Section M — FUEL SYSTEM — ALL MODELS

INDEX

LIST OF ILLUSTRATIONS

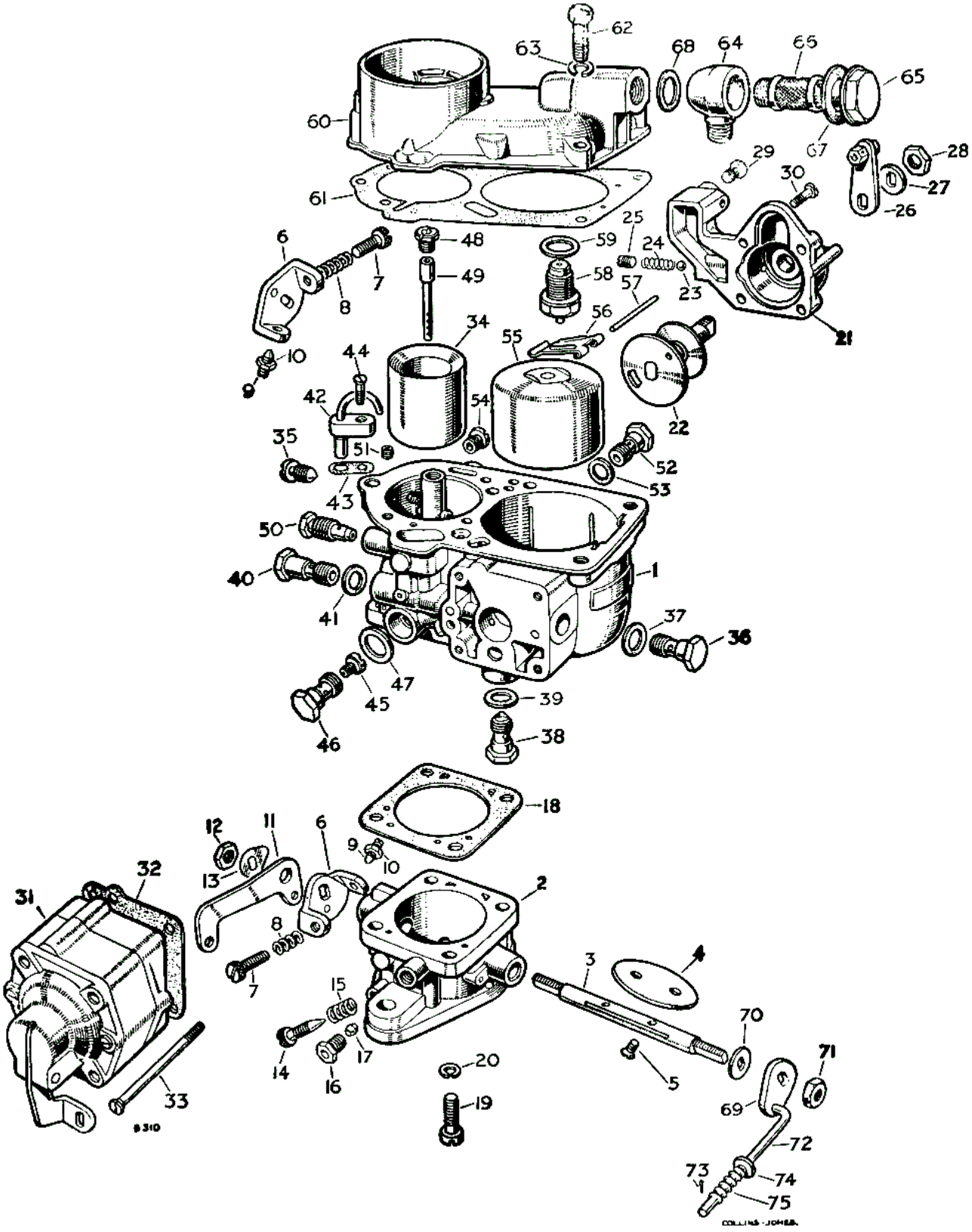


Fig M-1—Layout of carburetter, Petrol Models

Key to Fig. M-1

1 Carburetter body
2 Throttle chamber
3 Spindle for throttle
4 Butterfly for throttle
5 Special screw fixing butterfly
6 Plate, throttle abutment
7 Special screw } For slow running adjustment
8 Spring }
9 Special screw } For throttle stop
10 Locknut }
11 Throttle lever
12 Nut fixing throttle lever
13 Lockwasher for nut
14 Special screw } For mixture control
15 Spring }
16 Screwed union } For suction pipe
17 Olive }
18 Joint washer for throttle chamber
19–20 Fixings for chamber
21 Starter body
22 Starter valve complete
23 Ball } For starter valve
24 Spring }
25 Plug retaining starter valve spring
26 Lever for starter
27 Special washer for lever
28 Nut fixing starter lever
29 Special bolt fixing starter cable
30 Special screw fixing starter body
31 Accelerator pump complete
32 Joint washer for pump
33 Special screw fixing pump
34 Choke tube (25)
35 Special screw fixing choke tube
36 Jet economy (50)
37 Fibre washer for jet
38 Non-return valve
39 Fibre washer for valve
40 Jet (75) accelerator pump
41 Fibre washer for jet
42 Pump injector
43 Joint washer for pump injector
44 Special screw fixing injector
45 Main jet (115)
46 Bolt, main jet carrier
47 Fibre washer for bolt
48 Correction jet (170)
49 Emulsion tube
50 Pilot jet (55)
51 Jet air bleed (1.5)
52 Starter jet, petrol (135)
53 Fibre washer for jet
54 Starter jet, air (5.5)
55 Float
56 Toggle for float
57 Spindle for toggle
58 Needle valve complete
59 Fibre washer for valve
60 Top cover for carburetter
61 Joint washer for top cover
62 Special screw fixing top cover
63 Spring washer for screw
64 Banjo union
65 Special bolt for union
66 Filter gauze for union
67 Fibre washer, large } For union
68 Fibre washer, small }
69 Lever for accelerator pump rod
70 Special washer for lever
71 Nut fixing lever to spindle
72 Control rod for accelerator pump
73 Split pin } For control rod
74 Plain washer }
75 Spring }

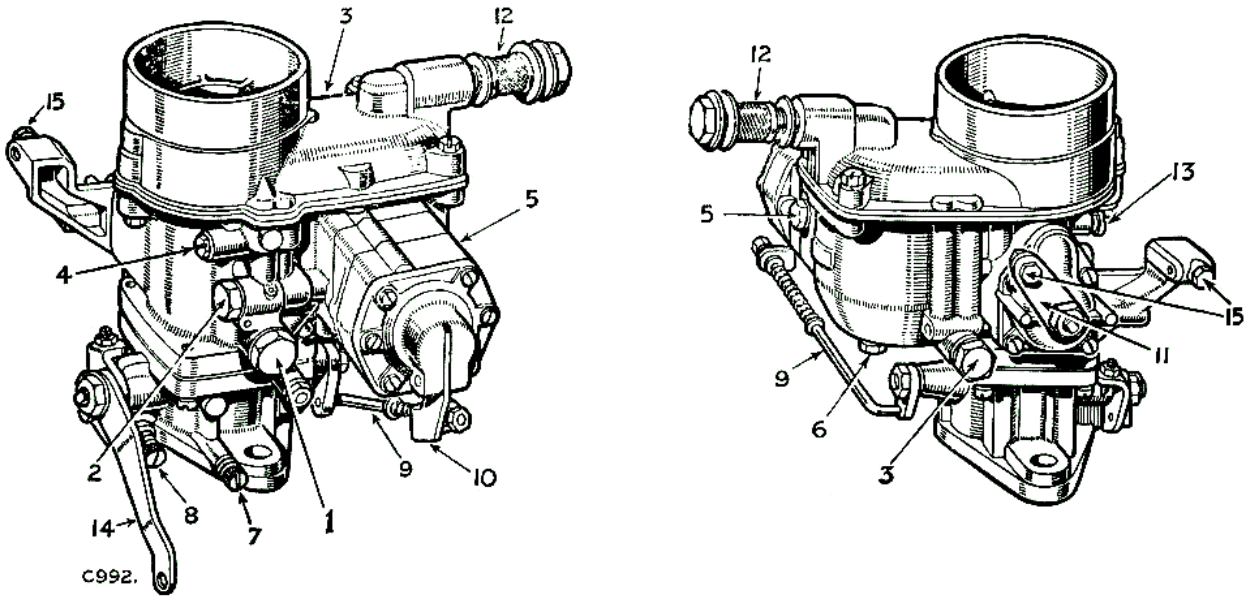


Fig. M-2—Carburetter jets and controls, Petrol models

1 Main jet
2 Accelerator pump jet
3 Starter jet, petrol
4 Pilot jet
5 Economy jet
6 Non-return valve
7 Mixture control
8 Slow running adjustment
9 Pump operating rod
10 Pump operating lever
11 Lever for starter
12 Banjo union
13 Special screw fixing choke tube
14 Throttle lever
15 Cold start cable clamping bolts

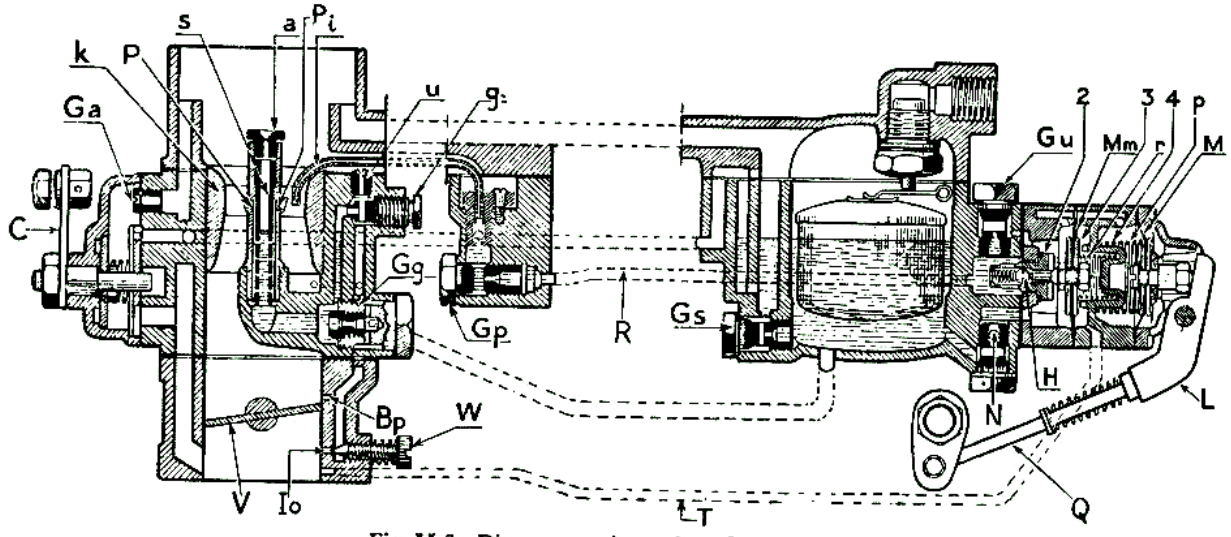


Fig. M-3—Diagrammatic section of carburetter.

a—Air correction jet
A—Slow running adjustment screw
Bp—Slow running duct
C—Bi-starter operating lever
D—Main jet carrier
g—Pilot jet
Ga—Starter air jet
Gg—Main jet
Gp—Speed jet
Gs—Starter petrol jet
Gu—Economy jet
H—Ball valve
i—Injector nozzle
Io—Slow running mixture delivery
k—Choke tube
L—Accelerator pump operating lever
M—Accelerator pump membrane
Mm—Economy action membrane
N—Non-return valve
p—Spring for membrane M.
P—Emulsion tube orifices
Q—Accelerator pump operating rod
r—Spring for membrane Mm
R—Accelerator pump delivery
s—Emulsion tube
T—Duct operating membrane Mm
u—Pilot air bleed jet
V—Throttle butterfly
W—Slow running mixture adjustment

Carburetter

To remove **Operation M/2**

1. Disconnect the air cleaner connection from the carburetter intake orifice.
2. Remove the air cleaner.
3. Disconnect the feed pipe from the carburetter inlet banjo.
4. Disconnect the distributor suction pipe from the carburetter and pull pipe clear.
5. Disconnect the accelerator connecting rod from the carburetter throttle lever, at a ball joint.
6. Release the cold start control cable from the cold start lever on the carburetter.
7. Remove the carburetter from the inlet manifold, together with two joint washers and a packing washer.

To refit **Operation M/4**

1. Reverse the removal procedure.
2. Renew the joint washers and packing washer.
3. Check the operation of the cold start control. (Three positions on the cold start lever.)

Carburetter jets and controls

Fault location **Operation M/6**

1. If acceleration is bad, make sure that the speed jet is not choked (such a condition, however, will seriously affect the general performance).
2. Failure of the accelerator pump membrane will be shown by weak mixture and spitting in the carburetter on rapid acceleration.

   It can be checked by pumping the throttle with the engine running and vehicle stationary, and noting the petrol delivery from the injector tube; if the delivery is small, renew the accelerator pump membrane. Operation M/12.
3. Failure of the speed jet membrane will cause a rich mixture at all times, particularly at small throttle openings, and result in excessive fuel consumption. To rectify, renew the speed jet membrane Operation M/14.
4. At all times when accelerator pump trouble is suspected, the non-return ball valves in the pump system should be inspected for correct seating. The valves are positioned as follows: one valve in the petrol inlet to pump, the second in the injector tube, and a third in the pump assembly outlet, visible when the pump is removed from the carburetter.

To overhaul

Accelerator pump

To renew **Operation M/8**

1. Disconnect the operating rod from the pump lever and remove the four set screws at the corners of the pump body and lift off the pump complete. Do not remove the other two set screws in the centre of the body.
2. Fit the new accelerator pump, entering the rod into the pump operating lever at the same time.
3. Adjust the pump operating rod. Operation M/10.

Accelerator pump operating rod

To adjust **Operation M/10**

1. Remove the split pin behind the spring and allow the spring to move back along the rod.
2. Slacken the slow running screw right off.

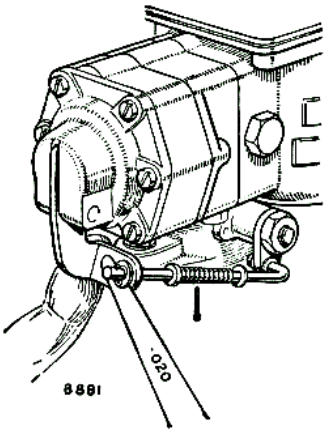


Fig. M-4—Setting accelerator pump operating rod

3. With the throttle fully closed and the operating lever just about to operate the pump diaphragm, add washer(s) on the end of the rod up to the nearest split pin hole, ensuring that there remains .20 in. (0,5 mm) clearance between the lever and the first washer when the outer split pin is fitted.

   This clearance ensures that there is no lost movement of the lever travel.
4. Compress the spring and replace the inner split pin.
5. Check that the spring is not coilbound when the throttle is fully open.

Accelerator pump membrane

To renew **Operation M/12**

1. Remove the outer split pin and washer(s) securing the operating rod to the pump lever (the washer(s) should be preserved).
2. Remove the four set screws at the corners of the pump body and lift off pump complete.

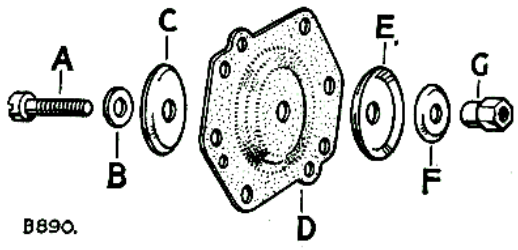


Fig. M-5—Layout of accelerator pump membrane assembly,

A—Operating rod.
B—Fibre washer.
C—Dished washer.
D—Membrane.
E—Dished washer
F—Distance washer
G—Securing nut.

3. Remove the two set screws in the centre of the body and part the pump end cover, together with the membrane assembly, from the pump body; remove the spring from the recess in the pump body.
4. Part the membrane from the outer cover and remove the operating rod from its centre. Discard the membrane.
5. Fit the operating rod to the new membrane (Fig. M-5), taking care not to twist the membrane when tightening the securing nut.
   Secure the nut by staking.
6. Clean the pump body and end cover joint faces.
7. Replace the spring in the recess of the pump body. Place the end cover together with the membrane assembly in position on the pump body and insert the two set screws, which must not be tightened at this stage.
8. Depress the pump membrane by means of the operating lever and tighten the two screws fully.
9. Refit the accelerator pump unit to the carburetter, entering the rod into the pump operating lever at the same time; renew the neoprene joint washer if necessary.
10. Adjust the pump operating rod. Operation M/10.

Speed jet membrane

To renew **Operation M/14**

1. Remove the outer split pin and washer(s) securing the operating rod to the pump lever (the washer(s) should be preserved).
2. Remove the four screws at the corners of the pump body and lift off the pump complete.
3. Remove the two set screws in the centre of the body and separate the two halves of the pump body; remove the speed membrane assembly and the spring.
4. Remove the pump shaft from the centre of the membrane and discard the membrane.
5. Fit the pump shaft to the new membrane so that the small hole for the air duct tube (E) is on the left of the securing nut (G) (Fig. M-6). Care must be taken not to twist the membrane when tightening the securing nut. Secure the nut by staking.

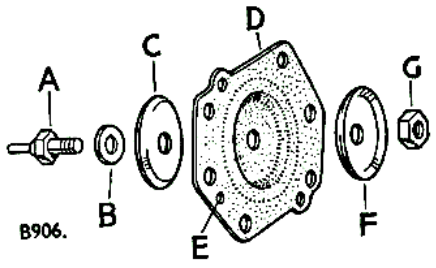


Fig. M-6—
Layout of speed jet membrane assembly.

A—Pump shaft.
B—Fibre washer
C—Dished washer
D—Membrane.
E—Air duct tube hole.
F—Dished washer.
G—Securing nut.

6. Clean the joint faces of the two halves of the pump body.
7. Place the membrane assembly in position on the inner half of the pump body, locating it by means of the small air duct tube.
8. With the spring in its recess, place the outer half of the pump body in position on the inner half and secure with two set screws.
9. Refit the accelerator pump unit to the carburetter, entering the rod into the pump operating lever at the same time; renew the joint washer if necessary.
10. If necessary, adjust the pump operating rod, Operation M/10.

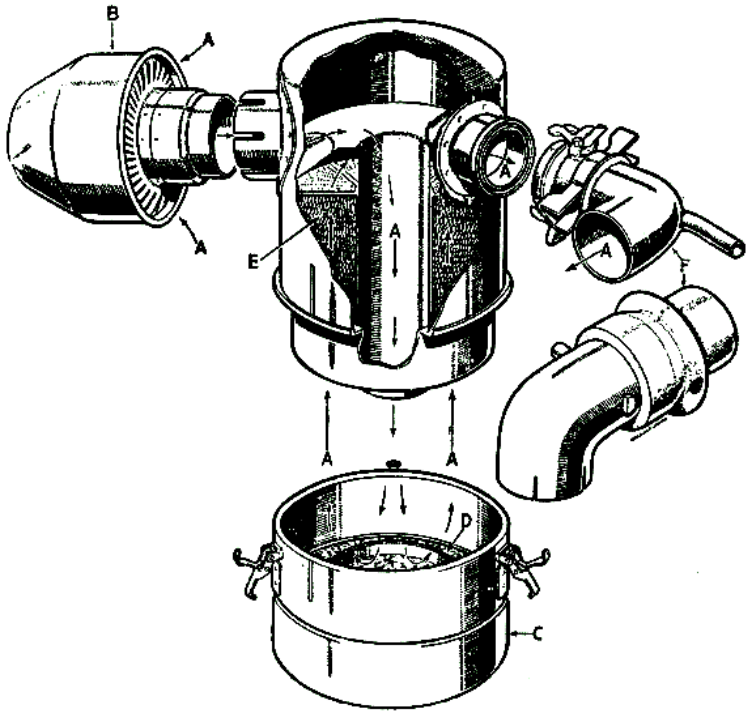


Fig. M-7—Air cleaner, 1948-53 models

A—Path of air shown ⟶ ⟶
B—Centrifugal pre-cleaner
C—Oil bath
D—Oil level
E—Woven steel packing
F—Outlet to carburetter

Air cleaner—all models

The air cleaner must be removed and cleaned at frequent intervals if an excessive rate of engine wear is to be avoided; the actual intervals will depend solely on operating conditions.

Under clean road conditions in a temperate climate, the oil bath need only be cleaned and refilled when engine oil changes are due, but when the vehicle is operated in a dust-laden atmosphere, desert, sub-tropical or tropical conditions—cleaning may be necessary twice daily.

To remove (1955-58 models) Operation M/16

1. Remove the clamping strap wing nut.
2. Disconnect the rubber connection at the carburetter.
3. Lift out the air cleaner complete with rubber connection and pre-cleaner when fitted.

To refit **Operation M/18**

1. Reverse the removal procedure.

To strip **Operation M/20**

1. Detach the rubber connection.
2. Remove the pre-cleaner when fitted.

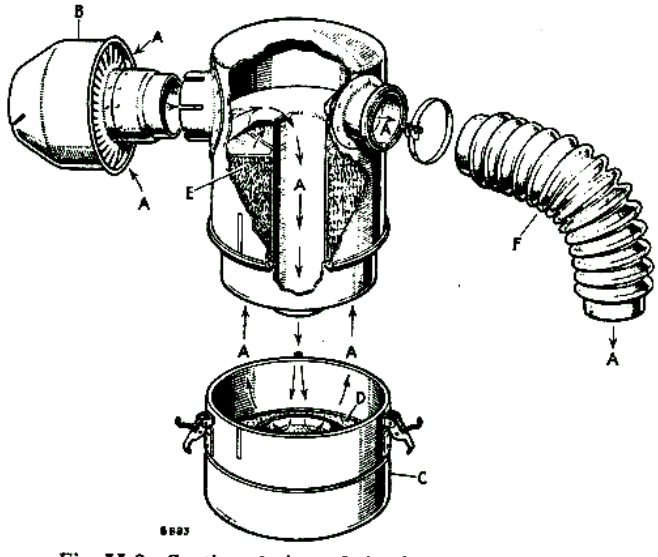


Fig. M-8—Sectioned view of air cleaner, 1954 models.

A—Path of air shown ⟶ ⟶
B—Centrifugal pre-cleaner
C—Oil bath
D—Oil level
E—Woven steel packing
F—Connection air cleaner to carburetter

3. Remove the oil bowl from the air cleaner body and empty.
4. If necessary, remove the cork washer from the air cleaner body.

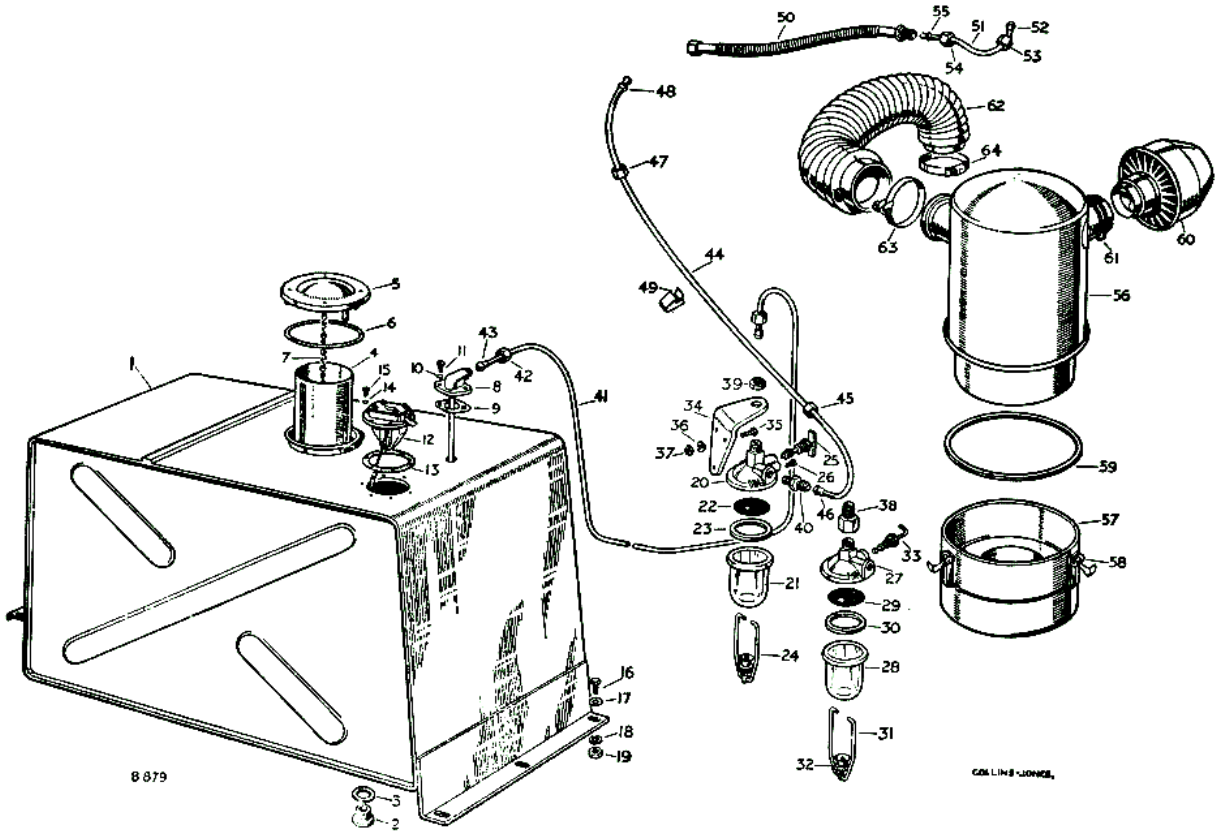


Fig. M-9—Layout of fuel system, Petrol models.

1 Petrol tank complete
2 Drain plug for petrol tank
3 Joint washer for drain plug
4 Telescopic filler tube
5 Filler cap
6 Joint washer for cap
7 Chain for filler cap
8 Outlet elbow complete for tank
9 Joint washer for outlet elbow
10–11 Fixings for elbow
12 Gauge unit for petrol tank
13 Joint washer for gauge unit
14–15 Fixings for gauge unit
16–19 Fixings for petrol tank
20 Body only
21 Bowl only
22 Gauze for bowl
23 Joint washer for bowl
24 Retainer for bowl
25 Tap and gland complete
26 Special screw for tap
27 Body only
28 Bowl only
29 Gauze for bowl
30 Joint washer for bowl
31 Retainer for bowl
32 Screw cap for retainer
33 Tap and gland complete
34 Bracket for sediment bowl
35–37 Fixings for bracket
38 Inlet adaptor for sediment bowl
39 Special nut fixing adaptor and bowl to bracket
40 Outlet union for sediment bowl
41 Petrol pipe complete, tank to bowl
42–43 Fixings for pipe
44 Petrol pipe complete, bowl to pump
45–48 Fixings for pipe
49 Clip for petrol pipe
50 Flexible petrol pipe complete
51 Petrol pipe complete, flex to carburetter
52–55 Fixings for pipe
56 Filter and case
57 Oil container
58 Toggle clip for oil container
59 Cork washer for oil container
60 Centrifugal air cleaner
61 Clip fixing cleaners together
62 Rubber connection, air cleaner to carburetter
63–64 Fixings for connection

To assemble **Operation M/22**

1. Clean the filter gauze and oil bowl in petrol and refill oil bowl with clean oil.
2. Reverse the stripping procedure, renewing the cork washer if necessary.

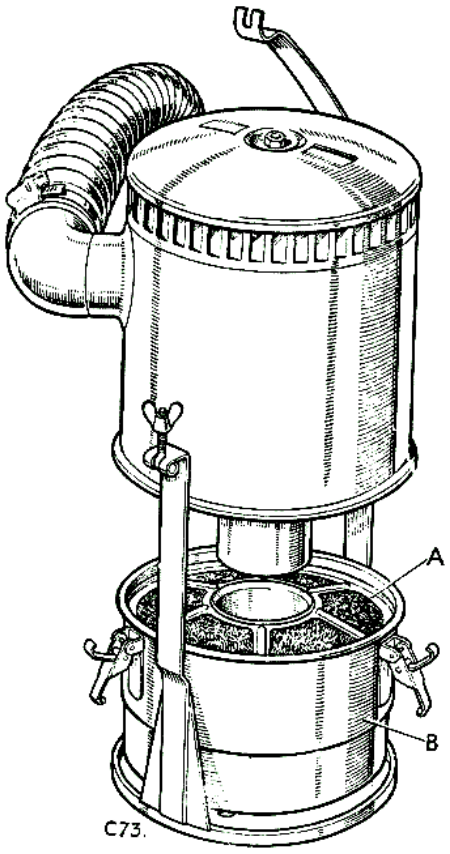


Fig. M-10—Air cleaner, 1955-58 models.

A—Removable filter gauze.
B—Oil bowl.

Note:

At all times when the diesel engine is running, it is necessary to ensure that the oil bath air cleaner is fastened securely in the vertical position.

If adjustments are made with the engine running and the oil bath air cleaner balanced on top of the engine, it is possible, should the cleaner tip to one side, for oil to be drawn into the intake manifold and hence into the engine, where it will act as a fuel and cause the engine to overspeed out of control and serious damage may result.

Should it be necessary to run the engine with the air cleaner out of the normal position, the rubber hose should be disconnected from the inlet manifold and the whole oil bath removed from the vehicle.

Fuel tank—all models

To renew **Operation M/24**

1. Disconnect the battery.
2. Remove the right-hand seat and raise the locker lid.
3. Detach the fuel feed pipe from the outlet union on the top of the tank.
4. Disconnect the wire from the level gauge unit.
5. Drain off the fuel.
6. Remove the fuel tank and undershield, if fitted, from below.
7. Remove the outlet elbow from the tank and fit together with a new joint washer, to the replacement tank.
8. Remove the gauge unit from the tank and fit together with a new joint washer, to the replacement tank.
9. Fit the replacement tank to the vehicle by reversing the removal procedure.

Fuel gauge tank unit

To renew **Operation M/26**

1. Disconnect the battery.
2. Drain off the fuel.
3. Remove the right-hand seat and raise the locker lid.
4. Disconnect the wire from the tank unit.
5. Remove the gauge unit from the fuel tank complete with joint washer.
6. Fit the new unit by reversing the removal procedure.

Fuel tank outlet union

To renew **Operation M/28**

1. Remove the right-hand seat and raise the locker lid.
2. Disconnect the union nut securing the fuel feed pipe to the outlet union.
3. Remove the outlet union and suction pipe from the fuel tank complete with joint washer.
4. Fit the new union by reversing the removal procedure.

Sediment bowl, Petrol models

To remove **Operation M/30**

1. Disconnect the inlet and outlet pipes at the sediment bowl unions.
2. Remove the sediment bowl complete from the dash bracket.
3. If necessary, remove the bracket from the dash.

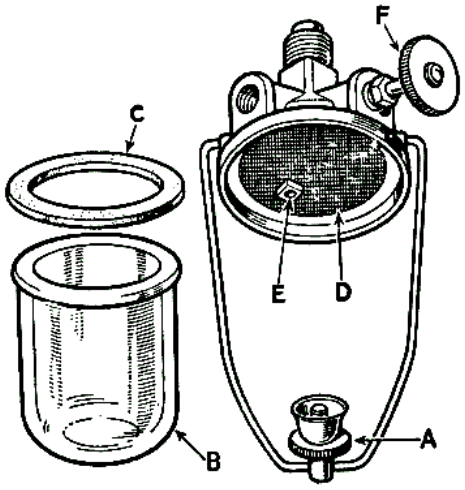


Fig. M-11—Fuel sediment bowl.

A—Thumbscrew
B—Glass bowl.
C—Joint washer.
D—Filter gauze.
E—Fuel inlet.
F—Shut-off tap

To refit **Operation M/32**

Reverse the removal procedure.

Fuel pipe: tank to sediment bowl, Petrol models

To renew **Operation M/34**

1. Disconnect the union nuts securing the pipe to the fuel tank outlet elbow and sediment bowl inlet union.
2. Withdraw the pipe from below the vehicle.
3. Replace the pipe by reversing the removal procedure.

Fuel return pipe, Diesel models

To renew **Operation M/36**

1. Remove the union nuts securing the flexible pipe to the fuel tank and leak-off pipe.
2. Remove the clips and withdraw the pipe from below the vehicle.

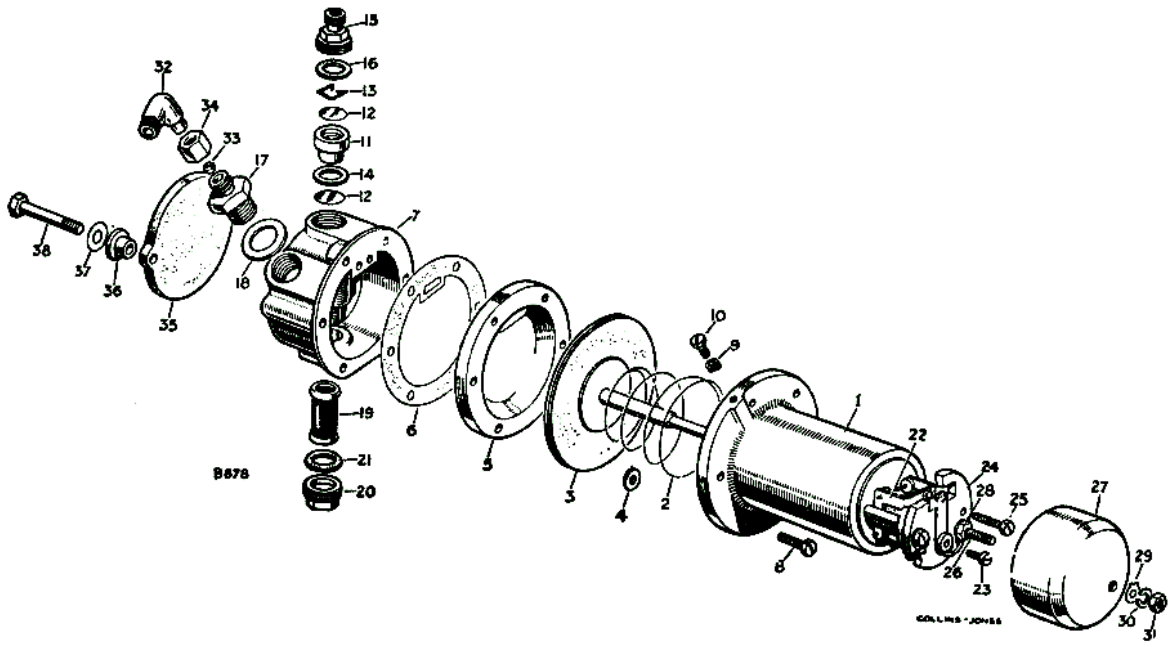


Fig. M-12—Exploded view of fuel pump, Petrol models.

1 Coil complete
2 Spring for armature
3 Diaphragm complete
4 Roller for diaphragm
5 Plate body
6 Joint washer for plate body
7 Body
8 Screw fixing coil housing to body
9 Special spring washer } For earth terminal screw
10 Special nut }
11 Valve cage
12 Disc for valve
13 Spring clip retaining valve disc
14 Washer for valve cage
15 Outlet union
16 Washer for outlet union
17 Inlet union
18 Washer for inlet union
19 Filter
20 Plug for filter
21 Washer for filter plug
22 Contact set complete
23 Special screw for contact blade
24 Moulding for end plate
25 Screw fixing moulding
26 Terminal screw
27 Cover for end plate
28 Terminal nut
29 Tag for terminal
30 Spring washer
31 Nut
32 Elbow for pump
33–34 Fixings for elbow
35–38 Fixings for electric petrol pump

Fuel pump—Petrol models

To remove **Operation M/38**

1. Disconnect the battery.
2. Detach the inlet and outlet pipes from the elbows on the fuel pump.
3. Disconnect the feed and earth wires from the pump terminals.
4. Remove the pump.

To refit **Operation M/40**

Reverse the removal procedure.

To strip **Operation M/42**

Note: **Under no circumstances should any attempt be made to move the core of the magnet.**

1. Remove the cast iron body from the aluminium body.
2. Unscrew the armature from the inner rocker and remove it complete with rollers, spring and impact washer.
3. If necessary, remove the impact washer (Fig. M-16) from the recess of the armature.
4. Remove the contact blade.
5. Disconnect the earth connection (held under one of the pedestal securing screws).
6. Withdraw the outer and inner rocker hinge pin and remove the rocker assembly complete from under the pedestal.
7. Separate the two halves of the aluminium body.
8. Remove the inlet union from the rear portion of the aluminium body.
9. Remove the outlet union and withdraw the thick fibre washer, the valve cage complete with delivery valve and retaining clip, the thin fibre washer and the suction valve.
10. Remove the filter plug, fibre washer and filter.

To assemble **Operation M/44**

1. Carefully clean all the component parts, renewing the diaphragm, contact breaker assembly and valves assembly as necessary.

Valve cage (See Fig. M-13)

2. The delivery valve (H) and suction valve (K) should both be fitted with the smooth side downwards.
3. Care should be taken that the valve retaining clip (I) in the valve cage (E) is located correctly in its groove.

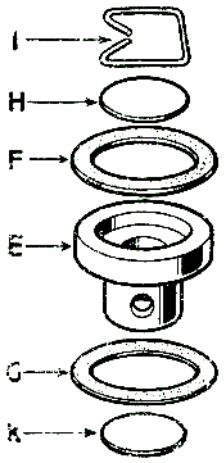


Fig. M-13—
Layout of valve cage

E—Valve cage
F—Thick fibre washer
G—Thin hard fibre washer
H—Delivery valve
I—Valve retaining clip
K—Suction valve

4. The thin fibre washer (G) should be fitted under the valve cage and the thick washer (F) above the cage.
5. Thick fibre washers are also fitted under the inlet union and the gauze filter.

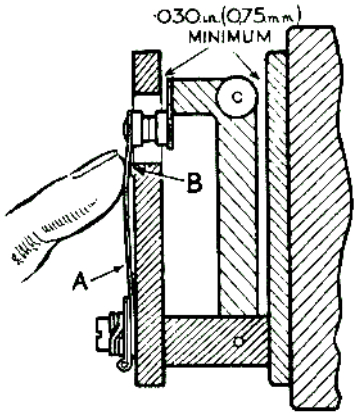
Contact breaker (See Fig. M-14)

6. The contact breaker should be assembled on its pedestal in such a way that the rockers are free in their mountings, without appreciable side play.

   Any excessive side play on the outer rocker would permit the points to get out of line while excessive tightness would make the contact breaker sluggish in operation.

   To obtain the correct freedom, it may be necessary to square the outer rocker with a pair of thin nosed pliers. The rocker hinge pin is case-hardened and must not be replaced by ordinary wire.

   The contact blade (A) should be fitted next to the bakelite pedestal, that is, underneath the tags. It should rest against the ledge (B) on the pedestal when the points are apart. The points should just make contact when the rocker is in its midway position.



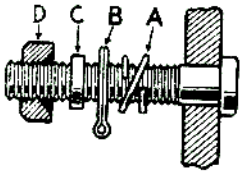
A—Contact blade
B—Ledge

Fig. M-14—Contact breaker

7. Check the position by holding the blade in contact with the pedestal, being careful not to press on the overhanging portion (Fig. M-14); then ensure that a .30 in. (0,75 mm) feeler just slides between the white rollers and the cast iron body of the pump. If necessary the tip of the blade may be set in order to obtain the correct clearance.

8. The spring washer on the 2 B.A. screw to which the earth connection is made should be fitted between the tag and the pedestal, and the brass tag next to the head of the screw.

9. All four connections, that is, the two ends of the earthing tag and the two ends of the coil, should be soldered.



A—Spring washer
B—Tag
C—Lead washer
D—Countersunk nut

Fig. M-15—Feed terminal assembly

10. In the case of the feed terminal screw, which holds the bakelite cover in position, the correct order for assembly is spring washer (Fig. M-15, A) next to the bakelite pedestal, then the tag (B), lead washer (C) and countersunk nut (D). Under no circumstances should this assembly be shortened by leaving out the spring washer, or in any other way, as this would probably result in distortion or breakage of the pedestal when the nut holding the cover in position is tightened.

Magnet assembly

11. Fit the armature return spring with its large diameter towards the coil. The spring must not be stretched or the action of the pump will be affected.

12. Swing the contact blade on the pedestal to one side.

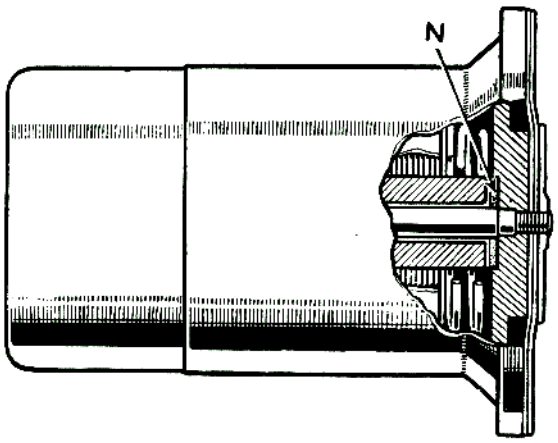


Fig. M-16—Armature impact washer
N—Impact washer.

13. Fit the impact washer (N) in the recess of the armature.

14. Screw the armature into position.

15. Fit the eleven guide rollers in position round the armature.

16. Hold the magnet assembly in the left hand in an approximately horizontal position. Push the armature in firmly but steadily, with the thumb of the right hand (Fig. M-17).

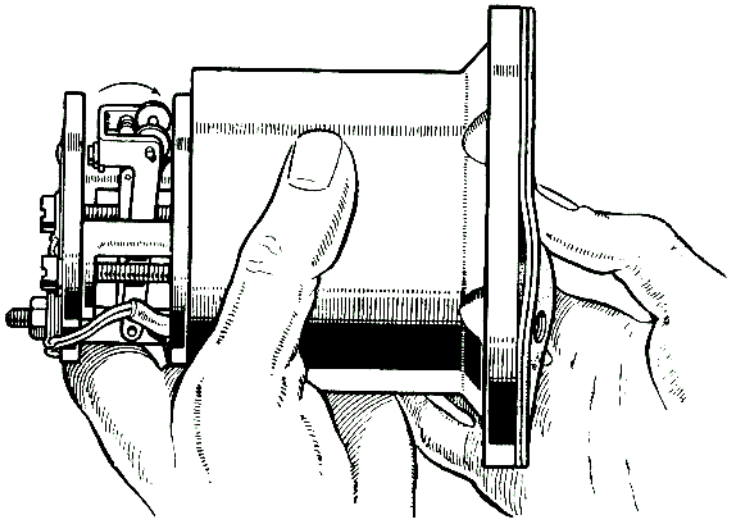


Fig. M-17—Armature adjustment

17. If the contact breaker throws over, the armature should be screwed in further until it ceases to do so. It should then be unscrewed one-sixth of a turn at a time until a position is found at which the contact breaker just throws over, care being taken to avoid jerking the armature. The armature should then be unscrewed for two-thirds of a turn, i.e. four holes; the setting is then correct.

    Note: **Do not forget that this setting must be carried out with the points out of contact.**

    When a new diaphragm is fitted, it is possible that considerable pressure will be required to push the armature right home. If there is any doubt about the point at which the contact breaker throws over, come back one-sixth of a turn.

18. Place the cast iron body in position on the aluminium body, with the drain hole in the cast iron member at the bottom in line with the filter plug in the aluminium body. Ensure that all the rollers are in their correct position. If one of the rollers falls out of position, it will get trapped between the two parts and cut a hole in the diaphragm.

19. Make sure that the cast iron body seats properly on the aluminium body, and insert the six screws. These screws must not be tightened up at this stage, as it is absolutely necessary to first stretch the diaphragm to its outermost position.

    This is best effected by using a special forked wedge to keep the armature in its extreme position (Fig. M-18); the wedge is inserted between the white rollers of the outer rocker and pressed in under the tips of the inner rocker, until it lifts the trunnion in the centre of the inner rocker as far as it will go. Tighten the retaining screws fully, and remove the wedge.

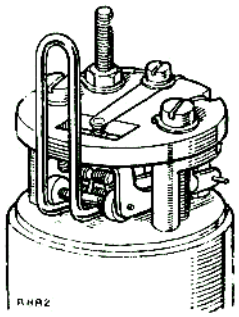


Fig. M-18— Use of forked wedge to keep the armature in position

    Note: If a wedge is not available, the diaphragm may be stretched by holding the points in contact, by inserting a matchstick under one of the white fibre rollers and passing a current through the pump; this will excite the magnet, actuate the armature, and so stretch the diaphragm.

20. Test the fuel pump. It is best to use a cut-away cover while testing the pump, as this prevents the hinge pin from falling out, and, at the same time, makes it possible to observe the action of the contact breaker. The pump should be mounted three feet above the supply tank for testing; either paraffin or petrol may be used. When switched on, the pump should prime itself promptly, and fluid should flow from the outlet union. If the pump output is restricted, the pump should slow down gradually, and if completely cut off it should stop for at least 15 seconds.

Fuel pump—Diesel

Testing fuel pump on vehicle

Ensure that there is sufficient fuel in the tank, then disconnect the fuel inlet pipe from the filter mounted on the front R.H. side of the engine. Turn the engine over by hand, with injection nozzles removed if necessary; there should be a well-defined spurt of fuel from the disconnected pipe every second revolution of the starting handle.

To remove — Operation M/46

1. Disconnect the inlet and outlet pipes, remove the securing nuts and withdraw the pump complete.

To overhaul — Operation M/48

1. Unscrew the nut at base of sediment bowl, move the retainer aside and withdraw the bowl, cork sealing gasket and gauze filter disc. Care must be taken to avoid damage to the filter disc.

2. Mark the upper and lower halves of pump casing to ensure correct alignment on re-assembly and **note the position of diaphragm**

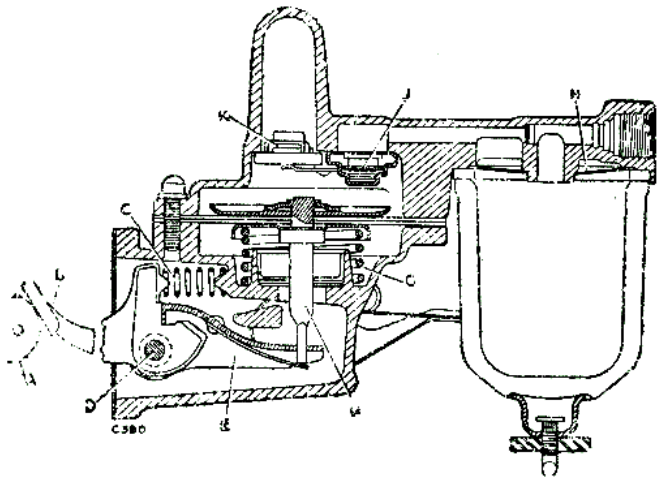


Fig. M-19—Sectioned view of fuel pump

tab. Remove the six screws securing the casings and, with the thumb pressing the diaphragm tab against the lower casing, lift the upper half clear.

3. Ease the diaphragm flexible material from the lower body joint face and holding the metal part of the diaphragm with the fingers, turn it 90° in either direction, whereon the diaphragm spring will push the diaphragm clear.

4. Remove the circlips (on late models the pivot pin is secured by two retainers), then drift the rocker arm pivot pin from the lower casing and withdraw the rocker arm, operating link, return spring and plain washers.

5. It is extremely unlikely that the hand priming mechanism will ever require replacement, but the hand lever, cork washers and hand rocker may be removed by filing the hexagon each side of the operating lever and springing the lever clear. Withdraw the cork washers and hand rocker.

   Note: If removed, the hand operating mechanism must be replaced by new parts.

6. If necessary the oil seal and retainer may be removed by filing away the spread of metal caused by the four peening marks and then drift from below.

7. Remove the retaining plate and withdraw the valves and valve gasket from the upper casing.

8. Clean all parts thoroughly in paraffin and immediately before assembly, in Shell Fusus 'A' oil.

9. Examine all parts for wear and replace as necessary. Observe the following points:

   (*a*) All gaskets to be renewed.

   (*b*) Sediment bowl filter disc must be free of damage and fit tightly round the inlet neck of the upper casing.

   (*c*) Renew the diaphragm assembly if any sign of hardening, cracking or porosity is present.

   (*d*) Only very slight wear should be tolerated at the rocker arm contact face, pivot pin, link and pull-rod slots.

   (*e*) Springs should be renewed, but ensure that the correct type are used.

   (*f*) Valves to be tested for air tightness by suction.

Early models

10. Assembly of the components is a reversal of dismantling procedure, but the location of the rocker arm, washers and operating link on a piece of .240 in. (6,1 mm) diameter rod inserted in place of the pivot pin and then driven out by the pin will facilitate this part of the operation. Replace circlips.

Late models

If rocker arm pin and related parts have been detached from pump body, re-assemble rocker arm, link and spacing washers on to pin, and refit to body, after replacing return spring. Tap the retainers into their grooves, then holding the retainers firmly against the rocker pin, peen over the ends of the grooves to ensure that they cannot work loose.

Always use replacement retainers, as these are slightly shorter than the original to allow for satisfactory fixing in the body.

11. To refit the diaphragm assembly, hold the pump lower casing with the return spring in position and the rocker arm held outwards. Position the diaphragm over the spring with the

1 Upper casing
2 Securing screws
3 Spring washer
4 Valve gasket
5 Valves
6 Retainer for valves
7 Screw securing retainers
8 Gauze filter disc
9 Cork sealing gasket
10 Sediment bowl
11 Bowl retainer
12 Diaphragm assembly
13 Diaphragm spring
14 Oil seal retainer
15 Sealing washers
16 Lower casing
17 Hand priming lever
18 Return spring for hand lever
19 Hand rocker
20 Cork washers
21 Rocker arm pivot pin
22 Operating link
23 Plain washers
24 Rocker arm
25 Return spring
26 Joint washer

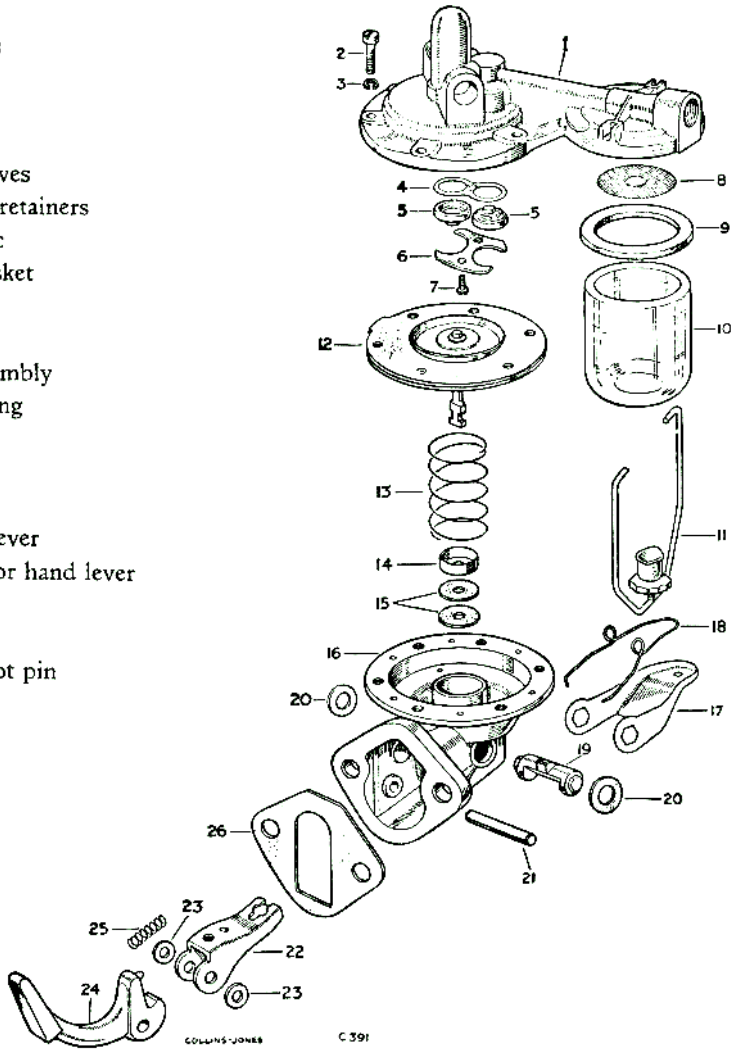


Fig. M-20—Exploded view of fuel pump, Diesel models.

flattened end of pull rod in line with the slot in operating link and the large tab on diaphragm 90° from original fitted position. Press the diaphragm assembly downward to engage the operating link slot and turn it 90° to the position noted whilst dismantling.

12. Push the rocker arm towards the pump until the diaphragm is level with the joint face, then place the upper casing assembly in position, aligning the marks made before dismantling. Fit the six securing screws and spring washers but tighten the screws just sufficiently for the heads to contact the spring washers. The rocker arm must now be pushed inward to the fullest extent before the screws are finally tightened.

    Note: The diaphragm outer edges should be approximately flush with the outer edges of the pump joint faces when fitted.

    Any appreciable protrusion of the diaphragm beyond the joint face edges, indicates improper fitment and necessitates the release of the six securing screws and refitment in accordance with item 12.

Fuel pump—to test without special equipment
Operation M/50

1. Immerse the pump in a bath of fuel oil or Shell Fusus 'A' oil, and operate the rocker arm several times to flush.
2. Hold the pump clear of the bath and continue to operate the rocker arm until the pump is empty, then place a finger over the inlet port ('in') and work the rocker arm several times more. A distinct suction sound should be heard when the finger is removed from the inlet port, denoting that a reasonable degree of suction has been developed.

3. Place a finger over the outlet port and again operate the rocker arm. Air pressure should be felt for two or three seconds after rocker movement has ceased. Build up the air pressure in the pump again, and with the finger held firmly over the outlet, submerge the pump completely in the paraffin or oil bath, then observe the joint face edges for signs of air leakage.

Fuel pump filter and sediment bowl

To remove and clean **Operation M/52**

1. Unscrew the nut at base of sediment bowl, move the retainer aside and withdraw the bowl, cork sealing gasket and gauze filter disc. Care must be taken to prevent damage to the filter disc.
2. Clean the bowl and filter disc in petrol or (Diesel) fuel oil, directing a compressed air jet on the gauze to remove any obstinate particles.
3. Examine the cork gasket for filter bowl and renew if signs of deterioration are evident.

To replace **Operation M/54**

1. Reverse the removal procedure ensuring that the gauze filter disc fits tightly round the inlet neck and is quite undamaged in any way.

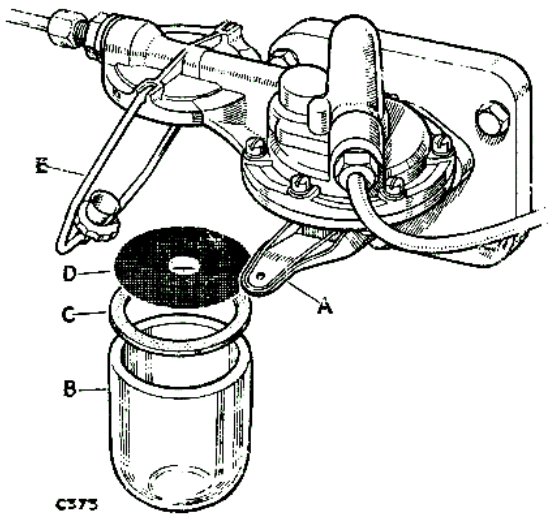


Fig. M-21—Removing sediment bowl—Diesel models

A—Hand priming lever
B—Sediment bowl
C—Cork gasket
D—Filter gauze
E—Retainer for sediment bowl

Fuel system—Diesel models

Note: **Details of fuel lift pump will be found on Pages M-15 to M-17.**

If the injection pump is drained by disconnecting the drain pipe or by running the vehicle until all the fuel has been used, the injection pump **must** be primed before attempting to restart the engine. To minimise the possibility of inadvertently running out of fuel, a blue fuel level warning light is fitted to the instrument panel which glows when only two gallons of fuel remain in the tank and remains "on" until more fuel is added. This device is in addition to the usual fuel contents gauge.

Clean fuel is essential for the efficient operation of the fuel injection pump and injection nozzle assemblies, and for this reason four filters in all are fitted in the system. The first one is fitted in the fuel tank and requires no attention; the second—a sediment bowl and filter disc—is part of the fuel lift pump; the third is a large self-contained unit mounted on the R.H. front side of the engine, and lastly a small tubular gauze filter is fitted in the injection pump head.

An additional filter is fitted to all export Diesel Land-Rovers. This filter is dealt with in Operation M/60.

Filters

Wear of injection pump, injection nozzle parts and the subsequent loss of power and efficiency is primarily due to the presence of dirt in the fuel.

Filters are situated in the Rover system in a manner calculated to minimise the possibility of foreign matter reaching the injection pump or injection nozzles, but the element in the main filter must be renewed, the sediment bowl and filter gauze on lift pump and the filter gauze in injection pump cleaned, at appropriate intervals. These intervals vary and are dependent on operating conditions, but reference to the Owner's Instruction Manual will provide a guide.

Complete sludging up of the main filter element in an unreasonably short operating period is usually due to an excessive quantity of wax in the fuel. Attention should be paid to the method of storage (where bulk storage is used) and the advice of supplier requested. Never draw fuel from the **lowest** point of a storage tank or barrel for refuelling purposes; the lowest point should only be used for draining off sludge and other impurities which accumulate at the bottom end.

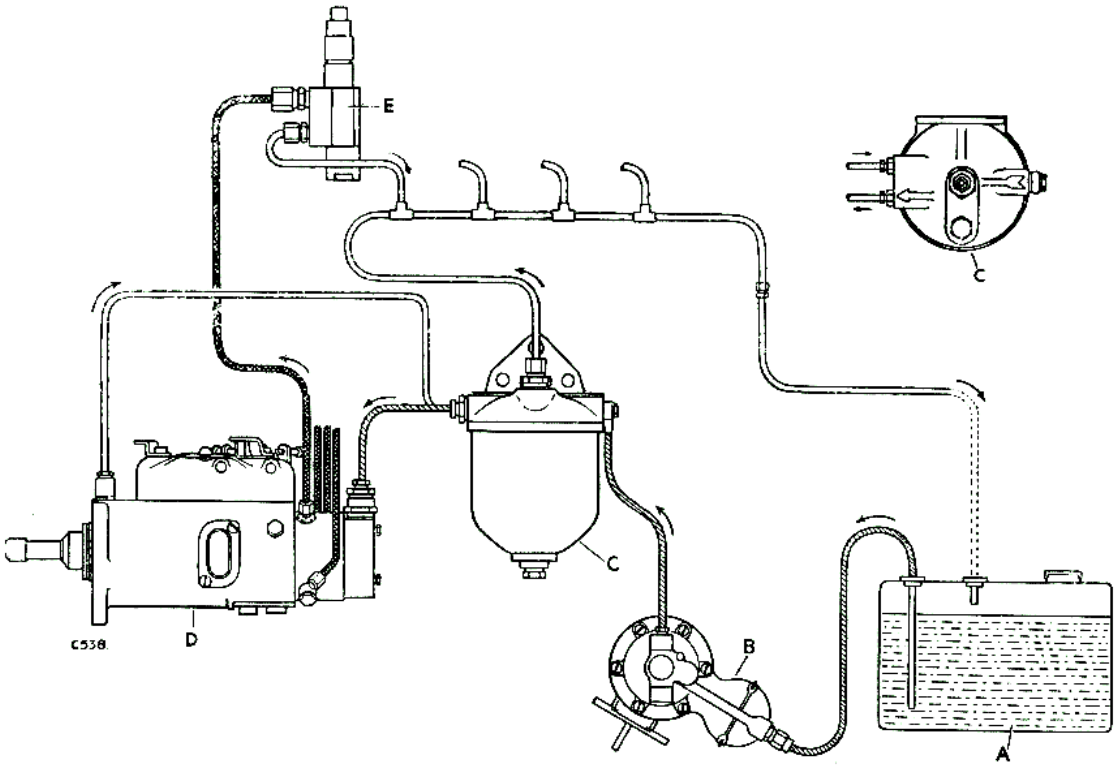


Fig. M-22—Diagram of fuel system.

A—Fuel tank
B—Fuel pump
C—Main filter
D—Injection pump
E—Injection nozzle
VVVVVVV—Low pressure delivery
XXXXXXX—High pressure delivery
———————Excess fuel spill back

Main filter

To remove **Operation M/56**

1. Slacken the drain plug at the base of filter container and allow fuel to flow into a suitable receptacle.
2. Disconnect the fuel inlet, outlet and bleed back pipes.
3. Remove the securing bolts and lift the assembly clear.

Note: A non-return valve is incorporated in the excess fuel spill back pipe. It can be removed by disconnecting the union at the top of the filter, and withdrawing the valve complete with holder.

To refit **Operation M/58**

1. Reverse the removal procedure and prime as in Operation M/64.

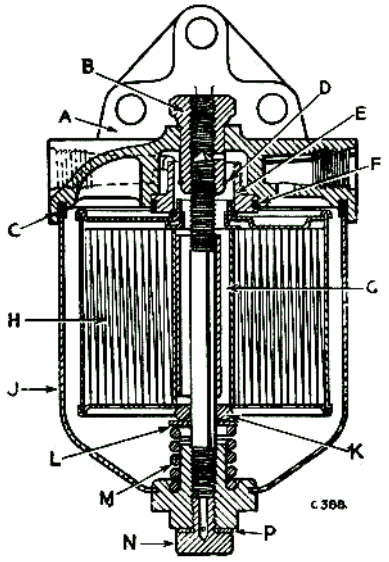


Fig. M-23—Sectioned view of main fuel filter.

A—Housing cover	H—Element
B—Cap nut	J—Container
C—Oil seal	K—Seal
D—Circlip	L—Plain washer
E—Sealing ring	M—Spring
F—Oil seal	N—Drain plug
G—Location sleeve	P—Washer

To remove element—filter in position on vehicle **Operation M/60**

1. Slacken the plug at base of filter container and allow the fuel to flow into a suitable receptacle.
2. Disconnect the bleed back pipe from the top of filter unit.
3. Unscrew the centre cap nut at top of filter whilst supporting the container.
4. Withdraw the container complete with small sealing ring at top of element and remove the large sealing ring from the underside of filter c oer.
5. Discard the filter element, then wash the container thoroughly in fuel oil. Clean the holes in drain plug and boss with a wire. Great care should be taken to ensure that the centre spindle above lower sealing ring is absolutely clean.
6. Renew the lower sealing ring if its serviceability is in any way doubtful—a new top sealing ring is supplied with each element and should always be used.
7. Examine the large sealing gasket for container and replace if necessary.
8. Fit the new element, top sealing rings, and refit container.
9. Reconnect pipes, tighten drain plug and prime. Operation M/64.

Additional filter

All Export Diesel models are fitted with an additional C.A.V. paper element type fuel filter mounted on the engine side of the dash, in the pipe line between the fuel tank and the mechanical fuel pump. See Fig. M-24.

This means that the bowl on the additional filter becomes the water trap, therefore when two C.A.V. filters are fitted, the sediment bowl on the mechanical fuel pump and second fuel filter ('F') mounted at the front right hand side of the engine will only need cleaning and the element changed, every 24,000 (40.000 km).

The bowl of the filter mounted on the dash should be emptied and cleaned every 3,000 miles (5.000 km) and the paper element replaced every 6,000 miles (10.000 km).

If the amount of dirt and water collected when cleaning the bowl at 3,000 miles (5.000 km) appears excessive the element should also be changed; it will also indicate that more frequent checking of the filter bowl is required.

To renew additional filter element **Operation M/62**

1. Unscrew the special bolt on the top of the filter, until the element holder can be removed.
2. Remove and discard the used element and the rubber washer.
3. Wash the container in petrol or fuel oil.

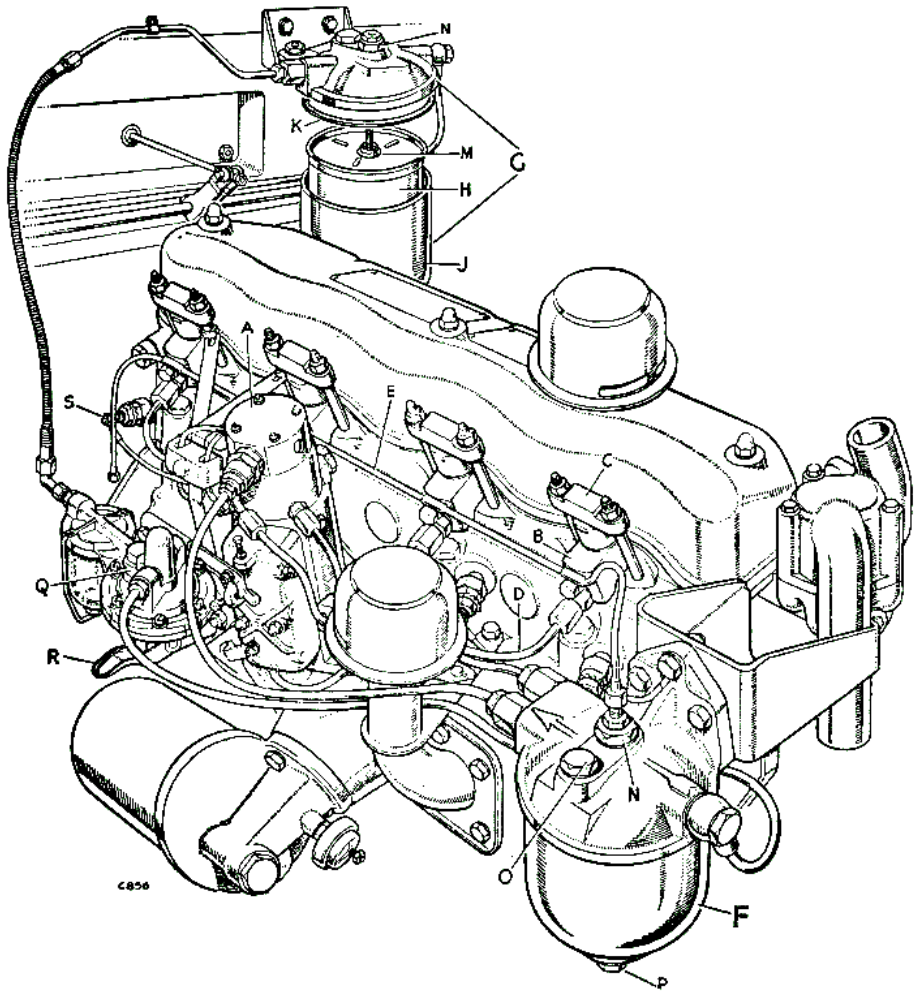


Fig. M-24—Layout of twin filters.

A—Distributor pump.	G—Fuel filter at dash.	O—Air vent plug.
B—Injector	H—Element.	P—Drain plug.
C—Clamp bar.	J—Container.	Q—Mechanical fuel pump.
D—Feed pipes.	K—Large washer	R—Hand priming lever.
E—Spill pipes.	M—Small washer.	S—Heater plug.
F—Fuel filter at engine.	N—Retainer nut.	

4. Renew the large rubber washer in the filter top, place a new element in the container, with the perforated holes to the bottom. Renew the small rubber washer on the top of the element.
5. Fit the container complete with element to the filter top and tighten the special bolt.
6. Prime the system. Operation M/64.

Priming the fuel system Operation M/64

A—When the filter bowl has been cleaned or the paper element changed on **either or both** fuel filters, the system must be primed as follows:—

1. Do not attempt to start the engine hoping to draw the fuel through in this way, otherwise the full priming procedure will be necessary.
2. Slacken the air vent screw on the top of the engine filter.
3. Operate the hand priming lever in the mechanical pump until fuel free from bubbles emerges.
4. Tighten the bleed screw.
5. Operate the hand priming lever once or twice to clear the last bubbles of air into the filter bleed pipe.
6. Start the engine in the normal way and check for leaks.

B—When fuel system has been completely emptied proceed as follows:

7. Carry out operations above 1 to 5 inclusive.
8. Release air vent screw (A) on distributor pump. See Fig. M-25.
9. Operate the fuel pump hand priming lever until fuel free of air emerges. See Hand lever, Fig. M-24.

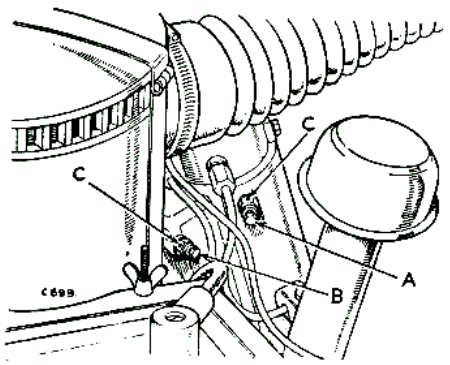


Fig. M-25—Priming the fuel system.
A—Air vent screw on distributor body.
B—Air vent screw on distributor control cover.
C—Fuel orifice.

10. Retighten the air vent screw.

11. To ensure that all air is exhausted from the pump it may also be necessary to slacken air vent screw 'B' in the distributor control cover and repeat items 9 and 10.

12. Start engine in normal way and check for leaks.

C When distributor pump only has been drained it is only necessary to carry out operations 8 to 12 inclusive.

Note : Ensure that fuel pump lever is on the bottom of the operating cam when priming the fuel system, otherwise maximum movement of the priming lever will not be obtained.

It should not be necessary to remove additional filter, but if removed, note that it is secured to the dash by three bolts and rivnuts.

Injection pump filter

To remove and clean **Operation M/66**

1. Remove the pipe filter to injection pump.
2. Unscrew the pipe connection from injection pump head and withdraw the filter.
3. Wash the filter in fuel oil.

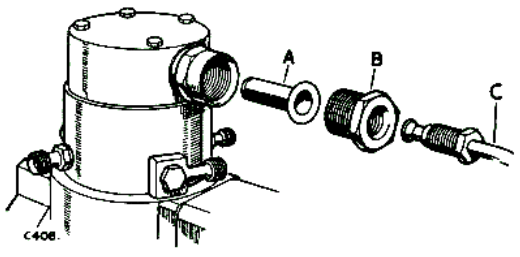


Fig. M-26—Injection pump filter.
A—Filter B—Connection C—Inlet pipe

To refit **Operation M/68**

1. Replace the filter and pipe connection and reconnect the feed pipe at main filter end. Operate the lift pump by hand and couple the pipe to injection pump head whilst fuel flows from the pipe.

Injection pump

To remove **Operation M/70**

1. Remove the air cleaner and flexible air intake pipe.
2. The fuel pipes, injection pump to injection nozzle, filter to injection pump and drain from injection pump should now be removed.
3. Disconnect the accelerator and cut-off controls.
4. Remove the securing nuts and washers then withdraw the pump.
5. Blank off all openings with special caps or adhesive tape if caps are not available.

To refit **Operation M/72**

1. **Timing**

A—Early engines

On early engines the flywheel is marked SI.

(i) Early, unmodified engines.

In order to time these engines correctly, turn the crankshaft in the direction of rotation, until the timing pointer is exactly in line with the SI mark, with both valves on No. 1 cylinder closed.

(ii) Early engines with latest type pistons and early type hot plugs.

The injection pump timing for these engines must be altered to 17° B.T.D.C. Turn the crankshaft in the direction of rotation, until the timing pointer is 0.1 in. (2,5 mm) past the SI mark on the flywheel, with both valves on No. 1 cylinder closed.

(iii) Early engines with latest type pistons and hot plugs.

The correct timing for these engines is 16° B.T.D.C.

Turn the crankshaft in the direction of rotation, until the timing pointer is 0.2 in. (5 mm) past the SI mark on the flywheel, with both valves on No. 1 cylinder closed.

B—Late engines

On late engines the flywheel is marked 16° and 18°.

(i) Late engines with latest type pistons and early type hot plugs.

The correct timing for these engines is 17° B.T.D.C.

Turn the crankshaft in the direction of rotation, until the timing pointer is exactly between the 16° and 18° mark on the flywheel, with both valves on No. 1 cylinder closed.

(ii) Late engines with latest type pistons and hot plugs.

This type of engine must be timed at 16° B.T.D.C.

Turn the crankshaft until the timing pointer is exactly in line with the 16° mark on the flywheel, with both valves on No. 1 cylinder closed.

Note: Engines fitted with late type hot plugs are identified by a splash of red paint on the cylinder head.

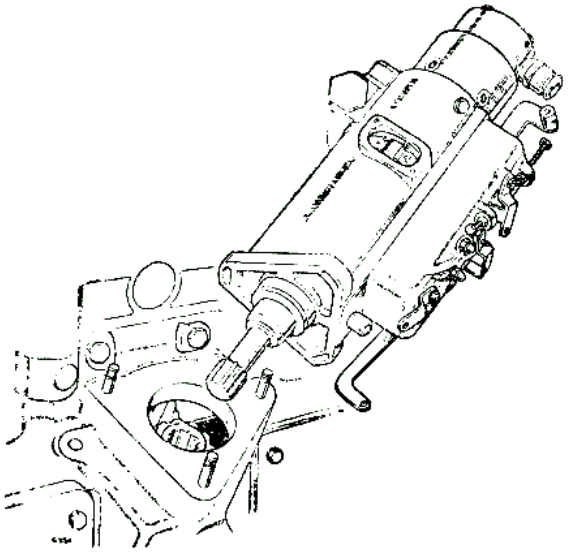


Fig. M-27—Fitting injection pump

2. Remove the inspection cover from fuel injection pump and turn the rotor until the mark (A) on drive plate is in line with the arrow on timing circlip.

3. Offer the pump to engine and fit the securing nuts and washers loosely. Observe the injection pump timing marks again and adjust if necessary by turning the pump body to align the marks.

4. Tighten securing nuts, turn the flywheel against direction of rotation for approximately 90° and then in direction of rotation until the markings (see item 1) on flywheel are again in line with the timing pointer and check finally that the timing marks in injection pump are aligned.

   It is very important that the injection pump is timed as accurately as possible. Two or three degrees retardation can cause excessive white smoke when starting from cold and running at light load. Two or three degrees advance can cause excessive black smoke at low speed full load.

   The timing must be checked by turning the engine until the timing marks on the pump are dead in line and then checking the timing marks on the flywheel. In this way any slight error is magnified by the 2 : 1 ratio of camshaft to crankshaft and the large diameter of the flywheel. An error of a given width on the pump markings will be 12 times that width if transferred to the flywheel.

5. Reconnect the pipes and controls; check the cut-off and throttle controls for full movement. Prime the system in accordance with Operation M/64, then refit the air cleaner and rubber connection.

6. Run the engine and adjust the slow-running control if necessary. Turn the stop screw inward to increase idling speed and outward to decrease.

   The upper maximum power output stop screw setting is sealed at the works and must not be altered.

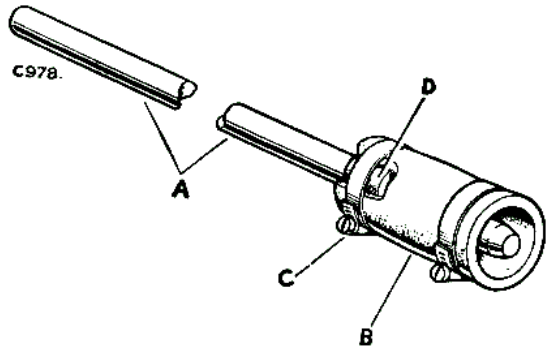


Fig. M-28—Extension shaft for revolution counter.

A—Starting handle. 26 in. (660 mm) long x .687 in. (17 mm) diameter.
B—Rubber hose. 3 in. (75 mm) long x 1¼ in. (32 mm) internal diameter.
C—Hose clips, to suit external diameter of rubber hose.
D—Rubber packing between hose and starting handle.

When a new or reconditioned distributor pump is to be fitted, it will be found that the slow running control screw is wired to the distributor pump and that the maximum output control screw is not sealed.

It is necessary, therefore, after the distributor pump has been assembled to the engine, first to fit the slow running control screw and then adjust both screws as detailed below.

Finally the maximum output control screw should be wired up and sealed as shown at Fig. M-29.

The slow running engine speed should be set at 590 r.p.m. ± 20 r.p.m.

The maximum engine speed should be set at 3,650 r.p.m. ± 20 r.p.m.

Note that the maximum engine speed corresponds to 55 m.p.h. (84 k.p.h.) in top gear, 41 m.p.h. (66 k.p.h.) in third gear and 28 m.p.h. (45 k.p.h.) in second gear.

The engine speeds should be checked with a revolution counter from the starting dog. To do this some form of extension shaft is required; a starting handle cut down with driving pin removed and modified as shown at Fig. M-28 is one method of doing this.

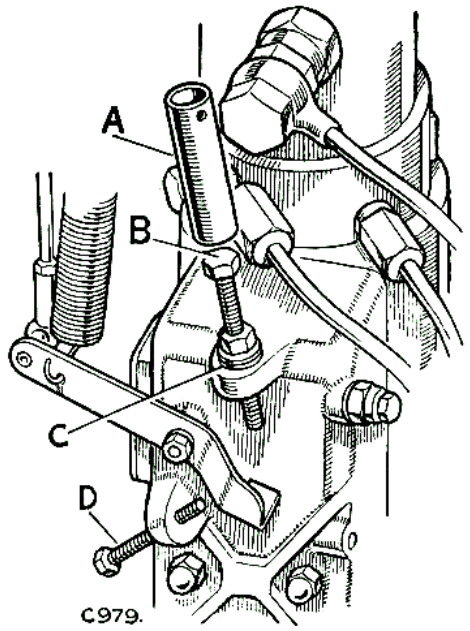


Fig. M-29—Distributor pump control screws.

A—Screw collar.
B—Maximum output control screw.
C—Screw retainer for collar
D—Slow running control screw.

To adjust the maximum output control screw, proceed as follows:—

(*a*) Fit extension shaft to starting dog by sliding the rubber hose over the dog, tighten by means of the hose clip.

(*b*) Check engine speed with revolution counter.

(*c*) Remove adjusting screw collar. See Fig. M-29.

(*d*) Slacken adjusting screw locknut; screw down to decrease engine speed and up to increase.

(*e*) When maximum engine speed of 3,650 r.p.m. ± 20 has been obtained, tighten locknut, replace adjusting screw collar, wire and seal screw collar as shown at Fig. M-30.

To adjust the slow running control screw, proceed as follows:—

(*a*) Check engine speed with revolution counter.

(*b*) Slacken adjusting screw locknut and screw inwards to increase speed and outwards to decrease.

(*c*) When a slow running speed of 590 r.p.m. ± 20 has been obtained, tighten locknut.

(*d*) Remove extension shaft.

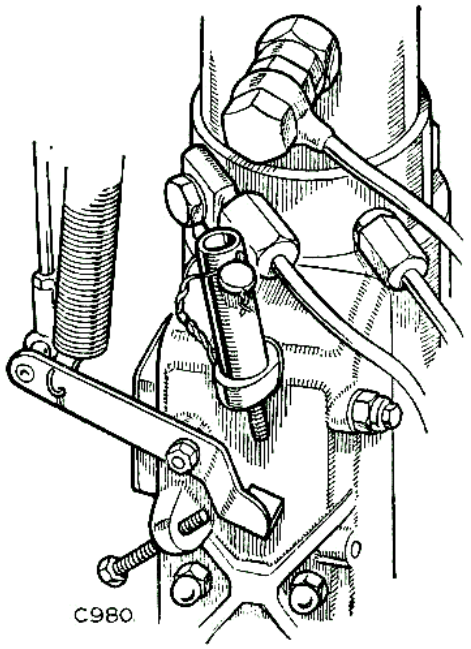


Fig. M-30—Control screws adjusted and sealed.

Fuel injection nozzles

Checking nozzle assemblies on vehicle
Operation M/74

When carrying out the first service inspection at 750 miles (1.000 km) it is important that the injectors are removed, dismantled, thoroughly cleaned, re-assembled, checked and refitted. Thereafter this procedure should be carried out every 12,000 miles (20.000 km).

This thorough checking is necessary at the first service inspection to ensure any small particles of dirt or scale which may have become detached from the pipe lines, filters, etc., are removed.

Dirt in injectors not only has an effect on performance, but also on the noise level of a diesel engine and it is therefore most important to carry out this operation.

When an injection nozzle is considered to be the cause of irregular running and loss of power, a quick check may be made by loosening the fuel feed pipe union nut on each nozzle in turn, whilst the engine is idling and again at approximately 1,000 r.p.m.

If the injection nozzle assembly being checked has been operating properly, there will be a distinct reduction in r.p.m. accompanied by obvious roughness, but a faulty injection nozzle may make little or no difference to the engine note when its fuel feed pipe is loosened.

Testing nozzle assemblies on vehicle
Operation M/76

1. Remove the fuel spill gallery pipe complete, from the injection nozzles, then disconnect the fuel feed pipe (injection pump to nozzle) from the nozzle to be tested and from the injection pump.

2. Release the clamping strap and withdraw the suspected injection nozzle assembly; reconnect the pipe and nozzle assembly to the injection pump in a position whereby fuel ejection may be observed.

3. Loosen the union nuts securing the remaining fuel pipes to injection nozzles.

4. Whilst the starter turns the engine over, observe the manner in which fuel issues from the nozzle and compare the spray form with section "A" of Fig. M-43.

   Very little fuel should issue from the main spray hole with the engine turning over at starter speed but a fine spray comparable to that illustrated in section "A" should be ejected from the auxiliary spray hole. If the ejected fuel is more in the form of a liquid jet or issues from the main pintle hole, then the nozzle and holder assembly should be removed for overhaul (Operation M/78) and a replacement unit fitted.

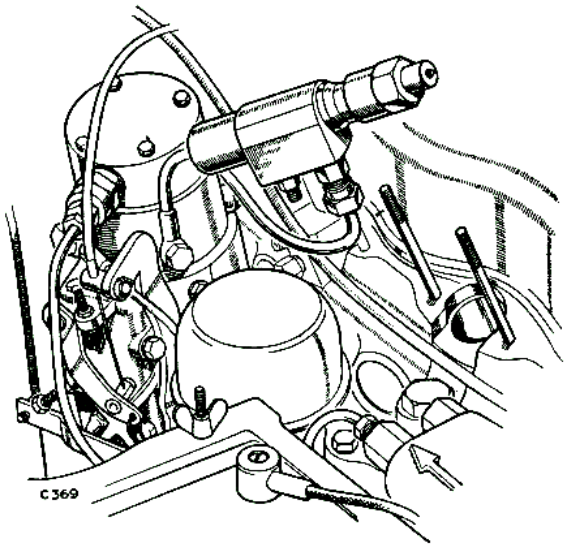


Fig. M-31—Testing nozzle assemblies on vehicle.

Bench testing of injection nozzle and holder assembly

To check a nozzle assembly and ensure that it is functioning correctly, a setting outfit as illustrated in Fig. M-33 is essential. A bench covered with linoleum or non-ferrous sheet metal is most suitable for mounting the outfit; such a surface facilitates the cleanliness essential when checking nozzle parts. Between the bench and setting outfit, a tray, also of non-ferrous metal, should be positioned to prevent spilt fuel spreading. Small containers may be attached to the bench to isolate the component parts of each assembly; these parts are carefully mated by the manufacturers and must **not** be interchanged. Lastly, a small bath with cover, containing Shell Fusus "A" oil for washing components, should be kept conveniently near.

The efficient operation of the injection nozzle assembly is dependent on four main conditions, as follows:—

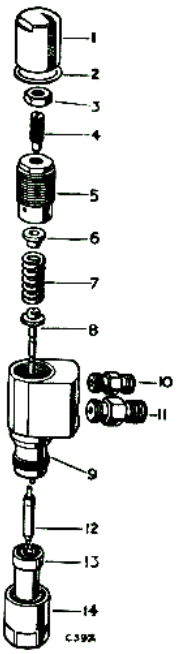
(*a*) The nozzle valve must open at 135 Ats.

(*b*) The rate of back leakage must be within 150 to 100 Ats.

(*c*) Seat tightness must be sufficient to prevent leakage.

(*d*) Spray form must compare favourably with the illustration Fig. M-43.

Pressure setting, back leakage and seat tightness tests may be made by coupling the injection nozzle and holder assembly direct to the pressure feed pipe on setting outfit, but an adaptor must be fitted between the pipe and injection nozzle and holder assembly when testing spray form. This adaptor, described in Operation M/72, increases the pressure of fuel to the injection nozzle and holder assembly sufficiently for the main and auxiliary spray form to be determined.



1 Protection cap
2 Copper washer
3 Locknut—adjusting screw
4 Pressure adjusting screw
5 Pressure sleeve
6 Spring cap
7 Pressure spring
8 Valve spindle and cap
9 Nozzle holder body
10 Spill-back pipe union
11 Feed pipe union
12 Nozzle valve
13 Nozzle valve body
14 Cap nut

Fig. M-32—Exploded view of injection nozzle and holder assembly.

Dismantling and cleaning Operation M/78

A cleaning kit (Part No. 271484) is essential for removing carbon from the component parts of the injection nozzle and holder assembly. The use of special spanners (set Part No. 271482) is recommended.

1. Remove the nozzle holder protection cap and copper washer, unscrew the locknut, pressure adjusting screw and pressure sleeve, then withdraw the spring cap, spring and valve spindle. Unscrew the pipe unions and remove the copper washers.

2. Unscrew the cap nut, then remove the nozzle valve and body.

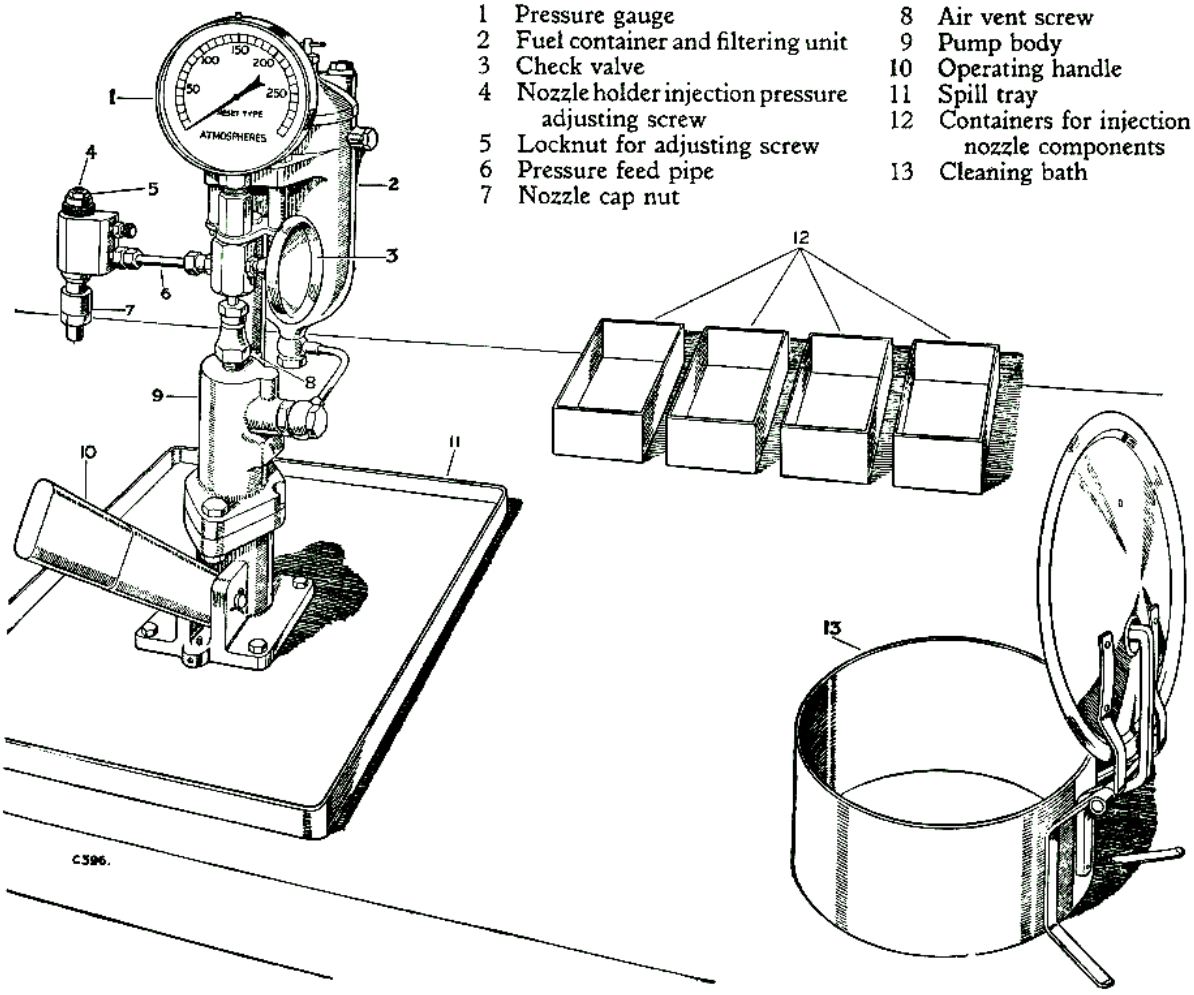


Fig. M-33—Injection nozzle setting outfit.

3. Soak the component parts of the assembly in Shell Fusus "A" oil to loosen carbon deposits but do not allow parts of any one assembly to be interchanged with those of another.

4. Brush away all external carbon deposits from component parts with a brass wire brush (Part No. ET.068) and replace them in the oil bath.

   Particular care must be exercised when cleaning the pintle and seat of nozzle valve to avoid scratching or scoring, which may result in spray distortion.

5. Clean the three oil feed passages in the nozzle body with a wire or drill of $\frac{1}{16}$ in. diameter. Remove the carbon from the annular recess with tool (Part No. ET.071) and from the valve seat, using tool (Part No. ET.070), with a rotary motion.

6. Select the appropriate size probe from the pocket of cleaning kit and secure it in the pintle hole cleaner (Part No. ET.069). Insert the probe into the bore of nozzle valve body and allow the end to extend through the main fuel outlet, then turn in a rotary manner to remove carbon.

7. Carbon may be removed from the nozzle valve cone by inserting the valve into tool (Part No. ET.072) and then rotating it alternatively in a clockwise then anti-clockwise manner whilst pressing the valve inward.

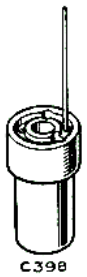


Fig. M-34—Cleaning nozzle body oil feed passages.

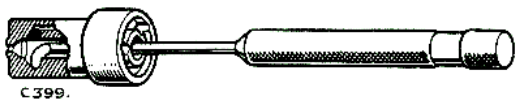


Fig. M-35—Scraping nozzle body annular recess.

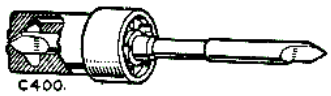


Fig. M-36—Removing carbon from valve seat.

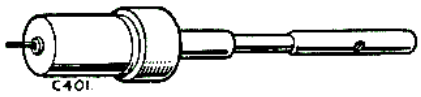


Fig. M-37—Cleaning Pintaux nozzle hole.

If the nozzle is blued or the seating has a dull circumferential ring indicating pitting or wear, the nozzle body and valve should be returned to a C.A.V. Service Agent and replacement parts fitted. See "Defect Location".

Do **not** attempt to lap the nozzle valve to body. This process requires special equipment and training.

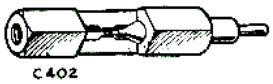


Fig. M-38—Removing carbon from nozzle valve cone.

8. Clean the auxiliary spray hole using tool (Part No. ET.120) fitted with probing wire (.008 in (0,20 mm) diameter). Allow $\frac{1}{16}$ in. (2,0 mm) only to extend from the chuck and thus minimise the possibility of the wire bending or breaking while probing. Great care must be taken to prevent breakage of the wire in the hole.

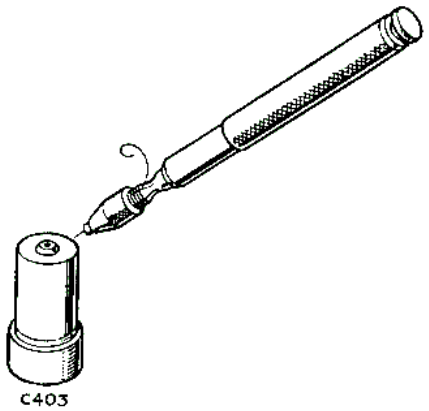


Fig. M-39—Cleaning auxiliary spray hole.

9. With flushing tool ET.427 secured to the nozzle testing outfit, fit the nozzle body (spray holes uppermost) to the flushing tool and pump test oil through vigorously. This flushing process is necessary for the removal of any tiny carbon particles which may have become lodged in the body after scraping and probing.

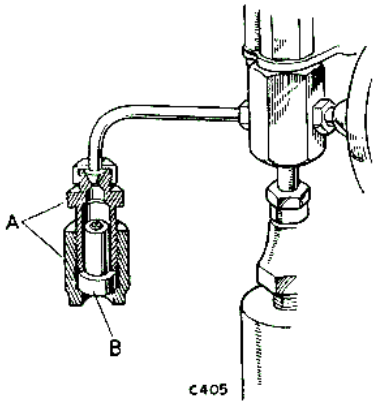


Fig. M-40—Flushing nozzle body.
A—Flushing tool. B—Nozzle body.

10. Examine the pressure faces of nozzle body and nozzle holder to ascertain their freedom from scoring and scratches. These surfaces must be perfectly smooth. Fit the nozzle to nozzle body and check for freedom of movement.

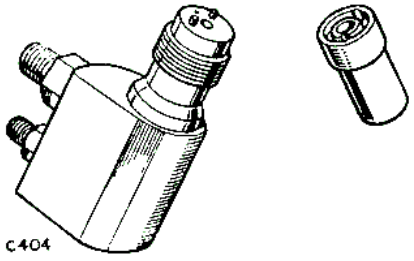


Fig. M-41—Injection nozzle assembly lapped pressure faces.

11. Immerse the nozzle body and valve in the oil bath and assemble whilst submerged. Wash the remaining components thoroughly and reverse dismantling procedure.

12. Test injection nozzle assembly in accordance with Operation M/80.

To test (Fig. M-32) **Operation M/80**

WARNING: The injection nozzle must **not** be allowed to point towards the operator when spraying and the hands must **never** be allowed to contact the spray, which has great penetrating force.

1. Remove the cap from oil container (2) and fill with 1½ pints (0,852 litre) of Shell Fusus 'A' oil.

2. Air vent the system by removing the vent screw (8), allow oil to flow freely for a few seconds and replace the screw whilst the flow continues. Operate the pump handle until oil flows from pipe (6).

3. Connect the injector and holder assembly to the pressure feed pipe with the nozzle pointing downwards. The length and bore of this pipe is important and replacement pipes must be approximately 75 mm (2.8 in.) between the union nuts and of 3 mm (.118 in.) bore.

4. Close the check valve (6) to keep the pressure gauge out of circuit and smartly operate the hand lever (10) several times to expel all air from the system.

Back leakage

5. Open the check valve (3), move the operating handle slowly downward and note the highest pressure at which the gauge needle "flicks". This "flick" indicates the opening of the needle valve and should occur for this test at 160 to 170 atmospheres. Adjustment is made by removing the cap nut from the nozzle holder, loosening locknut (5) and turning the adjusting screw (4) clockwise to increase and anti-clockwise to decrease the opening pressure.

6. Raise the pressure in the system to just less than valve opening pressure, release the operating lever and time the pressure drop from 150-100 atmospheres. This should be not less than 5 seconds for the original nozzle and not less than 7 seconds, if a new one is to be fitted, and not more than 36 seconds for either.

7. Check externally the top and bottom of nozzle cap nut (7) and pressure pipe union nuts for signs of oil leakage. If leakage occurs at the nozzle cap nut, remove the nut and examine the pressure faces of nozzle holders and nozzle body for presence of foreign matter or surface scoring, before tightening further.

   A leakproof nozzle assembly with an excessive rate of pressure drop, indicates a worn nozzle valve; the nozzle valve and nozzle body should be renewed.

Pressure setting

8. The selected **operational** opening pressure of the nozzle valve is 135 atmospheres. Readjust to this setting in the manner described in item 5.

Seat tightness

9. Wipe the bottom face of the injection nozzle dry and raise the pressure in the system to 125 atmospheres. A slight dampness on the bottom face is permissible, but blob formation or dripping indicates a badly seating valve in which case the assembly should be dismantled for further examination.

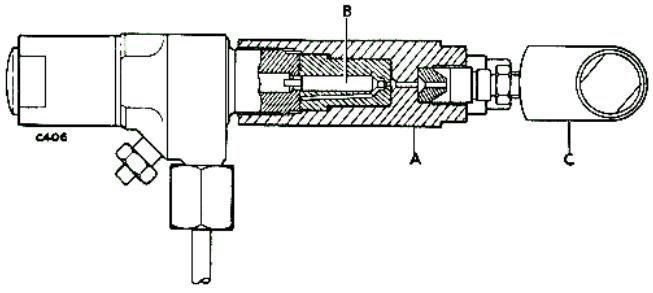


Fig. M-42—Sectioned view of adaptor (C.A.V.-E.T. 872).

A—Modified cap nut. B—Nozzle valve (less pintle).
C—Nozzle under test.

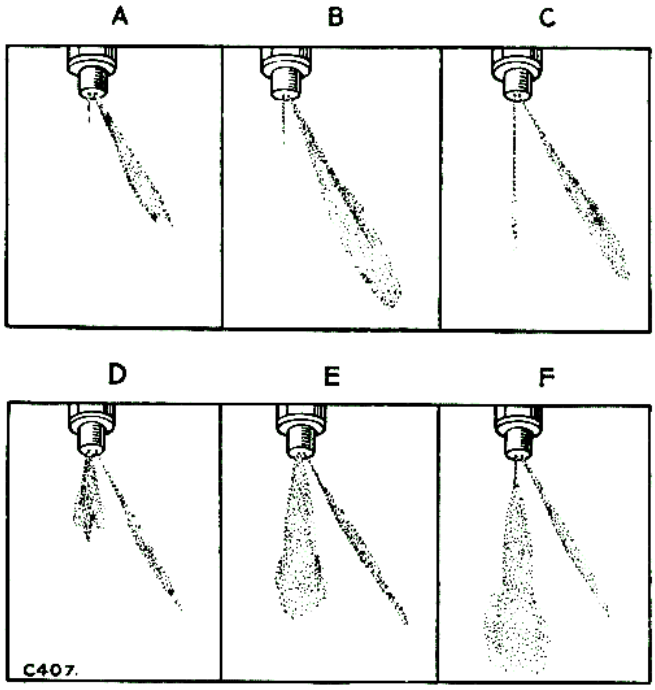


Fig. M-43—Injection nozzle spray form development —starting to running conditions

Spray form

10. Fuel delivery to the injection nozzle assembly when testing **spray form**, must be characteristically similar to fuel delivery under normal operating conditions and to effect these conditions an adaptor (CAV Y7044872) must be fitted between the injection nozzle assembly and the pressure pipe.

    The adaptor differs mainly in the cap nut and nozzle valve, from the ordinary type of injection nozzle and holder assembly as fitted to the engine; the nozzle valve has no pintle and the cap nut is extended, bored and threaded, to receive nozzles for testing.

11. Connect the adaptor assembly to the pressure pipe and adjust the opening pressure of the nozzle valve to 220 atmospheres. (See items 4 and 5.) Screw the injection nozzle and holder assembly to be tested, into the adaptor and with the check valve closed, operate the handle smartly to expel air from the system.

    The auxiliary spray form may be tested at 60 strokes per minute and the main spray at 140. Spray development from starting to running speeds is illustrated in Fig. M-43; this illustration should be referred to and compared with the spray form of nozzles under test.

DEFECT LOCATION

Symptom, Cause and Remedy

PETROL ENGINES

A—NO PETROL SUPPLY TO CARBURETTER
1. Blocked pump or bowl filter—*Clean.*
2. Stoppage in pipe lines—*Clear.*
3. Sticking needle valve—*Replace.*
4. Pump inoperative—*See item* B *below.*

B—INOPERATIVE FUEL PUMP (ELECTRIC)
1. Broken wiring or poor connections—*Rectify.*
2. Dirty contact points—*Clean.*
3. Foreign matter in pump—*Overhaul.*
4. Faulty pump—*Renew.*

C—ELECTRIC FUEL PUMP NOISY
1. Air leak between pump and tank—*Rectify.*
2. Dirt under pump valves—*Clean.*

D—LACK OF ENGINE POWER
1. Badly adjusted carburetter—*Adjust.*
2. Blocked jets—*Clear.*
3. Needle valve sticking—*Replace.*
4. Blocked filters or pipes—*Clean.*
5. Pump inoperative—*See items* B *or* F.
6. Engine fault—*See Section A.*
7. Accelerator linkage stiff—*Lubricate*
8. Water in petrol—*Drain and clear system.*

E—HEAVY PETROL CONSUMPTION
1. Badly adjusted or worn carburetter—*Adjust or replace.*
2. Float chamber flooding—*Replace needle valve*
3. Petrol leaks—*Rectify.*
4. Wrong main jet—*Check and rectify as necessary.*

DIESEL ENGINES

Note. Various defects may be caused by replacing any of the injection equipment on this engine with equipment of the incorrect type.

LIFT PUMP

F—INOPERATIVE FUEL PUMP (MECHANICAL)
1. Fuel tank empty—*Refuel.*
2. Cork sealing gasket for sediment bowl hardened or cracked—*Renew.*
3. Sediment bowl loosely fitted—*Tighten.*
4. Filter disc clogged—*Remove and clean.*
5. Diaphragm cracked or porous—*Renew—Operation* M/48.
6. Screws securing upper and lower casings loose—*Re-set diaphragm and tighten in accordance with Operation* M/48, *item* 12.
7. Rocker arm excessively worn—*Renew.*
8. Springs fatigued—*Renew.*
9. Valve seating gasket or valves damaged—*Renew.*
10. Dirt on valve or valve seats—*Clean and refit.*
11. Valve retainer screws loose—*Tighten.*
12. Pipe union—tank to pump—loose—*Tighten.*

G—FUEL LEAKING FROM BASE OF PUMP
1. Diaphragm porous or cracked—*Renew.*

INJECTION NOZZLES

A—NOZZLE BLUEING
1. Nozzle holder not tightened properly—*Renew nozzle body and valve—tighten fully.*
2. Inefficient cooling—*Check cooling system—renew nozzle body and valve.*
3. Small corrugated sealing washer not fitted or damaged—*Renew nozzle and valve, fit new washer.*

B—EXCESSIVE LEAK-BACK
1. Cap nut loose—*Tighten.*
2. Pressure seats scored—*Renew nozzle and holder assembly.*
3. Nozzle valve worn—*Renew nozzle and holder assembly.*

C—VALVE LIFTING PRESSURE TOO HIGH.
1. Compression screw incorrectly adjusted—*Re-adjust.*
2. Nozzle valve sticking—*Renew nozzle valve and nozzle body.*

D—VALVE LIFTING PRESSURE TOO LOW
1. Compression screw incorrectly adjusted—*Re-adjust.*
2. Spring fatigued or broken—*Renew.*

E—SPRAY FORM DISTORTED
1. Carbon on valve seat—*Remove.*
2. Nozzle tip distorted—*Renew nozzle valve and nozzle body.*
3. Spray holes distorted—*Renew nozzle valve and nozzle body.*
4. Injection holes partially blocked with carbon—*Remove deposit.*

F—NOZZLE DRIP
1. Valve seat scored—*Renew nozzle valve and nozzle body.*
2. Spring pressure incorrectly adjusted—*Re-adjust.*
3. Carbon deposit on valve or seating—*Remove.*
4. Nozzle valve sticking—*Clean and re-check, renew nozzle valve and body if trouble is not corrected.*

MAIN FILTER

A—LEAKAGE AT CONTAINER JOINT
1. Gasket unserviceable—*Renew.*
2. Container loose—*Tighten.*

B—FUEL PUMPED TO FILTER AT NORMAL PRESSURE BUT EMERGES AT MUCH REDUCED RATE
1. Element waxed up—*Renew element.*
2. Foreign body lodged in inlet connection—*Remove and examine.*

INJECTION PUMP

A—INJECTION PUMP DEFECTIVE
1. For any reason—*Return to CAV Agent—fit a replacement unit.*

DATA — ALL MODELS

Air cleaner .... A.C. Centrifugal—oil bath

Capacity:
1948-53 models .... 2 Imperial pints (1 litre)
1954-58 models .... 1.5 Imperial pints (0,85 litre

Carburetter

Type .... Solex

Details .... Petrol models

Choke size:
1948-51 models 23
1952-58 models 25

Main jet:
1948-51 models 107,5
1952-58 models 115

Correction jet:
1948-51 models 160
1952-58 models 170

Pilot jet:
1948-51 models 45
1952-58 models 55

Pump jet:
1948-51 models 50
1952-58 models 75

Economy jet 50

Air bleed jet 1.5

Starter air jet 5.5

Starter petrol jet 135

High speed circuit
Petrol jet ....
Air bleed ....

Petrol level .... $\frac{5}{8}$ in. $\pm\frac{1}{8}$ (16 mm $\pm$3) below float chamber joint face

Exceptions to standard settings to suit various altitudes:

	1948-51 models	1952-58 models
3,000 to 6,000 feet (900 to 1800 m):		
Main jet	100	110
Air bleed jet	2.0	2.0
6,000 to 10,000 feet (1.800 to 3.000 m):		
Main jet	95	107.5
Air bleed jet	2.0	2.0
10,000 to 14,000 feet (3.000 to 4.200 m):		
Choke size	24 or 25	26
Main jet	95	107.5
Correction jet	170	180
Air bleed jet	2.0	2.0

Exception to standard settings to suit tropical conditions:

Main jet:
1948-51 models 100
1952-58 models 110

Filters

Petrol models .... Sediment bowl, full flow

Diesel models, main.... C.A.V. Replaceable element, full flow

Fuel pump

Petrol models .... S.U. Electric

Diesel models .... A.C. mechanical

Pressure, Diesel models 5 to 8 lb./sq.in. (0,351 to 0,562 Kg/cm²)

Fuel tank

Capacity .... 10 Imperial gallons (45 litres). No reserve

Injection pump, Diesel models

Type .... C.A.V. Mechanically governed distributor

Injection nozzle assemblies .... C.A.V. Pintaux

Nozzle size B.D.N.O./SP6209

Opening pressure of nozzle valve .... 135 Ats.

Back leakage rate, 150 to 100 Ats.:

New nozzle .... 7 seconds

Original nozzle .... 5 seconds