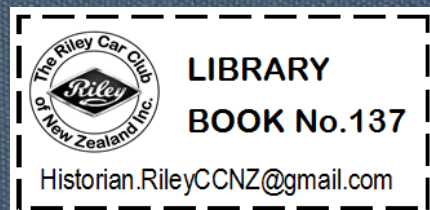


AUC9609A



WORKSHOP MANUAL
CARBURETTORS
AND
ELECTRIC FUEL PUMPS



Original supplied by
Cliff Goodman



WORKSHOP MANUAL

CARBURETTERS AND ELECTRIC FUEL PUMPS

Issued by

THE S.U. CARBURETTER CO. LTD.

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FOREWORD

The S.U. Carburetter is of the automatically expanding choke type in which the size of the main air passage (or choke) over the jet, and the effective area of the jet, are variable. The variable choke and the jet orifice are controlled by the degree of throttle opening used on the engine against the prevailing road load (which may differ widely from light cruising to heavy pulling).

The automatic regulation of the size of choke gives an approximately constant air velocity over the jet (sometimes called a constant vacuum carburetter), which is sufficient to ensure good atomization at all speeds without appreciably impeding the air flow necessary for maximum power.

Also under these conditions of constant vacuum there is no necessity for a separate idling jet, and therefore a single jet only is employed, into which slides the tapered fuel metering needle. The exact profile of this needle can be varied to suit the individual requirements of particular engines, climates or fuels—or indeed any other changing factor, and it forms a convenient and simple method of effecting a change of mixture strength.

Being electrically operated, the S.U. fuel pump is independent of the engine and may be mounted—within certain limits—in any convenient position on the car. It is manufactured in several types, and the second part of this Manual contains descriptions of those available with details of operation and fault diagnosis. A final section is devoted to service and overhaul procedure.

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CARBURETTERS

SECTION A

**CARBURETTER CONSTRUCTION,
FUNCTIONING, AND TUNING**

- Section No. A.1 Construction and functioning of basic-type carburetter.
- Section No. A.2 Tuning.
- Section No. A.3 Tuning multiple-carburetter installations.
- Section No. A.4 Auxiliary enrichment carburetter (Thermo-carburetter).
- Section No. A.5 Additional weakening device.
- Section No. A.6 HD-type or diaphragm jet type carburetter.
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- Section No. A.8 Types and capacities of S.U. carburetters.

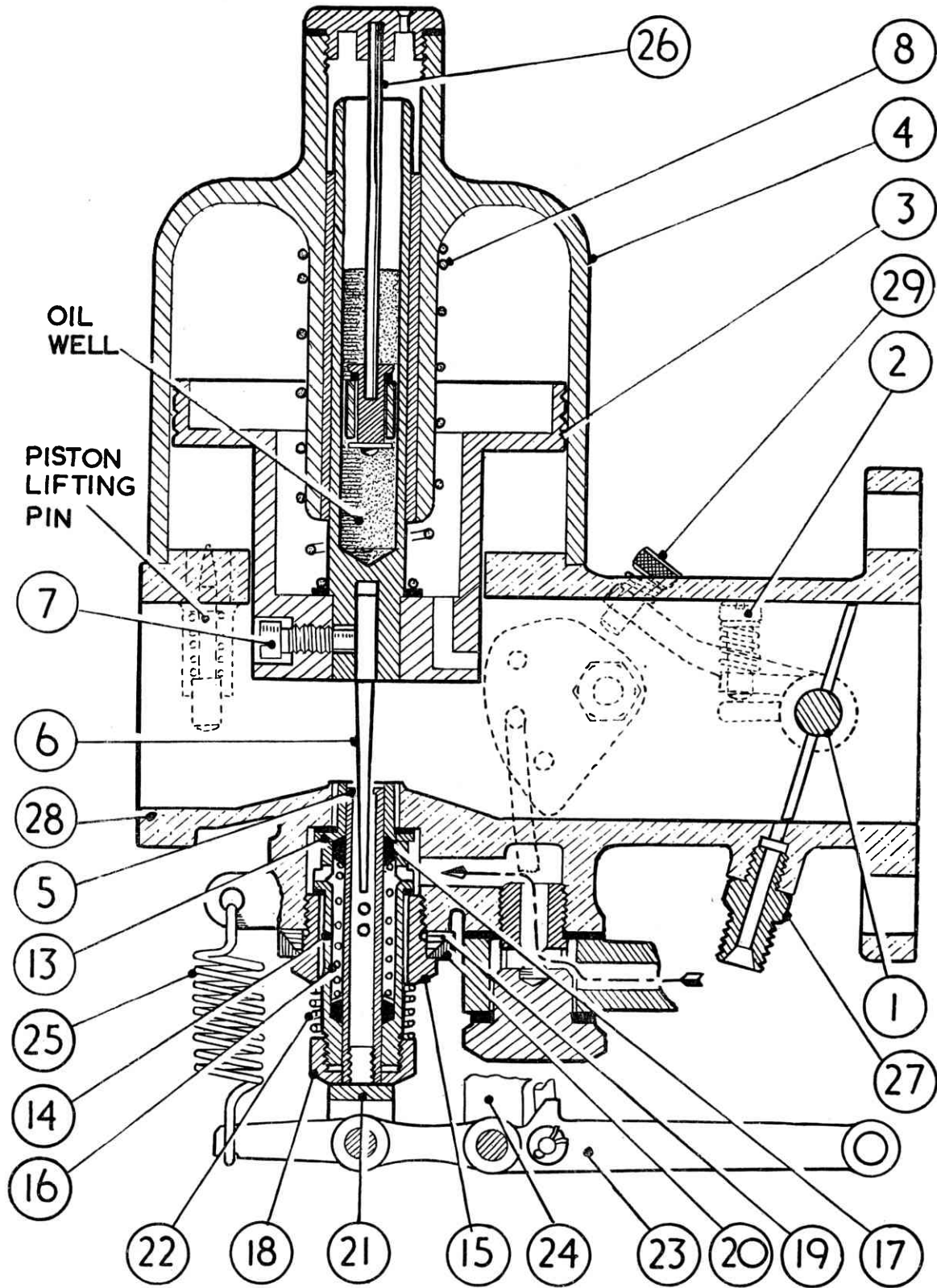


Fig. A.1
The basic carburettor
(See Section A.1)

Section A.1

CONSTRUCTION AND FUNCTIONING OF BASIC-TYPE CARBURETTER

The main constructional features of the carburetter in its simplest form are shown in Figs. A.1 and A.2, which illustrate a typical horizontal carburetter. Fig. A.1 gives details of the main body, the butterfly throttle, the automatically expanding choke (generally referred to as the suction piston unit) and the variable jet arrangement. Fig. A.2 illustrates a normal float-chamber assembly.

Turning to Fig. A.1, it will be seen that a butterfly throttle is mounted on spindle (1) at the engine end of the main air passage, and an adjustable idling stop screw (2) is arranged to prevent complete throttle closure.

Towards the other end of the main passage is mounted the suction piston unit (3), its lower and smaller diameter forming a shutter which enlarges or diminishes the size of the main air passage over the fuel jet (5) as the piston rises or falls under the influence of engine suction (controlled by the degree of throttle opening) on its upper and larger diameter moving axially within the suction chamber (4).

As the tapered fuel metering needle (6) is fixed into the piston by set screw (7), the rising or falling piston, in addition to varying the air passage, also correspondingly varies the jet discharge.

The rising and falling piston is guided by the very accurate fit of the hardened piston rod in the cast-iron guide bush incorporated in the suction chamber. The upper and larger diameter of the piston does not touch the bore of the suction chamber, but is held slightly out of contact with an extremely fine clearance (see Section E.5), and similarly the tapered needle, although at idling speed very closely approaching the bore of the jet, should never actually touch it—this is achieved by making the complete jet unit floating in sideways location when its large clamping screw (15) is slackened off; it can then be exactly centralized on the largest portion of the tapered needle and then locked in this final position. (Full details of this jet centring operation are given in Section B.1.)

The piston, falling either by its own weight or assisted by a light compression spring (8), impacts onto the internal rectangular facing called the 'jet bridge' (28), the impact being taken by a small spring-loaded pin projecting about .010 in. (.25 mm.) from the piston face.

The piston rises under the influence of induction depression (which is controlled by the throttle opening), this taking effect through single or twin holes in the lower face of the small diameter and exerting suction on the top of the larger diameter; the under face of this larger diameter is vented back to atmosphere by ducts not shown on the diagram.

These ducts were vented back to 'free air' on older carburetters, but as this led, in some tropical and dusty climates, to the smoothness of the piston travel being marred by deposits of dust inside the suction chamber, in later 'dustproof' carburetters these ducts are taken back into the air cleaner or pipe, using filtered air.

To prevent the piston rising too quickly as a result of brisk throttle opening, an oil-damped plunger unit (26) is positioned inside the hollow piston rod, and this puts a fluid brake on too rapid a piston rise but exerts no restriction on its fall. It provides an appropriate degree of enrichment for acceleration and improves cold starting and driveability from cold.

The oil reservoir in the hollow piston rod in which the damper plunger functions should be topped up periodically, about every three or four months, with thin engine oil S.A.E. 20 preferably (but no thicker than S.A.E. 30), and this topping-up level is not critical; simply unscrew and remove the damper unit and then pour sufficient oil into the reservoir to bring the oil to within about $\frac{1}{2}$ in. (13 mm.) of the top of the rod. Screw the plunger unit back into position.

The jet proper (5) is housed and slides in an upper bearing (13) and a lower bearing (14), and positioned in each bearing is a small cork gland sealing washer (17) which prevents fuel leakage, a compression spring (16) giving the necessary loading on each gland.

A large cork (or synthetic rubber) sealing ring (19) prevents leakage between the main body casting and the jet locking screw (15); this screw clamps the complete jet unit in the necessary concentric position relative to the taper needle (see Section B.1, 'JET CENTRING').

The jet head (21) under normal running conditions should abut hard up against the adjusting nut (18), the position of which determines the idling mixture strength when the engine is fully warmed up. For cold starting this jet head is lowered manually, approximately $\frac{3}{8}$ in. (9.5 mm.) away from the tapered needle, thus giving a larger fuel discharge area and producing the very rich mixture necessary for cold starting.

For winter conditions it is sometimes preferable, after a cold start, to bring the jet only part way back, not reaching the 'full weak' position, so that the first mile or two of running with a near-cold engine is done with a slightly lowered jet giving a mildly richer mixture than normal—the best intermediate position of the dashboard control giving this slightly lowered jet will be readily found after a little experience, care being taken not to run needlessly rich.

The lowering of the jet is done through the jet lever (23), and a tension spring (25) provides the necessary upward thrust on the jet head (21), ensuring that after a cold start the jet always tends to be brought back to 'full weak' and kept there during normal running.

Referring again to cold starting: it was normal on pre-war cars to have two separate controls on the carburetter, one of which enriched the mixture, and the other gave a modest degree of throttle opening. In later years, however, it has become usual to have only one hand control combining both functions, so that on the carburetter the lever controlling the lowering of the jet is also interconnected with a throttle opening mechanism.

On an earlier type of this throttle and jet interconnection the two movements, throttle opening and jet lowering, took place together, but in a later type (using a cam operation in place of a rocker) the throttle is opened in advance of the lowering of the jet and also closes after the raising of the jet; this can be an advantage in winter as it prevents the engine stalling during slow speed manœuvring with a cold engine as it enables a generous amount of hand throttle to be used.

With this cam-type interconnection, or its preceding rocker type, the outer adjusting screw should be about $\frac{1}{16}$ in. (40 mm.) (thickness of a visiting card) away from the cam face or rocker face when the engine is warm and idling on a closed throttle; with the rocker type this figure should not be exceeded, but with the cam type a larger gap can be used if desired.

An entirely different solution of the cold starting problem is given by the thermostatic type of carburetter, where, in addition to the main instrument, a separate and auxiliary carburetter is brought into action to provide the initial very rich mixture for cold starting and also the milder degree of enrichment necessary during the warming-up period. A complete description of this type of carburetter is given in Section A.4. After a matter of two or three miles, when the engine has reached full working temperature, an automatic thermostatic switch (sometimes an alternative hand switch is used) cuts off the current which brings this auxiliary carburetter into action, and the main instrument then provides all the necessary mixture. Section G.1 gives details of the 'tuning variables' on this auxiliary carburetter and Section D.2, para. 3, gives details of the different main jet assembly also used.

The majority of current body castings incorporate a throttle edge union (27) for actuation of an automatic ignition control, and on certain carburetters (generally single-carburetter layouts for six-cylinder engines) there is an additional similar pipe and union fitting for actuating what is termed the 'weakening device' providing a weakened-off mixture for part throttle cruising when the engine is pulling against a light load. This fitting cannot be supplied except as car manufacturers' original equipment owing to the complicated tuning problems involved. The weakening device is dealt with in Section A.5.

A.4

Jet air bleed

On some carburetters produced between 1950 and 1954 a small air bleed was added to the chamber housing the main jet assembly. The top of this air bleed unit protrudes at an angle from the side of the carburetter body, and its function is to stabilize the jet discharge under certain conditions.

The jet bleed protrudes through the side of the jet housing to finish with a screwed union and pipe-line leading either to the lid of the float-chamber or to some portion of the air inlet pipe.

To inspect the orifice of this air bleed it is only necessary to detach the pipe-line nut at the union close to the carburetter body, and inspect the actual bleed hole which is part of the bore of the union.

There is nothing that can go wrong with these air bleeds apart from blockage by dirt—and the average driver would not detect the slight deterioration in performance which results. If, however, the screwed union of the pipe-line unit worked loose, then a drastic weakening effect on the mixture strength would immediately be noticeable.

Turning now to the float-chamber in Fig. A.2, it will be observed to be of orthodox construction, comprising a needle valve (9) located within a separate seating screwed into the casting of the float lid, and a float (10), the upward movement of which in response to the rising fuel level causes final closure of the needle upon its seating through the action of the hinged fork (11). (See Section F.1 for various types of seatings and needles.)

It will be seen that the float-chamber is a unit separate from the main body of the carburetter, to which it is attached by means of bolt (12), suitable drillings in the float-chamber, bolt, and body casting leading the fuel to the jet. (See Section F.2 for types of holding-up bolt and washer.)

The fuel level in the float-chamber need not be exact or to a critical dimension (unlike a fixed choke carburetter), but the standard level is $\frac{3}{8}$ in. (9.5 mm.) below the level of the rectangular facing known as the jet bridge, and full details of this and any corrections that may be necessary are given in Section B.5.

Section A.2

TUNING

On the bulk of carburetter installations, which are car manufacturers' original equipment, the type of needle (of which there are many) fitted to a specific car has been settled only after prolonged tests, and therefore it is not usual for the recommended type to need changing in practice.

If, however, unsatisfactory carburation raises a doubt about the correctness of the needle type fitted, it can be withdrawn for inspection after first detaching the suction chamber and piston unit (4), Fig. A.1, and loosening the needle clamping screw (7). The needle type, identified by letters or numerals (or both), is rolled around the shank diameter or stamped upon the shank end—and owing to the smallness of the available space these markings are not too obvious; a magnifying glass may assist.

Having re-inserted the needle after checking that the identification marking indicates a suitable needle form, tuning is confined to correct idling adjustment.

prevent the jet head from correctly abutting the nut. When the idling tuning has reached a satisfactory conclusion, this control should be re-clamped in such a position that there is a small amount of cable slack and the taut condition avoided.

The stop screw (2) should be carefully slackened off until the slowest idling speed is found, and then the jet position should be so adjusted, vertically, that for this given position of screw (2) the *fastest idling speed is obtained consistent with even firing.*

If the firing is uneven, with a 'splashy', irregular type of misfire and a colourless exhaust, then the mixture is too weak and the jet position should be suitably lowered;

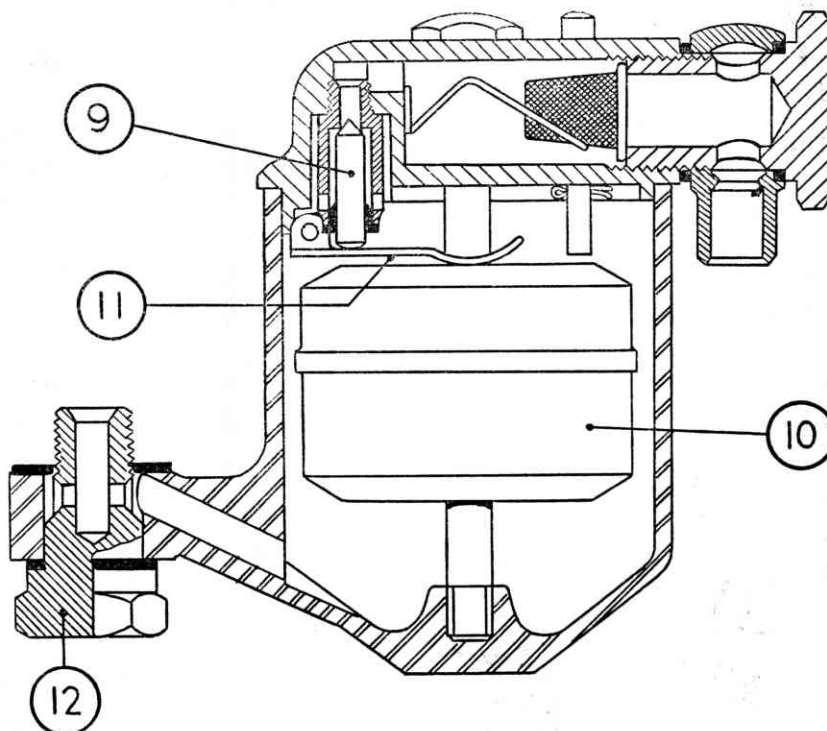


Fig. A.2
The float-chamber

9. Needle valve. 10. Float. 11. Float lever. 12. Bolt.

(When re-locking the needle in place, which should be done firmly, note that the standard needle position is with the shoulder on the needle shank just flush with the bottom of the piston into which it is inserted. See Section E.2 for full details of needle fitting.)

Idling adjustment is carried out by movement of the idling stop screw (2), Fig. A.1, and the jet stop nut (18), but before making these adjustments it is essential that the engine should have attained its normal running temperature.

It is advisable, before commencing adjustments to nut (18), to slacken off the choke cable clamp anchored to the end of the jet lever, otherwise a taut cable may

whilst if the firing is uneven, with a rhythmical or regular misfire and a blackish exhaust, then the mixture is too rich and the jet position should be raised.

Here it may be observed that there are two methods of finalizing the vertical position of the jet to give a satisfactory mixture as follows:

First method. Detach the return spring (25), Fig. A.1, and screw the nut up to its topmost position out of the way and leave it there while the jet proper is moved vertically into the most satisfactory position for idling mixture by careful movement of the lever (23), and when this position has been found screw the stop nut carefully downwards until it meets the shoulder on the

jet head (21) without disturbing the setting just obtained; the return spring can then be replaced.

It must be emphasized that with this first method the lever (23) must be moved with great care as, disregarding possible backlash, a movement of $\frac{1}{64}$ in. (.40 mm.) of the end of the lever on some engines will give an observable difference in engine beat, and a movement of $\frac{1}{16}$ in. (1.59 mm.) a marked alteration.

Second method. In this method, leave the spring in its normal position so that it keeps the jet head (21) always hard up against the stop nut (18), then adjust the nut upwards for weakening or downwards for enriching until a satisfactory engine beat is obtained.

If the return spring on the jet lever is temporarily removed in order to give easier access to the stop nut (18), make sure that the jet head is abutting hard up against the under side of this nut after every adjustment. Bear in mind that really good slow running is critical, on some engines to a sixth of a turn (one flat of the hexagon) of the stop nut.

Having adjusted the mixture strength to suit the originally set position of the stop screw (2), the idling speed may be found to be too fast. A slight slackening off of the stop screw can be made to lower this speed, which may also entail a small alteration to the stop nut, possibly to the extent of one flat.

When the slow-run mixture is correct, lifting the piston by means of the small spring-loaded pin on the side of the body casting (or on older models with a wire nail poked through one of the air vents in the suction chamber mounting flange) will slightly increase the speed of idle to start with, but when the full travel of the pin is reached, giving about $\frac{1}{4}$ in. of piston lift, then the resulting weakening effect should stall the engine.

If any difficulty is found in obtaining a good idling speed with the needle in the 'standard' position, it may be necessary, very occasionally, to vary it, as described in Section E.2.

Note that where an alteration in mixture strength is required for the main throttle range (that is, not idling speed), then a different type of needle should be fitted, but the jet will remain the same.

A Jet Needle Recommendation Folder is published, under Part No. AUC9603, priced at 9d., which gives the standard needle tuning for various models of cars issued since 1933, together with alternative rich and weak needles used in special conditions of climate or fuel, or other variable factors.

There is also a complete folder of needle types with their corresponding sizes, published under Part No. AUC9618, priced 1s. 0d., but this is only necessary to or suitable for those people engaged in the comprehensive tuning of carburetters, including non-

standard and special 'conversion' installations or for racing and competition cars.

Before arriving at the conclusion that a change of needle is necessary in order to restore satisfactory carburation, a careful examination should be undertaken for the detection of other possible faults in the carburetter, for air leaks in flange gaskets, for faults in the sparking plugs or ignition system, or the general mechanical condition of the engine, including sticking valves or defective valve seats.

The influence of air cleaner type should be checked if a change (not usually to be recommended) is made from the standard size or type, as the carburation may be affected—also a carburetter originally tuned with a cleaner will show a pronounced weakening off if run without it.

When writing for advice about the choice of a more suitable needle, quote the type identification of the existing needle and indicate whether the mixture appears to be too weak (or too rich) at quarter, half or full throttle or over the whole range.

Effect of altitude and climatic extremes on standard tuning

The standard tuning employs a jet needle broadly suitable for temperate climates from sea-level up to 6,000 ft. Above that altitude it may be necessary, depending on extremes of climatic heat and humidity, to use a weaker tuning.

The factors of altitude, extreme climatic heat, and humidity each tend to demand a weaker tuning, and a combination of any of these factors would naturally emphasize this demand. This is a situation which cannot be met by a hard and fast factory recommendation owing to the wide variations in the conditions existing, and in such cases the owner will have to do a little experimenting with alternative weaker needles until one which is satisfactory is found.

If the carburetter is fitted with a spring-loaded suction piston, the necessary weakening may be effected by changing to a weaker type of spring or even discarding the spring itself and running without one.

Section A.3

TUNING MULTIPLE-CARBURETTER INSTALLATIONS

To make a thorough job of adjusting twin or triple S.U. carburetters it is first advisable to check all engine details which affect performance, such as compression, tappet clearances, plug gaps and distributor gap, with the engine manufacturer's recommendations.

The carburetters should then be checked over for dirt-free suction chambers and pistons (see Section B.1 at [1]), and also that the piston falls freely into a correctly

centred jet assembly—if it does not the jet unit will need recentring as described in Section B.1 at (3).

Now slacken the clamping bolts on the universally jointed connections between the throttle spindles so that the throttles can be set independently of each other, and disconnect the mixture control linkage by removing one or, in the case of triple carburetters, two of the fork swivel pins. While the suction chambers are off for cleaning see that the needles are located in the same position in all the pistons, and that the jets are the same distance below the rectangular facing of the jet bridge; one method of making sure of this is to screw each adjusting nut (18), Fig. A.1, right up to its topmost position and then unscrew each nut one full turn or six flats of the hexagon, which is a reasonable starting point.

Unscrew the throttle adjusting screws (2), Fig. A.1, and screw these back until they will just hold a thin strip of paper between the end of the screw and the fixed stop web on the body casting when the throttle disc is fully shut; then screw them in one complete turn.

The engine may now be started and left running until thoroughly warmed up, when it may be found necessary to readjust the idling screws (2) by equal amounts in either direction according to whether a higher or lower speed is required. To check for exact matching of the throttle openings, it is best to listen to the air intake hiss, after first removing the air cleaners. This is most easily done by holding one end of a piece of rubber tubing against the ear and the other end against the intake of each carburetter in turn, when the intensity of the intake hiss can be gauged. The larger the throttle opening, the more intense is the intake hiss, and with this as a guide the necessary adjustments for matching can readily be made after a little experience.

When the degree of throttle opening has been dealt with, the mixture strength given by each jet can be varied by moving all jet adjusting nuts (18), Fig. A.1, the same amount, either upwards for weakening or downwards for enriching, until a satisfactory engine beat has been found, which should give *the fastest idling speed consistent with even firing*.

When this has been found, it may be necessary to lower the idling speed by slackening off slightly the throttle adjusting screws, all an equal amount.

Note that a weak idling mixture gives a 'splashy', irregular type of misfire, with a colourless exhaust, whilst a rich idling mixture gives a 'rhythmical' or regular misfire, with a blackish exhaust.

When the mixture strength is correct on all carburetters, lifting the piston about $\frac{1}{8}$ in. (3.1 mm.) with a penknife blade (or by the special piston lifting pin on the side of the body casting) will give uneven firing from excessive weakness on that particular carburetter.

If lifting the piston of one carburetter stops the engine and lifting that of another does not, this indicates that the mixture on the first carburetter is set weaker than that on the second, and therefore the mixture strength on the first one should be enriched by unscrewing the jet adjusting nut one or two flats of the hexagon.

There is one occasion when the above check does not give a correct indication, and that is the rare condition when the throttle on one carburetter is set open a generous amount coupled with a weak setting of the jet adjusting nut.

Then if the second carburetter so happens to be set the opposite way, with a rich setting of the jet adjusting nut coupled with a slight throttle opening, then the overall effect will probably give a fair idling performance for the complete unit; but lifting the piston on the second carburetter will stop the engine although it is actually running rich—thus contradicting the original instruction. Also, lifting the piston on the first carburetter will not stop the engine although it is actually running weak—the lifting of the piston in this case only slightly weakens off an already markedly weak mixture and is not enough to stall the engine.

The obvious cure for such a combination of extremes is to make sure firstly (possibly by using the simple rubber stethoscope already mentioned) that both throttles are open the same amount for idling, giving approximately the same suction on each jet.

Make sure that the jet is hard up against the bottom face of the adjusting nut after any movement of the latter; and also check the same point when reconnecting the link rod between the jet units, as it may be necessary to lengthen or shorten this linkage so that the clevis pin can be inserted easily when the jets are in the correct hard-up position.

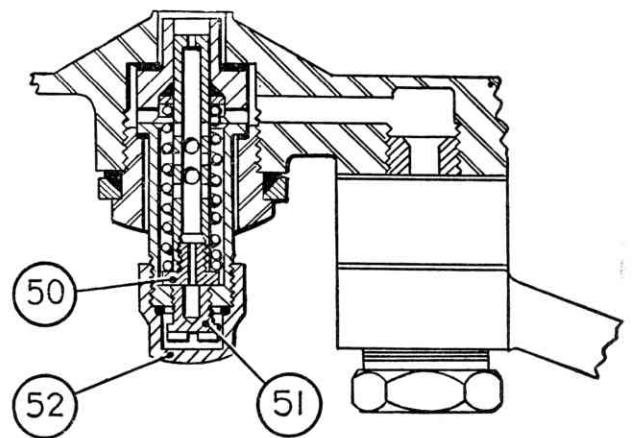


Fig. A.3

The jet assembly: auxiliary enrichment carburetter

50. Jet. 51. Adjusting screw. 52. Cap nut.

Although it is advisable, before the actual start of the tuning operation, to check that the jet adjusting nuts are all screwed the same amount downwards from the top-most position, later, when a satisfactory setting for each nut has been found giving a correct slow run, it may be that this finalized position is not exactly similar for each nut; that is, one may be two turns down and another two and a half turns down.

This apparent discrepancy is well within normal variation, and even on new carburetters may be as much as one full turn, depending on such factors as exactly similar positioning of each jet needle in the piston, etc. On older carburetters, where there is also the influencing factor of unequal wear on individual parts, then the variation in jet nut position may be greater, and up to two full turns down.

The throttle connection bolts may now be retightened, taking care to see that light pressure is put on the head of each throttle stop screw as the last bolt is tightened.

Section A.4

AUXILIARY ENRICHMENT CARBURETTER (THERMO-CARBURETTER)

On certain installations an electrically operated auxiliary carburetter is used in conjunction with a single or a multiple installation of S.U. carburetters. This may be controlled either by a thermostatically or manually operated switch.

In all cases where this additional starting device is employed the more usual means of manually withdrawing the jet for enrichment is, of course, omitted. The device is diagrammatically illustrated in Fig. A.4.

Before considering the construction and operation of the additional apparatus involved, reference may first be made to Fig. A.3, which shows the somewhat simplified construction of the main carburetter jet. It will, of course, be realized that it is still necessary, in the case of the main jet of the carburetter, to provide facilities for centring as referred to in Section A.1. Similarly, provision must also be made for some degree of vertical adjustment of the jet in order to achieve the correct idling mixture strength.

Reference to Fig. A.3 will show that the general construction of this jet, which is mounted within a pair of jet bearings, follows closely the design of that described in Section A.1. The jet does not emerge from the lower jet bearing but terminates in a flange (50) which forms the lower abutment for the loading spring corresponding to (18) in Fig. A.1.

Thus the jet is urged downwards by the load of the gland spring, the lower face of the flanged end (50), Fig. A.3, coming into contact with the adjusting screw

(51). A cap nut (52) encloses the adjusting screw (51) which, when tightened in position, seals the bottom of the lower jet bush against leakage of fuel which would otherwise occur down the thread of the adjusting screw.

The operation of centring the jet is similar to that described in Section B.1.

The process of adjustment for idling differs, however, from that formerly described in that the operation is performed by rotation of the slotted head of the screw (51). The general procedure for this adjustment is, of course, similar to that given for the normal sliding type of jet, with the exception that the cap nut (52) must first be removed, and the jet adjusted with a coin in the slot in the head of the adjusting screw (51). During this process of adjustment some slight leakage of fuel may occur, but it will, of course, cease as soon as the cap nut (52) is replaced.

The enrichment apparatus for starting is, in effect, an auxiliary carburetting system and is shown in Fig. A.4. The main body casting (34) containing a solenoid-operated valve and fuel metering system is illustrated as a separate unit attached by means of a ducted mounting arm to the base of the main carburetter fuel inlet.

The auxiliary carburetter forms, therefore, a separate unit additional to the normal float-chamber retained by the hollow cross-drilled bolt (43), which is equivalent to that shown in Fig. A.2 (12). In certain cases, however, the casting (34) is formed integrally with the main float-chamber body (33), drawing its fuel supply directly therefrom.

Fuel is supplied in either case to the base of the jet (42), which is obstructed to a greater or lesser degree by the tapered slidable needle (45).

When the device is in action air is drawn from atmosphere through the air intake (40) and thence through the passage (41), being carburetted with fuel as it passes the jet (42). The mixture is thence carried upwards past the shank of the needle (45) through the passage (49) and so past the aperture provided between the valve (36) and its seating (35). From here it passes directly to the induction manifold through the external feed pipe shown.

The device is brought into action by energizing the winding of the solenoid (38) from the terminal screws (39). The centrally located iron core (37) is thus raised magnetically, carrying with it the ball-jointed disc valve (36) against the load of the small conical spring (53) and thus uncovering the aperture provided by the seating (35).

Considering the function of the slidable needle (45), it will be seen that this is loaded upwards in its open position by means of the light compression spring (46) which abuts against a disc (47) attached to the shank of the needle. The needle continues upwards through the vertically adjustable stop (48) in which it is slidably mounted and it finally terminates in an enlarged head.

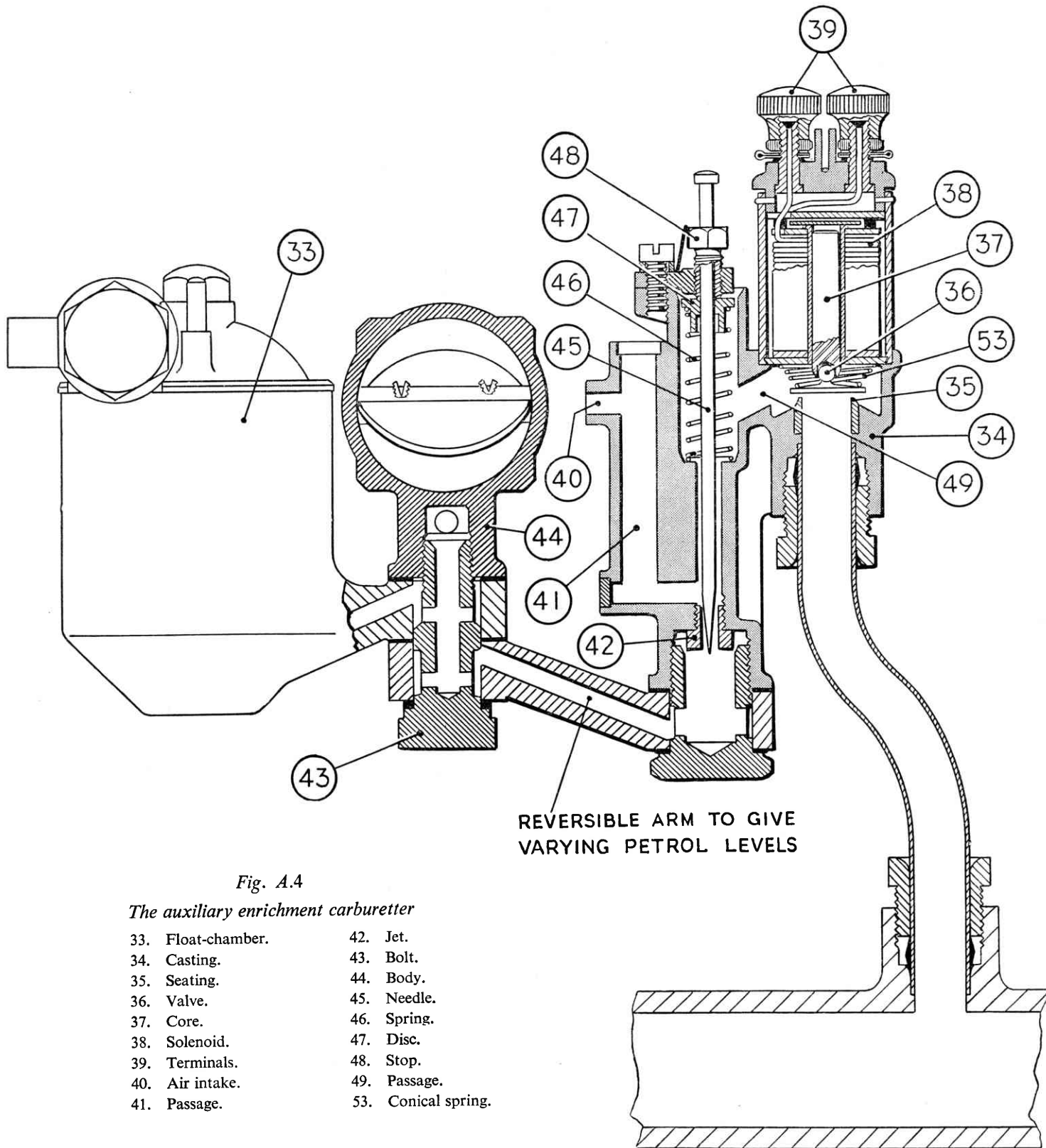


Fig. A.4

The auxiliary enrichment carburettor

- | | |
|--------------------|---------------------|
| 33. Float-chamber. | 42. Jet. |
| 34. Casting. | 43. Bolt. |
| 35. Seating. | 44. Body. |
| 36. Valve. | 45. Needle. |
| 37. Core. | 46. Spring. |
| 38. Solenoid. | 47. Disc. |
| 39. Terminals. | 48. Stop. |
| 40. Air intake. | 49. Passage. |
| 41. Passage. | 53. Conical spring. |

A CARBURETTORS—CONSTRUCTION AND TUNING

Depression within the space surrounding the spring (46) is directly derived from that prevailing in the induction tract, and this exerts a downward force upon the disc (47), which is provided with an adequate clearance with its surrounding bore. This tends to overcome the load of the spring (46) and to move the needle downwards, thus increasing the obstruction afforded by the tapered section which enters the jet (42).

The purpose of this device is to provide two widely different degrees of enrichment, the one corresponding

to the needle assembly, as determined by the adjustment of the stop (48).

In most installations the solenoid (38) is energized by means of a thermostatically operated switch housed within the cylinder head water jacket. This is generally arranged to bring the apparatus into action at temperatures below about 30 to 35° C. (86 to 95° F.) In some instances, however, a manual switch is provided, and in such cases a warning light is generally provided to indicate to the driver that the apparatus is in operation.

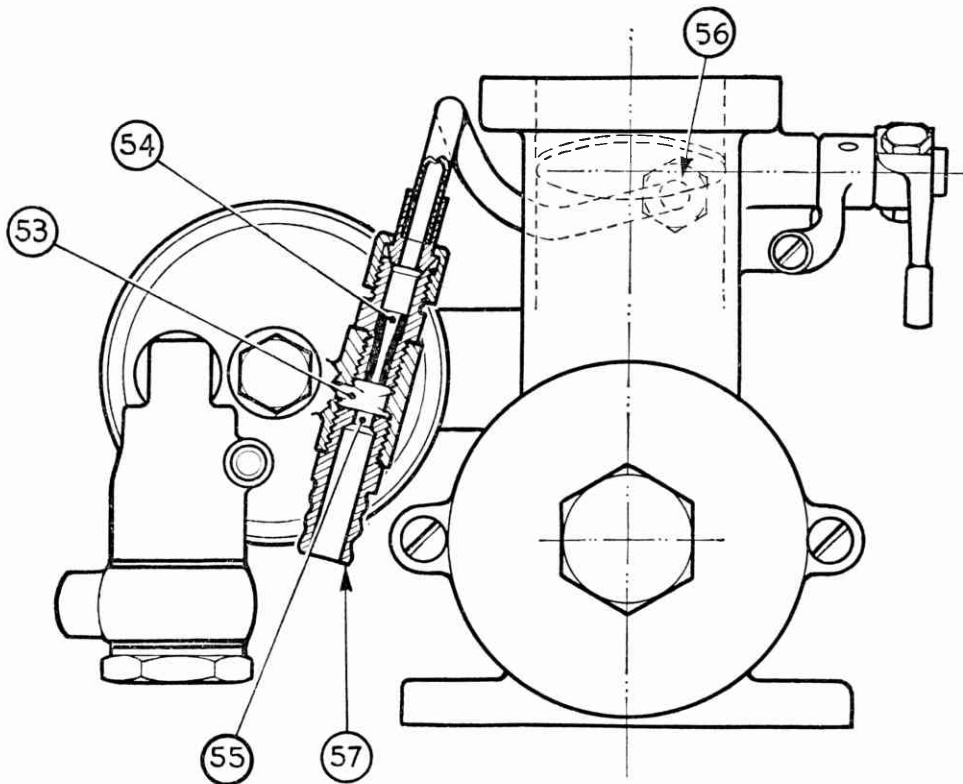


Fig. A.5

The additional weakening device

53. Cap nut fitting. 54. Venturi. 55. Orifice. 56. Throttle edge drilling. 57. Nipple.

to idling or light cruising conditions and the other to conditions of open throttle or full-power operation. In effect, under the former conditions the high induction depression prevailing will cause the disc (47) to be drawn downwards, drawing the tapered needle into the jet (42), while under the latter, the lower depression existing in the induction tract will permit the collar to maintain its upward position with the needle withdrawn from the jet.

The tuning elements concerned in this device are the size and degree of taper of the lower end of the needle (45), the diameter of the disc (47), the load provided by the spring (46) and the degree of movement permitted

Tuning and adjustment

It will, of course, be understood that the normal adjustment to the main carburetter or carburetters, as dealt with in Section A.2 or A.3, must be performed with the engine at its normal running temperature before any attempt is made to tune the auxiliary enrichment device.

As it can generally be assumed that the tapered form of the needle (45), the strength of the spring (46), and the diameter of the disc (47) have already been appropriately chosen, tuning is generally confined to the adjustment of the stop screw (48). It will be appreciated that the main purpose of this adjustment is to limit the downward movement of the needle, the head of which abuts

against the upper surface of the stop screw at the lower extremity of its travel. The final downward movement of this needle determines, as has been described, the degree of enrichment provided under idling conditions with the auxiliary enrichment carburetter in operation.

An approximate guide to its correct adjustment in this respect is provided by energizing the solenoid when the engine has already attained its normal running temperature. The stop screw (48) should then be so adjusted that the mixture is distinctly although not excessively rich, that is to say, until the exhaust gases are seen to be discernibly black in colour, but just short of the point where the engine commences to run with noticeable irregularity.

Anti-clockwise rotation of the stop screw will, of course, raise the needle under these conditions, and increase the mixture strength, while rotation in the opposite direction will have the opposite effect. In order to energize the solenoid under conditions when the thermostatic switch will normally have broken the circuit, it is merely necessary to short-circuit the terminal of the thermostatic switch directly to earth or, if this is not readily accessible, to make a connection between the appropriate terminal of the pair (39) to earth by means of a separate wire. In cases where a manual switch is provided, no difficulty, of course, arises in bringing the auxiliary enrichment carburetter into action under any condition of engine temperature.

Section A.5

ADDITIONAL WEAKENING DEVICE

It is normally desirable to provide a somewhat richer mixture when the engine is running under full load than under cruising conditions. On the majority of installations the S.U. carburetter automatically achieves this due to the pulsating nature of the air flow on full load as against the steady flow when cruising with the throttle partly shut.

This effect, which is referred to as mixture ratio spread, can generally be achieved to exactly the right degree by careful design on the air intake and induction passages. Certain engines, however, demand a rather greater degree of mixture ratio spread than can conveniently be met in this way, and in such cases the additional weakening device illustrated in Fig. A.5 may be employed.

This comprises a fitting attached to the float-chamber cap nut, the interior of which (53) is placed in communication with the interior of the float-chamber by suitable drillings and passages.

Apart from this communication, the float-chamber is otherwise sealed from the atmosphere by the omission of the normal atmospheric vent, and by the provision

of a sealing washer between the float-chamber bowl and the lid.

It will be seen from the diagram (Fig. A.5) that, in addition to the communication to the interior of the float-chamber, there is a communicating orifice (55) to the atmosphere, or to the intake region at the mouth of the carburetter, by means of a neoprene tube attached to the nipple (57). A further communication is formed via the small venturi-shaped member (54) to a drilling (56) located at the throttle edge. The action of the device is as follows:

When the throttle is shut back to the normal idling position, the drilling (56) emerges on the carburetter side of the throttle and is therefore only subject to the slight depression on the downstream side of the choke piston. This slight depression will cause a flow of air through the neoprene tube from the mouth of the carburetter through the orifice (55) and thence through the venturi member (54), but since the degree of depression causing this flow is small, its effect upon the pressure in the region (53), and hence in the float-chamber, is negligible, and the float-chamber is maintained substantially at atmospheric pressure, as is normally the case.

Similarly, when the throttle is fully open, or substantially fully open, or at full engine torque, or substantially full engine torque, the depression which the device produces and its effect upon the float-chamber pressure are negligible.

When, however, the throttle is partially shut, and at any stage between idling and full torque, a substantially higher depression is exercised at the drilling (56) and air will flow through the economizer fitting at such a velocity that a definite depression will be produced in the region (53). This depression will be communicated to the interior of the float-chamber, and will produce a diminution in the discharge from the jet.

The employment of a venturi-shaped member (54) instead of a plain orifice in this situation ensures that the velocity of air passing through this member will attain a limiting maximum value at a fairly low value of depression at the drilling (56), and that there will be no substantial increase in this velocity with further increase in the depression.

This ensures that the maximum air velocity through the venturi, and, consequently, the maximum weakening effect, are produced when the throttle is shut back by a relatively small amount from the full-load position, and that further shutting of the throttle does not increase this weakening effect to a point at which misfiring would occur.

This device is not usually applicable to types of carburetter on which it was not fitted as original equipment, since the resultant weakening effect would be excessive.

Section A.6

THE HD TYPE OR DIAPHRAGM JET TYPE CARBURETTER

The HD carburetter differs from the more familiar type in that the jet glands are replaced by a flexible diaphragm, and the idling mixture is conducted along a passage-way, in which is located a metering screw, instead of being controlled by the throttle disc; the throttle/jet interconnection mechanism is also redesigned.

These alterations give more consistent idling, greater reliability of metering, and reduced choke control load. This carburetter is made in three sizes, 1½ in. (38.1 mm.), 1¾ in. (44.4 mm.) and 2 in. (50.8 mm.), and can have either the manual mixture enrichment already described, or the auxiliary cold starting attachment referred to in Section A.4.

The details of these alterations are as follow: The jet (1), Fig. A.6, which is fed through its lower end, is attached to a synthetic rubber diaphragm (2) by means of the jet cup (3) and jet return spring cup (4), the centre of the diaphragm being compressed between these two parts; at its outer edge it is held between the diaphragm casing (5) and the float-chamber arm. The jet (1) is controlled by the jet return spring (6) and the jet actuating lever (7), the latter having an adjusting screw (8) which limits the upward travel of the jet (1) and thus constitutes the idling adjustment; screwing it in (clockwise) enriches the mixture, and unscrewing it weakens the mixture.

Throttle lever and jet interconnection

The jet and throttle interconnection mechanism is operated by a cam (9), Fig. A.6, mounted on the jet lever spindle (10), the whole being housed in the diaphragm casing (5). The cam (9) on being rotated by means of the jet hand control lever (11) actuates the cam shoe (12), thereby causing vertical movement of the push-rod (13). To the top of this push-rod (13) is attached the top plate (14), which is fitted with an adjusting screw (15) which makes contact with the throttle stop lever (16).

It will be seen that angular movement of the jet hand control lever (11) will turn the jet lever spindle (10) and, therefore, the jet actuating lever (7) which controls the jet cup (3) and the jet (1). The cam controls the cam shoe (12), push-rod (13), top plate (14) and the throttle. Suitable setting of the two adjustment screws (8) and (15) will clearly give any desired combination of mixture enrichment and throttle opening.

Vacuum-controlled ignition and economizer ports

The connection to the vacuum ignition control and to the float-chamber vacuum-type economizer is made at the top of the carburetter instead of underneath or at the side, as with the older type. This means that the

throttle is opened downwards, assuming the throttle lever to be in the normal position, facing the air intake.

Throttle spindle glands

Provision is made for the use of throttle spindle glands consisting of the cork gland itself (22), a dished retaining washer (23), a spring (24) and a shroud (25). This assembly should not require servicing and can only be removed by dismantling the throttle spindle and disc.

Idling

The HD carburetter still idles on the main jet, but the mixture, instead of passing under the throttle disc, is conducted along the passage-way (17) connecting the choke space to the other side of the throttle disc.

The *quantity* of mixture passing through the passage-way (17) and, therefore, the idling speed of the engine are controlled by the 'slow-run' valve (18), the *quality* or relative richness of the mixture being determined by the jet adjusting screw (8), as mentioned in paragraph 2 under '**Throttle lever and jet interconnection**'. It follows that when idling, once the engine has reached its running temperature, the throttle remains completely closed against the bore of the carburetter; for fast idle, when the engine is cold, it continues to be partially open as with the current design, mixture passing under the throttle disc as well as along the passage-way (17).

Centring the jet

This is carried out in much the same way as on the standard H-type carburetter, except that the float-chamber and jet casing must be removed and the jet held in the uppermost position by hand. It is important to keep the diaphragm and, therefore, the jet in the same radial position in relation to the carburetter body and jet casing throughout this operation, as the jet orifice is not necessarily concentric with its outside diameter, and turning might cause decentralization. The simplest way to do this is to mark one of the diaphragm and corresponding jet casing screw holes with a soft pencil.

Adjustment

The adjustment of the HD carburetter is extremely simple. Whereas with the older type the jet was controlled by a nut, it is now set by a screw (8), and whereas the engine speed was determined by adjustment of the throttle, it is now controlled by the 'slow-run' valve (18). To enrich the mixture the screw (8) should be screwed in, and to increase the idling speed the 'slow-run' valve (18) should be undone.

Defects in operation

Since the jet of the HD carburetter is fed through its centre and has no glands, leakage can only be caused by an insecure fit of the jet cup, an imperfect seal of the

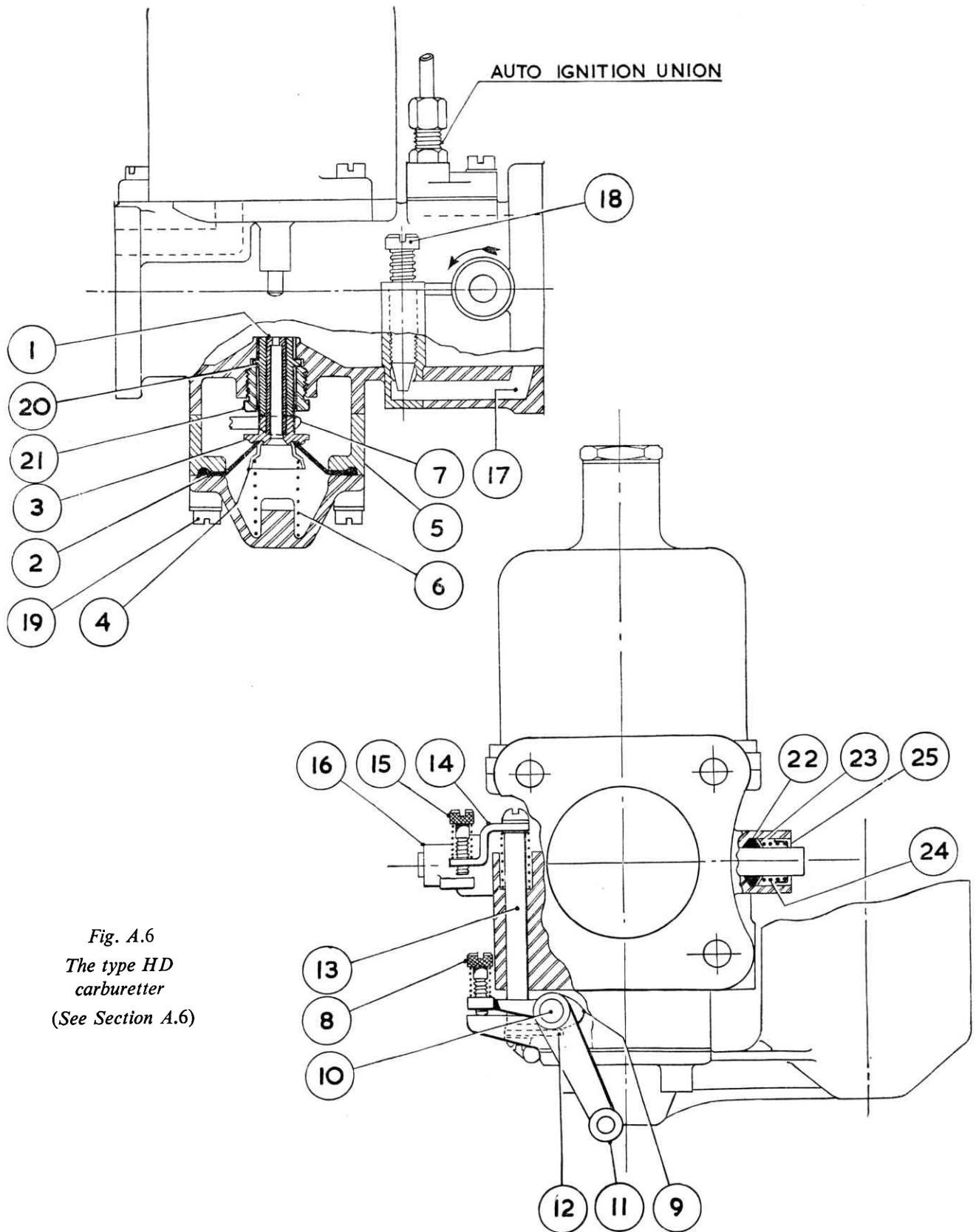


Fig. A.6
The type HD
carburettor
(See Section A.6)

diaphragm, either at its outer edge, where it is compressed between the float-chamber and the diaphragm casing, or at its inner edge, where it is fitted to the jet, or by fracture of the diaphragm. Leakage at the outer edge may be cured by tightening the float-chamber securing screws (19), but fracture or leaking at the inner edge will probably call for a new jet assembly.

The jet may also stick, either up or down, due to dirt between it and its bearing (20), or due to corrosion. The cure is to remove the parts by undoing the jet screw (21), clean, and refit.

Section A.7

HS2-TYPE CARBURETTER WITH NYLON TUBE JET FEED

The HS2 carburetter differs from the earlier models, its two main differences being (a) the jet unit, (b) the float-chamber.

Jet unit

This assembly has been considerably simplified as the 'old' cork glands and sealing washers have been deleted and the jet is a simple metal tube sliding in a single bearing bush, fed by fuel along a small-diameter nylon tube leading direct from the base of the float-chamber. This nylon tube is fastened into the float-chamber by nut and nipple fixing, where it can be detached if jet removal is necessary.

Float-chamber

The float lid is attached by three small screws on the outer diameter, and the float is of simpler construction, having no central tube. The needle and seating are the same as on the older float-chamber, also the fuel level is raised or lowered by bending the float hinged lever either upwards or downwards respectively (but not to the test bar diameters quoted for the older models).

Adjustment and tuning

For the adjustment and tuning of the HS2 carburetter reference should be made to Section A.6.

<i>Carburetter type</i>	<i>Throttle diameter</i>	<i>Max. capacity in b.h.p.</i>	<i>Style</i>
*HV0	$\frac{7}{8}$ in. (22.2 mm.)	20	Horizontal or semi-downdraught
*HV1	1 in. (25.4 mm.)	27	Horizontal or semi-downdraught
OM & UB, 2 types	1 in. (25.4 mm.)	27	Horizontal or semi-downdraught
HV2	$1\frac{1}{8}$ in. (28.58 mm.)	35	Horizontal or semi-downdraught
HV3	$1\frac{1}{4}$ in. (31.75 mm.)	45	Horizontal or semi-downdraught
HV4	$1\frac{3}{8}$ in. (34.9 mm.)	55	Horizontal or semi-downdraught
HV5	$1\frac{5}{8}$ in. (41.27 mm.)	75	Horizontal or semi-downdraught
HV8	$1\frac{7}{8}$ in. (47.63 mm.)	100	Horizontal or semi-downdraught
$2\frac{3}{16}$ in.	$2\frac{3}{16}$ in. (55.56 mm.)	135	Horizontal or semi-downdraught
H1	$1\frac{1}{8}$ in. (28.58 mm.)	35	Horizontal or semi-downdraught
H2	$1\frac{1}{4}$ in. (31.75 mm.)	45	Horizontal or semi-downdraught
H3	$1\frac{3}{8}$ in. (34.9 mm.)	55	Horizontal or semi-downdraught
H4 & HD4	$1\frac{1}{2}$ in. (38.1 mm.)	65	Horizontal or semi-downdraught
H6 & HD6	$1\frac{3}{4}$ in. (44.45 mm.)	85	Horizontal or semi-downdraught
H8 & HD8	2 in. (50.8 mm.)	110	Horizontal or semi-downdraught
†H10	$2\frac{1}{4}$ in. (57.15 mm.)	145	Horizontal or semi-downdraught
†H12	$2\frac{1}{2}$ in. (63.5 mm.)	180	Horizontal or semi-downdraught
HS2	$1\frac{1}{4}$ in. (31.75 mm.)	45	Semi-downdraught
D.2	$1\frac{1}{8}$ in. (28.58 mm.)	35	Downdraught
D.3	$1\frac{1}{4}$ in. (31.75 mm.)	45	Downdraught
D.4	$1\frac{3}{8}$ in. (34.9 mm.)	55	Downdraught
D.4.L	$1\frac{1}{2}$ in. (38.1 mm.)	65	Downdraught
D.5	$1\frac{5}{8}$ in. (41.27 mm.)	75	Downdraught

* Main body castings and piston units no longer available as spares. † Special order only.

Section A.8

TYPES AND CAPACITIES OF S.U. CARBURETTERS

The original horizontal range of carburetters was made under the type letters 'HV' and lasted until about 1938, when the present range under the letter 'H' replaced them.

The main difference between these two ranges is that generally (but not invariably), for a given size of suction piston, the throttle diameter is larger in the newer H range than in the HV; for example, the HV4 carburetter and the H4 both have a piston with a choke diameter of $1\frac{1}{2}$ in. (38.1 mm.) diameter, but the former has a $1\frac{3}{8}$ in.

(34.9 mm.) diameter throttle and the latter a $1\frac{1}{2}$ in. (38.1 mm.) diameter throttle.

The pre-war full downdraught carburetters, made under the type letter 'D' and now discontinued except for service replacements, followed the same lines as the 'HV' series in respect of the throttle diameter.

On page A.14 are given, in tabular form, the major details of these three ranges plus the addition of the new HS2 carburetter. It may be noted that horizontal carburetters in the current range are frequently fitted with float-chambers which convert the original 'horizontal' into a semi-downdraught of 20° or 30° —sometimes briefly termed 'slopers'; in all aspects, except that of the float-chamber body casting, they can be regarded as 'horizontal'.

SECTION B

DEFECTS IN OPERATION

General.

- Section No. B.1 Sticking piston and incorrect jet centring.
- Section No. B.2 Jet gland leakage.
- Section No. B.3 Sticking jet.
- Section No. B.4 Failure of fuel supply to float-chamber.
- Section No. B.5 Flooding from float-chamber or over jet.
- Section No. B.6 Water or dirt in the float-chamber.
- Section No. B.7 Poor cold starting.

GENERAL

In the case of unsatisfactory behaviour of the engine, before proceeding to a detailed examination of the carburettor it is advisable to carry out a check of the general condition of the engine, attention being directed in particular to the following:

- (1) The ignition system, including plug leads and condenser.
- (2) Incorrectly adjusted contact breaker gap; pitted or dirty contact breaker points.
- (3) Incorrect plug gaps or oily or dirty plugs.
- (4) Sticking valves or worn inlet valve guides.
- (5) Defective fuel supply.
- (6) Air leaks at carburettor flange gasket or induction pipe gasket.
- (7) Poor or uneven compressions.
- (8) Incorrect tappet clearances.

If none of the above defects is present to a degree which would account for the unsatisfactory engine performance, the carburettor should be checked over for the faults detailed in Sections B.1 to B.7.

Section B.1

STICKING PISTON AND INCORRECT JET CENTRING

It is essential that the piston should move smoothly and evenly within its limits of travel, and if any sticking does take place it is generally the fault of:

- (1) Excessive dirt deposit on piston and bore of suction chamber.
- (2) Rubbing high spots on large diameter of piston or bore of chamber.
- (3) Jet unit incorrectly centred on needle.
- (4) A bent needle.

A sticking piston can be checked on the older type of carburettor by inserting a wire nail upwards through one of the air vent holes underneath the suction chamber mounting, and then pushing the piston upwards, after which it should fall freely until it hits the jet bridge with a soft metallic click—on later carburettors not having these air vent holes a spring-loaded lifting pin is provided in the same position and this gives a limited piston lift.

A sticking piston may give erratic running, stalling of engine at idling speed, and a lack of power probably accompanied by a heavy fuel consumption.

The cure for (1) is easily effected and consists of detaching the suction chamber and piston and cleaning, with a rag moistened in petrol fuel, the inside large bore of the chamber and the two piston diameters, re-assembling in a dead dry and clean condition with a few spots of thin oil on the piston rod only.

To trace (2) is a little more difficult, but if metallic contact is taking place between high spots either in the large bore of the suction chamber or the corresponding large piston diameter (an uncommon fault), these rubbing surfaces should be located and carefully eased down, using a scraper in the bore of the chamber or a flat superfine file on the piston—do not use emery-cloth, however, as this method is not exact enough, and serious harm may result.

The fault of a sticking piston is more commonly attributable to (3) because the jet unit is incorrectly centred on the taper needle. This may be checked by raising the piston manually, as already described, and observing whether, when released, the piston hits the jet bridge with a soft but definite click—if it only does so when the jet is fully lowered, then the whole jet unit needs re-centring, and this important operation is relatively simple if the following instructions are followed carefully:

- (a) Remove the pivot pin holding the jet lever to the jet head, and swing the linkage well to one side (also it may be necessary to detach the lower end of the link rod between the jet lever and throttle).
- (b) Withdraw the jet and unscrew the jet adjusting nut, removing its lock spring, which should be placed on one side. Replace the adjusting nut and screw it right up to its topmost position; replace the jet and see that the slot in the jet head lies in the same angular position *as when assembled on the jet lever*, marking with a pencil the one face adjacent to the air inlet.
- (c) Slacken off the large jet locking screw (which locks the whole jet unit in position) until the bottom half jet bearing is just free to rotate by finger pressure.
- (d) It will now be evident that if the tapered needle (locked into the piston and suction chamber, already in position) is lowered into the jet bore, with the jet in its highest position, until the piston hits the inner jet bridge, then the complete jet unit will have been concentrically located around the needle. Gentle pressure with the end of a pencil on the top of the piston rod (damper or oil cap removed) will make sure that the piston is completely down on the jet bridge.
- (e) Tighten the jet locking screw, observing that the jet head is still in its correct angular position.
- (f) Lift the piston and check that it falls freely and evenly, hitting the jet bridge with a soft metallic click. Then fully lower the jet and re-check to see if there is any difference in the sound of the impact, and if there is and the second test produces a sharper impact sound, the centring operation will have to be repeated until successful.

(g) In the occasional obstinate case the jet adjusting nut (as well as its lock spring) should be temporarily removed to enable the jet to reach a higher position and so make the centring effect more positive, the nut and lock spring being replaced after the successful conclusion of the operation.

The correct diagnosis of a bent jet needle (4) is not always obvious as most of the symptoms are similar to those given by an incorrectly centred jet, except that with a bent needle the piston may fall freely just before hitting the jet bridge but be inclined to stick at the top position or half-way down.

The best check is to detach the suction chamber and piston unit, and with the needle in its normal position spin the piston on its rod whilst the suction chamber is held steady in a horizontal position on a table top. Any eccentricity of the point of the needle, indicating a bent axis, can then be observed. It is practically impossible to straighten a bent needle, and replacement is the only cure.

Do not forget that after checking any of the points (1), (2), (3), and (4) the oil reservoir in the hollow piston rod will need refilling.

Section B.2

JET GLAND LEAKAGE

If persistent slow leakage is observed at the base of the jet unit (a mere surface dampness can generally be disregarded) it is probable that the two small jet cork glands (17), Fig. A.1, and the large sealing cork ring (19) require replacement. Careful study of Fig. A.1 (or Section D.1) should enable the replacement to be performed without difficulty. The jet lever (23) should first be detached from the jet head, the locking screw (15) removed and the jet unit can then be withdrawn. After refitting complete with the new glands, the whole unit must be correctly centred on the taper needle as described in Section B.1—this is most important.

Incidentally, whilst a defective bottom jet gland is apparent by a fuel leak from the base of the jet unit, a similar leak from the top gland is not so noticeable, but its effect is that of enrichment of the mixture strength, particularly at idling speeds. If the jet nut is then raised (in ignorance of the true fault) in order to correct this richness, the mixture strength for the general throttle range may be found to be on the weak side—possibly definitely so.

A similar unwanted richening effect can be given by a piece of grit or swarf under the top copper washer of the top bearing after careless assembly of the jet unit. Therefore the top gland and the top copper washer should be checked if an unduly rich idling mixture is

given with the jet adjusting nut right up, and if the needle and jet are both unworn and correct in type and position.

Section B.3

STICKING JET

After long service the outside diameter of the jet proper tends to oxidize slightly just under the shoulder by the jet head, and this may tend to prevent the head abutting hard up against the adjusting nut. In such a case, smear a little petroleum jelly or grease around the lower part of the jet when in its fully lowered position, and then raise and lower the jet several times in order to work the lubricant well over the surfaces; a little oil should also be applied to the various pivot pins and the linkage, as these are frequently neglected for long periods.

Section B.4

FAILURE OF FUEL SUPPLY TO FLOAT-CHAMBER

If the engine is found to stop under idling or light running conditions, notwithstanding the fact that a good supply of fuel is present at the float-chamber inlet union (observable by momentarily disconnecting this), it is possible that the needle has become stuck to its seating. This possibility arises in the rare cases where some gummy substance is present in the fuel system. The most probable substance of this nature is the polymerized gum which sometimes results from the protracted storage of fuel in the tank.

After removal of the float-chamber lid and float lever the needle may be withdrawn, and its point thoroughly wiped with a rag dipped in alcohol. Similar treatment should also be applied to the needle seating, which can conveniently be cleaned by means of a matchstick and cloth dipped in alcohol.

(The pre-1955 float lever and needle can easily be withdrawn for cleaning, but after that date the $\frac{3}{32}$ in. hinge pin was fixed and cleaning is necessarily confined to brisk agitation of the complete lid in a bowl of clean alcohol.) Persistent trouble of this nature can only be cured properly by complete mechanical cleansing of the tank and fuel system or, in the worst cases, complete renewal of these parts.

If the engine is found to suffer from a serious lack of power, which becomes evident at higher speeds and loads, this is probably due to an inadequately sustained fuel supply; the fuel pump output should be checked and any filters in the system inspected and cleaned.

Section B.5

FLOODING FROM FLOAT-CHAMBER OR OVER JET

This can be caused by:

- (1) A fuel level which has been set too high, giving intermittent flooding.
- (2) Dirt or grit on the needle seating.
- (3) Worn needle seating.
- (4) Defective float.

Regarding (1), the position of the fuel level in an S.U. carburettor need not be exact and to a critical dimension, but the standard level is $\frac{3}{8}$ in. (9.5 mm.) below the level of the rectangular facing known as the jet bridge. If it is higher and only just short of the jet bridge, then leaving the car idling on a fairly steep drive may cause slow flooding, and in this circumstance re-setting to a lower level is desirable.

Even with the piston unit removed and the jet fully lowered it is not easy to observe the top surface of the bead of fuel in the jet well, so an alternative mechanical 'cut-off' position of the hinged lever is given, this being much simpler to observe.

This cut-off position is checked by sliding a rod of a given diameter between the lid and the inside curve of the forked end of the needle actuating lever as shown in Fig. B.1. The diameter of the rod is: For the smallest T.1 type float-chamber and the middle-sized T.2 type float-chamber, $\frac{7}{16}$ in. (11.1 mm.); for the largest T.4 type float-chamber, $\frac{5}{8}$ in. (15.8 mm.). The diameters of the float-chambers are: T.1, $1\frac{7}{8}$ in. (36.5 mm.); T.2, $2\frac{1}{4}$ in. (57.1 mm.); and T.4, 3 in. (76.2 mm.).

If the hinged lever fails to conform to within $\frac{1}{32}$ in. (.8 mm.) of these check figures it must be carefully bent at the start of the fork section, downwards to lower the level and upwards to raise it in the necessary direction for correction.

When bending, see that both fork prongs are approximately level in a horizontal plane.

The cure for (2) is the simple and obvious one of cleaning—agitating the complete float lid in a bowl of clean fuel is one method, after first detaching the hinge pin, fork and stainless steel needle, if that can easily be done, as in the pre-1955 type.

(3) can be checked by observing whether slow flooding gradually takes place at idling speeds, when the leak past a defective seating may exceed the flow required by the idling engine. A few *very light* taps on the end of the stainless steel needle may provide a cure, but generally a new seating and needle will require fitting (note that a hexagon box spanner .338 in. [8.58 mm.] across the flats is required to tighten the seating).

(4) A defective float is sometimes due to porosity or leakage around one of the soldered seams—shaking such a float gives a 'swishing' liquid sound, not to be confused with the rattle of bits of loose solder. Immersion in boiling water will indicate the exact position of the leak by bubbles, and when all the fuel has been evaporated out, a temporary repair can be made with a blob of solder until a replacement float can be obtained.

Section B.6

WATER OR DIRT IN THE FLOAT-CHAMBER

Very occasionally it happens that a deposit of water condensate or grit may accumulate in the bottom of the float-chamber and cause erratic running. To remove, detach the complete float-chamber at the central holding-up bolt and thoroughly clean out the inside of the chamber, the angular feed hole in the arm, and also the hollow holding-up bolt after first removing the float lid and float.

Section B.7

POOR COLD STARTING

The carburettor is very seldom the cause of this fault although it is frequently blamed for it, and the only two likely maladjustments concerned on an S.U. are insufficient jet drop or lack of oil in the piston damper. It should be remembered that poor cold starting is more

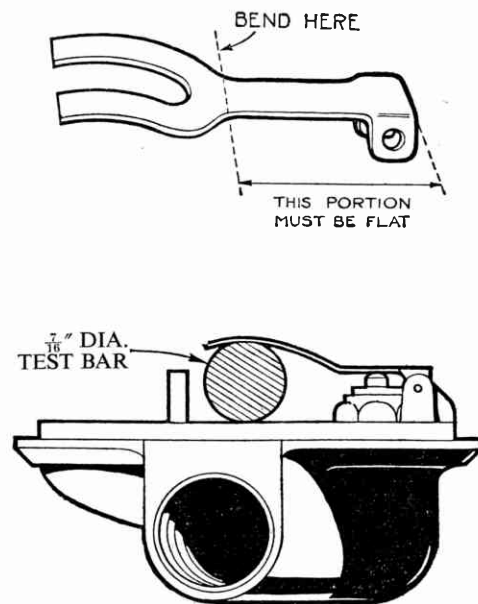


Fig. B.1

The correct setting of the float lever

likely to be the result of bad valve seats, incorrectly adjusted plug gaps or distributor points, or other engine or ignition faults.

When fully lowered the jet head should drop away from the adjusting nut by at least $\frac{5}{16}$ in. (7.94 mm.), and preferably $\frac{3}{8}$ in. (9.52 mm.) if severe winter conditions are involved or the engine concerned is known to be poor at cold starting.

If this dimension is not being achieved it is probably because the setting of the jet adjusting nut is four or five full turns down from its topmost position, and this therefore cuts into the total travel available for the jet.

The 'normal' position of the jet adjusting nut can be raised by repositioning the needle about $\frac{1}{16}$ in. (1.5 mm.) farther into the piston, which will allow the adjusting nut to be raised by an equal amount, this in turn

giving a more generous jet travel. (A 'normal' position of the jet adjusting nut can be anywhere between three flats or half a turn down from the topmost position to three full turns down.)

It should be noted that with the jet adjusting nut screwed up to its topmost position, the full available jet travel should be at least $\frac{13}{32}$ in. (10.32 mm.), and at most $\frac{15}{32}$ in. (11.91 mm.). If the minimum figure is not being attained, a judicious filing of the small stop lug on the jet lever, where it contacts the link, may be indicated—do not overdo this filing and exceed the maximum drop figure of $\frac{15}{32}$ in. (11.91 mm.).

The second possible fault of lack of oil in the damper should be investigated, as although the chief gain resulting from this fitment is improved acceleration, nevertheless on some particular engines it gives a marked improvement in cold starting.

SECTION C
WORKSHOP REPAIR AND ADJUSTMENT
THROTTLE AND BODY

Section No. C.1 The body casting.

Section No. C.2 Assembly of throttle disc in carburetter body.

Section C.1

THE BODY CASTING

If a new body casting is being built into the old carburetter nothing on it needs checking before re-assembly, but if the old body is being used again, check that the two 4 B.A. countersunk screws holding the piston plate (if fitted) are tight—do not attempt to detach the piston plate itself, as this is machined in position to fine limits.

To check the suitability of an old body casting for further use examine the following points:

(1) **Wear in the bore of the throttle spindle bearings**

When new there is approximately .0025 in. (.063 mm.) clearance between the diameter of the spindle and its bearing bores—it must not be closer or distortion from engine heat may cause jamming. If wear causes this clearance to increase appreciably, the consequent air leak will put up the idling speed and a new casting will be needed, or, alternatively, the bearing bores must be reamed out with an oversize reamer. After reaming out, a suitable new oversize throttle spindle will be required, and any levers or fittings positioned on this particular spindle will also need opening out with the oversize reamer.

(2) **Wear in the throttle bore**

This is apparent by a circumferential groove where the edge of the throttle disc has bitten into the main throttle bore—generally the result of bad side thrust from incorrect actuation of the throttle lever. Whilst a shallow groove resulting from this circumstance will do no harm other than raise the idling speed rather high, a marked depth of groove is impossible to remedy, and a new body casting will have to be fitted; also the throttle lever actuation should be investigated for side thrust defects, and these rectified if present.

(3) **Warped or bowed engine flange**

This is usually the result of a mistaken impression that a thicker jointing washer between the carburetter flange and the induction flange is desirable. If such a washer is fitted it increases the distance that the two ends of the carburetter flange can be warped towards the induction flange by excessive spanner pressure when tightening the holding nuts. A flange gasket $\frac{1}{32}$ in. (.8 mm.) to $\frac{3}{64}$ in. (1.2 mm.) thick gives an adequate margin for sealing on normal surfaces, and if this thickness is deemed inadequate because of an already badly bowed flange, do not fit a still thicker gasket, but

true off the flange face with a file, and then fit a normal gasket, taking care to tighten down the holding nuts evenly, as markedly uneven tightening also leads to flange distortion. The air intake flange on the carburetter is nothing like so critical regarding air leaks, and truing up is seldom necessary.

Another cause of bowed engine flanges is over-tightening of fixing nuts when an asbestos-type insulating distance piece is used between the carburetter and the induction flanges. The heat-resisting material of which these distance pieces are made is not hard enough to resist excessive tightening-down pressure, and if this is mistakenly applied a bowed or fractured flange will result.

(4) **Loose piston guide key**

If this is of the riveted-over type it can easily be retightened by lightly riveting over the outer end until firm—take care not to strike too hard a blow, which might distort the body in the important region of the piston bore.

(5) **Obvious and serious defects such as stripped threads for the float-chamber bolt, or fractured jet lugs, will mean scrapping the old casting. The smoothing over of minor bruises can be left to the discretion of the examiner, but, in particular, the suction chamber register and its flange face should be examined for unwanted abrasions, as these could interfere with the ease of detaching the suction chamber. Whilst this part should be an exact fit over the body register and free of any suspicion of shake, it is not helpful if the presence of bruises makes it difficult to detach, as this might lead to a bent jet needle.**

Section C.2

ASSEMBLY OF THROTTLE DISC IN CARBURETTER BODY

Turn the throttle spindle so that the slot is in line with the main bore and slide the disc into place with either the fingers or a small pair of pliers. The spindle should now be turned until the throttle is closed, and adjusted endwise until the two holes in the disc correspond with those in the spindle, when the clamping screws can be inserted. Do not tighten these up immediately, however, but leave them slackened two or three turns from 'home'. Then open the throttle and close it again quite smartly and with some impact (using the clipped-on throttle lever for leverage), which will have the effect of exactly centring the disc in relation to the main bore; take care to put some tension on the throttle lever to

keep it in the shut position, in order to prevent the disc moving, and then finally tighten the two clamp screws.

If the unit is held up to the light with the eye viewing along the bore of the throttle barrel, the degree of 'black-out' of light given by the completely closed disc will be an indication of the correct centralization and

fit. A well-fitting disc will give a substantially complete 'black-out'.

After tightening, open out the split end of the screws *only just sufficiently to prevent rotation*—to splay them out fully is quite unnecessary and may lead to fracture.

SECTION D
WORKSHOP REPAIR AND ADJUSTMENT
JET UNIT

Section No. D.1 Assembly of jet unit, standard type.

Section No. D.2 Variations of the jet assembly.

Section D.1

ASSEMBLY OF JET UNIT, STANDARD TYPE

The correct sequence of assembly of the various parts in the unit is as follows (Fig. D.1):

Assemble the bottom half jet bearing, its mating copper washer, the jet screw, the jet adjusting nut and its locking spring, which should be screwed up as far as it will go by hand or *very light* spanner pressure. Then insert the jet upwards into the bottom half bearing, and next slide one of the small cork glands with its mating brass gland ('dish' facing downwards) into

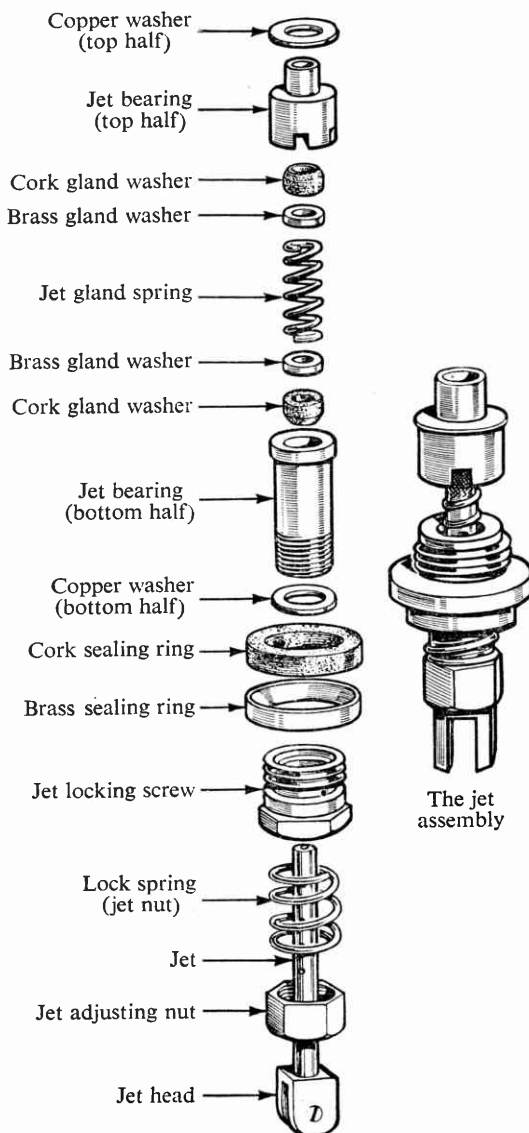


Fig. D.1

Components of a standard jet

the bottom of the jet bearing, using the gland spring to push them there. Then drop the large coned metal sealing ring over the jet screw, cone upwards, and add the large cork sealing ring. (This ring is sometimes supplied in synthetic rubber.)

Next slide over the top of the jet the second small brass gland ('dish' uppermost) and the second small cork jet gland, then the top half bearing, and finally the top copper washer. The complete unit can then be screwed into the body casting, but only finger-tight, as it will need correct centring on the piston and needle assembly, as described in Section B.1, before it is finally tightened.

There are two other types of jet assembly, the 'Thermo' jet and the 'Invicta' jet, differing slightly from the standard pattern already dealt with, but these are fairly similar in general construction, and after a little consideration the minor modifications necessary in the assembly operation, compared with the above, should present no difficulty.

Section D.2

VARIATIONS OF THE JET ASSEMBLY

(1) The standard jet

This now has a maximum travel, for cold starting, of $\frac{7}{16}$ in. (11.11 mm.), but prior to 1937 this figure was smaller, at $\frac{5}{16}$ in. (7.94 mm.) (generally referred to as 'long travel' and 'short travel').

Some of the parts, including the jet proper, are interchangeable between the two assemblies, but the following parts are not:

Bottom half jet bearing

'Short travel' No. AUC2116

'Long travel' No. AUC3231

Copper washer for ditto

'Short travel' No. AUC2123

'Long travel' No. AUC3233

Top half jet bearing

'Short travel' No. AUC2115

'Long travel' No. AUC3230

Jet locking screw

'Short travel' No. AUC4113

'Long travel' No. AUC3232

The 'longer travel' of the jet gives improved cold starting in extreme winter conditions.

(2) The 'Invicta' jet

This particular jet has a very limited movement and is not intended to be lowered for cold starting—the small movement available is sufficient only for general mixture strength tuning. It is used when cold starting is looked after by a separate 'Ki-gass' cold starting unit, or some similar fitting.

All parts of the 'Invicta' jet unit are similar to the standard assembly, with the exception of the jet proper, which uses a different jet head, allowing the jet to be attached positively to the adjusting nut, but leaving the latter free to revolve. A number of cars originally fitted with the 'Invicta' jet have since used the 'Thermo' jet (see next paragraph) as a complete Service Replacement, as it is in rather better supply on stock shelves.

(3) **The 'Thermo' jet (see Fig. A.4)**

This jet is used in conjunction with the electrically controlled cold starting auxiliary unit referred to generally as the Thermo-carburettor.

The 'Thermo' jet assembly uses a number of parts common to the standard unit, together with some completely fresh parts, including the jet proper. The main difference is a much stronger internal spring and no second gland in the lower half jet bearing.

Jets of the two smaller sizes are marked with a numeral '9', identifying a .090 in. (2.29 mm.) size jet, or '1' for the larger .100 in. (2.54 mm.) size.

There are three larger sizes of .125 in. (3.18 mm.), .1875 in. (4.8 mm.), and .250 in. (6.35 mm.), which are used chiefly on racing and special high-performance cars, and the last two sizes are always of the 'fixed' racing

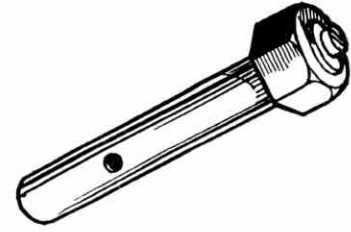


Fig. D.2
The 'Invicta' jet

type, having no adjustment at all, whilst the .125 in. (3.18 mm.) size can either be of this fixed racing type or, alternatively, of the fully slidable and adjustable variety, as the standard jet.

If a jet has worn oversize and thereby gives an unduly rich mixture, this wear is almost invariably caused by the needle rubbing slightly on the inside bore of the jet because the jet unit has *not* been centred correctly. In this circumstance a polished streak down the side of the needle, where the rubbing has taken place, is much more definite evidence of jet wear than checking the jet bore with a plug gauge, which cannot give evidence of local wear only, such as produced by a rubbing needle.

If the wear has been sufficient to give an increase in fuel consumption a new jet and needle should be fitted, and this must be carefully centred as described in Section B.1.

SECTION E

WORKSHOP REPAIR AND ADJUSTMENT SUCTION CHAMBER AND PISTON

- Section No. E.1 Periodical cleaning of suction chamber and piston.
- Section No. E.2 Positioning of needle in piston.
- Section No. E.3 Types of suction piston and piston spring.
- Section No. E.4 Dustproofing of suction chambers and pistons.
- Section No. E.5 ‘Timing’ of the piston drop.
- Section No. E.6 Oil damper unit in piston.

Section E.1

PERIODICAL CLEANING OF SUCTION CHAMBER AND PISTON

This unit can only be supplied in its complete form and individual pistons or suction chambers are not issued separately owing to the very fine measurements involved in the pairing up. The two parts can of course be separated for inspection and cleaning, which should be done on the horizontal carburetter about every 12 months, and every 3 months on the full downdraught (not inclined 'horizontal') instrument.

The cleaning should be carried out on the two outside discs of the piston, and the large bore of the suction chamber, with a clean rag moistened in fuel. After this the parts should be reassembled in a dry and clean condition, with a few spots of thin oil on the steel piston rod *only*.

If oil finds its way onto the outside diameter of the piston or large bore of the suction chamber, harm will result until it is cleaned off. When cleaning the piston take care that the needle is not bent in the general handling (this can be checked by rotating the piston in the suction chamber): also put a screwdriver on the clamp screw holding the needle and check that it is tight.

It may be observed that suction chambers on full downdraught carburetters (not 'inclined' horizontals) have three or four grooves recessed into the main bore—these act as dirt traps into which grit can fall out of the path of the piston travel; in the absence of these traps such grit would be continually scuffed and scrubbed between piston and suction chamber, until eventually the piston would start intermittent sticking and general engine performance would suffer.

In these downdraught suction chambers there is also a small $\frac{1}{16}$ in. (1.5 mm.) diameter drain hole in the bottom or 6 o'clock position (a little way up from the large open end), and this allows any liquid fuel that may have accumulated there to drain away, otherwise it would give unstable slow running.

Section E.2

POSITIONING OF NEEDLE IN PISTON

The recommended position is with the shoulder on the needle shank just flush with the end face of the piston. In older needles (made by a now superseded method) the shoulder was rounded and rather vague in definition so that its correct positioning was not so easily carried out. However, Fig. E.1 clearly shows the two types of needle and their shoulder positions in relation to the end face of the piston.

If, with this recommended position of the needle, the

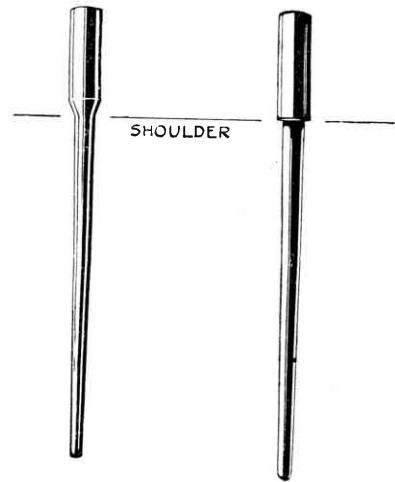


Fig. E.1

Two types of shoulder are in use, and the correct datum is shown for each

idling mixture is unduly rich even with the jet adjusting nut in the topmost position, this is probably due to a worn needle and jet which must be replaced and correctly centred. Alternatively, the rich mixture may be the result of a defective top jet gland or top copper washer—see Section B.2.

Also, when finding by trial and error a suitable needle for a special job having no recommended needle tuning, it is sometimes necessary to locate the needle about $\frac{1}{2}$ in. (.79 mm.) farther into the piston to avoid a too low position of the jet adjusting nut. The nut should not be lower than three full turns from the topmost position, and any excess over this figure would cut down cold starting capability in extreme winter conditions.

From the two preceding paragraphs it will be seen that, although not advisable in normal circumstances, it may sometimes be necessary to vary the position of the needle in the piston as a form of rough tuning, making the final fine adjustment on the jet adjusting nut. On those carburetters, few in number, fitted with the large fixed racing jets, adjustment of the position of the needle in the piston is the only method of mixture variation.

A cautionary word may be necessary about the practice of lightly tapping the small end of the needle with the wooden handle of a screwdriver when positioning it, and if this is done to the odd needle which is a tightish fit in the piston, difficulty may be experienced when trying to extract it. If this should happen and the needle be jammed, grip the last $\frac{1}{8}$ in. (3 mm.) only in a good pair of pliers or a small vice, and gently ease the needle out, using a steady twisting and pulling motion, but avoiding side thrust or the needle will be bent and will have to be scrapped.

Section E.3

TYPES OF SUCTION PISTON AND PISTON SPRING

- (1) Zinc die-cast pistons were used up to 1939 in the majority of carburettors, but this metal sometimes had the defect of slowly distorting or growing with age, leading to loosened piston rods (originally a tight press fit). This can be checked by holding the piston firmly in one hand (not a vice) whilst the second hand grasps the rod and checks for shake—if this is detected there is nothing that can be done as a remedy and the complete piston and suction chamber will have to be renewed.
- (2) The brass piston replaced the zinc type and ran in general production up to 1950—there was of course no trouble with instability of this metal.
- (3) The current thin-walled aluminium piston used with a weak compression spring in turn displaced both the previous types, and can also be used as a service replacement for either, providing a suitable strength of spring is selected.

To select a correct spring, weigh the old brass or zinc piston complete with rod, and then similarly weigh the new aluminium piston and rod, and the difference in weight, in ounces, should be taken as the required spring rating, varying if anything on the weaker side; e.g. old piston unit weighs 10½ oz., new unit 5 oz., giving a difference of 5½ oz., so use a 4½-oz. spring. The springs available are:

- 2½ oz. coloured with Light Blue paint on end coil.
- 4½ oz. " " Red " " "
- 8 oz. " " Yellow " " "
- 12 oz. " " Green " " "

- (4) The old pre-war thick-walled aluminium piston used without a spring, dropping by its own gravity weight, was used generally on twin- and triple-carburettor layouts and is now practically out of production. It can be replaced by the current thin-walled type plus a piston spring, the rating of which can be found as already explained in the previous paragraph.

Piston springs and skid washers

The four piston springs in common use, coloured Blue, Red, Yellow and Green, and giving loads of 2½ oz., 4½ oz., 8 oz. and 12 oz., in their original pattern incorporated a reduced end coil which was diminished to fit over the ½ in. diameter piston rod, and under this smaller end coil was positioned a thin flat skid washer made from stainless steel or hard rolled brass.

The function of this washer was to prevent accidental 'winding up' of the compression spring, which if it occurred would put a continual twisting force on the piston against its guide key, thereby altering the rise and fall characteristic of the piston and upsetting mixture strength.

After 1955, however, it was decided to eliminate this smaller end coil in order to gain a little extra piston lift, and for the same reason the flat skid washer was eliminated and replaced on the larger carburettors by a pressed cup performing the same function, but on the smaller carburettors any such fitting was dispensed with.

Section E.4

DUSTPROOFING OF SUCTION CHAMBERS AND PISTONS

There are two degrees of 'dustproofing' on the suction piston assembly: the milder type achieves a very substantial degree of imperviousness to dust, whilst the second type gives complete protection at some slight cost of simplicity. This latter type is identified by a small $\frac{3}{32}$ in. (2.38 mm.) diameter transverse hole in the neck of the suction chamber, drilled from just below the inner thread for the damper cap into the main chamber and at an angle.

Note that the piston damper used on this chamber having the transverse hole must be of the type having *no* vent hole in the top brass cap—whereas the damper having a vent hole in the cap is always fitted to the first-mentioned suction chamber with no transverse hole.

Briefly, the rule is if there is a hole in the suction chamber neck there is no hole in the damper cap—and vice versa.

Section E.5

'TIMING' OF THE PISTON DROP

The large outside diameter of the piston should not touch the bore of the suction chamber; there should be a clearance of between .002 and .003 in. (.05 and .07 mm.).

If high spots or bruises have grown either on this piston diameter or on the corresponding bore of the suction chamber (causing piston sticking or uneven travel), then these high spots should be carefully eased down with a superfine file on the piston, or a scraper in the bore of the chamber.

Although a new and accurate piston will revolve easily or fall easily (when detached from the carburettor) in any position of the suction chamber, in actual working conditions it is only called upon to operate in one position. Old pistons, where some slight metal distortion due to age has taken place, should be checked for free

falling at least in their functioning position in relation to the suction chamber. If a piston sticks or jams elsewhere it is only a mild defect and not detrimental to essential working.

The fixed clearance between the piston outside diameter and the bore of the suction chamber is important as it governs the rate of piston rise, and therefore of choke area.

This clearance is checked, not mechanically, but by counting in seconds the time taken by a given quantity of air to leak through it—obviously if the clearance or gap is larger, the time taken will be shorter, and vice versa.

Or translated into practice, if the suction piston assembly is held upside-down, with the smaller piston diameter uppermost, the index finger of the holding hand blocking off and sealing the small suction hole, the other hand can then steady the suction chamber in its topmost position—then if this hand is withdrawn the chamber will slowly, as the air is drawn inwards through the circumferential gap, fall downwards and away from the piston; in a typical case of a 1¼ in. (31.75 mm.) throttle horizontal carburetter this time will be between three and five seconds for the chamber for the piston to reach the bottom of its travel.

If the suction chamber is of the fully dustproofed type having a ⅜ in. (2.38 mm.) transverse hole, before making the above check screw the damper into position, even although it is obvious that no oil can be introduced into the inverted piston rod.

The time in seconds for this piston drop varies from three to five seconds for the smaller carburetters up to five to seven seconds for the larger 1½ in. (38.1 mm.) and 1¾ in. (44.45 mm.) throttle carburetters. (See full list below.)

Also the full downdraught carburetter (not the 'inclined' horizontal) has a faster piston timing because the clearance around the suction diameter is greater.

A 'fast' piston timing, if it is markedly so, will have a richening effect on the 'standard' tuning and a 'slow' piston timing a weakening effect, sometimes even taking the general mixture strength outside the range normally given by the standard needle.

Piston timing (horizontal carburetters)

1 in., 1⅝ in., 1¼ in. dia. throttles	..	3 to 5 seconds
1⅜ in. dia. throttle	4 to 6 seconds
1½ in., 1¾ in. dia. throttles	5 to 7 seconds.

Downdraught carburetters (not 'inclined')

1⅝ in. dia. throttle	1½ to 3 seconds
1¼ in. dia. throttle	2 to 4 seconds
1⅜ in., 1½ in. dia. throttles	3 to 5 seconds.

Section E.6

OIL DAMPER UNIT IN PISTON

If a piston damper is replaced, see that the replacement resembles the original fitting either by having a small ⅛ in. (1.5 mm.) diameter vent hole in the top brass cap, or by *not* having this vent hole. The two types are not interchangeable, and if wrongly used in an attempt to make them so, serious trouble will result.

At a pinch, of course, one type can be made into the other by plugging the hole in the one case, or drilling the extra hole in the second, but this should only be done in case of supply difficulty.

Prior to 1955, the identification of these two types was much more obvious as the type with the vent hole had a circular knurled top brass cap, whereas the type without the vent hole had a hexagon brass cap; since 1955 both caps have been hexagonal owing to a tendency for the knurled one failing to remain tight on particular engines inclined to vibrate.

An earlier type of damper used between 1938 and 1948 had a rather slender centre spoke which could be bent by rough handling, and if this happened the resulting side drag of the brass plunger on the inside bore of the piston rod could have a bad effect on the smoothness and uniformity of the piston lift.

In such a case straightening and truing of this centre spoke is necessary, followed by a check to see that the piston falls smoothly and evenly after assembly when lifted by hand.

SECTION F

WORKSHOP REPAIR AND ADJUSTMENT NEEDLE, SEAT, AND FLOAT-CHAMBER

- Section No. F.1 Types of needles and seats in float lids.
- Section No. F.2 Types of float-chamber holding-up bolts and their washers.
- Section No. F.3 General notes on float-chamber details.

Section F.1

TYPES OF NEEDLES AND SEATS IN FLOAT LIDS

There are two sizes of needle seatings in common use, both made from $\cdot338$ in. (8.58 mm.) A/C flats hexagon stock, and looking very similar on the outside, except that close to the six small radial holes, either *one* groove or *two* grooves are turned on the outside.

The one groove identifies the smallest type T.1 seat, having a feed hole of $\cdot086$ in. (2.18 mm.) diameter, and is used on the size T.1 float-chamber when this is fed by a *low*-pressure petrol pump (e.g. the S.U. 'L' type pump); but it is also used on the larger T.2 float-chamber when this is fed by a *high*-pressure pump (e.g. the S.U. 'high-pressure' pump).

The seating with two grooves identifies the T.2 seat having a $\cdot100$ in. (2.54 mm.) feed hole, and this is used on the T.2 size float-chamber when fed by a low-pressure pump.

On some pre-war cars a third seating was used, the T.3 type, having three identification grooves, but this is now out of production as its use was confined to fuel systems, now obsolete, which utilized a very low-pressure system of fuel delivery. This had a feed hole of $\cdot125$ in. (3.18 mm.) diameter, and if its use were attempted with a high-pressure pump, flooding would ensue.

It may be noticed that the stainless steel needle used with these seatings has been issued in the past with two differing types of pointed end. The original type, used up to 1954, had a 'straight' coned point, whereas since that date a 'curved' spearpoint has been used, as it has a slight mechanical advantage in operation.

Regarding the largest size float-chamber, type T.4, of 3 in. (76.2 mm.) outside diameter, this is only encountered rarely, chiefly on racing cars and very high performance sports cars—it uses two sizes of needle seatings (both much larger than the T.1, T.2 and T.3 already described), having respectively $\frac{5}{32}$ in. (3.97 mm.) and $\frac{3}{16}$ in. (4.76 mm.) diameter feed holes, according to whether a high- or medium-pressure fuel feed is used.

A cautionary word is necessary about the practice of tapping the end of the stainless steel needle into the seating, using a light hammer or spanner end to improve the cutting-off effect and cure occasional or slow flooding. If this is done, the blows must be *very light* indeed, or the original finely machined seating will crumble slightly under the impacts and will be worsened, not improved.

If a suspected seating does not respond to this very mild 'impact' treatment, and it has been checked that the flooding is not due to other parts or circumstances, then replacement seats and needles will be necessary.

Service replacement seatings and needles are supplied already matched together, pressure tested and sealed in small envelopes.

Section F.2

TYPES OF FLOAT-CHAMBER HOLDING-UP BOLTS AND THEIR WASHERS

Early types of holding-up bolts used for attaching the float-chamber to the main body casting employ a sunk cork ring for a seal, and as this is enclosed on three sides in the head of the bolt, it will last almost indefinitely providing no attempt is made to dig it out, when replacement is almost inevitable.

The cork ring type was followed by a different bolt using a simple flat seating made on to a solid flat aluminium washer, or its later successor, a rolled bronze washer.

These two washers were in turn displaced (but using the same bolt) by a set of three washers, twin fibre ones in the 'outer' positions with a brass centre washer sandwiched between them.

Section F.3

GENERAL NOTES ON FLOAT-CHAMBER DETAILS

The float-chamber on full-downdraught carburettors can be confused rather easily with the standard float-chamber for the more usual horizontal carburetter, but in fact it gives a $\frac{5}{16}$ in. (7.94 mm.) higher petrol level as the attachment arm is positioned much lower compared with the needle and seat mechanism in the lid. If this downdraught float-chamber were used on a horizontal carburetter, fairly severe flooding would take place.

Conversely, if a float-chamber intended for a horizontal carburetter were used on a downdraught some difficulty with cold starting in severe winter conditions might be experienced, together with erratic idling.

Regarding the hinged fork lever attached to the float lid, the mechanical fit of this, either axially or radially, is not important and a rather definite degree of play or slackness can be disregarded—it must not on any part suffer from even the slightest friction or tightness. The hinge pin itself, until 1955, was generally a loose sliding fit in the lugs on the lid, but since that date it has been made a light press fit—the later press fit pin is quite suitable for the older float lid.

The smaller T.1, T.2 and T.3 needle seats can be screwed into position with a hexagon box spanner $\cdot338$ in. (8.58 mm.) across the flats, and there is no separate sealing washer between the seat and the lid. It is a metal-

to-metal seal ; but do not, on this account, put too much pressure on the box spanner or the seating may be distorted or the thread stripped.

The tickler pin has, since 1955, been generally discarded owing to the necessity on many layouts for making the top of the float-chamber airtight—and in

the majority of cases service replacement lids will not have ticklers, even although the original fitting had.

When reconditioning a float-chamber lid it is advisable to renew the twin fibre washers on the main fuel feed banjo bolt as old washers in this position can give a small but annoying leak.

SECTION G

WORKSHOP REPAIR AND ADJUSTMENT NEEDLE AND SUCTION DISC UNIT (THERMO-CARBURETTER)

Section No. G.1 Variations of needle and suction disc unit (Thermo-carburetter).

Section G.1

VARIATIONS OF NEEDLE AND SUCTION DISC UNIT (THERMO-CARBURETTER)

The usual 'variable' on the Thermo auxiliary carburetter is the combined tapered needle and its pressed-on suction disc, and for individual makes and models of car these two variables lie (1) with the degree of the taper on the needle (which regulates the petrol flow), and (2) with the outside diameter of the suction disc (which regulates the air flow).

The acuteness of the taper is in four stages, the least taper being of .004 in. in the diameter for every $\frac{1}{8}$ in. in length; the second stage being .008 in. for every $\frac{1}{8}$ in.; the third stage .012 in. for every $\frac{1}{8}$ in. and the last and most acute taper being .016 in. per $\frac{1}{8}$ in. An identifying numeral of 4, 8, 12, or 16 is stamped on the shank of the needle just above the taper, but this is of necessity small and not too easily seen.

The second part of the variable, the outside diameter of the suction disc, can be checked by examining the numerals stamped around the solid part of the disc. On those made after 1948 the three numerals given are its outside diameter to three figures of decimals, i.e. 455

represents .455 in. diameter. Those produced before 1948 had only two stamped-on numerals, and these represented the number of thousandths of an inch the disc was smaller than .500 in. diameter, i.e. '45' means 45-thousandths smaller than .500 in. diameter, which equals .455 in. diameter. If a Thermo auxiliary carburetter is unsatisfactory, check that the markings on needle and disc are according to the manufacturer's recommendations, since incorrect replacements may have been fitted at some time.

There is a third variable on this auxiliary carburetter, which should be checked in the event of trouble, and that is the colour of the identifying dab of paint on the end coil of the weak compression spring which pushes on the suction disc—there are two normal loads of this spring, one having a 'green' painted end coil and the other a 'red'. A 'light blue' painted spring is used occasionally, chiefly for the American market. If replacements springs are ever fitted, see that the correct colour is obtained.

The green is the heaviest spring, having Part No. AUC3127.

The red is the middle load spring, having Part No. AUC3427.

The light blue is the lightest spring, having Part No. AUC1041.

SECTION H

THE MOTOR-CYCLE CARBURETTER, TYPE MC2

- Section No. H.1 General outline.
- Section No. H.2 Use of jet lever for cold starting.
- Section No. H.3 Regular oiling of piston rod.
- Section No. H.4 Removal of suction chamber.
- Section No. H.5 Miscellaneous notes.

Section H.1

GENERAL OUTLINE

The main construction of the MC type carburetter varies only in detail compared with the car model, the only three noticeable points of divergence being firstly, a bolted-up two-piece body casting in place of the single-piece car type; secondly, there is no interconnection between the throttle and jet lever on the MC type; and thirdly, no damper unit is used to limit the rate of piston rise.

The normal adjustments, such as mixture setting for idling, are the same as on the car carburetter in Section A.2, and also any possible 'defects in operation' can be checked over according to Section B. Similarly Sections C to F are also substantially applicable to the MC type carburetter—the following paragraphs, however, deal with matters particularly related to this type.

Section H.2

USE OF JET LEVER FOR COLD STARTING

For cold starting the jet lever is pulled upwards to its full extent, but immediately the engine has fired the lever should be pressed down towards the 'weak' position, either fully, as is possible in warm weather, or to a satisfactory intermediate position in colder weather. This intermediate position is readily found after a little experience, but a rough guide is to weaken off by depressing the lever until the engine beat starts to falter or spit back from weakness, and then ease the lever upwards a shade until the engine beat picks up and fires evenly. In very cold weather it may be advisable to let the jet remain in this slightly 'rich' position for a few hundred yards until the engine has reached a reasonable temperature.

Section H.3

REGULAR OILING OF PISTON ROD

The piston rod should be oiled every 14 days (except in very dry climates, when the period may be extended) with one squirt or four to six drops of thin engine oil or grade S.A.E. 20—or thin cycle oil, but *not* heavy-bodied oil.

Before doing this, the grey plastic top cap must be unscrewed from the top of the suction chamber, and when this is replaced, make sure that it is complete with washer and screwed up tight, as a leak here would cause a loss of power and heavy fuel consumption as a result of restricted piston lift. Also, these same ill effects would

be experienced if the correct grey plastic cap were replaced by the rather similar black plastic cap used on some car carburetters.

Section H.4

REMOVAL OF SUCTION CHAMBER

This may be necessary on very rare occasions in order to change the needle, but it should be done at long periods of about 12 months to clean the inside bore of the main chamber and the two outside diameters of the piston; these portions should be wiped with a clean rag moistened in fuel and then left in a dry and clean condition, with a few spots of thin oil on the piston rod *only*.

If difficulty is experienced, owing to lack of head room, in detaching the suction chamber, first remove the grey plastic top cap, and then raise and detach the chamber and inner piston as one. This will call for some care and dexterity; one hand will be required to lift up the chamber as far as head room permits whilst the second hand raises the piston inside the chamber against the mild load of its spring until the complete unit can be moved sideways and away from the main carburetter body—care must be taken not to bend the comparatively fragile needle.

When refitting, the procedure is reversed, the piston being held as high up as possible inside the chamber whilst the whole unit is carefully guided into the main body and jet bore.

Section H.5

MISCELLANEOUS NOTES

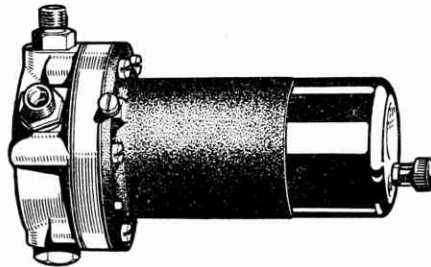
- (1) The two-piece body casting is bolted together by four countersunk 2 B.A. screws, and when the carburetter is detached for engine decarbonizing, check that these four screws are as tight as possible.
- (2) Lifting the suction piston by hand is necessary when checking the idling mixture, and this can be done on most installations by detaching the rubber sleeve over the air inlet; but if this is alternatively a rigid connection and inconvenient to detach, then the piston can be lifted by unscrewing the small hexagon-headed 2 B.A. screw under the carburetter air intake and lifting the piston, using a wire nail or bit of stiff wire.
- (3) Do not run the engine for any substantial period without the air cleaner as this will weaken off the mixture strength, with possible harmful results, although it can, of course, be temporarily disconnected whilst the idling mixture is being adjusted and checked.

- (4) If the slow run is uneven, remember to check over the ignition setting and tappet clearances according to the handbook instructions; also there may be air leaks at the carburetter engine flange or at the induction pipe flanges.
- (5) *Do not unnecessarily dismantle or loosen the main jet assembly*, as if this is not correctly centred on the needle, the whole range of carburation and engine performance will suffer. (Refer to Section B.1 for correctly re-centring the jet unit.)

ELECTRIC FUEL PUMPS

SECTION A
CONSTRUCTION AND FUNCTIONING
TYPE "L" SINGLE AND DUAL

- Section No. A.1 Description.
Section No. A.2 Action of the pump.
Section No. A.3 Fault diagnosis.



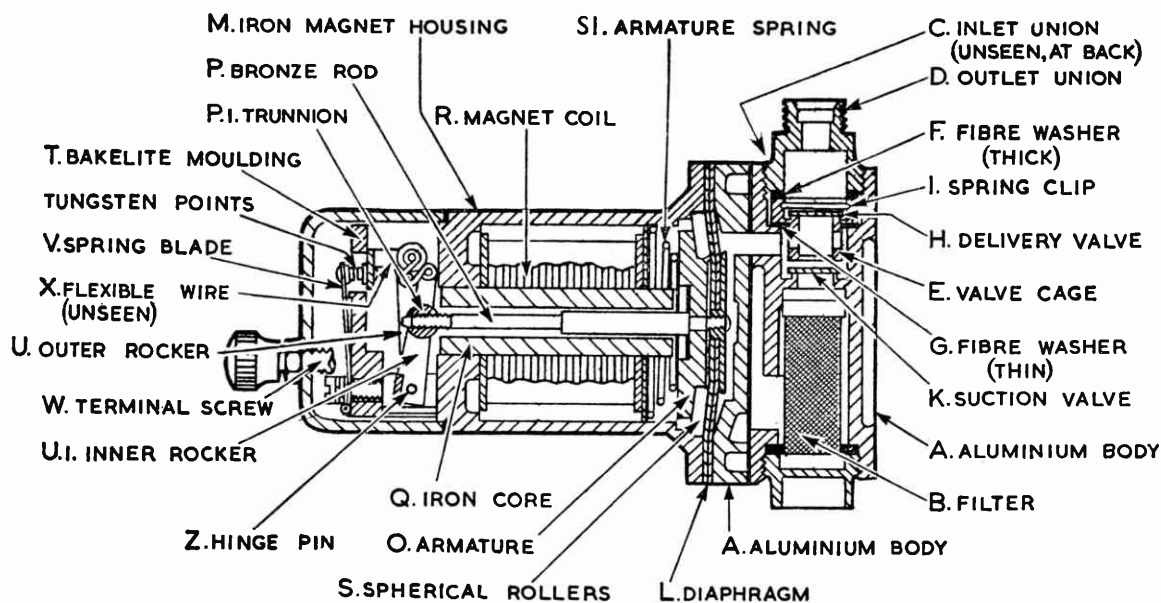


Fig. A.1.

An "L" type pump in section. (See Fig. D.1 for "Dual" type.)

Section A.1

DESCRIPTION

The "L" type pump should be mounted in the region of the engine at approximately carburettor level and in such a position that a minimum of exhaust manifold heat is radiated upon it; also, consistent with that position, the delivery pipe to the float-chamber should be kept as short as possible—the filter plug should be positioned at the bottom and the delivery union at the top.

The pump consists of three main assemblies—the body, the magnet assembly and the contact breaker.

The body "A" is composed of two aluminium die-castings; into the bottom of the larger one the filter "B" is screwed. The inlet union "C" is screwed in at an angle on one side. The outlet union "D" is screwed into the top. This tightens down onto the delivery valve cage "E," which is clamped between two fibre washers "F" and "G." In the top of the cage is the delivery valve, a thin brass disc "H" held in position by a spring clip "I," the suction valve "K" being a similar disc resting on the burnished end of an inserted brass tube.

Holes connect the space between the valves to the two pumping chambers, which are shallow depressions in each end face of the body casting. Each chamber is closed by a diaphragm assembly "L," which is clamped at its outer edge between the magnet housing "M" and the body. A bronze rod "P" is screwed through the centre of the armature to which the diaphragm is attached and passes through the magnet core to the contact breaker, which is located at the opposite

end. A spring "S.1" is interposed between the armature and the end plate of the coil. There is a fabric joint washer between the larger and smaller body castings.

In a "Dual" type pump (see Fig. D.1) twin filters "B" are held in the lower face of the casting. The inlet union "C" and the outlet union "D" are positioned at the side of the main casting. On the top of the body casting are twin hexagon-headed screwed plugs "F" giving access to the hollow screws "G" which retain the delivery valve cages "E." In the top of the cage is the delivery valve, positioned smooth side downwards and held in place by a spring clip "I," the suction valve "K" being a similar disc resting on the burnished end of an inserted brass tube.

Holes connect the space between the valves to the two pumping chambers, which are shallow depressions in each end face of the body casting. Each chamber is closed by a diaphragm assembly "L," which is clamped at its outer edge between the magnet housing and the body casting.

The magnet consists of a cast-iron pot having an iron core "Q" on which is wound a coil of copper wire "R" which energises the magnet. Between the magnet housing and the armature are fitted eleven spherical-edged brass rollers "S." These locate the armature "O" centrally within the magnet and allow absolute freedom of movement in a longitudinal direction.

The contact breaker (two in "Dual") consists of a small bakelite moulding "T" carrying two rockers "U" and "U.1," which are both hinged to the moulding at

one end of the rocker hinge pin "Z" and are connected together at the top end by two small springs arranged to give a "throw-over" action. A trunnion "P.1" is fitted into the centre of the inner rocker, and the bronze rod "P" connected to the armature is screwed into this. The outer rocker "U" is fitted with a tungsten point which makes contact with a further tungsten point on a spring blade "V." This spring blade is connected to one end of the coil and the other coil end is connected to the terminal "W." A short length of flexible wire "X" connects the outer rocker to one of the screws which hold the bakelite moulding onto the magnet housing, in order to ensure a good earth.

Section A.2

THE ACTION OF THE PUMP

When the pump is at rest the outer rocker lies in the outer position and the tungsten points are in contact. The current passes from the terminal through the coil, back to the blade, through the points and to earth, thus energising the magnet and attracting the armature. This comes forward, bringing the diaphragm with it, thus sucking fuel through the suction valve into the pumping chamber. When the armature has advanced nearly to the end of its stroke the "throw-over" mechanism operates, and the outer rocker flies back, separating the points and breaking the circuit. The spring "S.1" then pushes the armature and the diaphragm back, forcing fuel through the delivery valve at a rate determined by the requirements of the engine. As soon as the armature gets near the end of this stroke the "throw-over" mechanism again operates, the points again make contact and the cycle of operations is repeated.

The spring blade rests against a small projection on the bakelite moulding, and it should be set so that when the points are in contact it is deflected back from the moulding. The width of the gap at the points is approximately .030 in. (.76 mm.) when the rocker is pulled back against the face of the iron housing.

Section A.3

FAULT DIAGNOSIS

First disconnect the delivery pipe to the carburetter, and if the pump then works, the most likely cause of the trouble is a sticking needle in the float-chamber. Should the pump not work, however, disconnect the lead from the terminal and strike against the body of the pump to see if it sparks and therefore if any current is available. If the current is there, remove the bakelite

cover and touch the terminal with the lead when the points are in contact—then if the pump still fails to work it may be due to dirt on the contact faces. This may be cleaned off by inserting a piece of thin card between them and sliding it to and fro. If, however, the pump still fails to work with dirt-free points, check that the bottom filter is not clogged, as this will stop a pump, although a rare happening. Next slacken off the inlet pipe union, and if the pump then operates the trouble is probably due to an obstruction in the pipe line to the rear tank which can possibly be cured by blowing down the line with a tyre pump.

If, however, with the inlet pipe union slackened off, the pump fails to work, or only works slowly and spasmodically, then the trouble is probably due to a fault in the pump itself, such as a stiffened-up diaphragm, or to undue friction in the rocker "throw-over" mechanism, or a combination of both.

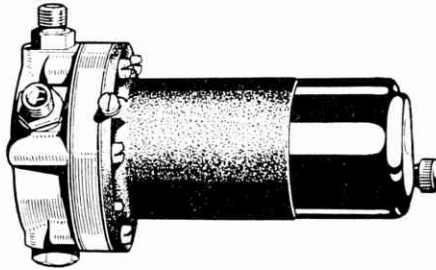
To check over these two matters, unscrew the six flange screws and detach the coil housing and rocker unit from the main body (taking care not to lose any of the eleven rollers under the diaphragm), and then by gently pressing the centre of the diaphragm assembly in and out observe whether the "throw-over" mechanism seems to operate freely. If it does not or there are traces of rust on any of the small steel spindles, lubricate *sparingly* with a spot of thin oil on a matchstick where they pass through the brass rockers. Then turn to the diaphragm, and in order to restore its original pliability ruckle each of the two fabric layers vigorously between the thumb and fingers, after which it can be reassembled and carefully reset for the "throw over" according to the instructions for this operation given in Section D.

If the pump becomes noisy look for an air leak on the suction side. The simplest way to check for this fault is to disconnect the fuel pipe from the carburetter and allow the pump to pump fuel into a pint can. If the end of the pipe is then submerged in the fuel and bubbles come through there must be an air leak, and it must be found and cured. Noise can also be caused by fuel boiling before it gets to the pump. This occurs most particularly on cars on which the fuel pipe runs near the exhaust pipe, and is usually noticed in hot weather when slowing down after driving hard. This trouble can sometimes be overcome by using a different brand of fuel.

If the pump keeps beating without delivering any fuel, it is possible that a piece of dirt is lodged under one of the valves. These can be removed for cleaning by unscrewing the top union and lifting the valve cage out. When replacing it see that the thin hard fibre washer is below the valve cage and the thick one above. A choked filter or an obstruction on the suction side will make the pump very hot and eventually cause a failure.

SECTION B
CONSTRUCTION AND FUNCTIONING
TYPE “HP” SINGLE AND DUAL

- | | |
|-----------------|---------------------|
| Section No. B.1 | Description. |
| Section No. B.2 | Action of the pump. |
| Section No. B.3 | Fault diagnosis. |



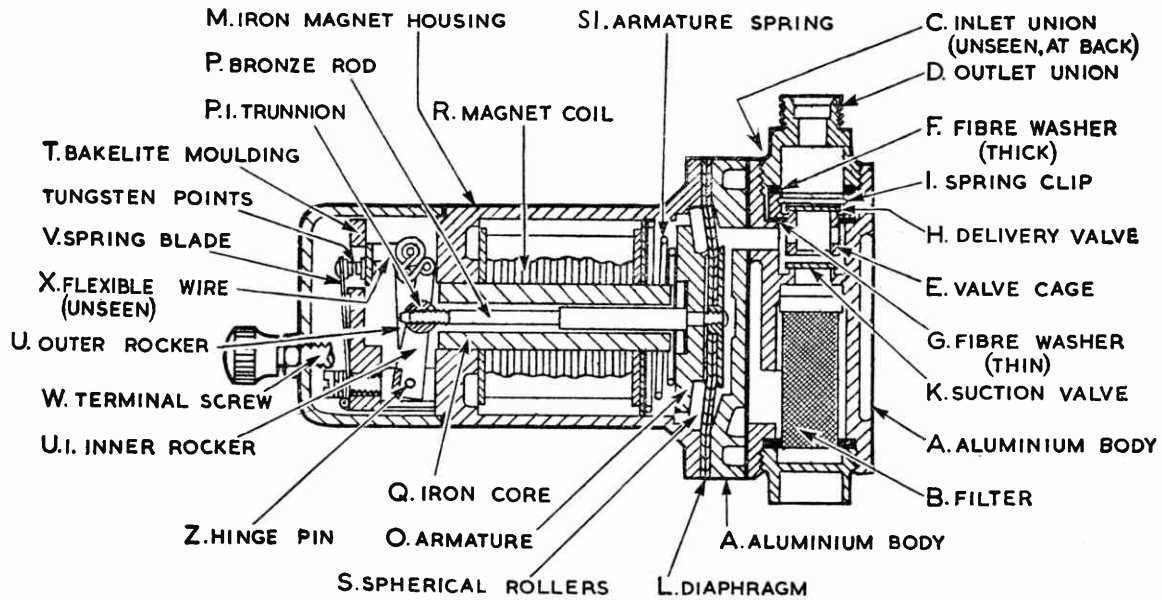


Fig. B.1.

An "HP" type pump in section. (See Fig. D.1 for "Dual" type.)

Section B.1

DESCRIPTION

The "HP" pump, which is identified by a slightly greater length of body than that of the "L" type, gives an increased pressure feed to the float-chamber and may be mounted at any point between the region of the engine and the region over the rear tank. It should be approximately at the height of the carburetter or just below it, and be mounted with the filter plug in the bottom or 6 o'clock position. It should not be mounted in such a position that it is affected by heat from the engine and the pipe lines should be as short as possible.

The "HP" pump may be fitted with single or double contact points, a condenser, an air bottle or a light spring on the inlet valve.

The pump consists of three main assemblies—the body, the magnet assembly and the contact breaker.

The body "A" is composed of two aluminium die-castings; into the bottom of the larger one the filter "B" is screwed. The inlet union "C" is screwed in at an angle on one side. The outlet union "D" is screwed into the top. This tightens down onto the delivery valve cage "E," which is clamped between two fibre washers "F" and "G." In the top of the cage is the delivery valve, a thin brass disc "H" held in position by a spring clip "I," the suction valve "K" being a similar disc resting on a seating machined in the body. Holes connect the space between the valves

to the pumping chamber, which is a shallow depression on the forward face of the smaller body casting. This space is closed by a diaphragm assembly "L," which is clamped at its outer edge between the magnet housing "M" and the body. A bronze rod "P" is screwed through the centre of the armature to which the diaphragm is attached and passes through the magnet core to the contact breaker located at the opposite end. A spring "S.1" is interposed between the armature and the end plate of the coil. There is a fabric joint washer between the larger and smaller body castings.

In a "Dual" type pump (see Fig. D.1) twin filters "B" are held in the lower face of the casting. The inlet union "C" and the outlet union "D" are positioned at the side of the main casting. On the top of the body casting are twin hexagon-headed screwed plugs "F" giving access to the hollow screws "G" which retain the delivery valve cages "E." In the top of the cage is the delivery valve, positioned smooth side downwards and held in place by a spring clip "I," the suction valve "K" being a similar disc resting on the burnished end of an inserted brass tube.

Holes connect the space between the valves to the two pumping chambers, which are shallow depressions in each end face of the body casting. Each chamber is closed by a diaphragm assembly "L," which is clamped at its outer edge between the magnet housing and the body casting.

The magnet consists of a cast-iron pot having an iron core "Q" on which is wound a coil of copper

wire "R" which energises the magnet. Between the magnet housing and the armature are fitted eleven spherical-edged brass rollers "S." These locate the armature "O" centrally within the magnet and allow absolute freedom of movement in a longitudinal direction.

The *contact breaker* (two in "Dual") consists of a small bakelite moulding "T" carrying two rockers "U" and "U.1," which are both hinged to the moulding at one end on the rocker hinge pin "Z" and are connected together at the top end by two small springs arranged to give a "throw-over" action. A trunnion "P.1" is fitted into the centre of the inner rocker, and the bronze rod "P" connected to the armature is screwed into this. The outer rocker "U" is fitted with a tungsten point which makes contact with a further tungsten point on a spring blade "V." This spring blade is connected to one end of the coil and the other coil end is connected to the terminal "W." A short length of flexible wire "X" connects the outer rocker to one of the screws which hold the bakelite moulding onto the magnet housing, in order to ensure a good earth.

Section B.2

THE ACTION OF THE PUMP

When the pump is at rest the outer rocker lies in the outer position and the tungsten points are in contact. The current passes from the terminal through the coil, back to the blade, through the points and to earth, thus energising the magnet and attracting the armature. This comes forward, bringing the diaphragm with it, thus sucking fuel through the suction valve into the pumping chamber. When the armature has advanced nearly to the end of its stroke the "throw-over" mechanism operates, and the outer rocker flies back, separating the points and breaking the circuit. The spring "S.1" then pushes the armature and the diaphragm back, forcing fuel through the delivery valve at a rate determined by the requirements of the engine. As soon as the armature gets near the end of this stroke the "throw-over" mechanism again operates, the points again make contact and the cycle of operations is repeated.

The spring blade rests against a small projection on the bakelite moulding, and it should be set so that when the points are in contact it is deflected back from the moulding. The width of the gap at the points is approximately .030 in. (.76 mm.) when the rocker is pulled back against the face of the iron housing.

If the magnet is removed from the body for any reason, care should be taken that the rollers "S" do not drop out.

Section B.3

FAULT DIAGNOSIS

First disconnect the delivery pipe to the carburetter, and if the pump then works, the most likely cause of the trouble is a sticking needle in the float-chamber. Should the pump not work, however, disconnect the lead from the terminal and strike against the body of the pump to see if it sparks and therefore if any current is available. If the current is there, remove the bakelite cover and touch the terminal with the lead when the points are in contact—then if the pump still fails to work it may be due to dirt on the contact faces. This may be cleaned off by inserting a piece of thin card between them and sliding it to and fro. If, however, the pump still fails to work with dirt-free points, check that the bottom filter is not clogged, as this will stop a pump, although a rare happening. Next slacken off the inlet pipe union, and if the pump then operates the trouble is probably due to an obstruction in the pipe line to the rear tank which can possibly be cured by blowing down the line with a tyre pump.

If, however, with the inlet pipe union slackened off, the pump fails to work, or only works slowly and spasmodically, then the trouble is probably due to a fault in the pump itself, such as a stiffened-up diaphragm, or to undue friction in the rocker "throw-over" mechanism, or a combination of both.

To check over these two matters, unscrew the six flange screws and detach the coil housing and rocker unit from the main body (taking care not to lose any of the eleven rollers under the diaphragm), and then by gently pressing the centre of the diaphragm assembly in and out observe whether the "throw-over" mechanism seems to operate freely. If it does not or if there are traces of rust on any of the small steel spindles, lubricate *sparingly* with a spot of thin oil on a matchstick where they pass through the brass rockers. Then turn to the diaphragm, and in order to restore its original pliability ruckle each of the two fabric layers vigorously between the thumb and fingers, after which it can be reassembled and carefully reset for the "throw over" according to the instructions for this operation given in Section D, "Repair and overhaul."

If the pump becomes noisy look for an air leak on the suction side. The simplest way to check for this is to disconnect the fuel pipe from the carburetter and allow the pump to pump fuel into a pint can. If the end of the pipe is then submerged in the fuel and bubbles come through there must be an air leak, and it must be found and cured. Noise can also be caused by fuel boiling before it gets to the pump. This occurs most particularly on cars on which the fuel pipe runs near the exhaust pipe, and this is usually noticed in hot

B

PUMPS—CONSTRUCTION AND FUNCTIONING

weather when slowing down after driving hard. This trouble can sometimes be overcome by using a different brand of fuel.

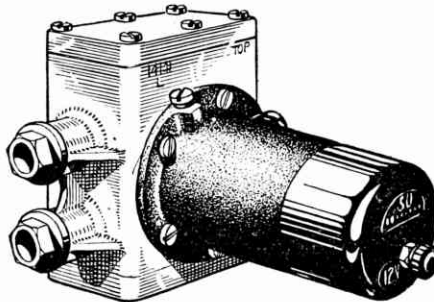
If the pump keeps beating without delivering any fuel, it is possible that a piece of dirt is lodged under one of the valves. These can be removed for cleaning

by unscrewing the top union and lifting the valve cage out. When replacing it see that the thin hard fibre washer is below the valve cage and the thick one above. A choked filter or an obstruction on the suction side will make the pump very hot and eventually cause a failure.

SECTION C

CONSTRUCTION AND FUNCTIONING TYPE "LCS"

- Section No. C.1 Description.
- Section No. C.2 Action of the pump.
- Section No. C.3 Fault diagnosis.



C PUMPS—CONSTRUCTION AND FUNCTIONING

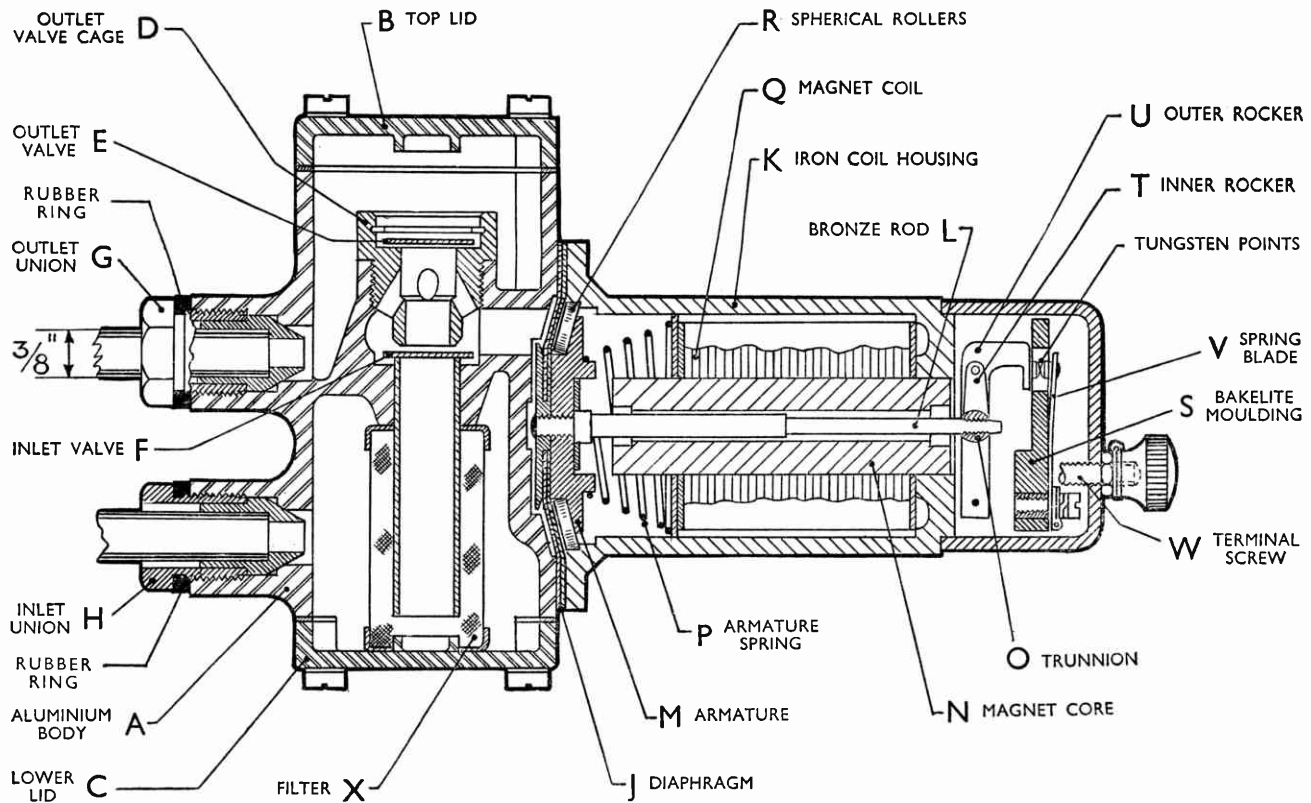


Fig. C.1.

A section through a pump : Type "LCS."

Section C.1

DESCRIPTION

The "LCS" type pump can be mounted at any point between the region of the carburetter and the region over the rear tank, and in the vertical plane should be just level with the carburetter or just below it; whilst consistent with the above locations, the pipe lines should be as short as possible.

Do not mount the pump in a position exposed to close and direct heat radiation from exhaust manifolds, etc.

The pump consists of three main assemblies—the body, the magnet assembly (sometimes also referred to as the coil housing assembly), and the contact breaker.

The body "A" is an aluminium die-casting, to which is attached by 2 B.A. screws two identical lids ("B" the top and "C" the lower), the lower one retaining the filter. The top lid gives access to the cage "D" for the outlet valve "E" and, when the cage is unscrewed, to the inlet valve "F" also. These inlet and outlet valves are thin brass discs and should be assembled smooth side downwards; the outlet valve can be extracted (rarely necessary) after the spring circlip has been detached, and care should be taken not

to distort this circlip or the correct valve lift may be affected. A $\frac{3}{8}$ in. diameter hole connects the space between the valves to the pumping chamber, which is a shallow depression in one face of the body casting. This space contains the diaphragm unit "J," which is clamped on its rim between the iron coil housing "K" and the main body "A."

A bronze rod "L" is screwed to the centre of the armature "M," to which the diaphragm is also fastened, and it passes through the magnet core "N" to the trunnion "O" in the contact breaker. An armature return spring "P" is interposed between the armature and the end of the magnet coil.

The magnet consists of a cast-iron housing "K" having an iron magnet core "N" on which is wound a coil of copper wire "Q" which energises the magnet. Between the magnet coil housing "K" and the armature "M" are fitted eleven spherical-edged rollers "R." These locate the armature centrally within the magnet and allow absolute freedom of movement in a longitudinal direction.

The contact breaker consists of a small bakelite moulding "S" carrying two rockers, an inner rocker "T" and an outer rocker "U," which are both hinged to the moulding at one end and connected together at

their top end by two small springs arranged to give a "throw-over" action. A trunnion bearing "O" is fitted into the centre of the inner rocker, and the bronze armature sliding rod "L" is screwed into this.

The outer rocker is fitted with tungsten points, which make contact with corresponding points on the spring blade "V." This blade is connected to one end of the coil and the second coil end is connected to the terminal screw "W."

A short length of flexible wire connects the outer rocker to one of the screws which holds the bakelite moulding, in order to provide a good earth.

This pump has a good delivery head and can be mounted fairly low down on the chassis. On such a layout it is possible for water or spray from the road wheels to find its way onto the pump, and cases have occurred where this water has percolated between the threads of the union nuts on the fuel pipes and their corresponding threads in the aluminium body; corrosion between the threads has followed, ultimately causing the union nuts to become immovable. To cure this a rubber sealing ring (Part No. AUA.4979) has been introduced which should be slipped over the unions before they are screwed into the pump body so that they are nipped between the head of the union and the boss on the pump body to make a watertight seal.

Section C.2

ACTION OF THE PUMP

When the pump is at rest the outer rocker lies in the outer position and the tungsten points are in contact. The current passes from the terminal through the coil, back to the blade, through the points and to earth, thus energising the magnet and attracting the armature. This comes forward, bringing the diaphragm with it, thus sucking fuel through the suction valve into the pumping chamber. When the armature has advanced nearly to the end of its stroke the "throw-over" mechanism operates, and the outer rocker flies back, separating the points and breaking the circuit. The spring "P" then pushes the armature and the diaphragm back, forcing fuel through the delivery valve at a rate determined by the requirements of the engine. As soon as the armature gets near the end of this stroke the "throw-over" mechanism again operates, the points again make contact and the cycle of operations is repeated.

The spring blade rests against a small projection on the bakelite moulding, and it should be set so that when the points are in contact it is deflected back from the moulding. The width of the gap at the points is approximately .030 in. (.76 mm.) when the rocker is pulled back against the face of the iron housing.

If the magnet is removed from the body for any reason, care should be taken that the rollers "R" do not drop out.

Section C.3

FAULT DIAGNOSIS

First disconnect the delivery pipe to the carburetter, and if the pump then works, the most likely cause of the trouble is a sticking needle in the float-chamber. Should the pump not work, however, disconnect the lead from the terminal and strike against the body of the pump to see if it sparks and therefore if any current is available. If the current is there, remove the bakelite cover and touch the terminal with the lead when the points are in contact—then if the pump still fails to work it may be due to dirt on the contact faces. This may be cleaned off by inserting a piece of thin card between them and sliding it to and fro. If, however, the pump still fails to work with dirt-free points, check that the bottom filter is not clogged, as this will stop a pump, although a rare happening. Next slacken off the inlet pipe union, and if the pump then operates, the trouble is probably due to an obstruction in the pipe line to the rear tank which can possibly be cured by blowing down the line with a tyre pump.

If, however, with the inlet pipe union slackened off, the pump fails to work, or only works slowly and spasmodically, then the trouble is probably due to a fault in the pump itself, such as a stiffened-up diaphragm, or to undue friction in the rocker "throw-over" mechanism, or a combination of both.

To check over these two matters, unscrew the six flange screws and detach the coil housing and rocker unit from the main body (taking care not to lose any of the eleven rollers under the diaphragm), and then by gently pressing in and out the centre of the diaphragm assembly observe whether the "throw-over" mechanism seems to operate freely. If it does not and there are traces of rust on any of the small steel spindles, lubricate *sparingly* with a spot of thin oil on a matchstick where they pass through the brass rockers. Then turn to the diaphragm, and in order to restore its original pliability, ruckle each of the two fabric layers vigorously between the thumb and fingers, after which it can be reassembled and carefully reset for the "throw over" according to the instructions for this operation given in Section D.

If the pump becomes noisy look for an air leak on the suction side. The simplest way to check for this is to disconnect the fuel pipe from the carburetter and allow the pump to pump fuel into a pint can. If the end of the pipe is then submerged in the fuel and

C PUMPS—CONSTRUCTION AND FUNCTIONING

bubbles come through there must be an air leak, and it must be found and cured. Noise can also be caused by fuel boiling before it gets to the pump. This occurs most particularly on cars on which the fuel pipe runs near the exhaust pipe, and this is usually noticed in hot weather when slowing down after driving hard. This

trouble can sometimes be overcome by using a different brand of fuel.

If the pump keeps beating without delivering any fuel it is possible that a piece of dirt is lodged under one of the valves. These can be removed for cleaning by unscrewing the top lid and out let valve cage.

SECTION D
CONSTRUCTION AND FUNCTIONING
TYPE PD

- Section No. D.1 Description.
- Section No. D.2 Operation of the pump.
- Section No. D.3 Servicing the pump.

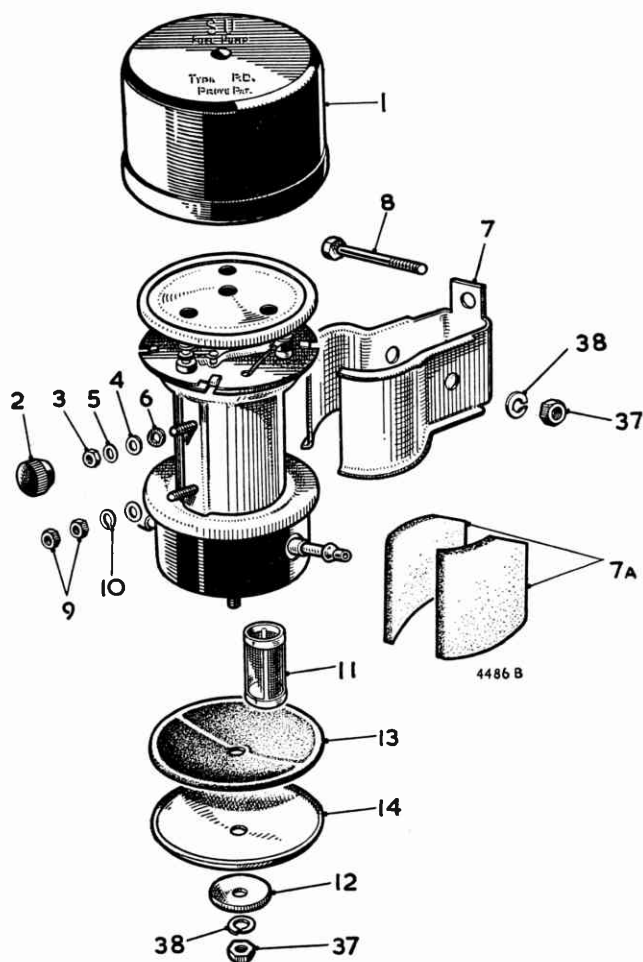


Fig. D.1

The S.U. fuel pump (PD type) serviced components

1.	Top cover.	AUA576	9.	Earth terminal nut (4 BA).	AUA584
2.	Terminal knob.	AUA577	10.	Earth terminal washer (4 BA).	AUA585
3.	Terminal nut.	AUA578	11.	Filter.	AUA571
4.	Plain washer (4 BA).	AUA579	12.	Dished washer.	AUA575
5.	Lead washer.	AUA580	13.	Cork gasket.	AUA573
6.	Insulating collar.	AUA581	14.	Cover-plate.	AUA574
7.	Holding bracket.	AUA582	37.	Nut (2 BA).	AUC2156
7A.	Bracket packing.	AUA625	38.	Spring washer (2 BA).	AUC2246
8.	Clamp bolt (2 BA).	AUA583			

Section D.1

DESCRIPTION

The type PD pump differs from previous designs in that the diaphragm is actuated magnetically through the medium of a hydrostatic as distinct from a direct

mechanical connection. By this arrangement the lost motion between the volumetric displacement of the pump diaphragm and its centre plate by mechanical means is eliminated. The pumping diaphragm suffers very little flexure, and it is, therefore, possible to make use of a terylene film diaphragm in place of the synthetic rubber material formerly employed.

Three pressings soldered to a central brass tube comprise the main structure of the pump. The brass tube houses a permanent magnet with two steel pole-pieces, a steel plunger separated from the magnet by an insulated distance piece, and a coil spring to impel the magnet and plunger downwards. The tube is completely filled with a light mineral oil and hermetically sealed by the upper and lower diaphragms. The contact breaker mechanism is mounted on a plate above the solenoid windings, and is not serviced separately.

Section D.2

OPERATION OF THE PUMP

The following résumé of the PD fuel pump action is given for information only, and dismantling must not be undertaken.

When the pump is at rest the plunger assembly with the magnet and pole-pieces is at the bottom of its stroke; in this position the lower pole-piece will attract the lower ear of the contact breaker rocker, and with the rocker finger pressing upwards against the spring blade will ensure that the tungsten points are in contact. With the electric circuit completed the solenoid is energized, and the plunger, magnet, and pole-pieces are magnetically impelled upwards. The fluid contained in the tube is hermetically sealed and will therefore follow the plunger and displace the diaphragm upwards, causing a volumetric increase in the pumping space below the diaphragm and thereby drawing in fuel via the inlet valve.

As the plunger approaches the extremity of its upward stroke the upper pole-piece will attract the upper ear of the contact breaker rocker; the rocker finger will recede from the lower contact blade and allow the tungsten points to break contact. The electro-magnetic system will now become demagnetized, allowing the plunger and its associated parts to descend under the load of the feed spring, and so reverse the action of the diaphragm to expel fuel through the delivery valve. The pumping cycle is then repeated.

When the outlet valve is obstructed by the limited rate at which the engine will draw upon the maximum flow available some downward movement of the plunger under spring pressure will still take place. To prevent the plunger becoming hydraulically locked a recuperating valve is incorporated in the plunger, returning any excess fluid from the upper to the lower regions bounding the plunger.

Section D.3

SERVICING THE PUMP

Owing to the hermetic sealing employed in the main construction of the pump, only the component parts

listed in the caption to the illustration (Fig. D.1) are accessible and serviced separately.

Cleaning the filter

Blockage of the filter will result in gradual falling off in maximum delivery of the pump, and will be detected by a tendency to fuel starvation at high engine speeds and loads. When such symptoms are detected release the cover-plate and gasket from the bakelite moulding and withdraw the filter. Wash the filter in fuel, lightly blow through with air, and clean any sediment from the bakelite moulding. When replacing the cover-plate it is advisable to renew the cork gasket.

Cleaning the contact points

If trouble from the contact points be suspected the top cover should be removed and the points cleaned by drawing a piece of clean paper or card between them. Great care must be taken during this operation to avoid overstressing the contact blades.

Air-leakage

Rapid operation accompanied by a diminished fuel delivery is indicative of air leakage into the suction side of the pump. This fault is best detected by disconnecting the delivery pipe at the carburetter and allowing fuel to discharge into an open receptacle with the end of the pipe submerged in the fuel. Should any significant quantity of air bubbles be observed, check, and if necessary replace, the cover-plate cork gasket. The rubber connections at either end of the suction line should be examined and renewed if they show signs of damage or deterioration.

Installation of pump

The pump should be installed as close as possible to the fuel supply tank; this will ensure that the pump is not subjected to under-bonnet temperature and that the delivery line is pressurized at all times.

The limiting suction head is approximately 3 ft. (91.4 cm.), but it is recommended that 18 in. (45.7 cm.) is not exceeded as the recuperating valve renders it unsuitable for high lift operating.

The maximum delivery head when handling petrol is approximately 6 ft. (1.829 m.), normal passenger car application is less than 4 ft. (1.219 m.) under the most adverse conditions. Against this delivery head with a suction lift of not more than 18 in. (45.7 cm.), and supplying through 8 ft. (2.438 m.) of $\frac{3}{16}$ in. (4.76 mm.) bore line, the flow capacity is about 45 pints (25.54 litres) per hour.

The inlet and outlet nipples are suitable for $\frac{1}{4}$ in. (6.35 mm.) bore push-on neoprene tubing.

A special set of adaptor pipes and fittings can be obtained enabling the type PD pump to be tested on the existing test stands. Order these through your usual Distributor.

SECTION E
REPAIR AND OVERHAUL

- Section No. E.1 Assembling and testing.
Section No. E.2 Defects in operation.
Section No. E.3 Special note on pre-1938 pumps.

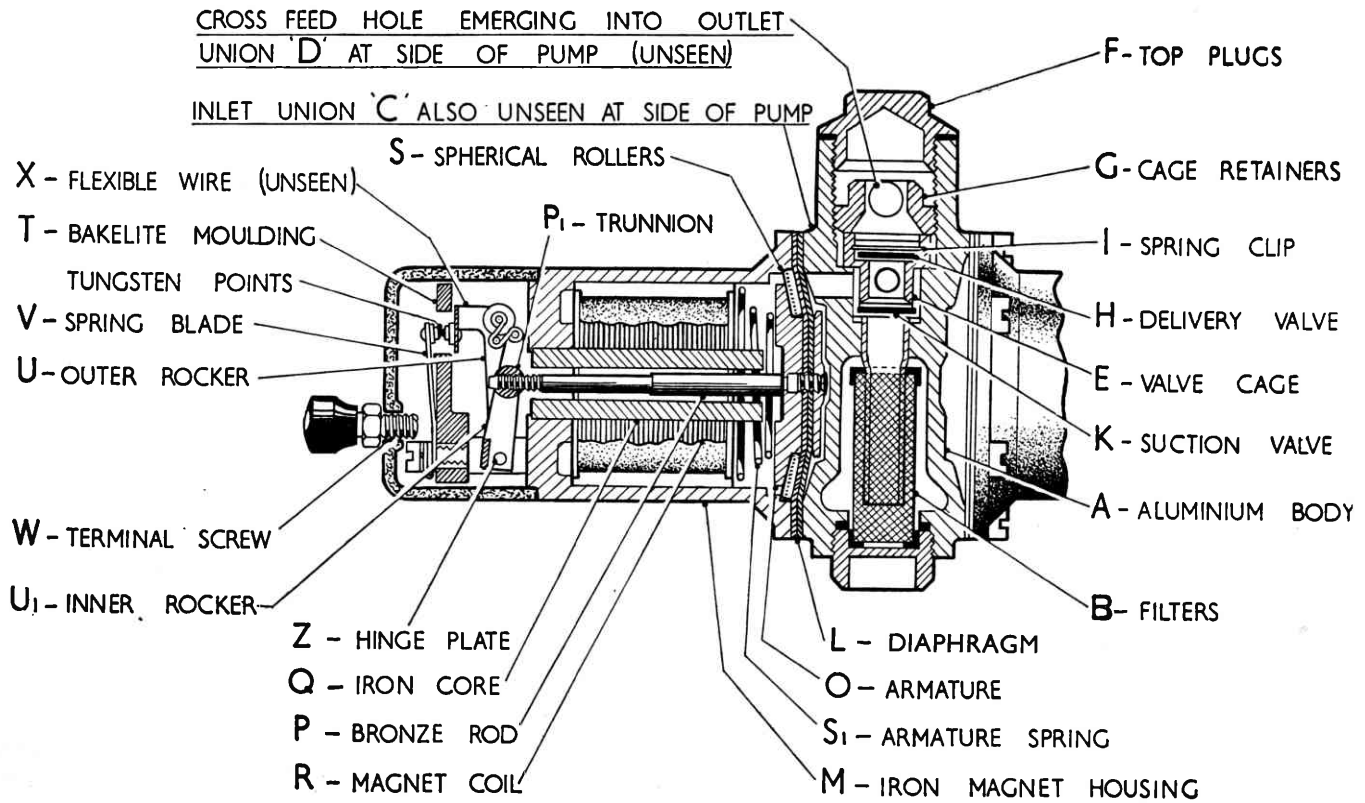


Fig. E.1

Part-section of a dual-type pump

Section E.1

ASSEMBLING AND TESTING

Should it be found necessary to overhaul an S.U. fuel pump, particular attention should be paid to the condition of the diaphragm, valves, and contact breaker parts.

To examine these parts it is necessary to dismantle the pump completely.

When reassembling, first see that all parts are clean. The valves (H and K) should be fitted with the smooth side downwards. Care should be taken that the valve retaining clip (I) in the delivery valve cage (E) is correctly located in its groove. A thin, hard, red fibre washer should be fitted under and a medium one above the valve cage and also above the filter plug. The washer on the inlet union is a thick, hard, red fibre one.

The brass body of the L old-type pump has been replaced and entirely superseded by one of aluminium. The only difference besides that of material is the method of manufacture, which results in a minor alteration to the assembly.

In place of the original hot brass stamping with the back plate soldered in position, the aluminium body is an assembly of two pressure die castings held together by the screws which secure it to the cast-iron coil housing, a fabric gasket being used as a seal. These screws are longer than those used with the brass type, and are not interchangeable.

The contact breaker should be assembled onto the pedestal in such a way that the rockers are a free fit on it, but without side-play. Excessive side-play on the outer rocker permits the points to get out of line. Excessive tightness makes the contact breaker sluggish. It may be necessary to square up the outer rocker after assembly with a pair of thin-nosed pliers.

Pieces of wire must not be used for a hinge pin; the standard hinge pin is case-hardened.

The contact blade (V) should be fitted next to the bakelite pedestal, that is, underneath the tag. It should rest against the ledge on the pedestal when the points are apart, and it must not be so stiff as to prevent the outer rocker from coming right forward when the points are in contact. The points should just make contact when the rocker is in its mid-way position. The simplest way to check this is to hold the blade in contact with the

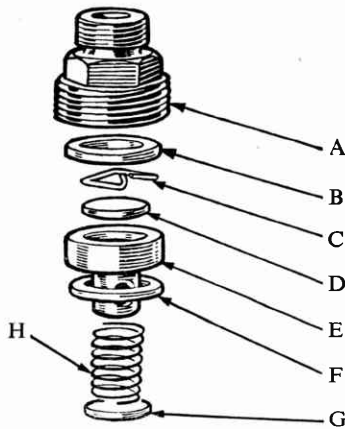


Fig. E.2

- A. Outlet union. B and F. Washers. C. Spring clip.
 D and G. Valve discs. E. Valve cage. H. Spring.

pedestal, being careful not to press on the overhanging portion, and then to test the gap between the white rollers and the cast-iron body of the pump; it should be .030 in. (.76 mm.). If necessary, the tip of the blade may be set in order to correct the gap.

The spring washer on the 2 BA screw to which the earthing connection is taken should be fitted below the tag, that is, next to the pedestal. The reason for this is that the spring washer cannot be relied on as a conductor, and the brass tag should therefore be next to the head of the screw.

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

The coil end going to the terminal should be soldered to its tag and not to the nut.

The correct order for the assembly on the terminal, Fig. E.6, is spring washer (1) next to the bakelite pedestal, then the tag (2), lead washer (3), countersunk nut (4). A lead washer has been found necessary at this point as some cases of bad connection have been found. This assembly **must never** be shortened by leaving out the spring washer or by any other means, as this would probably result in breakage of the pedestal when the nut holding the cover in position was tightened.

In no conditions should any attempt be made to move the core of the magnet. This can only be located in position correctly with special press tools.

The armature spring should be fitted with its large diameter in the mouth of the pot and the small diameter resting against the armature. **Do not stretch the spring.**

The armature should be adjusted as follows: **the contact blade on the pump must be swung to one side while the adjustment is being made.** Care should be

taken to see that an impact washer (26), Fig. E.4, is fitted in the recess in the armature, and the latter should then be screwed in and the rollers put in position. There are 11 of these. Do not use jointing compound on the diaphragm.

The magnet assembly should then be held in the left hand in an approximately horizontal position and the armature pushed in with the thumb of the right hand, pressing firmly but steadily.

If the contact breaker throws over, the armature should be screwed in farther until it does not. It should then be unscrewed one-sixth of a turn at a time until a point is found at which the contact breaker just throws over, care being taken that the armature is not jerked in but pressed in with a steady pressure. The armature should then be unscrewed a further two-thirds of a turn, that is, four holes, and the setting is correct. **Do not forget that this is to be done with the points out of contact.** When a new diaphragm is fitted it is possible that considerable pressure will be required to push it right home. If there is any doubt about the point at which the contact breaker throws over, come back one-sixth of a turn.

The cast-iron magnet body should then be placed in position on the main body, the drain hole in the former being in line with the filter plug on the main body, that is, at the bottom.

Care should be taken to see that the magnet body sits down on the main body before the screws which hold them together are inserted. If one of the rollers has fallen out of position, it will get trapped between the

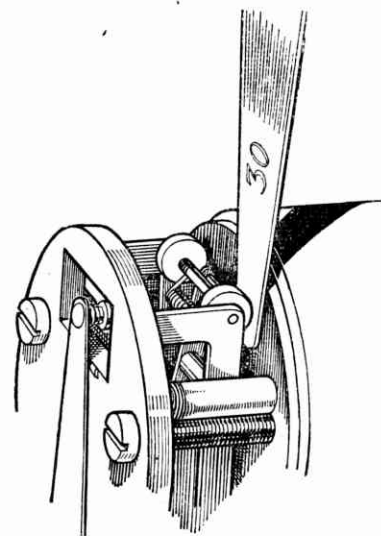


Fig. E.3

The correct gap at the points

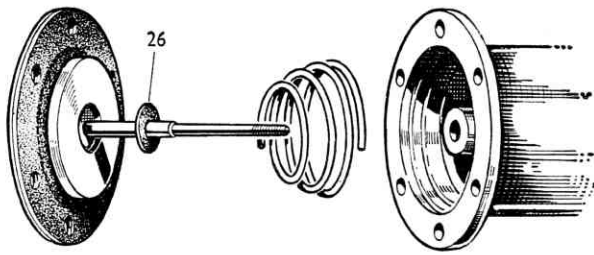


Fig. E.4
The impact washer (26)

two parts and will cut a hole in the diaphragm. Five screws and the earthing terminal should then be fitted to hold the two parts together. (Later models have six screws and a separate earthing screw in a boss on the magnet casting.) These should not be screwed right home at first. Before tightening them down it is absolutely necessary to stretch the diaphragm to its outermost position. This is most easily effected by using a special forked wedge which can be obtained from Nuffield Exports Ltd. or, if conditions permit, can be made from ordinary mild steel to dimensions given in Fig. E.7.

This is inserted between the white rollers on 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. If this 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. While the diaphragm is held in this position the six screws (one an earthing terminal on early models) should be tightened down fully.

Three important points are frequently overlooked :

- (1) Keep the blade out of contact while setting the diaphragm.
- (2) Press steadily and firmly on the armature—do not bump—while setting.
- (3) Stretch the diaphragm to the end of its stroke while tightening the screws.

The pump should then be put on test. It is best to use a cutaway 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 test apparatus illustrated in Fig. E.5 can be supplied by Nuffield Exports Ltd.

When the pump is switched on it should prime promptly, and the paraffin (kerosene), which is normally used for testing, should rise in the glass tube until it flows over the top of the pipe having a $\frac{5}{32}$ in. (3.9 mm.) hole drilled in it. If the output of the pump is not up

to normal, the $\frac{5}{32}$ in. (3.9 mm.) hole will be able to carry all the paraffin (kerosene) pumped and the liquid will not flow over the top.

This therefore constitutes a simple form of flowmeter which establishes in a simple manner whether the pump is giving a sufficient output or not. If by any chance there is any air-leak in the pump or in its connections, bubbles will be seen coming out of the pipe projecting downwards into the flowmeter. Bubbles will certainly come through here for a short while after starting up, but they should cease after the pump has been running for a minute or so. The tap should then be turned right off and the pump should stand without repeating for at least 15 seconds. If it repeats, the foot valve is not seating correctly.

The tap should then be turned on slightly to see if the pump idles satisfactorily, and that the outer rocker comes forward till it makes contact with the pedestal, and while it is in this position the tip of the blade should be pressed inwards gradually to reduce the stroke of the pump. However much this stroke is reduced, the pump should go on pumping normally until it fails altogether owing to there being no gap left. If instead of pumping it buzzes, it usually indicates excessive flexibility in the diaphragm. This, of course, is not likely to be experienced with a new diaphragm. The tap should

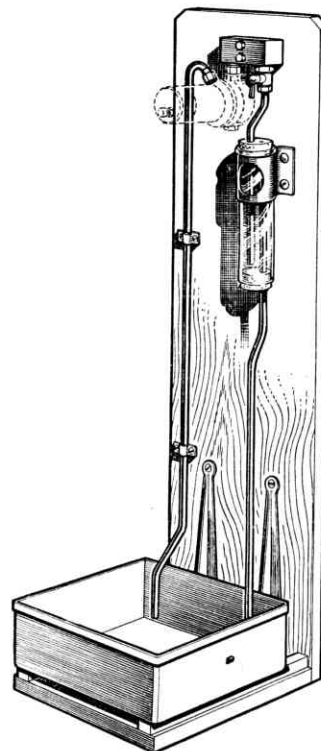


Fig. E.5
A pump test rig

then be turned on again and the pump tested on 8 volts, or on 4 volts if it is a 6-volt pump, and it should work satisfactorily under these conditions, although probably with a reduced output.

It is as well to let the pump run for 10 minutes or so before carrying out these various tests. The cover, which is black for 12-volt and brown for 6-volt, should then be fitted and held in place with an ordinary brass nut and an insulated dome nut fitted on the end of the terminal. The voltage of the pump can always be identified by the colour of the sleeving on the coil ends, this being red, black or brown for 12-volt and green for 6-volt.

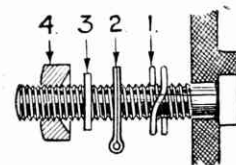


Fig. E.6

The terminal assembly

NOTE.—A special attachment is required for testing type HP pumps. This attachment is easily fitted and can be obtained through the usual channels.

TEST DATA

BRIEF TECHNICAL DATA FOR S.U. FUEL PUMPS

Figures quoted are for the single pump, but it should be noted that the dual editions of the L or the HP are the same, except that the maximum output is just over double.

Type	Recommended mounting position	Fuel pipe diameter	Maximum output gal./hour	Maximum suction lift (approx.)	Maximum output lift (approx.)
L	In region of engine, at approximately carburetter level ..	$\left. \begin{array}{l} \frac{1}{8} \text{ in. single O/D.} \\ \frac{1}{8} \text{ in. dual O/D.} \\ \frac{1}{8} \text{ in. single O/D.} \\ \frac{1}{8} \text{ in. dual O/D.} \\ \frac{1}{8} \text{ in. O/D.} \end{array} \right\}$	8 (36 litres)	48 in. (122 cm.)	10 in. (25.4 cm.)
HP	Amidships or over rear tank, at carburetter level or just below		10 (45 litres)	33 in. (83.8 cm.)	48 in. (122 cm.)
LCS	Amidships or over rear tank, at carburetter level or just below		$12\frac{1}{2}$ (56 litres)	33 in. (83.8 cm.)	48 in. (122 cm.)
PD	Immediately adjacent to fuel tank		$\frac{3}{16}$ in. I/D. (25.5 litres)	$5\frac{3}{8}$ (91.4 cm.)	36 in. (91.4 cm.)

Section E.2

DEFECTS IN OPERATION

In the event of trouble, first disconnect the fuel delivery pipe from the pump. If the latter then works, the most likely cause of the trouble is a sticking needle in the float-chamber of the carburetter. Should the pump not work, disconnect the lead from the terminal and strike it against the body of the pump to see if it sparks and therefore if any current is available in the wire. If the current is there, remove the bakelite cover and touch the terminal with the lead. If the pump does not operate and the points are in contact and a spark cannot be struck off the terminal, it is probable that there is some dirt on the points. These may be cleaned by inserting a piece of thin card between them, pinching them together and sliding the card backwards and forwards. If, when the wire is connected to the terminal and the tickler of the carburetter is depressed, the points fail to break, it is possible that there is either an obstruction in the suction pipe, which should be cleaned by blowing down it with a tyre pump, or something in the pump itself which is preventing a correct movement. This may be due either to the diaphragm having stiffened or to foreign matter in the roller assembly which supports

the diaphragm. The diaphragm should therefore be removed, and the whole assembly cleaned and re-assembled in accordance with the instructions given in Section E.1.

If the pump becomes noisy, look for an air-leak on the suction side. The simplest way to check up on this is to disconnect the fuel pipe from the carburetter and allow the pump to pump fuel into a pint can. If the end of the pipe is then submerged in the fuel and bubbles come through, there must be an air-leak, and it must be found and cured. Noise can also be caused by fuel boiling before it gets to the pump. This occurs most particularly on cars on which the fuel pipe runs near the exhaust pipe, and this is usually noticed in hot weather when slowing down after having been driving hard. This trouble can often be overcome by using a different brand of fuel.

If the pump keeps on beating without delivering any fuel, it is possible that a piece of dirt is lodged under one of the valves. This can be remedied by removing the top lid and unscrewing the valve cage in order to examine both valves, in the case of the LCS pump, removing the outlet union in the case of the L or HP pumps and the valve covers in the case of dual pumps.

FORK FOR DIAPHRAGM STRETCHING. Material—Mild Steel

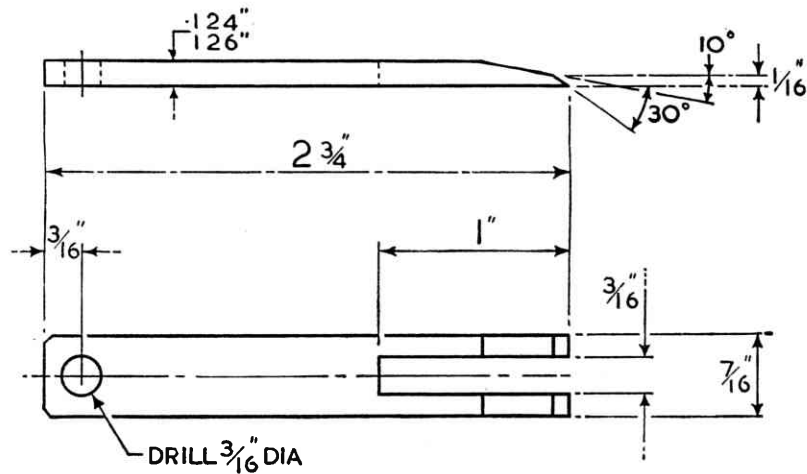


Fig. E.7

Dimensioned sketch for manufacture of wedge

A choked filter or an obstruction on the suction side will make the pump get very hot and eventually cause a failure. Make sure also that the six flange screws clamping the diaphragm are tight.

Section E.3

SPECIAL NOTE ON PRE-1938 PUMPS

On pumps issued prior to 1938 the cast-iron coil housing is not entirely suitable by itself for assembly with the neoprene (synthetic rubber) type of diaphragm.

In the past these coil housings were made suitable by an additional part, a thin white fabric distance ring, positioned between the diaphragm and the face of the coil housing, but these rings are no longer available, and all these old coil housings will be gradually withdrawn from service.

These old housings may be identified by measuring (fairly accurately) the distance from the large end, face down, to the edge of the second step. On the old housing this dimension is between .193 and .203 in. (4.8 and 5 mm.). On the current model it is deeper, and should measure between .213 and .223 in. (5.3 and 5.5 mm.).

