fuel tap closed Air in the pipe line Broken fuel pipe or leaking connection Fuel filter choked Faulty injector nozzle Fuel pump plunger sticking Fuel pump tappet plunger sticking	Fill tank and bleed fuel system Open tap Bleed the system Repair or replace the pipe and tighten the connection Fit new filter element Fit new nozzle Fit new pump Free and clean the plunger
	Poor compression	Valves sticking Cylinder head loose Cylinder head gasket blown Piston rings stuck in grooves Worn cylinder and piston Valves not seating properly	Free the valves Tighten all nuts Fit new gasket Check rings and clean the piston Overhaul the engine Check valve springs Grind if necessary Check valve rocker clearance
	Incorrect lubricating oil		Drain the sump and fill with correct oil

TROUBLE LOCATING CHART—contd.

Trouble	Reason	Causes	Suggested Remedy
Engine starts but fires intermittently or soon stops	Faulty fuel supply	Air in the fuel lines Water in the fuel Faulty injector nozzle Fuel filter choked	Bleed the system Drain fuel system and fill with clean fuel Fit new nozzle Fit new filter element
	Faulty compression	Broken valve spring Sticking valve Pitted valve	Replace Free the valve Grind in or replace
	Dirty engine	Blocked exhaust pipe or similar	Clean out
Engine lacks power and/or shows dirty exhaust	Faulty fuel supply	Faulty fuel pump Faulty injector nozzle Unsuitable fuel	Fit new pump Fit new nozzle Drain the fuel system and fill with correct fuel
	Out of adjustment	Valve rocker clearance incorrect Fuel timing retarded	Adjust Adjust timing
	Dirty engine	Blocked exhaust pipe or similar Dirty air cleaner Faulty piston ring Excessive carbon on piston and cylinder head Worn cylinder and piston	Clean out Clean out Replace Decarbonise Overhaul the engine

TROUBLE LOCATING CHART—cont.

Trouble	Reason	Causes	Suggested Remedy
Faulty running	Knocking	Carbon on piston crown Injector needle sticking Fuel timing too far advanced Broken piston ring Slack piston Worn large end bearing Loose flywheel Worn main bearing	Decarbonise Fit new nozzle Adjust timing Fit new ring Replace Replace and check lubrication Refit the key Replace and check lubrication
		Overload Lubricating oil failure Excessive valve rocker clearance Cooling system failure	Reduce the load Fill the sump and check system Adjust Check that the cooling system is in order and free from obstruction
		Air in fuel pipes Governor sticking	Bleed the system Free the governor
	Sudden stop	Empty fuel tank Choked injector Fuel pipe broken Seized piston	Fill tank and bleed fuel system Fit new nozzle Replace or repair Fit new piston or, in an emergency, stone down
	Heavy vibration	Loose holding down bolts	Tighten up



**b****installation****1. Engine bearers**

Engine mounting superstructure must be of rigid construction and neither deflect nor twist when subjected to the engine weight.

**2. Erection**

- (a) Installation drawings are obtainable from *Petters Limited* or their agents.
- (b) *Petters Limited* or their agents should be consulted in the following cases:
  - (i) Before proceeding with any new form of installation.
  - (ii) Where the use of anti-vibration mountings is contemplated. (An unsuitable choice can be dangerous.)
  - (iii) When a portable installation is contemplated. In this instance a *Petter* engineer should be present when the installation is made.
- (c) On direct driven sets, the driving and driven units must be lined up and a flexible coupling fitted.

**3. Exhaust**

- (a) The exhaust manifold is tapped to take a pipe with a 1 in. B.S.P. thread.
- (b) An accoustic silencer and exhaust piping can be supplied loose and are similarly threaded, but with male connections. A tail pipe, 18 in. (457 mm) long, must be fitted to the silencer.
- (c) The exhaust system should be as short as possible and with a minimum of bends, otherwise a serious reduction of power will result.
- (d) An installation having more than 12 ft (4 metres) of piping must have the pipe and silencer sizes increased to 1½ in. B.S.P.

**4. Air Intake**

Air is taken in through an air cleaner.

Engines installed in confined spaces require good ventilation to ensure a plentiful supply of cool, clean air.

**5. Cooling**

- (a) Cooling air is supplied by the flywheel fan and care must be taken to ensure that the fan cowling air intake is unobstructed.
- (b) Engines mounted inside housings or confined spaces must be provided with ample openings for the free circulation of air.
- (c) UNDER NO CIRCUMSTANCES MUST THE ENGINE BE RUN WITHOUT THE FAN COWLING IN POSITION.

**c****drive arrangements****Engine marks**

Power can be taken from any two shafts at the same time provided the total power absorbed is not greater than the rated power of the engine.

Drive and starting arrangements are as follows:

- MARK I Drive at half engine speed on camshaft extension at end remote from flywheel. Starting handle at flywheel end.
- MARK II Drive at engine speed on crankshaft extension at end remote from flywheel. Starting handle at flywheel end.
- MARK III Clutch drive at half engine speed on camshaft extension at end remote from flywheel. Starting handle at flywheel end.
- MARK IV Clutch drive at engine speed on crankshaft extension at end remote from flywheel. Starting handle at flywheel end.
- MARK V Drive at engine speed on crankshaft at flywheel end. Starting handle on half speed extension at end remote from flywheel.

**Pulley Drive**

When belt drives are used the belt should be as close to the engine as possible. When fixed and loose pulleys are fitted, the fixed drive must be nearest the engine.

**Rotation**

Standard rotation is clockwise when looking at the flywheel.

**d****operation****6. To prepare a new or overhauled engine for starting (Fig. 1)**

- (a) Check that the cooling system is in order and free from obstruction.
- (b) Remove the oil filler cap and fill with lubricating oil to the high level mark on the dipstick. Replace cap. (After a few

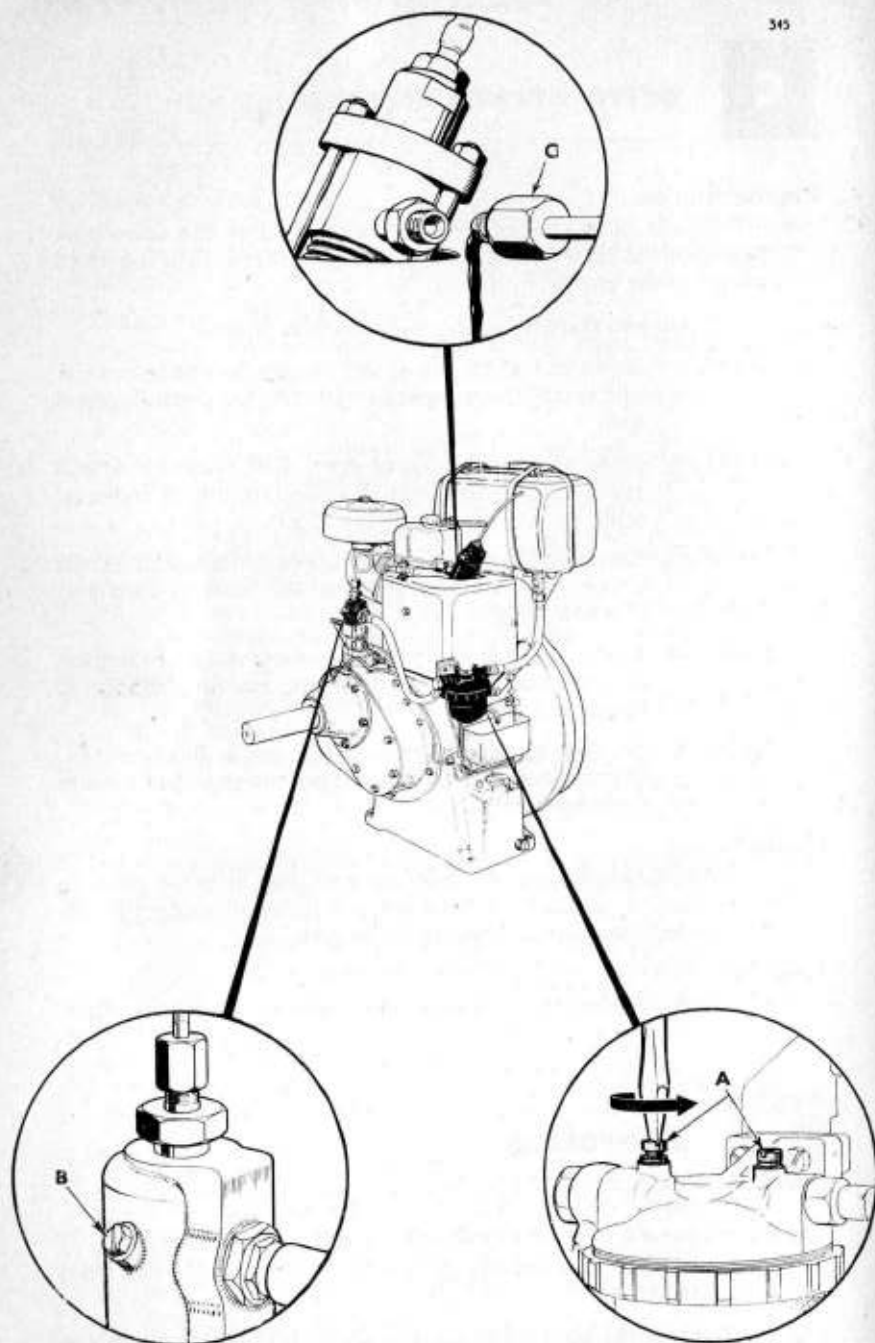


Fig. 1.

minutes running stop the engine and top up the oil, as the level always falls slightly after the initial circulation.)

- (c) Turn the decompressor lever and turn the engine one or two dozen times to help circulate the oil.
- (d) Fill the fuel tank.
- (e) Open the tap between the fuel tank and filter and bleed and prime the fuel system as follows:
  - (i) Loosen the two vent screws (A) on top of the fuel filter and keep loose until clean, bubble-free fuel leaks out. Retighten screws.
  - (ii) Loosen the vent screw (B) at the side of the fuel pump. Slowly crank the engine a few times until clean, bubble-free fuel leaks out. Retighten screw.
  - (iii) Unscrew the delivery pipe connection (C) from the fuel injector. Crank the engine over until bubble-free fuel leaks out. Replace pipe connection.
  - (iv) Repeat the slow cranking of the engine until the injector is heard to squeak. This operation is called priming.

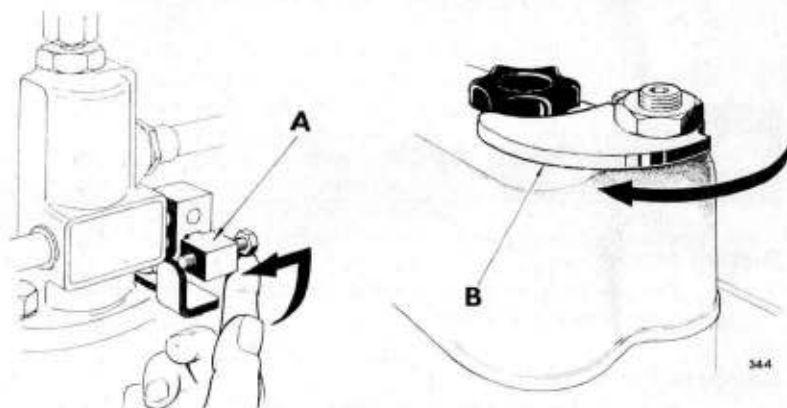


Fig. 2.

### 7. To start (Fig. 2)

- (a) Lift the red painted overload stop (A) and allow the fuel pump rack to move into the fully open position.
- (b) If a variable speed control is fitted set the control lever in the full speed position.
- (c) Turn the decompressor lever (B) and crank over slowly, thus priming it. (This is unnecessary with a warm engine.)
- (d) Turn the engine as fast as possible. When it is turning at a good speed, knock back the lever. The engine should now fire.



- (e) If the engine does not fire, turn the decompressor lever and slowly crank the engine a few times before attempting to start again.
- (f) On an engine with starting handle on the full speed shaft it may be found easier to start without the use of the decompressor gear.
- (g) Where the ambient air temperature is 5° F (—15° C) or below, a cold starting aid should be fitted.

#### 8. To stop

- (a) Run without load for a few minutes. Push governor lever towards the fuel pump until the engine stops.

#### 9. Important don'ts

- (a) DON'T stop the engine by means of the decompressor. This will lead to damaged valve seats and cylinder head joints.
- (b) DON'T stop the engine by closing the fuel tap or allowing the fuel tank to run dry. This will let air into the fuel lines and make it necessary to bleed and prime the system.

## e

### working cycle

#### Suction stroke

The air inlet valve opens and the piston moves down and draws air into the cylinder.

#### Compression stroke

The air inlet valve closes and the piston moves up, compressing the air and thereby heating it. Just before top dead centre, a very small quantity of fuel oil is injected under high pressure.

#### Working stroke

The fuel ignites at top dead centre, due to the heat of the compressed air. The combustion of the fuel creates a rise of pressure which forces the piston down.

#### Exhaust stroke

The exhaust valve opens and the rising piston pushes out the burnt gas. The exhaust valve closes, thus completing the cycle.

## f

### running maintenance

#### 10. Daily

- (a) Check the lubricating oil level on the dipstick and top up if necessary.
- (b) Check that the cooling system is in order and free from obstruction.

#### 11. Every 250 hours

- (a) Clean the fuel oil filter bowl.
- (b) Check cylinder head joint for leaks and tighten nuts if necessary.
- (c) Check all nuts, bolts and keys for tightness.
- (d) Make sure the fuel tank filler cap vent hole is clear.
- (e) Clean the air cleaner by removing the element and gently tapping it free of dust. Alternatively, the element may be cleaned by blowing compressed air from the inside to the outside.
- (f) Clean out deposit from exhaust silencer.
- (g) Drain the sump, flush out with flushing oil and refill with new oil. Clean the oil strainer. (Paraffin oil may be used if flushing oil is unobtainable.)
- (h) Test the fuel system for leaks.
- (j) Remove fuel injector and test spray. If in order, replace without further interference.
- (k) Check valve rocker clearance and adjust if necessary.
- (l) Clean the lubricating oil feed restrictor to rockers.

#### 12. Every 500 hours

- (a) Fit new fuel filter element.

#### 13. Every 1000 hours

- (a) Remove the cylinder head and decarbonise cylinder head, piston top and exhaust and inlet ports.
- (b) Examine exhaust and inlet valves. Grind in, if necessary.
- (c) Withdraw the piston and clean out oil return holes. Examine cylinder bore.

#### 14. Every 2000 hours

- (a) Examine the large end bearing and replace if clearance is excessive.
- (b) Wash out lubricating oilways and pipes.
- (c) Clean out the fuel tank thoroughly.

**15. Decarbonising**

A carbon deposit forms on piston and cylinder heads and the presence of an excessive carbon deposit is usually indicated by a dirty exhaust and a falling off of power.

As it depends solely upon the operating conditions, it is not possible to lay down any hard and fast rules as to how frequently it is necessary to decarbonise.

As a general guide, the engine should be decarbonised after a period of 1000 hours.

Decarbonising necessitates the removal of the cylinder head, followed by the removal of all carbon and the grinding in of the valves. These operations are described in subsequent paragraphs.

**16. To remove cylinder head**

- (a) Remove the cylinder cowling.
- (b) Remove the air inlet and exhaust manifolds.
- (c) Remove the fuel injector.
- (d) Disconnect the lubricating oil pipe to the rocker shaft.
- (e) Remove rocker box.
- (f) Remove the cylinder head nuts and lift off the cylinder head.
- (g) Remove the push rods.
- (h) Remove the cylinder head gasket.

**17. To dismantle cylinder head**

- (a) Loosen the locknut from the decompressor screw.
- (b) Remove the decompressor screw complete with the lever and thackeray washer.
- (c) Unscrew the rocker shaft support nuts and withdraw the rocker assembly. Remove the two circlips and withdraw the rocker shaft and extract the rockers.
- (d) To remove the valves. Remove the split pin locating the inlet valve. Press down the valve spring cups and remove the split collets from the valve stems. A special tool for this purpose can be obtained from *Petters Ltd., or their agents.* Valves and springs can now be withdrawn.

**18. To remove carbon**

- (a) Turn crankshaft until piston is at top of its stroke.
- (b) Scrape carbon from the cylinder head and top of piston. An old screwdriver or other blunt tool may be used. Emery cloth must NOT be used. Do not allow carbon dust to fall between the piston and the cylinder bore.



Make sure that the vent hole in the fuel tank filler cap is clear.



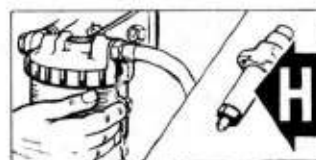
Clean the air cleaner element



Clean the carbon deposit from the exhaust silencer.



Drain the sump, flush out with paraffin and refill with new oil. Clean the oil strainer.



Remove injector and test spray. If in order replace without interference. Test fuel system for leaks.



Replace the fuel filter element



Check valve clearances and adjust if necessary.

Keep cooling system

free from

obstruction.

Use only the lubricants

recommended

in the handbook

500 HOURS

- (c) Thoroughly clean out the exhaust and inlet ports and manifolds.
- (d) Thoroughly clean the valves and examine the valve seats. If these show signs of pitting, they should be ground in.
- (e) Make sure the valves are seating properly. Leaking valves cause loss of compression and difficult starting.

## 19. To grind in valves

- (a) Care must be taken that the valves are returned to their correct seatings for this operation.
- (b) Place a very small quantity of valve grinding paste evenly around the valve seat and insert the valve. By means of a screwdriver inserted in the valve head slot, partially rotate the valve backwards and forwards on its seating, exerting a gentle but firm pressure.
- (c) Periodically lift the valve from its seating and give it a quarter turn, thus ensuring that the grinding paste is evenly spread. A convenient method is to insert a light coil spring beneath the valve head for raising it every time pressure on the screwdriver is released. The valve can then easily be rotated into a new position.
- (d) It is unnecessary to continue grinding once the faces of the valve and its seating have a clean, even, matt-surfaced appearance. A polished surface must not be expected and is unnecessary.
- (e) Wash out the ports thoroughly with petrol or paraffin making sure that all traces of grinding paste are removed from the ports and guides.
- (f) Replace the valves and rotate them backwards and forwards a few times. If the valves have been correctly ground a thin polished line will appear all round the seat.

## 20. To replace cylinder head

- (a) Generally reverse the instructions for removing and dismantling.
- (b) If the valves are distorted or very badly pitted, replace with new ones.
- (c) If new valves or guides are fitted, the valves must be ground in.
- (d) A new cylinder head gasket must be fitted if the old one shows any signs of damage. It is a wise policy to fit a new gasket every time a cylinder head is removed.
- (e) As the engine is fitted with long through studs from the crankcase to the cylinder head it is MOST IMPORTANT that the cylinder head nuts are correctly tightened and in the right sequence. Proceed as follows:
  - (i) Screw down each cylinder head nut until finger tight.
  - (ii) Tighten each nut a quarter of a turn, working diagonally across the cylinder head until all nuts are tight.



- (f) If the decompressor screw and lever have been removed, refit as follows:
- Place the thackeray washer between the lever and rocker box with the lever the right way up and in the decompressed position.
  - Compress the washer between the lever and the rocker box and screw the decompressor screw through the lever and into the rocker box.
  - Fit the locknut and adjust the decompressor setting.

## 21. To adjust valve rockers (Fig. 3)

- (a) To adjust the clearance, set the engine with valves closed (T.D.C. of firing stroke), loosen the locknut (A) and turn the rocker adjusting screw (B) with a screwdriver. Measure the gap with a feeler gauge and when the correct setting (see Technical Data) is obtained re-tighten the locknut. Re-check the gap.

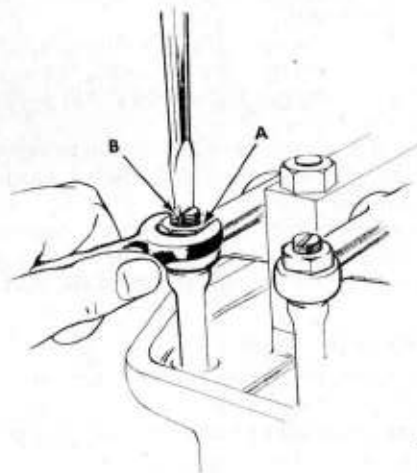


Fig. 3.

- (b) The exhaust valve should be lifted the correct amount by the movement of the decompressor lever. The setting may be obtained as follows:
- Make sure that the rocker box is firmly bolted down.
  - Turn engine until cylinder is on the compression stroke, i.e. both valves closed.
  - Turn the decompressor lever to the running position.

- (iv) Slacken the locknut and turn the decompressor screw until it just touches the valve rocker. Turn back the screw a quarter-turn and tighten the locknut. Make sure the lever and screw do not move while the locknut is being tightened.

NOTE: The valve should not be lifted more than the specified amount (see Technical Data) or it will cause serious damage by hitting the piston. When the decompressor is in operation, air is allowed to escape from the cylinder through the slightly opened exhaust valve. Compression cannot therefore build up and the engine will turn easily and will not fire.

- (c) **IMPORTANT:** The cylinder head must be firmly bolted in position, with the nuts finally tightened, before the rocker clearances are adjusted. This applies also to the rocker box when adjusting the decompressor lift. ALWAYS check the decompressor lift after removing the rocker box cover and readjust, if necessary.

## 22. To remove cylinder and piston

- Remove the cylinder head.
- Lift the cylinder off the crankcase and draw it off the piston.
- To remove piston, take out one gudgeon pin circlip and push out gudgeon pin. This may need forcing and care must be taken to avoid damaging the piston and connecting rod.

## 23. Cylinder maintenance

- After the cylinder has worn more than 0.010 in. (0.25 mm) on the bore diameter, it should be bored out and an oversize piston and rings fitted.
- The cylinder should be rebored and honed to the sizes shown under Technical Data.

## 24. Piston maintenance

Excessive lubricating oil consumption, loss of compression and knocking are signs that a piston may need attention.

- If the ring gaps are excessive (see Technical Data) the rings should be renewed. To measure the gaps remove the rings from the piston noting the order of assembly and which ring face is uppermost.
- Remove all the carbon deposit from the rings and ring grooves. The small holes in scraper ring grooves should receive attention as their purpose is to return excess oil to the sump.
- Insert the piston into the cylinder bore with the crown towards the bottom end of the bore and about  $\frac{1}{2}$  in. (12 mm) from the bottom edge. Insert the rings one at a time, pushing each ring hard up against the piston crown to ensure that it is level in the cylinder bore. The gap can now be checked with a feeler gauge.

- (b) Assemble the rings on the piston in the correct order with the correct face uppermost. Rings should not be slack or stuck fast in the groove. With the piston held in a horizontal position the rings should not fall downwards unless the piston is shaken. This applies only to a piston and rings free from grease or oil.

## 25. To replace cylinder and piston

- (a) When replacing the piston see that the hemispherical recess in the crown is at the side opposite to the camshaft.
- (b) Take care that the piston ring gaps are not in line but well distributed around the piston circumference.
- (c) Replace the shims between the cylinder and the crankcase. The thickness of the shims controls the bumping clearance between the piston and the cylinder head at T.D.C.
- (d) Before completing reassembly, check the bumping clearance (see Technical Data) as follows:  
Place two pieces of lead wire on top of the piston roughly at right angles to the gudgeon pin. Replace the cylinder head gasket and cylinder and bolt down firmly. Turn the engine over T.D.C., remove the cylinder head and measure the thickness of the now flattened lead wire with a micrometer.
- (e) After completing reassembly, check the valve rocker clearance and reset the decompressor.

## 26. To examine connecting rod

- (a) Remove the crankcase inspection cover.
- (b) Insert hand and grasp the large end of the connecting rod. Check for undue play or shake in the bearing. The engine should be decompressed during this operation and the flywheel rocked backwards and forwards.
- (c) Check that the connecting rod bolts are tight with tabwashers in position.

## 27. To remove connecting rod

- (a) Remove the cylinder head and cylinder.
- (b) Remove the crankcase inspection cover.
- (c) After bending the tabwashers away, remove the large end nuts and withdraw the connecting rod and piston assembly, taking care to note the position in which the bearing halves are fitted.

## 28. Connecting rod maintenance

- (a) When replacing a small end bush take care that the oil hole coincides with that in the connecting rod and that it enters the connecting rod squarely. In the absence of a press, a block of wood and mallet may be used for driving it home.
- (b) Large end bearings are of the precision thin wall steel backed type and consist of two half shells lined with bearing metal. They should be replaced in their original positions.

- (c) When fitting a new large end bearing care must be taken to position the half shells correctly. This is ensured by fitting the half shell stamped 'TOP' into the connecting rod and the other into the connecting rod cap.
- (d) New bearings are machined to give the required fit when in position and should never be scraped or bedded in, nor should shims of any description be fitted. If the faces of the connecting rod or its cap are filed the rod becomes useless regarding replacement bearing shells. When fitting make sure that the connecting rod bore and the outside of shells and their split faces are clean.
- (e) Connecting rods and caps are stamped with an assembly serial number and care must be taken that numbers are correctly assembled and on the same side.
- (f) Undersize bearings are obtainable from *Petters Ltd. or their agents*.

## 29. To replace connecting rod

- (a) Generally reverse the instructions for removal, making sure that NEW tabwashers are used on the large end nuts.
- (b) When replacing the cylinder and cylinder head, check the bumping clearance and adjust valve rocker clearance.

## 30. To remove crankshaft

- (a) Remove the cylinder head, cylinder and connecting rod.
- (b) Withdraw the flywheel key with a tapered key drift and remove the flywheel. A special tool for this purpose can be obtained from *Petters Ltd. or their agents*.
- (c) Remove the flywheel fan cowling.
- (d) Disconnect the spring from the fuel pump rack extension to the governor lever.
- (e) Disconnect the pump-to-filter pipe, unscrew the pump bolts and remove the fuel pump.
- (f) Remove the gear cover. The two hexagon-headed dowels can be levered out with a spanner on edge.
- (g) Remove the bolt and gearwheel retaining plate from the gear end of the crankshaft and withdraw the gearwheel with a simple extractor. A special tool for this purpose can be obtained from *Petters Ltd. or their agents*.
- (h) Remove the flywheel end main bearing housing.
- (j) Withdraw the crankshaft by pulling towards the flywheel end.

## 31. Crankshaft maintenance

- (a) Carefully examine the bearing journals and crankpins. They should have a highly polished appearance and be free from scratches or score marks. If these defects are present, or if crankpin ovality is excessive, they should be reground and undersize bearings fitted.
- (b) Journals and crankpins should be reground to the diameters shown under Technical Data.

- (c) Carefully clean out the crankshaft oil holes and, if it has been reground, be sure that they have a radius edge.

### 32. Main bearing maintenance

- (a) Main bearings are of the precision thin wall steel backed sleeve type lined with bearing metal. When replacing a bearing take care that it enters the bearing housing squarely. In the absence of a press, a block of wood and mallet may be used for driving it home.
- (b) New bearings are machined to give the required fit when in position and should not be scraped or bedded in, neither should shims of any description be fitted.
- (c) Undersize bearings are obtainable from *Petters Ltd. or their agents*.

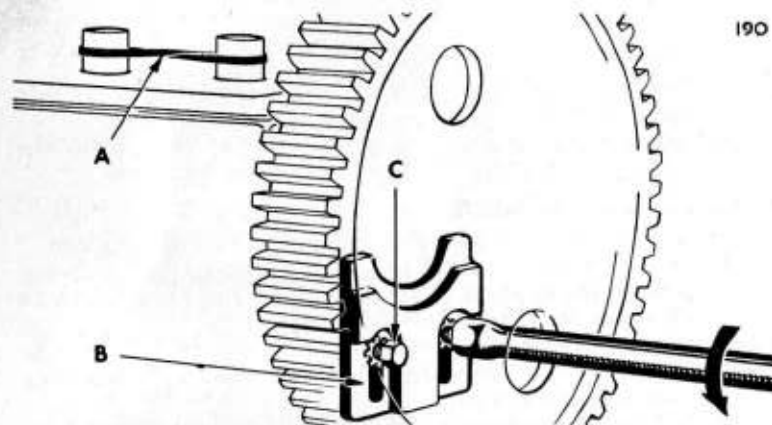


Fig. 4.

### 33. To replace crankshaft and time engine

- (a) Generally reverse the instructions for removal.
- (b) Fit new bearings if the old ones have excessive clearance or show signs of the metal having run.
- (c) Before completing the assembly check the end float. The crankshaft thrust is taken on the flanges of the main bearings and the end float (see Technical Data) is adjusted by means of shims fitted between the flywheel end main bearing housing and the crankcase.
- (d) Shims of 0.008 in. and 0.015 in. (0.2 mm and 0.38 mm) thickness are obtainable from *Petters Ltd. or their agents*.
- (e) See that the tooth marked with a dot on the camshaft gearwheel fits between the two teeth marked with dots on the crankshaft gearwheel.
- (f) Fit new locking wire to extension shaft setscrews.

### 34. To remove camshaft (Fig. 4)

- (a) Remove the gear cover.
- (b) Disconnect fuel pipes and remove the filter bracket assembly.
- (c) Remove the cylinder.
- (d) Wind a rubber band or piece of string (A) round the shanks of the valve tappets to prevent their falling into the sump when the camshaft is withdrawn.
- (e) A camshaft thrust plate (B) is located between the camshaft gearwheel and the crankcase, with two vertical slots for the holding screws (C). Loosen these screws, which are accessible through holes in the gearwheel, and the thrust plate will drop about  $\frac{1}{8}$ " (3 mm).
- (f) Withdraw the camshaft assembly, holding down the oil pump plunger to prevent the oil pump push rod cap from falling off.

### 35. Camshaft maintenance

- (a) Carefully examine the faces of the cams. If these are worn or chipped it will be necessary to fit a new camshaft.

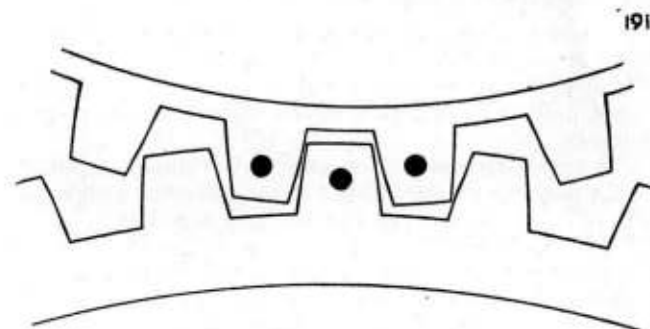


Fig. 5.

### 36. To replace camshaft and time engine (Fig. 5)

- (a) With the valve tappets held in position as previously described, insert the camshaft assembly from the gear end.
- (b) See that the tooth marked with a dot on the camshaft gearwheel fits between the two teeth marked with dots on the crankshaft gearwheel.
- (c) Free the valve tappets and raise the camshaft thrust plate about  $\frac{1}{8}$ " (3 mm) to engage in the groove in the camshaft at the end of the large diameter bearing.
- (d) Tighten the thrust plate setscrews and generally reverse the procedure for removing the camshaft.
- (e) Retime the fuel injection and adjust valve rocker clearances.



### 37. To remove governor

- (a) Disconnect the spring from the fuel pump rack extension to the governor lever.
- (b) Unscrew the governor housing nuts and remove the governor assembly from the gear cover.

### 38. To dismantle governor

- (a) Remove the cover from the governor housing.
- (b) Remove the bolt locating the governor lever and withdraw the lever.
- (c) Remove the pin securing the collar to the yoke spindle and remove collar and spring.
- (d) Remove the speeder spring adjuster clamp.
- (e) Remove the speeder spring and adjuster.
- (f) Loosen the grubscrew securing the yoke to its spindle and withdraw the spindle and key.
- (g) Remove the yoke and slide the sleeve off the governor spindle. Withdraw the spindle complete with gearwheel and weights.
- (h) Press the governor spindle out of the gearwheel after extracting the gearwheel locking pin.

### 39. Governor maintenance

- (a) Parts most likely to wear are the toes of the weights, the thrust ring and the sleeve.
- (b) The governor weights pivot on pins held in position by split pins, the removal of which allows the pins to be withdrawn.
- (c) The thrust ring moves on two pins retained in position by split pins in a similar manner to the governor weight pins.

### 40. To replace governor

- (a) Generally reverse the instructions for dismantling.
- (b) Replace the governor assembly on the gear cover.
- (c) Twist the yoke spindle clockwise as far as possible and connect governor lever to fuel pump rack extension spring.
- (d) Set the governor lever adjusting screw so that the fuel pump rack position gives a dimension of  $\frac{3}{16}$  in. (21.4 mm) from the pump boss (not the bush) to the fork flat on the rack on the right hand side of the pump as viewed from the gear end of the engine. Tighten the adjusting screw locknut.

### 41. To adjust speed control (Fig. 6)

- (a) Fixed speed
  - (i) The speed is set at the works and should not require further adjustment.  
However, if during the course of overhauling, the speeder spring is removed, the speed may be readjusted by loosening clamp screw (H) and turning the speeder spring adjuster (J) clockwise to increase the speed or

anti-clockwise to decrease it. Make sure the clamp screw is tightened after adjustment.

#### (b) Variable speed

Adjustments are carried out as follows:

- (i) Set the speeder spring adjuster (E) in the fully closed position. Adjust the idling speed to approximately 500-600 rev/min by screwing in the adjusting screw (D) to increase the speed, or out to decrease it, and tighten the locknut (C). After adjusting the idling speed, move the speeder spring adjuster across until it is stopped by the other adjusting screw (G). The adjustment for maximum speed can now be made by loosening the locknut

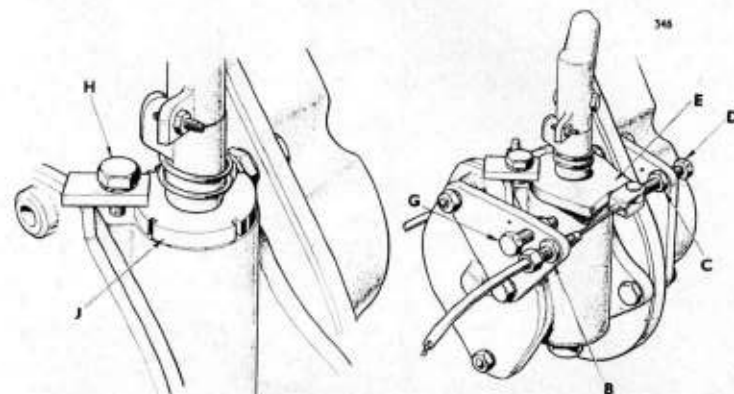


Fig. 6.

and screwing out the adjusting screw (G) to increase the speed or in to decrease it. Make sure the locknut is tightened after adjustment. Check the idling speed once more and readjust if not correct. Replace both adjusting screw seals with new locking wire.

- (ii) To adjust the control cable, when fitted, slacken the cable adjuster locknut (B) and screw the adjuster in until the speeder spring adjuster is hard against the adjusting screw (D) and there is a small amount of slack in the inner cable, with the cable lever in the closed position, i.e. the cable lever can just be moved before the inner cable begins to move the speeder spring adjuster (E). The locknut (B) should then be tightened.

### 42. Lubricating oil system (Fig. 7)

- (a) The engine oil pressure system is as follows:

- (i) A plunger type pump (A) is submerged in oil at the flywheel end of the crankcase sump, operated by a push rod (B) off the camshaft.

- (ii) Oil is drawn through the pump strainer (C) and delivered to the external pipe (D) via a drilled oilway in the crankcase.

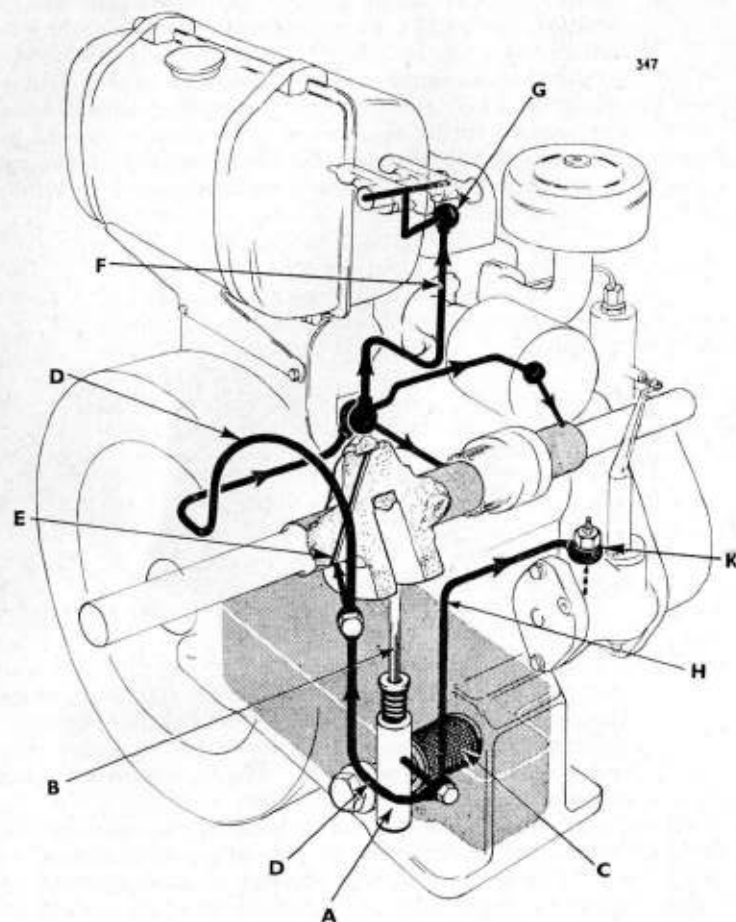


Fig. 7

- (iii) Oil under pressure reaches the main bearings and extension shaft bearing through the external pipe (D). The large end bearing is lubricated by oil from the flywheel end main bearing via a drilled hole (E) in the crankshaft.
- (iv) Valve rockers are supplied by an external pipe (F) through a restrictor (G).
- (v) The governor is lubricated through a restrictor (K) by pipe (H).

- (vi) A non-adjustable pressure relief valve is incorporated in the system to control the oil pressure.

- (b) The cylinders, small end bearing and camshaft are splash lubricated.
- (c) The sump can be drained by removing the plug at the bottom of the crankcase.
- (d) Oil must always be **CLEAN** and containers, funnels, etc., must be kept in a spotless condition. Use only recommended grades of oil. Cheap, unsuitable or dirty oil will cause trouble.

#### 43. Oil Pump strainer

- (a) To remove
- Drain the oil
  - Remove the crankcase inspection cover.
  - Unscrew the strainer from the adaptor.
- (b) To clean
- Wash the strainer in clean paraffin or fuel oil.
- (c) To replace
- Generally reverse the instructions for removal.

#### 44. To adjust oil flow to valve rockers

Normally there should be a film of oil visible between the valve rockers and their support when the engine is running. After wiping away, this should reappear rapidly.

- Loosen the restrictor locknut.
- Screw the restrictor in to reduce oil flow or out to increase it.
- Tighten locknut, taking care not to move the restrictor.

#### 45. To remove oil pump

- Drain the sump.
- Remove the oil strainer.
- Remove the strainer adaptor.
- Depress the plunger assembly and remove the push rod and cap.
- Remove the pump flange from the crankcase and gently lever out the pump body.

#### 46. Oil pump maintenance

- Dismantle the plunger by unscrewing its component parts, taking care not to damage the springs or the ball valves. The springs and ball valves must be returned to their original positions on reassembly.
- Thoroughly clean all parts in clean paraffin or fuel oil.

#### 47. To replace oil pump

- Generally reverse the instructions for removal.

#### 48. Fuel

- (a) To ensure proper working of the fuel injection equipment the fuel must always be CLEAN.
- (b) Barrels of fuel should be allowed to settle before use. Sludge or water at the bottom of the barrel must not be used. Due to increased engine repair costs, a cheap fuel may prove very expensive in the long run.
- (c) Funnels or cans used for fuel oil should not be used for anything else and must be kept absolutely clean. They should be thoroughly dried before use.
- (d) The fuel tank should always be filled through the strainer fitted to the filler opening. Occasionally the tank should be removed from the engine and flushed out with petrol or paraffin.
- (e) The fuel used should be high grade light diesel fuel, gas oil or D.E.R.V. fuel. It should comply with B.S.2869/1957 Class A, which is as follows:  
Cetane number, 45 min  
Viscosity Kinematic at 100° F (37.8° C), 1.6 to 7.5 secs  
Conradson Carbon (by weight), 0.1% max  
Distillation % by volume recovered at 357° C, 90  
Flashpoint (closed), 130° F (54.4° C)  
Calorific Value, gross 19,200 B.t.u./lb (10700 cal/g)  
Water % by volume, 0.1  
Ash % by weight, 0.01  
Sediment % by weight, 0.01  
Sulphur % by weight, 1.3  
Strong Acid number, nil  
Sulphur, Corrosive. Not more than slight tarnish

#### 49. Fuel system

- (a) Fuel oil from the tank flows through a filter to the injection pump which supplies it under high pressure to the injector.
- (b) A small amount of fuel is always leaking back along the injector nozzle needle and this is returned to the system by a pipe. When the tank is not mounted in a convenient position this fuel is collected in a small container and may be filtered and returned to the tank.
- (c) The quantity of fuel injected during each cycle is very small and the fuel injection equipment is manufactured to very fine limits. IT REQUIRES EXTREME CARE AND ABSOLUTE CLEANLINESS IN HANDLING.
- (d) Should any part of the fuel system, including pipes, be removed from the engine, it should be placed in a clean metal container which is filled with clean oil. NO FILING, GRINDING, SCRAPING OR SAWING SHOULD BE CARRIED OUT WITHIN A FEW YARDS OF DISMANTLED FUEL INJECTION EQUIPMENT.

- (e) Replace the equipment wet. No rag, cloth or waste should touch it.
- (f) Unless the user has been trained in the care and repair of fuel injection equipment, he should not dismantle it in any way other than as described in subsequent paragraphs.
- (g) Faulty fuel pumps and injectors should be returned to *Petters Ltd. or their agents*, for repair or replacement. Users are advised to keep a nozzle in their spares kit so that a faulty one can be replaced immediately.

#### 50. To clean fuel filter

- (a) Close the fuel tap.
- (b) Unscrew the clamp nut and remove the bowl.
- (c) Thoroughly clean out the bowl.
- (d) If the element shows a large deposit of dirt, it should be replaced by a new element, obtainable from *Petters Ltd. or their agents*. To remove element unscrew central retaining bolt.
- (e) Reassemble the filter.
- (f) Bleed the fuel system.

#### 51. To remove fuel injection pump

- (a) Close the fuel tap and disconnect pipes.
- (b) Disconnect the spring from the fuel pump rack extension to the governor lever.
- (c) Remove the pump.
- (d) The pump should not be dismantled and is not likely to require attention.

#### 52. To replace fuel injection pump

- (a) Generally reverse the instructions for removal.

#### 53. To time fuel injection pump

Before timing the pump be sure the fuel line is bled up to the fuel pump. For engines fitted with variable speed control set the control to the full speed position.

- (a) Be sure the overload stop adjusting screw is against the overload stop.
- (b) Turn off the fuel tap. Remove the pump-to-injector pipe and unscrew the union body from the pump. Lift out delivery valve assembly and place it in clean fuel. Do not disturb the delivery valve seat.  
Replace the union body on the pump leaving out the delivery valve.
- (c) Turn the flywheel until it is a quarter of a turn before T.D.C. with the piston on the compression stroke.
- (d) See that the fuel tank is quite full and open the fuel tap slightly until a small stream of fuel flows from the pump.



- (e) Turn the flywheel slowly in the normal running direction until the flow from the pump stops. Find by repeated trial the EXACT flywheel position at which this happens. This position is known as the spill point. (Do not use a starting handle but turn the flywheel by hand.)
- (f) When the flywheel is in the exact position where the flow stops, the flywheel pointer on the fan cowling should be opposite the appropriate timing mark preceding the T.D.C. mark on the flywheel. (For timing figures see Technical Data.)
- (g) If the pointer indicates a position before the timing mark, add shims between the pump and the crankcase until the correct timing is obtained. If the pointer indicates a position after the timing mark remove shims to obtain the correct timing.
- (h) Turn off the fuel tap and reassemble the fuel injection equipment including the fuel delivery valve.
- (j) Bleed the fuel injection.

#### 54. To remove and test fuel injector

- (a) Undo the pipe connections.
- (b) Remove the injector flange nuts and carefully lever out the injector.
- (c) Slide the finned cooling sleeve off the injector taking care not to damage the fins.
- (d) Reconnect the injector to the pump-to-injector pipe in such a way that the nozzle points away from the engine.
- (e) Turn the engine over slowly. The fuel should squirt out suddenly in three fine mist sprays which should stop just as suddenly. If the nozzle fails to spray, or gives solid squirts of fuel, or dribbles after the sprays have stopped, fit a new nozzle.
- (f) When testing, BE CAREFUL to see that the spray is not directed at any exposed part of the body. The force behind the spray will cause it to penetrate the skin.

#### 55. Fuel injector maintenance

- (a) Remove all visible carbon.
- (b) Remove the nozzle holder cap nut and the upper nut, complete with the spring adjusting screw and its locknut. The latter should not be disturbed as its setting provides correct fuel injection release pressure.
- (c) Remove the nozzle nut and nozzle assembly. Each needle is mated to one nozzle body and must never be used in another.
- (d) To ensure a thorough cleaning of all parts they should be left overnight in a bath of clean fuel oil. After this treatment, any remaining carbon can be scraped off with a piece of clean wood or brass. A special brass wire brush is obtainable from *Bryce Berger Ltd. or their agents.*

- (e) To fit a nozzle assembly to the nozzle holder body, hold it hard against the pressure face in the position determined by the dowels and tighten up the nozzle nut.
- (f) To complete the reassembly of the injector, grease the spring assembly and replace it, together with the adjuster, locknut and cap nut.
- (g) The fuel injector release pressure must be reset by means of a test pump to the figure shown under Technical Data.

#### 56. To replace fuel injector

- (a) Slide the finned cooling sleeve on to the injector. **THE ENGINE MUST NOT BE RUN WITHOUT THIS SLEEVE.**
- (b) Tighten the injector flange nuts evenly.
- (c) Reconnect the pipes.
- (d) Bleed the fuel system.

#### 57. Clutch

- (a) Lubrication  
The clutch is lubricated by the oil mist and spray from the restrictor (painted red) which is pressure fed from the engine and should pass 45 to 65 cu. cm of oil per  $\frac{1}{4}$  hour.
- (b) To adjust
  - (i) Remove the housing cover.
  - (ii) Slacken the adjusting ring grub screw and locknut. Turn the ring with a tommy bar until the clutch operating lever can be pushed into full engagement without undue strain.
  - (iii) After adjustment retighten the grub screw and locknut.
  - (iv) **DO NOT OVER-ADJUST THE MECHANISM, THIS MAY CAUSE SERIOUS DAMAGE.**
- (c) To remove
  - (i) Set the operating lever in the disengaged position.
  - (ii) Disconnect the oil pipe.
  - (iii) Remove the nuts holding the clutch housing to the engine gear cover and withdraw the clutch assembly.
  - (iv) Remove the lead seals and screws securing the driving flange and withdraw the flange.
  - (v) Remove the clutch spigot plate from the engine gear cover.
- (d) To dismantle
  - (i) Remove the housing cover.
  - (ii) Remove the pinch bolts from the clutch yoke and withdraw the operating lever and yoke shaft, leaving the yoke in the housing.
  - (iii) Remove the oil seal housing and the adjoining circlip.
  - (iv) Carefully push out the clutch shaft and plate assembly from the driving end.

- (v) Slacken the adjusting ring grub screw and locknut and screw the ring towards the driving end of the shaft until the sliding sleeve can be removed.
- (vi) Remove the sliding sleeve and thrust ring assembly.
- (vii) Take off the adjusting ring and clutch plates.
- (e) To replace
 

Generally reverse the instructions for removal and dismantling, paying particular attention to the following points:

  - (i) The countersunk screws attaching the spigot plate to the engine gear cover should be screwed tight and centre-popped for locking purposes.
  - (ii) The driving flange capscrews should be locked with lead seals.
  - (iii) Clutch plates should be refitted in the same order and position as when dismantled.
  - (iv) The clutch yoke must be replaced with the pinch bolt bosses facing the engine.

## 58. Protection and preservation

- (a) Dust protection
 

In a dust laden atmosphere lubricating oil filters and fuel pump rack covers should be fitted.
- (b) Covers
 

When not in use engines should be protected by a waterproof cover. Under tropical conditions a permanent awning should be provided.
- (c) Storage
 

Before despatch from the factory engines are preserved for storage and should not be disturbed until required for use.
- (d) Intermittent use
 

When not in regular use engines should be run for a thirty minute period each week to lubricate internal parts. External unpainted parts should be wiped with an oil rag and external controls, etc. lubricated.
- (e) Preservation
 

Engines remaining idle for more than a month may corrode and as serious damage may result it is recommended that engines be preserved as follows. (Suitable preserving fluids will be recommended by a local oil distributor but for the purpose of these notes *Shell* products are used as examples.)

  - (i) Drain the sump, flush out with flushing oil and refill with *Shell Ensio* 20. (Paraffin oil may be used if flushing oil is unobtainable but the engine must not be run with paraffin in the sump.) The *Shell Ensio* 20 provides internal protection of the engine.

- (ii) Drain the fuel system and refill with *Shell Fusus A* sufficient to run the engine on light load for five minutes. The *Fusus A* provides protection of the fuel injection equipment.
- (iii) The crankshaft should not be turned after this operation.
- (iv) Air inlet, exhaust manifold, etc. should be sealed against the ingress of moisture.
- (v) Preserved engines require no attention before use other than removing the seals, draining the preserving fluid from the sump and refilling with an approved lubricant. Alternatively, for short periods engines may be run with the preserving fluid in the sump.

## 10. Ersatzteile

Bei Bestellung von Ersatzteilen ist die Motortype und Laufnummer, die Teilnummer und die gewünschte Anzahl anzugeben.

Ersatzteile sind von den Vertretungen der *Hawker Siddeley Brush International Ltd.* zu haben.

Sämtliche *Petter* Ölmotoren sind mit *Bryce Berger* Einspritzgeräten ausgerüstet; es sollten keine anderen verwendet werden.

### WICHTIG

Bei Kauf von Ersatzteilen bzw. bei Aufträgen zu Reparaturen wird Kunden nahegelegt, in ihrem eigenen Interesse stets

#### ORIGINALE PETTER TEILE

vorzuschreiben. Ersatzteile, die nicht von Mitgliedern der *Petter* Organisation geliefert worden sind, sind in bezug auf richtigen Werkstoff, Masse und Ausführung nicht verlässlich. Die Fa. *Petter* lehnt daher jede Verantwortung für irgendwelche Schwierigkeiten ab, die sich aus der Verwendung solcher Teile ergeben, und in solchen Fällen erlischt auch die *Petter* Garantie.

In Ihrem eigenen Interesse verlangen Sie daher stets:

#### ORIGINALE PETTER TEILE



## Parts list

When ordering spares, state the engine type and serial number, the reference number of the part and the quantity required.

Overseas customers can obtain spares from agents of *Hawker Siddeley Brush International Ltd.*

U.K. customers can obtain spares from any one of the depots of *Hawker Siddeley (Hamble) Ltd.*, *Petter Armstrong Service Division*, or from any approved stockist.

All *Petter* oil engines are fitted with *Bryce Berger* fuel injection equipment and no other make should be used.

### IMPORTANT

When purchasing spares or giving instructions for repairs customers should, in their own interest, always specify:

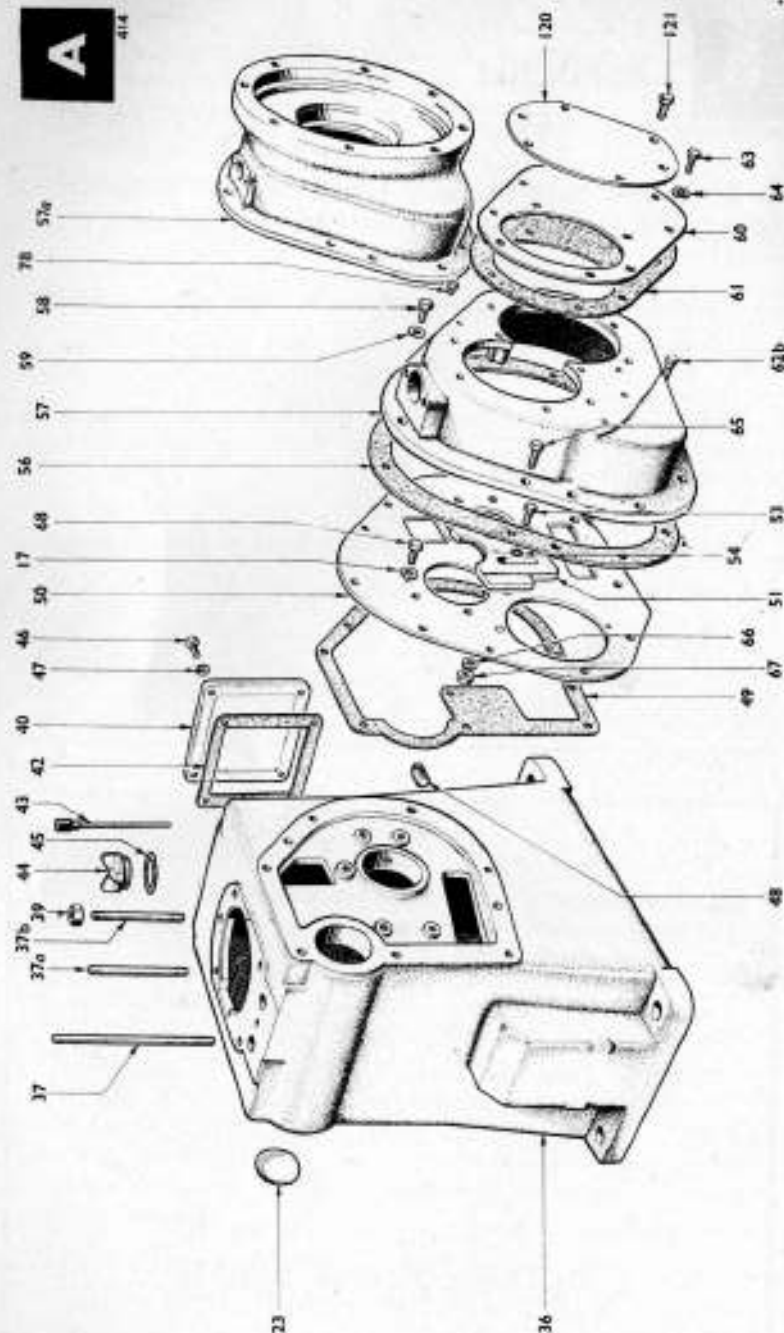
#### Genuine Petter Spares

Replacement parts that have not been supplied by the *Petter* organisation cannot be relied upon for correct material, dimensions or finish. *Petters* cannot, therefore, be responsible for any difficulties arising from the use of such parts and the *Petter* guarantee in such cases is invalidated.

In your own interest, therefore, specify:

#### Genuine Petter Spares



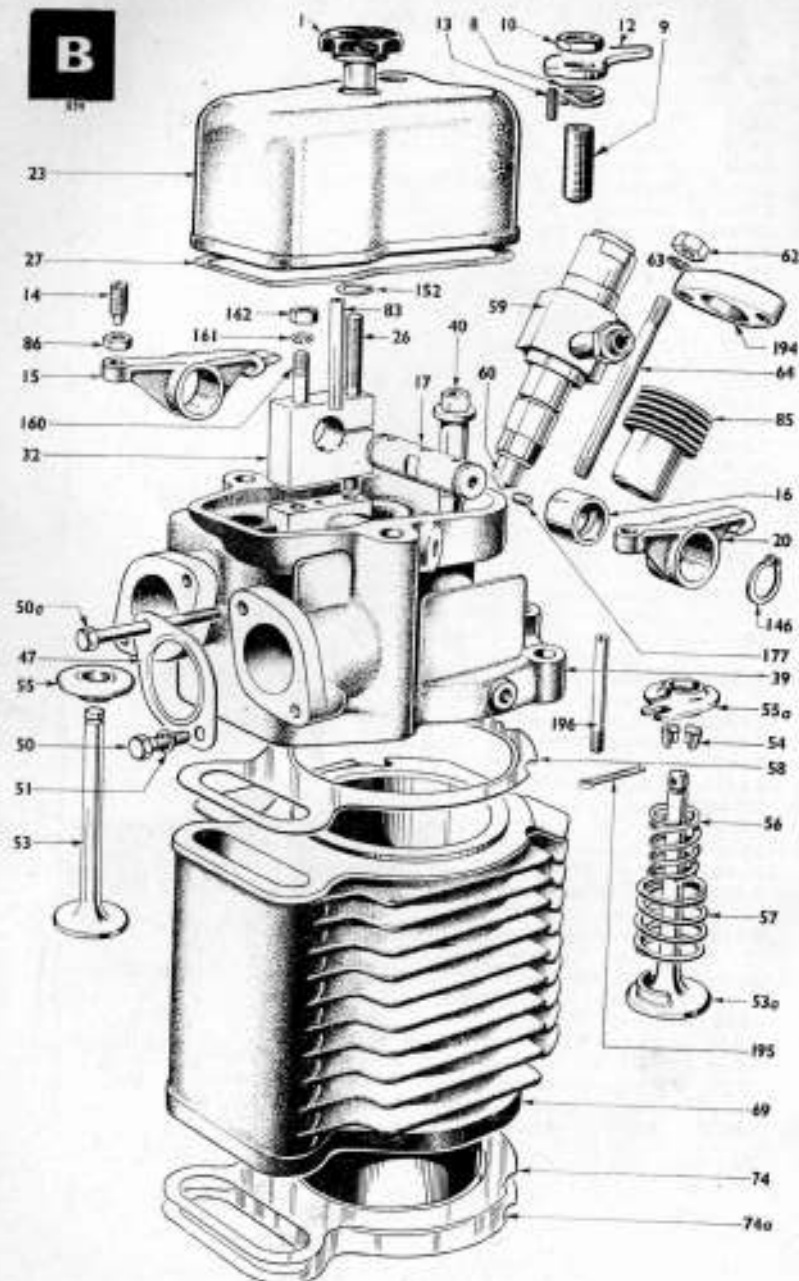


## PLATE A

Ref. No.	Description	PAZI
TA17	Spring Washer—Gear Cover Plate, $\frac{3}{8}$ "	5
TA23	Core Plug	1
PA36	Crankcase	1
ZPA37	Stud—Cylinder Head (Long)	2
ZPA37a	Stud—Cylinder Head (Short)	2
ZPA37b	Stud—Cylinder Head (Rear)	1
TA39	Nut	5
ZPA40	Cover—Crankcase Inspection	1
TA42	Joint—Inspection Cover	1
TA43	Dipstick	1
TA44	Cap—Oil Filler	1
TA45	Joint—Oil Filler Cap	1
TA46	Set screw—Inspection Cover, $\frac{3}{8}$ " B.S.F. x $\frac{3}{4}$ " long	4
TA47	Spring Washer, $\frac{3}{8}$ "	4
TA48	Plug—Crankcase Drain	1
TA49	Joint—Gear Cover Plate	1
PA50	Plate—Gear Cover	1
TA51	Plate—Camshaft Thrust	1
TA53	Set screw—Camshaft Thrust Plate, $\frac{3}{8}$ " B.S.F. x $\frac{1}{2}$ " long	2
TA54	Shakeproof Washer, $\frac{3}{8}$ "	2
TA56	Joint—Gear Cover	1
ZPA57	Cover—Gear	1
ZPA57a	Cover—Gear (Clutch and S.A.E. No. 6 Bellhousing)	1
JA58	Set screw—Gear Cover, $\frac{3}{8}$ " B.S.F. x 1" long	5
JA58	Set screw—Gear Cover, $\frac{3}{8}$ " B.S.F. x 1" long (Variable Speed)	7
*JA58a	Set screw—Gear Cover, $\frac{3}{8}$ " B.S.F. x $1\frac{1}{4}$ " long (Variable Speed)	1
*ZPA58	Set screw—Gear Cover, $\frac{3}{8}$ " B.S.F. x $\frac{1}{2}$ " long	3
TA59	Spring Washer, $\frac{3}{8}$ "	8
PA60	Cover—Gear Cover	1
PA61	Joint—Gear Cover Cover	1
HJA62b	Dowel—Gear Cover	2
*JA62a	Dowel—Gear Cover (S.A.E. No. 6 Bellhousing)	2
JA63	Set screw—Gear Cover Cover, $\frac{3}{8}$ " B.S.F. x $\frac{1}{2}$ " long	4
JA64	Spring Washer, $\frac{3}{8}$ "	4
PA65	Bolt—Gear Cover and Governor Housing, $\frac{3}{8}$ " B.S.F. x $1\frac{1}{2}$ " long	2
PA65	Bolt—Gear Cover and Governor Housing, $\frac{3}{8}$ " B.S.F. x $1\frac{1}{2}$ " long (Variable Speed)	1
*ZPA65	Bolt—Gear Cover and Governor Housing, $\frac{3}{8}$ " B.S.F. x $1\frac{1}{2}$ " long (Variable Speed)	2
JA66	Spring Washer, $\frac{3}{8}$ "	2
TA67	Nut—Gear Cover Plate, $\frac{3}{8}$ " B.S.F.	5
TA68	Set screw—Gear Cover Plate, $\frac{3}{8}$ " B.S.F. x $\frac{3}{4}$ " long	5
JA78	Plug—Gear Cover ( $\frac{3}{8}$ " B.S.F. x $\frac{1}{2}$ " long Set screw)	2
PA120	Plate—Gear Cover Blanking	1
PA121	Set screw—Blanking Plate, $\frac{3}{8}$ " B.S.F. x $\frac{3}{4}$ " long	6

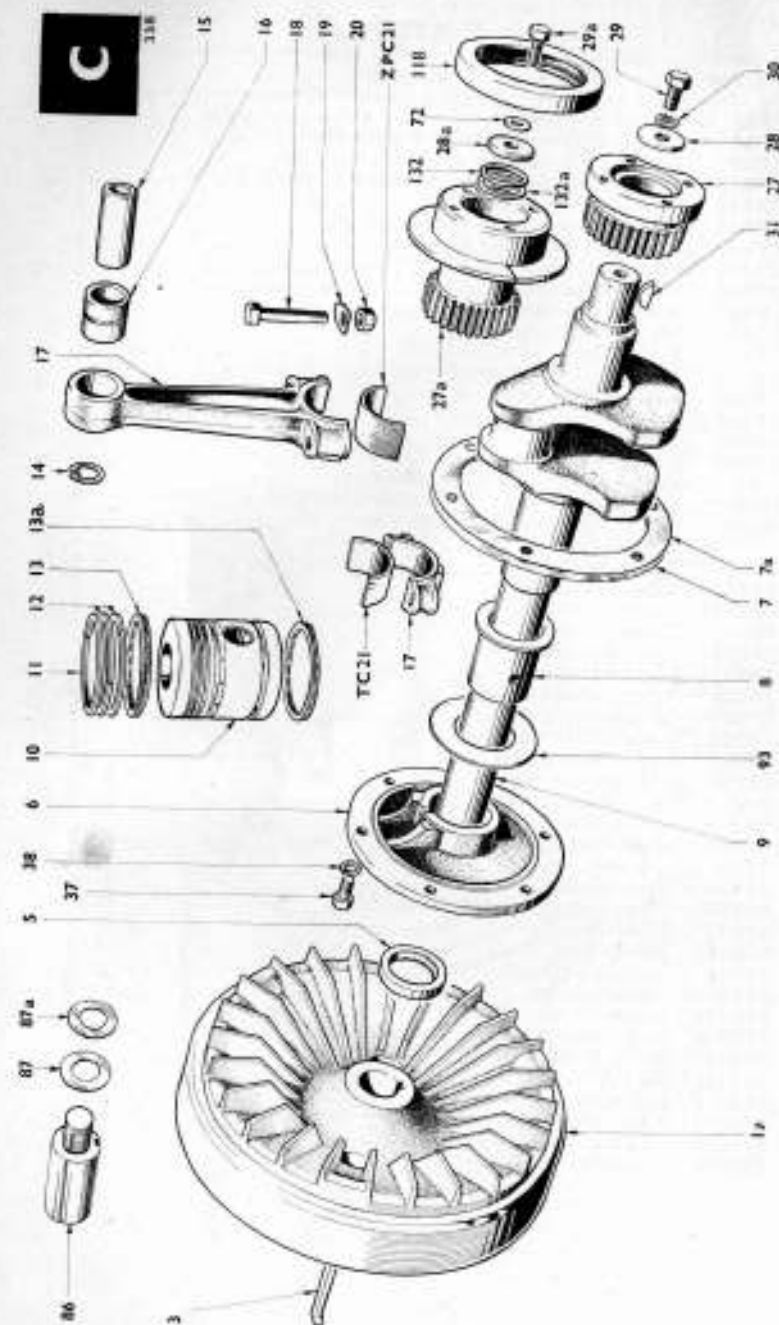
\* Not illustrated

**B**



**PLATE B**

Ref. No.	Description	PAZI
ZPB1	Nut—Rocker Box	1
ZPB8	Thackeray Washer—Decompressor Shaft	1
ZPB9	Screw—Decompressor Adjusting	1
ZPB10	Locknut—Decompressor Adjusting Screw, $\frac{1}{8}$ " B.S.W.	1
ZPB12	Lever—Decompressor	1
ZPB13	Cotter Pin—Decompressor Lever, $\frac{1}{4}$ "	1
ZPB14	Screw—Valve Rocker Adjusting	2
ZPB15	Rocker—Exhaust Valve	1
ZPB16	Bush—Valve Rocker	2
ZPB17	Shaft—Valve Rocker	1
ZPB20	Rocker—Inlet Valve	1
ZPB23	Rocker Box	1
ZPB26	Stud—Rocker Box and Rocker Shaft Support	1
ZPB27	Joint—Rocker Box	1
ZPB32	Support—Rocker Shaft	1
ZPB39	Cylinder Head	1
ZPB40	Guide—Valve	2
JB47	Gasket—Exhaust and Inlet Manifolds	2
JB50	Bolt—Exhaust and Inlet Manifolds, $\frac{1}{8}$ " B.S.F. x $\frac{3}{4}$ " long	4
JB50a	Bolt—Inlet Manifold (Extra Heavy Duty Air Cleaner) $\frac{1}{8}$ " B.S.F. x $2\frac{1}{2}$ " long	1
JB51	Spring Washer, $\frac{1}{8}$ "	4
ZPB53	Valve—Exhaust	1
ZPB53a	Valve—Inlet	1
TB54	Collet—Valve	2 prs.
ZPB55	Cup—Exhaust Valve	1
ZPB55a	Cup—Inlet Valve	1
ZPB56	Spring—Valve (Inner)	2
ZPB57	Spring—Valve (Outer)	2
ZPB58	Gasket—Cylinder Head	1
ZPB59	Injector—Fuel (less Nozzle)	1
ZPB60	Nozzle—Fuel Injector	1
JB62	Nut—Fuel Injector, $\frac{1}{8}$ "	2
JB63	Spring Washer, $\frac{3}{8}$ "	2
ZPB64	Stud—Fuel Injector, $\frac{1}{8}$ " B.S.F. x 4" long	2
ZPB69	Cylinder	1
ZPB74	Joint—Cylinder (0.015" thick)	As reqd.
ZPB74a	Joint—Cylinder (0.005" thick)	As reqd.
ZPB83	Tube—Breather	1
AJB85	Sleeve—Fuel Injector	1
ZPB86	Locknut—Valve Rocker Adjusting Screw	2
ZPB146	Circlip—Rocker Shaft	2
ZPB152	Circlip—Rocker Box Nut	1
ZPB160	Stud—Rocker Shaft Support, $\frac{1}{8}$ " B.S.F. x $2\frac{1}{2}$ " long	1
ZPB161	Spring Washer, $\frac{1}{8}$ "	2
ZPB162	Nut, $\frac{1}{8}$ " B.S.F.	2
ZPB177	Grubscrew—Rocker Shaft	1
ZPB194	Flange—Fuel Injector Locating	1
ZPB195	Split Pin—Inlet Valve Cup, $\frac{1}{8}$ " x $1\frac{1}{4}$ " long	1
ZPB196	Pin—Inlet Valve Locating	1

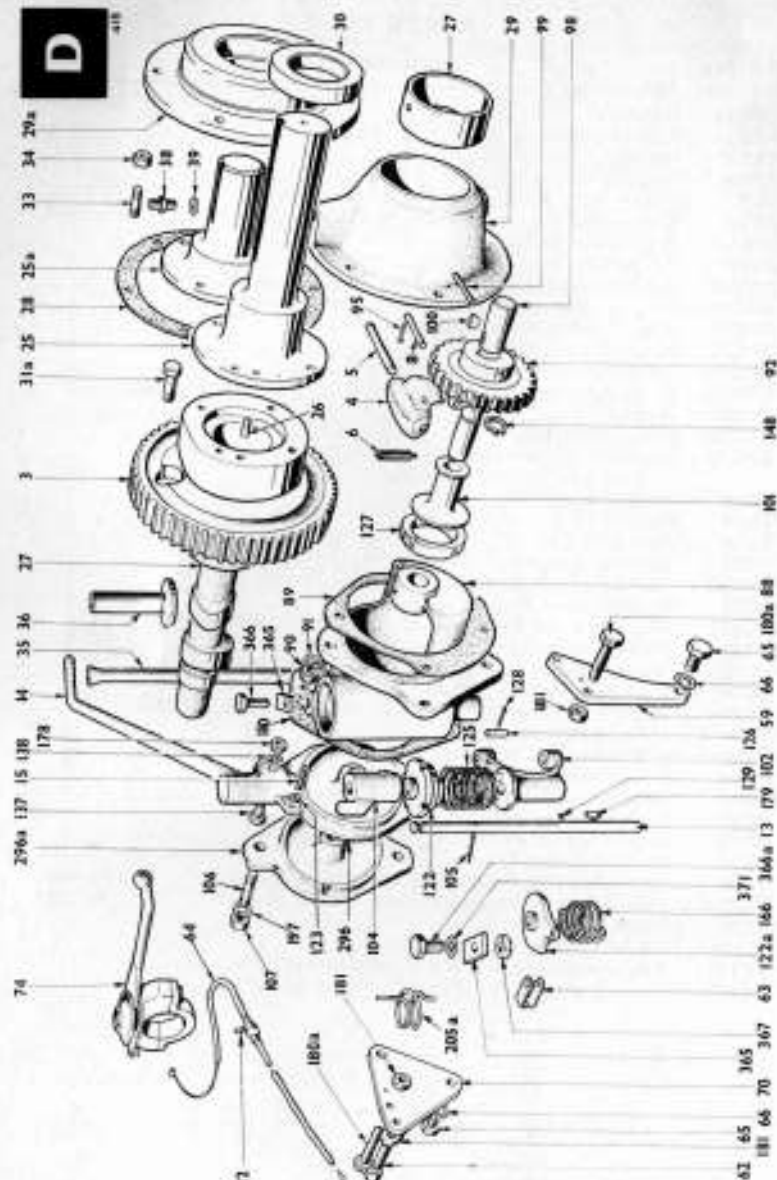


# PLATE C

Ref. No.	Description	PAZI
ZPC1a	Flywheel	1
PC3	Key—Flywheel, $\frac{3}{8}$ " x $\frac{1}{2}$ " x $2\frac{1}{4}$ " long	1
TC5	Oil Seal	1
ZPC6	Housing—Main Bearing	1
TC7	Shim—Main Bearing Housing (0-008" thick)	As reqd.
TC7a	Shim—Main Bearing Housing (0-015" thick)	As reqd.
PC8	Bearing—Main	2
ZPC9	Crankshaft	1
ZPC10	Pistol Assembly, complete with Rings, Pin and Circlip	1
ZPC11	Ring—Compression (Chromium Plated)	1
ZPC12	Ring—Compression (Plain)	2
ZPC13	Ring—Scraper (Slotted)	1
ZPC13a	Ring—Scraper (Chromium Plated)	1
ZPC14	Circlip—Gudgeon Pin	2
ZPC15	Gudgeon Pin	1
ZPC16	Bush—Small End	1
ZPC17	Connecting Rod Assembly, complete with Small End Bush, Large End Bearing and Bolts	1
TC18	Bolt—Large End	2
TC19	Tabwasher	2
TC20	Nut, $\frac{3}{8}$ " B.S.F.	2
TC21	Bearing—Large End (Bottom)	1
ZPC21	Bearing—Large End (Top)	1
PC27	Gearwheel—Crankshaft	1
PC27a	Gearwheel and Oil Thrower (S.A.E. No. 6 Bellhousing)	1
TC28	Plate—Gearwheel Retaining	1
PC28a	Plate—Gearwheel Retaining (S.A.E. No. 6 Bellhousing)	1
TC29	Setscrew—Retaining Plate, $\frac{1}{8}$ " B.S.F. x $\frac{1}{2}$ " long	1
PC29a	Setscrew—Retaining Plate, $\frac{1}{8}$ " B.S.F. x $\frac{1}{2}$ " long (S.A.E. No. 6 Bellhousing)	1
TC30	Spring Washer, $\frac{1}{8}$ "	1
TC31	Key—Crankshaft Gearwheel (Woodruff)	1
TC37	Setscrew—Main Bearing Housing, $\frac{1}{8}$ " B.S.F. x $\frac{1}{2}$ " long	6
PC38	Spring Washer, $\frac{1}{8}$ "	6
PC72	Joint Washer, $\frac{1}{8}$ " (S.A.E. No. 6 Bellhousing)	1
PC86	Shaft—Starting Extension	1
TC87	Shim—Starting Extension Shaft (0-010" thick)	As reqd.
TC87a	Shim—Starting Extension Shaft (0-030" thick)	As reqd.
TC93	Ring—Oil Retaining	1
JCI18	Oil Seal (S.A.E. No. 6 Bellhousing)	1
PCI32	Ring—Sealing (S.A.E. No. 6 Bellhousing)	1
PCI32a	Ring—Sealing (S.A.E. No. 6 Bellhousing)	1



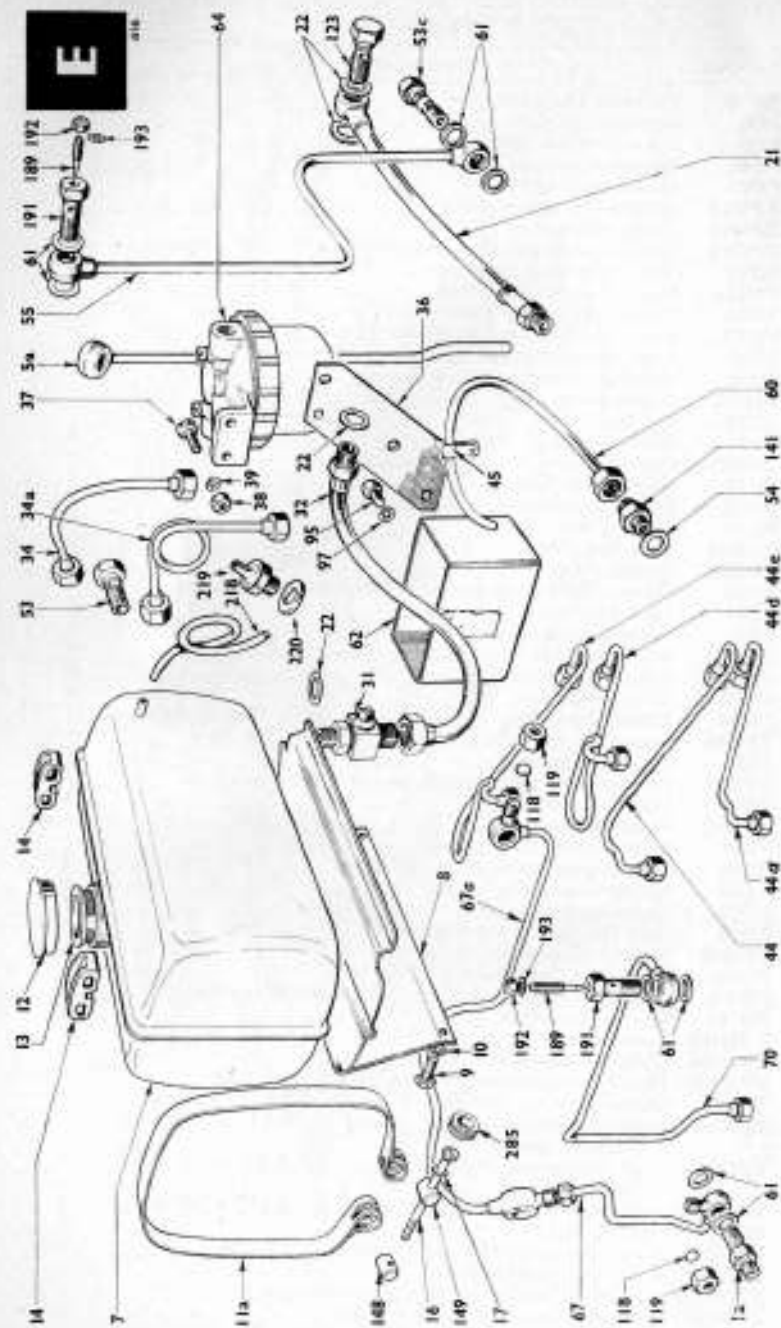
**D**



**PLATE D**

Ref. No.	Description	PAZI
ZPD3	Camshaft and Gearwheel	1
PD4	Governor Weight	2
PD5	Pin—Governor Spring	2
PD6	Spring—Governor (1301 to 1800 rev/min)	2
PD8	Pin—Governor Weight	2
ZPD13	Spindle—Governor Yoke	1
ZPD14	Lever—Governor	1
ZPD15	Screw—Governor Lever Adjusting	1
JD25	Shaft—Camshaft Extension	1
PD25a	Shaft—Starting Extension	1
TD26	Dowel—Extension Shaft	1
PD27	Bush—Camshaft and Extension Shaft Bearing	2
JD28	Joint—Extension and Starting Shaft Housing	1
JD29	Housing—Extension Shaft Bearing	1
PD29a	Housing—Starting Extension Shaft	1
JD30	Oil Seal	1
*JD31	Bolt—Extension Shaft (Mk II)	4
ZPD31a	Bolt—Extension Shaft (Mks I and V)	4
*JD32	Wire—Bolt Locking	1
PD33	Stud—Extension Shaft Bearing Housing	6
PD34	Nut, $\frac{3}{8}$ " B.S.F.	6
ZPD35	Push Rod—Valve	2
ZPD36	Tappet—Valve	2
JD38	Union—Oil Pipe to Extension Shaft Bearing Housing	1
JD39	Joint Washer, $\frac{1}{2}$ "	1
JD42	Nipple—Cable (Variable Speed)	1
ZPD59	Bracket—Idling Stop (Variable Speed)	1
PD62	Adjuster—Cable	1
PD63	Shackle—Cable	1
TD64	Cable—Operating (Variable Speed) (To length required)	1
ZPD65	Setscrew—Idling Stop Bracket, $\frac{3}{8}$ " B.S.F. x $\frac{1}{2}$ " long	1
JD66	Spring Washer, $\frac{3}{8}$ "	1
ZPD70	Bracket—Maximum Speed Stop (Variable Speed)	1
TD74	Lever—Cable Control	1
ZPD88	Housing—Governor	1
PD89	Joint—Governor Housing	1
TD90	Nut—Governor Housing, $\frac{3}{8}$ " B.S.F.	1
TD91	Spring Washer, $\frac{3}{8}$ "	1
PD92	Gearwheel—Governor	1
PD95	Split Pin—Governor Weight Pin, $\frac{1}{8}$ " x $\frac{1}{2}$ " long	4
ZPD98	Spindle—Governor	1
PD99	Mills Pin—Gearwheel, $\frac{1}{8}$ " x $1\frac{1}{4}$ " long	1
PD100	Key—Governor Sleeve and Gearwheel (Woodruff)	2
PD101	Sleeve—Governor	1
ZPD102	Yoke—Governor	1
ZPD104	Collar—Governor Yoke	1
ZPD105	Mills Pin—Governor Yoke Spindle, $\frac{1}{8}$ " x $\frac{1}{2}$ " long	1
TD106	Stud—Governor Housing Cover, $\frac{3}{8}$ " B.S.F. x $1\frac{1}{2}$ " long	1
TD106	Stud—Governor Housing Cover, $\frac{3}{8}$ " B.S.F. x $1\frac{1}{2}$ " long (Variable Speed)	1
*ZPD106a	Stud—Governor Housing Cover, $\frac{3}{8}$ " B.S.F. x $1\frac{1}{2}$ " long (Variable Speed)	1
*ZPD106b	Stud—Governor Housing Cover, $\frac{3}{8}$ " B.S.F. x $1\frac{1}{2}$ " long	1
PD107	Nut, $\frac{3}{8}$ " B.S.F.	2
PD110	Joint—Governor Housing Cover	1
ZPD122	Adjuster—Speeder Spring	1
ZPD122a	Adjuster—Speeder Spring (Variable Speed)	1
ZPD123	Locknut—Governor Lever Adjuster	1
ZPD125	Spring—Speeder (1300 to 1800 rev/min)	1
ZPD125a	Spring—Speeder (1000 to 1299 rev/min)	1

\* Not illustrated



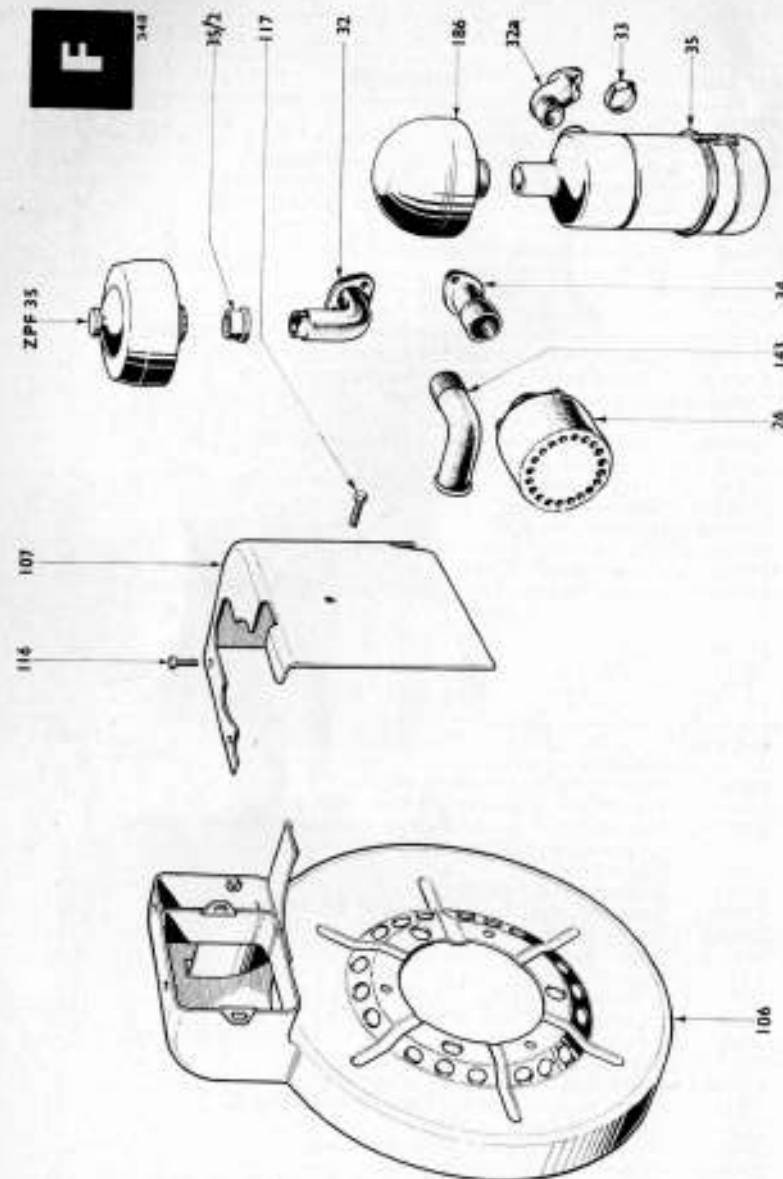
Ref. No.	Description	PAZI
PD126	Pin—Governor Thrust Sleeve	2
ZPD127	Sleeve—Governor Thrust	1
PD128	Split Pin—Thrust Sleeve Pin, $\frac{3}{8}$ " x $\frac{7}{8}$ " long	2
ZPD129	Grubscrew—Yoke, 2 B.A. x $\frac{1}{2}$ " long	1
ZPD137	Bolt—Governor Lever, $\frac{1}{2}$ " B.S.F. x $1\frac{1}{2}$ " long	1
ZPD138	Spring Washer, $\frac{1}{2}$ "	1
PD148	Circlip—Governor Spindle	1
ZPD166	Spring—Variable Speed	1
ZPD178	Nut—Governor Lever Bolt, $\frac{1}{2}$ " B.S.F.	1
PD179	Key—Yoke (Woodruff)	1
ZPD180a	Setcrew—Maximum Speed Stop Bracket (Variable Speed)	2
ZPD181	Locknut—Adjuster and Speed Stops, $\frac{3}{8}$ " B.S.F.	3
ZPD197	Spring Washer—Governor Housing Cover, $\frac{3}{8}$ "	2
ZPD205a	Spring—Fuel Pump Rack Lever	1
ZPD296	Cover—Governor Housing	1
ZPD296a	Cover—Governor Housing (Variable Speed)	1
*JD297	Seal—Maximum Speed Stop	1
*JD298	Wire—Maximum Speed Stop Setcrew Locking	1
ZPD365	Clamp—Governor	1
ZPD366	Setcrew—Clamp	1
ZPD366a	Setcrew—Clamp (Variable Speed)	1
ZPD367	Collar (Variable Speed)	1
ZPD371	Spring Washer—Clamp Setcrew, $\frac{1}{8}$ " (Variable Speed)	1

## PLATE E

Ref. No.	Description	PAZI
PE1a	Banjo Bolt—Main Bearing (Flywheel end)	1
*JE4	Joint Washer—Clutch Oil Restrictor, $\frac{3}{8}$ "	1
ZPE5a	Pipe—Injector Leak-off (For use with engine having separately mounted Fuel Tank)	1
HE7	Tank—Fuel	1
ZPE8	Bracket—Fuel Tank	1
ZPE9	Setcrew—Fuel Tank Bracket, $\frac{1}{2}$ " B.S.F. x $\frac{3}{4}$ " long	2
ZPE10	Spring Washer, $\frac{1}{2}$ "	2
HE11a	Strap—Fuel Tank	2
TE12	Cap—Fuel Tank	1
JE13	Strainer—Fuel Tank	1
JE14	Packing—Fuel Tank Strap	2
PE16	Screw—Tank Strap	2
PE17	Washer, $\frac{1}{2}$ "	2
CJE21	Pipe—Fuel (Flexible) (Filter to Pump)	1
TE22	Joint Washer—Flexible Fuel Pipes and Tap, $\frac{1}{2}$ "	5
JE31	Tap—Fuel Tank	1
JE32	Pipe—Fuel (Flexible) (Tank to Filter)	1
ZPE34	Pipe—Fuel (Pump to Injector)	1
ZPE34a	Pipe—Fuel (Pump to Injector) (1000 to 1150 rev/min)	1
ZPE36	Bracket—Fuel Filter	1
JE37	Bolt—Fuel Filter Bracket, 2 B.A. x $\frac{3}{8}$ " long	2
JE38	Nut, 2 B.A.	2
JE39	Spring Washer, 2 B.A.	2
PE44	Pipe—Oil (Gear End Bearing to Extension Shaft Bearing Mk. V)	1

\* Not illustrated

**F**



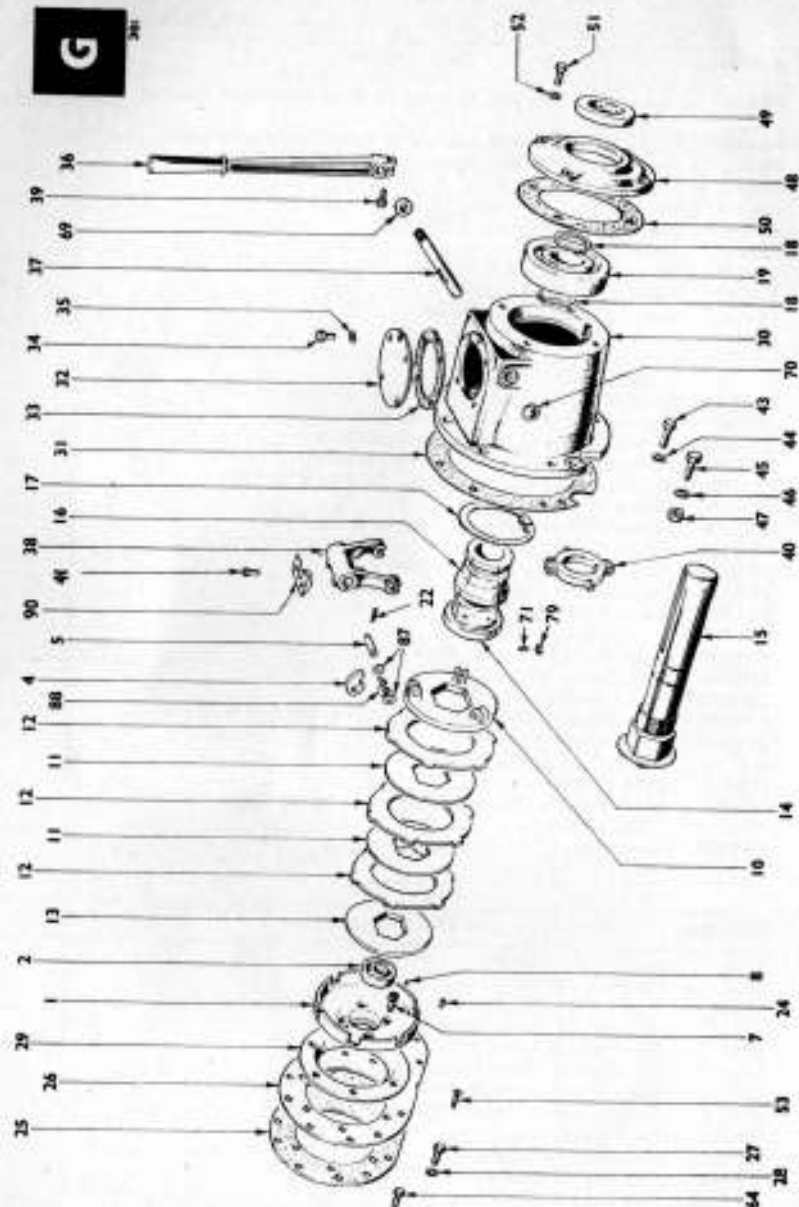
Ref. No.	Description	PAZI
PE44a	Pipe—Oil (Gear End Bearing to Extension Shaft Bearing Mk. II) ...	1
PE44d	Pipe—Oil (Gear End Bearing to Speed Increasing Gear) ...	1
PE44e	Pipe—Oil (Gear End Bearing to Clutch Mk. IV) ...	1
JE45	Clip—Oil Pipe ...	1
JE53	Banjo Bolt—Oil Pipe, $\frac{1}{8}$ " B.S.P. ...	1
ZPE53c	Banjo Bolt—Oil Pipe, $\frac{1}{8}$ " B.S.P. ...	1
JE54	Joint Washer, $\frac{3}{8}$ " ...	3
ZPE55	Pipe—Oil (Gear End Main Bearing to Rockers) ...	1
ZPE60	Pipe—Fuel Pump Drain ...	1
JE61	Joint Washer—Pipe Banjos, $\frac{3}{8}$ " ...	1
JE62	Container ...	1
*ZPE62a	Container (For use with engine having separately mounted Fuel Tank) ...	1
JE64	Filter—Fuel (For details see separate list) ...	1
ZPE67	Pipe—Oil (Pump to Flywheel end) ...	1
ZPE67a	Pipe—Oil (Flywheel end to Gear end) ...	1
ZPE70	Pipe—Oil (Pump to Governor Housing) ...	1
ZPE95	Setcrew—Filter Bracket, $\frac{1}{8}$ " B.S.F. x $\frac{1}{2}$ " long ...	2
VPE97	Spring Washer, $\frac{1}{2}$ " ...	2
MJE118	Seal—Oil Pipe, PE67, and Banjo Bolts, PE1a ...	2
MJE119	Union Nut—Seal ...	2
CPE123	Banjo Bolt—Fuel Filter, $\frac{1}{4}$ " B.S.P. ...	1
VPE141	Union—Fuel Pump Drain ...	1
PE148	Boss—Fuel Tank Strap ...	2
PE149	Boss—Fuel Tank Strap ...	2
ZPE189	Restrictor (Governor, Rocker and Clutch) ...	3
ZPE191	Banjo Bolt—Restrictor ...	3
ZPE192	Locknut—Restrictor ...	3
ZPE193	Joint Washer—Restrictor, $\frac{1}{4}$ " (Governor and Rocker) ...	2
ZPE218	Pipe—Injector Leak-off ...	1
HE219	Connector—Injector Leak-off ...	1
HE220	Joint Washer ...	1
*HE221	Banjo Bolt (For use with engine having separately mounted Fuel Tank) ...	1
ZPE285	Grommet ...	2

**PLATE F**

Ref. No.	Description	PAZI
JF26	Silencer—Exhaust ...	1
JF32	Manifold—Inlet ...	1
JF32a	Manifold—Inlet (Extra Heavy Duty Air Cleaner) ...	1
JF33	Clip (Extra Heavy Duty Air Cleaner) ...	1
JF34	Manifold—Exhaust ...	1
JF35	Air Cleaner (Extra Heavy Duty) ...	1
JF35/2	Seal—Air Cleaner (Extra Heavy Duty) ...	1
*JF35/6	Element—Air Cleaner (Extra Heavy Duty) ...	1
ZPF35	Air Cleaner ...	1
*ZPF35/6	Element—Air Cleaner ...	1
ZPF106	Cowling—Fan ...	1
ZPF107	Cowling—Cylinder ...	1
PF111	Spring Washer—Cowling and Fuel Tank Bracket $\frac{1}{2}$ " ...	4
PF116	Setcrew—Cowling and Fuel Tank Brackets $\frac{1}{4}$ " B.S.F. x $\frac{1}{2}$ " long ...	5
ZPF117	Setcrew—Cylinder Cowling, $\frac{1}{4}$ " B.S.F. x $1\frac{1}{2}$ " long ...	1
JF143	Elbow—Exhaust (Extra Heavy Duty Air Cleaner) ...	1
JF186	Pre-Cleaner (Extra Heavy Duty Air Cleaner) ...	1

\* Not illustrated





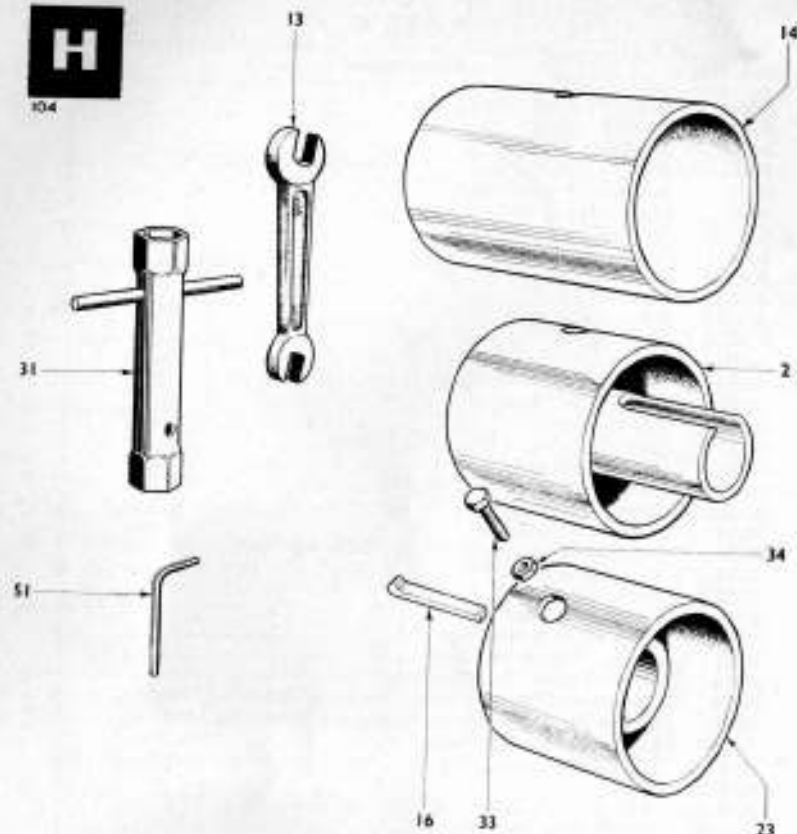
## PLATE G

Ref. No.	Description	PAZI
AJG1	Flange—Clutch Driving	1
AJG2	Bearing—Roller	1
AJG4	Toggle	3
JG5	Pin—Toggle	3
JG7	Screw—Driving Flange, $\frac{1}{8}$ " B.S.F. x $\frac{1}{2}$ " long	4
JG8	Seal—Driving Flange Screw	4
AJG10	Plate—Outer	1
AJG11	Plate—Driven	2
AJG12	Plate—Driving	3
AJG13	Plate—Inner	1
AJG14	Ring—Adjusting	1
AJG15	Shaft—Clutch	1
AJG16	Sleeve—Sliding	1
AJG17	Circlip—Clutch Housing	1
JG18	Circlip—Ball Bearing	2
AJG19	Bearing—Ball	1
JG22	Split Pin—Toggle Pin, $\frac{1}{8}$ " x $\frac{1}{2}$ " long	6
JG24	Dowel—Driving Flange	1
JG25	Joint—Adaptor Plate (Mk. IV)	1
JG25a	Joint—Adaptor Plate (Mk. III)	1
JG26	Plate—Adaptor	1
JG27	Set screw—Adaptor Plate, $\frac{1}{8}$ " B.S.F. x $\frac{3}{8}$ " long	4
JG28	Spring Washer, $\frac{1}{8}$ "	4
JG29	Plate—Spigot	1
AJG30	Housing—Clutch	1
JG31	Joint—Clutch Housing	1
JG32	Cover—Clutch Housing	1
JG33	Joint—Clutch Housing Cover	1
JG34	Set screw—Clutch Housing Cover, $\frac{1}{8}$ " B.S.F. x $\frac{1}{2}$ " long	4
JG35	Spring Washer—Housing Cover and Operating Lever, $\frac{1}{8}$ "	5
AJG36	Lever—Clutch Operating	1
AJG37	Shaft—Yoke	1
AJG38	Yoke	1
AJG39	Bolt—Clutch Operating Lever, $\frac{1}{8}$ " B.S.F. x $1\frac{1}{2}$ " long	1
AJG40	Thrust Ring Assembly	1
JG41	Bolt—Yoke, $\frac{1}{8}$ " B.S.F. x $1\frac{1}{2}$ " long	2
JG43	Bolt—Clutch Housing, $\frac{1}{8}$ " B.S.F. x $1\frac{1}{2}$ " long (Mk. IV)	3
JG43	Bolt—Clutch Housing, $\frac{1}{8}$ " B.S.F. x $1\frac{1}{2}$ " long (Mk. III)	8
JG44	Spring Washer, $\frac{1}{8}$ " (Mk. IV)	3
JG44	Spring Washer, $\frac{1}{8}$ " (Mk. III)	8
JG45	Bolt—Clutch Housing, $\frac{1}{8}$ " B.S.F. x $\frac{3}{4}$ " long (Mk. IV)	5
JG46	Spring Washer, $\frac{1}{8}$ " (Mk. IV)	5
JG44	Nut, $\frac{1}{8}$ " B.S.F. (Mk. IV)	5
AJG48	Housing—Oil Seal	1
AJG49	Oil Seal—Clutch Shaft	1
AJG50	Joint—Oil Seal Housing	1
AJG51	Bolt—Oil Seal Housing, $\frac{3}{8}$ " B.S.F. x $1\frac{1}{4}$ " long	5
JG52	Spring Washer, $\frac{1}{8}$ "	5
JG53	Screw—Spigot Plate, $\frac{1}{8}$ " B.S.F. x $\frac{3}{8}$ " long	4
JG64	Plug—Gear Cover ( $\frac{1}{8}$ " B.S.F. x $\frac{1}{2}$ " long Setscrew) (Mk. IV)	5
AJG69	Oil Seal—Yoke Shaft	1
AJG70	Core Plug	1
JG71	Grubscrew	1
JG79	Nut, $\frac{1}{8}$ " B.S.F.	1
AJG86	Key—Yoke Shaft (Woodruff)	1
JG87	Washer—Toggle Pin	6
JG88	Spring—Toggle	3
AJG90	Tabwasher—Yoke Bolt	1

\*Not illustrated

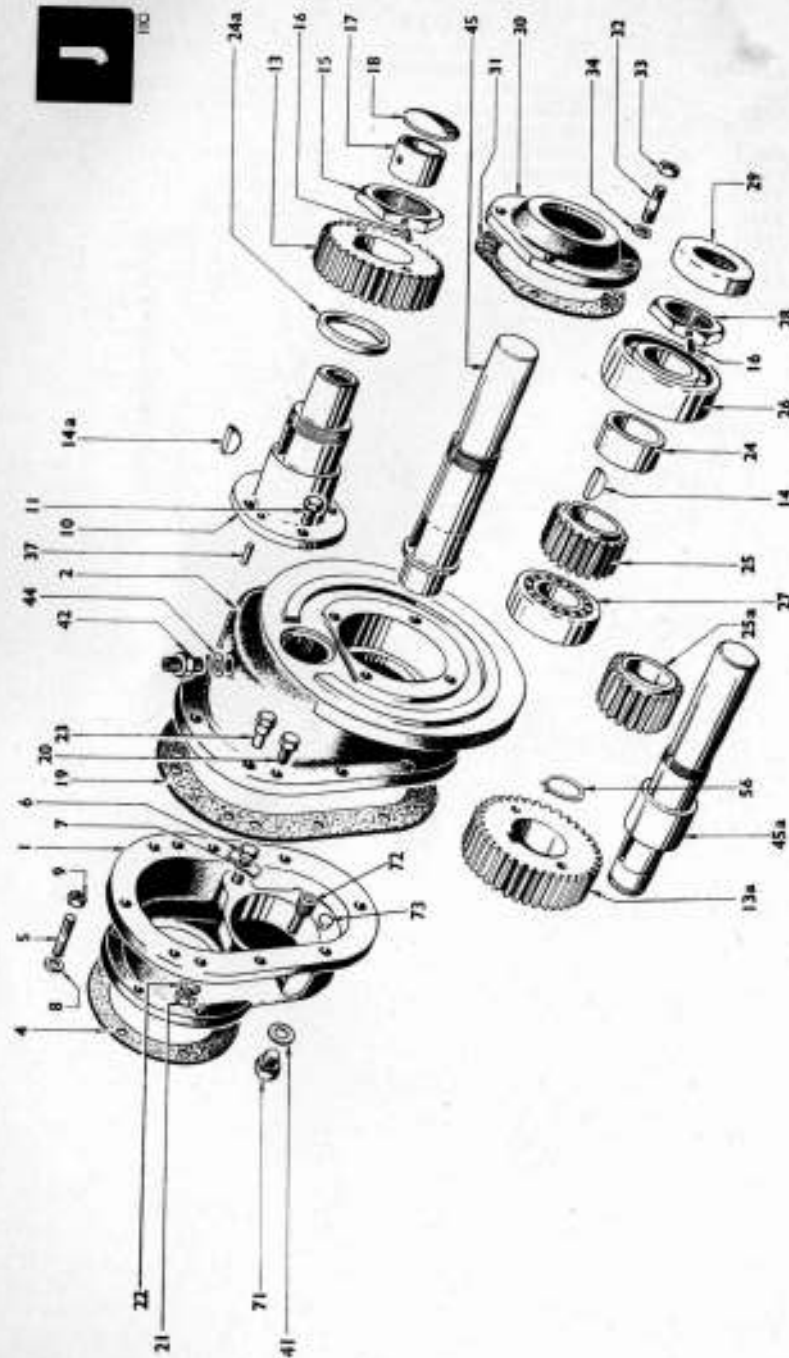


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# PLATE H

Ref. No.	Description	PAZI
PH2	Pulley—5" diameter x $4\frac{1}{2}$ " face (Mk. V and Drive and Start at Flywheel End) ... ..	1
JH13	Spanner—Open Ended, $\frac{7}{8}$ " x $\frac{1}{4}$ " ... ..	1
PH14	Pulley—5" diameter x 7" face ... ..	1
TH16	Key—Pulley, $\frac{3}{8}$ " x $\frac{1}{4}$ " x $2\frac{1}{2}$ " ... ..	1
TH23	Pulley—5" diameter x $4\frac{1}{2}$ " face (Mks. I, II, III and IV) ... ..	1
JH31	Spanner—Box, $\frac{1}{2}$ " x $\frac{3}{4}$ " (With Tommy Bar) ... ..	1
TH33	Setcrew—Pulley, $\frac{1}{8}$ " B.S.F. x $\frac{1}{4}$ " long ... ..	1
TH34	Locknut, $\frac{3}{8}$ " B.S.F. ... ..	1
JH51	Wrench—Allen Screw ... ..	1

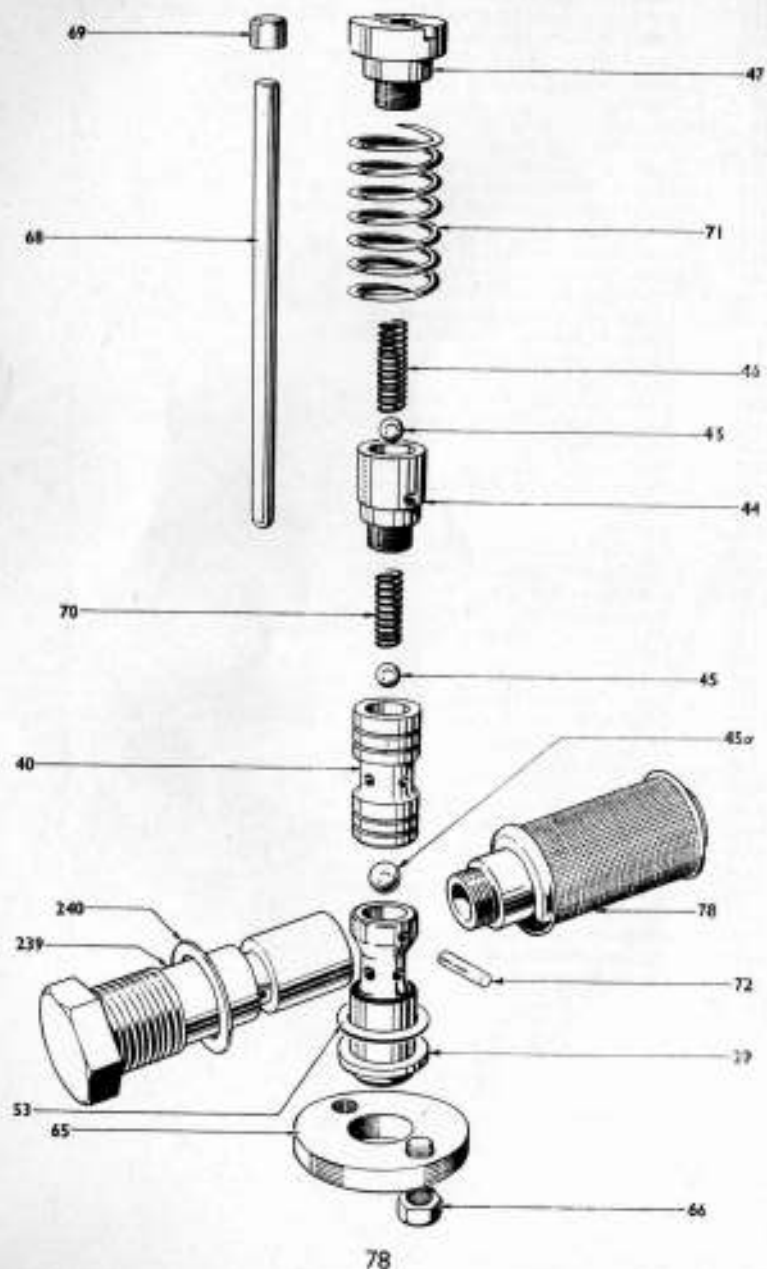


Ref. No.	Description	PAZI
JJ1	Housing—Speed Increasing Gear (Engine half) ...	1
JJ2	Housing — Speed Increasing Gear (Power take-off half)	1
JJ4	Joint—Housing (Engine half) ...	1
JJ5	Stud—Housing (Engine half), $\frac{1}{8}$ " B.S.F. x $1\frac{1}{2}$ " long	4
JJ6	Bolt—Housing (Engine half), $\frac{1}{8}$ " B.S.F. x $2\frac{1}{2}$ " long	1
JJ7	Tabwasher ...	1
JJ8	Washer—Housing Stud, $\frac{1}{8}$ " ...	4
JJ9	Nut—Housing Stud, $\frac{1}{8}$ " B.S.F. ...	4
JJ10	Shaft—Crankshaft Extension ...	1
JJ11	Setscrew—Extension Shaft ...	4
JJ12	Wire—Extension Shaft Setscrew Locking ...	1
JJ13	Gearwheel—Driving (1-61:1 Ratio) ...	1
JJ13a	Gearwheel—Driving (1-86:1 Ratio) ...	1
JJ14	Key—Gearwheel (Woodruff) ...	1
PJ14a	Key—Gearwheel (Woodruff) ...	1
JJ15	Locknut—Driving Gearwheel ...	1
JJ16	Screw—Locking (For JJ15 and JJ28)	2
JJ17	Bush—Extension Shaft ...	1
JJ18	Core Plug ...	1
JJ19	Joint—Housing (Power take-off half) ...	1
JJ20	Bolt—Housing (Power take-off half), $\frac{1}{8}$ " B.S.F. x $1\frac{1}{2}$ " long	8
JJ21	Nut, $\frac{1}{8}$ " B.S.F. ...	8
JJ22	Washer, $\frac{1}{8}$ " ...	8
JJ23	Dowel—Housing (Power take-off half) ...	4
JJ24	Collar ...	1
JJ24a	Collar ...	1
JJ25	Gearwheel—Driven (1-61:1 Ratio) ...	1
JJ25a	Gearwheel—Driven (1-86:1 Ratio) ...	1
JJ26	Bearing — Ball ...	1
JJ27	Bearing—Roller ...	1
JJ28	Locknut—Ball Bearing ...	1
JJ29	Oil Seal ...	1
JJ30	Housing—Oil Seal ...	1
JJ31	Joint—Oil Seal Housing ...	1
JJ32	Stud—Oil Seal Housing, $\frac{1}{8}$ " B.S.F. x $1\frac{1}{2}$ " long	4
JJ33	Nut, $\frac{1}{8}$ " B.S.F. ...	4
JJ34	Washer, $\frac{1}{8}$ " ...	4
JJ37	Dowel—Extension Shaft ...	1
PJ41	Joint Washer—Housing Plug, $\frac{1}{4}$ " ...	1
PJ42	Union—Housing (Power take-off half), $\frac{1}{4}$ " B.S.P. ...	1
JJ44	Joint Washer—Union, $\frac{1}{4}$ " ...	1
JJ45	Shaft—Power Take-off (1-61:1 Ratio) ...	1
JJ45a	Shaft—Power Take-off (1-86:1 Ratio) ...	1
JJ56	Circlip (1-86:1 Ratio) ...	1
PJ71	Plug—Housing (Engine half) ...	1
JJ72	Screw—Housing (Engine half) ...	1
JJ73	Seal—Housing Screw ...	1



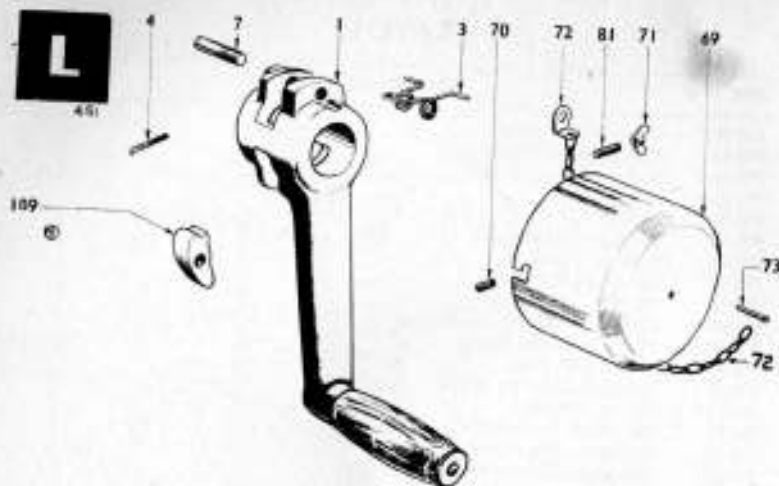


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# PLATE K

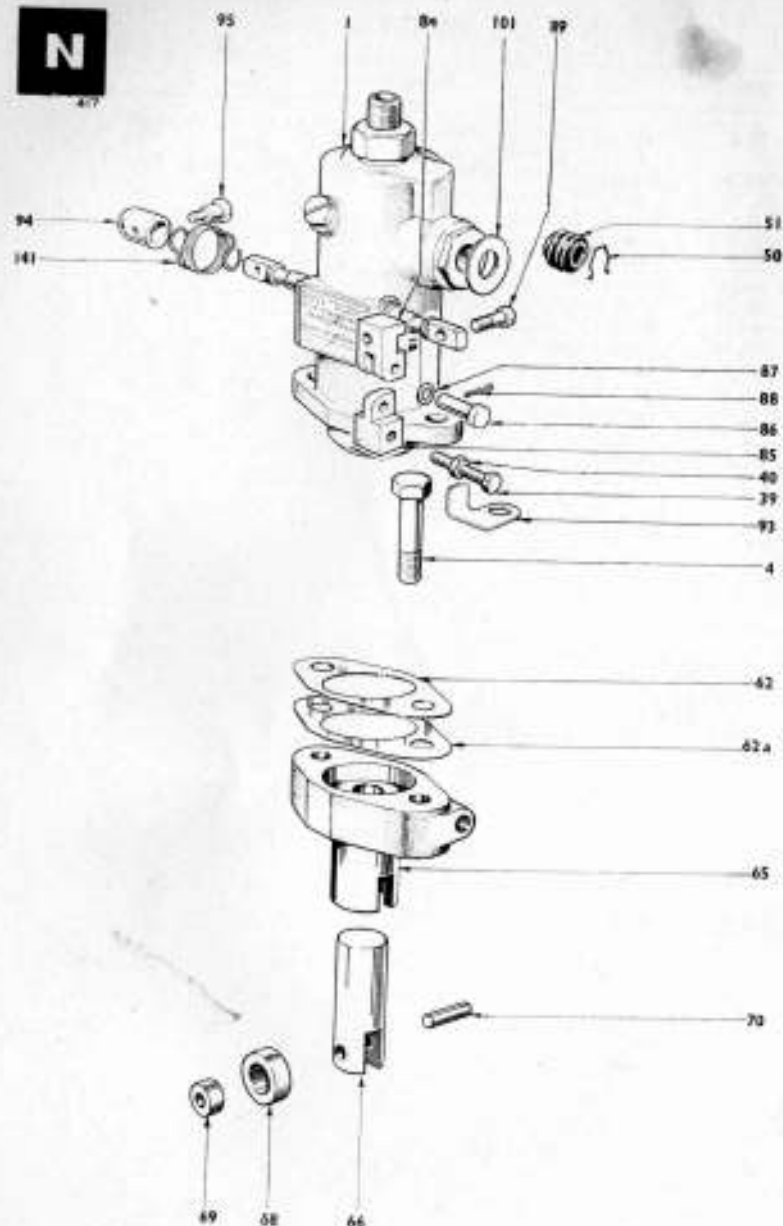
Ref. No.	Description	PAZI
PK39	Body—Oil Pump	1
PK40	Plunger—Oil Pump	1
PK44	Body—Relief Valve	1
PK45	Ball, $\frac{1}{8}$ "	2
PK45a	Ball, $\frac{1}{8}$ "	1
PK46	Spring—Relief Valve	1
PK47	Screw—Plunger	1
PK53	Joint—Pump Body	1
PK65	Flange—Oil Pump	1
PK66	Setscrew—Oil Pump Flange, $\frac{1}{8}$ " B.S.F. x $\frac{1}{2}$ " long	2
PK68	Push Rod—Oil Pump	1
PK69	Cap—Push Rod	1
PK70	Spring—Delivery Valve	1
PK71	Spring—Return	1
PK72	Pin—Ball Retaining	1
PK78	Strainer—Oil Pump	1
PK239	Adaptor—Oil Pump Strainer	1
PK240	Joint Washer—Adaptor, 1"	1



# **PLATE L**

Ref. No.	Description	PAZI
PLI	Starting Handle Assembly, complete with Spring, Pawl and Pin (Clockwise) ...	...
*PLIa	Starting Handle Assembly, complete with Spring, Pawl and Pin (Anti-clockwise) ...	...
JL3	Spring—Starting Handle Pawl ...	...
JL4	Split Pin—Starting Handle, $\frac{3}{8}$ " x $1\frac{1}{2}$ " long ...	...
JL7	Pin—Starting Handle Pawl ...	...
PL69	Guard—Starting Extension Shaft ...	...
PL70	Grub Screw—Guard, 2 B.A. x $\frac{1}{2}$ " long ...	...
PL71	Wing Nut—Guard, 2 B.A. ...	...
PL72	Chain—Guard ...	...
PL73	Split Pin—Guard, $\frac{1}{8}$ " x $\frac{3}{4}$ " long ...	...
PL81	Grub Screw—Guard, 2 B.A. x 1" long ...	...
JL109	Pawl—Starting Handle ...	...

\*Not illustrated

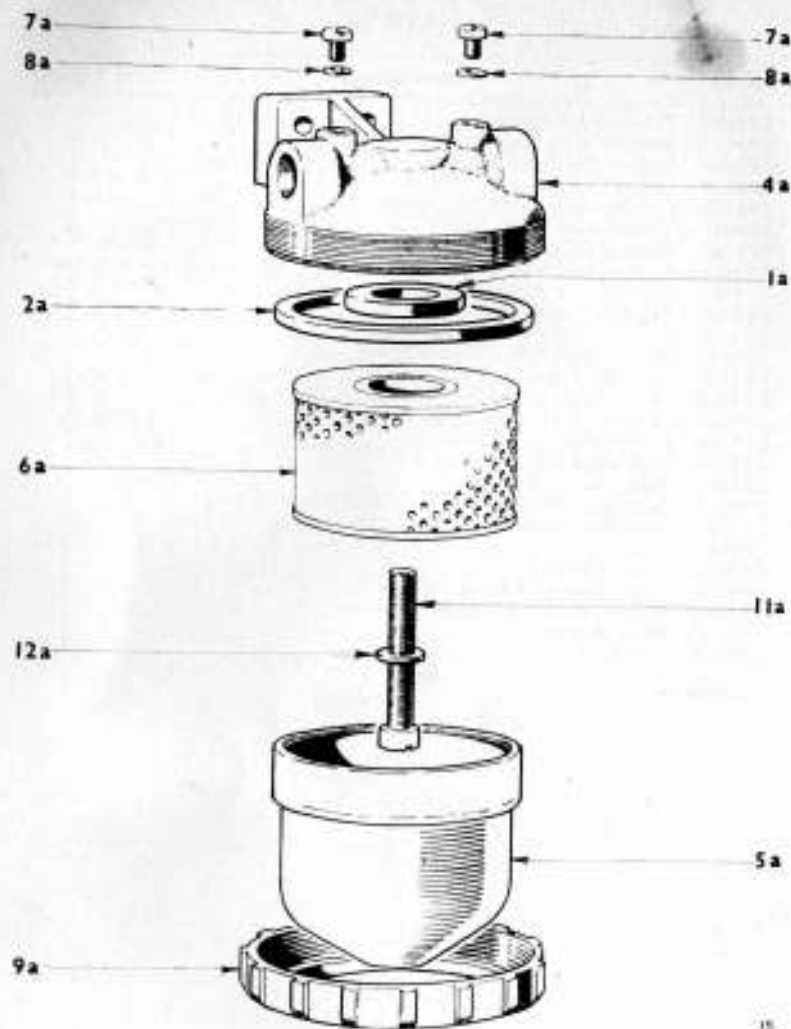


# PLATE N

Ref. No.	Description	PAZI
ZPN1	Pump—Fuel Injection	1
ZPN4	Bolt—Fuel Pump, $\frac{1}{8}$ " B.S.F. x $1\frac{1}{2}$ " long	2
ZPN39	Screw—Overload Adjusting	1
ZPN40	Nut, $\frac{1}{4}$ " B.S.F.	1
ZPN50	Circlip—Fuel Pump Rack Cover	2
ZPN51	Cover—Fuel Pump Rack	2
ZPN62	Shim—Fuel Pump (0.002" thick)	As reqd.
ZPN62a	Shim—Fuel Pump (0.005" thick)	As reqd.
ZPN65	Guide—Fuel Pump Tappet	1
ZPN66	Tappet—Fuel Pump	1
ZPN68	Roller—Fuel Pump Tappet (Outer)	1
ZPN69	Roller—Fuel Pump Tappet (Inner)	1
ZPN70	Spindle—Roller	1
ZPN84	Fork—Fuel Pump Rack Extension	1
ZPN85	Pawl—Fuel Pump Rack Extension	1
ZPN86	Pin—Pivot	1
ZPN87	Washer, 2 B.A.	1
ZPN88	Split Pin, $\frac{1}{8}$ " x $\frac{1}{2}$ " long	1
ZPN89	Setscrew—Rack Extension Fork, 2 B.A. x $\frac{1}{2}$ " long	1
ZFN91	Wire—Overload Adjusting Screw Locking	1
ZPN92	Seal	1
ZPN93	Stop—Overload	1
ZPN94	Extension—Fuel Pump Rack	1
ZPN95	Screw—Fuel Pump Rack Extension	1
ZPN101	Joint Washer	1
ZPN141	Spring—Fuel Pump Rack Extension	1

\*Not illustrated





FUEL FILTER JE64

Ref. No.	Description
JE64/1a	Joint Washer—Element
JE64/2a	Joint—Body
JE64/4a	Head
JE64/5a	Body
JE64/6a	Element
JE64/7a	Screw—Bleed
JE64/8a	Washer—Bleed Screw
JE64/9a	Nut—Clamp
JE64/11a	Bolt
JE64/12a	Washer

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# PAZI RUNNING MAINTENANCE CHART

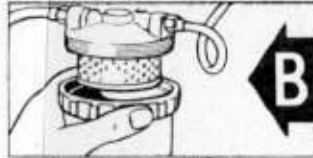
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DAILY

250 HOURS



Check the lubricating oil level on the dipstick and top up if necessary.



Clean the fuel oil filter bowl



Check if cylinder head joint is leaking and tighten nuts if necessary. Check all nuts, bolts and keys.



Make sure that the vent hole in the fuel tank filler cap is clear.



Clean the air cleaner element



Thoroughly clean out the fuel tank to remove sludge.



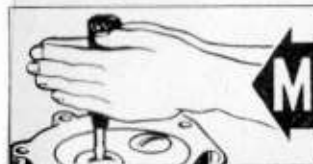
Wash out the lubricating oil-ways and pipes.



Examine large end bearing and replace if clearance is excessive.



Withdraw the piston and carefully clean out oil return holes. Examine the cylinder bore.



Examine and grind in, if necessary, the inlet and exhaust valves.



Remove cylinder head, decarbonize piston top and insides of inlet and exhaust ports.



Replace the fuel filter element



Check valve clearances and adjust if necessary.

This chart has been

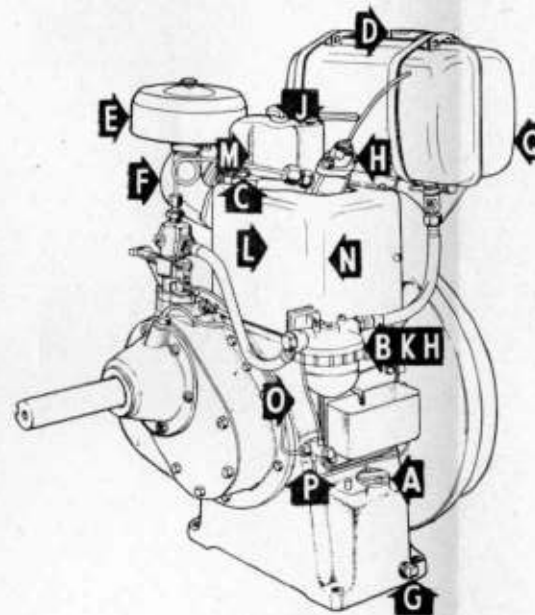
designed to help you.

Its correct application

will ensure maximum

service from your

Petter engine



Keep cooling system

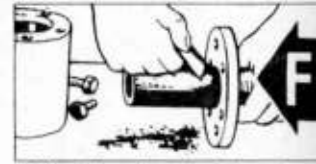
free from

obstruction.

Use only the lubricants

recommended

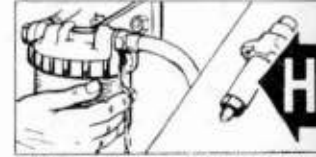
in the handbook



Clean the carbon deposit from the exhaust silencer.



Drain the sump, flush out with paraffin and refill with new oil. Clean the oil strainer.



Remove injector and test spray. If in order replace without interference. Test fuel system for leaks.

1,000 HOURS

500 HOURS