COVENTRY VICTOR VIXEN

HDA (Mk I and Mk II) Air Cooled
HDW (Mk I and Mk II) Water Cooled

Servicing instructions and spare parts list

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TECHNICAL DATA.

SECTION 1.

A.

COMPONENT.	MARK I.	MARK II.
Cylinder Bore:	3.5433" (90mm)	3.75" (95mm)
Stroke:	4.00" (101.6mm)	4.00" (101.6mm)
Capacity:	1292 cc.(79cu.in.)	1448 cc.(88.36 cu.in.)
Compression Ratio:	$17\frac{1}{2}$:1	18:1
Piston Speed per 1000 rpm:	666 ft/min.	
Cycle:	Four Stroke.	
Combustion System:	Pre-combustion chamber with patented cold starting device.	
FUEL Injection Pumps:	C.A.V.- BPF/ 1A65AS6251.	C.A.V. - BPF/ 1A70PS6568. Bryce A1AA70/6S292 fitted to engine nos. HDA.1649 to 1674, 1687 and 1699 onwards. HDW.5195/6 and 5204 onwards.
Fuel Injection Nozzle Holders:	BKB/50SD671	
Fuel Injection Nozzles:	BDN/OSD21.	
Injection Pressure:	130 A.T.S.	
Fuel Filter:	H.2007/S845.	
Fuel Filter Element:	S845	
Oil Filter & Element:	No.529. Now M.5407 with M.5383.	
Oil Pressure:	50/60 lbs/sq.in.	
Oil Capacity:	10 pints (5.7 litres)	
Lubrication:	Pressure feed to main and big end bearings via a full flow filter from gear type oil pump.	
Tappet Clearance:	HDA (Mk.I) and HDW (Mk.I) .002" INLET .003" EXHAUST) ENGINE HDA(Mk.II) and HDW (Mk.II) .010" INLET AND EXHAUST.) COLD.	

RECOMMENDED LUBRICANTS.

We recommend oils of the types listed:-

TEMPERATURE.	B.P.	CASTROL	ESSO	SHELL
0^{o} - 32^{o} F	Vanellus M.20.	Deusol RX.20.	Tromar HD.20.	Rotella SX20.
33^{o} - 90^{o}F	Vanellus M.30.	Deusol RX.30.	Tromar HD.30.	Rotella SX30.
Above 90^{o}F	Vanellus M.40.	Deusol RX.40.	Tromar HD.40.	Rotella SX40.

These are detergent oils suitable for use with fuel oils having a sulphur content of not more than 1.3%. Inferior or reclaimed oils must not be used.

Fuel Oils: Light Diesel or Pool Gas Oil to approximately the following specification :-

Knock Rating:	40 Octane.
Viscosity:	35 Secs. Redwood No.1. at 100°F.

Special oils may be recommended to meet conditions, but consult us.
The foregoing data applies to both air and water-cooled engines.

B) COOLING:

1. AIR-COOLED: Centrifugal flywheel fan delivers air blast via special cowl to finned cylinder heads and barrels.

2. WATER-COOLED: A water circulating pump delivers coolant to cylinder barrels and heads via balanced system, with temperature control.

NOTE: All main parts on the Mark I air and water-cooled engines are interchangeable, with the exception of cylinder barrels, heads, and flywheel housings, and the same remarks apply to the two Mark II engines. Unified threads and hexagons are used throughout the engine unit but not necessarily on proprietary auxiliary parts outside our control.

SECTION 2.

INSTALLATION AND INITIAL RUNNING OF A NEW ENGINE.

A) Installation - Industrial Units.

The first essential of trouble-free running is a good installation. The engine and unit must be firmly and correctly fitted on to a satisfactory bed, the exhaust and fuel systems carefully fitted and an adequate supply of air for engine cooling ensured.

Whilst smooth running of the engine at all speeds is excellent, incorrect foundations can give rise to many troubles, both in running and necessity for maintenance. Fig. No. 1 gives an indication of the type of bed required for an Industrial installation. We will gladly supply further details of resillient mountings on request as it is necessary to consider each installation on its own merits.

Care must be taken to ensure sump drain plug and filters remain fully accessible.

B) Installation - Marine Units.

General remarks regarding firmness of bedding and accessibility as stated in the previous paragraph, apply here.

SECTION 2.

Installation - Marine Units

Make sure mounting channels or beams are of adequate length to distribute the load. They should be at least three feet longer than the unit. It should be remembered when lining up propeller shafts with solid couplings: The hull often changes attitudes when put into the water, and necessary allowance should be made for this by re-checking the alignment once afloat. If in doubt consult us.

Sump and gearbox drain plugs often become inaccessible and it is recommended a sump pump, if necessary with a two way cock to drain gearbox as well, should be fitted in such circumstances.

These parts are available on request.

C) Fitting Fuel Supply Systems.

Either pump feed or gravity systems may be used - each engine is fitted with a fuel pump cam and has appropriate mounting points. The pump is capable of a suction lift of 24", but when suction pipe is greater than 10 ft. in length, it is advisable to use 3/8" outside diameter copper pipe beyond that point.

When gravity feed is used, the minimum head above the fuel injection pumps should be 6" and the coupling pipe not greater in length than 4 ft. at this head. Taps are not recommended in the supply system.

Attached to the injector on top of each cylinder head is a short length of pipe which carries away the fuel allowed to leak past the injector control plunger. These pipes should be connected together with return to the main fuel tank. A maximum length of 15' in conjunction with 3' head is allowable here. If length required is greater, the leak-off may be connected to the main feed pipe from the tank. Please note if this is done, great care must be taken to prevent air locks, and leak-off pipes must be bled when priming the fuel system. (For full details of this see SECTION 3 under ENGINE STARTING.)

D) Permitted Angles of Installation.

In certain cases, such as Marine Installation, a maximum tilt of 13° (the flywheel being the lowest end) is permitted.
No permanent side tilt is allowed, i.e. one cylinder permanently lower than the other, although the natural rolling of a ship in motion will not upset the satisfactory working of the engine.

SECTION 3.

STARTING AND STOPPING ENGINE.

Starting a new engine.

A.1. Remove sump drain plug and check to see if there is any inhibiting oil in the engine. If so, drain this off.

A.2. Replace sump plug and fill sump with recommended grade of oil (see SECTION 1A) via filler on top of crankcase. Dipstick is screwed into the sump and registers correct level when fully screwed down. Sump content is approximately 10 pints. Do not over-fill.

A.3. Decompress the engine by pressing down the decompressor knob smartly. Set latch to hold in position (see Fig. No.2). Turn engine over a number of times by hand until steady oil pressure registers on the gauge. Failure to do this can damage the engine as the full flow filter must first be filled before oil can reach the bearings.

A.4. Fill fuel tank with recommended fuel (see SECTION 1A) and prime fuel system to eliminate all air bubbles. Procedure as follows :-

a) Ensure 1, there is fuel in the tank, 2, fuel cock is open, and 3, fuel control cam is at "stop".

b) Slacken "In" bleed screw on top of filter, wait until bubble-free fuel appears and tighten screw. Repeat the operation on the "Out" bleed screw.

c) In turn slacken the banjo union bolts on top of fuel injection pumps, wait until bubble-free fuel appears and tighten banjo bolts.

d) Slacken injection pump delivery pipe units at the injectors, set fuel control cam to excess fuel (start) and crank the engine until fuel appears at injectors, tighten unions.

e) With the control cam at excess fuel, crank engine until each injector "creaks", indicating priming is complete.

Bleeding a system which includes a fuel lift pump differs from the above only in that the pump priming lever must be continuously operated to prime the system.

SECTION 3.

STARTING AND STOPPING ENGINE.

A.4. The system is now primed. To check this turn the control cam to "START" position in the case of engine fitted with constant speed governor (see Fig. 5) or, in the case of engine fitted with variable speed governor, move the control lever "A" to "RUN" position (see Fig.5B), then, with the decompressor latch down, turn the engine over a few times. Each injector should emit a sharp "creak" as fuel is injected. If either fail to do this, bleed the pump and pipes concerned again. IT IS USELESS TO TRY TO START AND RUN THE ENGINE UNTIL BOTH INJECTORS ARE PASSING FUEL CORRECTLY.

A.5. If oil bath air filters are fitted, remove cover and fill reservoir with engine oil to indicated level. Do not over-fill. Replace cover.

A.6. The engine may now be started. Leaving the decompressor latch down and control cam on constant speed governor in "START" position (or speed control lever "A" in "RUN" position in the case of variable speed governor) turn the engine over 10 or 12 times as fast as possible, knock off decompressor latch and CONTINUE TURNING. It is essential this latter instruction should be carried out, as an oil engine starts on the heat generated by the compression of the air in the cylinder and cranking speed must be kept up.

A.7. Immediately the engine fires, the speed governor will take over regulating the maximum speed and, on engines fitted with constant speed governors, the control cam will automatically fall into the "RUN" position. In the case of engines fitted with variable speed governors the control lever should be positioned to give the desired speed. Watch oil pressure carefully and if 50/60 lbs per sq.in. is not registered on oil pressure gauge within 10 seconds stop the engine at once and investigate. (To stop the engine see paragraphs D.1.2. and 3.)

A.8 If engine fails to start at first attempt repeat starting sequence from A.6.

Check first that you are using the correct grade of lubricating oil and, if weather is cold use cold starting device. (See Cold Weather Starting.)

COLD WEATHER STARTING.

Patented cold starting injectors are fitted to each cylinder head (see Fig.6), and should be used as follows :-

B.1. Remove plunger and fill container with clean engine lubricating oil. A level hole is provided in the container. Do not fill above this.

SECTION 3.

STARTING AND STOPPING ENGINE.

B.2. Open the seating valve by turning knob two or three revolutions anti-clockwise. Insert plunger in container and press home. This will inject mixture into the combustion chamber.

B.3. Close seating valve firmly and go through the starting sequence as described in SECTION 3. A.6. onwards. Do not over-prime. If engine will not start, investigate reason for this (see FAULT FINDING, SECTION 5).

NOTE: It is advisable to clear cold starting injectors occasionally and this is accomplished when stopping the engine. After control cam (or speed control lever) has been moved to "STOP" position, remove plungers and open seating valve half a turn. It is important this operation be carried out only whilst engine is slowing down.

B.4. IN CASES WHERE SUB-ZERO STARTING IS REQUIRED, PLEASE CONSULT THESE WORKS.

C. NORMAL STARTING

Follow sequence as laid down in paragraphs A6 - A8 of this section.

STOPPING THE ENGINE.

D.1. ENGINE FITTED WITH CONSTANT SPEED GOVERNOR.

Decrease load on engine and allow to run "LIGHT" for a few minutes at its normal governed speed. This is particularly important in the case of air-cooled engines, as, when stopping, induced cooling ceases and for a short time engine temperature increases. If stopped suddenly under maximum output conditions this increase can be quite high. It is, therefore, wise in the interest of maximum life, to allow engine to run as previously stated at the normal operated speed for a few minutes before shutting down, which will prevent undue temperature rise.

To stop engine the control cam fitted to the left hand governor control bracket (HD.64) should be rotated 180° in clockwise direction (see Fig.5.)

D.2. ENGINE FITTED WITH VARIABLE SPEED GOVERNOR.

Decrease load as advised for engine fitted with constant speed governor and move the speed control lever to "STOP" position as shown in Fig. 5B.

SECTION 3.

STARTING AND STOPPING ENGINE.

D.3. WATER-COOLED ENGINES.

When stopping a water-cooled engine in cold weather, do not forget to take precautions against frost. If cooling system does not contain an anti-freeze solution, drain off all cooling water at lowest point, making sure none has been left trapped in the piping or engine due to installation peculiarities. If engine is not warm when this is carried out, start up and run for a timed minute to dry it out thoroughly. In the case of unit fitted with a gear type water circulating pump, remove pump drain plug (with slotted head) situated on underside of pump and allow water pump to drain also.

IN THE CASE OF ENGINES FITTED WITH "JABSCO" PUMPS, TO DRAIN PUMP SEE SECTION 4.R.12.

SECTION 4.

LUBRICATION SYSTEM.

A.1. A gear type oil pump, chain driven from the crankshaft at engine speed and situated in the timing cover delivers oil to all bearings, via the full flow filter, a renewable suction filter being fitted in the sump.

A.2. FULL FLOW FILTER is situated on the lower right hand side of the engine and is piped to the crankcase via a junction box incorporating the main pressure relief valve and oil pressure gauge take-off. The filter itself contains a by-pass valve which operates if the filter element becomes completely clogged and allows oil to continue to pass to the bearings. A pressure of 15 lbs. per sq. in. is needed to open this valve and it will, therefore, be accompanied by an equivalent drop on the indicated pressure on the oil gauge.

Completely clogged elements must be replaced. To replace element undo bolt at base of filter and lower container with element (For part numbers see SECTION 1A - ENGINE DETAILS). This procedure refers to earlier engines. On current models a full flow lubricating oil filter of the "spin-off" expendable type is fitted, see plate 1A.

A.3. PRESSURE RELIEF VALVE. This unit, as previously mentioned, is situated in the junction box on the lower right front of the engine adjacent to the oil filter. It is correctly set before leaving the Works and should need no re-adjustment. Do NOT re-adjust the setting for any change in working oil pressure. As previously stated, a permanently clogged filter will cause a drop in pressure.

Correct oil pressure is an indication of engine and filter condition so if it should be necessary to remove the threaded adjusting sleeve and locknut to clean the release ball and seating, be careful to replace it exactly in the same position, by counting the number of turns necessary to withdraw it.

A.4. BEARING FEEDS. Oil is ducted from the junction box direct to the main bearings and big ends, camshaft bearings are fed from angular grooves outside the mains. Each crankpin contains a large cavity which preven ts sludge formation reaching the bearing faces during prolonged running. The screwed plugs at the end of these cavities should be removed and the cavities themselves cleaned right out at every major overhaul. Make sure the plugs are tight and satisfactorily peened in on replacement.

SECTION 4.

LUBRICATION SYSTEM.

A.5. The engine governor is fed via an external pipe connected by a "T" piece to the pressure gauge pipe. The actual oil feed is open, i.e. a stream of oil is directed on the governor mechanism and is controlled by a jet inserted in the union on the governor body. This must be kept clear and should be checked every 500 hours. Do not poke with a piece of wire as this will damage the orifice. Remove union from governor body, take out jet and re-insert the other way up and blow out with air. If no air supply is available, replace union on the end of the feed pipe after reversing jet and turn engine over by hand, allowing the oil pressure to clear the obstruction. Re-fit to governor body when jet is cleared.

A.6. SUMP FILTER. This part may be removed for cleaning and is situated behind a small two stud cover plate on the left lower front of the crankcase. To remove filter, take off cover plate, taking care not to tear joint, and remove retaining spring and gauze filter element behind. Clean thoroughly with petrol or paraffin.

IMPORTANT. Sump should be drained before removing suction filter cover plate.

LUBRICATING OIL CHANGES.

B.1. Be sure that all lubricating oil used for your engine is of the recommended detergent type as listed under SECTION 1 - ENGINE DETAILS.

If by any chance you have used a non-detergent type of oil do not under any circumstances re-fill or replace with a detergent type without thoroughly flushing and re-flushing with fresh oil. If the engine has run a considerable time, it is advisable to strip it down and cleanse it thoroughly. Detergent oils circulate carbon in suspense and can, therefore, remove carbon formations formed by non-detergent oils in solid layers and block up oilways.

B.2. ROUTINE INSPECTION AND SERVICING AND LUBRICATION CHANGES.

EVERY 10 HOURS:

(a) Check contents of fuel tank and replenish as necessary.
(b) Check fuel pipe lines and connections for leaks.
(c) Check oil level in engine sump and replenish as necessary to correct level on dipstick with recommended brand and grade of lubricating oil. (see SECTION 1(A).)

SECTION 4.

B.2. ROUTINE INSPECTION AND SERVICING AND LUBRICATION CHANGES.

EVERY 50 HOURS.

(a) As per 10 hour inspection.
(b) Check all controls for freedom of movement. Lubricate lightly all governor control joints, Clevis pins, etc.
(c) Check water pump if fitted and all water connections.

EVERY 250 HOURS.

(a) As per 50 hour inspection.
(b) Drain engine sump.
(c) Remove and clean sump filter, replace.
(d) Drain full flow filter, if necessary renew element.
(e) Refill engine sump with correct grade of lubricating oil.
(f) Remove air filters, dismantle, wash in petrol, allow to dry, re-fit.
(g) Remove and clean rocker covers. Check cylinder base and cylinder head nuts for tightness. Check tappet clearances and reset, if necessary. (See Section4 J.2.) Replace rocker covers.
(h) Check engine holding down bolts and nuts, for tightness.
(i) Check exhaust system. Examine for leaks, and tighten joints as necessary.
(j) Check engine coupling and tighten coupling bolts and nuts as necessary.

EVERY 1000 HOURS.

(a) As per 250 hour inspection.
(b) Remove fuel injectors for cleaning and resetting. (See Section 4 (M).)

EVERY 2000 HOURS

(a) As per 1000 hour inspection.
(b) TOP OVERHAUL.
Remove cylinder heads, de-carbonise and grind in valves.
Remove cylinder barrels, clean pistons and piston rings.
(c) Remove fuel oil filter element. Renew element and bleed fuel system (See Section 4 (N).)

The initial top overhaul should take place at approximately 1500 hours. Naturally the frequency of subsequent top overhauls will depend on the duty and load. One sure indication an engine requires de-carbonising is when loss of compression and a falling off in power is noted.

SECTION 4.

CRANKSHAFT AND MAIN BEARINGS.

C.1. The crankshaft is a single forging in alloy steel, heat treated to give high tensile and fatigue characteristics.

C.2. Main/Big End Bearings are $2\frac{1}{2}$" diameter and the latter are counter balanced to give complete smoothness of running.

C.3. The main bearing surfaces are specially treated to give high surface hardness for maximum life, and must not be reground as surface treatment is only .003" to .004" deep. Service crankshafts are available when required.

C.4. The standard size of the big end journals is 2.500"/2.4995". (Undersize big end shell bearings - .010" and .025" are available)and the journals must be reground to the standard size minus .010" or .025" whichever is necessary to remove wear. Extreme care must be taken during regrinding not to remove, or reduce, the .110"-.120" radii at the point where the journals meet the crankshaft webbs. The journals are hollow and contain a sludge trap. After regrinding, maintenance must be carried out as stated in Section 4 A.4.

CONNECTING ROD, BIG END AND SMALL END BEARINGS.

D.1. The connecting rod is made from two forgings, the studs securing the big end cap are forged integrally.

D.2. Combination shell type bearings are used in the big end, the upper half in copper lead, the lower half white metal. The notch locks in each half bearing are arranged that they cannot be incorrectly assembled.

D.3. The small end phosphor bronze bush is splash lubricated. Only standard size bushes are available for replacement purposes.

D.4. When fitting connecting rod, make sure the gudgeon pin oil hole is on top. Connecting rods are slightly off-set and failure to do this will result in damage to cylinder bores and bearings.

D.5. Earlier engines, both Mark I and Mark II, con rod bolts are fitted with castelated nuts and split pins, which are now replaced with Cleveloc nuts with a torque setting of 35/40 lb/ft.

SECTION 4.

PISTONS.

E.1. These parts are made in special alloy the same piston being used for both Water and Air cooled engines.

E.2. 4 compression rings are used, the top ring is chromium plated. Take care when fitting to put into groove the right way up as this part can be a taper-faced ring and if so will be marked "TOP".

E.3. Second and third rings are plain faced cast iron, the fourth and bottom ring of the compression group are stepped. The face which contacts the cylinder bore must be uppermost, i.e. next to the third ring.

E.4. The scraper ring is of the slotted type and situated near to the base of the skirt. Take particular care when re-fitting the cylinder barrel over the rings.

E.5. The Gudgeon pin is lapped and matched to the piston. Make sure it is not changed, and is retained by circlips. These fit into grooves machined in the bore of the piston. After fitting make quite sure they are firmly in their grooves by inserting a suitable tool into one of the eyes and pulling it round in its groove. If re-fitting a piston after a long period of service, it is safest to fit a new circlip.

E.6. The pistons are not handed and may be fitted either way on to the connecting rod. Do not drive gudgeon pin into a cold piston, but warm piston, preferably in hot water, immediately before assembly.

E.7. One oversize piston is available, + .020" after which the fitting of a new liner and standard piston is advised.

CRANKCASE AND REAR BEARING HOUSING, AND RELATED PARTS.

F.1. These two parts form the backbone of the engine. The crankcase is a one piece aluminium casting of extreme rigidity, to which the rear bearing housing is fitted.

F.2. Adjustment of crankshaft end float is effected by varying the number of joints fitted between the Rear Bearing Housing face and the face on the crankcase. Correct end float is .009"/.012" engine cold.

F.3. Main Bearings are made of lead bronze and are pressed into the crankcase and rear bearing housing at room temperature, the same bearing being used in both parts. No reaming or scraping is required, the bearings are pre-finished to give desired size after fitting.

SECTION 4.

CRANKCASE AND REAR BEARING HOUSING, AND RELATED PARTS.

Care should be taken when fitting service bearings, to line up slot in bearing with dowel locating peg.

Make sure before inserting, bearings are scrupulously clean. Cover outside of bearings with lubricating oil before pressing home.

F.4. Camshaft bearings are fitted in precisely the same way as main bearings but are finally reamed in position. No dowel location pegs are fitted.

F.5. Valve and pump tappet bushes are pressed into position and located by a peg, screwed through the top face of the crankcase. When fitting service replacements, it will be found simpler to drill retaining peg hole through bush after fitting. Special care should be taken with fuel pump tappets as locating peg also registers in a groove in the pump tappet itself to prevent this part from rotating.

CYLINDER BARRELS AND LINERS.

G.1. All engines are fitted with dry liners.

G.2. Liners are made from special high grade centrifugally cast iron, providing maximum bore life.

G.3. One oversize piston (+020") only is available. The worn cylinder liners must be rebored and honed with a surface finish in the order of 30/40 micro inches to the following standard dimensions plus .020".

H.D.W. (MK.I) engines	3.5418"/3.5433"
H.D.A. (MK.I) engines	3.5438"/3.5453"
H.D.W. (MK.II)engines	3.7505"/3.752"
H.D.A. (MK.II)engines	3.7525"/3.754"

G.4. After liners have once been rebored to plus .020" or should wear exceed standard plus .020" it is necessary to fit new liners and revert to standard. Replacement liners are available which have a bore of .015"/.020" under standard size. These must first be fitted in the cylinders and then bored and honed to standard size using garage equipment type boring head and hone.

SECTION 4.

CYLINDER BARRELS AND LINERS.

G.5. Removal of worn liner may be effected by use of a press, in which case a plug should be made to slide into the bore, shouldered at one end to register on liner. This shoulder should be slightly narrower than liner in order that removal may be effected without damaging the bore of the barrel. As an alternative, liner may be bored to leave wall thickness of .005"/.010" and "broken" out.

G.6. Insertion of new liner:
Clean outside of liner removing preservative grease completely. Coat with lubricating oil or light grease and insert under press. A load of 2 - $3\frac{1}{2}$ tons is required for this operation, as there is an interference fit of .003".

It is essential that force should be applied vertically and evenly. To ensure precise location, the first $\frac{1}{4}$" of the lower end of the liner is reduced in diameter to provide a lead. (See Fig.7).

G.7. Cylinder Barrel should be supported firmly at the base, preferably on the mounting flange, and clearance left beneath the spigot to ensure liner can be pressed home flush. Failure to observe this point can result in damage, leaking gaskets, and bore distortion.

CYLINDER HEAD GASKETS.

H.1. Water-cooled gaskets are made from copper, with asbestos interlining, these are used to control the water flow from the cylinder barrel to the cylinder head and must not be altered. Fit carefully.

H.2. When fitting a new gasket after top overhaul etc., the cylinder head bolts should be re-tightened after initial run (Torque loading 55 lb/ft).

CYLINDER HEADS

I.1. The basic design of both air and water-cooled heads is identical and the same valves are employed on both models.

I.2. The inserts which close the lower half of the pre-combustion chamber (see Fig.8) are pressed home and are permanent assemblies. The chamber is self-cleaning and this should never be removed.

SECTION 4.

CYLINDER HEADS.

I.3. Combustion chamber throats, when cleaned, should never be touched with a file, as their shape is important, use stiff wire brush.

I.4. If it is necessary to renew valve guides do not forget the valve seats must be re-cut and valves ground in.

Valve heads should be at least .005" below cylinder head facing.

I.5. Air-cooled Heads. Make sure cooling fins are quite clean and free from oil deposits when any maintenance is being carried out. Cooling efficiency will otherwise be impaired.

I.6. Water-cooled Heads. Water jackets should be cleaned thoroughly whilst maintenance is being carried out. Soak in proprietary solvent to remove any hard deposits that may have been formed.

I.7. TOP CLEARANCES.

This is the clearance between the cylinder head facing and the flat top of the piston in its top dead centre position. It should always be checked on re-assembly. This may be carried out in the following manner:

Take a piece of 1/8" diameter lead wire and insert through injector hole in cylinder head, push out through combustion chamber throat and bend so that it lays flat on cylinder head facing. Make sure it will coincide with flat position of piston top on assembly. Assemble cylinder head and turn engine over a few times, making sure engine passed through Top Dead Centre. Then, with piston well down the cylinder bore, remove wire by pulling back carefully through injector hole. Measure flattened end of wire with micrometer. Any necessary adjustment can be effected by changing shims see SECTION S.1 (II) - SPARES LIST.

Top clearances should be as follows :-

Mark I.	(Water-cooled)	.050" to .053"
Mark II.	(Water-cooled)	.060" to .065"
Mark I.	(Air-cooled)	.050" to .053"
Mark II.	(Air-cooled)	.064" to .067"

NOTE:
These figures should be checked with the engine cold and valve clearances correctly set. The position of the injection pump cam is automatically set using figures above.

SECTION 4.

ROCKER GEAR.

J.1. Rocker gear is simple and robust, rockers are fixed to cylinder heads by two brackets and separated by a spacing sleeve and spring.

J.2. On assembly, make sure there is sufficient end float on rockers by placing .005" feeler gauge between rocker and bracket at one end before finally tightening up.

J.3. To make sure engine is in correct position for tappet adjustment, remove both rocker covers and turn engine until valves on one cylinder are "rocking", i.e. both slightly open at Top Dead Centre. The engine is now in position to set valve clearance on the other cylinder. Ensure decompressor is not depressed during this operation.

Now repeat the process on cylinder on which valves have been adjusted, moving engine until valves are "rocking" at Top Dead Centre. The first cylinder will now be ready for adjustment. Check clearances on all valves after completing all adjustments. Ensure decompressor is NOT depressed during this operation. This is important.

J.4. Tappet adjustment. Loosen the locking bolt and turn push rod cup with screw-driver, inserting feeler gauge between top of valve stem and rocker pad. Tighten bolt after adjusting.

TAPPET CLEARANCES.

H.D.A. (Mark I.)	.002" INLET	.003" EXHAUST)	
H.D.W. (Mark I.)	.002" INLET	.003" EXHAUST)	ENGINE
H.D.A. (Mark II.)	.003" INLET	.003" EXHAUST)	COLD.
H.D.W. (Mark II.)	.010" INLET	.010" EXHAUST)	

J.5. Rockers are operated by thimble type tappets which should require no attention during normal life.

CAMSHAFT AND CAMSHAFT DRIVE.

K.1. The camshaft is a hardened steel forging fully machined and should require no maintenance during the normal life of the engine. If, however, it should be necessary to remove the camshaft, the two countersunk head screws holding the camshaft thrust plate must be removed and, when replacing the camshaft, two new screws ($\frac{1}{4}$" UNF x 5/8" long, countersunk, socket head nyloc screws) should replace the original screws. It should be noted that on engines provided

with half-speed shafts, a different camshaft is required since they turn in the opposite direction, i.e. counter to the crankshaft.

K.2. Standard engines (i.e. no half-speed shaft) are provided with heavy duty duplex roller chain, whilst half-speed shafts are driven via a pair of robust spur gears.

K.3. In order to provide facilities for precise timing a special vernier arrangement connects the timing wheel to the camshaft (See Fig. 9). Seven holes are drilled in the driving flange on the camshaft, the drive pin fitting into any one of these holes is screwed into the cam wheel. The threaded hole for the latter has two positions, one opposite to the top of a tooth and one opposite to the bottom. By careful use of this assembly it is possible to vary the timing by increments of 2° crank. For example, there are 48 teeth on the camshaft chain wheel, each tooth representing a timing variation of 15°. There are seven holes on the driving flange of camshaft, a movement of one hole representing 103° timing variation, thus if the chain wheel is advanced seven teeth in the chain and moved back one hole, the timing is advanced 2° as shown here:

Advance 7 teeth = t x 15 = 105°
Retard 1 hole = 103°
= 2°

The construction of half-speed shaft drive, using gears, is the same.

The camshaft is carried in two bronze bearings, the front and rear being different sizes. Spare bearings can be obtained, if required. They are pressed in and finally reamed in position. No location pegs are used.

K.4. Correct timing is as follows :

Mark I engine. Inlet opens 6° to 8° before top dead centre.
Exhaust closes 4° to 6° after top dead centre.

Mark II engine. Inlet opens 2° to 4° before top dead centre.
Exhaust closes 2° to 4° after top dead centre.

NOTE:
Mark II engines are fitted with dural push rods and have a different tappet clearance setting. To set valve timing both tappet clearances on No.1 cylinder should be set as for Mark I engines and, after setting valve timing as stated for Mark I engines, tappets should be re-set to the correct tappet clearances.

SECTION 4.

INJECTION PUMP AND TIMING.

L.1. Two injection pumps, one for each cylinder, are situated on the sides of the crankcase, and operate from a single cam on the engine camshaft via roller tappets.

L.2. These pumps can be removed and replaced as complete units, but in so doing, great care must be taken to see accurate timing and correct load setting is maintained.

L.3. It is essential no black smoke should be visible from the exhaust under any condition of load, for this smoke is an indication that too much fuel is being injected in one or both of the cylinders. This can give rise to serious internal over-heating with consequent reduction in general engine life, and is generally due to mal-adjustment of the fuel delivery system.

L.4. Figure 10 shows section through the plunger arrangement of one of the injection pumps. Also shown is the delivery valve and the plunger in various positions.

L.5. The working of the pump. The operation of the pump element, which is comprised of the plunger and barrel, is as follows :- When the plunger is at B.D.C. (Bottom Dead Centre)as at (a) oil can enter through the barrel ports either by gravity from an overhead tank, or force feed from the fuel filter to ensure absolute cleanliness of the fuel. As the pump plunger rises a certain amount of fuel is pushed back, through the barrel ports until the plunger reaches position (b) where the top land of the plunger has closed both ports. The fuel above the the plunger is then trapped and its only outlet is via Delivery valve (2) which is mounted at the top of the pump barrel.

The pressure exerted by the rising plunger on the oil causes this to lift the valve and to enter the pipe which connects with the injector.

The extra oil which is being pumped in at the pump end, causes a rise in pressure throughout the line and lifts the nozzle needle or injector valve (this particular part will be described later in Section M.) Thus oil is sprayed into the combustion chamber, so, at the moment we have oil being pumped in to the line at the pump end, an equal quantity is pushed out via nozzle. This continues until the plunger reaches position (C). Here the lower edge of the control helix has uncovered the barrel port, thus allowing fuel to be by-passed back to the suction chamber (which is at a much lower pressure than the fuel oil above the plunger.) This causes the delivery valve to shut under the action of its spring, and with the consequent collapse of pressure in the pipe line the injector valve also shuts.

SECTION 4.

INJECTION PUMP AND TIMING.

By means of the helical edge which runs round the plunger, which is rotated in the barrel, it is possible to make this point of cut-off earlier or later in the stroke - compare positions (c), (d) and (e) which show full-load, half-load and idling respectively. To stop the engine, the plunger is turned so that the vertical slot coincides with the barrel port (f) during the whole of the plunger stroke.

The plunger is rotated axially by means of a toothed quadrant (6) machined on sleeve (7) which has slots at its lower end into which the lugs on the plunger engage, the quadrant being moved by the rack to which the engine controls are fitted.

L.6. Checking Pump Timing. As can be seen from the operating sequence described in L.5, the one point in the injection cycle which never varies is the point at which injection begins (Fig.10.b) and pump timing is set from this point in the following manner.

First remove pipe between injector and pump, then loosen delivery valve holder on top of pump and remove delivery valve and spring. These should be placed in a small vessel containing fuel oil and be kept scrupulously clean. Re-fit delivery valve holder, tightening securely, and fit pipe as shown in Fig.11. This can be conveniently made from the standard connection pipe with end cut off at an angle, the longer lip being on the lowest side.

Turn engine over in the normal direction of rotation until the piston is coming up on the compression stroke on the cylinder under consideration, with the rack set in the maximum delivery position, i.e. the rack will be as far down in a vertical direction as it will go. With the delivery valve removed, fuel will flow freely through the pump and run from the pipe now fitted.

Continue to turn engine in normal direction of rotation until flow ceases, this point can be accurately determined using pipe as previously described.

Flow should cease at 24° to 25° B.T.D.C.(Before Top Dead Centre) and should coincide with markings on flywheel. If this is not so, pump head clearance must be adjusted.

First remove two top covers on the crankcase, adjacent to the pumps (one of these also serves as the oil filler.) Beneath these will be found the pump tappet adjusters. These should be re-set until the desired timing is attained, increasing the clearance to bring timing nearer to T.D.C. and decreasing clearance to advance timing.

SECTION 4.

INJECTION PUMP AND TIMING.

After completing timing, replace top covers, fit delivery valve and spring to holder and replace on pump, fit pipe from pump to injector and bleed system (as described SECTION 3).

IMPORTANT. Once pumps have been correctly set they should not be altered, any matching between cylinders being carried out by linkage adjustment only.

WARNING. The maximum tightening torque on the delivery valve holders is 400 lbs/in and this part should never be tightened when engine is hot.

L.7. MATCHING THE PUMPS. (Read warning at end of L.7)

All engines are completely tested and the pumps carefully matched before leaving the works, but should it be necessary to dismantle the governor control linkage for any reason, the matching of the pump must be carefully checked before any further running.

From the general description of the injector pump operation (SECTION 4 L.5)it will be seen the amount of fuel oil injected into the cylinder for each power stroke can be varied by movement of the control rack and it is necessary to match the delivery to each cylinder exactly.

To check matching, first set both pump racks to the closed position (both racks as far up as they will go - see Fig.12 or 12A) and the governor operating lever moved as far to the right as it will travel. This means it must be pulled against the governor spring, which may be removed for this particular operation. Note on removal, the hole in the governor operating lever to which the spring was fitted.

Connect linkage, adjusting if necessary to maintain the set position of racks and governor operating lever previously stated.

Make sure the Injection Control Cam (Fig.5) when set to the "STOP" position holds the racks as they have been positioned.

Final adjustment must be completed under running conditions. Start engine in normal manner and allow to run under light load only until it is warmed through. Adjustment is carried out by watching the smoke level on each cylinder under accelerating conditions. If exhausts are not separate, or their ends visible when standing by the engine. It will be

necessary to make two holes, about $\frac{1}{4}$" dia. one in each exhaust pipe in a convenient position close to the engine. After use they should be suitably plugged.

With engine warm, reduce speed to about 350 rpm. by over-riding the governor by hand (in the case of variable speed governors, this method should still be employed, setting control to normal maximum first.) Take hand off governor operating lever smartly allowing engine speed to rise to controlled speed and watch for black smoke from the exhaust.

If both cylinders are smoking heavily, reset load stop adjusting bolt screwing out towards control cam to reduce level, until on one cylinder smoke is only just visible.

If, on the other hand,no smoke is visible, screw load stop adjusting bolt in until smoke is visible under accelerating conditions on both cylinders. It should be mentioned engine need not be on load to carry this test out, but will, under this condition, only emit smoke during the time when engine is actually increasing in speed.

You will now have arrived at a condition where one cylinder is smoking more than the other under accelerating conditions, the load stop being adjusted so on one cylinder smoke is only just visible.

Undo the outer ball joint, on the arm connecting the governor operating lever, on the side connected to the cylinder which is smoking heaviest, turning clockwise to reduce on left hand and right hand cylinders. The right hand rod has left hand threads at ball end. Make adjustments one turn at a time, re-fit ball end to the ball and re-test until on both cylinders smoke is only just visible.

Return now to the load stop adjusting bolt and screw out, a turn at a time, until on test no smoke is visible on either cylinder.

The pumps are now matched and the load stop re-set.

The following points, however, must be emphasised:-

a) Do not adjust matching unless a new pump is fitted or linkage disturbed. It should never be used to try to rectify an inefficient injector or cylinder which has some running defect.

INJECTION PUMP AND TIMING.

b) Apart from this test never allow engine to run emitting black smoke, but investigate cause.

WARNING: If operating engine in enclosed space, it should be remembered that the breathing of heavy exhaust fumes can be dangerous. If adequate and continuous ventilation is not available, work in conjunction with somebody who can view exhaust outlets from a position outside, and omit drilling of holes in exhaust pipes as previously stated.

If it should be necessary to remove injector assemblies it is important - when re-assembling - that the bridge support nuts are tightened carefully and evenly.

INJECTOR NOZZLE AND HOLDER ASSEMBLIES.

M.1. The injector nozzle and holder assemblies are fitted to the cylinder heads by studs, copper washers and nuts.

M.2. The assemblies on both water and air cooled engines are identical.

M.3. The assemblies should be treated at all times as a complete unit and must not be taken to pieces or adjusted in any way, except by an approved Service Station which is equipped with the necessary apparatus.

M.4. Injector assemblies, which are pre-set and ready for fitting to the engine, are available from these works and users are most strongly recommended to have a spare pair available at all times.

M.5. Details of part numbers are given in SECTION 1 - ENGINE DETAILS.

M.6. Each injector is provided with two pipe connections one is piped to the injector pump, through which the oil delivery is effected. The other is a connection which passes small quantities of fuel necessary to lubricate the internal mechanism. Short leak off pipes are fitted to these points on the engine as standard.
For further pipe details see SECTION 2 (C).

SECTION 4.

FUEL FILTER.

N.1. The fuel filter is attached to the top of the timing cover and is always connected directly to the fuel tank.

N.2. Direction of flow is indicated on the top of the body.

N.3. Make sure pipe banjo bolts are securely tightened.

N.4. Filter life varies considerably according to the particular application and it is difficult to lay down a pre-determined service time. On average fuel, with clean tanks, a life of 2,000 hours may be expected.

N.5. Remove filter by unscrewing the large metal ring which releases the perspex bowl, remove the central screw in the element, on current filter unscrew cannister and replace it. Renew element - never attempt to clean it.

N.6. Do not forget to cut off fuel supply before removing element. Bleed air out by use of top screws (see SECTION 3 A.4) after re-fitting.

AIR FILTERS.

O.1. Renewable paper element air filters are fitted to all models and the element should be replaced with a new one from time to time.

Oil bath filters are fitted to order and these should be maintained to correct level with clean oil.

O.2. Efficient protection to the engine can only be maintained if these points are observed and where engine is working under arduous conditions, checks should be taken twice a day until correct service period is determined.

O.3. In connection with oil bath filters oil requires replacing when sediment in bottom reaches depth of $\frac{1}{4}$". Container should be lifted off induction pipe and cleaned right out.

O.4. To remove container, undo wing nut on top of cleaner, remove cap with top element containing wire gauze. Container may then be lifted off for cleaning. Re-fit and refill to level indicated on outside of container itself.

O.5. Wire gauze in top of cleaner should also be cleaned, washing thoroughly before replacing on engine.

SECTION 4.

ENGINE BREATHER.

P.1. This assembly is situated on top of the crankcase, at the back of the timing cover, Fig.13 shows details.

P.2. On a horizontal twin cylinder engine, considerable pumping action takes place within the crankcase, due to the fact that both pistons approach their inner, or bottom dead centre positions together. This can give rise to pressure within the crankcase, resulting in oil leaks.

P.3. To overcome this a special breather is fitted which allows air to come out of the crankcase but will not permit its return. This is controlled by a disc valve (Fig.13).

P.4. An extension pipe is fitted to the outlet, the bore being 3/8" dia. This may be extended if required, but any additions increasing the overall length above 30" should be made in $\frac{1}{2}$" diameter bore pipe, and total length in this case should not exceed 6 ft.

NOTE.

A modified type of Breather as shown in Fig. 13A is fitted to:

H.D.A. (Mark I) engines from crankcase No.1378.

H.D.A. (Mark II) engines from crankcase No.1643.

H.D.W. (Mark II) engines from crankcase No.5192.

SECTION 4.

ENGINE GOVERNOR.

Q.1. This unit is fitted directly on to the crankshaft, the housing bolted to the timing cover.

Q.2. The governor operating lever is connected to the fuel pump linkage as shown in Fig. 12 and 12A and described in SECTION 4 (L), balance being maintained between the governor spring and the force exerted by the weights to give any output demanded of the engine at its controlled speed.

Q.3. If it is necessary to take the governor to pieces, the following procedure should be taken for all engines prior to H.D.W. crankcase Nos. 5234, excepting crankcase Nos. 5231 and 5232, and H.D.A. 1745.

Undo outer Amal joints (See Fig. 12) being careful to maintain their position. Remove fuel lift pump, if fitted, and then take off six nuts retaining the governor housing. The governor assembly on the crankshaft will now be exposed.

Q.4. For engines of later manufacture, H.D.W. from crankcase No. 5234 and including crankcase Nos. 5231 and 5232 and H.D.A. from crankcase No. 1745, the procedure for dismantling is as follows :-

Remove lower ball joint on governor lever (HD.458) as shown on Plate 4A, taking care not to alter setting. Remove governor spring and fuel lift pump (if fitted) and take off six nuts retaining the governor housing. The governor assembly on the crankshaft will now be exposed.

NOTE:

A number of Mark I engines are fitted with a cone and ball type governor. Before unscrewing the pump eccentric on engines fitted with this type of governor it is advisable to insert a cardboard shield between the governor assembly and the spigot in the timing cover which locates the governor housing. This will form a trough beneath the assembly and so prevent the four steel balls from falling into the timing cover or some other inaccessible place.

Q.5. For lubrication of the governor see SECTION 4. A5.

SECTION 4.

WATER CIRCULATING PUMP (GEAR TYPE).

R.1 Apart from an occasional half turn of the knurled screw, which adjusts the automatic packing gland, this pump requires very little attention.

R.2. Before starting up the engine see greaser cap is filled with best quality water grease and screw the greaser down slowly to fill the pump with grease, then unscrew the cup and refill with grease to about half-way and replace but do not screw right down. See all cover screws and joints are tight to avoid water leakage.

R.3. WATER LEAKAGE.

Should water leakage occur it can easily be detected, being thrown out by a deflector disc on the pump spindle. To correct such leakage tighten the knurled screw to the packing gland, but if this should prove to be screwed right down remove it and insert a $\frac{1}{2}$" long 'Victor' packing, replace the screw and tighten up until the leakage stops.

R.4. It is emphasised that no sand, grit or weeds be allowed to pass into the pump or engine water-jacketing and so causing obstruction. It is advisable to fit a fine gauze filter and filter guard in the intake piping, especially in the case of craft working in sandy, muddy or weed-infested waters.

R.5. WATER CIRCULATION.

The water delivery pipes from the pump are connected with the bottom water ports on each cylinder. Water enters here and flows through the water jacketing around the cylinders and cylinder heads and thence upwards to the water outlets. The outlet pipes rise from the cylinders to a point above the engine and are connected together by a Tee piece, in order that the balance of water in both cylinders is maintained.

R.6. WATER TEMPERATURE.

This should not exceed 180° F at the outlet. Water temperature gauges and fittings for same can be supplied on request at list price.

R.7. It is important to make sure that no undue strain is thrown on to the pump by bent or strained water pipes which are attached to the pump body. A drain plug should be incorporated at the lowest point on the pipe line and below the level of the cylinder water-jacketing and then by operating the taps fitted to both water pipes to Nos. 1 and 2 cylinders.

SECTION 4.

R.8. FROSTY WEATHER.

It is important during frosty weather all water should be drained from the system. When draining see that water-cooled silencers and exhaust systems are also drained. It is possible water may remain in the water pump but this can be drained away by removing the drain plug situated on the underside of the pump.

R.9. WATER CIRCULATING PUMP ('JABSCO' TYPE).

This is the vane type consisting of a Neoprene Vane rotating on a stainless steel shaft on a bronze bearing. The pump itself is water lubricated and requires no regular attention.

R.10. Before starting up the engine check that cover retaining screws and all pipe unions are tight to prevent any leakage of water.

R.11 It is emphasised no sand, mud or weeds should be allowed to pass into the pump as such may block the pressure jets on the delivery side of the water system. It is advisable to fit a fine gauze filter and filter guard in the intake piping, especially in the case of craft working in sandy, muddy or weed infested waters.

R.12. To drain the pump in frosty weather, slacken off the front cover when water from the pump will drain off. When storing the engine, or otherwise putting it out of use for a lengthy period, the front cover should be removed and the impellor taken out and placed in safety until required again.

R.13. For closed circuit systems do not use any petroleum based anti-freeze as this may cause damage.

NOTE:

ENGINES FITTED WITH "JABSCO" WATER CIRCULATING PUMPS MUST NOT BE STARTED AND RUN WITHOUT WATER, EVEN FOR SHORT PERIODS, AS DAMAGE IS LIABLE TO OCCUR TO THE WATER PUMP IMPELLOR.

SECTION 5. FAULT FINDING.

TROUBLE.	REMEDY.
A.1. ENGINE WILL NOT START	
a) No fuel in tank and air in fuel lines.	Fill up and bleed fuel system. (See SECTION 3A.4.b. to 4A.e.)
b) Fuel delivery valve dirty.	Remove and wash in clean fuel oil, flush pumps.
c) Fuel pipe leaking.	Inspect fuel supply, renew pipe and washers if faulty, tighten all unions.
d) Water in fuel tank.	Thoroughly clean fuel system.
e) Starting cam incorrectly set.	Set cam to "Start" position.
f) Sticky valve.	Lubricate valve stems, check water ports or fins are not blocked thus causing overheating and valve stem seizure.
g) Decompressor sticking.	Remove top cover and check for fouling, check spring.
h) Excessive oil drag.	Use correct grade and check room temperature.
i) Piston rings gummed up.	Remove and clean, see rings are staggered.
j) Exhaust system choked.	Clean out.
A.2. ENGINE MISFIRES.	
a) Valve or valves sticking.	As A1.(f).
b) Induction system obstructed.	Clean air filters, renew paper elements.
c) Dirt in injector or injectors	Strip and clean with correct cleaning apparatus.
d) Injector not seating squarely.	Slack off injector holding down nuts and tighten evenly.
e) Air lock in fuel system.	Bleed fuel system. (See SECTION 3 A4b to A4e)
f) Fuel pump spring broken.	Return to nearest C.A.V. Depot or Agent.
g) Fuel delivery valve dirty.	Remove and wash in clean fuel, flush pumps.
h) Fuel filter element clogged.	Replace with new element.
i) Fuel in tank too low.	Top up and check for air-locks.
j) Dirt in pumps rack teeth.	Thoroughly clean.
A.3. POOR COMPRESSION. May be due to:	
a) Poor valve seating.	Grind in all valves.
b) Lack of valve clearance.	Re-set to instructions.
c) Induction system obstructed.	Clean filters.
d) Broken valve spring or springs.	Replace with new.
e) Injector not seating squarely.	Slack off injector holding down nuts and tighten evenly.
f) Need for de-carbonising and grinding in valves.	Remove cylinder heads, decarbonise and grind in valves.
g) Worn cylinders and pistons.	Rebore and renew pistons.

SECTION 5. FAULT FINDING.

TROUBLE.	REMEDY.
A.4. ENGINE KNOCKING BADLY.	
a) Nozzle pintle sticking.	Strip and clean with correct cleaning apparatus.
b) Inlet valve or valves fouling piston.	Correct valve timing and bump clearance.
c) Broken valve spring or springs.	Replace with new.
d) Worn gudgeon pin.	Fit new piston with pin complete.
e) Big End Failure.	Renew shell bearings.
f) Excessive cylinder head carbon.	Decarbonise and check for overload.
g) Overheated engine.	Ease the load, check water circulation on water-cooled models.
h) Dirt in injector or injectors.	As A2 (c).
A.5. UNEVEN RUNNING.	
a) Injector not seating squarely.	Slack off injector holding down nuts and tighten evenly.
b) Fuel delivery valve dirty.	Remove and wash in clean fuel, flush pumps.
c) Fuel pipe leakage.	Inspect fuel supply, tighten all unions, renew pipe and washers if faulty.
d) Fuel filter element clogged.	Replace with new element.
e) Fuel level in tank too low.	Top up and bleed fuel system.
f) Air-lock in fuel system.	Bleed fuel system.
g) Stiffness in pumps to governor linkage.	Ease off, check adjustment and alignment.
h) Faulty injectors.	Replace.
i) Dirt in pump rack teeth.	Thoroughly clean.
A.6. LOW OIL PRESSURE.	
a) Suction filter dirty.	Clean out thoroughly.
b) Full flow filter dirty.	Remove and replace element.
c) Oil relief valve not seating or dirty.	Remove and clean, replace in original position.
d) Insufficient oil in sump.	Top up.
e) Incorrect grade of oil.	Use correct grade (See SECTION 1A).
f) Oil pump clearances excessive.	Remove and re-fit correctly.
g) Worn bearings.	Replace.

TROUBLE.	REMEDY.
A.7. ENGINE BOILS. (Water-cooled).	
a) Insufficient water.	Top up.
b) Water passages obstructed.	Thoroughly flush system.
c) Water filter clogged.	Clean out.
d) Water pump worn.	Replace parts as necessary.
e) Excessive leak past pump gland.	Renew gland seal.
f) Obstruction in cylinder jackets.	Clean out passages thoroughly.
g) Faulty joint at inlet port.	Replace.
h) Cylinder head gasket faulty.	Replace.
A.8. ENGINE OVERHEATS. (Air-cooled)	
a) Cooling intake or outlets, obstruction.	Thoroughly clean out.
b) Insufficient air supply to engine.	Arrange for improved ventilation and air supply.
c) Dirt in engine cooling.	Clean out.
d) Cylinder fins choked.	Clean out.
e) Breather choked.	Clean out.
f) Late injection.	Re-adjust timing accordingly.
g) Injection obstructed.	Clean both filters, renew air filter elements.
h) Overload.	Ease the load.

SECTION 6.

SPECIAL INSTRUCTIONS REGARDING 'LAYING UP' AND STORAGE OF "VICTOR VIXEN" ENGINES.

(a) Make sure the fuel tank is at least half full of clean fuel oil and fuel cock is left in 'on' position.

(b) Start up engine and run until oil is warm. During this period the suction pipe to the water pump should be connected to a soft fresh water container in order to thoroughly flush the cooling system. Run for about 20 minutes before stopping the engine.

(c) Drain oil from sump completely and clean sump oil filter; replace filter and drain plug.

(d) Fill engine with 6 pints of STORAGE OIL 30 (if for any reason this is unobtainable a secondary recommendation is SHELL ENSIS 452.) Restart engine and run for 10 minutes to distribute oil throughout the engine. This operation will prevent rust and corrosion from taking place.

(e) Drain water from water circulating system and cylinders, by means of the plug provided on the delivery pipe near water pump. Grease water pump.

(f) The cold starting injector caps should next be filled to the level hole with the same Storage oil which should then be injected in the usual manner into the cylinder. Close the needle valves tightly and again turn the engine over slowly for five or six times, making sure to keep the de-compressor pressed down or otherwise the engine may start. This operation will spread the oil over the cylinder walls and piston rings.

(g) Remove rocker covers, paint liberally rocker and valve assemblies with storage oil. Replace covers.

(h) Disconnect exhaust system as near as possible to the cylinder heads and tape over outlets.

(i) Remove air cleaners and wash thoroughly in petrol. When clean and dry, soak in fresh oil and re-fit to the engine. Air cleaners should then be covered and taped up, (a suitable method being the use of a greaseproof bag).

(j) Thoroughly clean exterior of engine and wash down with paraffin. All exposed working parts such as governor control rods should be painted with Storage oil to prevent corrosion.

SECTION 6.

STARTING UP THE ENGINE AFTER STORAGE.

(a) Remove tape coverings from air cleaners and exhaust pipe outlets.

(b) Connect up exhaust pipes.

(c) In the case of water-cooled engines, connect up the water circulating system and make sure the drain plug is replaced.

(d) Start up the engine and run on light load, using the same storage oil remaining in the sump. When thoroughly warm stop the engine. Remove sump drain plug and drain off storage oil. Clean sump oil filter and replace filter and drain plug.

(e) Remove rocker box covers, check valve clearance and re-set if necessary. (see Section 4. J2 - J.4.)
Re-fill engine sump with 10 pints of recommended oil.

(f) Generally clean up engine. Renew fuel and oil filter element if necessary. Check all joints and connections, paying particular attention to fuel pipe banjo unions.
Oil all governor control rod pivot points.
Tighten engine holding down bolts as necessary. In the case of water-cooled engines see the water circulating pump unions are tightened up and apply grease to the water pump.

(g) Replace batteries (if fitted) and top up with distilled water.

(h) Drain Storage oil from gearbox and reduction gearbox (if fitted) and refill with correct quantities of normal recommended lubricating oils.

(i) Start up engine for normal use.

(j) If necessary bleed the fuel system as per instructions (See Section 3, paragraph A.4).

SPARE PARTS LIST.

"VICTOR VIXEN" H.D.A.(AIR-COOLED) AND H.D.W.(WATER-COOLED) MODELS MARK I AND MARK II

NOTE: RIGHT HAND (R.H.) AND LEFT HAND (L.H.) REFERENCES ARE AS VIEWED FROM THE STARTING HANDLE, OR FREE END OF THE ENGINE.

PART NO.	DESCRIPTION.	ENGINE. Mk.I	ENGINE. Mk.II	NO.OFF.
	SECTION S.1 (1) CRANKCASE ASSEMBLY. PLATE 1.			
HD.7.	Crankcase	"	"	1
HD.444.	Stud - crankcase to cylinder barrel	"	"	8
HD.104.	Stud - crankcase to timing cover	"	"	12
HD.326.	Stud - crankcase to junction box	"	"	2
HD.108.	Stud - tappet covers	"	"	14
HD.110.	Stud - filter - tappet and decompressor	"	"	10
NEP.580.	Oil filter	"	"	1
AD.167.	Oil filter cover plate	"	"	1
AD.255.	Oil filter joint washer	"	"	1
AD.178.	Oil filter spring	"	"	1
AD.307.	Oil level dipstick	"	"	1
AD.144.	Oil level dipstick knob	"	"	1
HD.115.	Oil filler	"	"	1
HD.214.	Oil filler plate and joint washer	"	"	1
	½" drain plug, gas (front) 3/8" drain plug, gas (rear)	"	"	1
N.43A.	Oil filler cap	"	"	1
AD.197.	Oil filler cap fibre washer	"	"	1
AD.376.	Washer - fibre, for drain plug	"	"	1
HD.23.	Valve tappet bush	"	"	4
HD.112.	Valve tappet bush screw	"	"	4
HD.24/A.	Fuel pump tappet bush	"	"	2
HD.113/A.	Fuel pump tappet bush screw	"	"	2
	Washer, plain ¼" for valve tappet bush	"	"	4
	Washer, fibre ¼" for valve tappet bush	"	"	4
HD.402.	Stud - rear bearing housing 3/8"	"	"	8
	Nyloc nut 3/8" UNF.	"	"	8
	Washer, spring 3/8"	"	"	8
HD.403.	Bolt 1.5/16" x ½" - crankcase housing.	"	"	5
	Nut ½" UNF Cylinder base	"	"	8
	Spring washer cylinder base	"	"	8
	SECTION S.1. (2) CRANKSHAFT ASSEMBLY (Plate 2)			
HD.153.	Crankshaft	"	"	1
AD.133.	Crankshaft plug	"	"	2
HD.50.	Washer - crankshaft (front)	"	"	1
HD.40.	Nut - crankshaft(front) left hand thread	"	"	1
AD.205.	Woodruff key - crankshaft	"	"	2
HD.10.	Rear bearing housing	"	"	1
HD.55.	Rear bearing housing joint .010"	"	"	1
HD.55A.	Rear bearing housing joint .005"	"	"	1
HD.300.	Stud - rear bearing housing 5/16"	"	"	2
	Nut 5/16" UNF Nyloc	"	"	2

PART NO.	DESCRIPTION.	ENGINE. Mk.I	ENGINE. Mk.II	NO.OFF.
	SECTION S.1.(2) CRANKSHAFT ASSEMBLY. (Plate 2) continued.			
	Washer spring 5/16"	"	"	2
HD.268.	Oil seal - 3.1/8" o/d x 2.1/8" i/d x ½" wide	"	"	1
HD.13/A.	Main bearings (front and rear)	"	"	2
HD.216.	Dowel - main bearings	"	"	2
HD.164.	Chain sprocket - crankshaft	"	"	1
HD.16.	Chain sprocket - oil pump	"	"	1
HD.238.	Flywheel (air-cooled)	"	"	1
HD.175.	Flywheel (water-cooled)	"	"	1
AD.362.	Flywheel starter ring (AD.362A for Co-Axial starter)	"	"	1
HD.41.	Nut for flywheel	"	"	1
HD.42.	Lockwasher for flywheel nut	"	"	1
	Set screw ¼" UNF for flywheel fan	"	"	6
	Washer, spring ¼" for set screw	"	"	6
M.5286.	Adaptor housing (Electrics)	"	"	1
	SECTION S.1.(3) CONNECTING ROD & PISTON ASSEMBLIES (Plate 2)			
HD.605.	Con. rod and cap c/w bush HD.158	"		2
HD.151/2.	Con. rod and cap c/w bush HD.580		"	2
HD.194.	Connecting rod nut. (now Cleveloc)	"	"	4
HD.158.	Small end bush	"		2
HD.157.	Small end bush.Replaced by HD.580		"	2
HD.155.	Big End bearing top half.	"	"	2
HD.156.	Big End bearing bottom half.	"	"	2
HD.293.	Piston complete with rings & gudgeon pin	"		2
HD.154.	Piston complete with rings & gudgeon pin		"	2
WD.549.	Piston power ring, chrome (top)	"		2
HD.412	Piston power ring, chrome (top)		"	2
WD.574.	Piston power ring, plain (2nd & 3rd)	"		4
HD.409.	Piston power ring, plain (2nd & 3rd)		"	4
HD.243.	Piston oil control ring, stepped, (4th)	"		2
HD.410.	Piston oil control ring, stepped, (4th)		"	2
WD.575.	Piston super slotted ring (5th)	"		2
HD.411.	Piston super slotted ring (5th)		"	2
WD.573.	Gudgeon pin	"		2
HD.408.	Gudgeon pin		"	2
AD.145.	Circlip	"		4
HD.415.	Circlip		"	4
	OVERSIZE PISTONS AND RINGS, AND UNDERSIZE SHELL BEARINGS.			
HD.293/B.	Piston + .020" oversize with rings & gudgeon pin	"		2
HD.154/B.	Piston + .020" oversize with rings & gudgeon pin		"	2
HD.241/B.	Power ring, chrome (top) +.020"o/size	"		2
HD.412/B.	Power ring, chrome (top) +.020"o/size		"	2

PART NO.	DESCRIPTION.	ENGINE. Mk.I.	ENGINE. Mk.II	NO. OFF.
	OVERSIZE PISTONS AND RINGS, AND UNDERSIZE SHELL BEARINGS. Continued.			
HD.242/B.	Power ring plain (2nd & 3rd)+.020"o/size	"		4
HD.409/B.	Power ring plain (2nd & 3rd)+.020"o/size		"	4
HD.243/B.	Oil control ring, stepped (4th) + .020" oversize	"		2
HD.410/B.	Oil control ring, stepped (4th) + .020" oversize		"	2
HD.244/B.	Super slotted ring (5th) +.020" oversize	"		2
HD.411/B.	Super slotted ring (5th) +.020" oversize		"	2
HD.155/A.	Big End shell bearing top -.010" undersize	"	"	2
HD.155/B.	Big End shell bearing top -.025"undersize	"	"	2
HD.156/A.	Big End shell bearing bottom - .010" undersize	"	"	2
HD.156/B.	Big End shell bearing bottom - .025" undersize	"	"	2
	SECTION S.1.(4) CAMSHAFT ASSEMBLY (Plate 1)			
HD.162.	Camshaft	"	"	1
AD.141.	Camshaft thrust plate	"	"	1
HD.18.	Camshaft bearing - rear	"	"	1
HD.17.	Camshaft bearing - front	"	"	1
HD.20.	Camshaft washer	"	"	1
HD.163.	Camshaft chain sprocket	"	"	1
HD.93.	Timing screw	"	"	1
	$\frac{1}{4}$" UNF x 5/8" long c/sunk socket head screw	"	"	2
HD.165.	Camshaft chain (timing)	"	"	1
HD.190.	Camshaft chain sprocket retaining nut and starting dog	"	"	1
	SECTION S.1. (5) DECOMPRESSOR ASSEMBLY (plate 1)			
HD.43/A.	Decompressor head	"	"	1
HD.43/B.	Decompressor spindle	"	"	1
HD.177.	Decompressor guide	"	"	1
HD.45.	Decompressor knob	"	"	1
HD.46.	Decompressor spring	"	"	1
HD.178.	Decompressor stop	"	"	1
HD.179.	Decompressor lever	"	"	1
HD.290.	Sealing ring 1/16" x $\frac{1}{2}$" o/d x 3/8" dia. i/d	"	"	2
	Taper pin 1/8" dia. x $\frac{3}{4}$"	"	"	1
	Taper pin 1/8" dia. x 1"	"	"	1

PART NO.	DESCRIPTION.	ENGINE. Mk.I.	Mk.II.	NO.OFF.
	SECTION S.1.(6) LUBRICATING OIL RELIEF VALVE AND JUNCTION BOX (Plate 1) UP TO ENGINE CRANKCASE NO's HDA1900 & HDW.5286.			
HD.332.	Relief valve body and junction box	"	"	1
HD.184/A.	Relief valve adjusting screw	"	"	1
N.1194.	Relief valve locknut	"	"	1
HD.360.	Relief valve spring	"	"	1
HD.379.	Relief valve ball 7/16"dia.	"	"	1
N.421.	Washer fibre	"	"	1
HD.229.	Gasket for relief body valve	"	"	1
HD.331.	Gasket for junction box	"	"	1
HD.97.	Brass dome nut	"	"	1
	SECTION S.1.(6A) LUBRICATING OIL RELIEF VALVE AND FULL FLOW OIL FILTER ASSEMBLY (Plate 1A) FROM ENGINE CRANKCASE NO's HDA.1901 & HDW.5287.			
M.5383.	Lubricating oil filter		"	1
HD.483.	Oil filter head	"	"	1
HD.484.	Adaptor	"	"	1
5/16"	UNC x 2" long cap head screw	"	"	1
5/16"	UNC x $1\frac{3}{4}$" long cap head screw	"	"	1
HD.184/A.	Relief valve adjusting screw	"	"	1
N.1194.	Relief valve locknut	"	"	1
HD.360.	Relief valve spring	"	"	1
HD.379.	Relief valve ball 7/16" dia.	"	"	1
N.421.	Washer, fibre	"	"	2
HD.229.	Gasket for relief valve body	"	"	1
HD.97.	Brass dome nut	"	"	1
	SEE SECTION S.1. 19.			
	SECTION S.1.(7) BREATHER ASSEMBLY (Plate 1)			
HD.341.	Breather body	"	"	1
HD.342/A.	Breather body cover	"	"	1
HD.343.	Breather valve	"	"	1
HD.344/A.	Breather pipe	"	"	1
HD.348.	Breather deflector	"	"	1
	Screw $\frac{1}{4}$" UNF x $\frac{3}{4}$" long	"	"	1
	Washer, star $\frac{1}{4}$"	"	"	1
HD.228.	Tubing 10 mm bore x 18" long	"	"	1
HD.231.	Clip for breather pipe	"	"	1

PART NO.	DESCRIPTION.	ENGINE. Mk.I.	ENGINE. Mk.II.	NO.OFF.
	BREATHER ASSEMBLY AS FITTED TO HDA(MK.I) ENGINES FROM CRANKCASE NO.1378. HDA (MK.II) FROM CRANKCASE NO.1643 AND HDW (MK.II) FROM CRANKCASE NO.5192 (Fig. 13A)			
HD.445.	Breather body			1
HD.446.	Breather body cover			1
HD.447.	Breather valve			1
HD.448.	Breather check valve			1
	Bolt 2BA			1
	Nyloc nut 2BA			1
HD.228.	Breather pipe			1
	SECTION S.1.(8) TIMING COVER AND STARTING HANDLE ASSEMBLY (Plate 3A)			
HD.127.	Timing cover	"		1
HD.471.	Timing cover		"	1
HD.198.	Stud-governor cover	"	"	6
HD.274.	Starting handle bush	"	"	1
HD.276.	Starting handle shaft	"	"	1
HD.190.	Starting dog nut	"	"	1
HD.275	Starting handle spring) HD.98.	"	"	1
HD.98.A.	Starting handle crank) Assy.	"	"	1
HD.266.	Starting handle spindle)	"	"	1
HD.265.	Starting handle sleeve)	"	"	1
HD.272.	Starting handle bolt 7/16")	"	"	1
	Washer, spring 7/16")	"	"	1
N.1055.	Cover plate for use when pump not fitted	"	"	1
VVO.93.	Stud - governor control bracket	"	"	5
VVO.92.	Stud	"	"	3
M.3290.	Felt ring with 7/8" plain washer	"	"	1
	SECTION S.1. (9) FUEL PUMP TAPPET ASSEMBLY. (plate 8)			
HD.221.	Fuel pump tappet assembly complete	"	"	2
HD.53/A.	Tappet body including tappet roller, and pin (HD.204)	"	"	2
HD.21.	Tappet adjusting screw	"	"	2
	Locknut - tappet adjusting screw	"	"	2
	SECTION S.1.(10) PUSH RODS AND VALVE TAPPETS (Plate 5)			
HD.37.	Push rod	"		4
HD.395.	Push rod		"	4
HD.394.	Ball ends for push rods	"	"	8
HD.38.	Push rod tube	"	"	4
HD.269	Sealing ring $\frac{3}{4}$" i/d x 1" o/d x 1/8" (push rod tube)	"	"	16
HD.22.	Valve tappets	"	"	4

PART NO.	DESCRIPTION.	ENGINE. Mk.I	ENGINE. Mk.II	NO.OFF.
	SECTION S.1.(10) PUSH RODS AND VALVE TAPPETS (Plate 5) continued.			
HD.25.	Valve cover R.H.	"	"	1
HD.26.	Valve cover L.H.	"	"	1
HD.51.	Oil drain tube	"	"	2
HD.270.	Oil drain tube sealing ring 15/32" x 21/32" x 3/32"	"	"	4
	SECTION S.1. (11) CYLINDER BARRELS. (Plate 5)			
HD.35.	Cylinder barrel (air-cooled)	"		2
HD.215/A.	Cylinder liner (air-cooled)	"		2
HD.36.	Cylinder barrel (air-cooled)		"	2
HD.359/A.	Cylinder liner (air-cooled)		"	2
HD.135.	Cylinder barrel (water-cooled)	"		2
HD.215/W.	Cylinder liner (water-cooled)	"		2
HD.136.	Cylinder barrel (water-cooled)		"	2
HD.359/W.	Cylinder liner (water-cooled)		"	2
HD.101.	Stud cylinder head (air-cooled)	"		12
HD.451	Stud cylinder head (air-cooled)		"	12
HD.144.	Stud cylinder head (water-cooled)	"	"	12
HD.198.	Stud water port flange	"	"	4
AD.529.	Cylinder base washer (paper)	"	"	2
WD.318.	Sealing disc (water-cooled)	"	"	8
	Nut cylinder to c/c ½" UNF	"	"	8
	Spring washer ½"	"	"	8
AD.529/A.	Cylinder base brass shim .003"	"	"	As required
AD.529/B.	Cylinder base brass shim .005"	"	"	" "
	Washer, spring, single coil flat section ½"	"	"	8
	Washer plain ½"	"	"	As required
	SECTION S.1. (12) CYLINDER HEAD, VALVE & ROCKER GEAR ASSEMBLIES (Plate 6)			
HD.29.	Cylinder head R.H. (air-cooled)	"		1
HD.30.	Cylinder head L.H. (air-cooled)	"		1
HD.31/A.	Cylinder head R.H. (air-cooled)		"	1
HD.32/A.	Cylinder head L.H. (air-cooled)		"	1
HD.137/A.	Cylinder head R.H. (water-cooled)	"		1
HD.138/A.	Cylinder head L.H. (water-cooled)	"		1
HD.139/A.	Cylinder head R.H. (water-cooled)		"	1
HD.140/A.	Cylinder head L.H. (water-cooled)		"	1
HD.102.	Stud cylinder head to rocker bracket	"	"	4
HD.400.	Valve guide.	"	"	4
HD.87.	Valve(inlet)	"	"	2
HD.88.	Valve (exhaust)	"	"	2
AD.182.	Valve cotter	"	"	(prs.) 4
HD.396.	Valve spring (outer)	"	"	4
HD.397.	Valve spring (inner)	"	"	4
AD.196.	Valve collar	"	"	4

N.C.B. CAST IRON ENGINES:-
HDW.507 R.H. CYLINDER HEAD.
HDW.506 L.H. CYLINDER HEAD.

PART NO.	DESCRIPTION.	ENGINE. Mk.I.	ENGINE. Mk.II.	NO.OFF.
	SECTION S.1. (12) CYLINDER HEAD, VALVE & ROCKER GEAR ASSEMBLIES (Plate 6) continued.			
HD.105.	Stud - injector (air-cooled)	"	"	4
HD.150.	Stud - injector (water-cooled)	"	"	4
HD.202.	Seal retainer - valve guide	"	"	4
N.1176/A.	Seal pad - valve guide	"	"	4
HD.296.	Stud rocker box to cover	"	"	6.
HD.198.	Stud - inlet & exhaust (air-cooled)	"	"	8
HD.198.	Stud - inlet & exhaust & water pipes (water-cooled)	"	"	12
AD.178.	Spring - rocker spacer	"	"	2
AD.126.	Rocker bracket	"	"	4
AD.130.	Rocker shaft	"	"	2
AD.131.	Rocker distance tube	"	"	2
AD.319.	Rocker bush	"	"	4
HD.27.	Rocker R.H. Inlet No.1. Exhaust No.2.	"	"	2
HD.28.	Rocker L.H. Exhaust No.1. Inlet No.2.	"	"	2
HD.94.	Rocker adjusting screws	"	"	4
HD.114.	Rocker pinch bolt	"	"	4
HD.54.	Cylinder head cover (water-cooled)	"	"	2
HD.141.	Cylinder head cover (inner) (water-cooled) R.H.	"	"	1
HD.142.	Cylinder head cover (inner) (water-cooled) L.H.	"	"	1
HD.143.	Cylinder head cover joint washer (water-cooled)	"	"	2
HD.33/B.	Cylinder head cover (inner) (air-cooled) L.H.	"	"	1
HD.33/A.	Cylinder head cover (inner) (air-cooled) R.H.	"	"	1
HD.34.	Cylinder head cover (outer)	"	"	2
HD.230/A.	Cylinder head cover joint (outer half)	"	"	2
HD.148/A.	Cylinder head gasket (water-cooled)	"		2
HD.147.	Cylinder head gasket (water-cooled)		"	2
AD.818.	Cylinder head gasket (air-cooled)	"		2
HD.91.	Cylinder head gasket (air-cooled)		"	2
	Cylinder head nut ½" UNF	"	"	12
AD.455.	Joint washer - cylinder head to inner cover (small)	"	"	4
HD.92.	Joint washers - cylinder head to inner cover (large)	"	"	2
HD.203.	Flange for water pipe (water-cooled)	"	"	4
WD.338.	Joint for water port (water-cooled)	"	"	4
HD.108.	Stud-rocker bracket (short)	"	"	4
HD.505.	Cylinder head washer HDA with spring washer HDA only	"	"	12
	Cylinder head ½" spring washer HDW only	"	"	12

PART NO.	DESCRIPTION.	ENGINE. Mk.I.	ENGINE. Mk.II.	NO.OFF.
	SECTION S.1. (13) PATENT COLD STARTING INJECTOR ASSEMBLY (Plate 7).			
AD.263.	Cold starting injector complete.	"	"	2
AD.264.	Cold starting injector body.	"	"	2
AD.266.	Cold starting injector seating	"	"	2
AD.270.	Cold starting injector plunger	"	"	2
AD.271.	Plunger securing chain	"	"	2
AD.272.	Injector washer	"	"	4
AD.267.	Nut	"	"	2
AD.273.	Base washer for injector	"	"	2
AD.269.	Injector, priming cup	"	"	2
AD.417.	Injector needle valve	"	"	2
	SECTION S.1.(14) SPEED GOVERNOR ASSEMBLY. (Plate 3).			
	The following sections on the speed governor apply to engines HDW up to crankcase No.5233 with the exception of crankcase Nos.5231 and 5232. Subsequent engines are fitted with a modified type of governor, details of which are shown in Section 14A and on Plate No. 3A. On the H.D.A. engines the following sections apply to all units up to crankcase No.1744. Subsequent HDA engines are fitted with the modified type of governor (See section S.1. 14 a.)			
HD.167B.	Governor cover	"	"	1
HD.388.	Governor fork	"	"	1
HD.61.	Governor spindle	"	"	1
HD.385.	Governor bobbin	"	"	1
HD.386.	Governor thrust washer	"	"	2
HD.387.	Governor weights (variable speed)	"	"	2
HD.604.	Governor weights (constant speed)	"	"	2
HD.389.	Governor weight carrier	"	"	1
HD.391.	Governor pivot pin	"	"	2
197/202.	Washer	"	"	4
	Split pin 1/16" x $\frac{1}{2}$"	"	"	4
	Locknut $\frac{1}{4}$" UNC.	"	"	1
	Socket screw 2 BA x $\frac{3}{4}$"	"	"	1
	Locknut 2 BA.	"	"	1
	Washer, spring 2 BA.	"	"	1
VVO.92.	Stud - fuel lift pump	"	"	2
HD.218.	Cover plate for use when fuel lift pump is NOT fitted.	"	"	1
NEP.598/9.	Jet and union	"	"	1
M.1477.	Joint washer for pump facing	"	"	1
N.420.	Washer, fibre 1/8" gas	"	"	1
HD.187.	Cam for fuel pump	"	"	1
HD.63.	Blanking flange and washer for cover	"	"	1

PART NO.	DESCRIPTION.	ENGINE. Mk.I.	Mk.II.	NO.OFF.
	SECTION S.1.(14) SPEED GOVERNOR ASSEMBLY. (Plate 3) continued.			
HD.392.	Governor lever arm	"	"	1
	Grub screw, Allen 2 BA x 3/8"	"	"	1
	Bolt for governor arm $\frac{1}{4}$" x $\frac{3}{4}$" UNC.	"	"	1
	SECTION S.1. (14A) SPEED GOVERNOR ASSEMBLY (Plate 3A) FITTED ON ENGINES HDW (MK.II) FROM CRANKCASE NO.5234 ALSO ON CRANKCASE NO.5231 AND 5232, AND ON HDA (MK.II) FROM CRANKCASE NO. 1745.			
HD.467.	Governor casing		"	1
HD.63.	Governor cover		"	1
HD.218.	Governor blanking flange		"	1
M.1477.	Governor blanking flange washer		"	1
HD.393.	Governor spring		"	1
HD.468.	Governor spindle		"	1
VVO.92.	Stud		"	2
HD.388.	Governor fork		"	1
HD.385.	Governor bobbin		"	1
HD.386.	Governor thrust washer		"	2
HD.387.	Governor weight variable speed		"	2
HD.604.	Governor weight constant speed		"	2
HD.389.	Governor weight carrier		"	1
AD.246.	Governor pivot pin		"	2
HD.187.	Fuel lift pump camand locknut (& M.3224 when tacho fitted)		"	1
	2 BA x 3/8" Grub screw		"	1
NEP.598/9.	Oil pipe union		"	1
N.420.	Washer, fibre 1/8" gas		"	1
Type 1500 No.343.	Anderton circlip		"	1
	SECTION S.1. (15) CONTROLS FOR CONSTANT SPEED GOVERNOR L.H. ASSEMBLY (Plate 4)			
HD.64.	Control bracket	"	"	1
HD.66.	Pump lever	"	"	1
	Washer plain 5/16"	"	"	2
HD.72.	Lever, start and stop cam.	"	"	1
HD.75.	Pin for pump lever. L.H.	"	"	1
HD.71.	Start and stop cam	"	"	1
HD.76.	Pin for start/stop cam	"	"	1
HD.70.	Governor lever, inner	"	"	1
HD.69.	Governor lever, outer	"	"	1
HD.74.	Governor lever spindle	"	"	1
HD.73.	Governor lever screw-start and stop cam	"	"	1
HD.81.	Governor link rod	"	"	1
AD.345.	Amal joint for control rod thread R.H.	"early	"	2
	Locknut for control rod. $\frac{1}{4}$" BSF.	"	"	1

PART NO.	DESCRIPTION.	ENGINE. Mk.I.	ENGINE. Mk.II.	NO.OFF.
	SECTION S.1. (15) CONTROLS FOR CONSTANT SPEED GOVERNOR L.H. ASSEMBLY (Plate 4).			
HD.393.	Governor spring	"	"	1
HD.80.	Governor connecting link	"	"	1
AD.221.	Governor cotter pin	"	"	2
AD.274.	Fork end for control rod	"	"	2
	Washer plain 3/16"	"	"	2
	Taper pin 3/32" x 5/8"	"	"	3
	Nut $\frac{1}{4}$" BSF.	"	"	1
	Locknut 2 BA for link rod	"	"	1
HD.79.	Governor spring adjusting screw	"	"	1
HD.77.	Pin for fuel pump	"	"	1
	Split pin 1/16" dia x $\frac{3}{4}$" long	"	"	1
HD.220.	Governor thrust plate	"	"	1
	SECTION S.1. (16) CONTROLS FOR CONSTANT SPEED GOVERNOR R.H. ASSEMBLY. (Plate 4).			
HD.65.	Control bracket	"	"	1
HD.67.	Pump lever	"	"	1
HD.74.	Governor lever spindle	"	"	1
HD.69.	Governor lever	"	"	1
HD.82/A.	Governor link rod (RH and LH threads)	"	"	1
AD.345.	Amal joint for control rod RH thread	"	"	1
HD.77.	Pin for fuel pump	"	"	1
	Taper pin 3/32" x 5/8"	"	"	2
	Nut $\frac{1}{4}$" BSF.	"	"	1
HD.392.	Governor lever	"	"	1
HD.340.	Amal joint L.H. thread	"	"	1
	SECTION S.1. (17) CONTROLS FOR FULL RANGE GOVERNOR (Plate 4) AS FITTED ON ENGINES HDW UP TO CRANKCASE NO.5233 EXCEPTING CRANKCASE NO.5231 AND 5232 AND ON HDA ENGINES UP TO CRANKCASE NO. 1744.			
WD.496.	Control lever	"	"	1
AD.380/FR.	Washer for control lever	"	"	1
AD.518.	Trunnion for control lever cable	"	"	1
AD.629/FR.	Rack for control lever	"	"	1
WD.532.	Control plate	"	"	1
AD.630/FR.	Plunger for control rack	"	"	1
AD.375/FR.	Plunger knob	"	"	1
AD.370/FR.	Spring for control plunger	"	"	1
	Peg-control lever 1/8" dia x 3/16" long	"	"	1
M.2361.	Bracket for cable steady	"	"	1
M.2362.	Cable steady	"	"	1
	Nut $\frac{1}{4}$" BSF. for cable steady	"	"	1
	Washer plain $\frac{1}{4}$"	"	"	1

PART NO.	DESCRIPTION.	ENGINE. Mk.I.	ENGINE. Mk.II.	NO.OFF.
	SECTION S.1. (17) CONTROLS FOR FULL RANGE GOVERNOR (Plate 4) AS FITTED ON ENGINES HDW UP TO CRANKCASE NO.5233 EXCEPTING CRANKCASE NO.5231 AND 5232 AND ON HDA ENGINES UP TO CRANKCASE NO.1744. Continued.			
M.2548.	Bolt - control rack to bracket	"	"	1
M.1152.	Control cable	"	"	1
M.1151.	Nipple - control cable	"	"	1
AD.517.	Cable adjusting screw	"	"	1
	Locknut 3/8" whit.	"	"	1
HD.235.	Clip for cable	"	"	1
AD.373/FR.	Pivot pin for control lever	"	"	1
	Split pin 1/16" x 1" long	"	"	1
HD.226.	Control bracket LH	"	"	1
HD.224.	Control rack spring	"	"	2
HD.225.	Pin for control rack thimble	"	"	2
HD.236.	Link for cable	"	"	1
	SECTION S.1. (17A) CONTROLS FOR FULL RANGE GOVERNOR (Plate 4A) AS FITTED ON ENGINES HDW (MK.II) FROM CRANKCASE NO.5234 ALSO ON CRANKCASE NO.S.5231 AND 5232, AND ON HDA (MK.II) FROM CRANKCASE NO.1745.			
HD.476	Knob operating cable (pull to stop)		"	1
HD.453.	Cross shaft		"	1
Type 1500				
No.343.	Anderton circlip for HD.453		"	1
HD.457.	Cross shaft lever		"	1
HD.459.	Link rod		"	1
	2 BA Locknut for HD.459.		"	2
HD.458.	Governor lever		"	1
094-687LBS.	Spirol pin for HD.459		"	1
PG.35.	Ball joint for HD.458		"	2
HD.468.	Governor spindle		"	1
Type 1500				
No.343.	Anderton circlip for HD.468		"	1
HD.462.	Link		"	2
	3/16" o/d x $\frac{3}{4}$" long stainless steel pin for HD.462		"	2
	2 BA x 5/8" long hex. head bolt for HD.462		"	2
	2 BA nut for HD.462		"	2
	3/16" plain washer for HD.462		"	2
K.1036.	(was M.4548) Bolt		"	1
	$\frac{1}{4}$" UNF Nut		"	1
HD.454.	Governor operating lever		"	2
094-687LBS.	Spirol pin for RH lever only		"	1

PART NO.	DESCRIPTION.	ENGINE. Mk.I.	ENGINE. Mk.II.	NO.OFF.
	SECTION S.1. (17A) CONTROLS FOR FULL RANGE GOVERNOR (Plate 4A) AS FITTED ON ENGINES HDW.(MK.II) FROM CRANKCASE NO. 5234 ALSO ON CRANKCASE NO.S.5231 AND 5232, AND ON HDA (MK.II) FROM CRANKCASE NO.1745.(continued)			
HD.455.	Adjuster		"	1
094-687LBS.	Spirol pin for HD.455		"	1
HD.456.	Adjusting screw		"	1
HD.463.	Sliding cam		"	1
HD.464.	Pin		"	2
HD.465.	Control bracket		"	1
HD.433.	Governor linkage spring		"	1
PG.39.	Spring for "stop" control		"	1
HD.482.	Load stop, lever		"	1
094-687LBS.	Spirol pin for HD.482.		"	1
M.3105.	Arens control unit		"	1
HD.236.	was HD.460. Link and spring tab assembly		"	1
	FOR CONSTANT SPEED GOVERNOR ITEMS AS IN SECTION S.1.(17) EXCEPT THE FOLLOWING:			
HD.236.	Link and Spring Tab Assembly which are replaced by :-		"	1
HD.485.	Adjusting screw		"	1
	$\frac{1}{4}$" UNC nut		"	2
	SECTION S.1. (18) LUBRICATING OIL PUMP ASSEMBLY (Plate 9).			
HD.170.	Oil pump body	"	"	1
HD.171.	Oil pump driving gear	"	"	1
AD.118.	Oil pump sprocket	"	"	1
AD.249.	Oil pump backplate	"	"	1
HD.172.	Oil pump idler gear	"	"	1
HD.173.	Oil pump idler gear pin	"	"	1
HD.119.	Oil pump driving chain	"	"	1
HD.188.	Oil pump bush	"	"	1
HD.174.	Bolt - oil pump to crankcase	"	"	4
No.2.	Split taper pin	"	"	1
	SECTION S.1. (19) FULL FLOW LUBRICATING OIL FILTER UP TO ENGINE CRANKCASE NOS. HDA.1900 AND HDW.5286.			
153/847.	Oil filter complete	"	"	1
HD.299/A.	Oil filter head	"	"	1
AC.30B.	Oil filter element	"	"	1

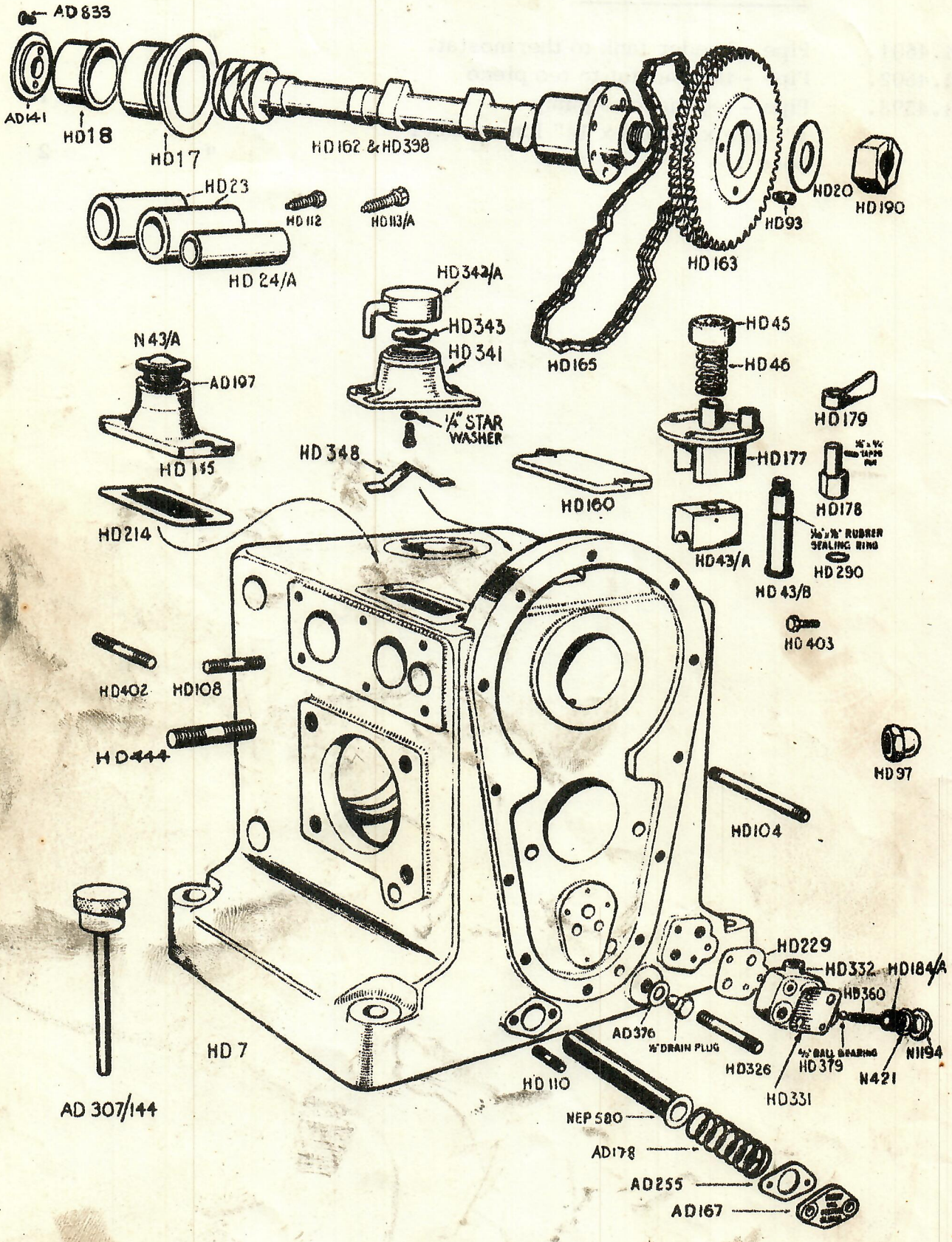
PART NO.	DESCRIPTION.	ENGINE. Mk.I.	Mk.II.	NO.OFF.
	FULL FLOW LUBRICATING OIL FILTER, FROM ENGINE CRANKCASE NOS. HDA.1901 AND HDW.5287.			
M.5383 or S. 803.	Lubricating oil filter		"	1
HD.483.	Oil filter head		"	1
HD.484.	Adaptor		"	1
	5/16" UNC x 1¾" long cap head screw		"	1
	5/16" UNC x 1¼" long cap head screw		"	1
	SECTION S.1.(20) LUBRICATING OIL PRESSURE GAUGE ASSEMBLY (Plate 9).			
WD.442.	Oil pressure gauge	"	"	1
HD.197A.	Oil pressure gauge bracket	"	"	1
HD.126B.	Oil pressure gauge pipe	"	"	1
Z.24.	Union nut for oil pressure gauge pipe	"	"	1
Z.2.	Sleeve-oil pressure gauge pipe	"	"	1
	Nut and nipple 1/8" gas.	"	"	1
	SECTION S.1.(21) AIR FILTER ASSEMBLY (Plate 9).			
CUA.616.	Air filter complete	"	"	2
A.616.	Air filter element	"	"	2
M.2383.	Air filter pipe	"	"	2
WD.580.	Air filter gasket	"	"	2
	Air filter rubber sleeve	"	"	2
WD.560.	Air filter pipe flange	"	"	2
	SECTION S.1.(22) FUEL PUMP AND FUEL INJECTION ASSEMBLIES (Plate 7).			
WD.613.CAV.	Fuel pump complete (BPF/1A65AS6251)	"		2
HD.413.CAV.	Fuel pump complete (BPF/1A70PS6568)	as per		2
HD.475.Bryce.	Fuel pump complete (A1AA70/6S292)	technical data section 1(a)		2
HD.181.	Fuel injector nozzle holder	"	"	2
WD.615	Fuel injector nozzle	"	"	2
AD.199.	Fuel injector nozzle washer replaces HD.149	"	"	2
HD.260.	Leak off pipe	"	"	2
	SECTION S.1.(23) FUEL FILTER ASSEMBLY (Plate 8).			
H.2007/S.845.	Fuel filter complete	"	"	1
S.845.	Fuel filter element	"	"	1
HD.195/A.	Fuel filter bracket	"	"	1
HD.122/B.	Fuel pipe to fuel pump (plate 7)	"	"	1
N.374.	Banjo bolt ¼" gas. short	"	"	2
M.5414.	Banjo bolt ¼" gas. long	"	"	1
N.422.	C.&A. Washer	"	"	6

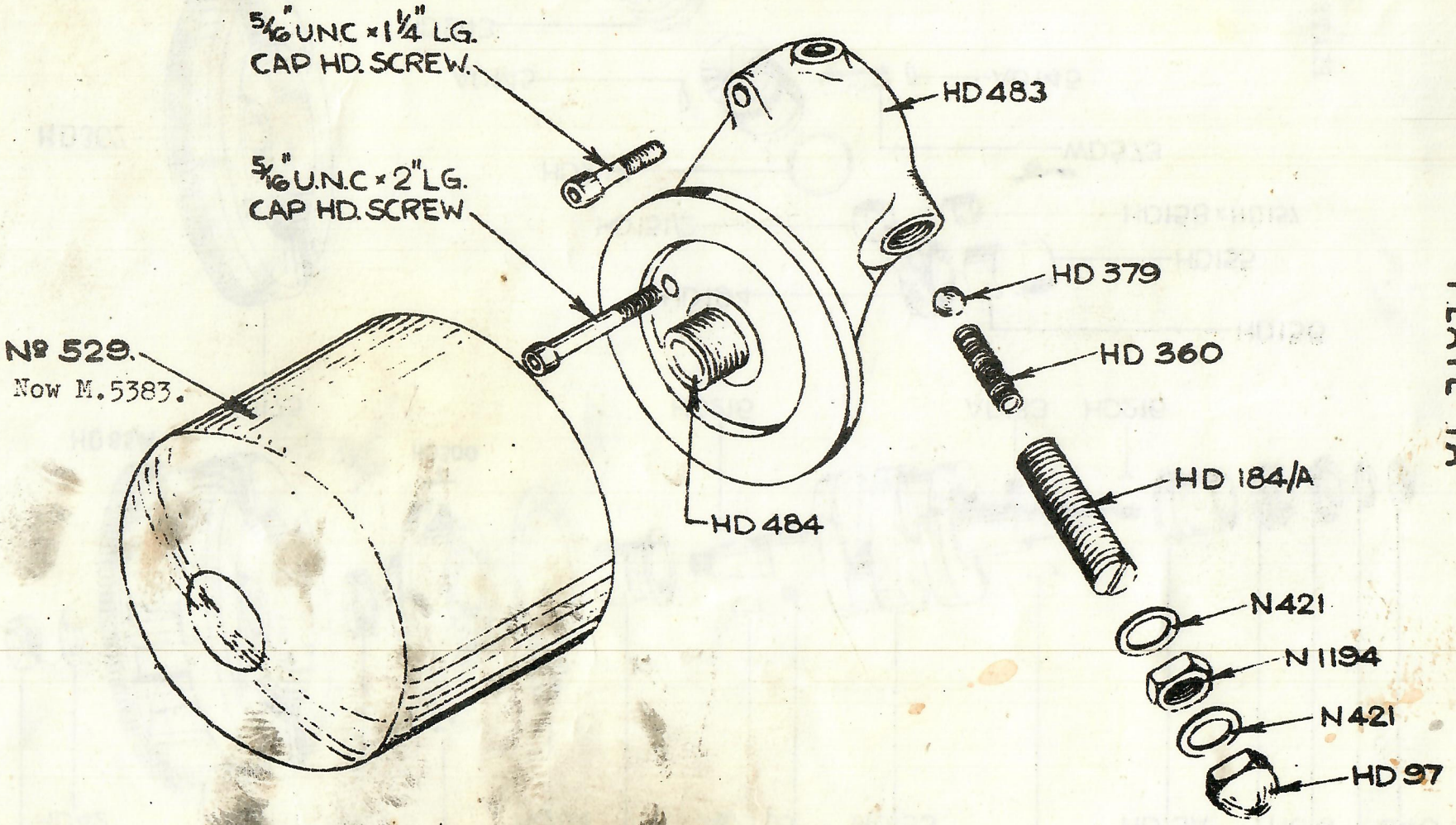
PART NO.	DESCRIPTION.	ENGINE. Mk.I.	Mk.II.	NO.OFF.
	SECTION S.1.(24) FUEL LIFT PUMP AND FUEL PIPE (Plate 8) and TACHO DRIVE.			
HD.218.	Fuel lift pump cover	"	"	1
7971329.	Fuel lift pump complete	"	"	1
HD.333.	Fuel pipe - fuel pump to filter	"	"	1
M.1477.	Fuel pump gasket	"	"	1
	Fuel lift pump Allen screws	"	"	2
M.3224.	Cam nut Tacho drive	"	"	1
HD.187.	Cam nut standard	"	"	1
M.3225.	Oldham coupling	"	"	1
M.3226.	Adaptor cover	"	"	1
	SECTION S.1.(25) EXHAUST SYSTEM.			
M.2383/A.	Exhaust pipe (HDA)	"	"	2
M.4182.	Y Exhaust pipe starboard)	"	"	1
M.4181.	Y Exhaust pipe port) H.R.G.	"	"	1
HD.206.	Exhaust stub pipe R.H.	"	"	1
HD.206.	Exhaust stub pipe L.H.	"	"	1
HD.246.	Silencer with clips Burgess Dry type		"	2
WD.580.	Joint washer - exhaust and inlet flanges		"	4
WD.560.	Exhaust and inlet flanges	"	"	4
M.3061.	Silencer water-cooled	"	"	1
M.1578.	Pepper pot silencer	"	"	2
	SECTION S.1. (26) FUEL PIPES.			
HD.122B.	Fuel pipe filter to fuel pumps	"	"	1
HD.192.	Fuel pipe to R.H. injector	"	"	1
HD.193.	Fuel pipe to L.H. injector	"	"	1
HD.259.	Fuel pipe - fuel pump to filter	"	"	1
N.414.	Banjo for fuel pump to filter	"	"	1
	SECTION S.1.(27) ENGINE COWLING ASSEMBLY, AIR-COOLED.			
HD.83.	Cowling complete	"	"	1
HD.83/10.	Cowling end piece	"	"	1
HD.83/11.	Cowling upper side piece, rear half L.H.	"	"	1
HD.83/12.	Cowling upper side piece, rear half R.H.	"	"	1
HD.83/4.	Cowling upper side piece, front half L.H.	"	"	1
HD.83/5.	Cowling upper side piece, front half R.H.	"	"	1
HD.83/1.	Cowling side piece, lower half	"	"	2
HD.83/13.	Main cowling, end cover L.H.	"	"	1
HD.83/14.	Main cowling, end cover R.H.	"	"	1
HD.83/6.	Cowling baffle L.H.	"	"	1
HD.83/7.	Cowling baffle R.H.	"	"	1
HD.83/15.	Deflector	"	"	1

PART NO.	DESCRIPTION.	ENGINE. Mk.I.	ENGINE. Mk.II.	NO.OFF.
	SECTION S.1.(28) "JABSCO" WATER CIRCULATING PUMP ASSEMBLY (Plate 4a) FITTED ON ENGINES FROM CRANKCASE NO.5234, ALSO ON CRANKCASE NOS.5231 AND 5232 (AC30 FILTER).			
11000.	"Jabsco" pump complete	"		1
	$\frac{1}{4}$" UNC x $\frac{3}{4}$" cap head screw	"		2
	$\frac{1}{4}$" spring washer	"		2
11004.	Pump body	"		1
4908.	Joint pump cover	"		1
9405.	Pump cover	"		1
11007.	Pump shaft	"		1
673-08.	Pump impellor	"		1
SP.2701-04.	Oil seals	"		2
SP.2000-23.	'O' ring	"		1
SP.1002-09.	Set screws	"		6
SP.1002-01.	Cam screws	"		1
2441.	Cam.	"		1
M.4597.	Pipe - pump to pressure chamber	"		1
M.4586.	Pressure chamber	"		1
M.4585.	Jet of pressure chamber	"		2
M.4595.	Pipe - pressure chamber to No.2 cylinder	"		1
M.4596.	Pipe-pressure chamber to No.1 cylinder	"		1
M.4599.	Pipe-header tank to No.2 cylinder (outlet)	"		1
M.4600.	Pipe-header tank to No.1 cylinder	"		1
M.4592.	Header tank	"		1
	$\frac{1}{2}$" BSP single ended union	"		3
	$\frac{1}{2}$" BSP fibre washer	"		3
	SECTION S.1.(28) "JABSCO" WATER CIRCULATING PUMP ASSEMBLY (Plate 4a) WATER PIPE VARIANCE WHEN M.5383 LUBRICATING OIL (SPIN OFF TYPE) FILTER IS FITTED.			
M.5200.	Pipe pump to pressure chamber	"		1
M.5195.	Pipe pressure chamber to No.2 cylinder inlet	"		1
M.5193.	Pipe pressure chamber to No.1 cylinder inlet	"		1
	ADDITIONAL PARTS WHEN THERMOSTAT IS FITTED			
1/20 140°F.	Amot thermostat (sea water cooling)	"		1
1/20 160°F.	Amot thermostat (fresh water cooling)	"		1
	Thermostat bracket	"		1
	$\frac{1}{4}$" UNC x $\frac{3}{4}$" long bolt	"		2
	$\frac{1}{4}$" UNC nut	"		2
	$\frac{1}{4}$" Spring washer	"		2
	$\frac{1}{2}$" BSP single ended union	"		6

PART NO.	DESCRIPTION.	ENGINE. Mk.I.	ENGINE. Mk.II.	NO.OFF.
	ADDITIONAL PARTS WHEN THERMOSTAT IS FITTED (Continued).			
M.4601.	Pipe - header tank to thermostat.		"	1
M.4602.	Pipe - thermostat to tee piece		"	1
M.4598.	Pipe - tee piece to pump		"	1
	$\frac{1}{2}$" bore x $\frac{3}{4}$" o/d x $1\frac{1}{2}$" long rubber hose		"	2

PLATE 1


AD 833
AD141
HD18
HD17
HD162 & HD398
HD23
HD112
HD113/A
HD 24/A
HD342/A
HD343
HD 341
¼" STAR WASHER
N43/A
AD197
HD 195
HD 348
HD214
HD165
HD 45
HD 46
HD179
HD177
HD160
HD178
HD43/A
HD 43/B
HD 290
HD 403
HD402
HD108
HD444
HD 97
HD104
HD 7
AD 307/144
HD229
HD332
HD184/A
HD360
AD376
½" DRAIN PLUG
HD326
HD379
N1194
N421
HD331
HD 110
NEP 580
AD178
AD255
AD167



COMPLETE ASSEMBLY M.5407.

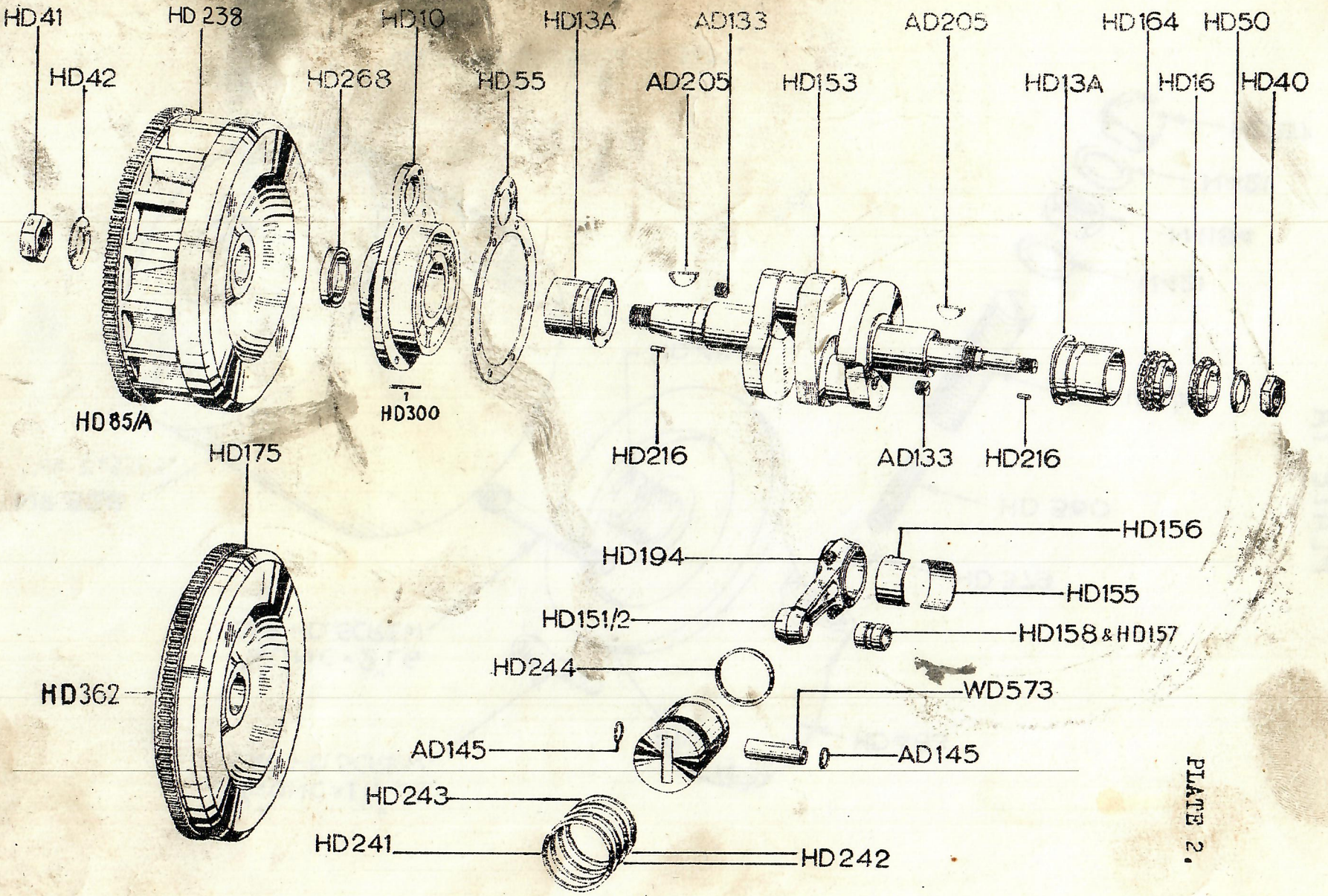
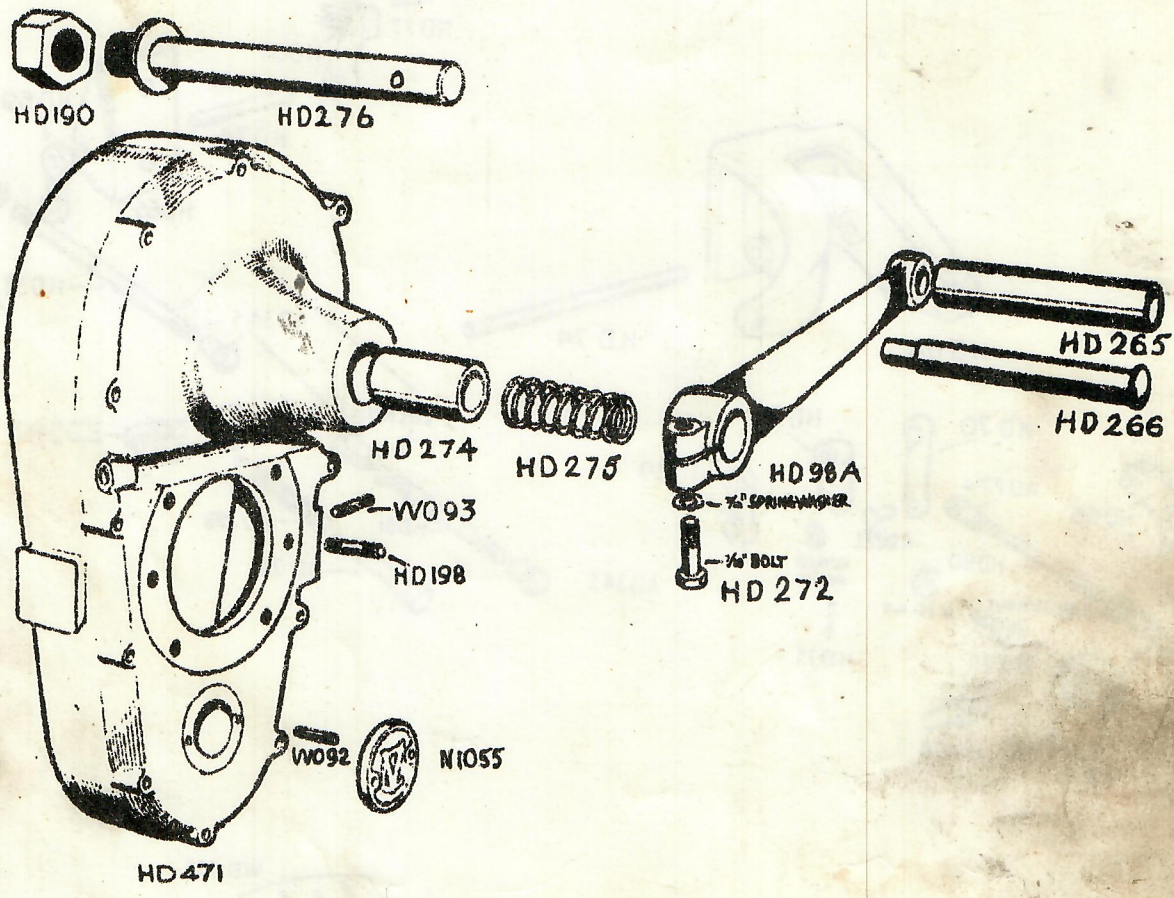

HD41
HD42
HD238
HD85/A
HD268
HD10
HD300
HD55
HD13A
HD216
AD133
AD205
HD153
AD133
AD205
HD216
HD13A
HD164
HD16
HD50
HD40
HD175
HD362
HD194
HD156
HD155
HD151/2
HD158 & HD157
HD244
WD573
AD145
AD145
HD243
HD241
HD242

PLATE 2.

PLATE 3A


HD190
HD276
HD274
HD275
HD265
HD266
HD98A
HD272
WO93
HD198
WO92
N1055
HD471

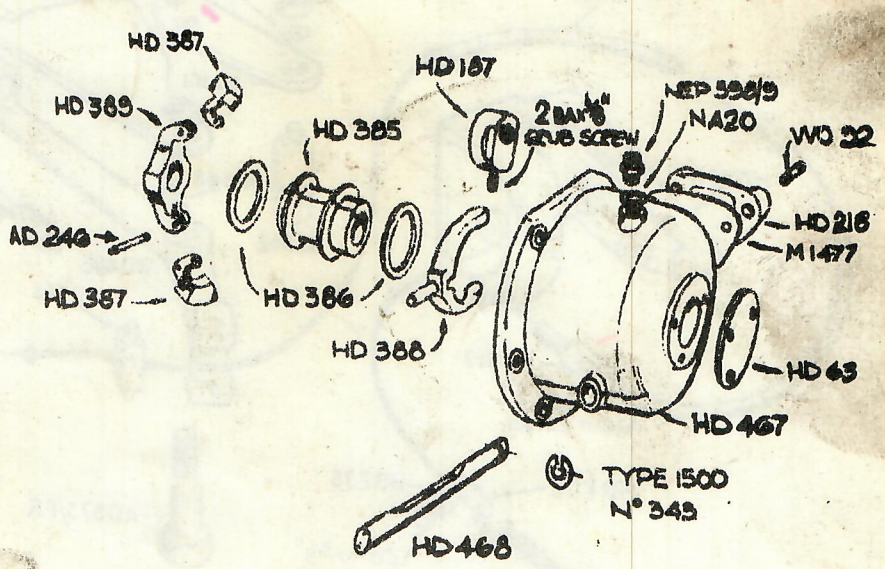
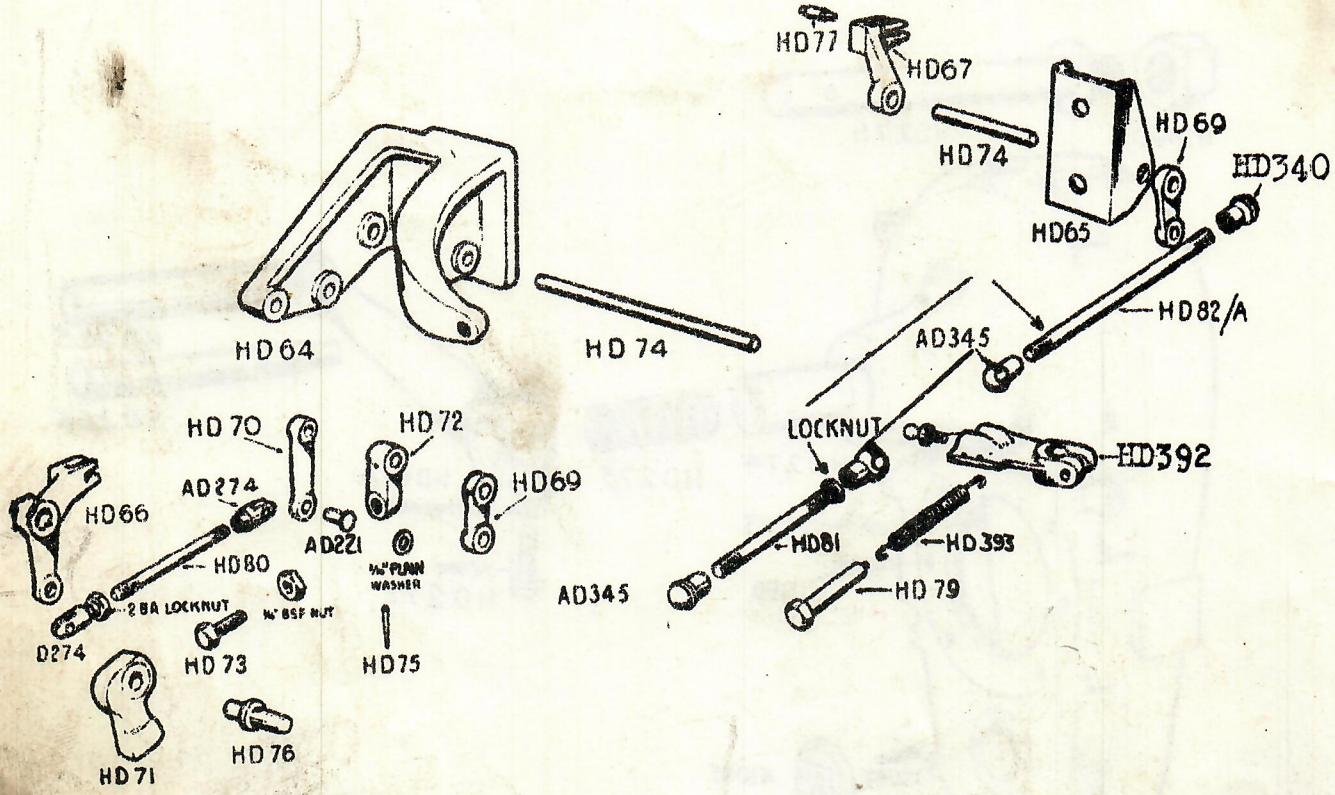

HD387
HD389
HD385
HD187
2 BA x ⅜" GRUB SCREW
NEP 336/9
NA20
WO 32
HD216
M1477
AD 240
HD387
HD386
HD388
HD63
HD467
TYPE 1500
N° 345
HD468

PLATE 4


HD77
HD67
HD74
HD69
HD340
HD65
HD64
HD74
HD82/A
AD345
LOCKNUT
HD392
HD70
HD72
HD69
HD66
AD274
AD221
HD81
HD393
HD80
AD345
HD79
2BA LOCKNUT
D274
HD73
HD75
HD71
HD76

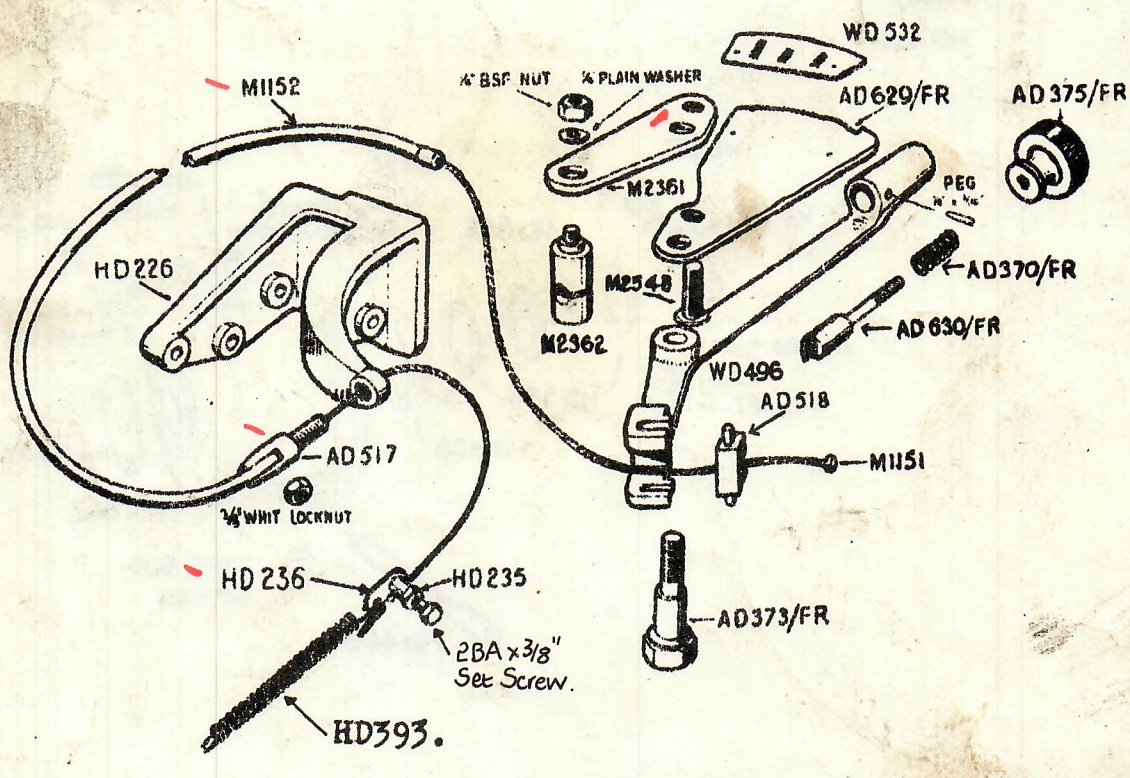
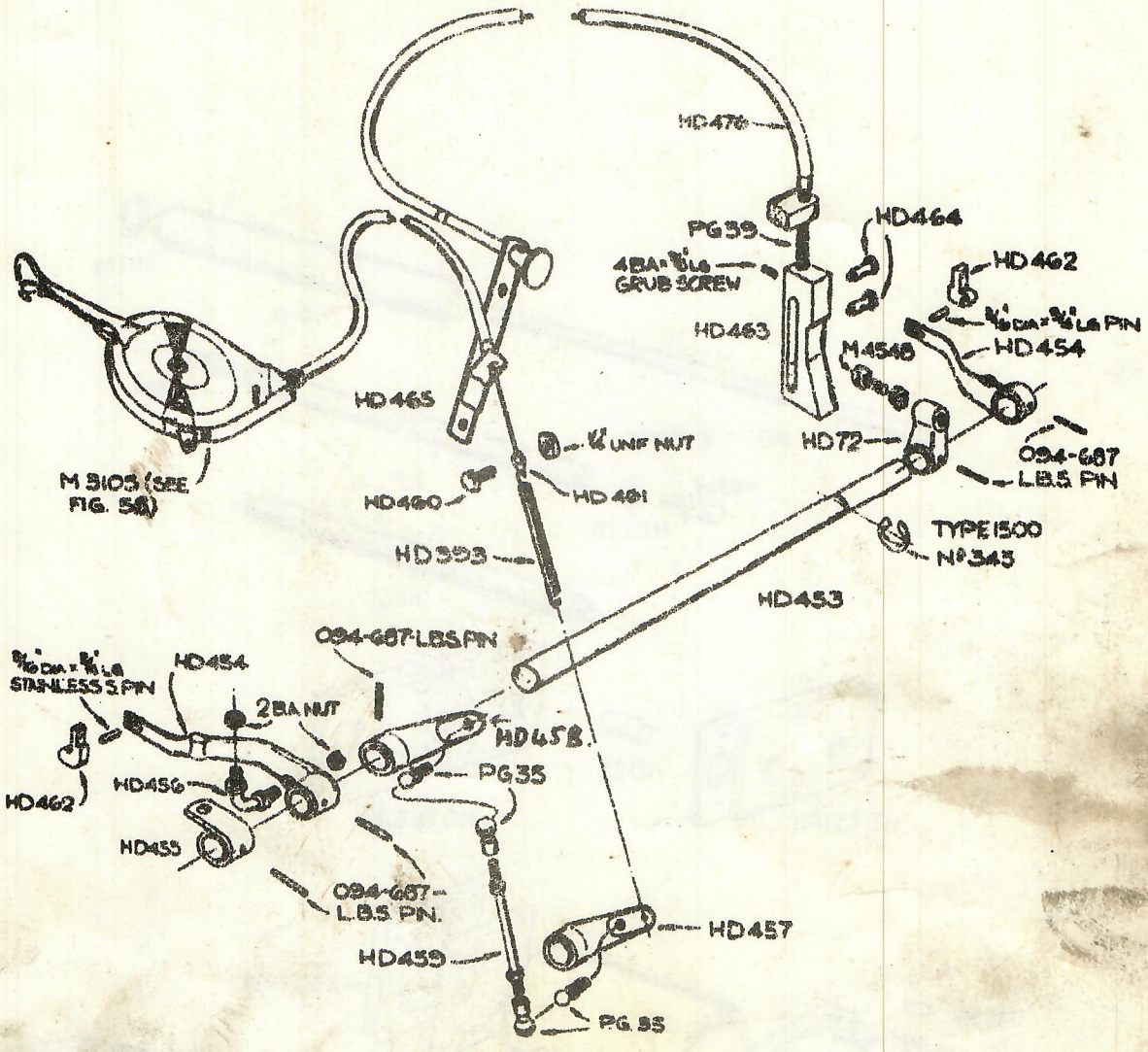

WD532
M1152
AD629/FR
AD375/FR
M2361
PEG
HD226
M2548
AD370/FR
M2362
AD630/FR
WD496
AD518
AD517
M1151
HD236
HD235
AD373/FR
2BA x 3/8" Set Screw.
HD393.

PLATE 4A


HD476
PG39
HD464
4BA-⅜Lg GRUB SCREW
HD462
⅛DIA-⅝Lg PIN
HD463
M4548
HD454
HD465
HD72
094-687 L.B.S PIN
M 3103 (SEE FIG. 58)
¼ UNF NUT
HD460
HD461
TYPE 1500 N°345
HD393
HD453
094-687 L.B.S PIN
⅛DIA-⅝Lg STAINLESS S. PIN
HD454
2BA NUT
HD458
HD462
HD456
PG35
HD455
094-687 L.B.S PIN.
HD457
HD459
PG. 35

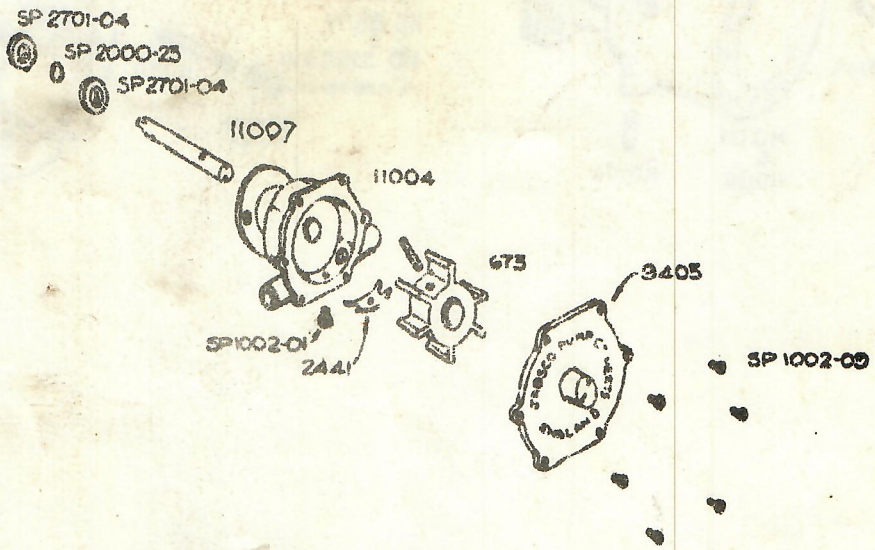

SP 2701-04
SP 2000-25
SP 2701-04
11007
11004
673
3405
SP1002-01
2441
SP 1002-09

PLATE 5

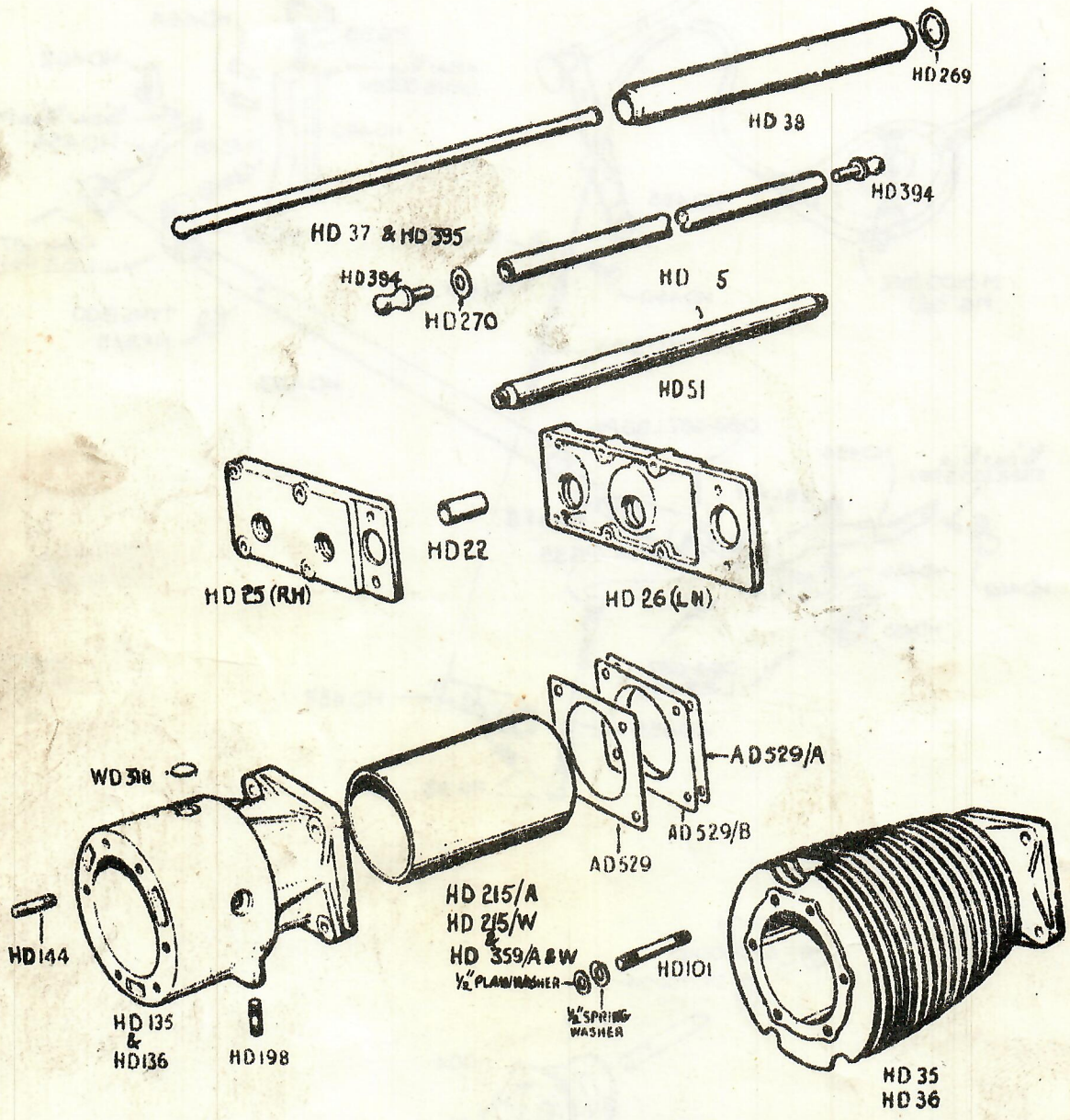

HD 269
HD 38
HD 394
HD 37 & HD 395
HD 394
HD 270
HD 5
HD 51
HD 25 (RH)
HD 22
HD 26 (LH)
AD 529/A
AD 529/B
AD 529
WD 318
HD 144
HD 215/A
HD 215/W
&
HD 359/A & W
½" PLAIN WASHER
½" SPRING WASHER
HD 101
HD 135
&
HD 136
HD 198
HD 35
HD 36

PLATE 6

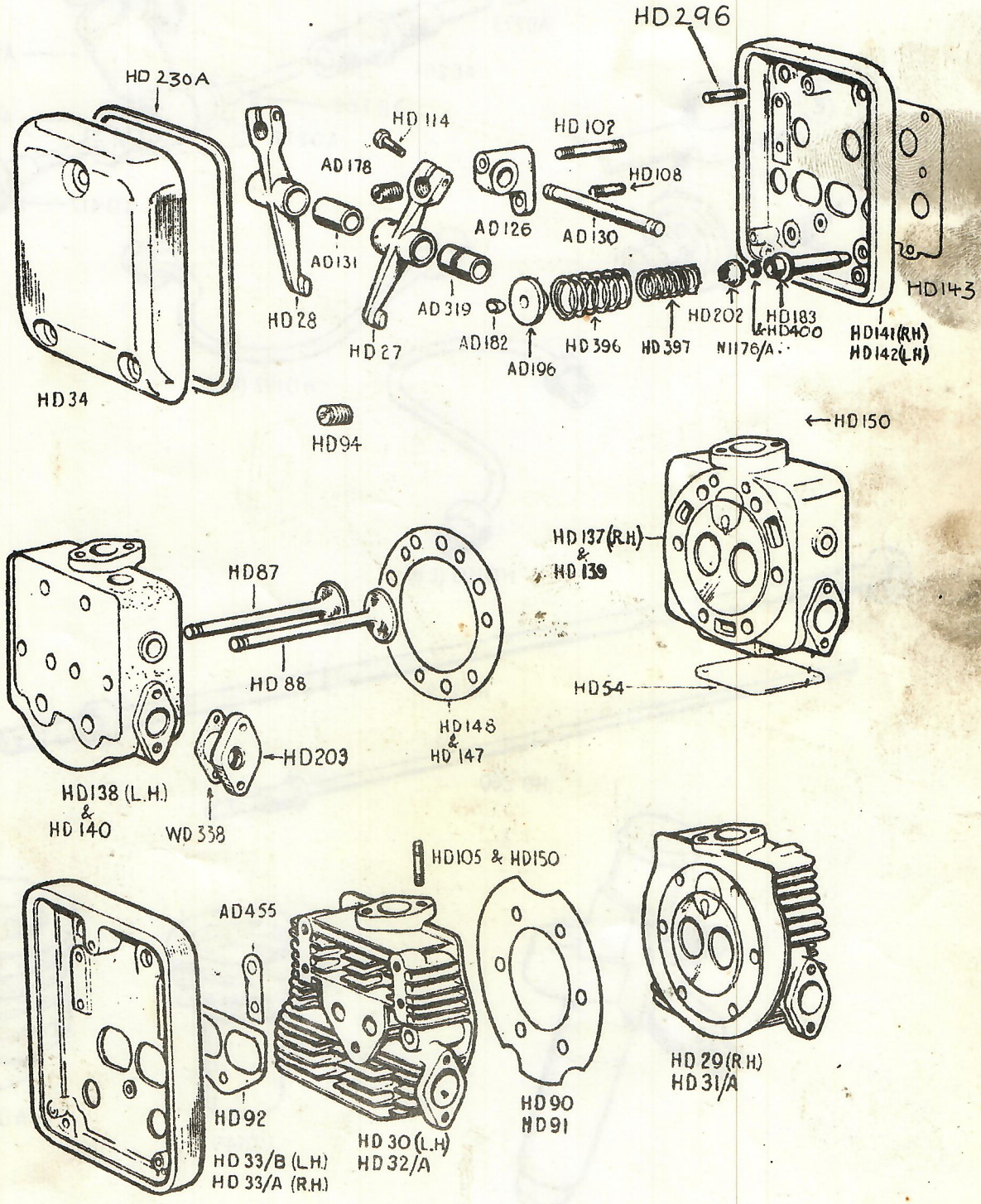

HD 296
HD 230A
HD 114
HD 102
AD 178
HD108
AD 126
AD 130
AD 131
HD 28
HD 27
AD 319
HD143
HD202
HD183
& HD400
HD141(RH)
HD142(LH)
AD182
AD196
HD 396
HD 397
N1176/A
HD 34
HD94
HD150
HD137(R.H)
&
HD 139
HD87
HD 88
HD54
HD148
&
HD 147
HD203
HD138 (L.H.)
&
HD 140
WD 338
HD105 & HD150
AD455
HD92
HD 33/B (L.H.)
HD 33/A (R.H.)
HD 30 (L.H)
HD 32/A
HD90
HD91
HD 29(R.H)
HD 31/A

PLATE 7.

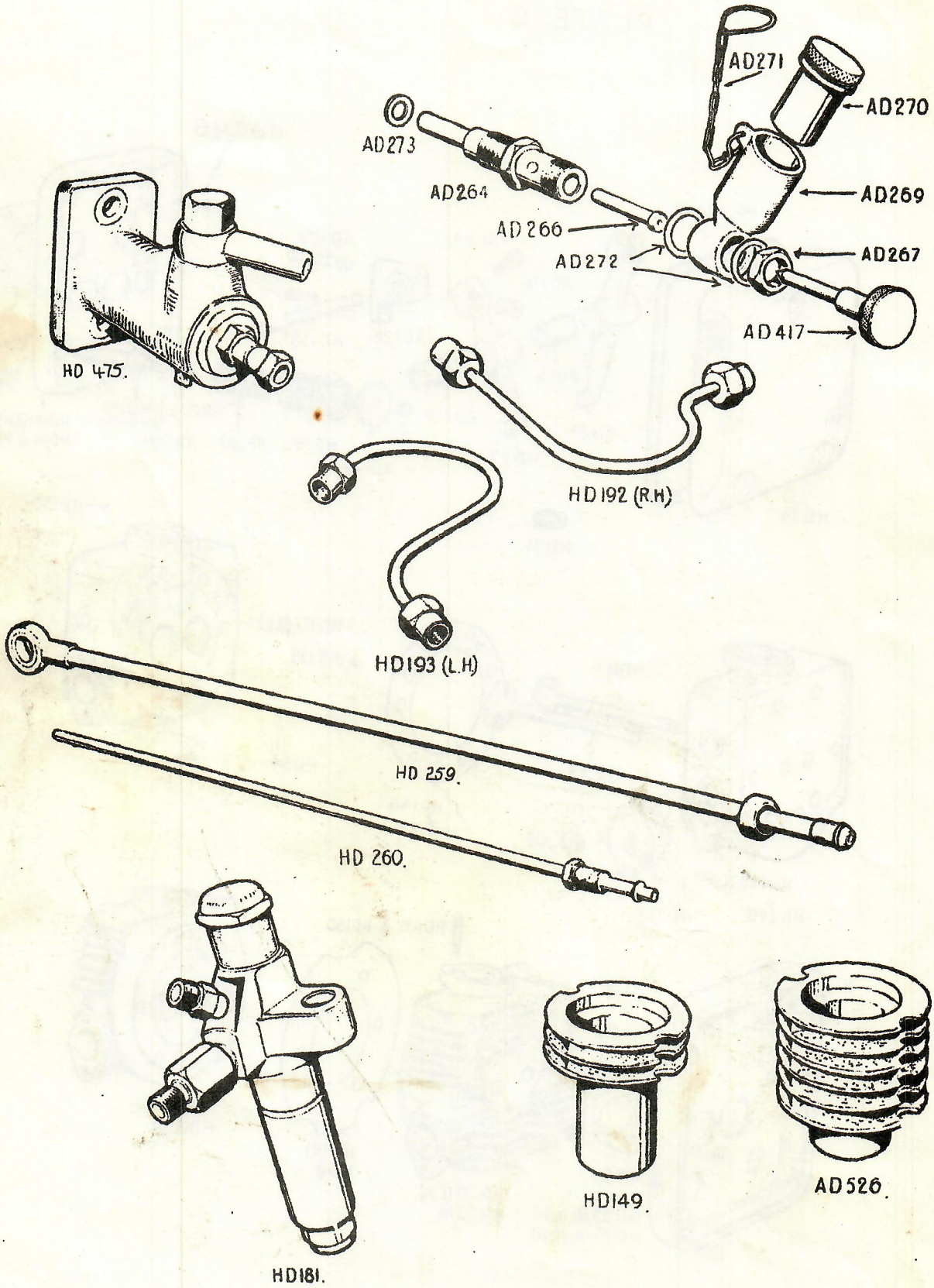

AD271
AD270
AD273
AD264
AD269
AD266
AD267
AD272
AD417
HD 475.
HD192 (R.H)
HD193 (L.H)
HD 259.
HD 260.
HD181.
HD149.
AD526.

PLATE 8

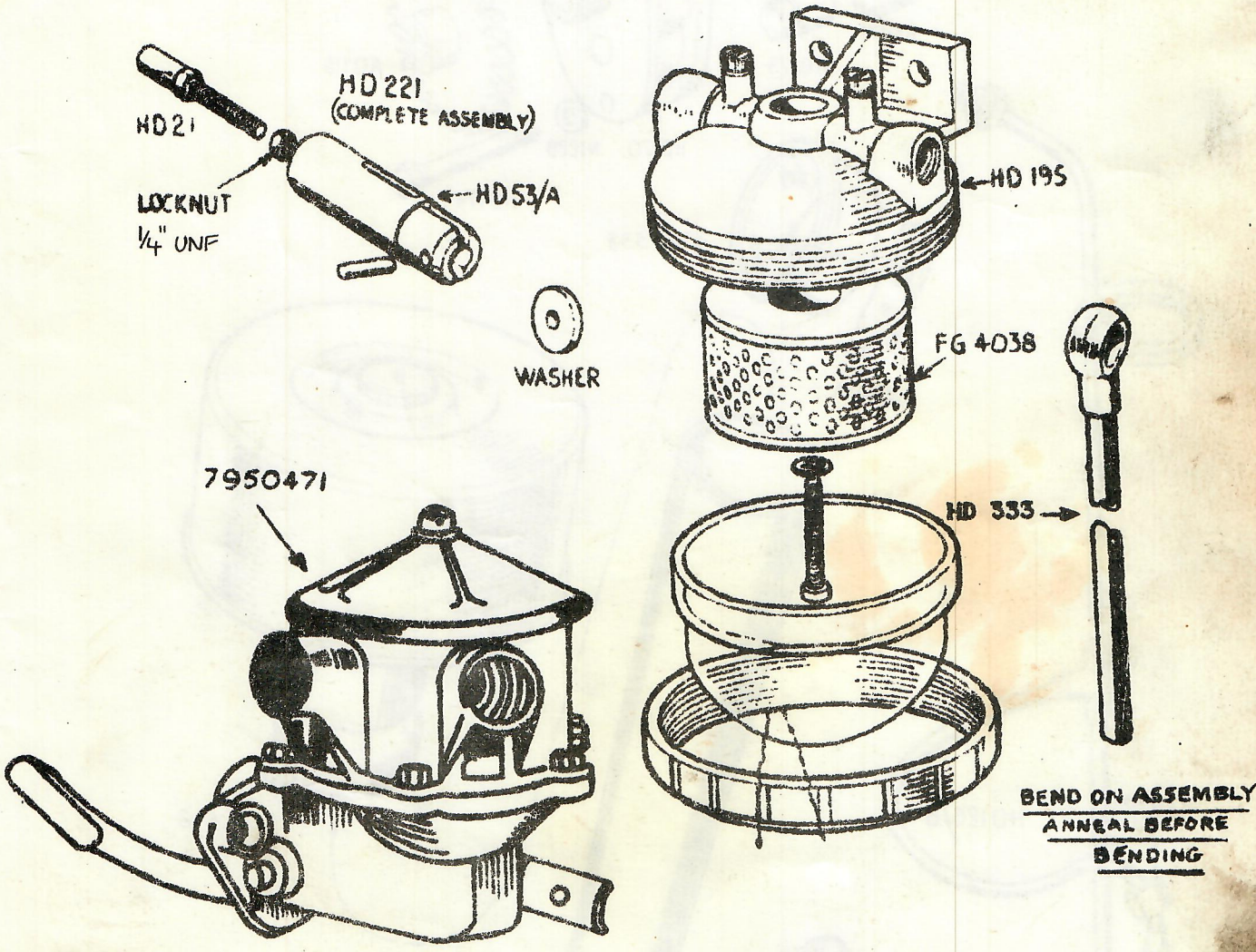
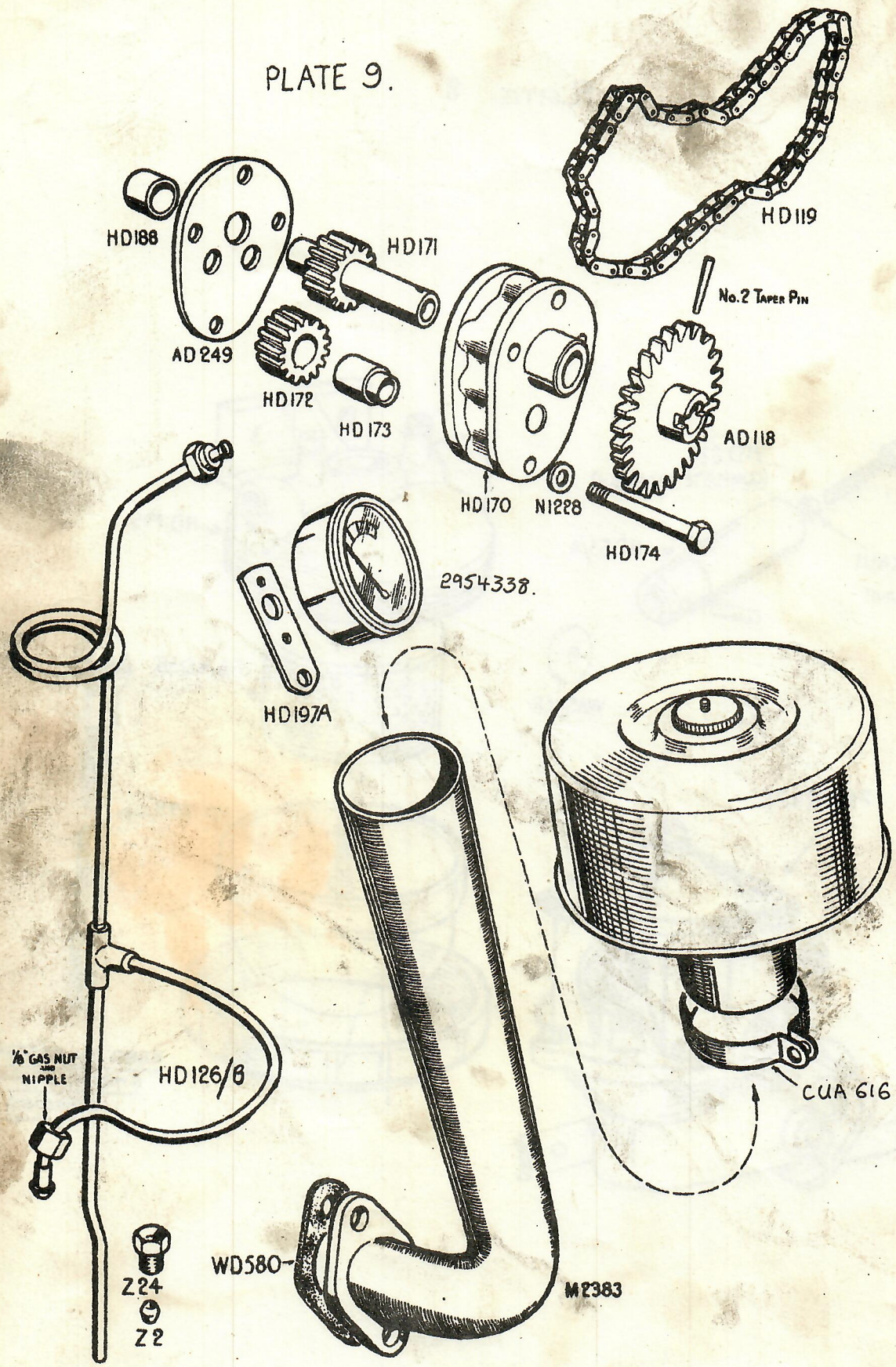
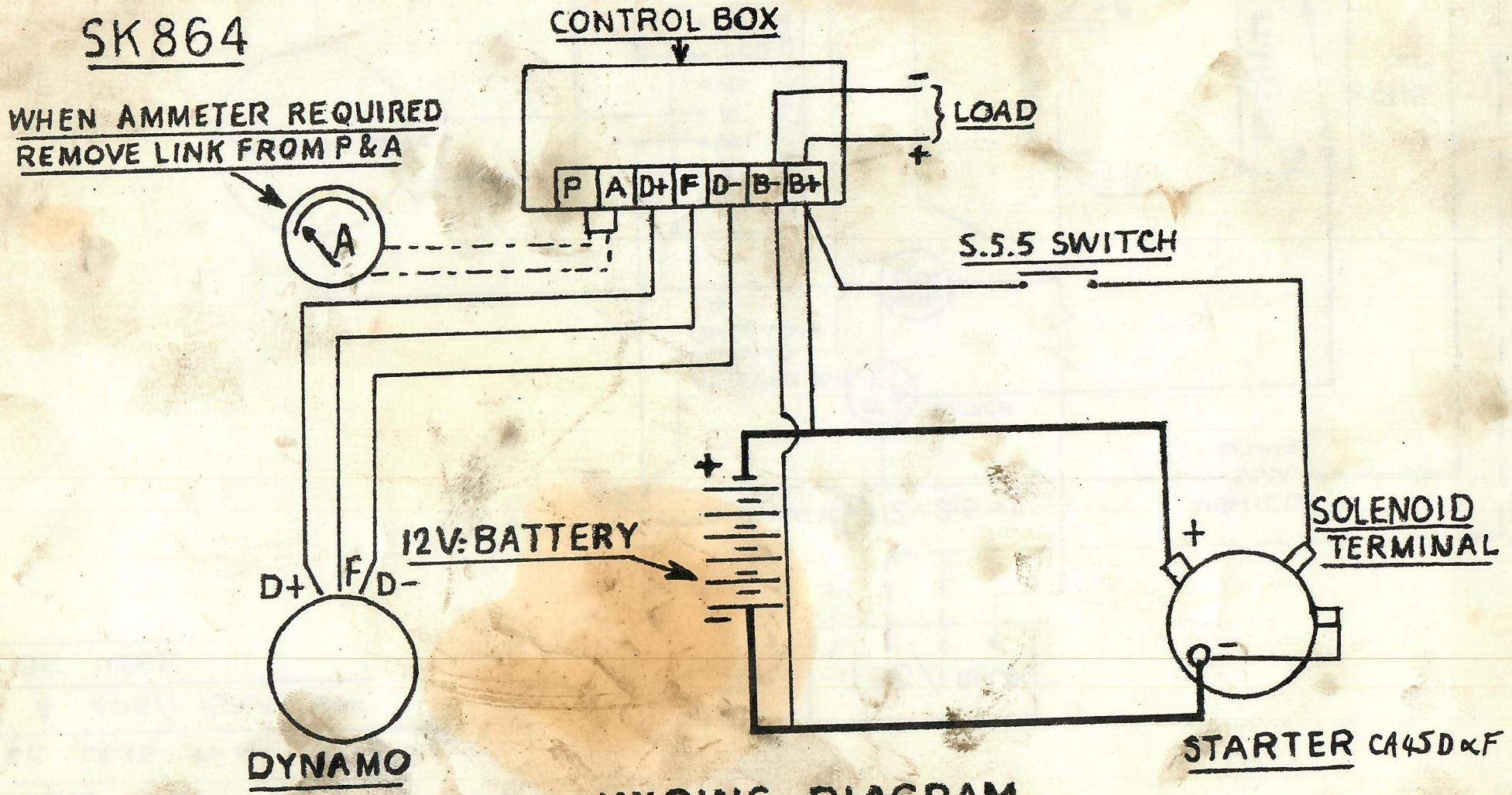

HD 221
(COMPLETE ASSEMBLY)
HD 21
LOCKNUT
1/4" UNF
HD 53/A
WASHER
HD 195
FG 4038
HD 333
7950471
BEND ON ASSEMBLY
ANNEAL BEFORE
BENDING

PLATE 9.

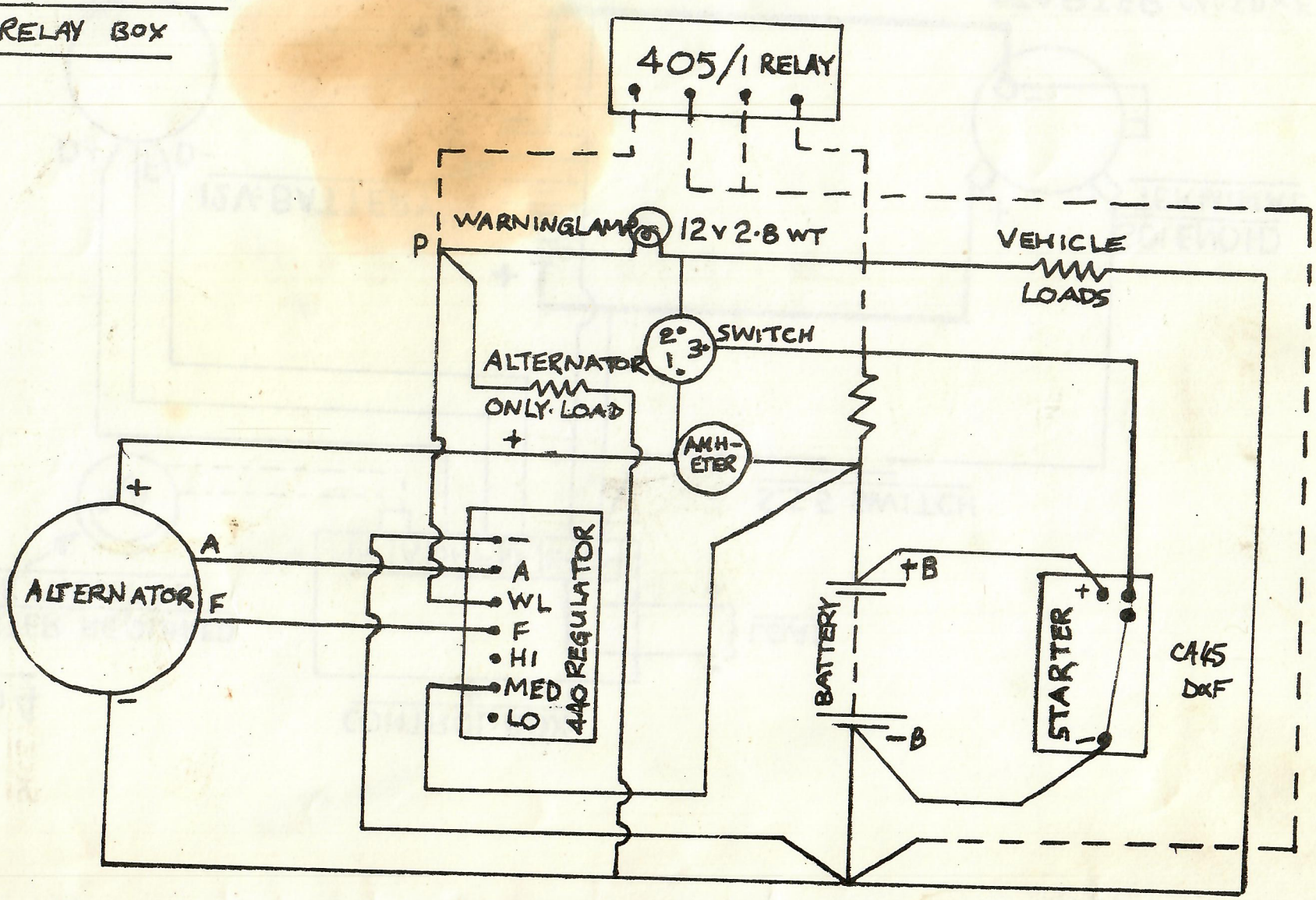

HD188
HD171
AD 249
HD172
HD 173
HD119
No. 2 Taper Pin
AD118
HD170
N1228
HD174
2954338.
HD197A
⅛" GAS NUT AND NIPPLE
HD126/6
CUA 616
WD580
M2383
Z24
Z2



WIRING DIAGRAM

THE CONTINUOUS CURRENT SUPPLIED FOR ALTERNATOR ONLY LOADS ACROSS POINTS P & B MUST BE LESS THAN 5 AMPS; IF NOT, A 405/1 RELAY BOX MUST BE USED

SK,1142. AC5 12V. ALTERNATOR WIRING DIAGRAM.



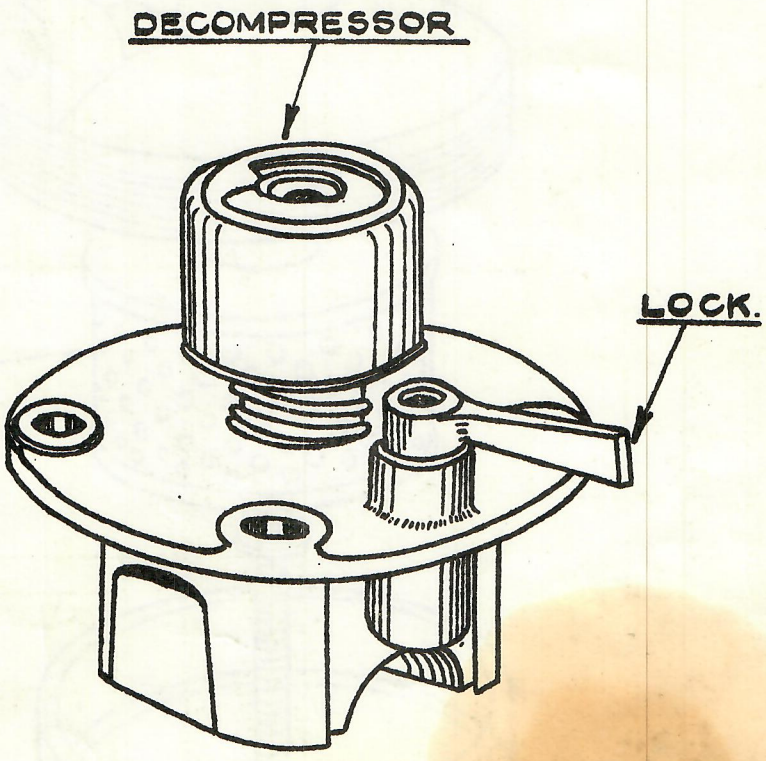


FIG:2.

SKETCH OF DECOMPRESSOR - SHOWING OPERATION.

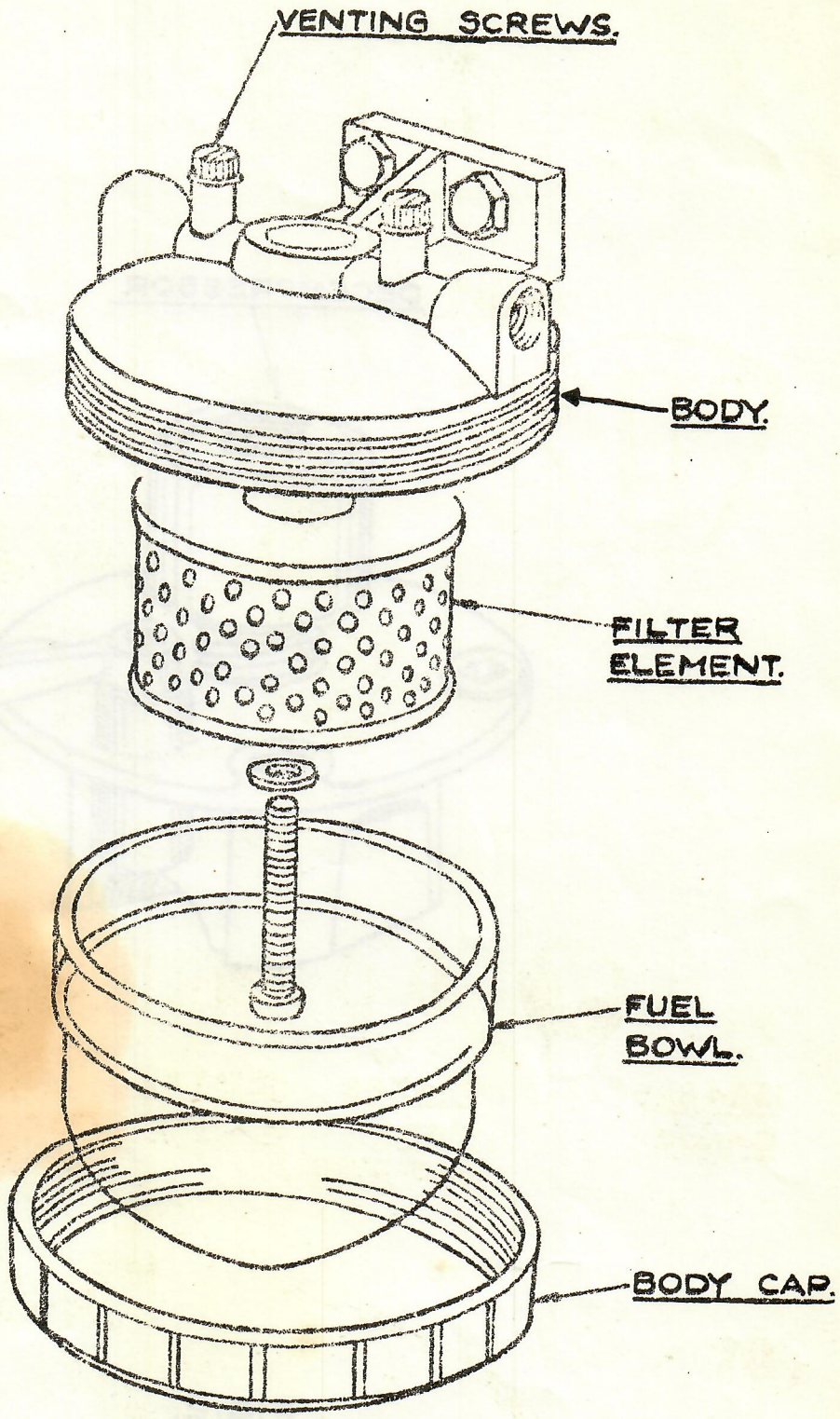


FIG: 3.

COOPER FUEL FILTER. N.C.B.

H.2007 FILTER COMMERCIAL.

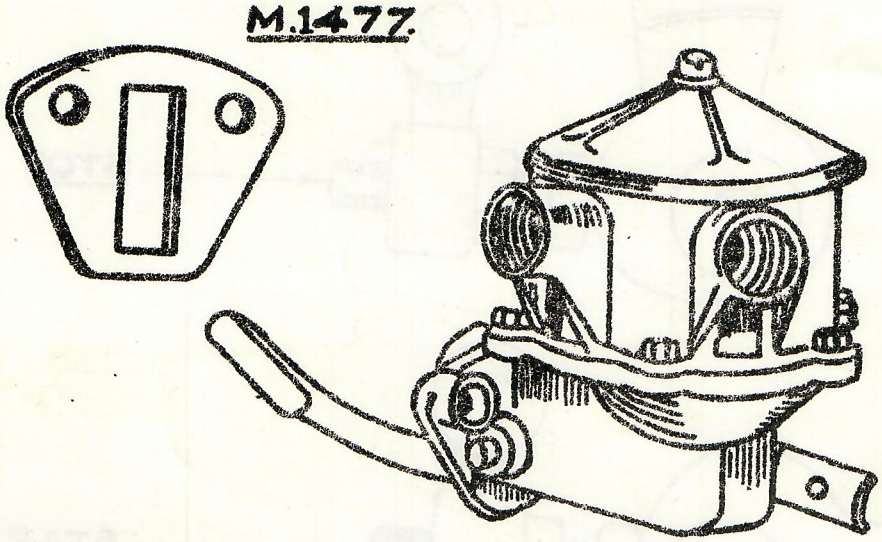


FIG: 4.

A.C FUEL LIFT PUMP.

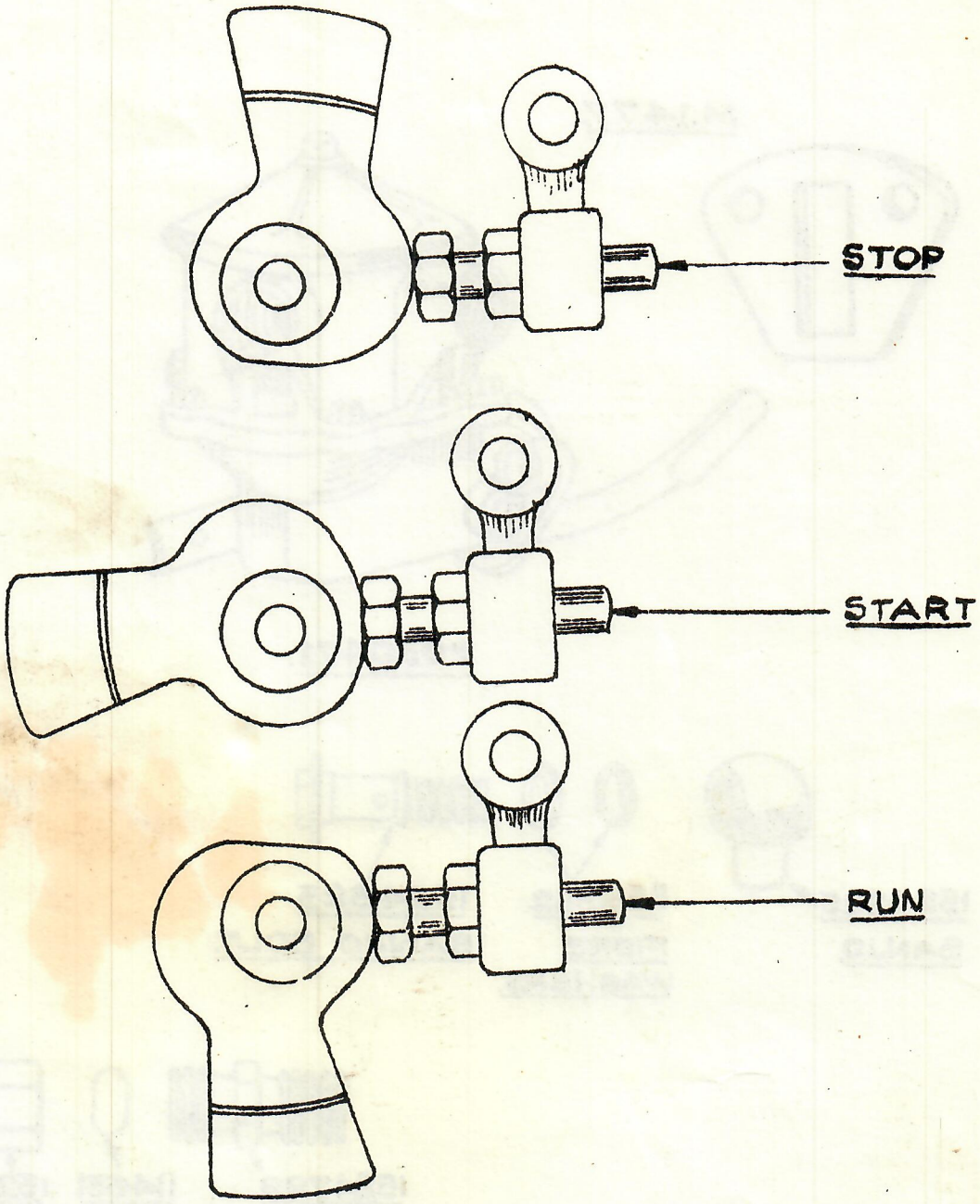


FIG. 5

INJECTION CONTROL CAM.

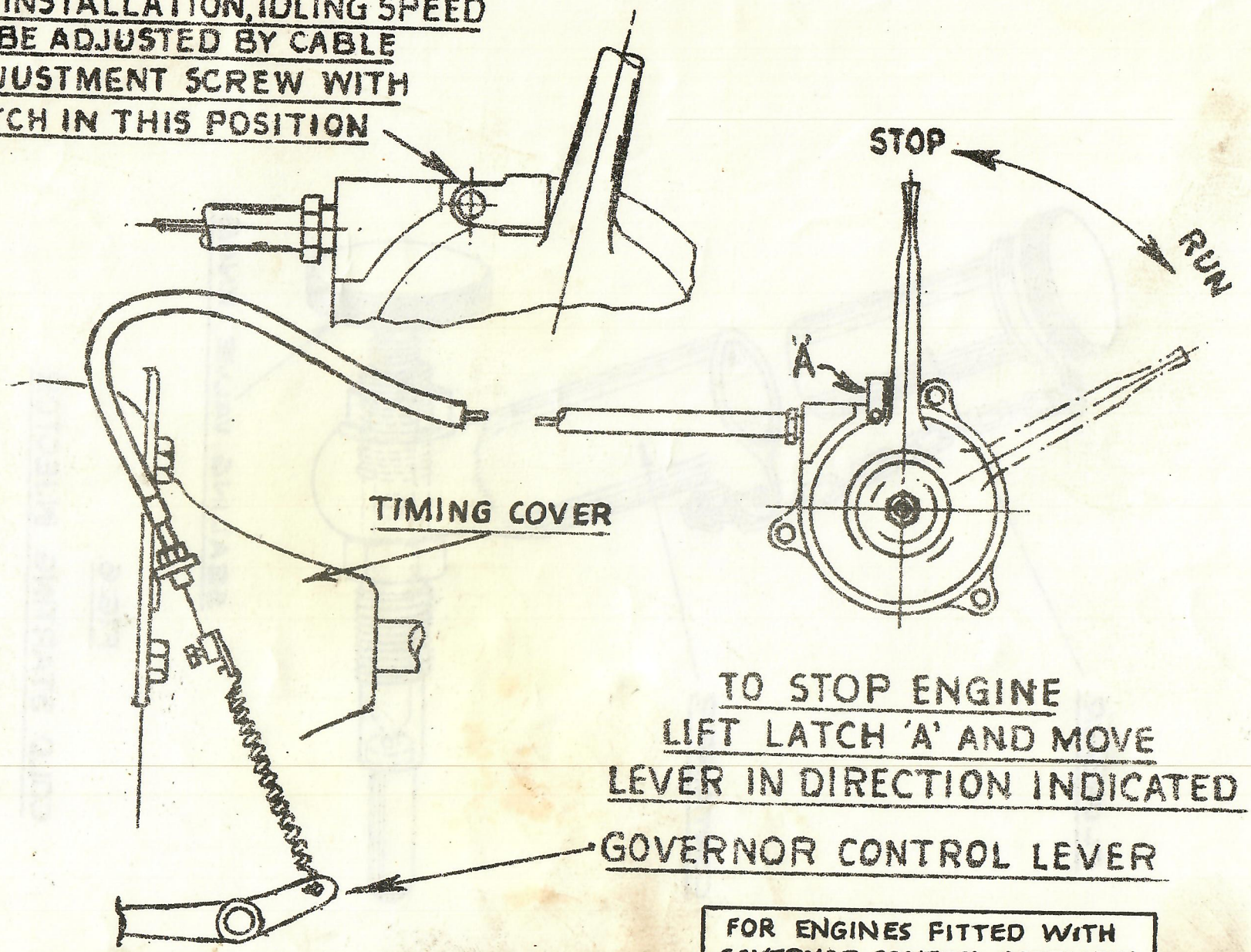


FIG: 5B

FOR ENGINES FITTED WITH GOVERNOR CONTROL ASSEMBLY AS SHOWN ON PLATE 4A.

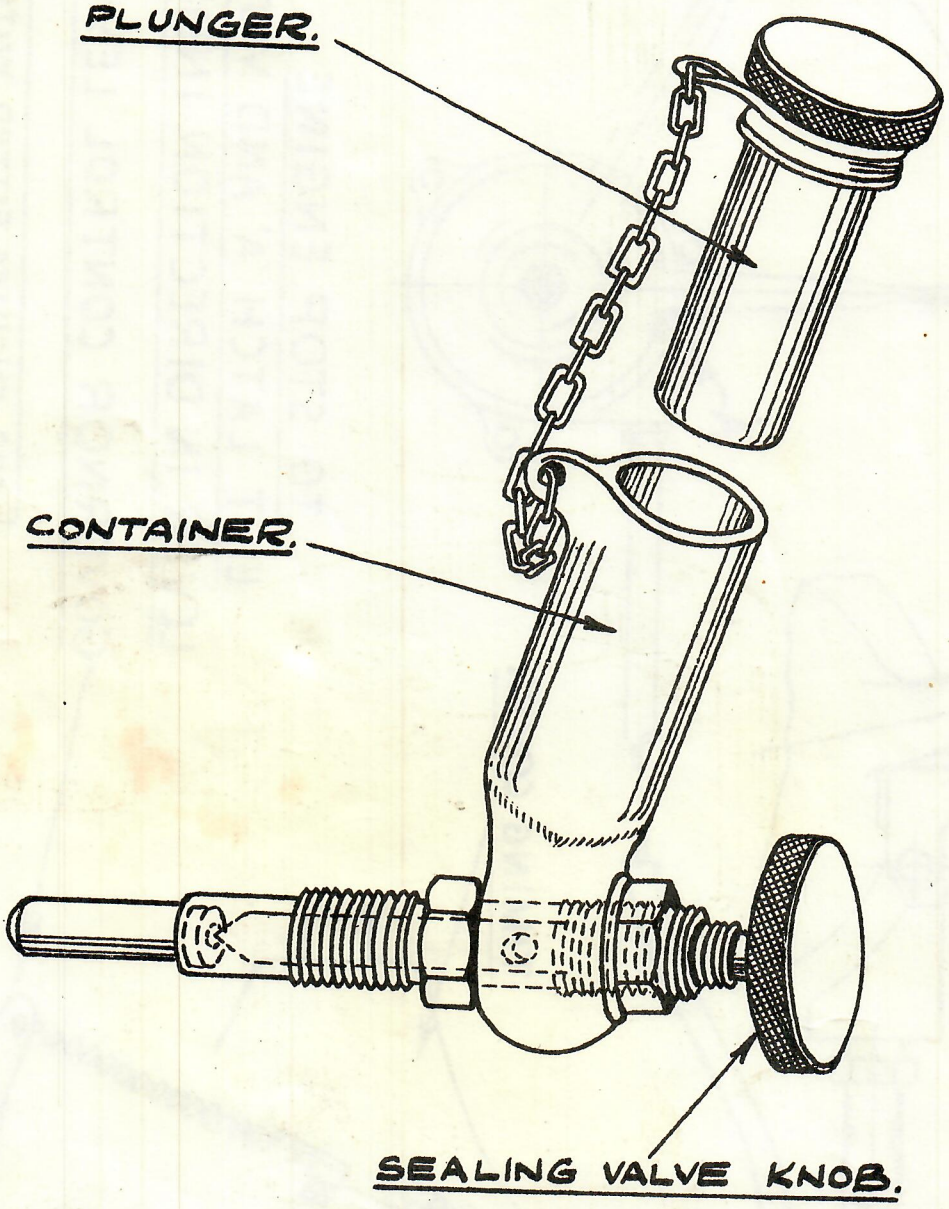


FIG:6.

COLD STARTING INJECTOR

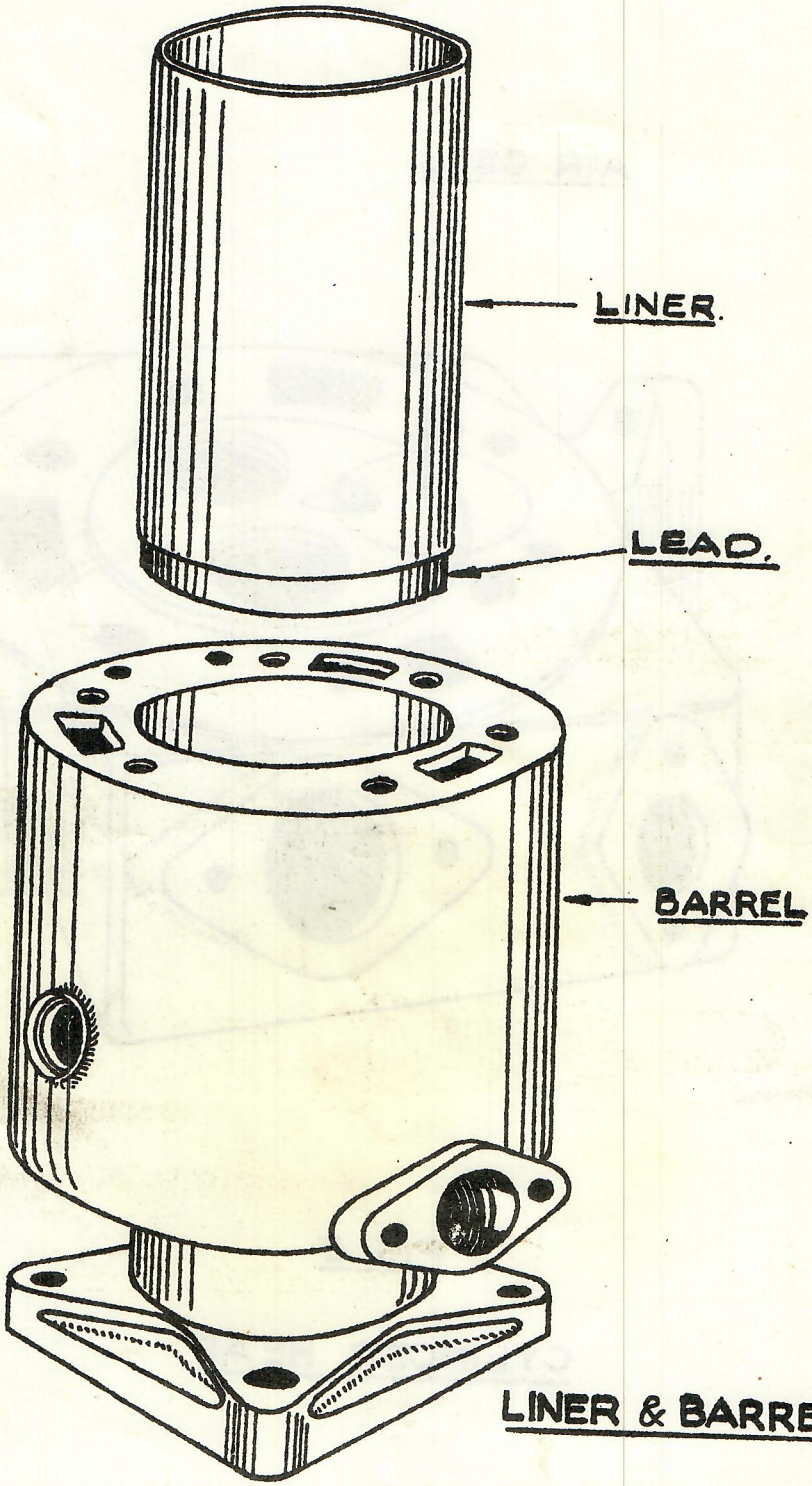


FIG:7

LINER & BARREL.

METHOD APPLIES TO BOTH AIR & WATER-COOLED.

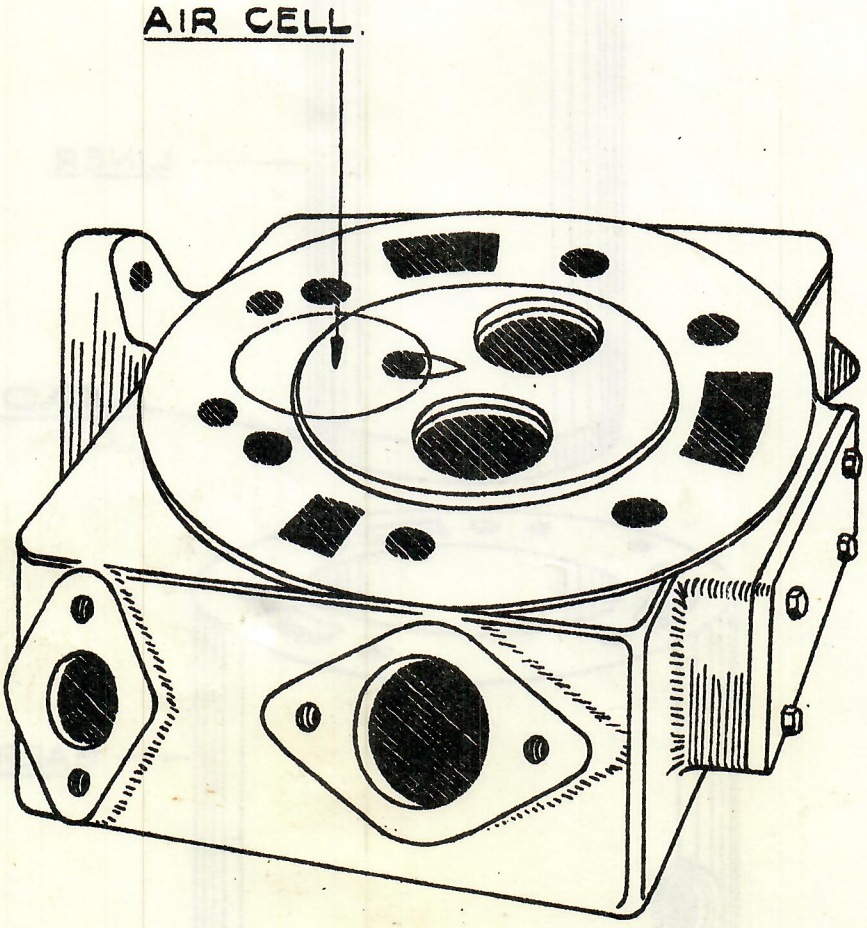


FIG: 8.

CYLINDER HEAD.

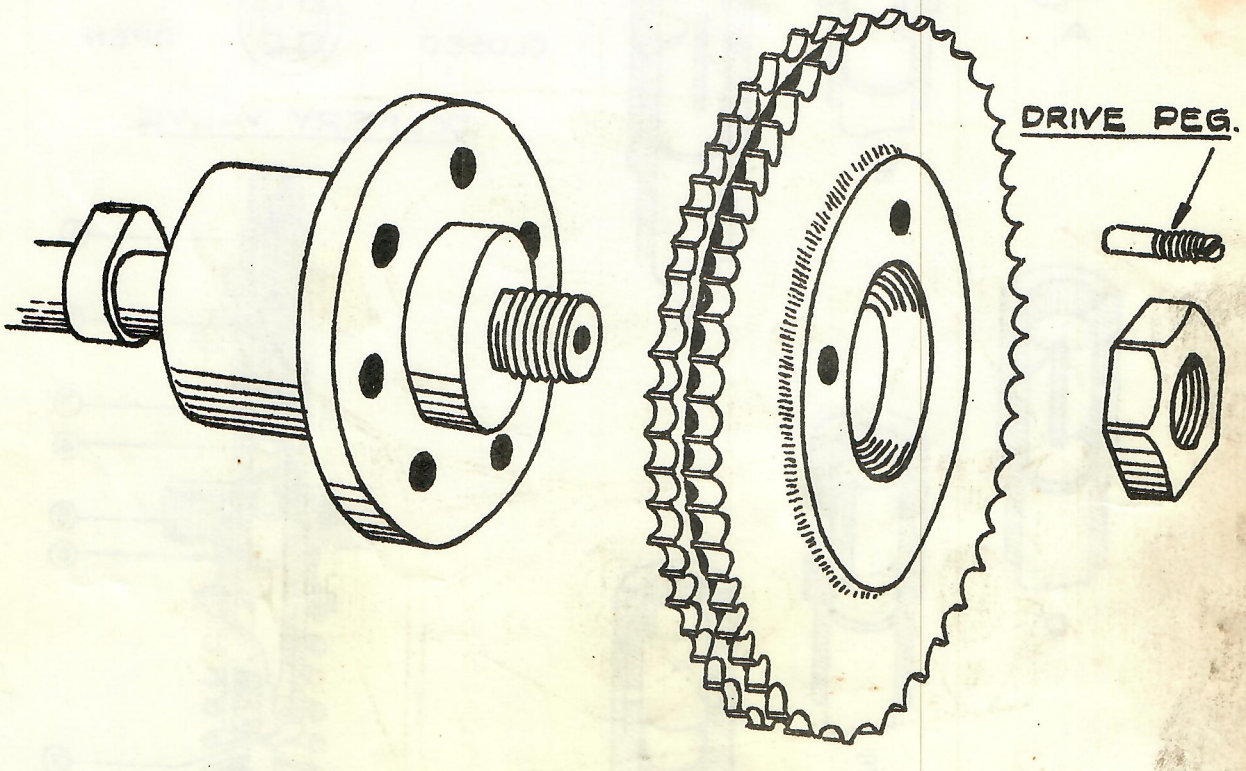
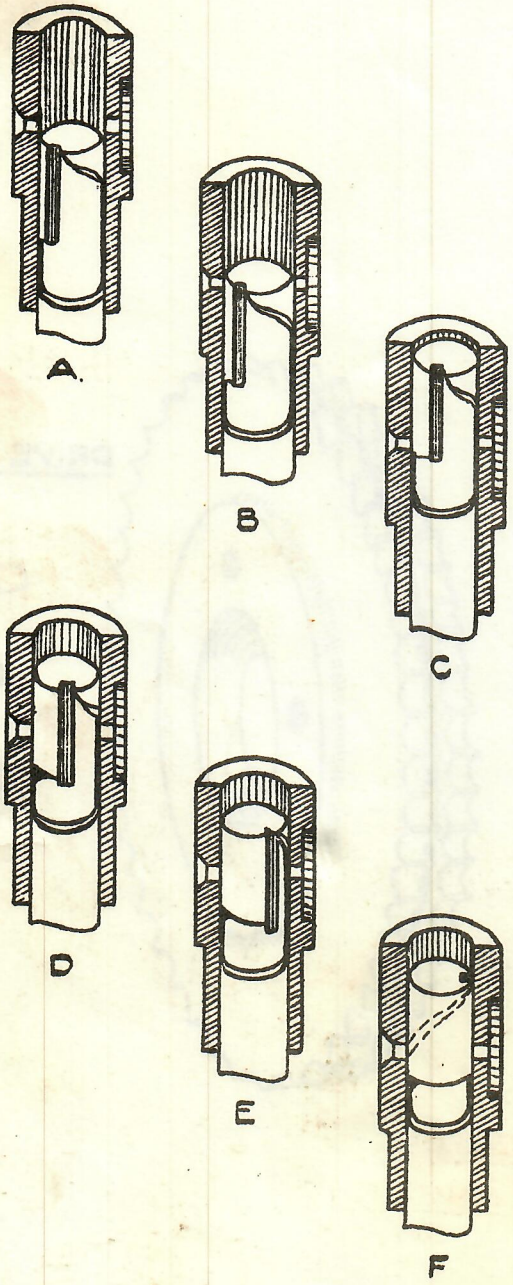


FIG: 9

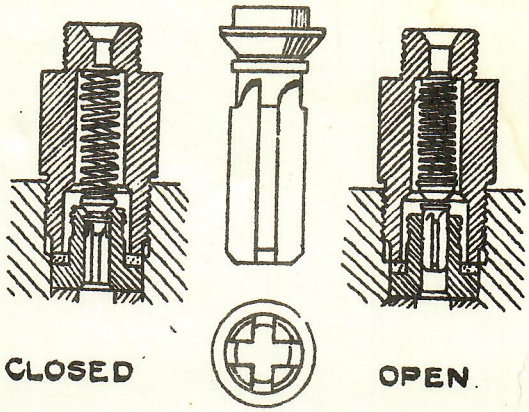
CAMSHAFT DRIVE WHEEL ASSEMBLY.

NOTE:-

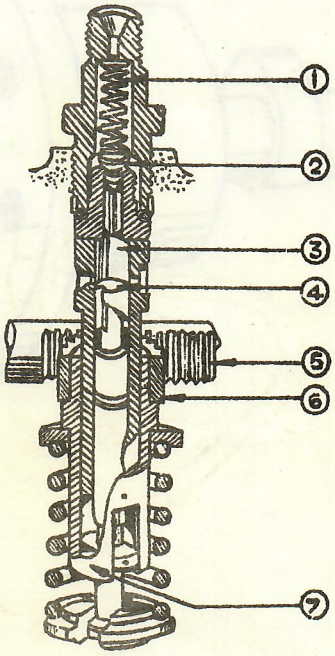
GEAR DRIVE FOR HALF SPEED SHAFT IN SIMILAR FASHION.



BARREL WITH VARIOUS PLUNGER POSITIONS.



DELIVERY VALVE.



PUMP ELEMENT IN SECTION.

1. VALVE SPRING.
2. DELIVERY VALVE & SEAT.
3. PUMP BARREL.
4. PUMP PLUNGER.
5. CONTROL ROD.
6. TOOTHED QUADRANT.
7. CONTROL SLEEVE.

FIG: 10.

C.A.V. INJECTION PUMP OPERATION.

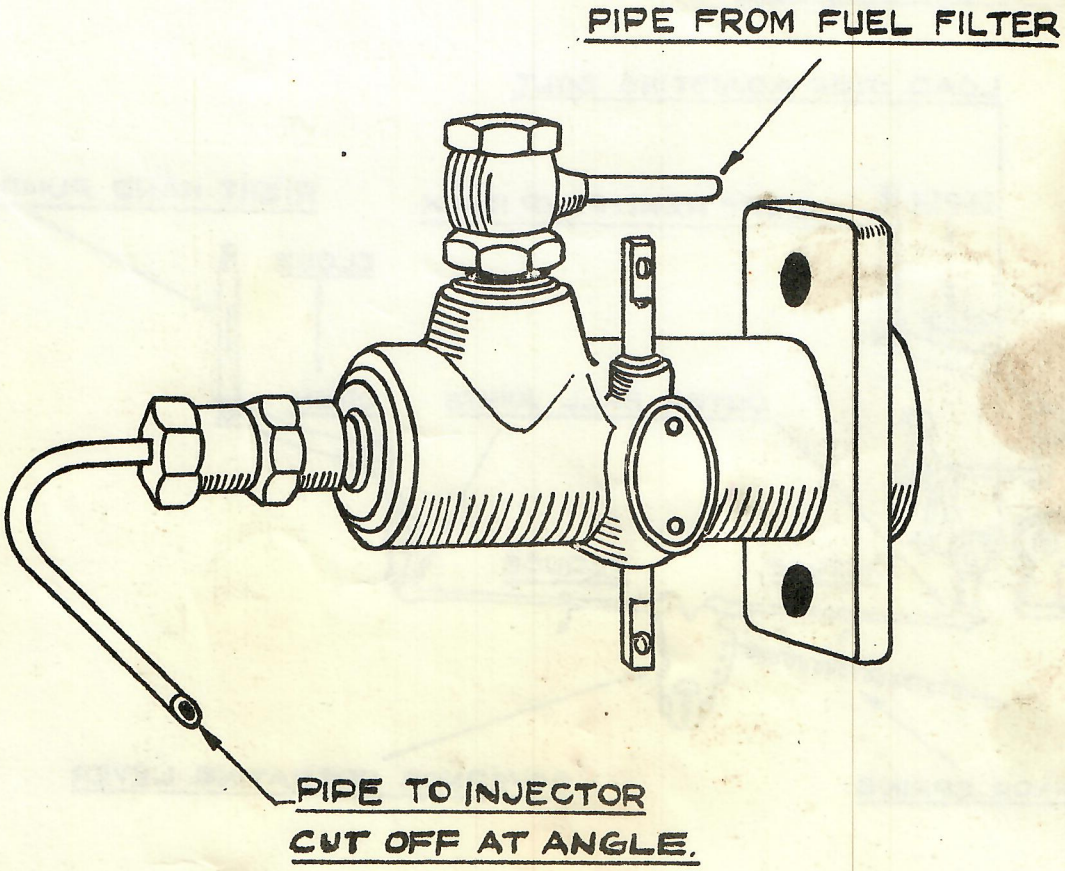


FIG:11.

SPILL TIMING PIPE.

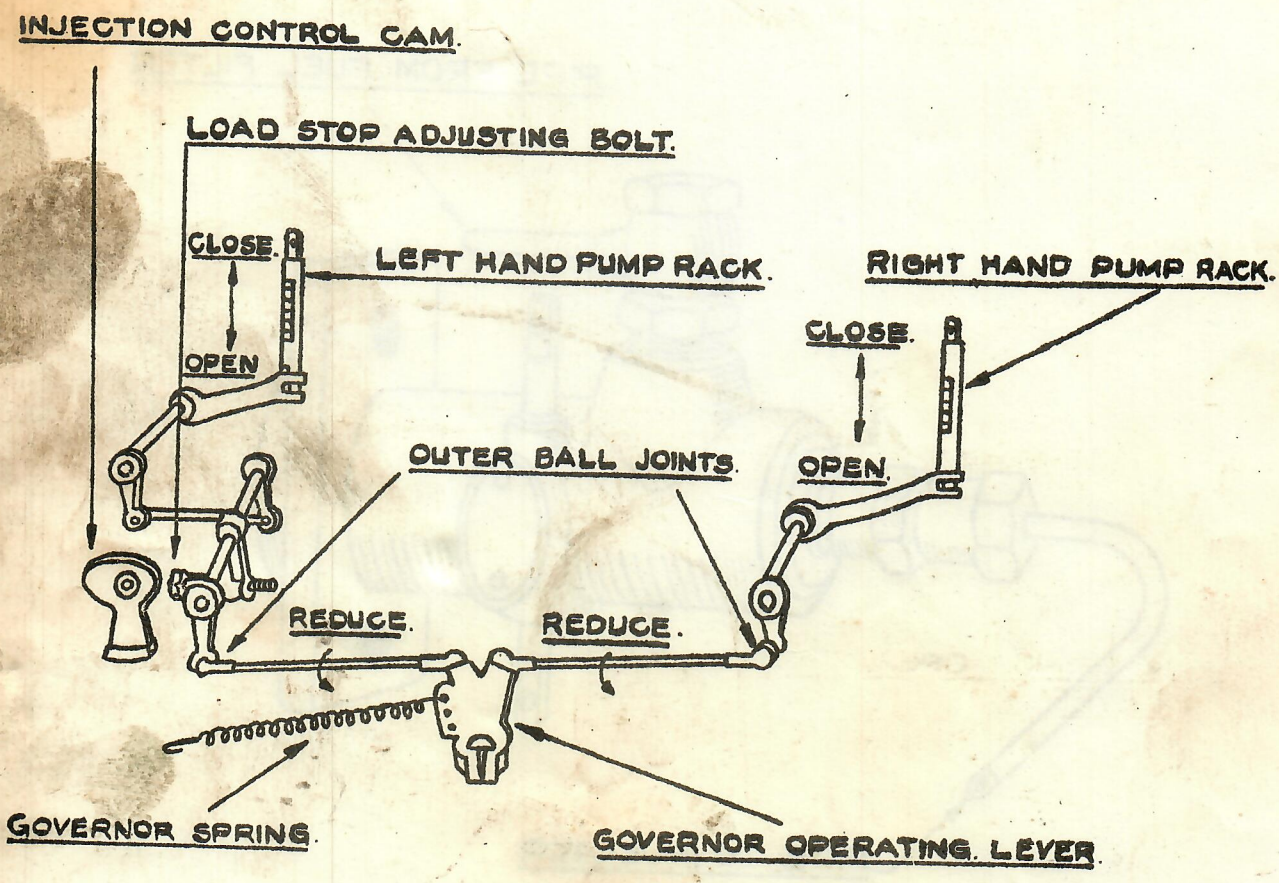


FIG: 12.

GOVERNOR AND INJECTION PUMP CONTROL.

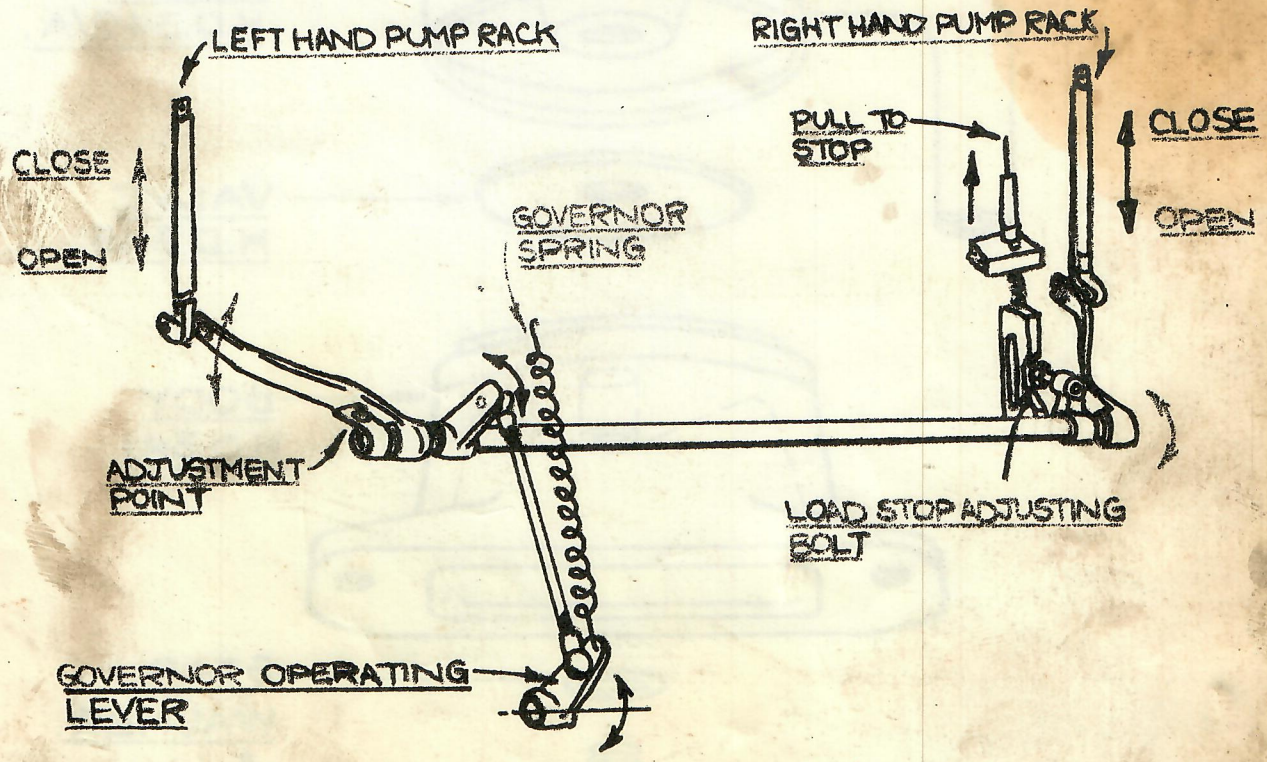


FIG:12 A.

GOVERNOR AND INJECTION PUMP CONTROL.

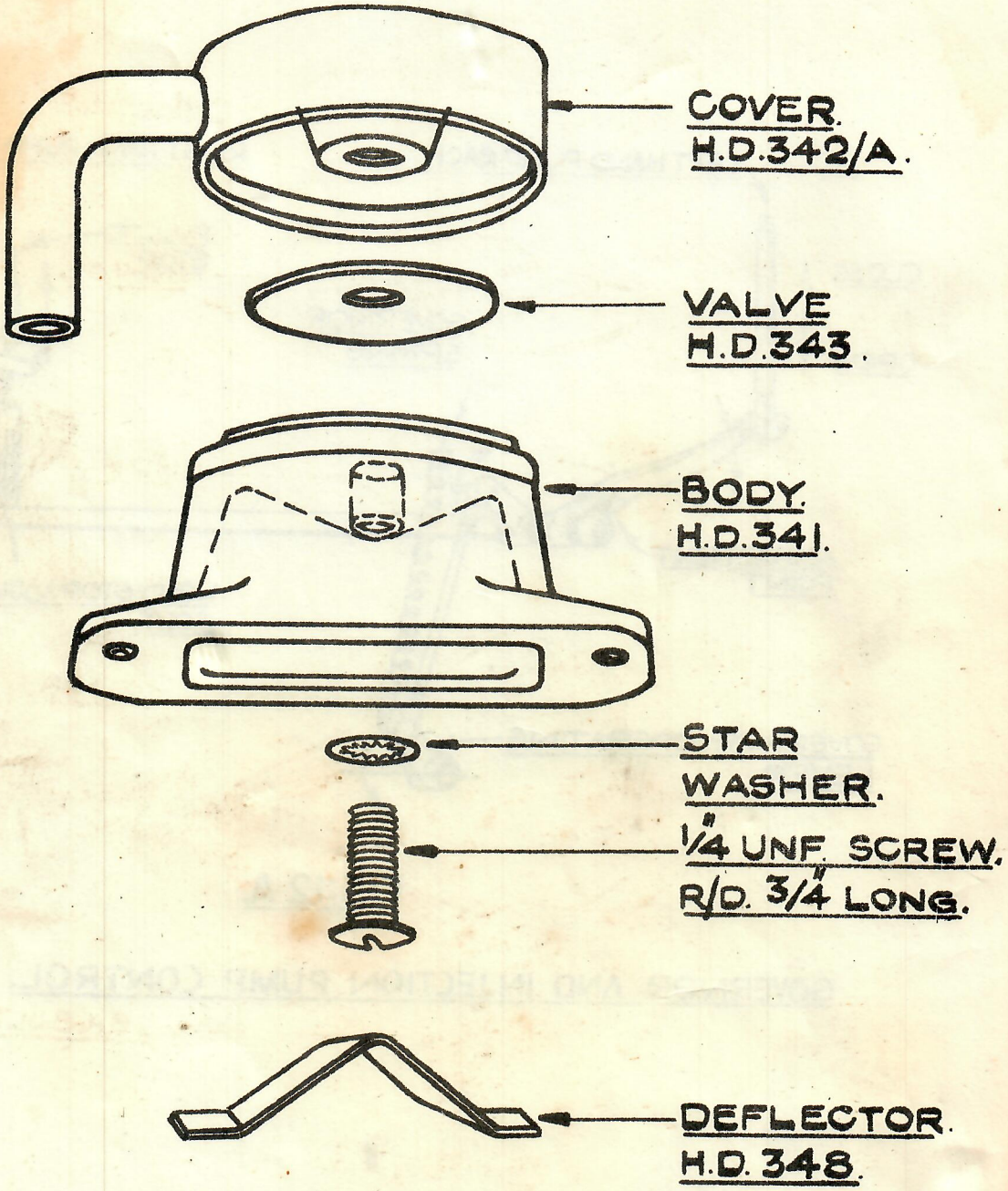


FIG. 13.

BREATHER.

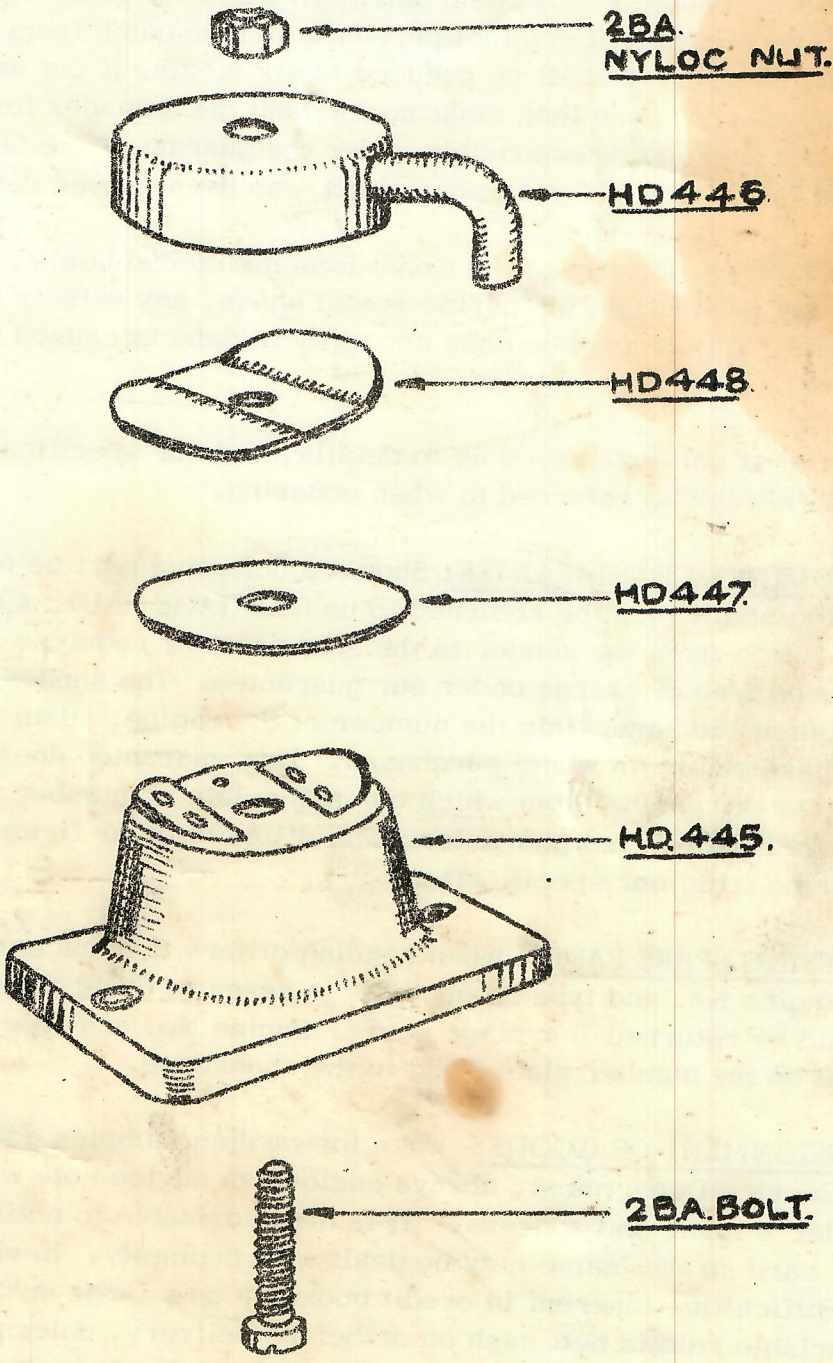


FIG:13A

BREATHER

AS FITTED TO H.D.A (MK.I) FROM CRANKCASE No. 1378
H.D.A. (MK. II) FROM CRANKCASE No. 1643 AND
H.D.W. (MKII) FROM CRANKCASE No. 5192.

TERMS OF BUSINESS AND CONDITIONS OF SALE.

GUARANTEE: We guarantee, subject to the Conditions mentioned below, that all precautions that are usual and reasonable have been taken by us to secure excellence of materials and workmanship; but this guarantee is to extend and be in force for twelve months only from the date of original purchase and despatch from our works, this period shall be reduced to six months if the average working day is more than eight hours, and the damages for which we make ourselves responsible under the guarantee are LIMITED TO THE REPLACEMENT of any parts which may have proved defective.

We undertake, subject to the Conditions mentioned below, to make good any time within the period stated above, any defects in this respect. This guarantee does not apply to defects caused by wear and tear, misuse or neglect.

This list is not guaranteed as to details, and our specification should always be referred to when ordering.

CONDITIONS OF GUARANTEE: Should a defective part be found in our engines it must be returned to us CARRIAGE PAID, accompanied by a notice from the sender to the effect that he requires it replaced free of charge under our guarantee. The sender must furnish at the same time the number of the engine, date of purchase and from whom purchased. This guarantee does not apply to any engine from which our nameplate or number has been removed. We do not guarantee specialities of other firms or parts differing from our specification.

ORDERING SPARE PARTS: When sending orders it is necessary that the Engine No. and type be quoted. In cases of doubt the old part should be returned "carriage paid". Engine No. and type will be found on the number plate fixed to the crankcase.

CONSIGNMENT OF GOODS: When forwarding samples addressed to the Service Department, always enclose an advice note with the Sender's name and address. It is also advisable to notify us by post card so that same may be dealt with promptly. In view of the difficulties inherent in credit bookings on a large scale, our invariable rule is nett cash on or before delivery, unless a customer has a firm credit account. Prices do not include packing and carriage or V.A.T. and sufficient funds to cover same must be included with remittance.

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