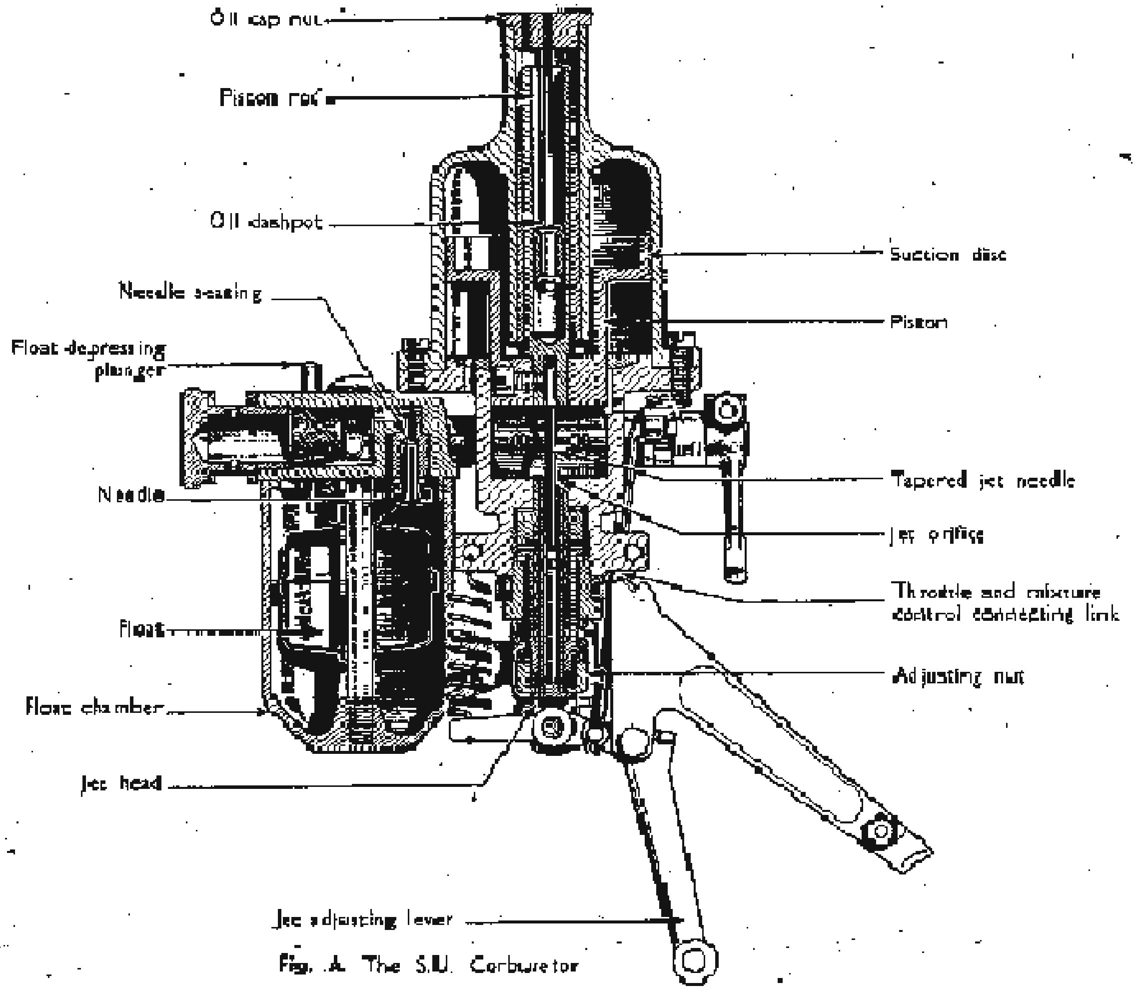


Fig. A The S.U. Carburetor

Note: This article was written in 1952 before the introduction of the SU HD6 or HD8. I have added most of the relevant information including diagrams. (Re-edited by R. Saber)

SU CARBURETORS **SERVICING AND TUNING**

By C. Gordon Bennet (Article in Road and Track Dec. 1952)

The SU Carburetor is fitted to a great number of British automobiles and has also proved very popular for use on racing engines. In addition, it is of interest to know that it is now being fitted as standard equipment to certain models of the Triumph motorcycle.

As the majority of British automobiles being imported into the United States are fitted with the SU as standard equipment, I think it would be of interest to many of you to know something about the principle of this type of carburetor; why it has proved so popular with British automobile manufacturers, and some general information on servicing and tuning.

The SU Carburetor—the "SU" standing for Skinner Union, a company originally formed by a Mr. Skinner and now controlled by the Nufileld Organization—is what is commonly known as the "expanding-choke type carburetor" and as far as I know, it is the only carburetor of this type in quantity production for automobiles in the world today.

ADVANTAGES

What are the advantages of this expanding- choke type over the more conventional fixed choke type (which is fitted to the majority of American automobiles)—and why has it proved so popular In England?

Maximum peak power has always been a matter of primary concern in, the case of the small capacity British engine whereas it has been a matter of less importance to the large American engine. Furthermore, the more accurate control which it is possible to maintain over mixture ratios with corresponding advantages in gasoline consumption in contrast to the fixed-choke type has always made a strong appeal to the British manufacturer, whereas, due to gas being relatively cheap and easy to obtain, the American manufacturer has always attached less importance to this question of economy.

If the expanding type of choke gives greater economy and more power, why then has it not been used by American manufacturers? The answer to this question is that, if the American engine designers had not gone over almost universally to the downdraft type of intake manifolding, the expanding type choke carburetor would, I am sure, have found favor in America.

Due to consideration of low hood line, the British manufacturer has not adopted the downdraft intake manifold and still keeps to the sidedraft installation in the majority of cases. When comparing the expanding SU type choke carburetor with the fixed-choke type, both mounted for sidedraft installation a very striking improvement is noticed both in economy and power for the expanding-choke types. With the adoption of the down- draft installation, this superiority was materially reduced the basic reason being, that with the downdraft fixed-choke type arrangement a very much larger choke area could be employed to the advantage of peak power with out the heavy corresponding disabilities involved as in the case of the side draft arrangement; that is to say, without the attendant difficulties experienced at low speed, full throttle operation which, renders a relatively small choke size necessary, the gas having to be carried horizontally from the paint of discharge at the jet to the inlet port of the engine. There has, of course, always been some prejudice against the use of a carburetor containing the moving parts which are essential to the expanding-choke Instrument. This; however, Is no more than a prejudice which has survived from the early days when various types of expanding-choke carburetors which were at one time on the market, gave trouble due to the derangement of the mechanical moving parts. lit was mainly for. this reason that this type of carburetor, despite its very marked functional superiority over the fixed- choke type did in general fall into disrepute and disappeared from the market. The fact that the SU carburetor avoided this general demise is due to the basic mechanical design in which the sole point of conjunction of the stationary and moving parts of, the carburetor is formed by the well-lubricated, cast iron suction chamber bushing and the case-hardened steel spindle of the moving piston. On the score of reliability and freedom from derangement under normal service, it is justifiably claimed that the liability for the moving parts to become deranged is very much less than the stoppage of the smaller fixed ‘jets which are an essential part of the open or fixed-choke type of carburetor, It will be appreciated in this connection that only one jet is employed in the S U and stoppage of this jet, even in the absence of adequate pre-filtration, is virtually unknown. These, then are the main reasons why the SU carburetor has survived and proved so popular with British manufacturers and racing drivers who demand nothing but the best. It is worth mentioning here, I think that a Lago Talbot Grand Prix car was fitted with three

SU carburetors last season and, with out any other alterations, proved to be very much faster than any of the other Lago Talbots running. .

TUNING & SERVICING OF SU CARBURETORS

Principal of Operation—Refer to the drawing, Figure A this shows quite clearly the complete carburetor and the various components. Also the drawing, Figure B shows an enlarged view of the jet and jet assembly. The float chamber and needle valve work exactly on the same principle as all other carburetors and ensures that a correct level of fuel is maintained in the jet at all times. It will be seen that the jet itself is mounted in a top and bottom bearing and is free to move up and down in these bearings, the purpose of which is to enable a rich mixture to be obtained for cold starting purposes and also allow adjustments be made to mixture strength when the engine, is idling. When the engine is stationary the piston and suction disc are at the bottom of the suction chamber and the tapered jet needle is well down inside the jet giving a very small choke area and also giving a very small opening in the jet itself. The rich mixture control, or “choke control” as it is more commonly known, is connected to the jet head and when the engine is started from cold the control knob is pulled to lower the jet thus increasing the effective size of the jet itself. Which means, of course, that a richer mixture will be obtained for starting purposes. As soon as the engine starts, a vacuum is created in the suction chamber (due to suitable drillings in the piston and suction disc) which will tend to lift the suction disc and piston and with it of course, the tapered jet needle. As the throttle is opened further, the vacuum in the suction chamber is increased, allowing the suction disc and piston to rise even further, thus giving a larger. choke area and. at the same time, the fuel is increased due to the tapered needles also being moved, further out of the jet. At full throttle, the suction disc and piston assembly are nearly at the top of the suction chamber, giving unrestricted air flow over the jet. Concurrently, the jet needle has moved well up the jet: an action calculated to give the correct air/fuel ratio throughout the range. This, in simple terms, is the working of the SU carburetor.

Jets: These are made in various sizes ranging from .099 inches to .1875 inches, the larger sizes being used only for racing or very high performance engines. The two sizes most commonly found on production cars are the .090 inch and the .100 inch. The size of the jet will be found stamped on the jet head. The figure “nine” wilt indicate that it is the .090 inch and the figure “one" will indicate the .100 inch jet. When tuning a production car the jets size should be checked to make sure that it is of the size recommended by the manufacturers.

Centering of Jet: If for any reason, the jet assembly has been removed, it will be necessary to re-center the jet. First, remove the clevis pin at the base of the jet which attaches the jet head to the jet operating lever. Withdraw the jet completely and remove the adjusting nut and spring, then replace the adjusting nut, without its spring, and screw it up to its highest position. Slide the Set into position until the jet head is against the base of the adjusting nut. When this has been done, find out if the piston is perfectly free by lifting it up with the finger and allowing it to drop. If the piston is not entirely free, slacken the jet screw and manipulate the lower part of the assembly, including the projecting part of the bottom half of the jet bearing, adjusting nut, and jet head. Make sure that this assembly is now slightly loose. The piston should then rise and fall quite freely as the needle is now able to move the jet into the required central position. The jet screw should now be tightened and a further check made to determine that the piston is still quite free. When complete freedom of the piston is achieved the jet adjusting nut should be removed, together with the jet, and the spring replaced.

Experience has shown that a large percentage of carburetors, which have given trouble has been due to the incorrect centering of jets.

Jet Needles— These are made in a great variety of sizes, probably now well over two hundred and fifty, and each type of engine has a needle that has been selected, after very careful tests have been carried out, to give the best all-round performance. Most manufacturers actually give three alternative needles for each type and size of engine, these needles clearly being listed by the manufacturer “Standard", “Rich” or “Weak” and before tuning is started the needle, which is marked on the shank should be checked against the manufacturer's recommendation to make quite sure that the right needle is fitted; this is most important.

. The chart below gives the carburetor specifications recommended by the manufacturers of the most popular types of British cars to be found over here in the States. The rich needle will usually give a little more performance at the expense of economy and the weak needle will give the best gas mileage at the expense of a little loss of power.

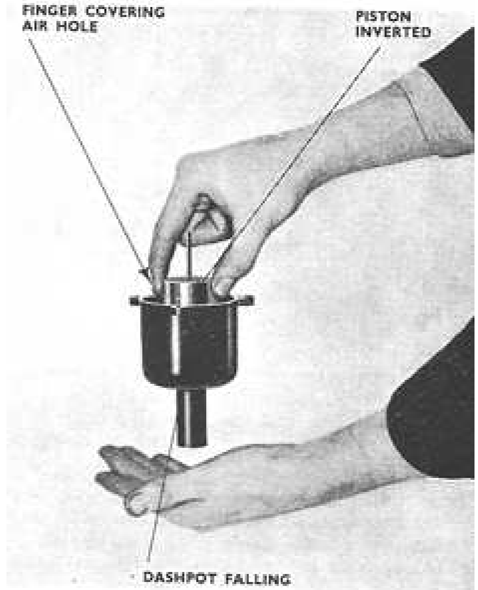
Fitting of Carburetor Needle— The position of the carburetor needle in the piston is very important. The correct position of the needle is with its shoulder flush with the face of the piston, Figure C on this page. The screw in the side of the piston should be slackened off, the needle removed and checked to make sure it is of the right type. It should be replaced and inserted into the piston until the shoulder is exactly flush and the screw tightened. This, again, is of the utmost importance if the best tuning results are to be obtained because it will be appreciated that, if the needle is too high up in the piston or too low down, the mixture strength will be upset.

Suction Chamber, Suction Disc, and Piston Assembly—These parts are all machined and fitted to very fine limits and should always be• replaced, when necessary as a complete unit and never separate]y. As previously mentioned the only point of conjunction of moving and stationary parts is formed by the cast iron Suction chamber bushing and the ease-hardened steel spindle of the moving piston.

Great care should be taken to ensure that, when the carburetors are being dismantled on twin carburetor installations, the piston and suction chamber of each carburetor are kept together and also kept spotlessly clean and dry. No oil whatsoever should be used, except a spot or two on the outside of the steel spindle. Never use metal polish or any other abrasives on the suction chamber or suction disc as this will upset the very fine tolerance to which these parts have been made.

It is possible to make a check to see whether these tolerances have been interfered with, and the method of doing this is to place the piston and suction disc assembly inside the suction chamber and then holding the assembly upside down. Then, placing a finger over the air hole in the side of the piston, the suction chamber should be allowed to slowly fall off the suction disc and the time required for it to fall completely away should be noted. (See Figure on page 32) • The times should he within the following limits:

Type	Size	Time
H-1 and H-2	1 1/8" and 1 1/4"	3 to 5 seconds
H-3	1 3/8"	4 to 6 seconds
H-4	1 1/2"	5 to 7 seconds
H--6	13/4"	6 to 8 seconds



The pistons and suction discs have been made from various materials from time to time are the most common are as follows :—

(1) Zinc-based. die-cast piston which was in use up to 1939 on some types of engines.

This material grows with age and the spindle becomes loose in the piston, causing jamming and excessive wear. Before tuning with this type of piston, always check to make quite sure the spindle is tight in the piston.

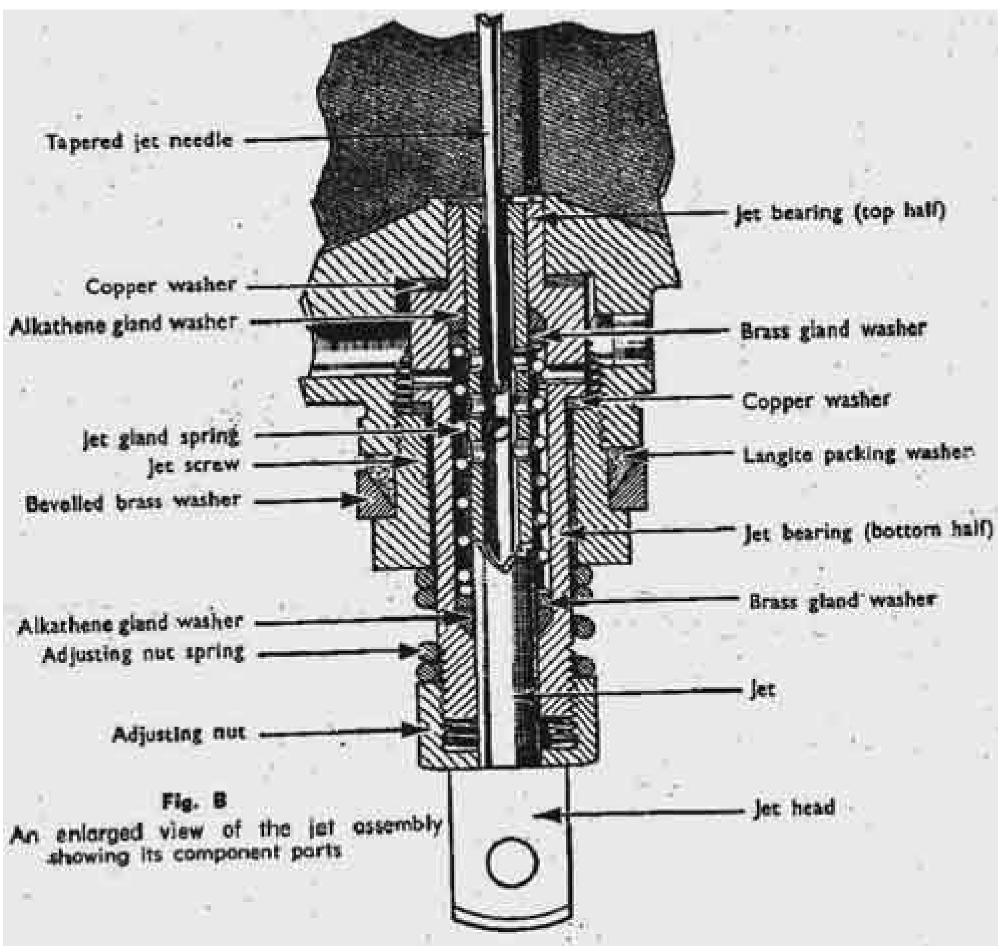


Fig. B
An enlarged view of the jet assembly showing its component parts

(2) The brass piston and suction disc which superseded the zinc-based type and may be fitted in its place. Some of these

have a hollow spindle for the fitting of an oil damper.

(3) Aluminum piston and suction disc used on quite a number of older sports cars.

(4) The light aluminum piston and suction disc always used in conjunction with a spring on all down-draft carburetors and in some horizontal or side-draft carburetors since 1948.

When a light aluminum piston is used on the horizontal or side-draft type of carburetor, it is always fitted in a horizontal type suction chamber and the timing mentioned above is always taken without the spring. Whenever a spring is fitted to the suction disc, always make quite sure that the small steel washer that is fitted at the bottom of the piston rod is in position before re-assembling. This washer is known as the "skid" washer and its function is to allow the spring to take up its natural position, thus avoiding any side loading on the piston keyway. Springs are of different tension for different carburetors and can be identified by the color of the paint with which they are marked (see Chart on page 32).

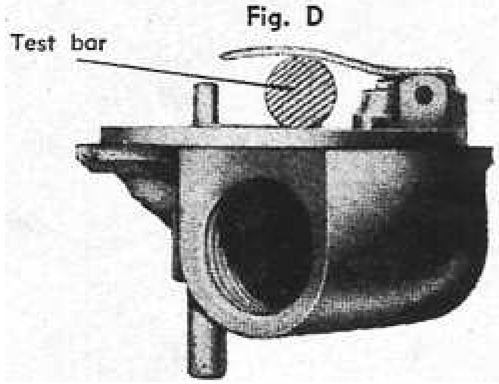
Note; It should be noted that there is a small hole below the suction chamber. The object of this is that by using a piece of steel wire it can be felt whether the piston is quite free in the dashpot without having to remove air cleaner and air cleaner manifold.

Oil Dashpot and Hydraulic Piston Damper— The hydraulic piston damper, when used, is attached to the oil cap and consists of a plunger with a one-way valve. Its function is to give a slightly enriched mixture by preventing the piston from rising unduly quickly on acceleration. The grade of oil to be used here should be SAE 30 in summer and SAE 20 in winter, and the correct level should be just below the top of the inside of the piston rod. When replenishing the piston rod with oil, it is advisable to have the piston at the top of the suction chamber; otherwise, it is difficult to prevent a certain amount of oil going on the outside of the piston rod.

Please note that this hydraulic piston damper is not fitted to all SU carburetors.

Float Chamber— The position of the fork lever in the float chamber must be such that the level of the float (and, therefore, the height of the fuel at the jet) is correct. Reference should be made to the drawing in Figure D, when it will be clearly seen the method of setting this fork. For outside chambers, with a diameter of 1 7/8", the test bar should be 5/16" diameter. For those of 2 1/4" in diameter it should be 3/8" diameter and for those of 3" diameter it should be 5/8" diameter. For the HD6 and HD8 carburetors the test bar should be 7/16".

Fig. D



Different types of float needles and seats are fitted and, generally speaking, the T-1 needle and seat are fitted to the type H-2 carburetor, the T-2 to the H-4, and the T-8 to the H-6. These can be identified by the machining mark on the needle seat assembly, one groove indicating T-1, two grooves indicating T-2, and three grooves indicating T-3.

Tuning— The tuning of an engine having only one carburetor is quite a simple job, provided, of course, that the information given above has been checked. To summarize:

(1) Make sure that the piston and suction disc are free in the suction chamber and that the clearances have not been interfered with by checking the timing of the suction disc (as explained above).
(2) Check that the right type of needle is fitted and that it is fitted in the right position relative to the piston.
(3) See that the jet is centered correctly.
(4) Check float level in float chamber by means of test bar.
(5) Check that the dashpot is filled with the right grade of oil.

When these points have been carefully checked, the engine may be started and allowed to warm up to 70 centigrade. Only two adjustments have now to be made. The throttle adjusting screw should be screwed in far enough so that the engine will tick-over without stalling. The mixture control nut should then be adjusted to give the correct mixture for a nice even tick-over. The nut should be screwed up to weaken the mixture and screwed down to enrich the mixture.

If the adjustment has been completely lost, it is advisable to screw the jet adjusting nut right up and then back eight flats of the nut. This will be somewhere near the right mixture strength and from this position the nut should be adjusted up or down a flat at a time until the correct mixture strength is obtained. When this has been determined, it may be necessary to re-adjust the throttle screw to bring the engine to the satisfactory idling speed. When adjusting the mixture control nut, make sure that the jet head is hard against the adjusting nut at all times. A good guide as to whether the right mixture strength has been obtained is to lift the piston in the carburetor approximately 1/16". If the engine tends to run faster, then the mixture is too rich and, if the engine tends to stall, then the mixture is too weak.

Tuning of Twin SU's— The tuning of twin carburetors is a little more complicated but, if the job is done methodically, little difficulty should be experienced.

Before attempting to tune an engine with twin carburetors, it is essential to remove the air cleaner, and air cleaner manifold. When this has been done, remove the clevis pin, holding one end of the mixture control lever inter-connecting rod so that each carburetor can be adjusted independently for mixture strength. It is advisable to start off by first screwing the two mixture adjusting nuts right up and then back eight flats of the nut. This will be approximately the correct mixture strength, and it is always a good starting-off point. Start the engine and allow to warm up to a nice operating temperature.

The first adjustment is to ensure that each carburetor butterfly disc is open the same amount and that the air flow over each jet is equal. To do this, slacken the pinch bolt on the throttle connecting spindle so that each slow running screw can be altered independently. Set the slow running stops so that the engine runs at approximately 800 to 1,000 rpm and, with the aid of a piece of rubber hose of approximately 3/4" inside diameter and approximately 2' long, listen to the suction of air on each carburetor intake. Place one end of the tube in the ear and the other end in the center of the carburetor intake. If the amount of "suck" is unequal, the throttle adjusting screws should be adjusted until the air intake to both carburetors is equal. When this has been achieved, tighten the pinch bolt, making sure that each throttle adjusting screw is held down on to its stop. It has now been ascertained that each carburetor is doing equal work.

The next step is to check the mixture strength. This is best done by lifting the piston on the front carburetor by using a small screwdriver to a height of approximately 1/16". If the engine now tends to run faster, then the mixture on the front carburetor is too rich and should be weakened by screwing the mixture adjusting nut up a flat at a time until such time as lifting the piston 1/16" makes very little difference to the speed of the engine. If the mixture were too weak, the engine would tend to stall and, naturally, the mixture adjusting nut would have to be screwed down a flat at a time.

When the front carburetor has been dealt with in this manner, the same procedure should be followed on the rear carburetor.

Finally, when it is felt that mixtures on both carburetors are correct, the slow running stops should be adjusted to give a nice even tick-over at a speed where there is no tendency for the engine to stall. On small, high-reving engines, it is not usually possible, with twin carburetor manifold, to get a nice even tickover at a speed of below 800 rpm. When finally adjusting the slow running stops, each screw should be adjusted equally so that there is no tendency to load one or the other of the throttle stops. When the throttle is completely closed, both adjusting screws should be down on their stops. The mixture control inter-connecting rod should now be adjusted for length and the clevis pin replaced and cotter-pinned. The air cleaner and air cleaner manifold should now be replaced and it may be found necessary to weaken the mixture strength a little on each carburetor about one flat because the air cleaner will tend to enrich the mixture slightly.

It is often forgotten that it is impossible— and a waste of time—to try to tune the carburetors unless the rest of the engine is in good shape. Tappets, plugs, ignition points, etc., should be carefully checked before attempting to tune the carburetors.

On some SU's a self-starting carburetor is incorporated which does away with the manual operation of the jets for cold starting performance. On these carburetors the jet is slightly different. A cap with a hexagon head will be found at the bottom of the jet and this should be removed. A small screw will be found underneath this cap . . . . this is the mixture adjusting screw and it works on exactly the same principle as the jet adjusting nut, namely, screwing it up weakens the mixture and screwing it down enriches the mixture.

Make	**Model**	**Year**	**Carburetor Needle Rich Std. Wk.**	**Oil Damper ?**	**Suction Disc Spring Color**	**Jet Size**	**Throttle Bore Dia.**	**Type**
Austin	A-40 Sports	1951	xx EK xx	Yes	Red	.090"	1-1/4"	H 2
Austin	A-90 Atlantic	1950-51	FO FT FU	Yes	Yellow	.090"	1-1/2"	H 4
Bentley	4 1/2 L	1949-51	x x SJ xx	Yes	Not fitted	.100"	1-3/4"	H 6
Daimler	18 hp, 6 cyl.	1949-51	DR EG 61	Yes	Not fitted	.090"	1-1/2	H-4
Daimler	27 hp, 6 cyl.	1949-51	56 CN 5	No	Blue	.090"	1-1/2	D 4 L
Daimler	36 hp, 8 cyl.	1949-51	xx FB FE	No	White	.090"	1-1/2	D 4 L
Daimler	2 1/2 L	1949-51	xx CE xx	Yes	Not fitted	.090"	1-3/8"	H 3
Jaguar	3-1/2L	1946-48	AQ DY GA	Yes	Not fitted	.090"	1-1/2	H 4
Jaguar	3-1/2L MK 5	1949-50	xx FW xx	Yes	Not fitted	.090	1-3/8"	H 3
Jaguar	3-1/2L MK VII	1951-54	RH JM SL	Yes	Red	.100"	1-3/4"	H 6
Jaguar	3-1/2L MK 8	1949-50	xx TL xx	Yes	???	.100	1-34"	HD6
Jaguar	3.8L MK 9	1958-61	xx TU xx	Yes	???	.100	1-3/4"	HD6
Jaguar	3.8 L MK 10	1960-64	xx UM xx	Yes	???	125	2"	HD8
Jaguar	3-1/2 L XK 120	1949-52	xx RB xx	Yes	Red	.100"	1-3/4"	H 6
Jaguar	3-1/2 L XK 140	1954-58	xx RB xx	Yes	???	.100"	1-3/4"	H 6
Jaguar	3-1/2 L XK 150	1957-61	xx TL xx	Yes	???	.100"	1-3/4"	HD6
Jaguar	3.4/3.8 L XK 150S	1957-61	xx UE xx	Yes	???	.125"	2 "	HD8
Jaguar	3.8L E-TYPE	1961-64	xx UM xx	Yes	???	.125"	2 "	HD8
M.G.	1 1/4 L TC	1946-47	EM ES AP	Yes	Not fitted	.090"	1-1/4"	H 2
M.G.	1 1/4 L Sedan	1948-51	DK F1 EF	Yes	Not fitted	.090"	1-1/4"	H 2
M.G.	1 1/4 L TC/TD	1948-51	EM ES AP	Yes	Not fitted	.090"	1-1/4"	H 2
M.G.	1 1/4 L TD II	1951	xx LS1 EM	Yes	Red	.090"	1-1/2"	H 4
Morris	8 hp, (Ser E)	1946-48	M9 EK MOW	Yes	Not fitted	.090"	1-3/8"	H 1
Morris	Minor	1949-51	M9 EK MOW	Yes	Not fitted	.090"	1-1/8"	H 1
Morris	Oxford	1949-50	ES F8 HB	Yes	Red	.090"	1-1/4"	H 2
Morris	Oxford	1951	xx V2 xx	Yes	Red	.090	1-l/4"	H 2

Riley	2 1/2 L	1948-51	CY EE EM	No	Not fitted	.090”	1-1/2”	H 4
Rover	“75”	1950-51	xx GE FV	Yes	Yellow	.090”	1-1/2”	H 4

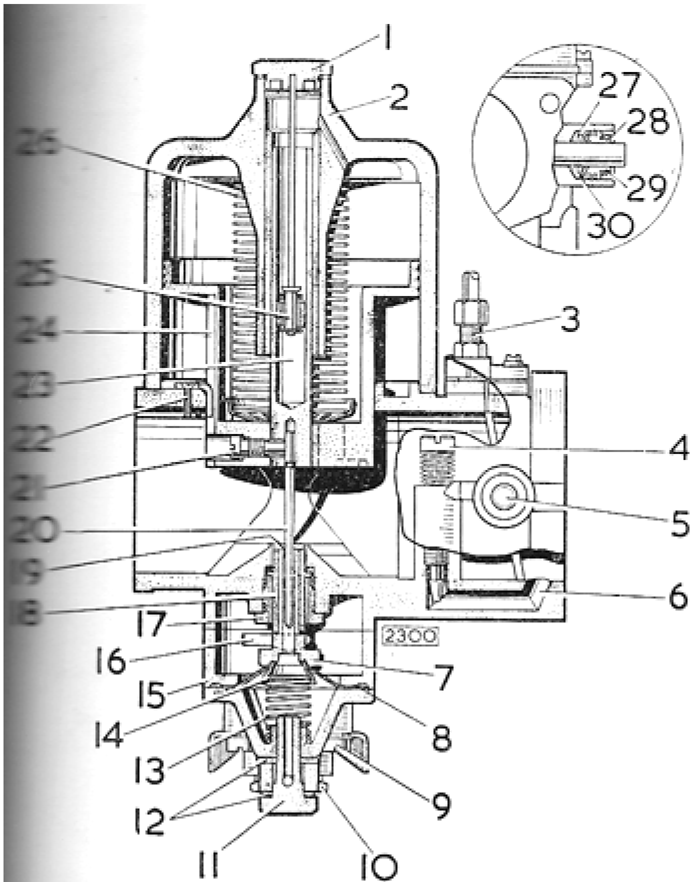


Fig. 1. Sectioned view of the HD.8 carburetter

1. Damper cap
2. Suction chamber
3. Union for vacuum advance/retard
4. Slow running volume screw
5. Throttle spindle
6. Slow run passage
7. Jet cup
8. Diaphragm
9. Float chamber securing screw
10. Banjo bolt
11. Banjo bolt
12. Fibre washers
13. Jet return spring
14. Return spring cup
15. Diaphragm casing
16. Actuating lever
17. Nut—jet bearing
18. Jet bearing
19. Jet
20. Needle
21. Needle retaining screw
22. Piston guide—retaining screw
23. Oil reservoir
24. Piston
25. Damper
26. Piston return spring
27. Throttle spindle gland
28. Shroud for spring
29. Spring
30. Washer

1. Front carburetter
2. Rear carburetter
3. Carburetter body
4. Ignition union adaptor
5. Gasket
6. Suction chamber and piston
7. Damper
8. Washer
9. Spring
10. Skid washer
11. Jet needle
12. Jet
13. Jet bearing
14. Nut—jet bearing
15. Spring
16. Jet unit housing
17. Float chamber
18. Float chamber cover
19. Float
20. Float needle and seat
21. Float needle lever
22. Knurled pin
23. Gasket
24. Cap nut
25. Fibre serrated washer
26. Aluminium washer
27. Filter
28. Banjo bolt
29. Fibre washer
30. Auxiliary starting earburetter body
31. Auxiliary starting cnrburetter needle
32. Spring
33. Jet
34. Spring clip
35. Dust shield
36. Screw
37. Double coil spring washer
38. Solenoid
39. Spring clip
40. Bracket
41. Connecting arm
42. Banjo bolt
43. Fibre washer
44. Fibre washer
45. Banjo bolt
46. Fibre washer
47. Aluminium washer
48. Slow running control valve
49. Spring
50. Neoprene washer
51. Brass washer
52. Connecting rod
53. Connecting rod coupling
54. Manifold insulator
55. Gasket
56. Overflow pipe
57. Overflow pipe clip
58. Distributor vacuum suction pipe
59. Neoprene coupling tube
60. Petrol feed pipe
72. Front carburetter spring bracket
73. Front carburetter throttle spring
74. Throttle return spring
75. Return spring bracket
76. Throttle stop bracket
77. Dowel bolt
78. Link
79. Trunnion
80. Link rod
81. Throttle lever

SU HD6

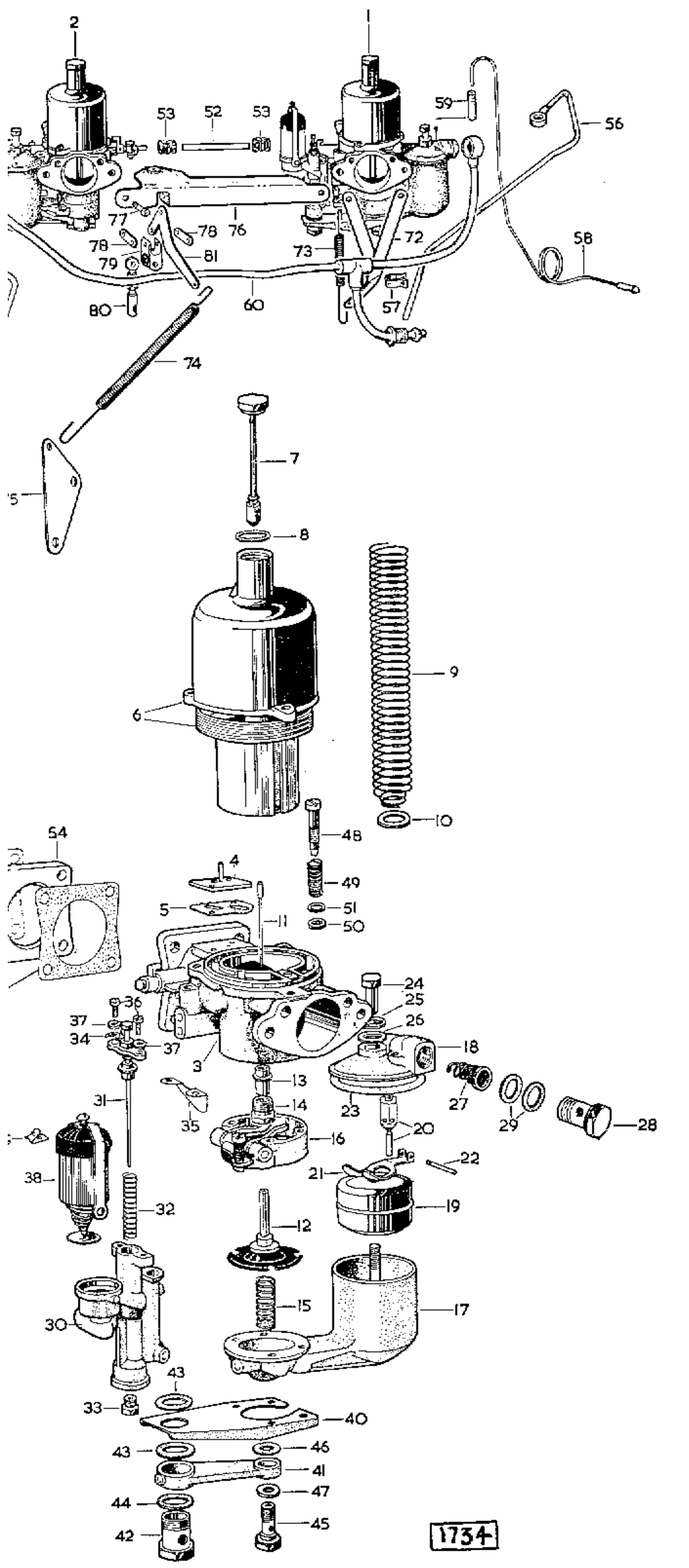
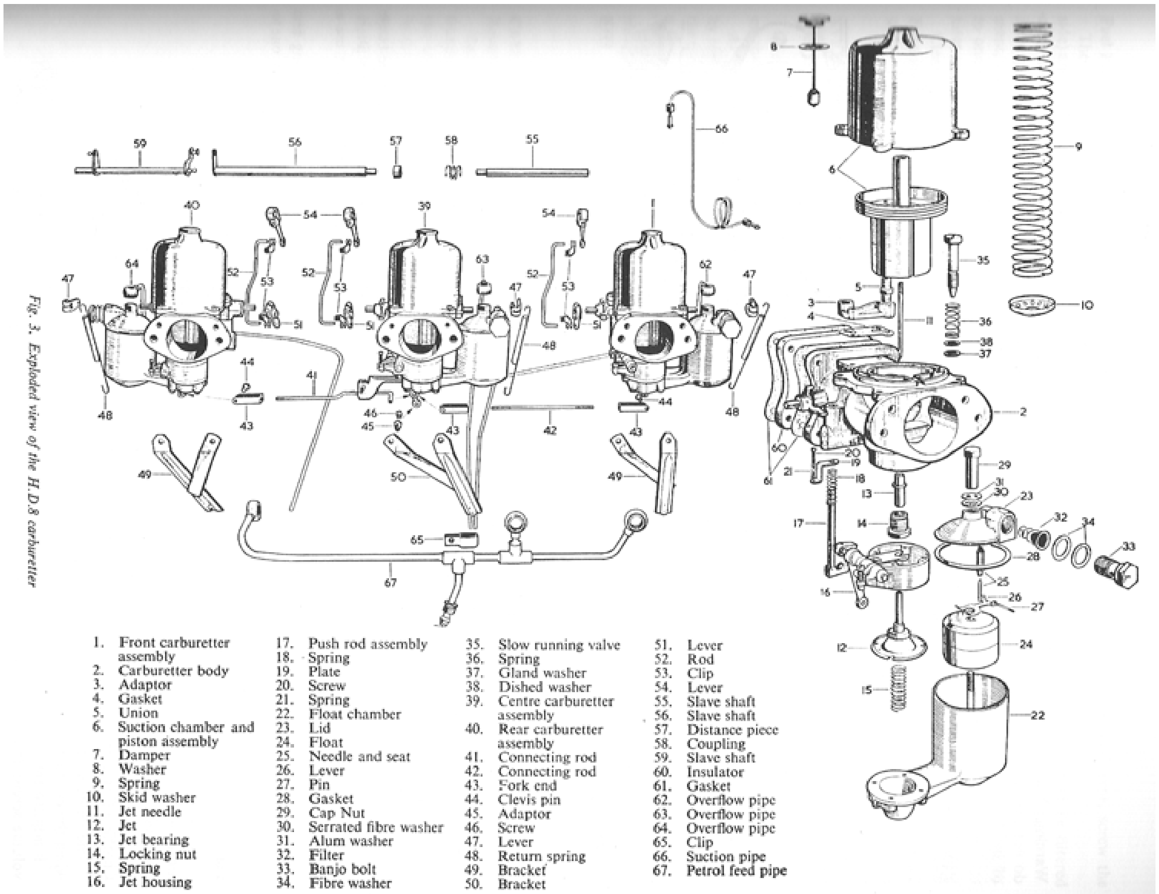


Fig. 7. Exploded view of the S.U. carburetter.



1. Front carburetter assembly
2. Carburetter body
3. Adaptor
4. Gasket
***5.* Union**
6. Suction chamber and piston assembly
7. Damper
8. Washer
9. Spring
10. Skid washer
11. Jet needle
12. Jet
13. Jet bearing
14. Locking nut
15. Spring
16. Jet housing
17. Push rod assembly
18. Spring
19. Plate
20. Screw
21. Spring
22. Float chamber assembly
23. Lid
24. Float
25. Needle and seat
26. Lever
27. Pin
28. Gasket
29. Cap Nut
30. Serrated fibre washer
31. Alum washer
32. Filter
33. Banjo bolt
34. Fibre washer
***35.* Slow running valve**
36. Spring
37. Gland washer
38. Dished washer
39. Centre carburetter
40. Rear carburetter assembly
41. Connecting rod
42. Connecting rod
43. Fork end
44. Clevis pin
***45.* Adaptor**
46. Screw
47. Lever
48. Return spring
49. Bracket
***50.* Bracket**
***51.* Lever**
52. Rod
53. Clip
***54.* Lever**
***55.* Slave shaft**
***56.* Slave shaft**
57. Distance piece
58. Coupling
***.59.* Slave shaft**
60. Insulator
61. Gasket
62. Overflow pipe
63. Overflow pipe
64. Overflow pipe
***65.* Clip**
66. Suction pipe
67. Petrol feed pipe