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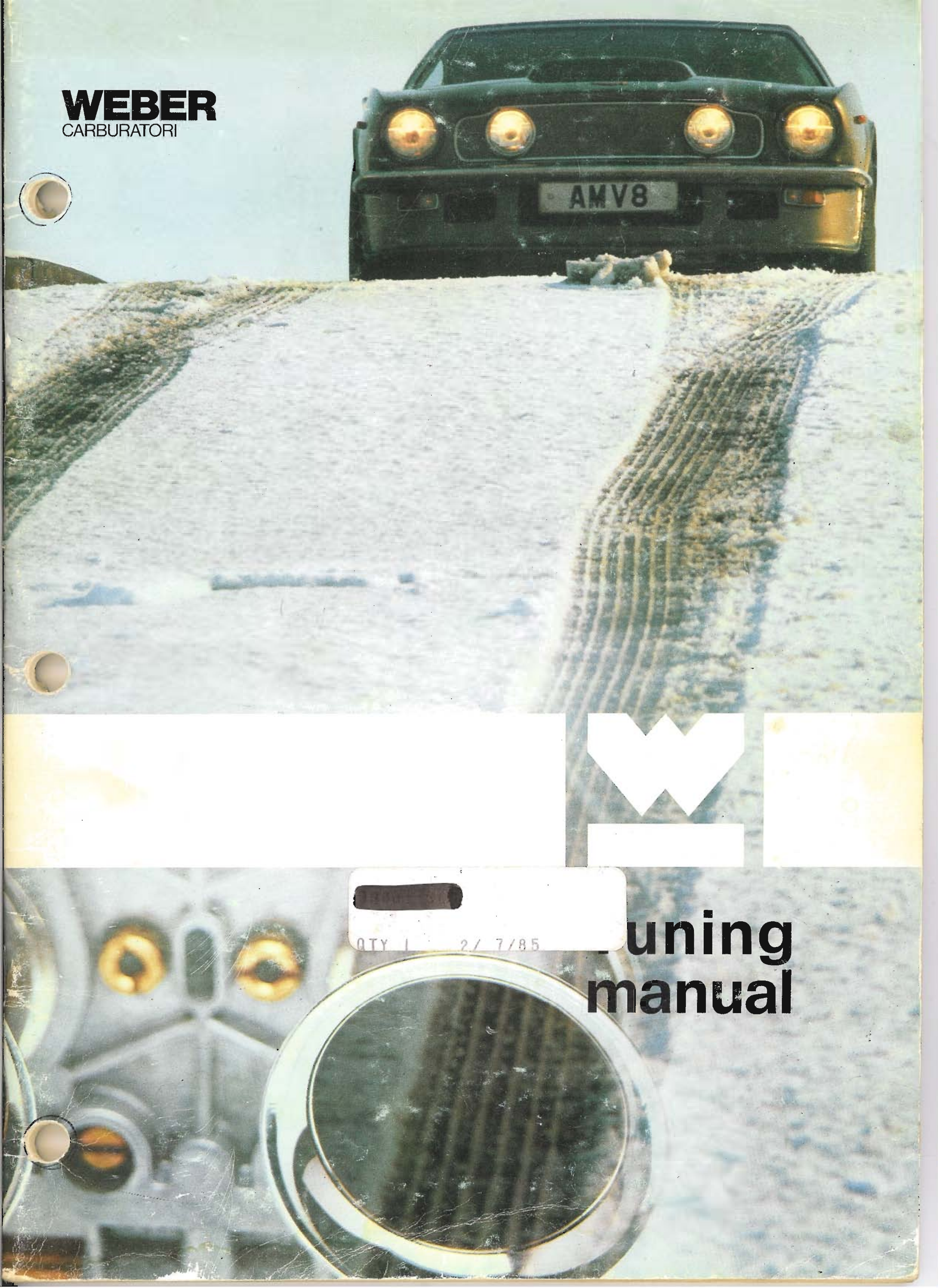

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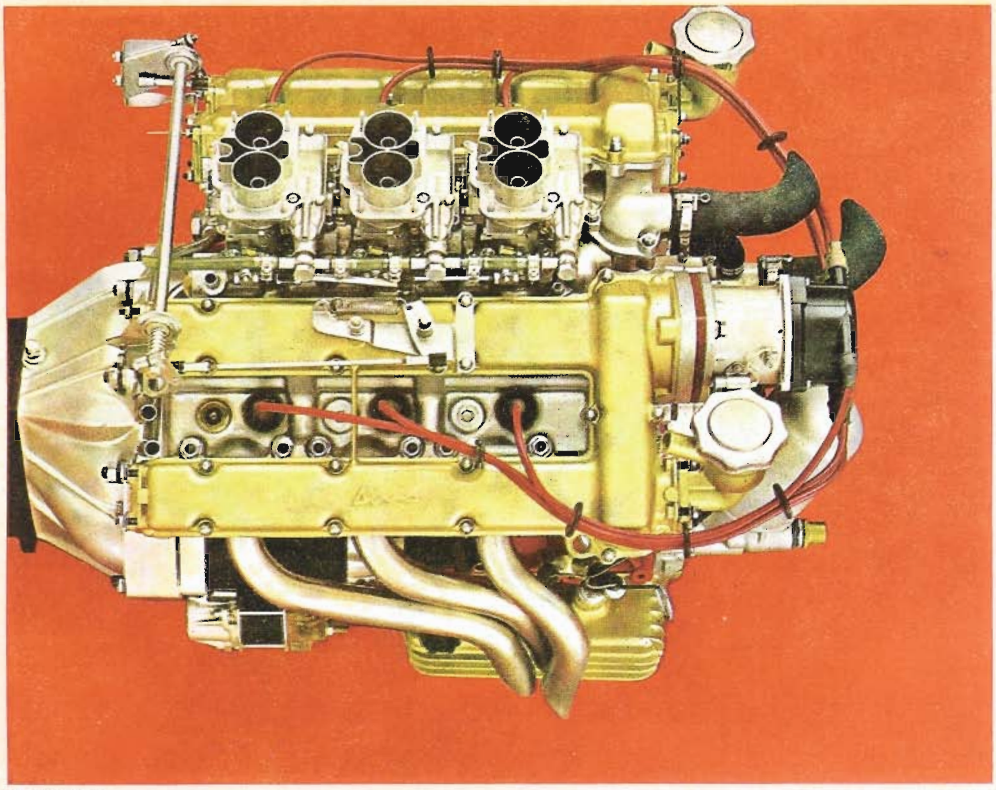
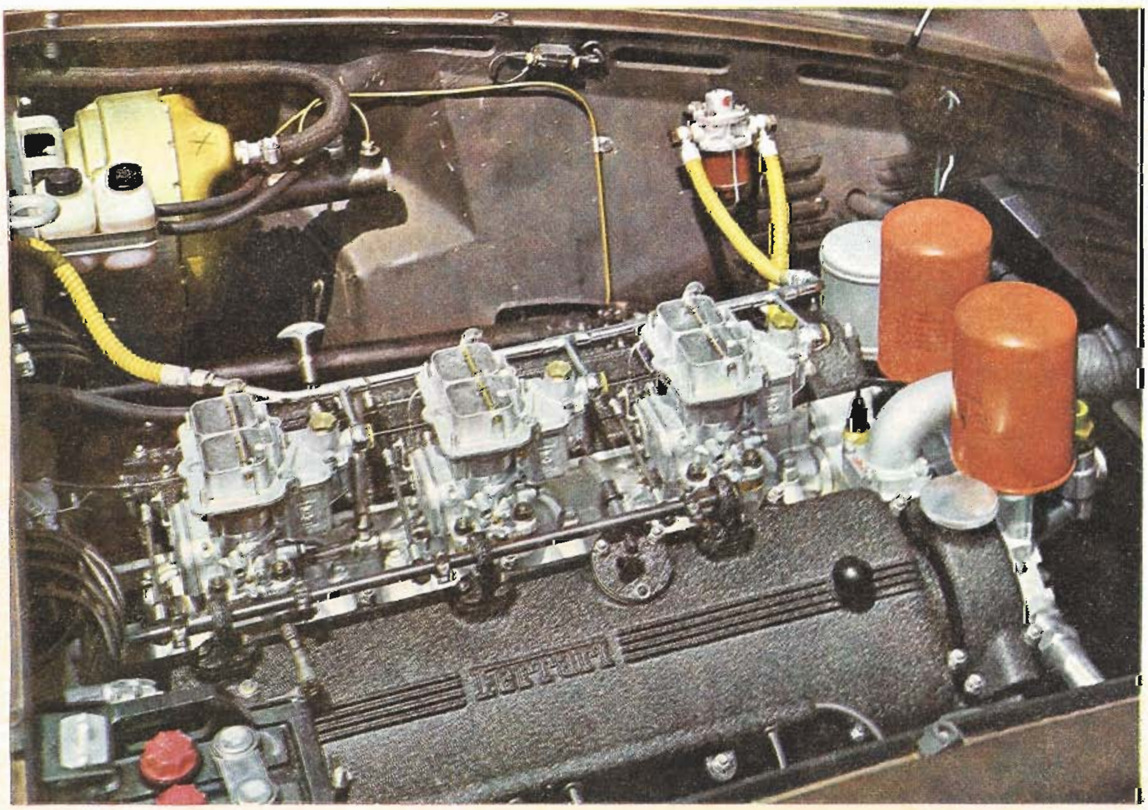


FIAT DINO

EUROPEAN SPORT ENGINES FITTED WITH WEBER CARBURETORS



FERRARI 365 GT

CONTENTS

PART ONE Carburetor Operation Principles

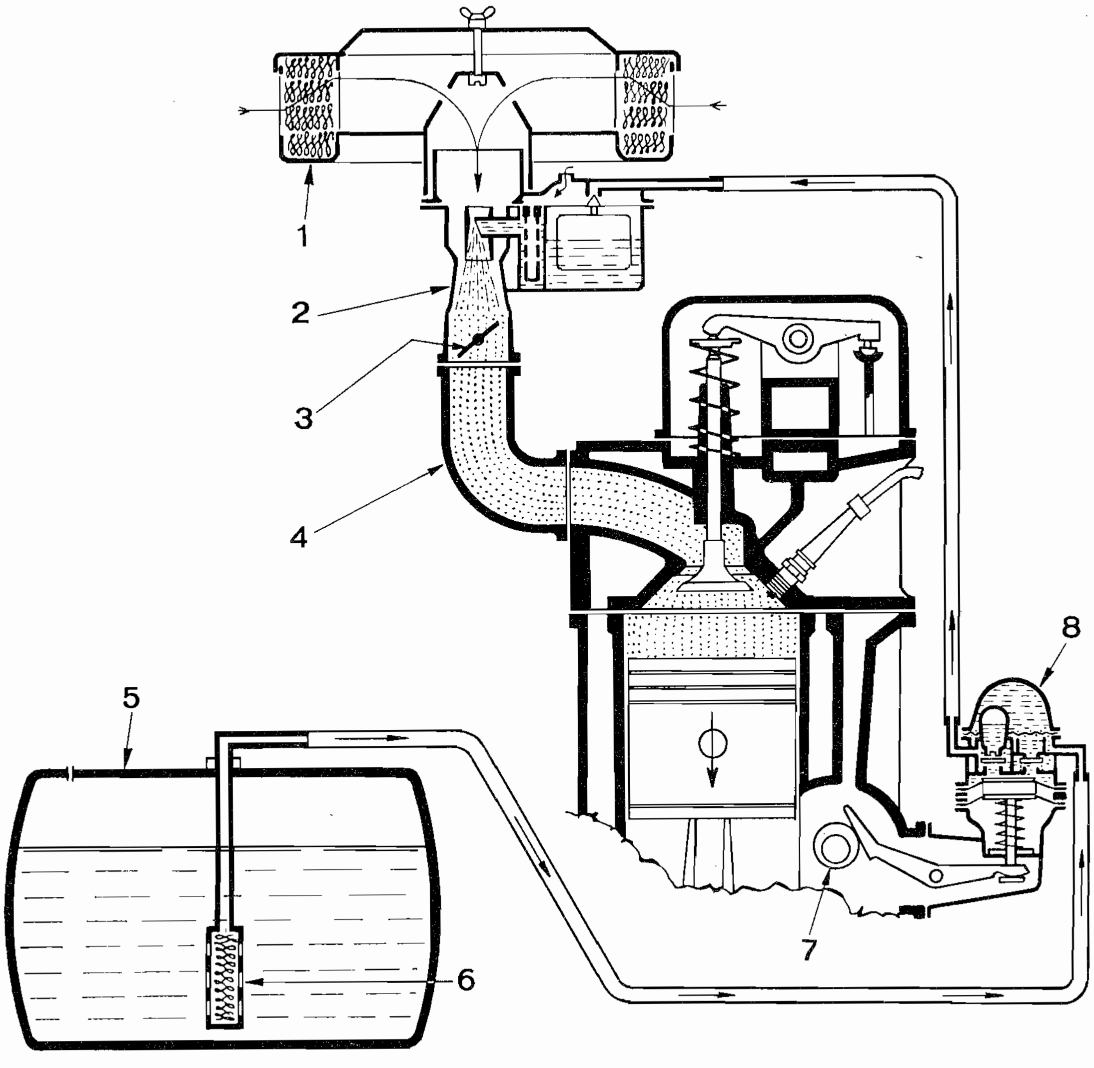


FIG. 1

Engine fuel and air feed systems: 1 Air cleaner - **2** Carburetor - **3** Throttle - **4** Intake manifold - **5** Fuel tank - **6** Fuel strainer - **7** Camshaft - **8** Mechanical lift pump.

Engine fuel and air feed systems

One type of feed system adopted for internal combustion engines is schematically shown in ˈig. **1** where the feed stages ˜re:

) **Air feed:** air is drawn i.. , the engine through an air cleaner (or filter).

b) **Fuel feed :** fuel is sucked from tank and delivered to carburetion area by an engine-operated mechanical lift pump.

c) **Fuel/air mixture :** is handled by the carburetor which governs the power produced by the engine through its throttle valve.

d) **Mixture delivery to cylinders:** through the intake manifold.

What the carburetor does

The carburetor is assigned the task of blending a

combustible mixture of air and fuel in the correct proportions to meet the variable requirements of the engine.
The mixture supplied must have a given **metering** and be as uniformly **blended** as possible.
The **metering** value, or mixture strength α, is given by the weight ratio between the amounts of air and fuel drawn in by the engine. For the normally available gasolines the correct mixture strength, that is, without any excess of either component, consists of approximately **15 kg** of air to **1 kg** of gasoline, brieflly known as **strength 15**. Engines may work satisfactorily with strong mixtures (excess fuel) down to around **strength 6** and with lean mixtures (excess air) up to around **strength 18.**
By optimum **blend** is intended a mixture in which air and fuel are as intimately and uniformly coalesced as possible, with the state of fuel changed from liquid into vapor.

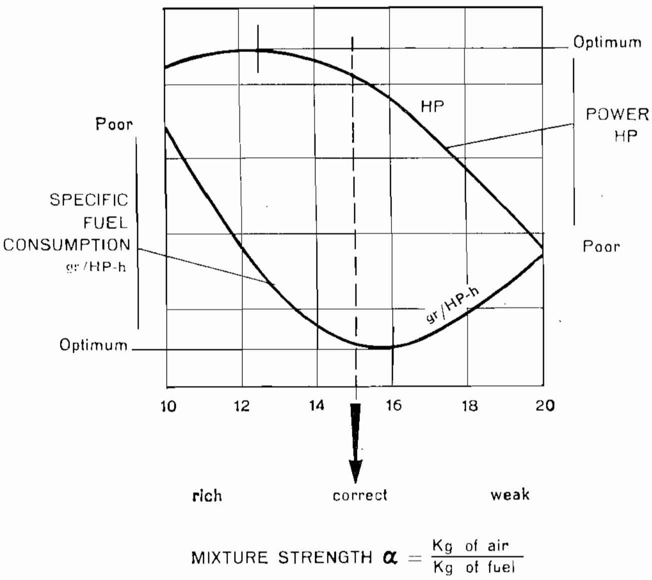


FIG. 2
Influence of mixture strength on engine performance. Maximum power is obtained with a strength of **12-13** and maximum economy (lowest specific consumption) with a strength of **15-16.5.**

Engine mixture metering requirements

Fig. 2 shows the influence of fuel/air mixture strength on the performance of a modern engine, considered at a random point in engine operation under average service range conditions. A slightly strong or rich mixture ratio gives the maximum power obtainable from the engine whereas a slightly lean or weak ratio gives the best economy (low specific fuel consumption).

Engine operation range

An automobile engine operates under the most diverse speed (rpm) rate and power output conditions. Some of the more significant service conditions are discussed below with the aid of Figures 3-4-5.
Fig. 3 - Full power: carburetor throttle is held wide open.
Fig. 4 - Partial power or part load: the throttle is opened progressively. Generally, this condition refers to the power required to move the car at a steady speed on level road, with transmission

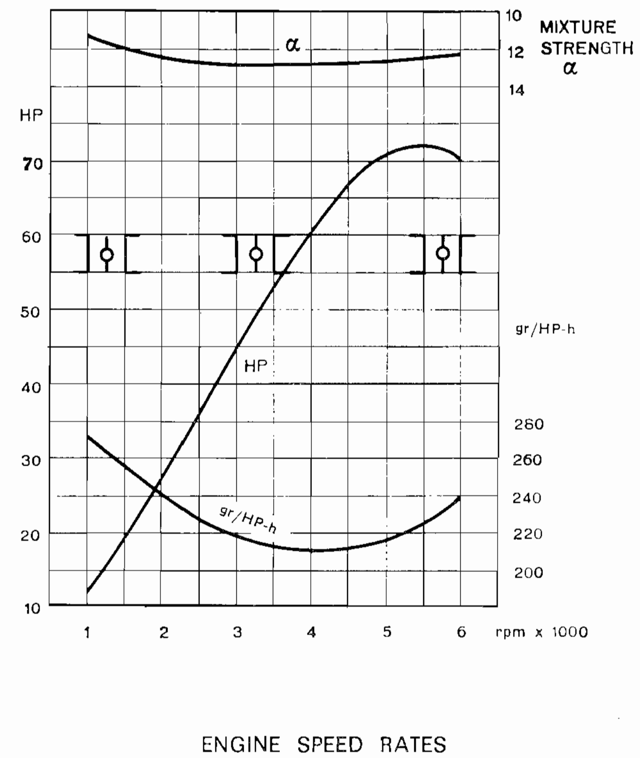


FIG. 3
Full power performance curves: maximum power produced by engine at different rpm rates. From top down: mixture strength, power in **HP**, carburetor throttle settings and specific fuel consumption in **gr/HP-h.**

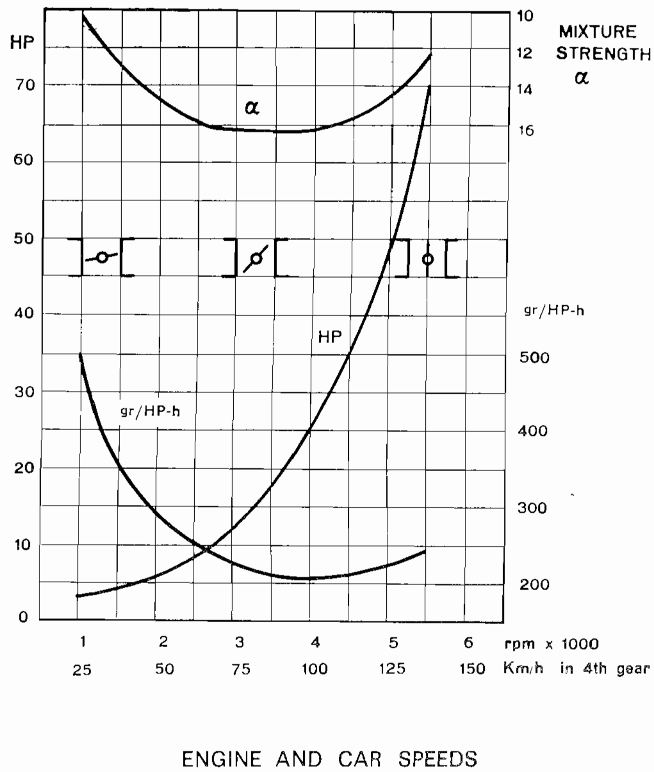


FIG. 4
Part load performance curves: power needed for car operation from lowest to highest road speed, in direct drive on level road. From top down: mixture strength, power in **HP**, carburetor throttle settings and specific fuel consumption in **gr/HP-h.**

in direct drive or highest gear ratio, from the lowest to the highest speed. The complete curve - plotted with engine on dynamometric test bench - starts with carburetor throttle in minimum opening position and ends, through progressive setting variations, with throttle wide open.

Fig. 5 - Pick-up or acceleration: the throttle is suddenly set to an opening wider than it had before and the engine must rapidly increase its rotational speed. This is accomplished properly if mixture strength α attains the value needed for full power operation; now, if the specified value is exceeded, pick-up will be poor owing to excessive mixture richness whereas if mixture strength is below the value specified for optimum part load operation engine « stutter » (or flat spots) will result because of excessive mixture weakness.

Idle (or slow running) speed: throttle is almost totally closed and allows the engine to operate at the minimum speed at which it will keep running but without producing any power for work.
In **Fig. 4** (left) idle speed rates are reached below **1000 rpm** of engine.
In **Fig. 5** (left) the depression (vacuum) and mixture strength curves at part load operation begin at engine idle speed.

As the set of graphs provide the curve patterns for power, throttle setting, specific fuel consumption, mixture strength α and manifold vacuum, a good idea may be had of what the engine requirements actually are. In brief, a strong or rich mixture is needed for full power, pick-up and extreme rpm rates while a lean or weak mixture is needed for best economy at limited power outputs.

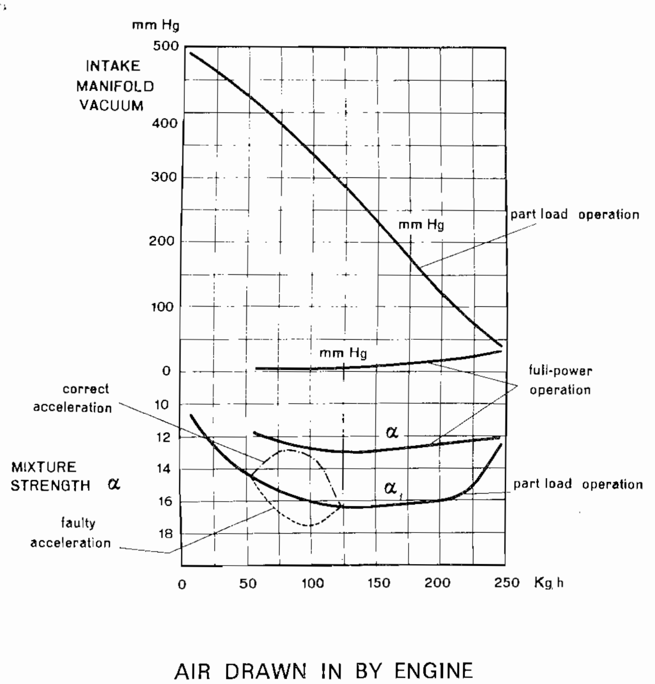


FIG. 5
Mixture strength versus amount of air drawn into the engine, under full and part power curve conditions, with respect to intake manifold vacuum values.
Mixture metering curves are the same as those plotted in **Figs. 3** and **4.**
Acceleration is best if mixture becomes richer instead of weaker but without exceeding the full power strength ratio otherwise the mixture would be too rich.

The Simple Spray Carburetor

It is shown in **Fig. 6** and consists of:

— **A fuel bowl or chamber V** in which a float-controlled needle valve keeps the fuel constantly at a level **5-6 mm** lower than the fuel in jet **G.**

— **A Venturi D.**

— **A spray tube or nozzle S** through which fuel flows from float chamber to calibrated jet **G.**

— **A throttle F** generally of the butterfly valve type which regulates the amount of fuel/air mixture drawn in by the engine.

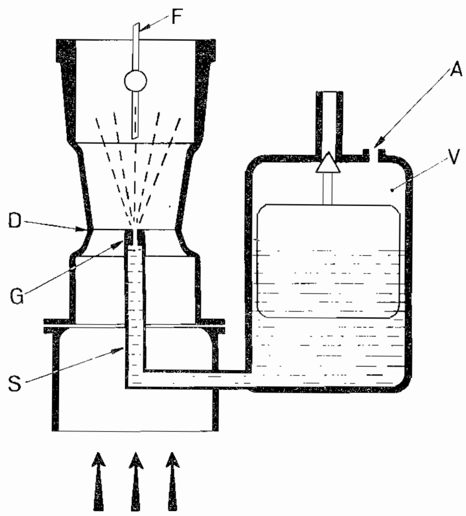


FIG. 6
Simple updraft carburetor - F Throttle - **D** Venturi - **G** Fuel jet - **S** Spray tube - **V** Fuel bowl or chamber, with float - **A** Float chamber vent.

The purpose of Venturi **D** is to increase the depression acting on jet **G** to favor the vaporization of the gasoline sprayed from the jet during engine operation: this occurs because of the physical laws illustrated in **Fig. 7.** The manometer connected to the Venturi restriction indicates the lowest pressure (highest vacuum) referred to the atmosphere: jet **G** is located in this area and delivers fuel sucked from the float chamber which is kept at atmospheric pressure through vent **A.**

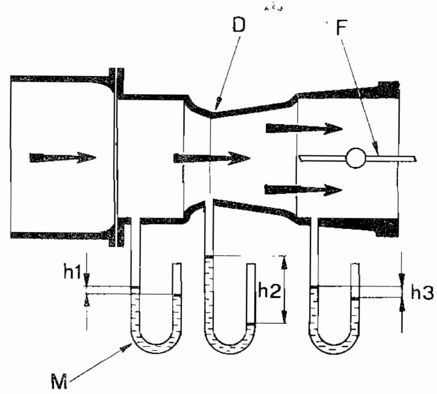


FIG. 7
Depression (vacuum) values along carburetor barrel - F Throttle butterfly valve - **D** Venturi - **M** Manometers - **h1, h2, h3** Readings.

Fundamental carburetor systems

Carburetor designs may have barrel arrangements different from the simple spray unit of Fig. 6: three basic patterns are shown in **Fig. 8.**

1 - Downdraft (or inverted) carburetor: air enters from the top. It is practically the standard pattern on the majority of current automobiles because it is more accessible and provides better engine feed as the mixture flow is assisted by gravity.

2 - Updraft (or vertical) carburetor: air enters from the bottom. Largely adopted in the past because it avoided admission of fuel in the liquid state to the engine. Abandoned in current applications because it is not easily accessible and fails to ensure proper cold starting and cylinder charge volumetric efficiency.

3 - Sidedraft (or horizontal) carburetor: air enters from the side. Preferred when low under-hood height is a design requirement.

Also used are some intermediate patterns with inclined barrels.

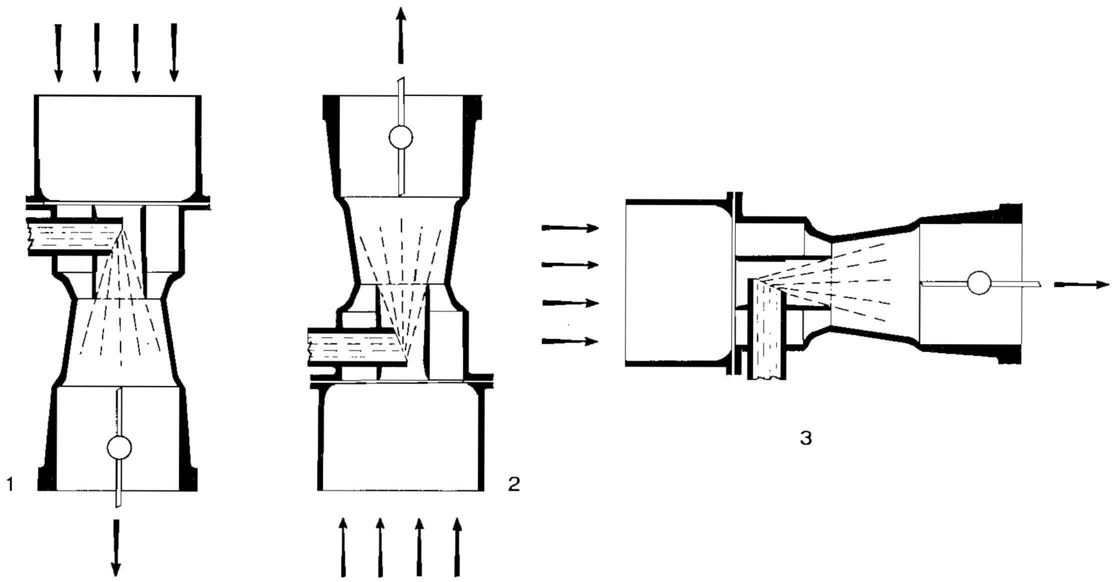


FIG. 8
Carburetor systems - 1 Downdraft - **2** Updraft - **3** Sidedraft.

Simple spray carburetor defects

a) Considering the physical laws governing the discontinuous efflux of fluids (both liquid and gaseous) from restricted apertures, it becomes possible to show that as the vacuum in the Venturi increases the amount of fuel issuing from the pilot jet will also increase but at a faster rate than the increase in the air swallowed in by the carburetor. The mixture formed in a simple carburetor becomes noticeably richer as the engine draws in larger amounts of air; as a net result, the mixture will be correctly proportioned at greater air flow rates but too lean at lower flow rates.
The simple spray carburetor, as considered here, also has the following failings:

b) it does not permit engine operation under no-load conditions as it has no **idle speed or slow running device.**

During this stage, the depression in Venturi is too weak to draw any fuel via spray tube **S - Fig. 6.**

c) It cannot meet sudden engine rpm rate variations as it has no **transition (or progression) orifice system or accelerating devices.**

d) It does not allow cold starting of the engine as the depression in Venturi drops still further on account of the lower cranking speed supplied by the starter motor while the engine needs a rich mixture; in other words, it is not equipped with a **starting device or choke.**

All these shortcomings are obviated by special features incorporated in modern carburetors.

The Modern Carburetor

To prevent the mixture strength from enrichening as the demand of engine increases, several provisions have been devised over the past 70 years one of the most suitable of which is the « air bleed correction » system, being automatic and without moving mechanical parts.

a) Air bleed correction

This feature was adopted on Weber carburetors and is illustrated in Fig. 9. When a depression is established in the restriction of Venturi **D** it communicates with well **P** through spray tube **S,** fuel is drawn out through jet **G** while outside air, via jet **Gf,** « bleeds » in through the lateral holes in emulsion tube **T.**

As the vacuum becomes stronger, following the increase in engine rpm rate, the fuel issuing from jet **G** is corrected by the increasingly higher « braking » action of the air drawn in through jet **Gf** and the orifices in emulsion tube **T.**

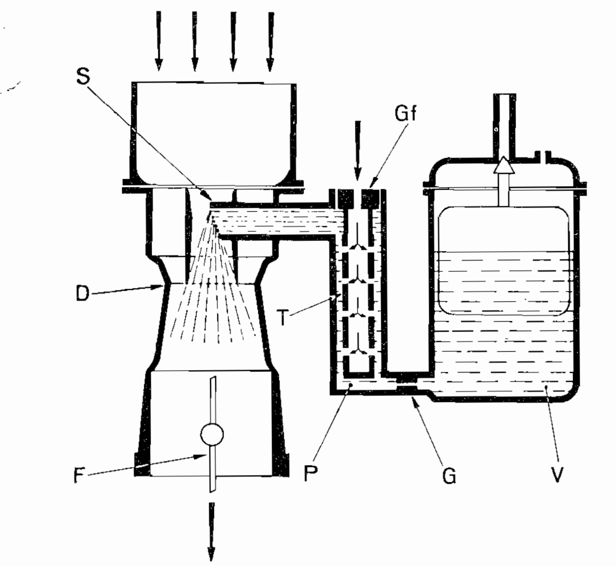


FIG. 9
Air bleed correction - **S** Spray tube or nozzle - **Gf** Air bleed jet - **T** Emulsion tube submerged in well **P** - **G** Main fuel jet - **V** Float chamber - **D** Venturi - **F** Throttle.

The main advantages of this automatic corrective bleeding action are:

- Better atomization of fuel because spray tube does not supply only gasoline, as occurs with the simple spray carburetors, but a suitably proportioned fuel/air mixture.

— As may be readily seen, jet **G** is no longer submitted to the full action of the vacuum in Venturi **D** whereby to a given fuel flow rate corresponds a larger sized jet **G**. The advantages offered by this arrangement are twofold : firstly, a larger size jet is easier to make and is less affected by possible impurities in the fuel; secondly, its efflux characteristics contribute to mixture correction improvement.

Also of great importance is the size of spray tube **S** and of the space between emulsion tube **T** and well **P** where the fuel flows: in fact, the reduced size of tube **S** and of the cavity around **T** means stronger resistance to the passage of the mixture, namely, the higher the vacuum in Venturi the higher the resistance or « braking » action. By varying also these two design features, the fuel supply curve can be further corrected thus obtaining the best possible mixture metering for proper engine feed.

b) Idle speed (or slow running) device

The idle speed device allows a warm engine to operate at the lowest rpm rate at which it will keep running. Under this condition, the throttle is nearly closed and the degree of vacuum promoted in the Venturi is inadequate to draw out any fuel from the nozzle, owing to the small amount of air breathed in by the engine.

Now, going back to **Fig. 5**, it may be seen how the vacuum in induction manifold is higher at lower air flow rates under part-load operation which, as mentioned earlier, at one end approaches the idling speed stage.

This low vacuum is therefore exploited for the idling engine feed circuit by connecting the throat area downstream of the throttle to a fuel jet **Gm, Fig. 10,** which is by-passed by an air corrector jet **Gam** that also cuts-out the syphoning action which would otherwise be present.

The mixture thus formed is drawn in via orifice **1** whose bore is varied by a taper-pointed screw **3**, hence called « **idle mixture adjusting screw** ». During idle the engine breathes the air it needs through the small gap around the throttle valve: this gap is varied by a specially provided « **idle speed adjusting screw** » **4.**

Two adjusting screws are thus provided for mixture and speed rate variations ensuring proper idle operation settings. In the more common applications, the idle speed circuit fuel is taken from the main system well at a given location which generally is level with the lower holes of emulsion tube — as shown in **Fig. 10** - or, at any rate, downstream of the main or pilot jet.

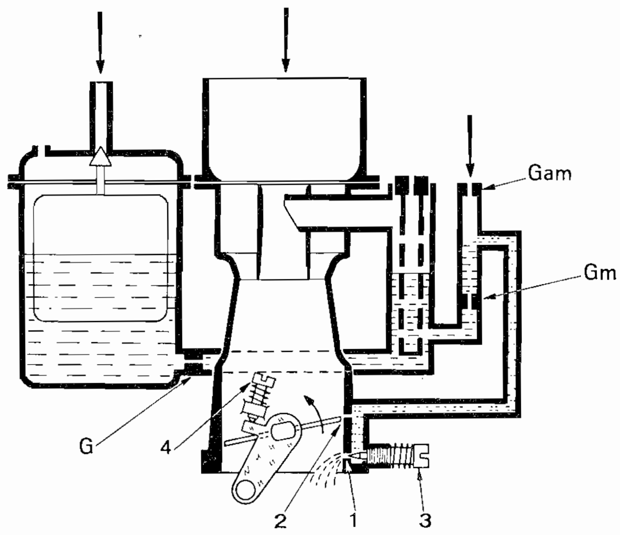


FIG. 10
Idle speed circuit - **Gam** Idle speed air jet - **Gm** Idle speed fuel jet - **G** Main fuel jet - **1** Idle speed mixture orifice - **2** Transition (or progression) orifice - **3** Idle mixture adjusting screw - **4** Throttle setting or idle speed adjusting screw.

This arrangement ensures the automatic exclusion of the idle speed circuit feed when it is not needed. For instance, under full power operation — when the depression in well is highest — a « **reversal** » may occur in the idle speed circuit, that is, air enters through orifices **1** and **2**, jet **Gam** and flows to the main well.

In some sports car designs the idle speed circuit is often fed directly from the float chamber; in others, said « reversal » is limited by varying the idle speed system.

c) Acceleration progression

As described so far, the carburetor can operate equally well at both idle and normal speeds, with part- or wide-open throttle. However, if the throttle is opened slightly from its idle setting to rev up the engine, a « stalling » results and engine will stop.

This occurs because the wider gap around throttle lets in a greater amount of air while the mixture issuing from the taper-pointed screw orifice instead of increasing proportionally tends to reduce with the decreasing depression: the engine thus receives an excessively lean mixture, is « starved » and stops.

To ensure a progressive action during acceleration a transition orifice **2** is drilled in carburetor, directly in line with the upper edge of the throttle in its idle speed setting and communicating with the idle mixture duct — see **Fig. 11.**

During idle speed operation — **see A, Fig. 11** — being the transition orifice **2** located upstream of throttle valve where pressure is almost the same as atmospheric, air is introduced into the barrel with the mixture issuing from orifice **1** below.

When the throttle opening is increased — **see B, Fig. 11** — transition orifice **2** will be located partially or totally in the area downstream of the throttle where vacuum is rather high and will thu supply the mixture in parallel with idle spee orifice **1.** If at this point the throttle is further opened the mixture supplied by the idle speed circuit alone would no longer be adequate but, now, the depression acting upon nozzle **S** is sufficient to draw a spray of fuel from it. — **see C, Fig. 11.**

In some cases two or three transition orifices are provided to prolong the progression stage accompanying the opening of the throttle valve.

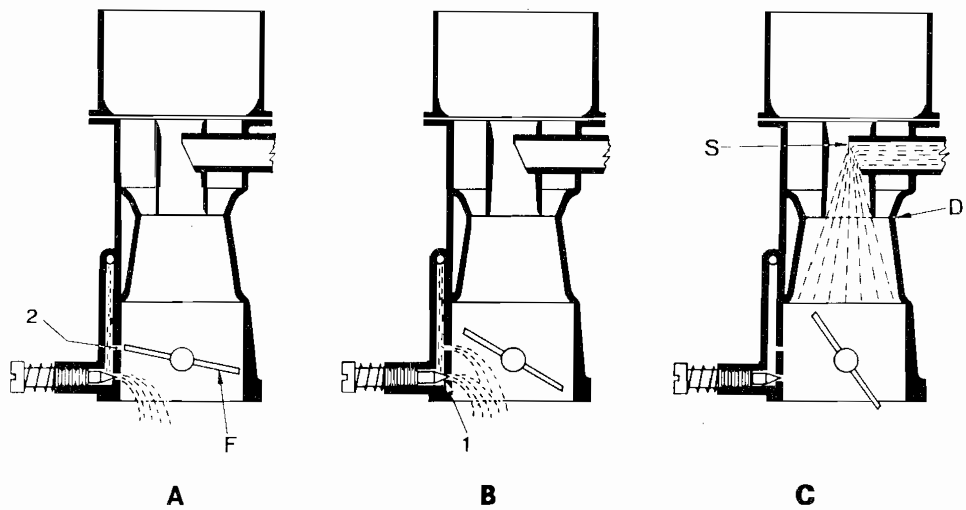


FIG. 11

Transition (or progression) stage - **A** Idle speed operation - **B** Transition stage - **C** Priming of the main circuit and idle speed circuit supply cut-off - **1** Idle mixture orifice - **2** Transition orifice - **F** Throttle - **D** Venturi - **S** Spray nozzle.

During these progressive acceleration stages, especially when the throttle is opened suddenly, the shape and the size of emulsion tube **T** — **Fig. 9** — become two extremely important design factors: in fact, with engine idling in tube T and in associated well **P** there is a certain amount of fuel whose level, owing to capillary action, is often at the same height as the level in float chamber. When the throttle is opened, even a slight vacuum (a few mm water column) will be sufficient to draw fuel from well **P** and prime the mixture supply from the main circuit.

In brief, there are two systems without moving parts that are generally adopted to ensure smooth engine operation during throttle opening stages:

— **One or more transition orifices,** and

— **A reserve of fuel in well P.**

In spite of the design features described there are cases in which an accelerating pump must be used to inject an additional amount of fuel at every quick opening of the throttle. Generally, the accelerating pump is incorporated in carburetors when:

— Venturi diameter is greater than 22-24 mm.

— A single carburetor feeds many cylinders.

— The application is for sports engines.

The quick opening of the throttle may cause a temporary leaning out of the mixture strength as a result of the faster rate at which air is swallowed with respect to the carburetor. This depends on the different densities and circuiting of the two fluids inside the carburetor. Generally, best results are accomplished if the injected fuel is directed against the edge of the throttle valve that does not affect the operation of transition orifices.

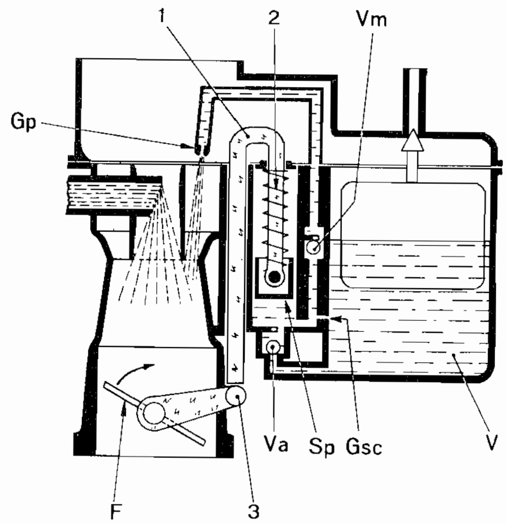


FIG. 12-A

Plunger-type accelerating pump - 1 Pump rod - **2** Spring - **3** Pump control rocker lever - **F** Throttle - **Va** Inlet valve - **Sp** Pump plunger - **Gsc** Pump drain jet - **V** Float chamber - **Vm** Delivery valve - **Gp** Pump jet.

The mechanically-operated pump may be either of the plunger or diaphragm type, **see Fig. 12-A and B.** With the plunger pump — **see Fig 12-A** — when the throttle is opened plunger **Sp** is pushed down by spring **2** and compresses the fuel beneath it: suction valve **Va** thus closes and the fuel, via delivery valve **Vm** which is lifted from its seat, flows partly through pump jet **Gp** and partly back o float chamber via pump drain jet **Gsc.** When the throttle is closed the plunger travels back up compressing spring **2** and sucks in fuel through valve **Va** and jet **Gsc.** With the other type of pump — **see Fig. 12-B** — a diaphragm replaces the plunger but operation is practically the same. The importance of jets **Gp** and **Gsc** will be explained later on.

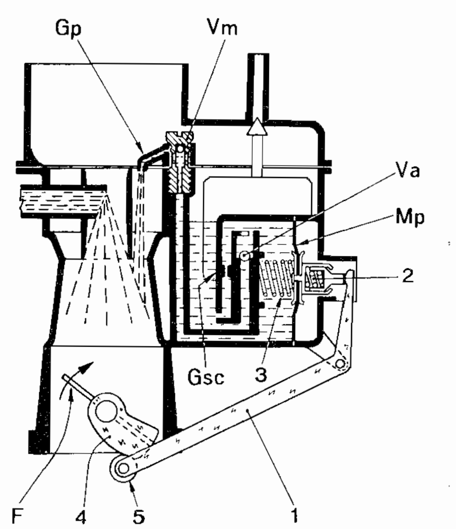


FIG. 12-B

Diaphragm-type accelerating pump - 1 Pump control lever - **2** Pump spring - **3** Diaphragm return spring - **4** Cam lever - **5** Roller - **F** Throttle - **Gsc** Pump drain jet - **Mp** Diaphragm - **Va** Inlet valve - **Vm** Delivery valve - **Gp** Pump jet.

d) Starting device or choke

This device completes the modern automatic carburetor in its simplest form. When a cold engine is started, and especially at low ambient temperatures, the following phenomena take place:

— **Too weak vacuum acting** on jets and developed in intake manifold because the starter-cranked engine turns very slowly, for various reasons, namely, about 70 to 150 rpm.

— **Inadequate mixture supply** from the idle speed circuit and no mixture at all from the main jet, owing to the extremely low vacuum.

— **Fuel condensation** on intake manifold and cylinder walls as a consequence of the low vacuum and temperature. The cylinders receive a lean and poorly blended mixture containing a high percentage of fuel which is still in the liquid state and hence the charge is difficult to ignite.

To ensure prompt starts and smooth operation during engine warm up the carburetor must supply a rich mixture and this is obtained by a special device known as the « **choke** ». Once the engine reaches its normal rated operation temperature the choke must be excluded.

Manual choke of the auxiliary carburetor type

This starting device consists of an auxiliary carburetion unit fed directly from the float chamber and which is cut-in or out, with throttle set in idle speed position, by a separate hand control.As shown in **Fig. 13,** when valve **3** is opened the depression present downstream of the throttle communicates with fuel reserve well **4** - via duct **1** - and hence with jet **Gs.** The mixture supplied by this circuit and leaned out by the air entering through jet **2,** allows engine to start and rev-up to an adequate power output during the warming up stage.

This type of starting device is provided with a simple blanking valve but the system may be impro-

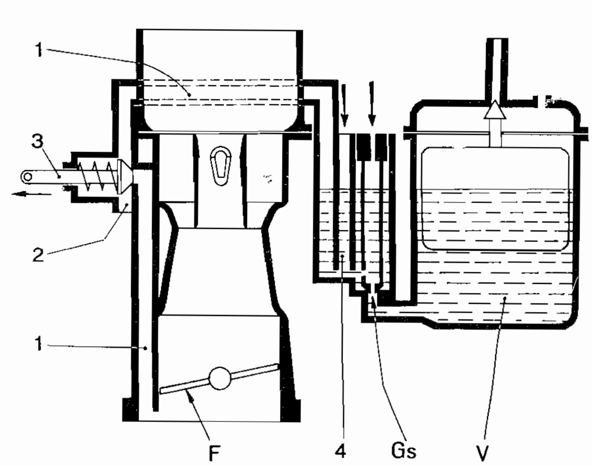


FIG. 13

Simple choke - 1 Starting mixture duct - **2** Starting air jet - **3** Starting valve - **4** Starting reserve well - **F** Throttle - **Ga** Starting jet - **V** Float chamber.

ved by adopting a progressive-action valve which permits the desirable « graduation » in choke operation.

Manual choke of the shutter valve type

With this system (**see Fig. 14**) the auxiliary carburetor described earlier is replaced by a shutter (or strangler) valve **Fs** positioned offset with respect to barrel centerline and upstream of Venturi **D**. During the starting stage — **Fig. 14-A** — shutter valve is closed while throttle valve **F** is slightly open — **fast idle position** — through a lever linkage control. As will be readily apparent, the vacuum produced by the cranked engine is no longer confined to the the area downstream of throttle **F** as occurred in the previously described system but now influences the whole area beneath shutter valve, including Venturi **D** and nozzle **S**. Once engine has started, the vacuum around nozzle **S** increases and the resulting mixture would be excessively rich but at the same time also the force tending to open shutter valve **Fs** increases; this is why the latter valve is not rigidly connected to choke control lever linkage but through the intermediary of a calibrated spring **M** so that valve **Fs** may open to keep the depression at the specified value. Once engine is warm, shutter valve **Fs** must be set back to its vertical position — **Fig. 14-B** — namely, the « choke » control must be excluded.

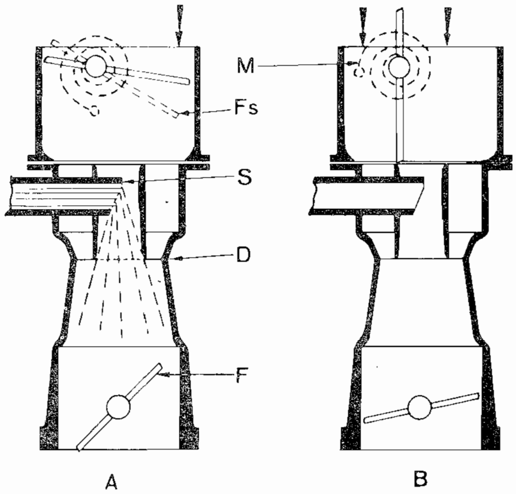


FIG. 14
Offset shutter (or strangler) valve choke - **Fs** Choke valve - **S** Spray nozzle - **D** Venturi - **F** Throttle valve - **M** Calibrated spring.

For improved engine warm-up operation also a **pneumatic overchoking or antiflooding device — Fig. 15** — is sometimes used. The vacuum downstream of throttle **F** increases once engine has started and by acting on diaphragm **A** it overcomes the resistance of spring **2**; as a result, valve **Fs** opens against the opposing action of the choke spring (not shown) to a position governed by the setting of adjusting screw **3**.
As long as the engine keeps running, shutter valve **Fs** may open further but cannot close.
One other shutter valve type of choke is shown in **Fig. 16**; during engine starting strangler **Fs** remains shut as its plate incorporates a poppet valve **1** which governs the amount of incoming air according to engine requirements.

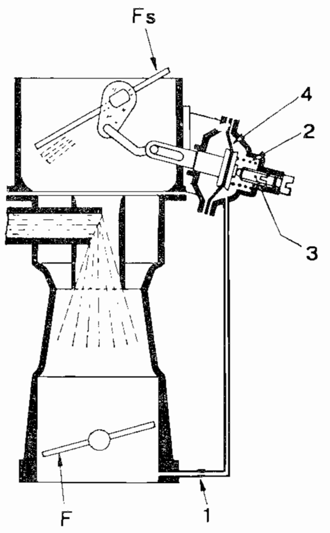


FIG. 15
Pneumatic overchoking or antiflooding device - **1** Limiter jet on vacuum channel - **2** Diaphragm return spring - **3** Adjusting screws - **4** Diaphragm - **Fs** Choke valve - **F** Throttle valve.

Over the auxiliary carburetor arrangement the shutter valve choke offers the advantage of obtaining prompter starts and higher power outputs from the engine at low temperature.

Automatic choke

To make driving easier, prevent misuse and avoid leaving the choke in even after the engine has reached its rated operation temperature, some carburetors have been fitted with an automatic choke which is independent of driver's will.

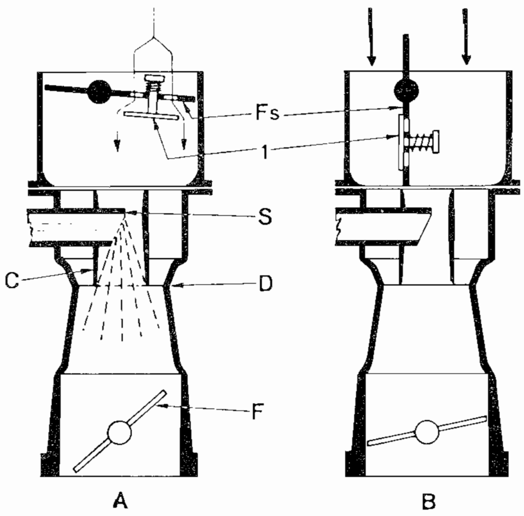
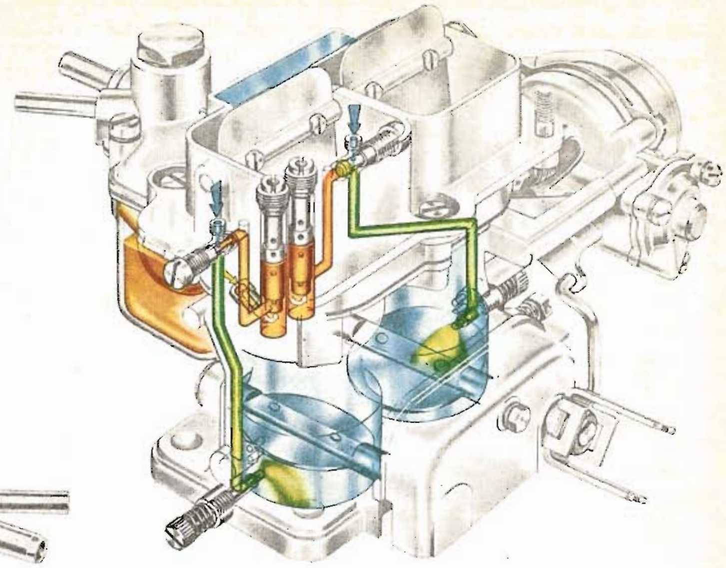


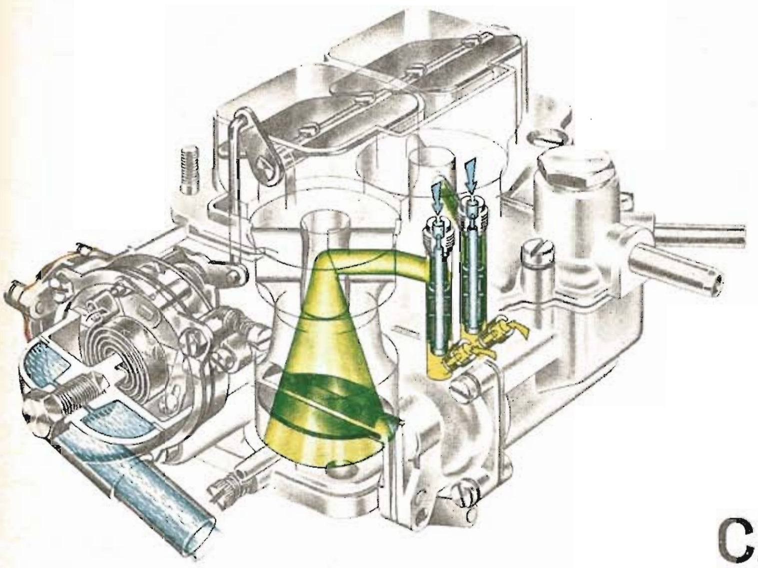
FIG. 16
Offset shutter with incorporated poppet valve type choke - **1** Anti-flooding poppet valve - **Fs** Shutter - **S** Spray nozzle - **C** Auxiliary (or secondary) Venturi - **D** Main (or primary) Venturi - **F** Throttle valve - **A** Choke in operation - **B** Choke excluded.

The automatic choke control, also shown in the color chart, is ensured via a temperature-sensitive element (bi-metal spring or expanding capsule) which, with engine cold, takes care of inserting the choke, be the latter of the auxiliary carburetor or offset shutter valve type.
Choke cut-out is controlled by the heating of the temperature-sensitive element: it receives heat

IDLE SPEED OPERATION



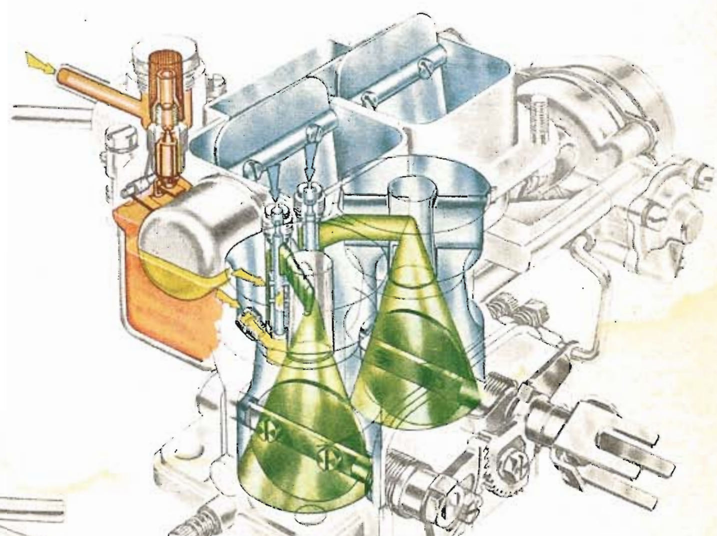
STARTING STAGE OPERATION



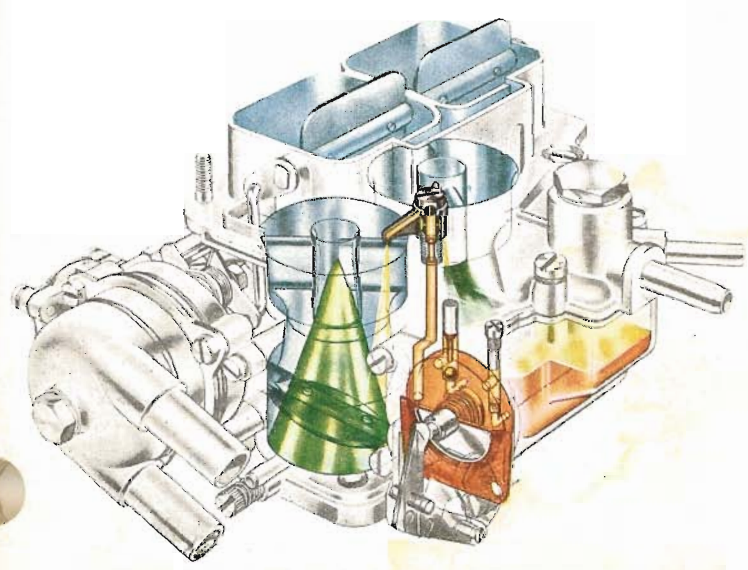
CARBURETOR

WEBER

SERIES 40 DFA



FULL POWER OPERATION



ACCELERATION STAGE OPERATION

from exhaust manifold heated air, engine cooling system water or an electric resistor wired to the ignition circuit.

The only action which the driver is normally called upon to take for choke insertion is to depress fully and release the accelerator pedal before starting the engine; for this reason, controls of this kind are often referred to as **semi-automatic.**

Referring to the schematic representation of parts involved in **Fig. 17** a description is given in the following paragraphs of the choke insertion, starting, acceleration and choke disinsertion stages.

Choke insertion - with engine cold, bi-metal spring **B** shifts pin **1** and lever **2**, in one with lever **3**, thus moving offset shutter valve **Fs** into closed position: this action occurs when the driver, before starting, depresses fully and then releases the accelerator pedal. This preliminary action by the driver is indispensable to move away from cam **4** screw **5** (carried on lever **6**) via rod **7** connected to accelerator lever **8**: in fact, unless screw **5** is moved out of the way, bi-metal spring **B** cannot rotate lever **3** which drags along also fast idle cam **4** through spring **9**. Before starting the engine, shutter valve **Fs** must be closed and screw **5** must rest against cam **4** to give throttle **F** the pre-set **fast idle** opening.

Starting and acceleration - Once engine has started, the vacuum beneath throttle **F** increases and gains enough force to shift diaphragm **D** and rod **10** of the amount allowed by the setting of the mixture weakening screw **11** — **pneumatic anti-flooding;** the shift of rod **10** causes a partial opening of shutter valve **Fs** to suitably proportion mixture strength to engine warm-up requirements, by overcoming the force of spring **M** and bi-metal spring **B.** If the accelerator pedal is pressed lightly and enough to move screw **5** away from cam 4 the latter — via spring **9** — will be turned through the same angle which the shift of rod **10** had earlier caused lever **3** to make. In case accelerator pedal is released, screw **5** will abut against cam **4** in another location, the cam now being set for a reduction in fast idle rate. Should the accelerator pedal be depressed more forcibly, the vacuum beneath throttle **F** will decrease, spring **M** sets

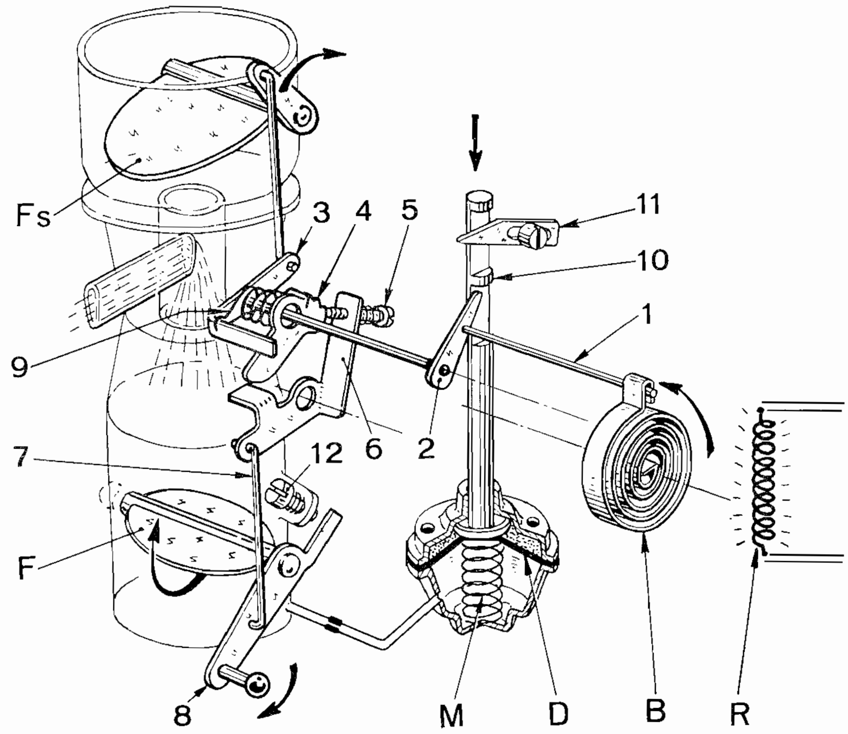


FIG. 17

Automatic choke schematic diagram - **1** Pin - **2** Lever - **3** Lever rigidly connected to lever **2** - **4** Fast idle cam - **5** Fast idle setting screw - **6** Fast idle lever - **7** Tie rod - **8** Accelerator lever - **9** Spring, connecting cam **4** with lever **3** - **10** Pneumatic anti-flooding device control rod - **11** Anti-flooding control rod travel adjusting screw - **12** Idle speed adjusting screw - **Fs** Shutter (or strangler) valve - **F** Main throttle valve - **M** Spring, diaphragm **D** - **B** Bi-metal thermostatic spring - **R** Heater.

back rod **10** and the opening of shutter valve **Fs** will be governed by bi-metal spring **B** alone. Should the starting be prevented by an excessively rich mixture, by depressing accelerator pedal fully in throttle **F** will open completely and, through rod **7** and the lug on lever **6**, it will rotate cam **4** and lever **3** thus causing shutter valve **Fs** to open of a given amount: at this point, by cranking with the starter motor it will be possible to lean out the mixture first and then repeat the starting operation as described above.

Choke disinsertion - With engine running, the heat produced by heater **R** is conveyed to bi-metal spring **B** which gradually deforms and reduces the force tending to keep shutter valve **Fs** closed: this reduces mixture richness and the fast idle rate. Once the rated temperature is reached, bi-metal spring **B** positions shutter valve **Fs** vertical and rotates cam **4** until it no longer contacts screw **5**: throttle **F** may thus return to its normal idle speed setting governed by idle speed adjusting screw **12.**

Modern Carburetor Features

Some basic carburetor devices have been described in the preceding paragraphs but there are also a few other particular systems which have found wide application in current automotive engineering and are worth being illustrated.

Auxiliary (or secondary) Venturi

The purpose of this second Venturi is to boost the depression existing in the main or primary Venturi and to improve the mixing of fuel with the incoming air. In some of the earlier illustrations this device is represented as a small Venturi surrounding spray nozzle **S** — for instance, **Fig. 16** — with its lower edge terminating in the narrower section (or striction) of the main Venturi **D**.

Multi-barrel carburetors

To improve engine performance at full power, the trend in automotive design is to adopt more than one carburetor on the same engine so that each carburetor or barrel feeds a limited number of cylinders, or even a single cylinder: in this way, volumetric efficiency (or combustion chamber charge) is improved with the added advantage that the fuel feed to each cylinder, or group of cylinders, is unaffected by the intake stroke of the others, thus ensuring a more uniformly blended mixture distribution.

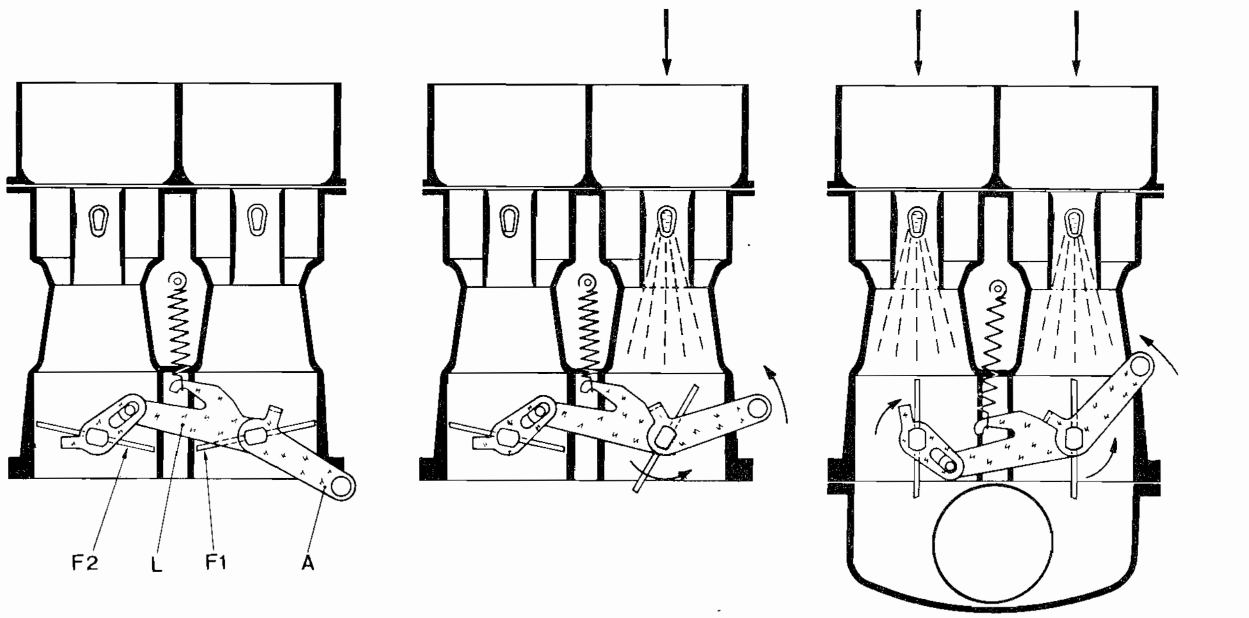


FIG. 18

Mechanically-controlled differential opening of the throttles - **A** Accelerator lever integral with primary throttle **F1** - **L** Intermediate lever for control of secondary throttle **F2**.

This same result could be achieved by adopting a number of **single-barrelled** carburetors but for evident reasons of simplicity and control positiveness, the carburetors with **two or more barrels** (or throats) incorporated in a single body casting are preferred, often having a single constant-level float chamber in common for fuel supply. An important feature is the method adopted for the opening control of the throttles which may be either of the **differential** or the **synchronized** type. The direct type (**mechanical**) **differential control** is shown in **Fig. 18**: accelerator lever **A** is integral with throttle **F1** which is opened first (hence, **primary throttle**) and when its opening reaches 2/3 the maximum setting, intermediate lever **L** begins to open throttle **F2** (**secondary**) and completes the opening within the remaining part of its travel.

The primary barrel — often smaller than the secondary in diameter — is adjusted to provide an economic mixture strength for part-load operation whereas the secondary barrel is adjusted for full power and acceleration performance.

The secondary barrel control may also be of the **pneumatic** type, that is, obtained through a diaphragm actuated by the vacuum by-passed from the primary throat. - **Fig. 19.**

Upon opening of the primary throttle **F1** the vacuum in main Venturi **D** is ducted to the chamber of diaphragm **P** through passage **1**. If throttle **F1**

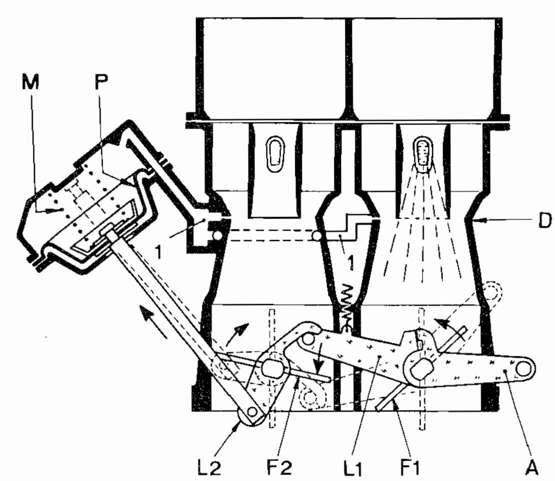


FIG. 19

Pneumatically-controlled differential opening of the throttles - **1** Vacuum duct interconnecting main Venturi **D** and diaphragm **P** - **M** Spring - **A** Accelerator lever integral with primary throttle **F1** - **L1** Intermediate lever for control of secondary throttle **F2** - **L2** Lever integral with throttle **F2** and actuated by diaphragm **P**.

is totally open, lever **L1** is lowered and frees lever **L2** which is connected (via a link rod) with diaphragm **P**: in this case, the vacuum acting on the diaphragm and opposed by spring **M**, opens throttle **F2** gradually and in accordance with the amount of air drawn in by the engine. Upon closing of throttle **F1** the lever linkage shown ensures the prompt closing of throttle **F2**. This type of pneumatic control finds wider application on engines which have the possibility of operating, at full power, over a wide rpm rate range.
The intake manifold used in conjunction with differential carburetors has a single cavity into which arrive the two carburetor ducts.
The **synchronized control** may be obtained by fitting the throttle valves on the same spindle or on separate spindles interconnected by two identical toothed sectors.
To ensure best engine performance, the opening angles of the two throttles must be the same at all times, whatever the position of the accelerator. The synchronized control is usually adopted when each carburetor barrel feeds one cylinder or a group of cylinders, independently of the others. In this case the intake manifold is provided with a separate tubing for each carburetor barrel, connected to the cylinder or group of cylinders involved. At times the separation of the ducts is limited by a common channelling known as the **« compensating type »**.

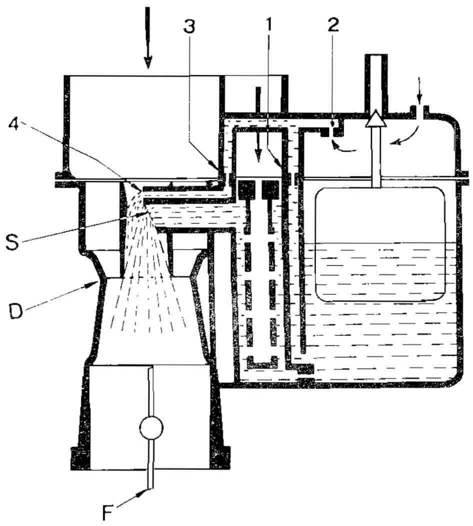


FIG. 20
Mixture enriching circuit (overfeed) - **1** Fuel jet - **2** Emulsion air jet - **3** Overfeeding device mixture jet - **4** Mixture channel in auxiliary Venturi - **S** Spray nozzle - **D** Main Venturi - **F** Main throttle.

Mixture strength control devices

As described earlier (**see Figs. 3-4-5**) for maximum engine efficiency and best use of the fuel, the mixture strength must be proportioned to engine requirements established by both laboratory and road tests.
With wide open throttle the mixture must be slightly rich for maximum power and good engine life, whereas with part-open throttle, hence part power, the mixture may be leaned out with all the ensuing advantages of greater economy and exhaust gas toxicity reduction.
If a carburetor barrel supplies fuel to just one or two cylinders, the fluctuations in incoming air flow rate already produce the necessary weakening in mixture strength during part-throttle operation. But often it becomes necessary to provide the carburetor with additional devices for the special purpose of adapting it to engine demands under any and all conditions.
One such arrangement — called **overfeeding device** — consisting of a mixture control system without moving parts is shown in **Fig. 20.**
It is a separate circuit, in parallel with and independent of the main circuit, consisting of a fuel jet **1**, an air jet **2** and a mixture jet **3**. The fuel drawn from the bowl and metered by jet **1**, emulsifies with the air coming in through jet **2** and the mixture thus formed — via calibrated bush **3** — is sprayed into channel **4** in auxiliary Venturi, just

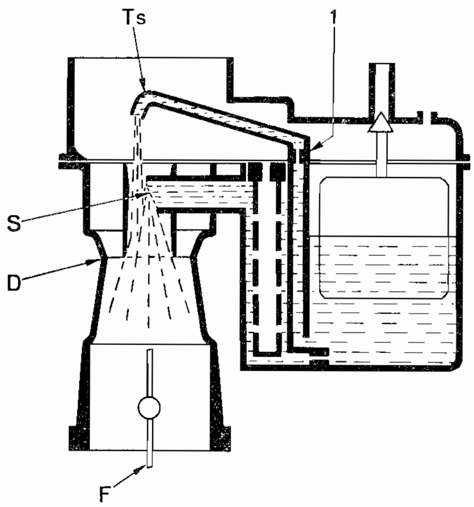


FIG. 21
Mixture enriching circuit - **1** Fuel jet - **Ts** Fuel spray tube - **S** Main spray nozzle - **D** Main Venturi - **F** Main throttle.

above nozzle **S**. The supply from this circuit serves mainly to enrichen the mixture to offset the greater amounts of air flowing both when throttle is partially or totally open.
Another quite similar system is shown in **Fig. 21**: in this case, however, there is no emulsioning air and the supply of fuel takes place through a special spray tube **Ts. Fig. 22** shows a system adopted to weaken the mixture under part-open throttle conditions. It consists of a valve **Vsm**

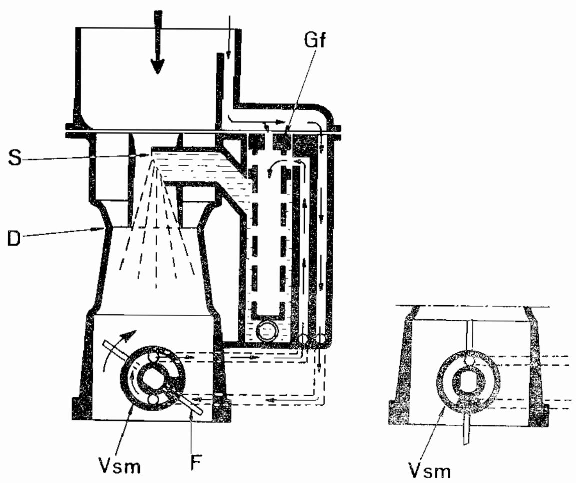


FIG. 22
Mixture weakening circuit - **Gf** Main air bleed correction jet - **S** Main spray nozzle - **D** Main Venturi - **Vsm** Rotary valve incorporated with main throttle **F**.

operated by the throttle spindle and serves to blank — at wide-open throttle — an additional air outlet in the carburetor main feed circuit.
At part-open throttle, instead, there is an addition of air (left, see arrows) in the well located below air corrector jet **Gf**, valve **Vsm** being open.
Fig. 23 (**A** and **B**) shows a special valve, in two versions, for mixture enrichment control either when the throttle is part-open (see **A**) or wide-open (see **B**). Control is by the vacuum existing in the intake manifold.
Fig. 23-A, part-load mixture enrichment: the vacuum, ducted from orifice **1** beneath the throttle, arrives in the chamber above diaphragm **2** which is lifted against the action of spring **3**.
The fuel drawn from bowl **V** flows through the valve seat (see arrows) is metered by jet **4** and then issues via the channel above spray nozzle **S**.

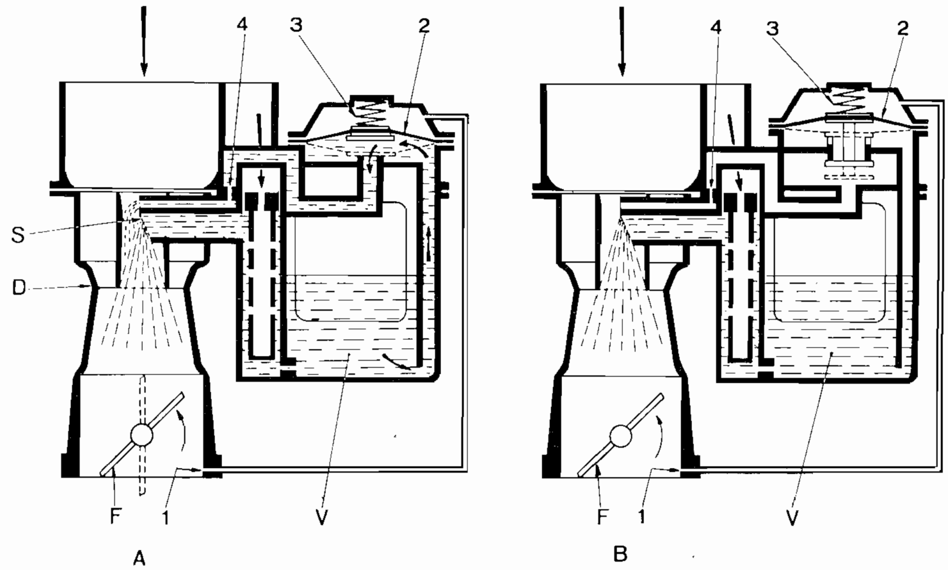


FIG. 23
Mixture enrichment valve for part-load (A) or full-power (B) operation: **1** Vacuum intake - **2** Diaphragm - **3** Reaction spring - **4** Fuel jet - **S** Spray nozzle - **D** Main Venturi - **F** Main throttle - **V** Constant-level float chamber.

With wide-open throttle, the depression is not strong enough to overcome the force of spring **3** and the valve remains closed (**position shown by the chain-dotted outline**).
Fig. 23-B, full power mixture enrichment: the vacuum action is the same as described above but valve operation is reversed. At part-open throttle, diaphragm **2** is in raised position, as shown, and the valve is in this case closed thus preventing any passage of fuel. With wide-open throttle the vacuum cannot keep the diaphragm **2** raised and thus the valve remains open (position shown by the chain-dotted outline).
Fig. 24 shows a mechanically-operated full-power mixture enrichment system. With wide-open throttle, the plunger of accelerating pump **Sp** is at bottom stroke and causes taper valve **Vp** to remain open. Via valve **Vp** the fuel from pump barrel arrives at jet **Gpp** thus providing a supply in parallel with main jet **G**. With part-open throttle, as shown in the figure, valve **Vp** remains closed and no additional supply of fuel is had. A similar circuit may also be adopted for the diaphragm-type accelerating pump.

Dust-proof carburetors

Current practice is to connect all air inlets and outlets of the carburetor — such as air bleed jets, float chamber vents, choke air jet, etc. — to the « clean » side of the air cleaner: this leads to advantages in carburetor interior cleanliness, silent running, less influence of filter dust build-up on fuel consumption, air pollution, etc. There are, however, also two notable drawbacks: starting difficulties when engine is hot due to an accumulation of evaporated fuel (**percolation**) and the engine « **hunting** » effects — rather complex and not utilizable to the best advantage in all cases — on mixture strength. For this reason the fully dust-proof carburetor cannot be adopted in some applications.

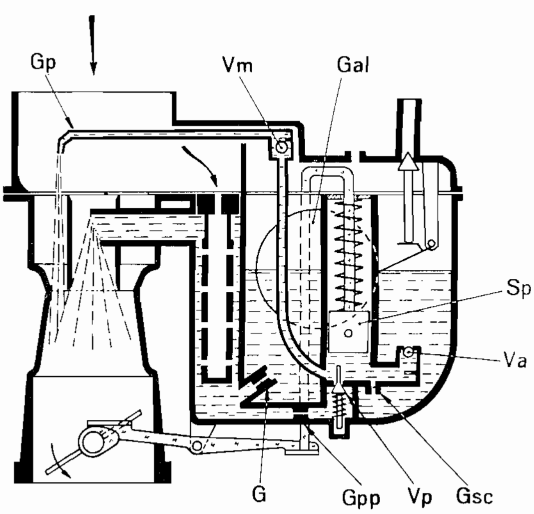


FIG 24
Full-power mixture enrichment system - **Gp** Pump jet - **Vm** Delivery valve - **Gal** Float - **Sp** Pump plunger - **Va** Intake valve - **Gsc** Pump drain jet - **Vp** Full power valve - **Gpp** Full-power fuel jet - **G** Main fuel jet.

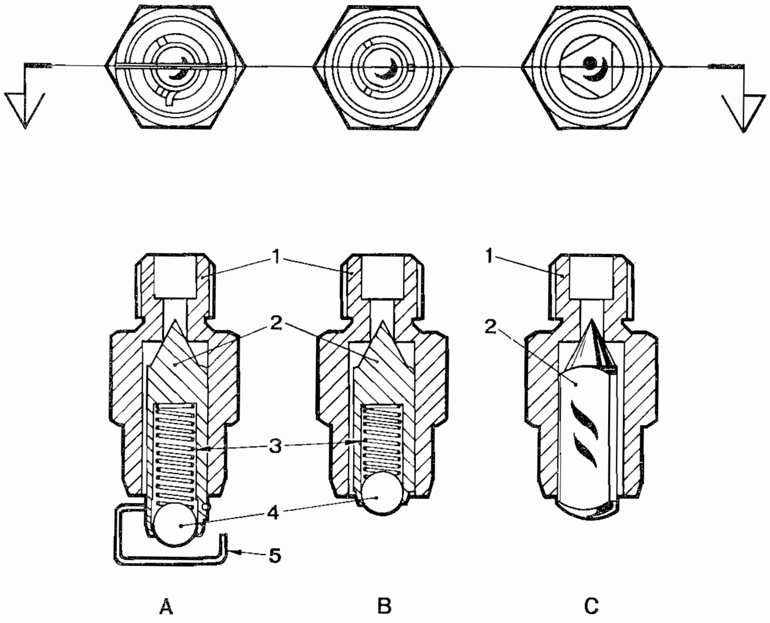


FIG. 25
Needle valve spring damper - **1** Needle valve seat - **2** Needle valve - **3** Damper spring - **4** Damper ball - **5** Needle valve drive hook.

Needle-valve spring dampers

To improve the maintenance of the correct fuel level in float chamber, a spring-dampened type of needle valve has found wide application — see **Fig. 25.**

This arrangement proves beneficial with carburetors subject to marked vibrations, on engines with few cylinders and high rpm rates.

In **A** and **B** (**Fig. 25**) are two sections of the needle valve showing its incorporated damper consisting of a spring and ball. A solid needle is shown in **C**. Sometimes it is better to have the needle controlled directly by the float to prevent « bindings » resulting from impurities or gums in the fuel. With some designs, the taper seat of the needle valve is made of a non-metallic material, for instance, synthetic rubber.

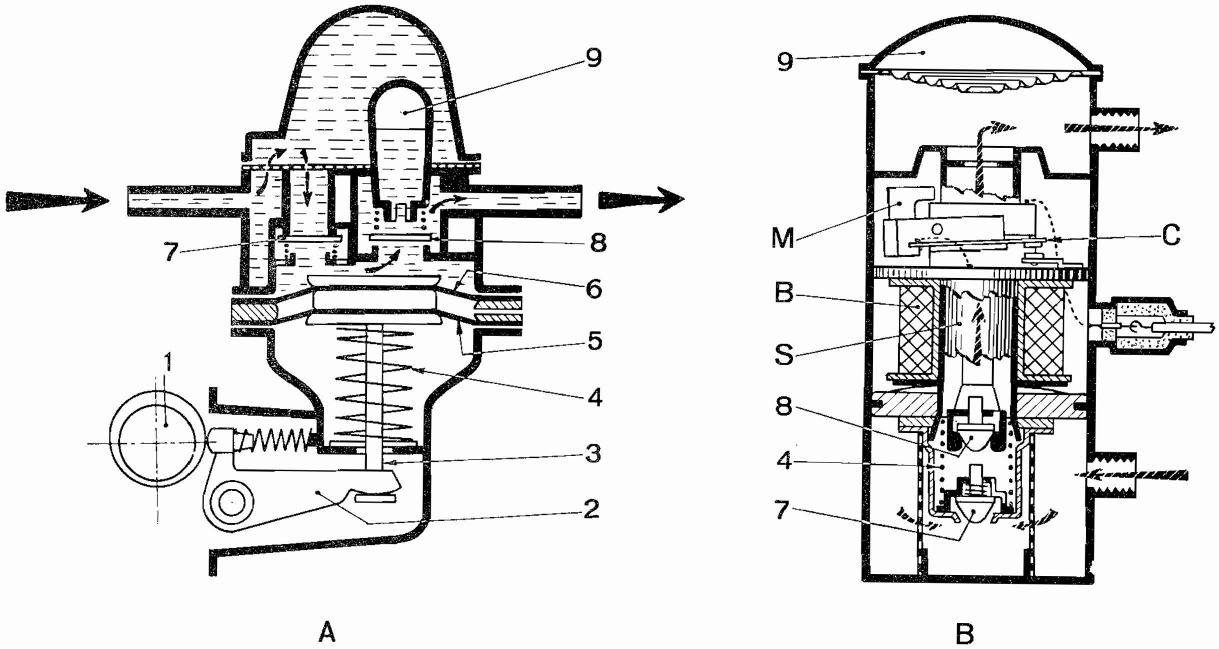


FIG. 26
Fuel feed (or lift) pumps, mechanical (A) and electrical (B).
1 Camshaft - **2** Rocker arm - **3** Rod - **4** Fuel delivery pressure adjusting spring - **5** Sealing diaphragm - **6** Pumping diaphragm - **7** Intake valve - **8** Delivery valve - **9** Air chamber - **M** Permanent magnet - **C** Contacts - **B** Coil - **S** Plunger.

Fuel feed system

For space and safety requirements, in current design feed systems the fuel is sent from tank to carburetor by an engine-driven mechanical pump — **Fig. 26-A** — or an electric pump — **Fig. 26-B** — located in proximity of the fuel tank.

Referring to **Fig. 26 A**, cam **1** actuates — via rocker **2** and rod **3** — the plates holding diaphragms **5/6** : diaphragm **5** provides fuel tighthess on engine side while diaphragm **6** pumps the fuel. In the figure, the pump is shown during the **delivery stage** with intake valve **7** closed and delivery valve **8** open: air chamber **9** serves to stabilize the flow rate. Upon further rotation, camshaft **1** causes the lowering of the diaphragms, this in turn closes the delivery valve and opens the intake valve for the arrival of new fuel from the tank. Spring **4** is rated to establish the maximum delivery pressure value, also known as **self-regulating pressure (0.2-0.3 kg/sq.cm.)**.

Fig. 26-B shows an electric pump; item numeration is the same for equivalent parts in **A** and **B**. During the delivery stage, plunger **S** travels upward under the action of spring **4**, magnet **M** causes contact **C** to « make », thus supplying battery current to coil **B**. The magnetic circuit pulls down plunger **S** (intake stroke) but also causes contact **C** to « break »: this way, spring **4** again pushes up plunger **S** for a new delivery stroke.

Fig. 27 is a graph showing the flow rate delivery pressure data versus engine rpm — referred to a mechanically-operated fuel feed pump — and consumption curve **C** of the engine on which the pump tested was used. In addition to ensuring a fuel delivery always greater than the amount used up by the engine, the lift pump must provide the following:

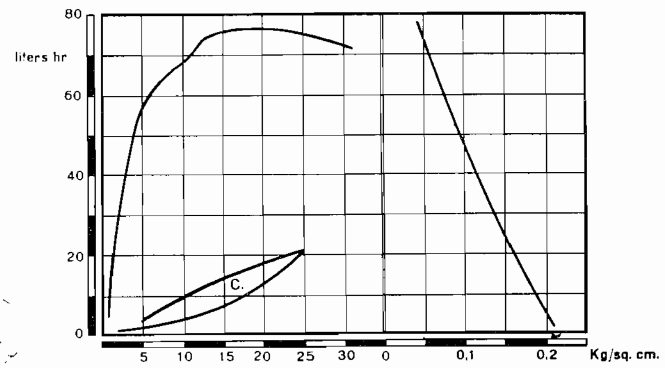
— **Quick priming** at low engine rpm (starting stage).

— **Delivery pressure** within the specified limits.

— **Effective heat insulation** for satisfactory operation during the hot season.

— **Silent running.**

To prevent the disadvantages ensuing from the overheating of mechanical pumps, the system shown in **Fig. 28** is sometimes adopted: this type of circuit serves to send the fuel vapors produced in pump or lines back to the fuel tank.



camshaft rpm x 100

DELIVERY PRESSURE at 2000 rpm (constant)

FIG. 27

Mechanical pump performance curves - Left: fuel pump free delivery rate (top), engine consumption **C** under part- and full-loads (bottom). **Right**: delivery pressure pattern versus flow rate variations at 2000 rpm (constant) of camshaft.

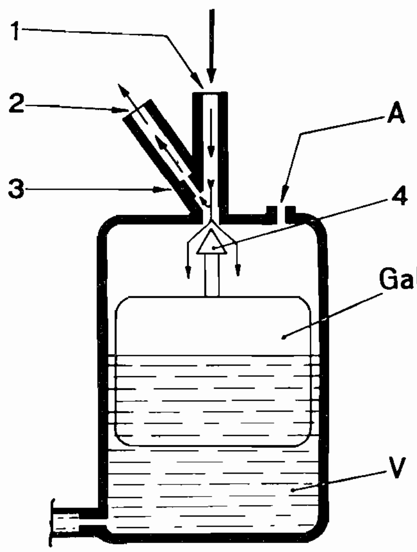


FIG. 28

Schematic fuel re-circulation system - **1** Fuel arrival from pump - **2** Fuel return to tank - **3** Striction - **4** Needle valve - **A** Float chamber vent - **Gal** Float - **V** Bowl or float chamber.

PART TWO Weber Carburetor Adjustment Settings

By « adjustment settings » is meant a list of values assigned to the calibrated parts of a carburetor application on a given engine. If the carburetor is a multi-barrelled unit with **synchronized** opening of the throttles, each barrel will have the same adjustment settings; if throttle opening is of the **differential** type, then the settings are distinguished in two lists as **primary** and **secondary.**
Now, by considering a typical carburetor, say the **40 DCOE,** it will be possible to explain the influence of the calibrated parts on engine operation and, with slight variations only, this information may be extended to the entire range of Weber carburetors.

40 DCOE 2 Carburetor Adjustment setting example

This is a **horizontal or sidedraft** carburetor having two identical barrels with synchronized throttles, fitted as a dual-unit application on a 4-cylinder, 1300 cc. engine providing 90 HP at 6000 rpm. It is a sports car power plant on which each carburetor barrel supplies fuel independently to one engine cylinder (**single-feed system**).

ADJUSTMENT SETTINGS

1) Main Venturi	29	mm
2) Auxiliary Venturi	4.5	mm
3) Main fuel jet	1.10	mm
4) Main air bleed (corrector) jet	2.00	mm
5) Emulsion tube	F16	
6) Idle speed fuel jet (fed from bowl)	0.50/F11	mm
7) Accelerating pump jet	0.35	mm
8) Accelerating pump drain jet	0.70	mm
9) Accelerating pump flow rate (per stroke, per barrel)	0.20	cc
10) Choke jet	0.60/F5	mm
11-12) Needle valve (w/damper)	1.50	mm
13) Fuel level: distance between float top and cover with gasket	8.5	mm
14) Weight of float	26	grams
15) Flared air horn extensions		none

To illustrate the **DCOE** Series carburetors, a section is shown in **Fig. 29** and a color chart on

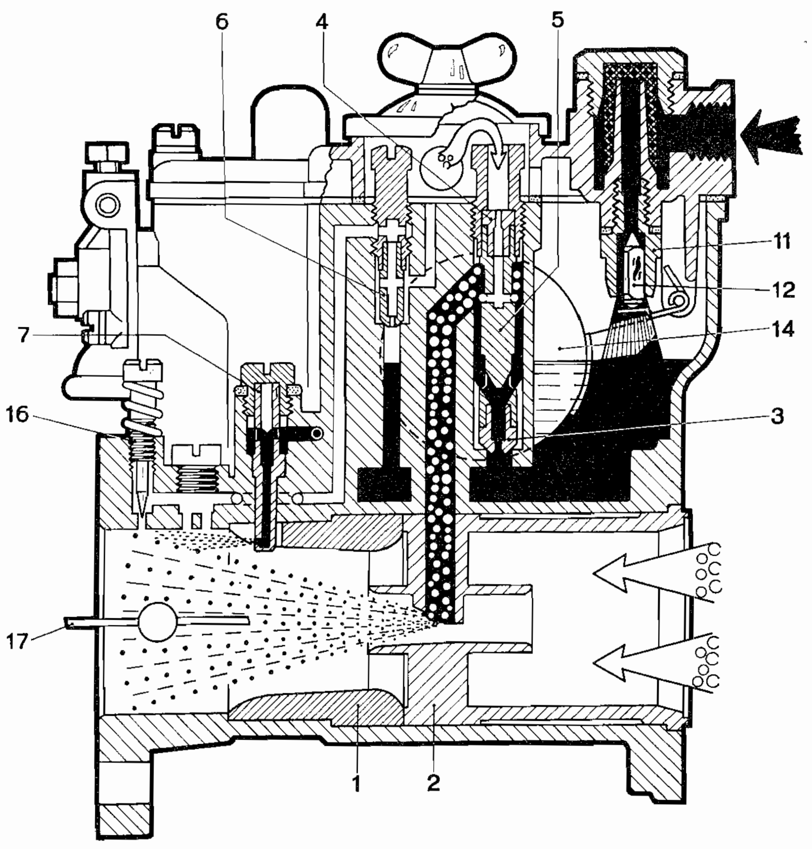


FIG. 29
Section through a DCOE Series carburetor
1 Main Venturi - **2** Auxiliary Venturi - **3** Main fuel jet - **4** Main air jet - **5** Emulsion tube - **6** Idle speed fuel jet - **7** Accelerating pump jet - **11** Needle valve - **12** Valve needle - **14** Float - **16** Idle mixture adjusting screw - **17** Throttle valve.

page 23. It is always possible to identify the main calibrated parts of a carburetor in spite of the different systems adopted when, for instance, the barrels are vertical. In the Weber carburetor designation, the first number indicates the barrel diameter in mm. at throttle level and is followed by a group of code letters and, sometimes, by a second number completing the identification.

Examples:

— **40 DCOE 32:** horizontal (sidedraft) carburetor with two 40 mm barrels.

— **28/36 DLE 2**: carburetor with two barrels, **28 mm primary and 36 mm secondary.**

Parts are described below in the same order as given under the **adjustment setting** list on previous page.

1) Main or primary Venturi - Fig. 30

The main Venturi diameter — in this case, 29 mm — is referred to the narrowest internal section (throat) and is selected from the results of tests run on the engine. The diameter chosen may be:

— **greater**, when maximum power at high rpm and maximum road speed are desired, or

— **smaller**, when better pick-up is desired with a penalty on maximum power.

In fact, the task assigned to the main Venturi is to increase the vacuum acting on the carburetor main circuit in order to draw in and atomize the mixture; the consequence is, however, an increased resistance encountered by the flow through the carburetor. The sharper the passage section variations, the more evident are the effects of this resistance. The following relationship is thus used in calculations:

— **Main Venturi diameter** = barrel diameter x 0.7 . . . 0.9.

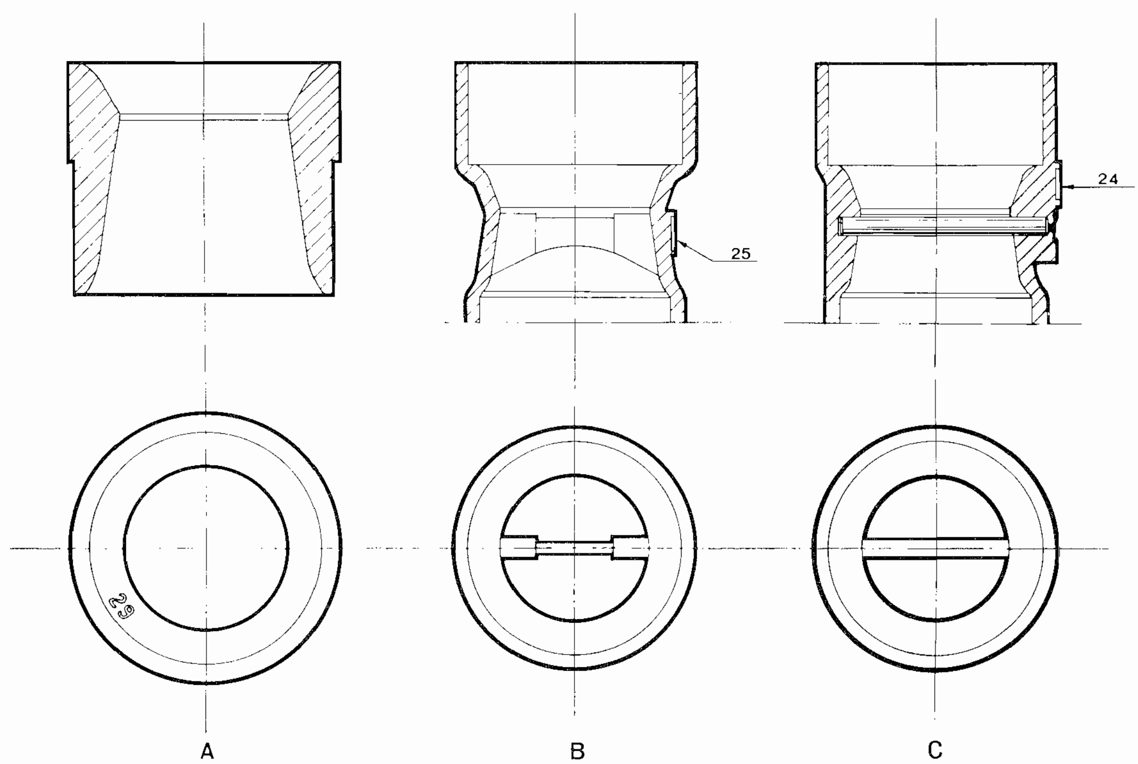


FIG. 30

Main Venturis - In **A**, the main Venturi for a series DCOE carburetor having a **29 mm** diameter. In **B**, section of a carburetor having an incorporated main Venturi with baffle for better mixture distribution and **25 mm** diameter. In **C**, another carburetor section in which, in lieu of the baffle, a round bar serves the same purpose; the diameter is **24 mm.**

The barrel diameter depends on engine and application specifications, and for this reason it will not be possible to give any detailed description here. **However, as a preliminary selection criteria, it will prove useful to refer to the Weber Catalog and Adjustment Setting Tables where also the other elements needed for a correct adjustment may be found.**

For an acceptable adjustmert setting, any reduction in main Venturi diameter **must be accompanied** by a reduction in the diameter of the main (pilot) jet to prevent excessive mixture enrichment, as described later.

The main Venturi bears a number, stamped on its **air cleaner side**, showing its major striction size or smallest diameter. When the main Venturi is cast integral with the carburetor body this diameter is **stamped on the outside face of the body casting**, as is the case, for instance, of units **30 DIC** and **26 IMB.**

Two graphs are provided for an approximate determination of main Venturi diameters: the first

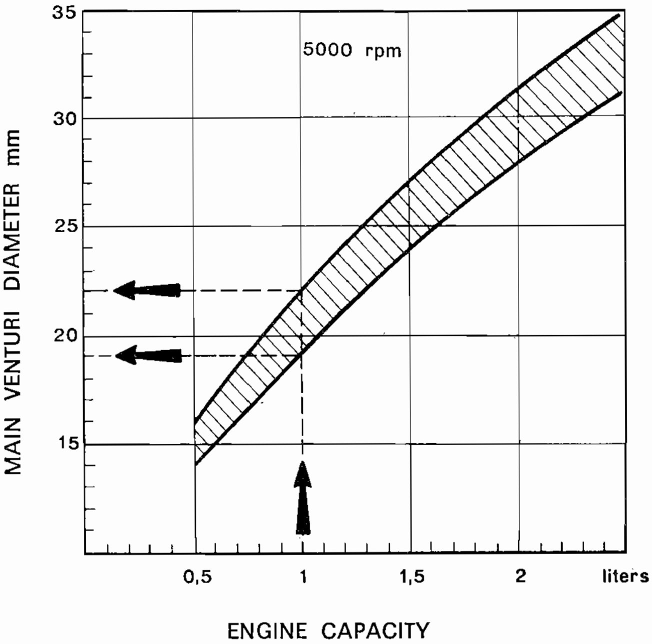


FIG. 31
Main Venturi diameter selection chart for 4-stroke, 1 to 6 cylinder engines having maximum output at around 5000 rpm. All engines fed by one single-barrel down- or side-draft carburetor, without supercharger. If the engine has 2 cylinders select a Venturi corresponding to twice the engine capacity.
Examples: a 1-liter, 4-cylinder engine requires a 19-22 mm dia. Venturi; a 1-liter, 2-cylinder engine requires a 27-32 mm dia. Venturi.

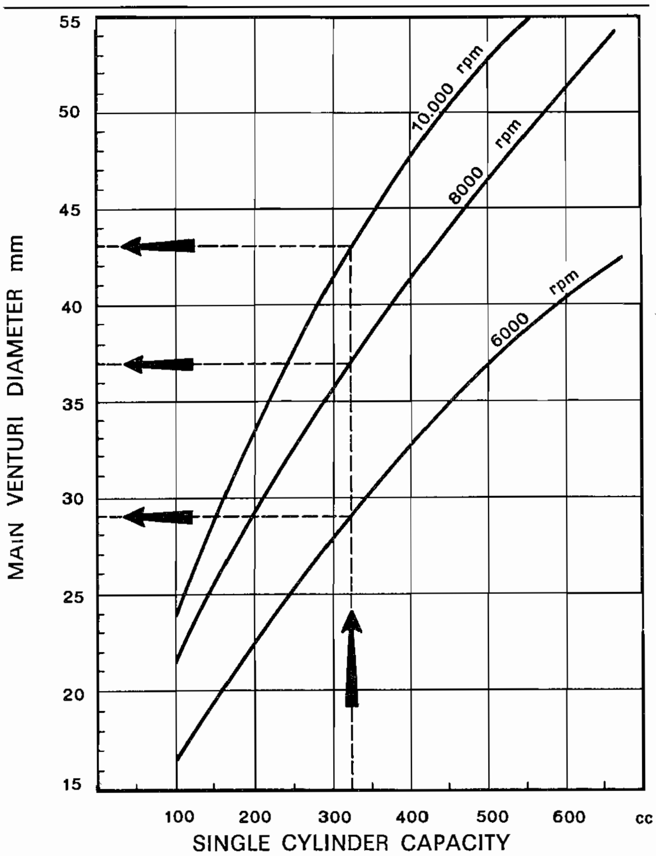


FIG. 32
Main Venturi diameter selection chart for 4-stroke sports engines without supercharger and with feed by one down - or side-draft carburetor to every cylinder. The three curves plotted refer to maximum output speed rates of 6000, 8000 and 10,000 rpm.
Example: a 4-cylinder, 1300 cc engine will have 325 cc unit capacity and will require Venturis of 29 mm dia. at 6000 rpm, 37 mm dia. at 8000 rpm. and about 43 mm. dia. at 10,000 rpm.

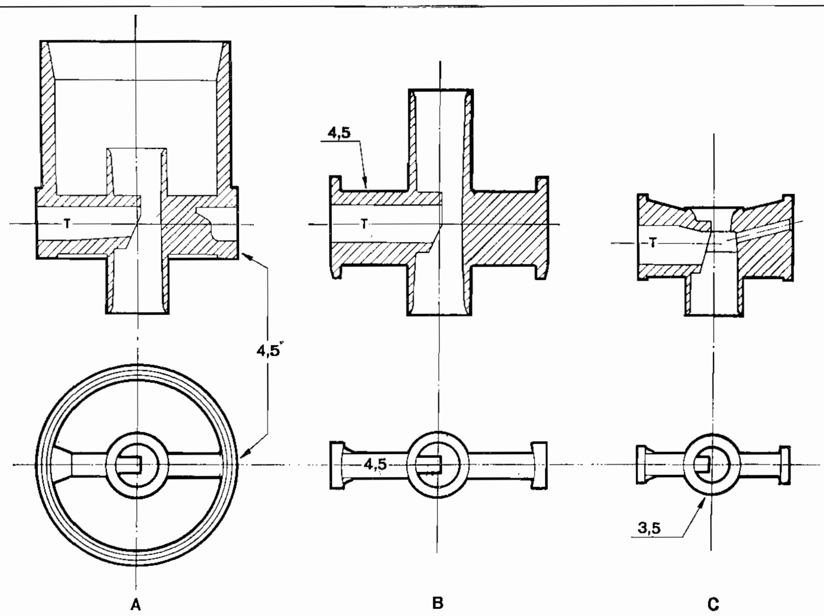


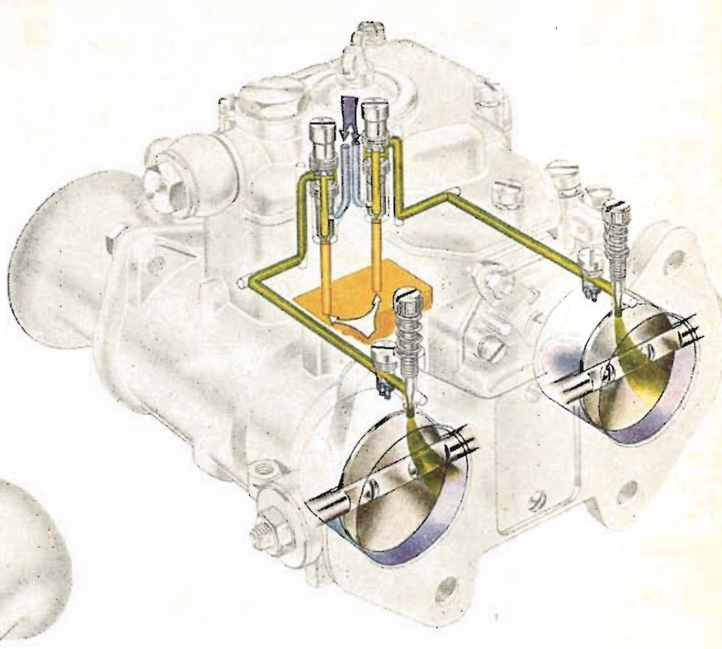
FIG. 33 **Auxiliary Venturi** - in **A** for DCOE series carburetors, in **B** for IDA series carburetors and in C for ICR series carburetors. **T** Spray nozzle tube minor section.

(Fig. 31) covers current types of 2 to 6 cylinder engines fitting a single-barrel carburetor and the second **(Fig. 32)** covers sports engines designed on the single-feed system, namely, one carburetor barrel to each cylinder. In both graphs, engines operate on the four-stroke cycle and are not fitted with superchargers.

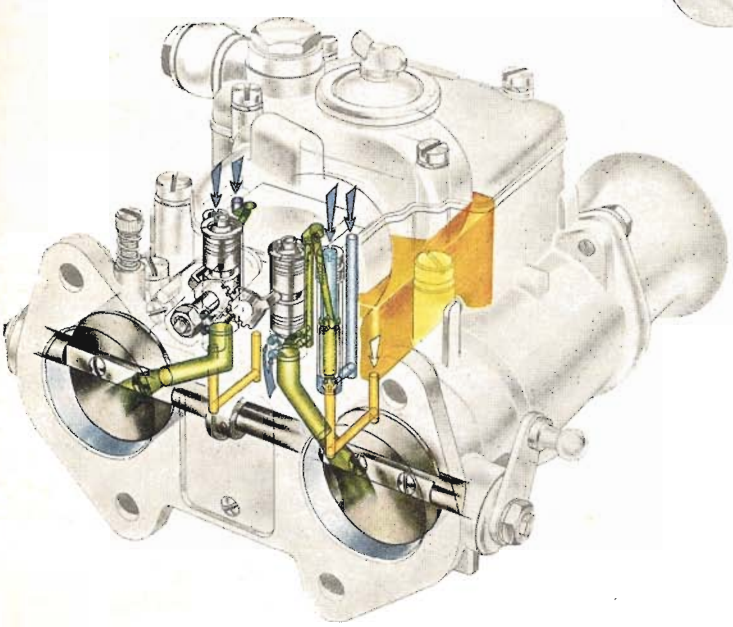
2) Auxiliary or secondary Venturi - Fig. 33

The value stamped in different locations refers to the narrowest section T of the spray nozzle through which the mixture flows and indicates that the cross-sectional area is the same as the one of a hole having the same diameter, say **4.5 mm** as in A and B. The more commonly adopted diameters fall in the range between **3** and **5 mm**, depending on different requirements: the influence of the flow passage section is felt more markedly at high rpm rates. For special purposes, such as a desirable reduction in « mixture rejection » caused by engine « pulsating » induction, the elongated type of auxiliary Venturi is adopted

IDLE SPEED OPERATION

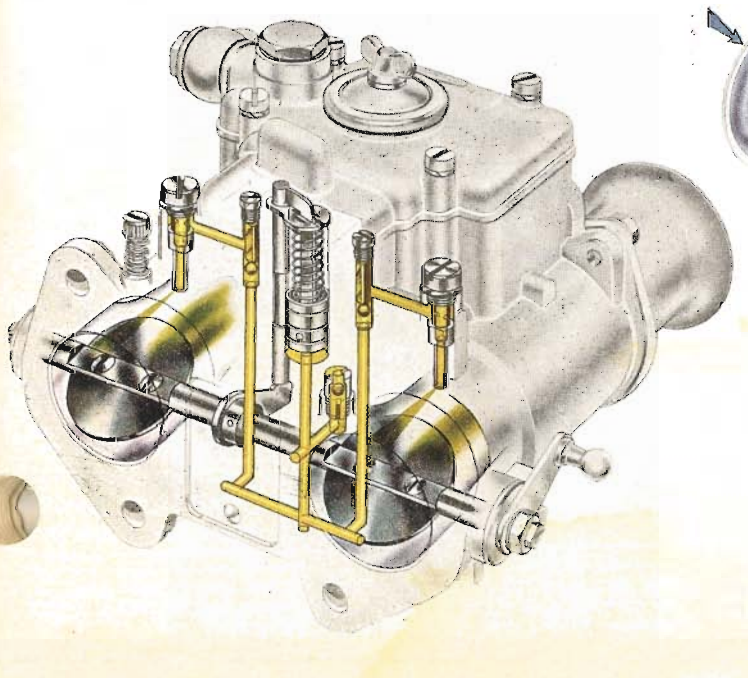


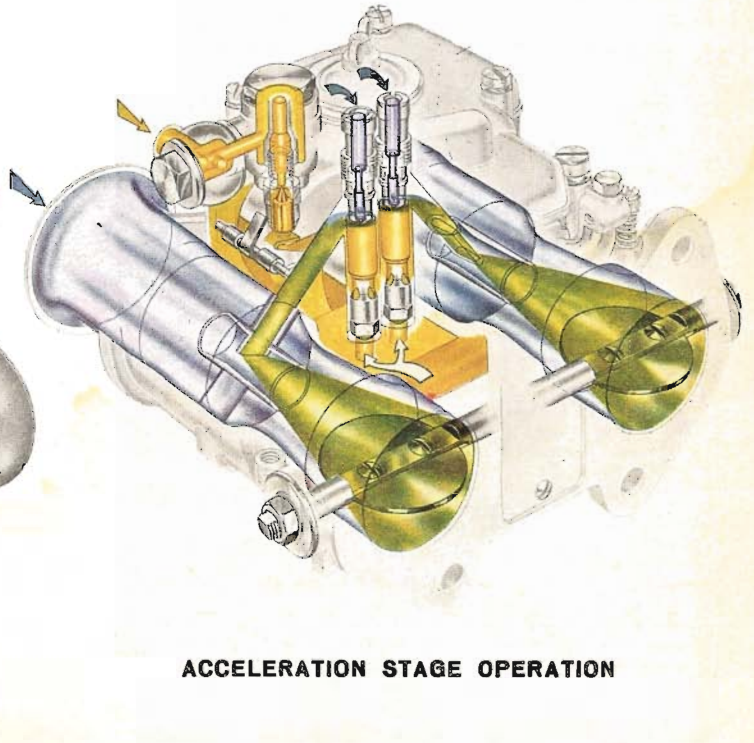
STARTING STAGE OPERATION



CARBURETOR
WEBER
SERIES 38-48 DCOE

FULL POWER OPERATION





ACCELERATION STAGE OPERATION

on sports cars. In other cases, it proves beneficial — for improved mixture distribution — to give an asymmetric shape to the auxiliary Venturi portion nearest the throttle.
For the smaller carburetors, a single diameter rating is factory-set and cannot be changed.

3) Main jet - Fig. 34

This is a calibrated component of great importance which is controlled with extreme care by measuring the **flow rating** of every single jet: the figure stamped on its side represents the **nominal**

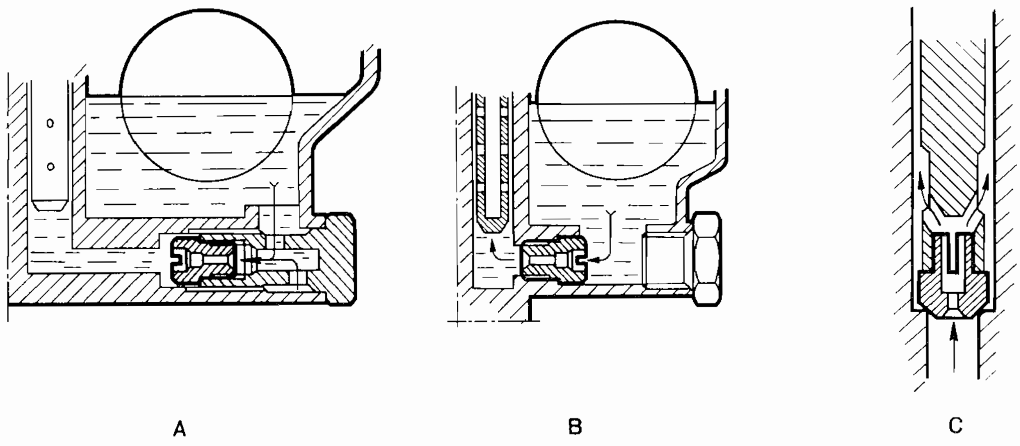


FIG. 34
Main jets - In **A** the jet is fitted in a special holder, in **B** it is screwed in carburetor body casting, in **C** it is co-axial with the emulsion tube as in the DCOE series carburetors.

diameter in 1/100 of mm. of the bore through which the fuel passes and **must not** be measured or cleaned with any pointed metal tool. The diameter — common values range between **0.80** and **1.80 mm** — must be chosen according to the main Venturi, the air bleed jet, the number of cylinders to be fed, the grade of fuel used, etc. Useful though approximate data for a preliminary choice may be found in the graph of **Fig. 35.**
A recommended procedure for testing purposes is to start with the larger diameter jet, then reducing the diameter according to requirements.
On the basis of a correct adjustment setting, it may be said that every **1 mm** increase in main Venturi diameter will call for an increase of abou **0.05 mm** in the main jet diameter.
Whenever the diameter of the main jet, or of any other jet, must be increased or decreased, it will be necessary to change the jet(s) with **genuine Weber spare**(s) and avoiding any use of pointed tools, etc.

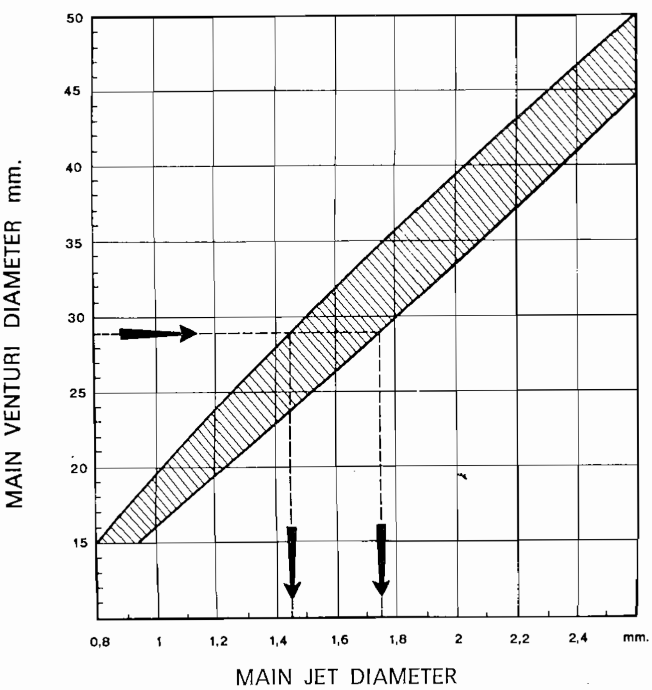


FIG. 35
Graph for the selection of the main jet diameter as a function of main Venturi diameter, with **2.00 mm** diameter as the datum figure for the air bleed jet.
Four-stroke, Otto-cycle engines.
The main Venturi considered in the chart feeds **4** or **6** cylinders; if the cylinders fed are only **2**, the jet diameter found must be multiplied by 0.90. In case it feeds just one cylinder (sports applications) the multiplication coefficient will be 0.75.
Example: if a 29 mm dia. main Venturi feeds 4 or 6 cylinders it will require a main jet having a diameter of **1.45** to **1.75 mm**; if it feeds only one cylinder the jet diameter will fall down to **1.10** or **1.30 mm**.
As these values are purely indicative, it is recommended to start the tests with the larger diameter jet, then reduce the size as needed.

4) Air correction jet - Fig. 36

The more commonly adopted diameters for this jet fall in the **1.50 to 2.30 mm** range; by increasing the diameter of this jet, the mixture is **weakened** more at higher than lower engine rpm rates whereas by increasing the diameter of the main jet the mixture is **enriched** uniformly at both high and low engine rpm rates.

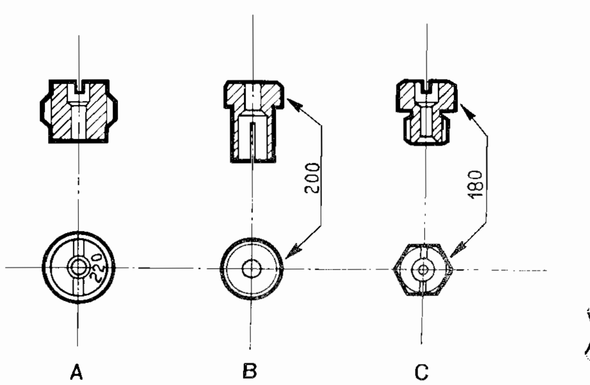


FIG. 36
Air correction jet - For ICP series carburetors **(A)**, for DCOE series carburetors **(B)** and for DCD series carburetors **(C)**.

The influence of the two jets thus used to best advantage in controlling adjustment setting and, for small variations, a **0.15 mm** increase in the air correction jet diameter may be equivalent to an **0.05 mm reduction** in the main jet diameter, considering the more common adjustment settings.

5) Emulsion tube

Its task is to emulsify the previously metered air issuing from the bleed jet with the fuel coming from the main jet. Its influence is more marked at small and average throttle opening angles and during accelerations (pick-ups). Significant factors are:

— **Location and size** of the orifices nearest the air bleed jet.

— **Maximum outside diameter.**

— **Location and size** of orifices nearest the main jet.

Some indicative information is provided below in tabulated form as an aid in selecting the right type of emulsion tube. Designation codes are subdivided in three columns, one for each series of tubes used by Weber. Designations — for instance F11 — are not progressive but only indicative and there are also some performance differences between the tubes grouped in any of the blocks.

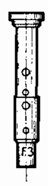
Important note - Frequently, any change in emulsion tube must be accompanied by a variation in the diameter of the main jet or air correction jet.

Calibrated parts -
The Weber part numbering system

All types of parts in a carburetor are given a basic five figure number which relates to the « family » or group to which they belong.

After the five figure number there follows a three digit number which identifies the particular part in question. Sizes are usually expressed in millimeters or fractions of a millimeter. For example, a fifty (point five mm.) idle jet would be shown thus .050. A 135 (one point three five mm.) would be shown .135 as the size exceeds one millimeter.

Indicative table for emulsion tube selection

	Weber Part Numbers		
	61440.....	61450.....	61455.....
Usual application	 for: 40-46 IDA (3V) 40 IF (3V) and a lot of the remaining carb. types	 only for: DCOE-DCNF IDF-IDA (2V) DATRA-DFTA DMTR-DMTRA carb. types	 only for: DCD-DCZ carb. types
Current usage	F2-F3-F6-F7 F8-F9-F15 F16-F20-F21 F24-F26-F33 F34-F35	F2-F3-F4-F7 F9-F11-F14 F15-F16	F8-F13-F23 F26-F30-F33
For mixture enrichment at low rpm or during slight accelerations (tubes without orifices at top)	F3-F5-F7-F21	F7	F23-F30
For mixture weakening at low rpm or during slight accelerations (tubes with orifices at top)	F20-F33-F34	F2-F3-F11 F14-F15-F16	F8-F26-F33
Tubes with many orifices for high rpm mixture richness reductions when air bleed jet is larger than 2.00 mm	F8-F16-F20	F11-F19	F8-F9-F31
When mixture enrichment for slight accelerations is needed, the fuel reserve in emulsion well must be increased: this is obtained by fitting a tube having small outside diameter, orifices located prevailingly in the lower portion and a larger size air bleed jet to prevent excessive mixture richness at high rpm.	F3-F5-F25	F7-F8	F13
Tubes for very large main fuel jets or for alcohol-based fuels.	F2-F20 F24-F25 F26	F2-F3-F4-F7 F17	F8-F10 F29

The basic numbers for calibrated parts are as follows:

- — Emulsion tubes = 61440, 61450, 61455
- — Aux. venturis = 68819 ÷ 71124
- — Chokes = 71502 ÷ 73204
- — Main jets = 73401, 73405, 73801
- — Idle jets = 74401 ÷ 74839
- — Acc. pump jets = 76201 ÷ 76801
- — Air correction jets = 77201 ÷ 77502
- — Needle valves = 79401 ÷ 79516

For better choice, here below and on successive pages, there are drawings of all Weber emulsion tubes fitted on all range of carburetors.
Drawing and relevant tables show the following measures:

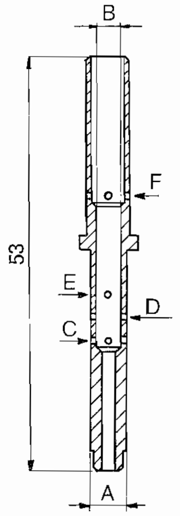
- — **Height**
- — **External diameter**
- — **Diameter of the internal channel**
- — **Number and diameters of orifices.**

At the end of the drawings there is a convertion table where is possible to find all emulsion tube « F » designation in progressive order.

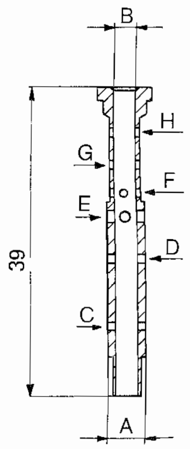
Emulsion tubes

Part number 61440.....

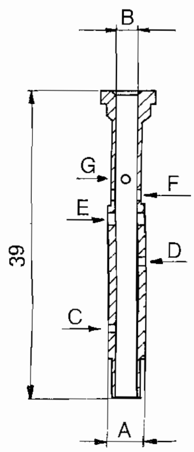
Part number	Type	mm.		Nr. holes x diameter (1/100 of mm.)							
		A	B	C	D	E	F	G	H	I	L
61440.120	F3	4,5	3,5	4x125	2x100	2x100	4x100				
61440.150	F1	4,5	2,75	1x100	1x100	2x140	2x100				
.151	F26	4,5	2,75	1x100	2x100	4x140	4x100				
.153	F49	4,5	2,75	1x100	1x100	2x140	2x100	2x100	2x100		
.154	F58	4,5	2,75	2x100	2x100	2x140	2x100	2x100	2x100		
61440.155	F63	4,5	2,75	1x100	1x100	2x150	2x150	2x125			
61440.166	F2	4,5	2,75	4x100	4x100	4x140	4x100				
61440.181	F3	4,5	2,75	4x100	4x100	4x140	4x100				
.182	F5	4,25	2,75	4x100	4x100	4x140	4x100				
61440.196	F4	4,75	2,75	4x100	4x100	4x140	4x100				
.197	F70	5	2,75	4x100	4x100	—	—	4x120	4x120		



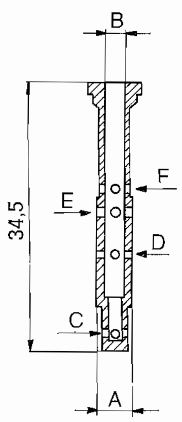
61440.120



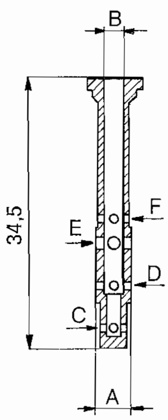
61440.150/151/153/154



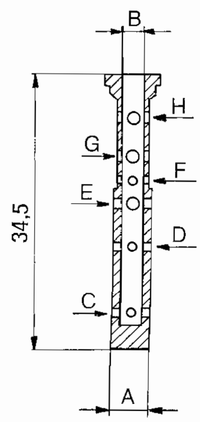
61440.155



61440.166



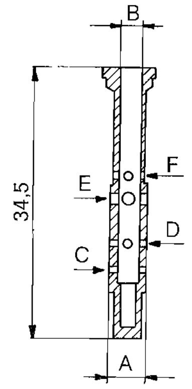
61440.181/182



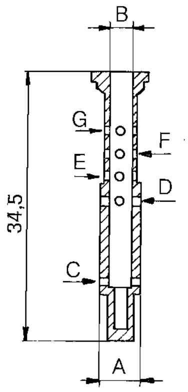
61440.196/197

Emulsion tubes **Part number 61440.....**

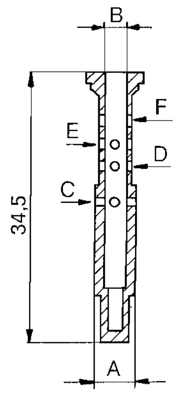
Part number	Type	mm.		Nr. holes x diameter (1/100 of mm.)							
		A	B	C	D	E	F	G	H	I	L
61440.211	F6	4,25	2,75	2x100	4x100	4x140	4x100				
.212	F8	5	3	2x125	4x125	4x140	4x100				
.213	F24	4	2,75	2x100	4x100	4x140	4x100				
.217	F53	4,5	2,75	2x100	4x100	4x140	4x115				
.218	F56	4,5	2,75	2x100	4x100	4x140	4x150				
.219	F57	4,5	2,75	2x100	4x100	4x140	4x130				
.223	F80	4	2,75	2x100	4x100	4x140	4x150				
61440.216	F50	4,5	2,75	—	4x140	4x140	4x140	4x140			
.224	F81	4,5	2,75	4x140	4x140	4x140	4x140	4x140			
61440.220	F66	4,5	2,75	4x160	4x120	4x120	—				
.222	F78	4,5	2,75	4x160	2x120	2x120	2x120				
61440.226	F7	4,5	2,75	4x100	4x140	4x100					
61440.229	F87	4,5	2,75	2x100	4x100	4x140	4x150	4x150			
61440.241	F9	4,5	3,5	2x100	2x100	2x100	2x115				
.246	F51	4,5	3,5	2x100	2x100	2x100	2x115	4x100			
.249	F75	4,5	3,5	2x100	2x100	2x100	4x115				
61440.242	F40	4,5	3,5	2x100	2x100	2x100	2x115				



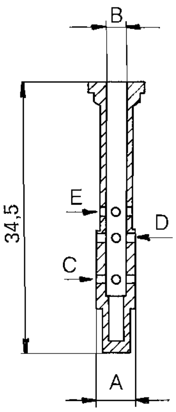
61440.211/212/213/217
218/219/223



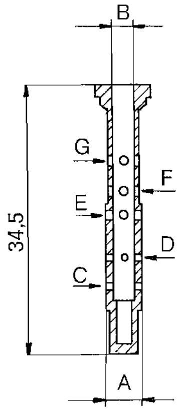
61440.216/224



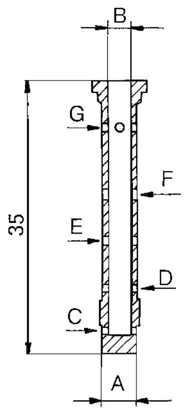
61440.220/222



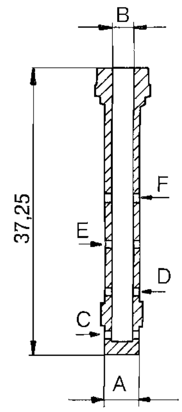
61440.226



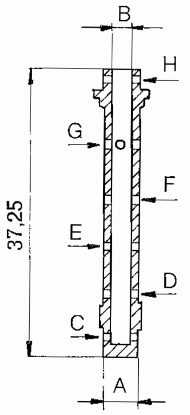
61440.229



61440.241/246/249

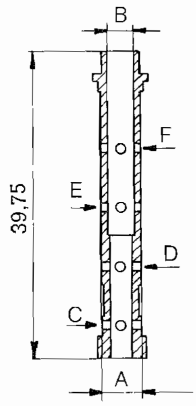


61440.242

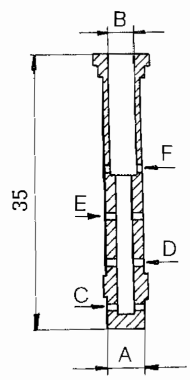


61440.243/244/245

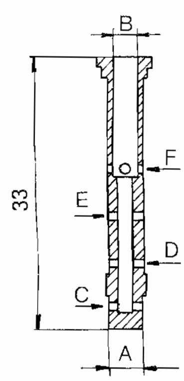
Part number	Type	mm.		Nr. holes x diameter (1/100 of mm.)							
		A	B	C	D	E	F	G	H	I	L
61440.243	F42	4,5	3,5	2x100	2x100	2x100	2x115	—	1x50		
.224	F47	4,5	3,5	2x100	2x100	2x100	2x115	—	2x100		
.245	F48	4,5	3,5	2x100	2x100	2x100	2x115	4x75	2x100		
61440.247	F54	4,5	3,5	4x110	4x110	4x110	4x120				
61440.261	F10	4,75	3,5	2x100	2x100	2x100	2x115				
61440.281	F11	4,5	3,5	2x100	2x100	2x100	4x125				
61440.301	F14	5	3	2x115	4x115	2x115					
.302	F43	5	3	2x115	4x140	2x115	2x120				
.303	F73	5	3	2x115	4x140	4x140	4x140				
.304	F74	5	3	2x115	4x140	2x115	2x120	2x100			
.305	F84	4	3	2x115	4x140	4x140	4x140				
61440.321	F15	4,75	3,50	—	2x115	2x115	4x115	4x115	—		
.328	F68	4,75	3,50	2x100	2x115	—	4x115	4x115	4x150		
61440.323	F52	4,65	3,50	2x115	2x115	4x115	2x75				



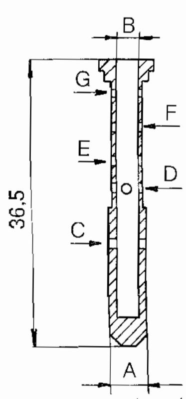
61440.247



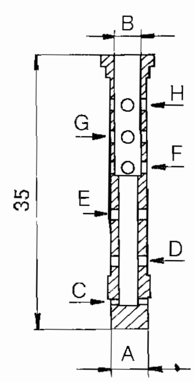
61440.261



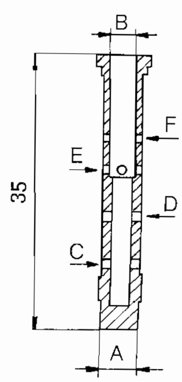
61440.281



61440.301/302/303
304/305



61440.321/328

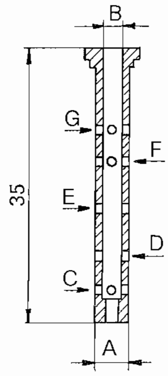


61440.323

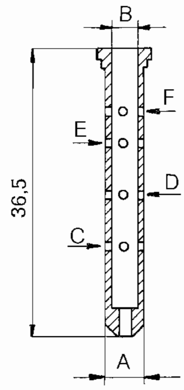
Emulsion tubes

Part number 61440.....

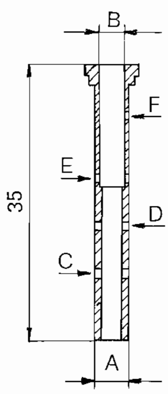
Part number	Type	mm.		Nr. holes x diameter (1/100 of mm.)							
		A	B	C	D	E	F	G	H	I	L
61440.325	F60	4,1	2,50	—	2x115	2x115	4x115	4x115			
.326	F61	4,1	2,50	—	2x115	2x115	4x115	—			
.329	F82	4,1	2,50	4x100	2x115	2x115	4x115	4x115			
61440.341	F16	4,75	3,25	4x115	4x115	4x115	—				
.343	F71	4,75	3,25	4x115	4x115	4x115	4x115				
.344	F85	4,75	3,25	4x140	4x115	4x115	4x115				
61440.351	F17	4,5	3,25	2x115	2x115	2x115					
.352	F38	4,5	3,25	2x115	2x115	2x115	1x125				
61440.356	F18	4,65	3,5	2x115	2x115	2x115	4x115	4x115	—		
.357	F67	4,65	3,5	2x115	2x115	2x115	4x115	4x115	4x150		
61440.359	F86	4,65	3,5	4x115	2x115	2x115	1x115	4x140			
61440.365	F20	4,5	3	4x115	4x115	4x145	4x145				
61440.371	F21	4,5	2,75	4x100	4x140	4x100	2x100	—			
.372	F23	4,5	2,75	4x100	4x140	4x100	2x100	2x100			



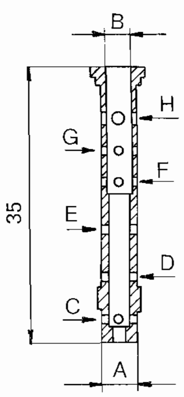
61440.325/326/329



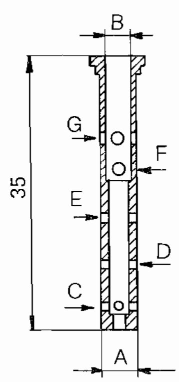
61440.341/343/344



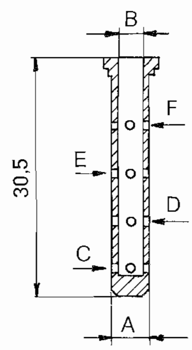
61440.351/352



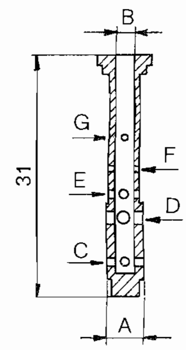
61440.356/357



61440.359



61440.365

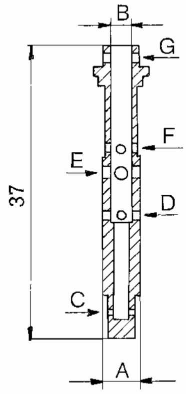


61440.371/372

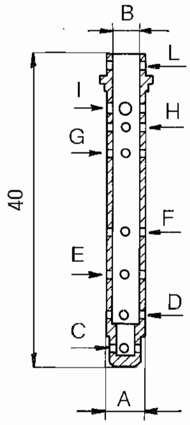
Emulsion tubes

Part number 61440.....

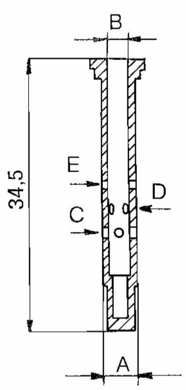
Part number	Type	mm.		Nr. holes x diameter (1/100 of mm.)							
		A	B	C	D	E	F	G	H	I	L
61440.452 .471	F3 F2	4,5 4,5	2,75 2,75	2x100 2x100	4x100 4x100	4x140 4x140	4x100 4x100	2x120 —			
61440.454	F77	4,7	3,7	4x130	4x100	4x100	4x100	4x100	4x130	4x150	2x100
61440.488	F25	4	2,75	4x140	4x140	2x100					
61440.501	F29	4,5	3,5	4x100	4x100						
61440.502	F33	4,5	3,5	4x120	4x120						
61440.515	F30	4,5	3,5	2x100	2x100	2x100	2x115	1x120			
61440.525 .526	F34 F35	4,5 4,5	2,75 2,75	2x100 —	2x100 2x100	2x100 2x100	2x100 —				



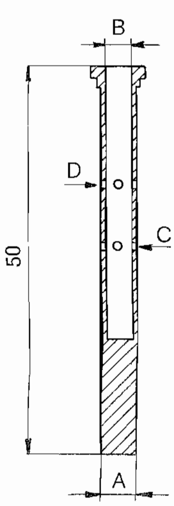
61440.452/471



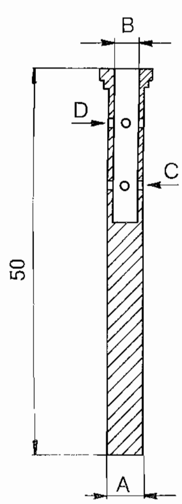
61440.454



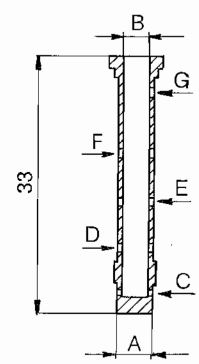
61440.488



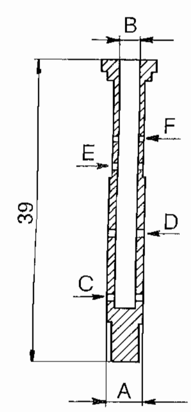
61440.501



61440.502



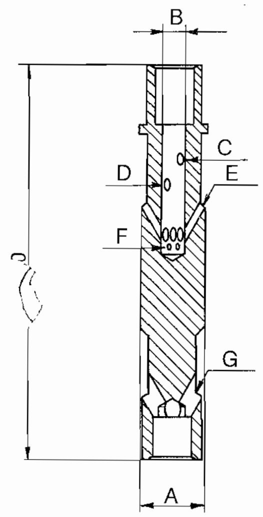
61440.515



61440.525/526

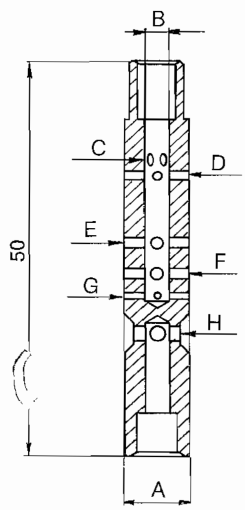
Emulsion tubes

Part number 61450.....

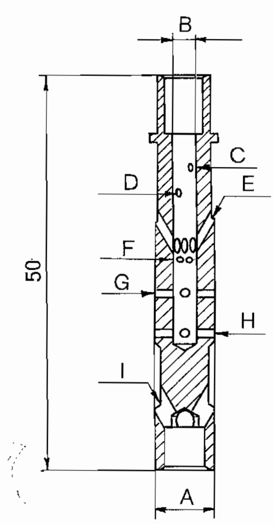


61450.026/027/028/029/
030/031/032

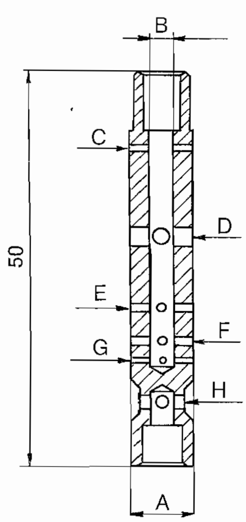
Part number	Type	mm.		Nr. holes x diameter (1/100 of mm.)							
		A	B	C	D	E	F	G	H	I	L
61450.026	F1	7,5	3	2x100	—	8x100	—	4x250			
.027	F2	7,5	3	2x100	2x100	8x100	—	4x250			
.028	F3	7,5	3	2x100	2x100	8x100	4x100	4x250			
.029	F5	7,5	3	—	2x100	8x100	4x100	4x250			
.030	F9	8,2	3	2x100	2x100	8x100	—	4x250			
.031	F11	8	3	2x100	2x100	8x100	4x100	4x250			
.032	F15	8	3	2x100	2x100	8x100	—	4x250			
61450.036	F50	8,1	3	4x110	4x110	4x100	4x100	4x80	4x200		
61450.051	F4	7,5	3	2x100	2x100	8x100	4x100	4x100	4x100	4x250	
.052	F17	6,5	3	2x100	2x100	8x100	4x100	4x100	4x100	4x250	
.053	F20	7,5	3	2x100	2x100	8x100	4x100	4x100	—	4x250	
.054	F34	7,5	4	2x100	2x100	8x100	4x100	4x100	4x100	4x250	
61450.057	F41	8,1	3	2x80	4x250	4x100	4x100	4x80	4x200		
.058	F47	8	3	2x80	4x250	4x100	4x100	4x80	4x200		
61450.071	F6	8,3	3	4x100	4x100	4x100	4x100	4x100	4x250		
61450.091	F7	7,5	3	—	8x100	4x100	4x250				
.092	F8	7,5	3	2x100	8x100	4x100	4x250				
61450.111	F10	7,5	3	4x100	8x100	4x250					



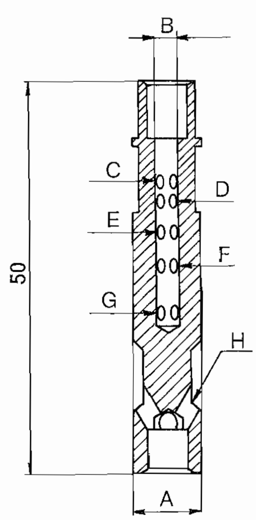
61450.036



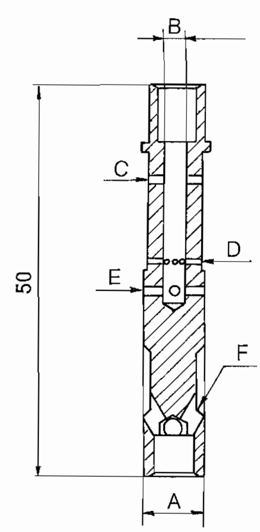
61450.051/052/053/054



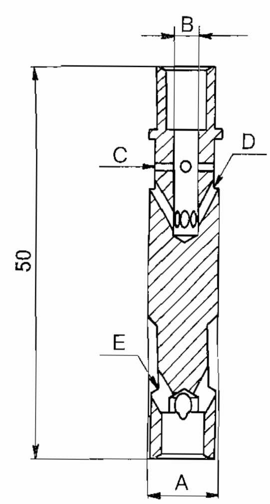
61450.057/058



61450.071



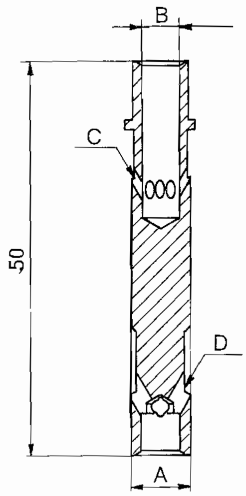
61450.091/092



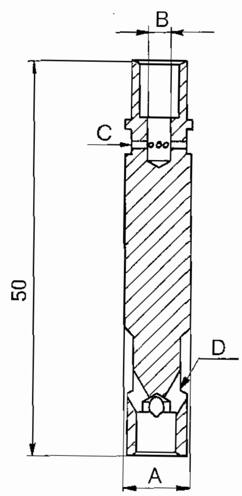
61450.111

Emulsion tubes

Part number 61450.....

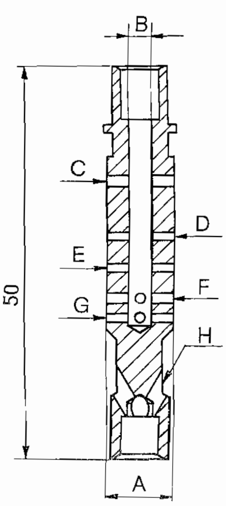


61450.131

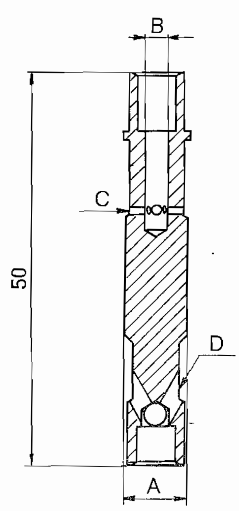


61450.166

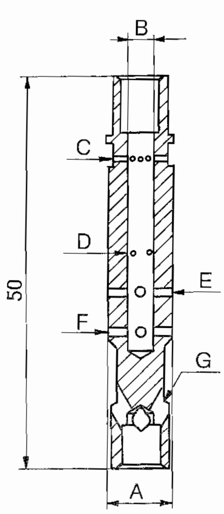
Part number	Type	mm.		Nr. holes x diameter (1/100 of mm.)							
		A	B	C	D	E	F	G	H	I	L
61450.131	F12	7,5	5	8x100	4x250						
61450.166	F14	8,2	3	8x100	4x250						
61450.167	F49	8,2	3	2x125	2x80	2x80	4x90	4x90	4x250		
61450.181	F16	8,2	3	8x100	4x250						
61450.210	F19	8,2	3,5	8x100	4x100	4x100	4x100	4x250			
61450.221	F21	5,7	3,5	4x120	4x120	4x200					
.222	F22	6	3,5	4x120	4x120	4x200					
61450.224	F24	5	3	4x150	—	4x150	—	4x200			
.226	F26	5	3	2x150	—	4x150	—	4x200			
.234	F38	5	3	2x150	2x150	4x150	4x150	4x200			



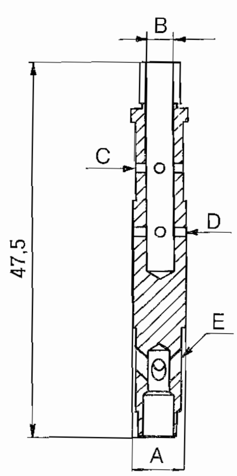
61450.167



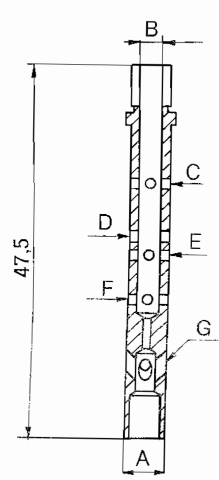
61450.181



61450.210



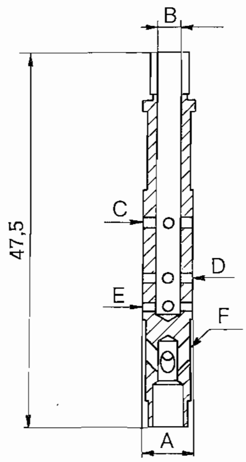
61450.221/222



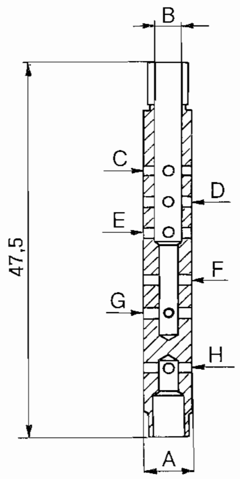
61450.224/226/234

Emulsion tubes

Part number 61450.....

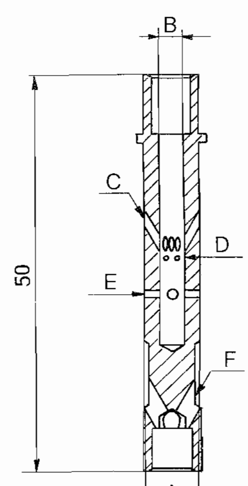


61450.225/228

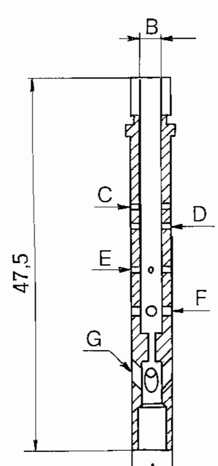


61450.227/229/232
238/241

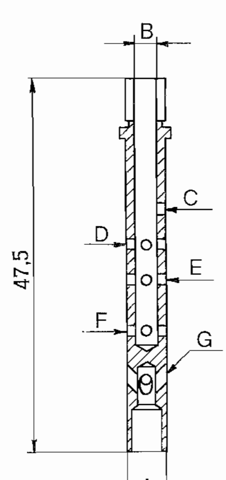
Part number	Type	mm.		Nr. holes x diameter (1/100 of mm.)							
		A	B	C	D	E	F	G	H	I	L
61450.225	F25	6	3,5	4x120	4x120	—	4x200				
.228	F28	6	3,5	4x120	4x120	4x120	4x200				
61450.227	F27	6,2	3,5	4x115	4x115	4x115	2x115	—	4x150		
.229	F30	6,2	3,5	4x140	4x140	4x115	2x115	2x115	4x150		
.232	F36	5 9	3,5	—	2x140	2x115	2x115	—	4x150		
.238	F44	5,5	3,5	4x140	4x140	4x115	2x115	2x115	4x150		
.241	F46	5,9	3,5	—	2x140	2x115	2x115	—	4x150		
61450.230	F32	7	3	8x100	4x100	4x100	4x250				
61450.231	F33	5	3	2x100	2x100	4x120	4x150	4x200			
61450.235	F39	5	3	1x150	4x150	4x150	4x150	4x200			
61450.236	F42	6,2	3,5	4x200	4x200	4x160	4x140	4x150	4x150	4x180	
61450.237	F43	6,2	3,5	4x180	4x200	4x120	4x140	4x115	2x115	4x150	



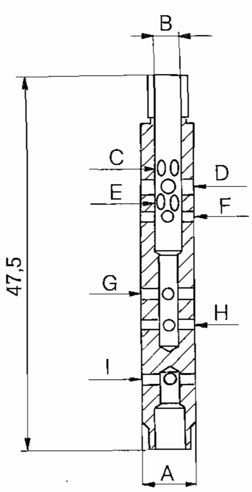
61450.230



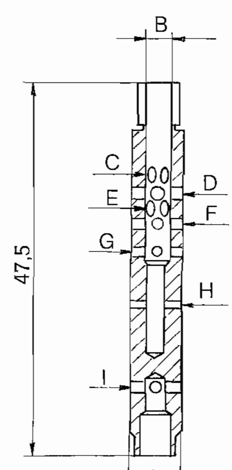
61450.231



61450.235



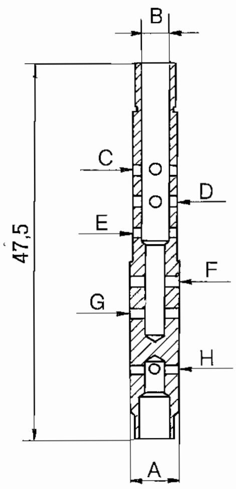
61450.236



61450.237

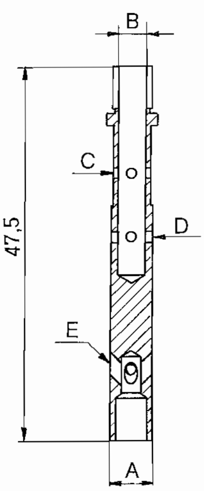
Emulsion tubes

Part number 61450.....

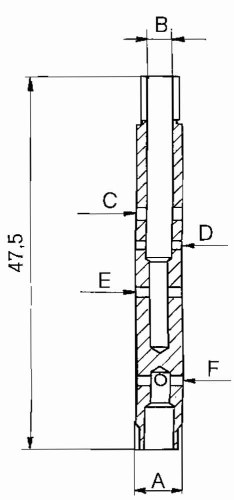


61450.239

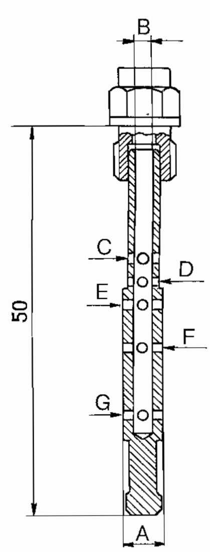
Part number	Type	mm.		Nr. holes x diameter (1/100 of mm.)							
		A	B	C	D	E	F	G	H	I	L
61450.239	F30 spec.	6,2	3,5	4x140	4x140	2x115	2x115	2x115	4x150		
61450.240	F45	5,3	3,5	4x120	4x120	4x200					
61450.242	F46 spec.	6	3,5	2x140	2x115	2x115	4x150				
Part number 61455.....											
61455.001	F4	5,25	2,5	—	4x100	—	4x100	4x125			
.002	F5	6,25	2,5	—	4x100	4x125	4x100	4x125			
.003	F6	5,25	2,5	4x125	4x100	—	4x100	4x125			
.005	F8	5,25	2,5	4x125	4x100	4x125	4x100	4x125			
.006	F9	6,25	2,5	4x125	4x100	4x125	4x100	4x125			
.007	F10	4	2,5	—	4x95	4x125	4x95	4x125			
.008	F11	4	2,5	—	4x95	4x125	—	—			
61455.031	F7	5,5	3	4x100	4x100	4x100	4x100	4x100			
61455.046	F13	5,5	3,5	4x125	4x125	4x125	4x125				
61455.061	F14	6	3,5	4x100	4x100	4x100	2x100				
.062	F18	5,5	3,5	4x125	4x125	4x100	2x100				



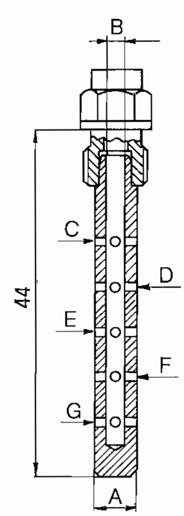
61450.240



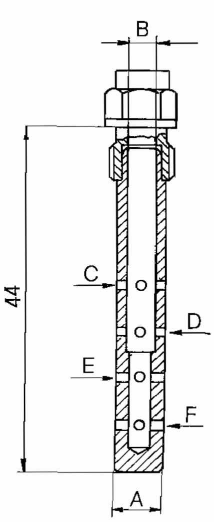
61450.242



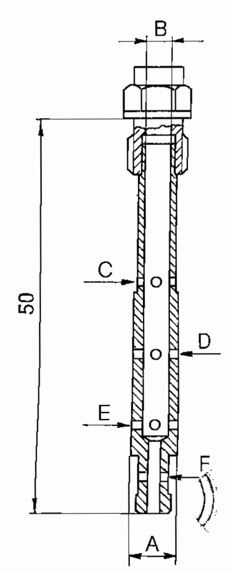
61455.001/002/003/005
006/007/008



61455.031



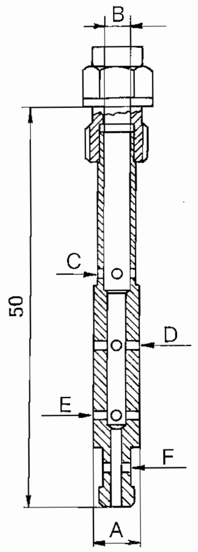
61455.046



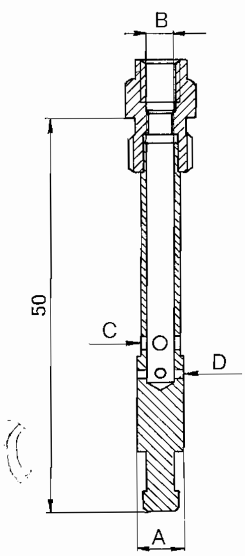
61455.061/062

Emulsion tubes

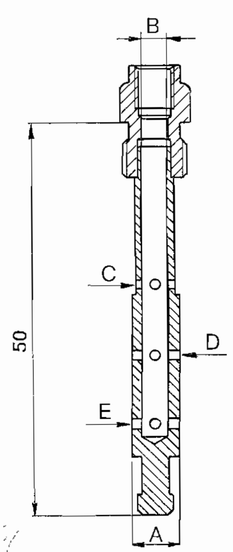
Part number	Type	mm.		Nr. holes x diameter (1/100 of mm.)							
		A	B	C	D	E	F	G	H	I	L
61455.091	F17	6	3,5	4x140	4x100	4x100	2x100				
61455.106	F19	6	3,5	4x200	4x100						
61455.121	F20	6	3,5	4x100	4x100	4x100					
61455.136	F22	6	3,5	—	4x125	4x125	4x125	4x125	4x125		
.137	F25	6	3,5	4x100	4x115	—	—	—	—		
.138	F26	5,75	3,5	—	4x125	4x125	4x125	4x125	4x125		
.139	F33	5,75	3,5	—	4x125	4x125	4x125	—	—		
61455.151	F23	5,5	3,5	2x115	2x100	2x100	2x100				
.152	F30	5,5	3,5	4x115	4x100	4x100	4x100				
61455.181	F27	5,5	3,5	2x125	2x125	4x125	4x125				
61455.196	F28	6	3,5	4x150							



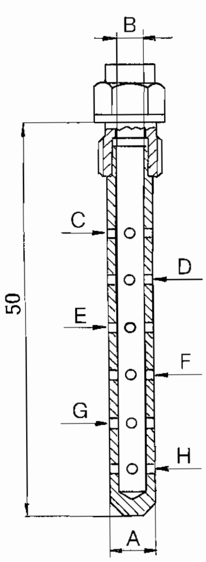
61455.091



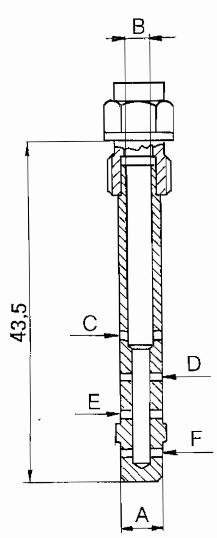
61455.106



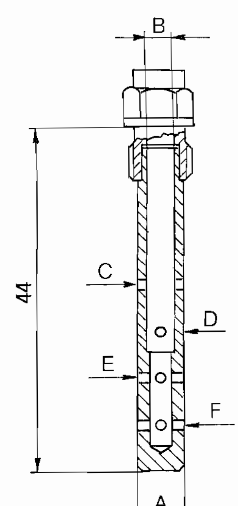
61455.121



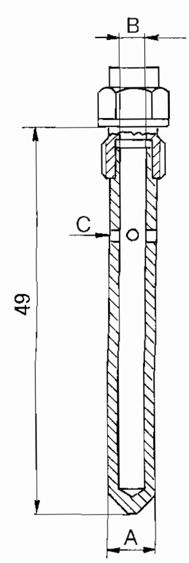
61455.136/137/
138/139



61455.151/152



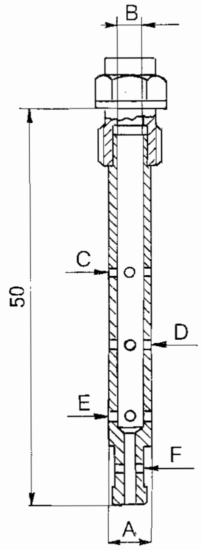
61455.181



61455.196

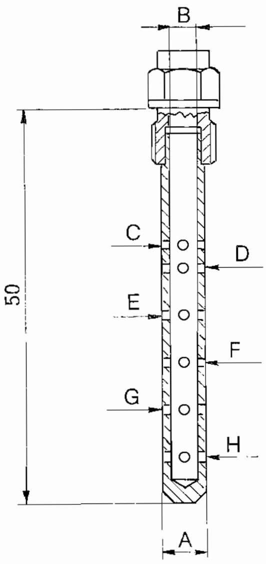
Emulsion tubes

Part number 61455.....

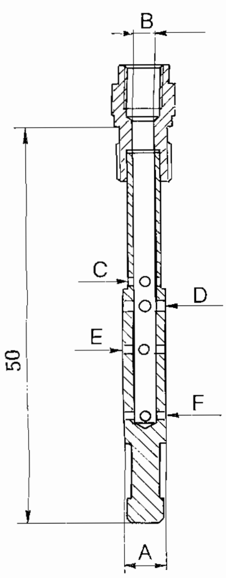


61455.211

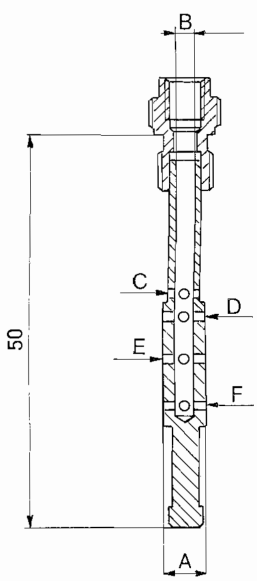
Part number	Type	mm.		Nr. holes x diameter (1/100 of mm.)							
		A	B	C	D	E	F	G	H	I	L
61455.211	F29	5	3,5	4x100	4x100	4x100	2x100				
61455.231	F31	5,5	3,5	4x125	4x125	4x125	4x125	4x125	4x125		
61455.351	F1	4,5	2,5	4x100	4x140	4x100	4x100				
.352	F2	4,75	2,5	4x100	—	4x100	4x100				
.353	F3	4	2,5	4x100	4x140	4x100	4x100				
61455.366	F16	5,35	2,5	4x100	4x100	4x100	4x100				
61455.421	F1	4,5	2,5	4x100	4x140	4x100	4x100				



61455.231



61455.351/352/353



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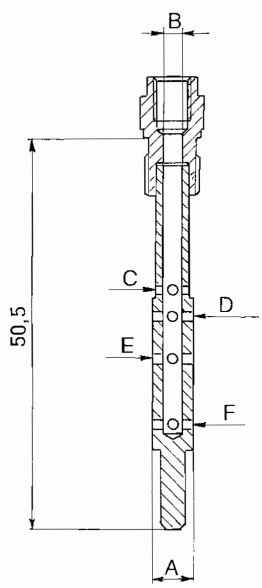


61455.421

Convertion table for « E » tubes

« F » designation	Part number	« F » designation	Part number	« F » designation	Part number
F1	61440.150	F78	61440.222	F1	61455.351/421
F2	.166/471	F80	.223	F2	.352
F3	.120/181/452	F81	.224	F3	.353
F4	.196	F82	.329	F4	.001
F5	.182	F84	.305	F5	.002
F6	.211	F85	.344	F6	.003
F7	.226	F86	.359	F7	.031
F8	.212	F87	.229	F8	.005
F9	.241			F9	.006
F10	.261	F1	61450.026	F10	.007
F11	.281	F2	.027	F11	.008
F14	.301	F3	.028	F13	.046
F15	.321	F4	.051	F14	.061
F16	.341	F5	.029	F16	.366
F17	.351	F6	.071	F17	.091
F18	.356	F7	.091	F18	.062
F20	.365	F8	.092	F19	.106
F21	.371	F9	.030	F20	.121
F23	.372	F10	.111	F22	.136
F24	.213	F11	.031	F23	.151
F25	.488	F12	.131	F25	.137
F26	.151	F14	.166	F26	.138
F29	.501	F15	.032	F27	.181
F30	.515	F16	.181	F28	.196
F33	.502	F17	.052	F29	.211
F34	.525	F19	.210	F30	.152
F35	.526	F20	.054	F31	.231
F36	.352	F21	.221	F33	.139
F40	.242	F22	.222		
F42	.243	F24	.224		
F43	.302	F25	.225		
F47	.244	F26	.226		
F48	.245	F27	.227		
F49	.153	F28	.228		
F50	.216	F30	.229		
F51	.246	**F30** (special)	.239		
F52	.323	F32	.230		
F53	.217	F33	.231		
F54	.247	F34	.054		
F56	.218	F36	.232		
F57	.219	F38	.234		
F58	.154	F39	.235		
F60	.325	F41	.057		
F61	.326	F42	.236		
F63	.155	F43	.237		
F66	.220	F44	.238		
F67	.357	F45	.240		
F68	.328	F46	.241		
F70	.197	**F46** (special)	.242		
F71	.343	F47	.058		
F73	.303	F49	.167		
F74	.304	F50	.036		
F77	.454				

AUXILIARY VENTURIS

CARB TYPE	BASIC PART NUMBER	SIZES AVAILABLE (IN MM)
28/36 DCD 36 DCD	69001	3.00, 3.50, 4.50
38/36 DHSA 32 DARA 32 DMSA	71113	3.50, 4.00
32 ADFA	70512	3.00, 3.50
32 DATRA, 32 DFTA 32 DMTR, 32 DMTRA 34 DMSA, 34 DMTR	71115	4.00, 4.50
32 DFM, 32 DIR 32/36 DFAV	71110	3.50
32/36 DGV or DGAV	71111	3.50
40 DCN Excluding 40 DCN 21	71102	3.50, 4.00, 4.50
40 DCN 21	70504	4.50
40 DCNF	71107	3.50, 4.50
40mm 3 BBL Carburetors	71103	3.50, 4.50
40 IDF 13, 15	69002	4.00, 4.50
40 IDF 19	69011	3.00
42 DCNF, 44 DCNF	70503	3.50, 4.00, 4.50
44 IDF	71102	3.50, 4.00, 4.50
46mm 3 BBL Carbs	71104	4.50, 5.00
48 IDA	69009	3.50, 4.00, 4.50, 5.00
48 IDF	71124	3.00, 3.50, 4.00, 4.50, 5.00

AUXILIARY VENTURIS FOR DCOE CARBURETORS

CARB TYPE	BASIC PART NUMBER	SIZES AVAILABLE (IN MM)
40 DCOE	70001 70003 70005	3.50, 4.50 Without air horns 3.50, 4.50 With air horns 4.50 Extended type with air horns
42 DCOE	70002	3.50, 4.50 With air horns
45 DCOE	70002 69904	3.50, 4.50 With air horns 4.50 Without air horns
48 DCOE	68819	4.50, 5.00 With air horns

CHOKES (MAIN VENTURIS)

CARB TYPE	BASIC PART NUMBER	SIZES AVAILABLE (IN MM)
28/36 DCD (Primary BBL)	71702	18, 19, 20, 21, 22, 23, 24, 25, 26
28/36 DCD (Secondary BBL) 36 DCD	71701	19, 20, 21, 22, 23, 24, 25, 26, 27, 28
40 DCN, 40 DCNF	72129	24, 25, 26, 28, 29, 30, 31, 32, 33, 34, 35, 36
40 DCOE	72303	24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36
40 IDA 3 BBL 40 IDT 3 BBL 40 IDTP 3BBL	71502	30, 32, 34
40 IDL 3BBL 40 IDS 3BBL	71505	27, 32
40 IDF 13, 15, 19	71506	27, 28, 30, 32
42 DCNF	72106	32, 34, 36
42 DCOE	72304	24, 25, 26, 27, 29, 30, 31, 32, 33, 34
44 DCNF	72108	34, 36, 37, 38
44 IDF	71507	32, 34, 36
45 DCOE	72110	28, 30, 32, 33, 34, 35, 36, 37, 38, 39, 40
46 IDA 3 BBL	71504	40, 42
48 DCOE	72117	40, 41, 42
48 IDA	72128	36, 37, 38, 39, 40, 41, 42, 43, 44, 45
48 IDF	71513	40, 41

MAIN JETS

CARB TYPE	BASIC PART NUMBER	SIZES AVAILABLE (IN MM)
DCO, DCOE, DCNL, IDF and 48 IDA	73401	0.80, 0.85, 0.90, 0.95, 1.00, 1.05, 1.07, 1.10, 1.12, 1.15, 1.17, 1.20, 1.22, 1.25, 1.30, 1.32, 1.35, 1.40, 1.42, 1.45, 1.50, 1.55, 1.60, 1.65, 1.70, 1.75, 1.80, 1.85, 1.90, 1.95, 2.00, 2.05, 2.10, 2.15, 2.20, 2.25, 2.30, 2.35, 2.40, 2.45, 2.50, 2.60, 2.90
DCNF, DATRA, DFTA DMTRA, DMTR	73405	0.90, 0.95, 0.97, 1.00, 1.02, 1.05, 1.07, 1.10, 1.12, 1.15, 1.17, 1.20, 1.25, 1.27, 1.30, 1.35, 1.40, 1.45, 1.50, 1.55, 1.60, 1.65, 1.70, 1.75, 1.80, 1.85, 1.90, 1.95, 2.00
ADFA, DARA, DCD, DIR, DFM, DGV DMSA, DCN, DCZ DIC, DICA, DHSA DFI, DGAV, DFAV and 3 BBL CARBURETORS	73801	0.40, 0.45, 0.50, 0.60, 0.65, 0.70, 0.75, 0.80, 0.82, 0.85, 0.87, 0.90, 0.95, 0.97, 1.00, 1.02, 1.03, 1.05, 1.07, 1.10, 1.12, 1.15, 1.17, 1.20, 1.22, 1.25, 1.27, 1.30, 1.32, 1.35, 1.37, 1.40, 1.42, 1.45, 1.47, 1.50, 1.52, 1.55, 1.57, 1.60, 1.62, 1.65, 1.70, 1.75, 1.80, 1.85, 1.90, 1.95, 2.00, 2.05, 2.10, 2.15, 2.20, 2.30

6) Idle jet - Figs. 37 and 38

Two widely used arrangements are illustrated in **Figs. 37** and **38**: the first shows a DCOE series carburetor with idle jet of the type incorporating the idle air jet; in the second, this air jet is separate. The idle jet belonging to the adjustment setting being considered here, has a diameter of **0.50 mm** and designation **50 F11.** Following is a tabulation showing — next to every **F designation** — the respective and equivalent air jet diameter.

Idle speed fuel jet table

	Idle speed air jet dia., in mm.	F Code
	0,70	F6
	0,90	F12
	1,00	F9
More common	1,20	F8-F11-F14
More common	1,30	F13
More common	1,40	F2-F4
More common	1,60	F5
More common	1,70	F7
	2,00	F1
	2,30	F3

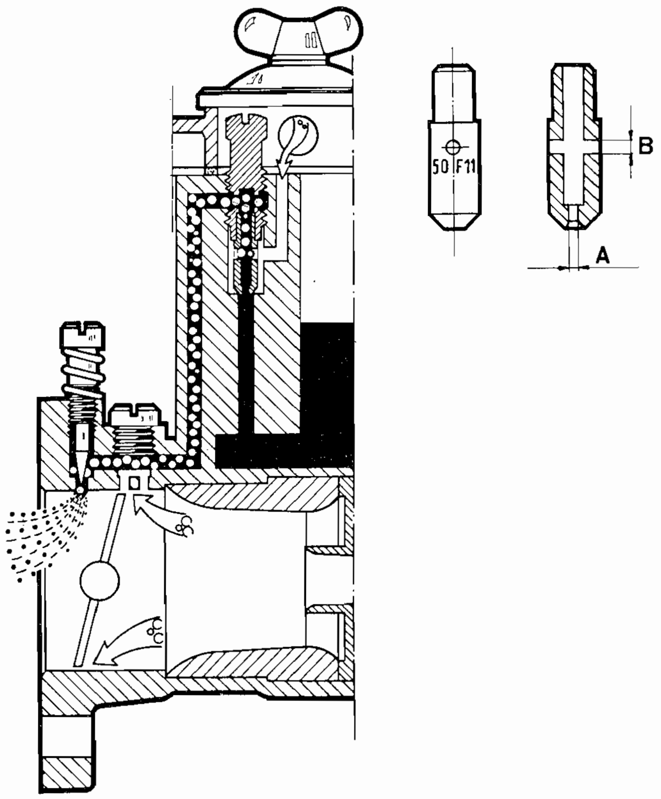


FIG. 37
Idle jet - Shown here is the idle speed circuit and fuel jet for the DCOE series carburetors, with air jet **(dimension B)** incorporated in fuel jet **(dimension A)**.
This is an example of idle speed system fed from float chamber.

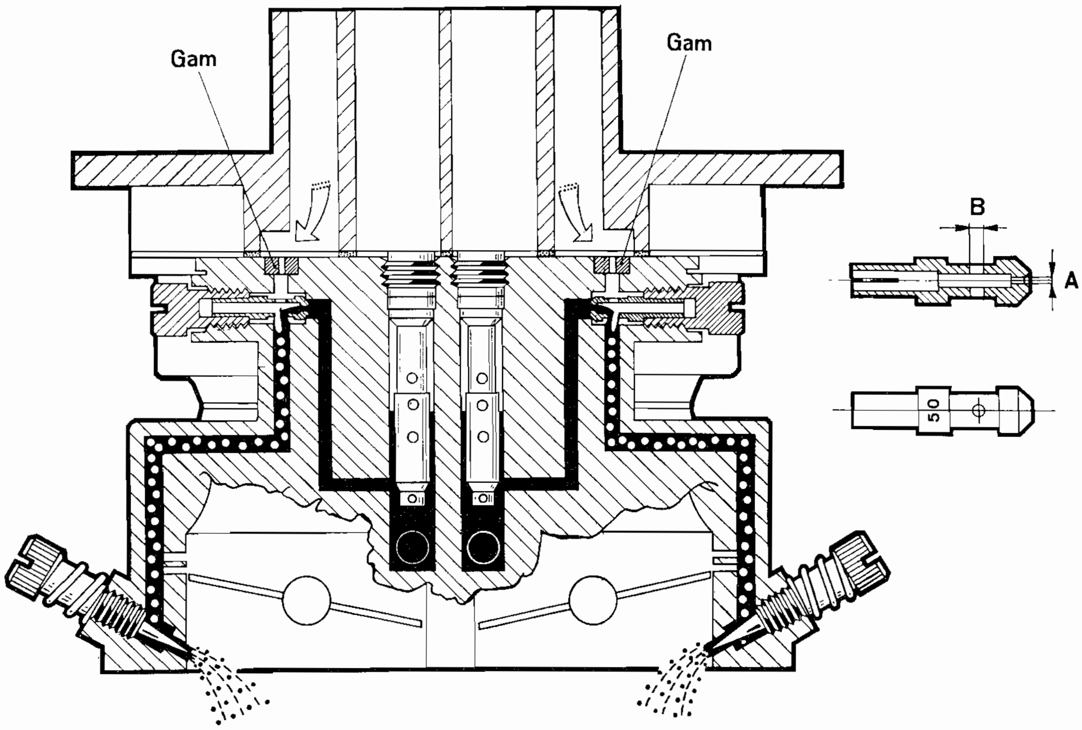
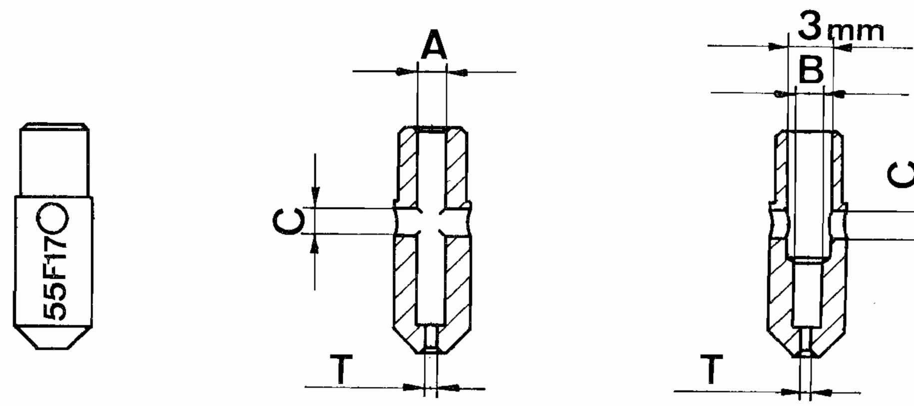


Fig. 38
Idle jet - As shown here, this jet is separate from the idle air jet **Gam**; dimension **B** is not a calibrated value.
This is an example of idle speed system fed from emulsion tube well.

CARB TYPE	BASIC PART NUMBER	SIZES AVAILABLE (IN MM)
IDLE JETS		
28/36 DCB-DCD, DCHE, ICF ICP, IMB, IMPE, 36 DCD 40 DCN, DCZ	74401	0.40, 0.45, 0.47, 0.50, 0.55, 0.60, 0.65, 0.70, 0.75, 0.80, 0.90, 0.95, 1.00, 1.20, 1.25
ADC, ADF ADFA, ADL, ADLA ADLD, DAC, DAR, DARA, DAT DATA, DATR, DATRA, DCOF, DFC DFD, DFE, DFM, DFV, DFT, DFAV DFTA, DGV, DGAV, DGAR, DGAS DHS, DHSA, DHTA, DIC, DICA DMS, DMSA, DMTR, DMTRA, DPS IBA, ICEV, IDAP, ICB, ICR, IDT 3 BBL Carburetors	74403	0.00, 0.40, 0.42, 0.45, 0.47, 0.50, 0.52, 0.55, 0.57, 0.60, 0.65, 0.70, 0.75, 0.80, 0.85, 0.90, 0.95, 1.00
28/36 DM-DMA, DCA DCNF, DCNFA, DCNV, DCNVH, IDF	74405	0.40, 0.42, 0.45, 0.47, 0.50, 0.52, 0.55, 0.57, 0.60, 0.65, 0.70
ADF, ADS, DIR	74407	0.40, 0.45, 0.50, 0.55
ADF, ADSD, DIR, DMS	74408	0.45, 0.47, 0.50, 0.55
ADFA, ADL, ADLA, ADHA DARA, DGF, DGAR, DGS, DIR DPS, IBSA, IBSH, IBP, ICH	74409	0.40, 0.42, 0.45, 0.47, 0.50, 0.52, 0.55, 0.57, 0.60
48 IDA (idle jet)	74823	0,40, 0.45, 0.50, 0.55, 0.60, 0.65, 0.70, 0.75, 0.80
48 IDA (idle jet holder)	77903	0.60, 1.00, 1.10, 1.20, 1.25, 1.50

Idle jets for DCOE series carburetors



Basic Part Number	Type	A	B	C		T
		Ø (mm.)	Ø (mm.)	Nr. holes	Ø (mm.)	Sizes available (in mm.)
74814. . . .	F 1	1,40		2	1,40	0.00, 0.30, 0.35, 0.40, 0.45, 0,50, 0.52, 0.55, 0.60, 0.65, 0,70, 0,75, 0.80, 0.85, 0.90, 0,95, 1.00, 1.10, 1.20, 1.30, 1.35, 1.40, 1.50, 1.60, 1.70
74815. . . .	F 2	1,50		1	1,40	
74816. . . .	F 3	1,40		2	1,60	
74817. . . .	F 4	2,00		1	1,40	
74818. . . .	F 5	1,40		1	1,60	
74819. . . .	F 6	2,00		1	0,70	
74820. . . .	F 7	2,00		2	1,20	
74821. . . .	F 8	2,00		1	1,20	
74822. . . .	F 9	2,00		1	1,00	
74824. . . .	F 11	1,50		1	1,20	
74825. . . .	F 12	1,50		1	0,90	
74826. . . .	F 13	2,00		2	0,90	
74827. . . .	F 14	1,70		1	1,20	
74828. . . .	F 15	2,00		2	1,05	
74829. . . .	F 16	2,10		2	1,30	
74830. . . .	F 17		2,10	2	1,35	0.00, 0.45, 0.47, 0.50, 0.55, 0.57, 0.59
74831. . . .	F 18		2,10	2	1,60	
74832. . . .	F 19		2,00	1	1,20	
74833. . . .	F 21		2,10	4	1,10	
74834. . . .	F 22		2,10	4	1,20	
74835. . . .	F 23		2,00	1	1,25	
74836. . . .	F 24		2,00	1	1,55	
74837. . . .	F 25		2,00	1	1,50	
74838. . . .	F 26		2,00	2	1,25	
74839. . . .	F 27		2,00	1	1,60	

CARB TYPE	BASIC PART NUMBER	SIZES AVAILABLE (IN MM)

ACCELERATION PUMP JETS

CARB TYPE	BASIC PART NUMBER	SIZES AVAILABLE (IN MM)
40 IDA 3 BBL 40 IDL 3 BBL 46 IDA 3 BBL	76201	0.40, 0.45, 0.50, 0,60
40 IDT 3 BBL 40 IDTP 3 BBL 40 IF3C 3 BBL	76202	0.40, 0.50
36/36 DCD, 36 DCD	76203	0.40, 0.45, 0.50, 0.55, 0.60, 0.65, 0.70, 0.80 Pump operates on primary BBL only
IDF Series	76210	0.35, 0.40, 0.50, 0.55
32/36 DFAV, 32 DFM, DIR, DFE DFD, DHSA, DMSA, ADSD, ADSA	76211	0.40, 0.45, 0.50, 0.55, 0.60, 0.65, 0.70
40 DFAV, DFI, DGAS	76212	0.40, 0.45, 0.50, 0.55, 0.60, 0.70
40 DCN or DCNF Series	76215	0.35, 0.40, 0.45, 0.50, 0.55, 0.60, 0.65, 0.70
32/36 DGAV & DGV	76226	0.50 (For alternative sizes use 76212 with secondary barrel pump orifice blocked)
32 DIR, DAR, DARA	76227	0.50, 0.60
48 IDA	76402	0.35, 0.50, 0.60, 0.70
ADF, ADFA, DMTR, DMTRA, DFT DGF, DATR, DATRA, DFTA, ICH 32/34 DMTC	76407	0.40, 0.45, 0.50, 0.55
DCOE	76801	0.30, 0.35, 0.40, 0.45, 0.50, 0.55, 0.60, 0.65, 0.70, 0.75, 0.85, 0.90

AIR CORRECTION JETS

CARB TYPE	BASIC PART NUMBER	SIZES AVAILABLE (IN MM)
ADF, ADFA, DHSA, DFM, ADHA ADSD, ADL, ADC, ADS, DGV DGAV, DFAV, DARA, DAR, DAC DMSA, DCN, DIR, DFD DFE, IBA, IBSA, ICF, IBP, IMB DIC, DICA, DFI, DCOF, DFC, DGS DHSA, OC, 3 BBL CARBURETORS	77201	1.00, 1.10, 1.15, 1.20, 1.25, 1.30, 1.35, 1.40, 1.45, 1.50, 1.55, 1.60, 1.65, 1.70, 1.75, 1.80, 1.85, 1.90, 1.95, 2.00, 2.05, 2.10, 2.15, 2.20, 2.25, 2.30, 2.35, 2.40, 2.45, 2.50, 2.55, 2.60, 2.65, 2.70, 2.80
DCO, DCNL, DCOE IDA, IDF	77401	0.80, 0.85, 0.90, 0.95, 1.00, 1.05, 1.10, 1.15, 1.20, 1.25, 1.30, 1.35, 1.40, 1.45, 1.50, 1.55, 1.60, 1.65, 1.70, 1.75, 1.80, 1.85, 1.90, 1.95, 2.00, 2.05, 2.10, 2.15, 2.20, 2.25, 2.30, 2.35, 2.40, 2.50
DCNF, DMTRA, DATRA DFTA, DMTR	77501	1.00, 1.20, 1.30, 1.35, 1.40, 1.45, 1.50, 1.55, 1.60, 1.65, 1.70, 1.75 1.80, 1.85, 1.90, 1.95, 2.00, 2.05, 2.10, 2.15, 2.20, 2.30, 2.40, 2.50
28/36-36 DCD, DCZ - 28/36 DCB, DCHE	77502	1.00, 1.05, 1.15, 1.20, 1.25, 1.30, 1.40, 1.45, 1.50, 1.55, 1.60, 1.65, 1.70, 1.75, 1.80, 1.85, 1.90, 1.95, 2.00, 2.05, 2.10, 2.15, 2.20, 2.25, 2.30, 2.35, 2.40, 2.45, 2.50, 2.55, 2.60, 2.65, 2.70, 2.75, 2.80, 2.85, 2.90, 2.95, 3.00

NEEDLE VALVES

CARB TYPE	BASIC PART NUMBER	SIZES AVAILABLE (IN MM)
DCOE (Solid Type)	79401	1.50, 1.75, 2.00, 2.25, 2.50, 3.00
DCO	79502	1.75
DCN-DCOE (Spring Loaded)	79503	1.50, 1.75, 2.00, 2.25, 2.50, 3.00
46 and 48 IDA (2 BBL)	79504	1.75, 2.00, 2.50, 3.00
DHSA, DCD, DIC, DICA ICA, ICF, DARA, DATRA DMTR, DMTRA, DFD DFM, DMSA, DATR, DCOF DHTA, DFC, DATC, DMTC DCOE, DGF, DGS, IBA, IBSA IBSH, IBP, IBR, ICB, ICR, ICEV ICE, ICF, ICH, ICP, ICT, OF	79507	1.50, 1.75, 2.00, 2.25
40 & 46mm 3 Barrel Carburetors	79508	1.75, 2.00
ADFA, DIR, DFM	79510	1.50, 1.75, 2.00, 2.50
IDF	79511	1.50, 1.75, 2.00, 2.50
DFI	79512	1.75
DCN & DCNF	79514	1.50, 1.75, 2.00
32/36-40 DFAV	79515	2.00, 2.50
32/36 DFAV 28/30-32/36 DGV 32-32/36 DGAV 32/36 DAC	79516	1.75, 2.00, 2.50

In the case of adjustment settings in which the idle fuel jet is separate from the idle air jet, only the value in mm of the latter jet is specified. The idle fuel jet diameter is usually included between **0.40** and **0.70 mm**: this jet strongly affects the idle speed mixture metering and the entire transition (or progression) stage. The idle air jet, instead, comes into play on the higher side of the transition period. By transition stage is intended the carburetor operation range that starts from the idle speed rate and ends slightly beyond the point of main circuit priming.

Idle speed circuit feed - Generally, in applications where a single carburetor barrel feeds two or more engine cylinders, the idle speed circuit receives its fuel supply from the main well, in a location between the main fuel jet and the lower end of the emulsion tube (**Fig. 38**). In sports engine applications where each carburetor barrel feeds a single cylinder, the part-load operation mixture tends to be weak; thus, the idle speed circuit receives its fuel supply directly from the constant-level float chamber (**Fig. 37**), in the majority of cases. In some applications, designers prefer a compound system in which the idle jet is fed simultaneously from both the float chamber and the well.

Engine idle speed rate adjustments

This brief description must be completed by the more detailed instructions outlined on page 54 under **Part Three.**

The engine must be connected to a revolution counter and be running at rated operation temperature. Engine idle speed rpm is set by a **speed rate adjusting screw** to the value specified by the Manufacturer: between **600-800 rpm** for touring car engines and about **1000 rpm or more** for sports car engines.

First, turn **in** or out slowly the idle **mixture adjusting screw** to find the position in which it gives the highest possible rpm rate. If the speed must be reduced to the previous mentioned rates, operate on the **speed adjusting screw**, then check again for proper metering by the **mixture adjusting screw.** Idle speed mixture is correct when the engine runs smoothly and upon turning in or out the mixture screw — that is, weakening or enriching the mixture strength — the rpm rate drops and becomes erratic.

Transition (or progression) stage check - Once the idle speed rate is properly set, increase engine rpm rate by the speed adjusting screw up to the point at which the mixture is about to issue from the auxiliary Venturi spray tube (say, 300 rpm above idle rate): now, check for correct metering by turning slowly in or out the mixture adjusting screw. If by **screwing in** the speed increases it means that progression is **rich** while it is **weak** if the mixture screw must be **backed out** (open) to obtain a speed increase: progression will instead be correct if by turning the mixture adjusting screw **either way** the rpm rate will drop. From the results of this check, the transition stage may be enriched by increasing the idle fuel jet diameter or by reducing the idle air jet diameter. It is off course possible to weaken the transition stage by proceeding in the opposite way.

Sometimes it may prove necessary to re-locate the transition orifice with respect to the throttle valve edge, for instance, when a carburetor servicing includes polishing of the barrel and throttle valve replacement. Such condition is illustrated in **Figs. 39** and **40.** In **Fig. 39-A** the transition orifice is blanked out by the throttle plate edge set in idle speed position as it should be for correct operation.

In **Fig. 39-B** the transition orifice results offset upwards (upstream of throttle) and though idle speed operation is quite smooth, « **flat spots** » will be experienced as soon as the throttle begins to open, owing to an excessively weak mixture. In fact, in this case the orifice is acted upon too late by the depression existing beneath the throttle plate.

In **Fig. 39-C** the transition orifice is offset down-

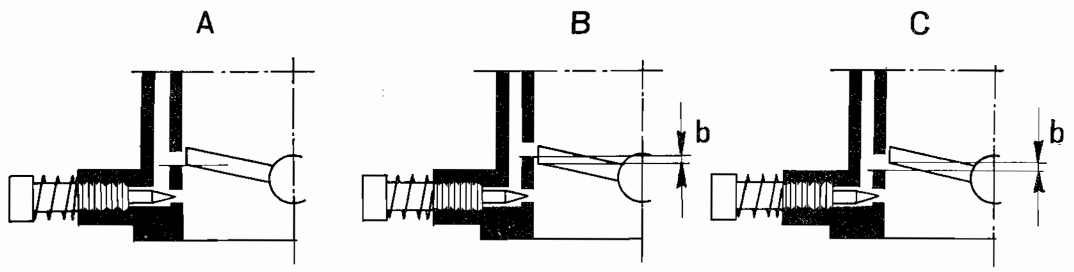


FIG. 39

Transition orifice location with respect to the edge of the throttle set for idle speed operation.
A correct location - **B** location offset upstream resulting in a **positive** head **b** - **C** location offset downstream resulting in a **negative** head **b.**

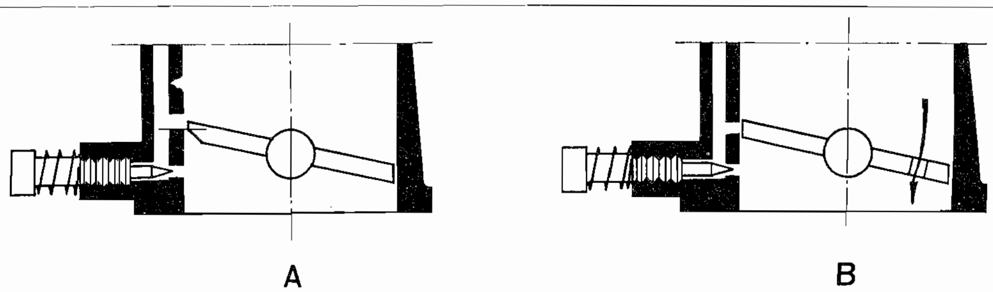


FIG. 40

To **advance** transition orifice action, a slight chamfer is cut in throttle plate (**see A**) whereas to **retard** this action a small hole is drilled through the throttle plate (**see B**).

wards (downstream of throttle) and idle speed operation is quite « rough » owing to an excessively rich mixture even with mixture adjusting screw tightened in fully (closed), as the supply from the transition orifice is too generous.
The remedial actions for such conditions are:

— case of **Fig. 39-B** - by trial and error cut a chamfer in throttle plate edge as shown in **Fig. 40-A.**

– case of **Fig. 39-C** - drill a hole in throttle plate, on the side opposite the transition orifice, so that part of the air drawn in by the engine will flow through, thus allowing the throttle valve to remain closed, as shown in **Fig. 40-B**. Initially, this hole should have a diameter of 0.7 mm and may be increased gradually up to **1.2 - 1.5 mm**, as required, but **never** to a diameter that would cause the throttle plate to blank out the barrel completely.
The above procedures serve to remedy slight faults and it is not possible to describe here other corrective measures such as variations in transition orifice location or diameter.
Weber throttle valve plates are stamp-marked with a value representing the lowest angle in degrees existing between closed throttle and barrel centerline — usually **78°** or **85°** — to prevent any replacement errors.

7-8-9) Accelerating pump jet and drain Figs. 41 and 42

The main features of accelerating pump operation are the amount of fuel injected at each stroke and the promptness and duration of each injection. When tuning up for proper adjustment settings, the pump jet and drain diameters are determined by trying to minimize, as far as practicable, the amount of fuel injected. Often, also the direction of the fuel spray proves to be a signficant factor. Generally, when engine operates at high rpm rates the pump jet (diameter between 0.35 and 1 mm) is subject to a vacuum sufficient to produce an uninterrupted flow of fuel, that is, it performs as a **high speed jet** and its role falls under the adjustment setting data.
If the pump supply ceases, « faltering » accelerations will result with « poppings » in carburetor, followed by possible stopping of the engine. Instead, if the pump supply is excessive, acceleration will still falter and an emission of black smoke at the exhaust will mark each acceleration.

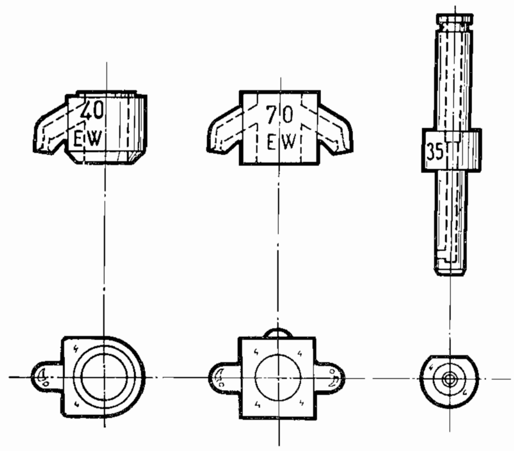


FIG. 41
Accelerating pump jet - Right: the DCOE series carburetor jet.

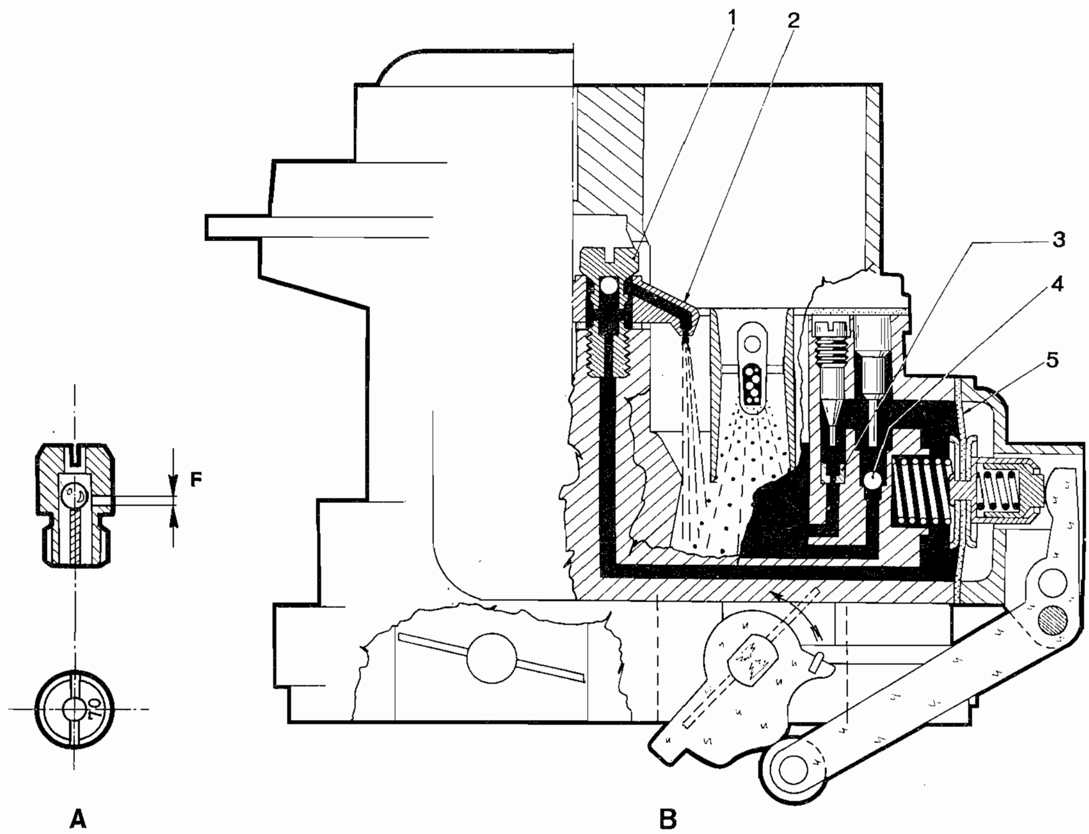


Fig. 42 - A and B
In **A** the pump jet is incorporated in the intake valve assembly and the diameter of drain **F** is marked on the part. In **B** the pump jet is of the separate type - **1** Pump delivery valve - **2** Pump jet - **3** Pump drain - **4** Pump intake valve - **5** Pump diaphragm.

The pump drain jet **(Fig. 42)** which may also be of the type incorporated in intake valve assembly, is selected in one of the following two settings :

— **Closed,** for maximum amount of injected fuel and maximum promptness.

— **Open,** with **0.35** to **1.5 mm** bore, to reduce the amount of fuel and to slightly retard promptnes.

Using some special provisions it is possible to measure the amount of fuel injected by the pump at every throttle opening: for the adjustment setting considered here, the value in **cc** referred to a single barrel is tabulated on **page 20.**

10) Choke jet - Fig. 43-A

The DCOE series carburetor is provided with an easy starting device (choke) of the progressive-action type consisting of two separate circuits (one to each barrel) in which two manually operated plungers govern the mixture rating.

The choke jet — which often incorporates th emulsion jet and the air jet — may have a dia

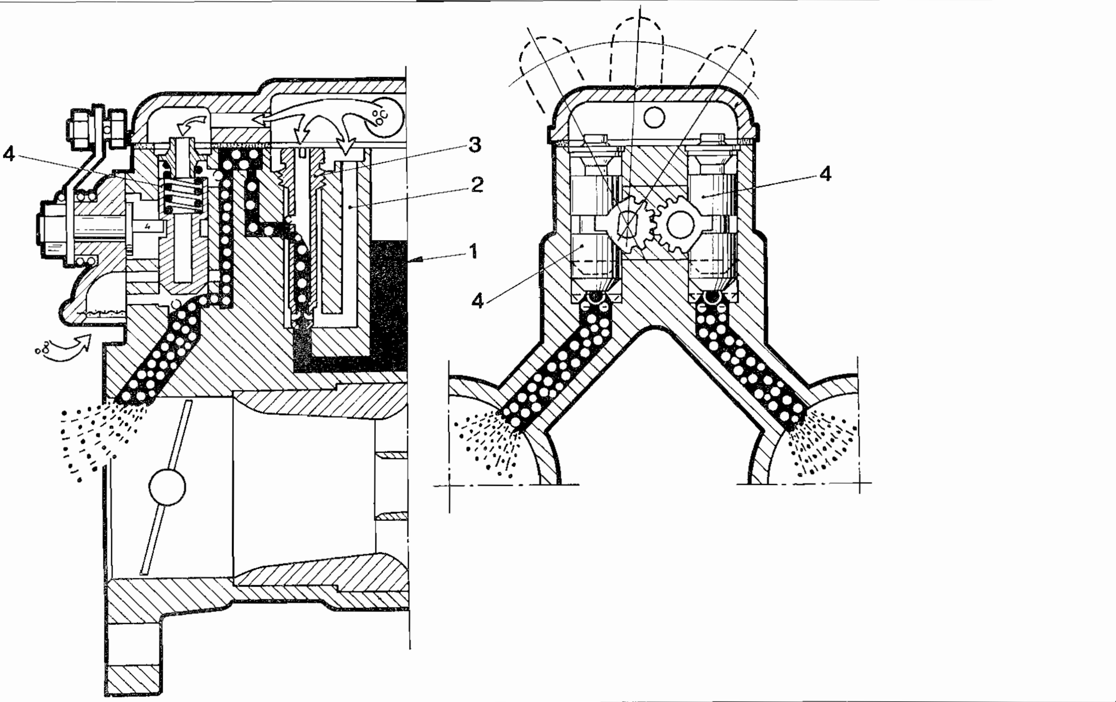


FIG. 43-A
Shows the DCOE series carburetor choke system and jet.
1 Constant-level float chamber or bowl - **2** Starting fuel reserve well - **3** Choke jet of the type with incorporated emulsion tube and a jet - **4** Plunger valve.

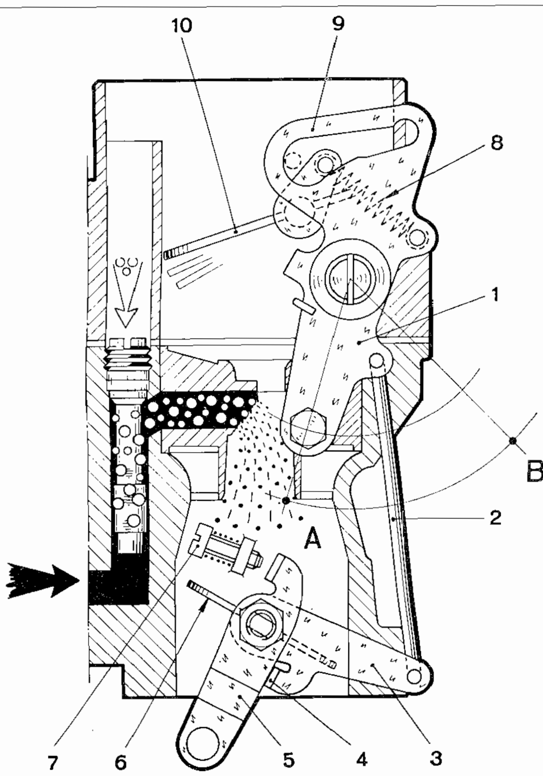


FIG. 43-B
Shows an offset shutter (or strangler) valve choke system - Position **A** Device IN; position **B** - Device OUT.
1 Control lever - **2** Rod controlling the opening of throttle **6** at fast idle, through idle lever **3**, lug **4** and lever **5** - **7** Idle speed adjusting screw - **8** Calibrated starting spring - **9** Stop limiting the opening of shutter valve **10.**

meter included between **0.60** and **2 mm**, thus permitting a wide range of possible adjustments to cope with different engines and starting temperatures. An increase in choke fuel jet bore enrichens the mixture over the entire operation range whereas any variation of the choke air jet is more influential once engine is started and during its warm-up period: the setting of the choke system involves several provisions such as the fuel reserve well, the arrangement of blanking element and its intervening action adjustment, a special valve for leaning out the mixture once engine is started, etc., all of which may vary from one carburetor to another.

Offset shutter valve choke - Fig. 43-B - shows a manually-controlled starting circuit of the offset shutter (or strangler) valve type. The more significant factors for adjustment settings, and referred to the choke-IN condition, are:

— **Opening** of the main throttle, known as the **fast-idle** setting: increases the idle speed rate of the engine once it has started and runs through the warm-up stage.

— **Calibrated starting spring:** it is essential to establish the mixture metering needed through the choke-IN stage.

— **Stopping** of the shutter valve opening to ensur appropriate meterings during warm-up at large main throttle openings.

Make sure the shutter (or strangler) valve moves freely without any binding caused by distortions, wear or dirt: for a correct adjustment of the manual control — a very important operation to prevent starting or idle speed rate difficulties — **refer to the instructions given on page 53 under Part Three.**

11-12) Needle valve

Through the needle valve the float regulates the admission of fuel into the bowl to keep the level constant independently of the variable engine requirements.

Level maintenance is improved by adopting needle valves having the smallest diameter that still provides the fuel supply necessary for engine operation at its highest power rating.

One of the more commonly adopted diameters is **1.50 mm** which is capable of supplying **25-30 liters per hour** of fuel if pressure ranges between **0.15** and **0.20 kg/sq.cm (2.1 - 2.8 psi)**: larger sizes are used for higher fuel consumption rates and fuels containing alcohols.

The needle taper point and seat are finished and checked as a pair and are not interchangeable with the respective parts of other valves. The needle valve is often damaged by engine vibrations and car motions if the float chamber is empty (LPG feed systems); in the case of sports cars transported on trucks, carburetor bowls should be filled with thin engine oil for proper protection.

13) Fuel level in float chamber or bowl - Figs. 44-45

The fuel height in bowl must be kept at a **lower level** with respect to the spray nozzle bore: this prevents fuel emissions when engine is inoperative and car inclined. The level may be set at a height of **less** than **5-6 mm** below nozzle bottom edge, depending on the type of carburetor and the performance required of the vehicle.

Fuel level variations have greater influence during accelerations, idle speed and part-load/low rpm operation, with particularly marked effects in sports car applications. The Catalog Data Sheet of each carburetor provides the necessary instructions for a correct level check which is performed as follows:

a) by a special gauge rod **C** - **Fig. 44** - taking care not to push in the ball of the spring-dampened valve. Usually, the cover gasket is removed if **to do this it is unnecessary** to take out the float; otherwise, check with gasket tight on cover held vertical.

b) Inside the well, after having removed the air jet and emulsion tube, by a Vernier caliper **1** and flash-light **6**, as shown in **Fig. 45.**

When the end of the gauge rod comes into contact with the fuel in the well it causes a sudden change in the reflected light thus giving a clear indication of the level measurement. This check is possible on almost all sports car carburetors which are often fed by an electric pump which turns out to be extremely useful on this occasion.

Check the float maximum lowering position: the needle must travel a distance equivalent to slightly more than the diameter value (in mm) stamped on its seat. If any correction is needed, bend delicately the two tongue plates located in proximity of the fulcrum pin.

14) Float - weight

In the case of the adjustment setting being considered here, the weight is **26 grams** because the float is double: the weight in grams is stamped on the tongue plate or float itself and **is an adjustment setting** specification for it is one of the factors establishing the fuel level in bowl. The metal float is delicate as it is made of **0.16-0.20 mm** thick sheet: for this reason, **absolutely avoid** blowing compressed air into the float chamber or fuel inlet port when float is installed in its place. The free and unimpeded movement of the float in chamber is a design requirement.

15) Flared air horn extensions - Fig. 45

They are necessary in sports car applications where quite frequently no air cleaner is provided. Their purpose is to:

— **Improve** cylinder charging.

— **Limit** dispersions due to mixture « rejections ».

— **Carry** the flame trap.

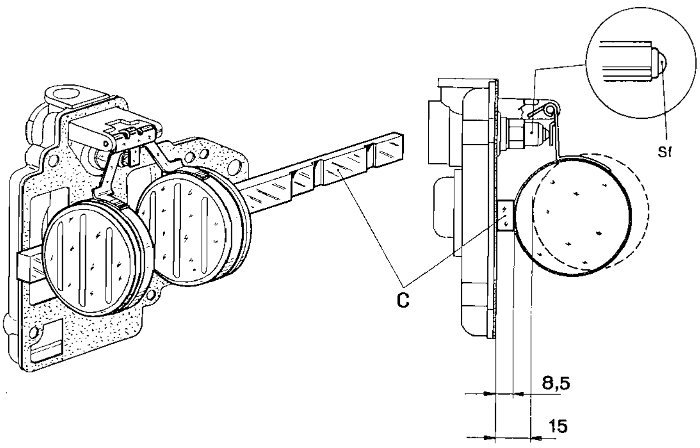


FIG. 44
Fuel level geometrical checks - 40 DCOE 2 type carburetor - C Weber gauge - **Sf** Valve damper ball.

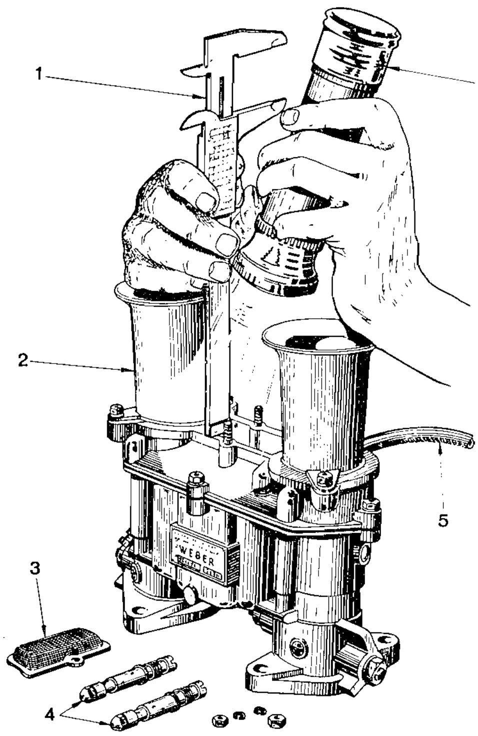


FIG. 45
Fuel level hydraulic checks - 48 IDA type carburetor - **1** Vernier caliper - **2** Flared air horn extension (or additional air intake) **3** Strainer - **4** Main calibrated parts - **5** Fuel arrival line - **6** Flashlight.

PART THREE Installation and Checks on Engine - Adaptations

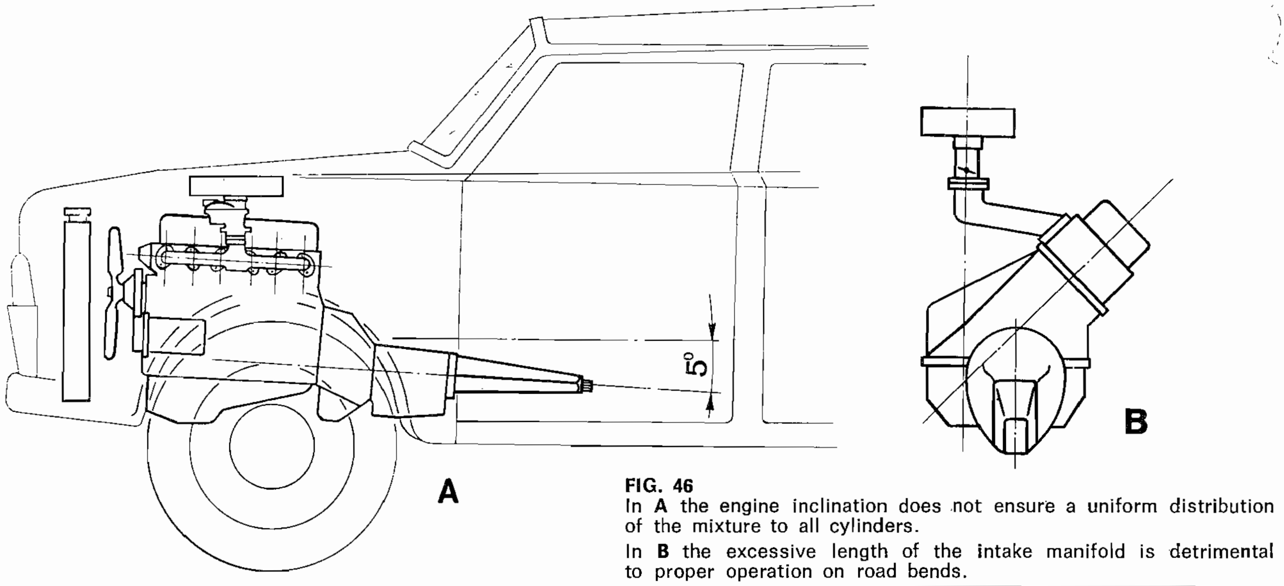


FIG. 46
In **A** the engine inclination does not ensure a uniform distribution of the mixture to all cylinders.
In **B** the excessive length of the intake manifold is detrimental to proper operation on road bends.

Intake manifold

With the majority of motor vehicles the carburetor feeds the cylinders through the ducting of an **intake (or inlet) manifold.** The purpose of this manifold is to distribute the mixture prepared in the carburetor and to favor as much as possible the vaporization of fuel so that under any and all service conditions the following requirements are met:

— Identical « charges » to individual cylinders.
— All « charges » have the same metering.
— All « charges » have the same blending.
— Mixture blending is the best possible.

The intake manifold must have the smoothest possible bores and an appropriate inclination so that in cold starts under extremely low temperatures the fuel condensing on the walls may continue to feed the cylinders regularly - See **Fig. 46.**

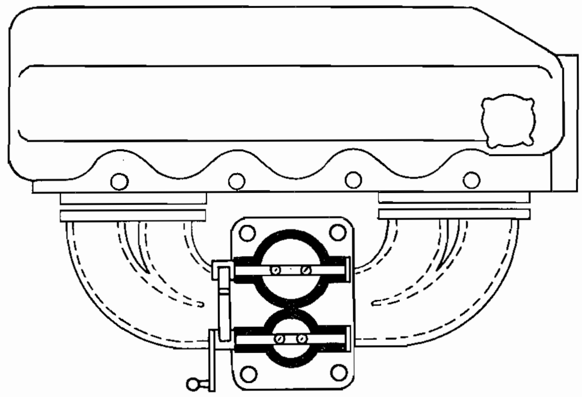


FIG. 47
Dual-barrel, downdraft carburetor with differential opening of throttles installed on an in-line engine.
In this case both carburetor barrels must communicate with a single chamber in manifold from which are branched the cylinder feed ducts.

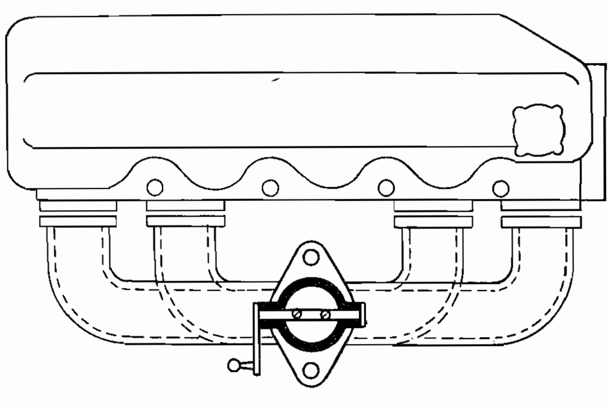


FIG. 47-A
Single-barrel, downdraft carburetor installed on an in-line engine. To prevent uneven mixture distribution to cylinders the throttle shaft must be parallel with engine longitudinal centerline.

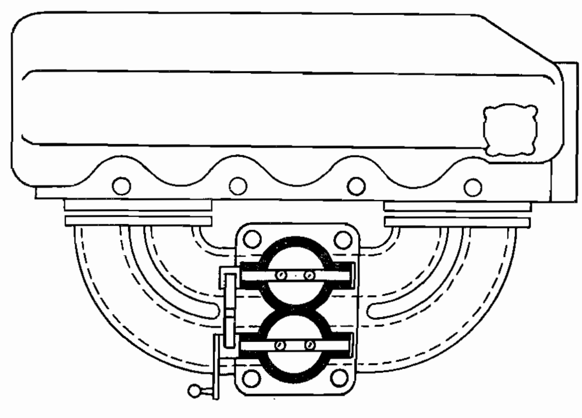


FIG. 47-B
Dual-barrel, downdraft carburetor with synchronized opening of throttles, installed on an in-line engine.
For maximum power each carburetor barrel feeds only two cylinders and the manifold does not have a common chamber under the carburetor.

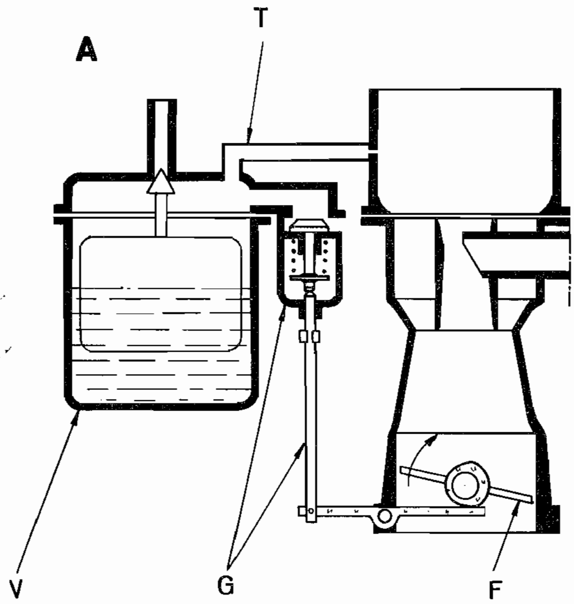
To favor fuel vaporization, the intake manifold is generally provided with an area which is heated by contact with the exhaust manifold (known as « **hot-spot** ») or by an enveloping cavity through which flows the cooling system water recirculated from the engine. Though without any impairment to the desirable engine volumetric efficiency at high rpm rates, the intake manifold ducts **must be dimensioned** so that even at low rpm the mixture 'ow will retain enough velocity to avoid liquid eposіtions on the walls. Manifold duct bores **must not** have sharp bends, or sudden changes in section or curvature. Under any service and climatic **(summer-winter)** conditions of operation the engine water re-circulation heating method offers **considerably steadier** thermal conditions than the exhaust manifold contact method. In fact, the former design permits the setting of leaner mixture ratios thus ensuring the best possible results as to fuel economy. Upon installation of the intake manifold **it is essential** to make sure that manifold bores are perfectly centered with respect to cylinder head bores, and the attachment flange gaskets **do not project** into the bore area; such gasket projections are a serious and most frequent complaint resulting in efficiency losses, cold starting difficulties, and deceleration troubles due to rapid induction from depression increases of the liquid fuel build-ups on the unflush gaskets. **Figures 47-A/B** and **Tables 1/2** show and list the more common Weber carburetor layouts and applications.

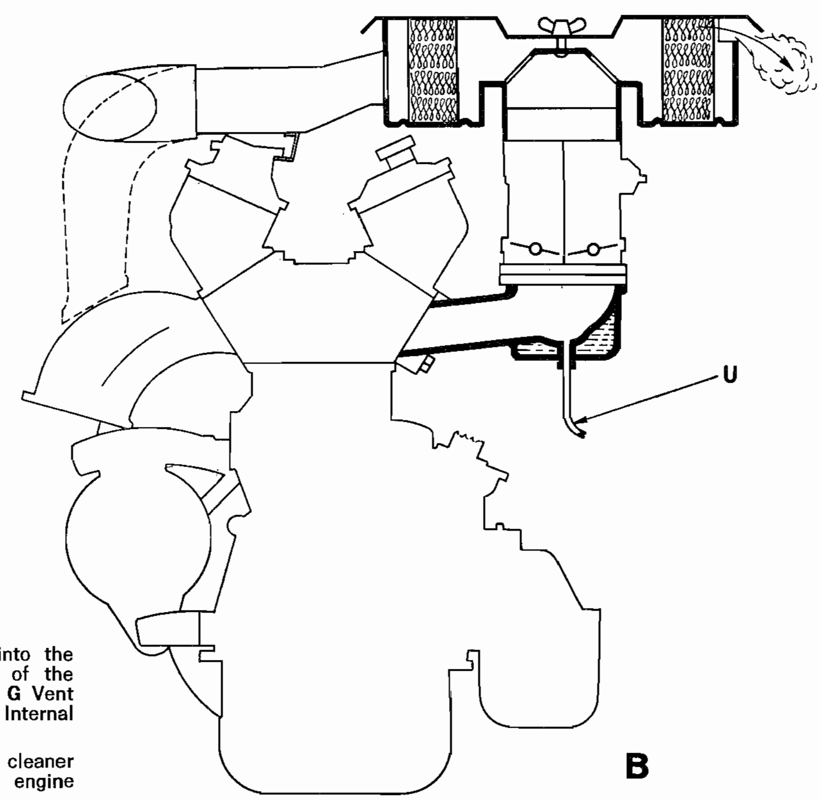
Exhaust system

The importance of the exhaust system on engine performance is well known. By appropriate design and accurate test bench tune-ups of the entire exhaust pipeline-silencer assembly it will be possible to obtain satisfactory running silentness without excessive penalties on power outputs.
It is advisable to check the exhaust manifold-to-cylinder head gasketing for proper tightness and the pipes and/or silencer for soundness (absence of slots or perforations).

Air cleaner

A well designed air cleaner (or filter) not only entrains dust and deadens induction noise but also does not detract from engine performance.
Unless comparative test data are available it is **never advisable** to modify or change the original equipment air cleaner. In single carburetor ap-





FIGS. 48-A and B

Shown in **A** is a vent system permitting the discharge into the atmosphere — with throttle in idle speed position — of the fuel vapors that form in float chamber. - V Float chamber - **G** Vent valve and control linkage operated by throttle **F** - **T** Internal ventilation tube.

Shown in **B** is a design for fuel vapor discharge from air cleaner top and intake manifold liquid fuel drain with stationary engine (tube **U** with **1.2 mm** end bore).

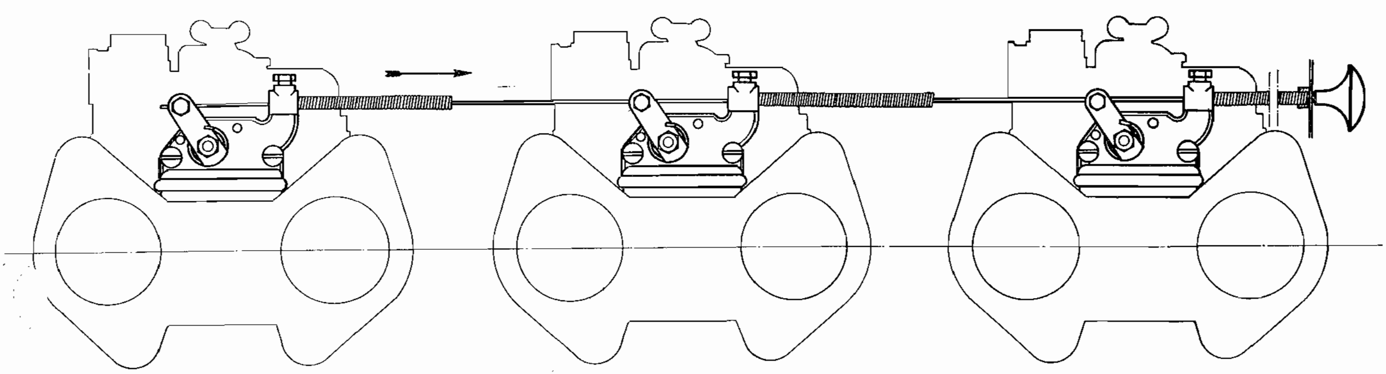


FIG. 49
Illustration of a simultaneous choke control by bowden on a three-carburetor engine.

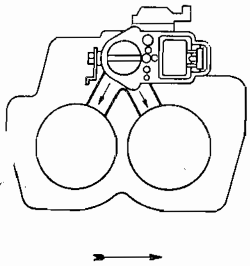
APPLICATION EXAMPLES **TABLE 1**

Some illustrative application layouts with pertinent main specifications of engine and carburetor are listed in the following tables. Engines are all of the four-stroke cycle type without supercharger and are grouped into classes, in the 2 to 12 cylinder range.

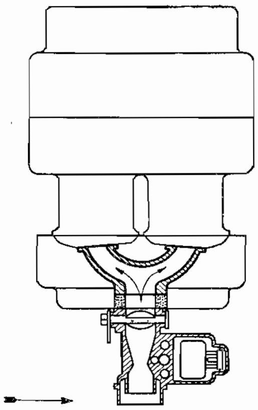
2 to 4 CYLINDER ENGINES

Engine arrangement	ENGINE DATA — MANUFACTURER AND MODEL	Total Capacity cc	Power HP (DIN)	Speed rate (rpm)	WEBER CARBURETOR DATA — Number of carburetors installed	TYPE	DESIGNATION	Diameters in mm. — Barrels 1° 2°	Venturis 1°
2-cyl. vertical	**Fiat** 500 F	500	18	4600	**1**	**26 IMB**	**1 barrel, downdraft**	26	21
2-cyl. horizontal	**Fiat** 500 Giardiniera	500	18	4600	**1**	**26 OC**	**1 barrel, sidedraft**	26	20
2-cyl. opposed	**Steyr** 650 T	643	20	**4800**	**1**	**32 ICS**	**1 barrel, downdraft**	32	27
4-cyl. in line vertical	**Alfa Romeo** Giulia Super	1570	98	5500	**2**	**40 DCOE**	**2 barrels, sidedraft** (synchronized)	40	30
	Alfa Romeo 1750	1779	132 (SAE)	5500	**2**	**40 DCOE**	**2 barrels, sidedraft** (synchronized)	40	32
	Autobianchi Primula Coupè S	1438	75 (SAE)	5600	**1**	**32 DFB**	**2 barrels, downdraft** (synchronized)	32	23
	B.M.W. 1800 TI/SA	1773	130	6100	**2**	**45 DCOE**	**2 barrels, sidedraft** (synchronized)	45	38
	Citroën DS 21	2175	109 (SAE)	5500	**1**	**28/36 DLE**	**2 barrels, downdraft** (differential)	28 36	23 27
	Fiat 850	843	37	5000	**1**	**30 ICF**	**1 barrel, downdraft**	30	21
	Fiat 850 Sport	903	52	6500	**1**	**30 DIC**	**2 barrels, downdraft** (differential)	30 30	23 23
	Fiat 1100 R	1089	48	5200	**1**	**32 DCOF**	**2 barrels, sidedraft** (synchronized)	32	22
	Fiat 124	1197	60	5600	**1**	**32 DCOF**	**2 barrels, sidedraft** (synchronized)	32	23
	Fiat 124 Sport	1438	90	6500	**1**	**34 DHS**	**2 barrels, downdraft** (vacuum)	34 34	24 [illegible]
	Fiat 124 Special	1438	70	6500	**1**	**32 DHS**	**2 barrels, downdraft** (vacuum)	32 32	23 [illegible]
	Fiat 125	1608	90	5600	**1**	**34 DCHE**	**2 barrels, downdraft** (vacuum)	34 34	24 24
	Fiat 125 Special	1608	100	6400	**1**	**34 DCHE**	**2 barrels, downdraft** (vacuum)	34 34	26 26
	Fiat 128	1116	55	6000	**1**	**32 ICEV**	**1 barrel, downdraft**	32	24
	Fiat 1500 C	1481	75	5000	**1**	**34 DCHD**	**2 barrels, downdraft** (vacuum)	34 34	25 25
	Ford Escort G.T.	1298	64	5800	**1**	**32 DFE**	**2 barrels, downdraft** (differential)	32 32	23 24
	Ford Cortina G.T.	1599	82	5400	**1**	**32 DFM**	**2 barrels, downdraft** (differential)	32 32	26 27
	Lotus Elan G.T.	1558	106	5500	**2**	**40 DCOE**	**2 barrels, sidedraft** (synchronized)	40	30
	Opel Rekord Sprint	1897	106	5600	**2**	**40 DFO**	**2 barrels, downdraft** (synchronized)	40	32
	Renault Caravelle 1100 S	1108	51	5400	**1**	**32 DIR**	**2 barrels, downdraft** (differential)	32 32	23 24
	Renault 16 TS	1565	83	5750	**1**	**32 DAR**	**2 barrels, downdraft** (differential)	32 32	24 26
	Simca 1000 D/GLS	944	42	5600	**1**	**32 ICR**	**1 barrel, downdraft**	32	25,5
	Simca 1501 S	1475	69	5200	**1**	**28/36 DCB**	**2 barrels, downdraft** (differential)	28 36	25 26
4-cyl. opposed	**Lancia** Flavia 1800	1800	105	5200	**2**	**40 DCN**	**2 barrels, downdraft** (synchronized)	40	32
	Porsche 904 GTS Carrera	1966	180	7000	**2**	**46 IDA**	**2 barrels, downdraft** (synchronized)	46	40
4-cyl. V	**Ford** Corsair 2000 E	1996	88	5000	**1**	**32 DIF**	**2 barrels, downdraft** (differential)	32 32	26 27
	Lancia Fulvia 2 C	1231	80	6000	**2**	**32 DOL**	**2 barrels, sidedraft** (synchronized)	32	26

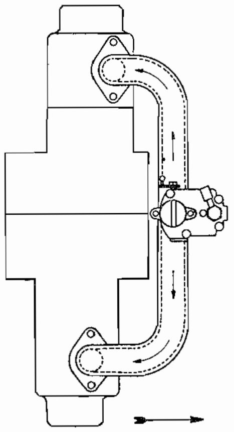
(1) Primary - (2) Secondary



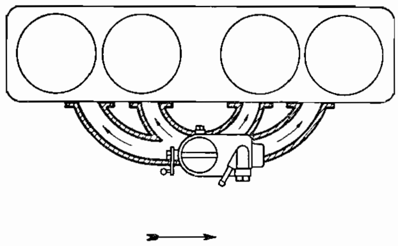
2-cylinder, vertical,
with one downdraft carburetor



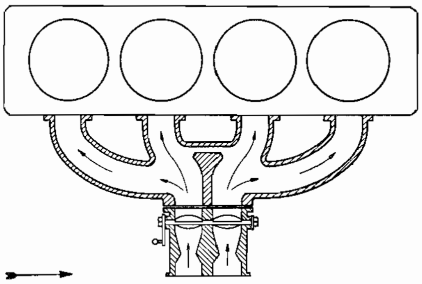
2-cylinder, horizontal,
with one sidedraft carburetor



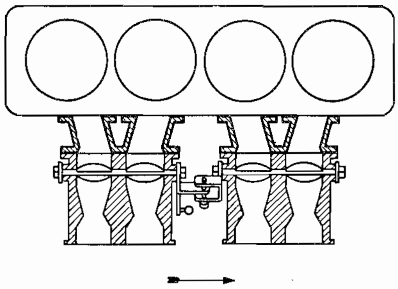
2-cylinder, opposed,
with one downdraft carburetor



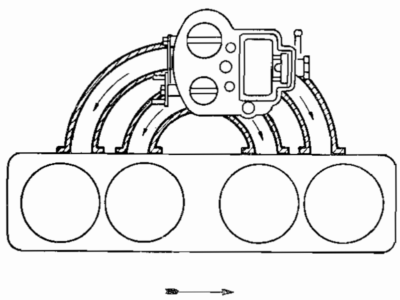
4-cylinder, in-line
with one downdraft carburetor



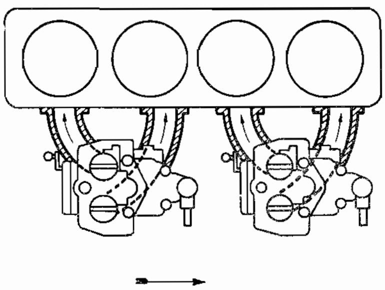
4-cylinder, in-line, with one
dual-barrel sidedraft carburetor



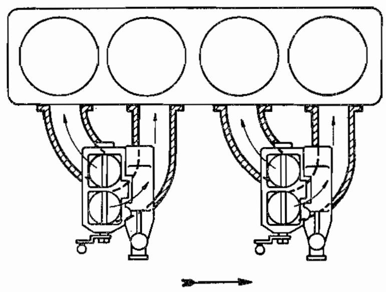
4-cylinder, in-line, with two
dual-barrel, sidedraft carburetors



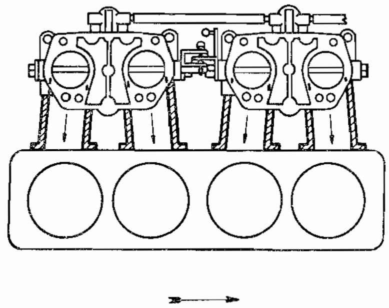
4-cylinder, in-line, with one dual-barrel
downdraft carburetor
(differential opening of throttles)



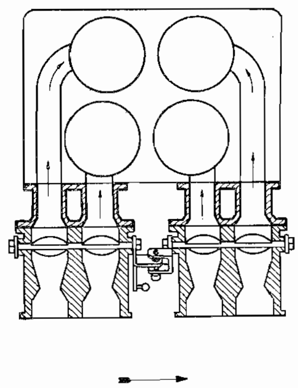
4-cylinder, in-line, with two dual-barrel,
downdraft carburetors
(synchronized opening of throttles)



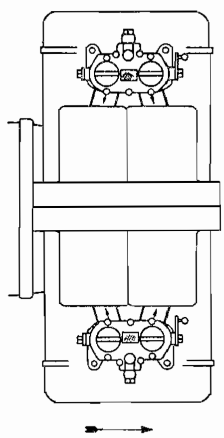
4-cylinder, in-line, with two dual-barrel,
downdraft carburetors
(synchronized opening of throttles)



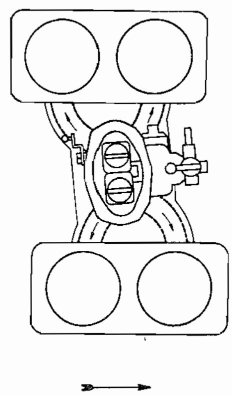
4-cylinder, in-line, with two dual-barrel,
downdraft carburetors
(synchronized opening of throttles)



4-cylinder, V, with two dual-barrel,
sidedraft carburetors
(synchronized opening of throttles)



4-cylinder, opposed, with two dual-barrel,
downdraft carburetors
(synchronized opening of throttles)



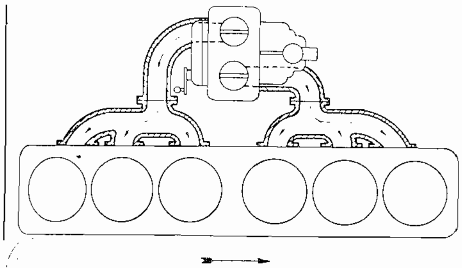
4-cylinder, V, with one dual-barrel,
downdraft carburetor
(differential opening of throttles)

6 to 12 CYLINDER ENGINES

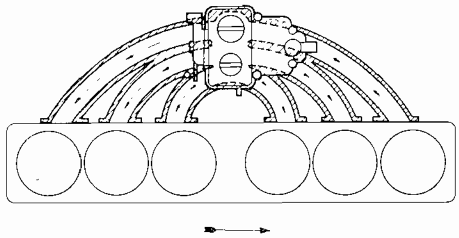
Engine arrangement	ENGINE DATA: MANUFACTURER AND MODEL	Total Capacity cc	Power HP (DIN)	Speed rate (rpm)	WEBER CARBURETOR DATA: Number of carburetors installed	TYPE	DESIGNATION	Diameters in mm. Barrels 1° 2°	Venturis 1° 2°
6-cyl. in line vertical	**Alfa Romeo** 2600 Sprint	2582	145	5900	3	**45 DCOE**	**2 barrels, sidedraft** (synchronized)	45	36
	Aston Martin DB6 - Vantage	3995	330	5750	3	**45 DCOE**	**2 barrels, sidedraft** (synchronized)	45	40
	Fiat 2100	2054	95 (SAE)	5000	1	**34 DCS**	**2 barrels, downdraft** (synchronized)	34	23
	Fiat 2300	2279	102	5300	1	**28/36 DCD**	**2 barrels, downdraft** (differential)	28 36	23 25
	Fiat 2300 S	2279	130	5600	2	**38 DCOE**	**2 barrels, sidedraft** (synchronized)	38 38	28
	IKA Torino 380 W	3770	176	4500	3	**45 DCOE**	**2 barrels, sidedraft** (synchronized)	45	33
	Maserati 3500 GT	3485	235	5500	3	**42 DCOE**	**2 barrels, sidedraft** (synchronized)	42	32
6-cyl. opposed	**Porsche** 911 R	1991	210	8000	2	**46 IDA 3C**	**3 barrels, downdraft** (synchronized)	46	42
	Porsche 911 T	1991	110	5800	2	**40 IDT 3C**	**3 barrels, downdraft** (synchronized)	40	27
6-cyl. V	**Fiat** 130	2860	140	5500	1	**42 DFC**	**2 barrels, downdraft** (synchronized)	42	32
	Fiat Dino	1987	160	7200	3	**40 DCNF**	**2 barrels, downdraft** (synchronized)	40	32
	Ford Zodiac MK IV	2994	128	4750	1	**40 DFA**	**2 barrels, downdraft** (synchronized)	40	2[illegible]
	Lancia Flaminia 3 C	2775	150	5400	3	**35 DCNL**	**2 barrels, downdraft** (synchronized)	35	30
8-cyl. V	**Ford** GT V8	4728	340 (SAE)	6250	4	**48 IDA**	**2 barrels, downdraft** (synchronized)	48	42
	Maserati 4 porte	4136	260	5200	4	**38 DCNL**	**2 barrels, downdraft** (synchronized)	38	30
	Maserati Ghibli	4719	330	5500	4	**40 DCNL**	**2 barrels, downdraft** (synchronized)	40	34
12-cyl. V	**Ferrari** 275 GTB/4	3286	300	8000	6	**40 DCN**	**2 barrels, downdraft** (synchronized)	40	32
	Ferrari 330 GTC	3967	300	7000	3	**40 DFI**	**2 barrels, downdraft** (synchronized)	40	28
	Lamborghini Miura P 400	3929	350	7000	4	**40 IDL 3C**	**3 barrels, downdraft** (synchronized)	40	30
	Lamborghini 400 GT Islero	3929	320	6500	6	**40 DCOE**	**2 barrels, sidedraft** (synchronized)	40	30

NOTE: Engine specifications are those published by the Manufacturers and in technical literature. In schematic layouts the arrow indicates direction of vehicle travel.

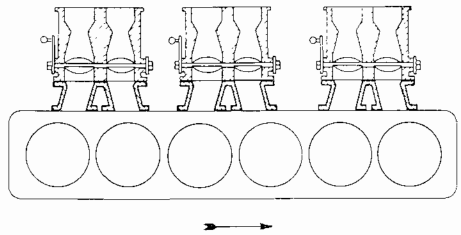
(1) Primary - (2) Secondary



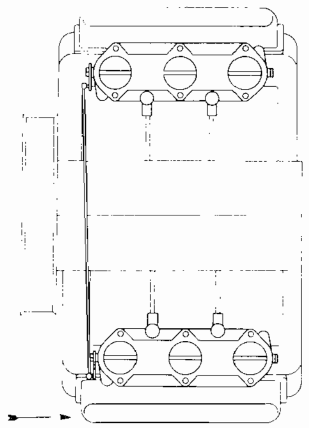
ylinder in-line, with one dual-barrel, downdraft carburetor (synchronized opening of throttles)



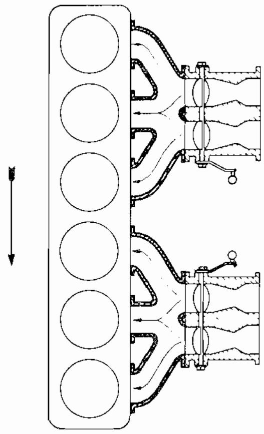
6-cylinder in-line, with one dual-barrel, downdraft carburetor (differential opening of throttles)



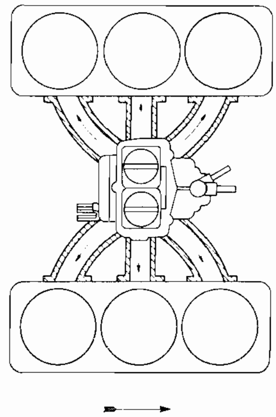
6-cylinder, in-line, with three dual-barrel sidedraft carburetors (synchronized opening of throttles)



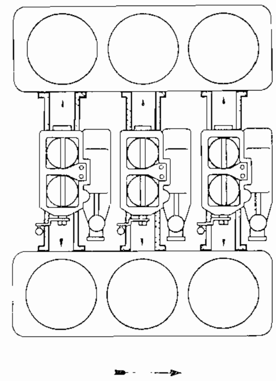
6-cylinder, opposed, with two triple-barrel, downdraft carburetors (synchronized opening of throttles).



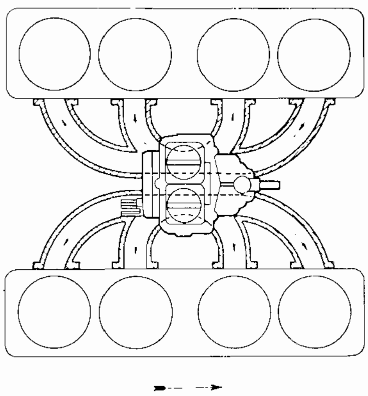
6-cylinder, in-line, with two dual-barrel, sidedraft carburetors (synchronized opening of throttles).



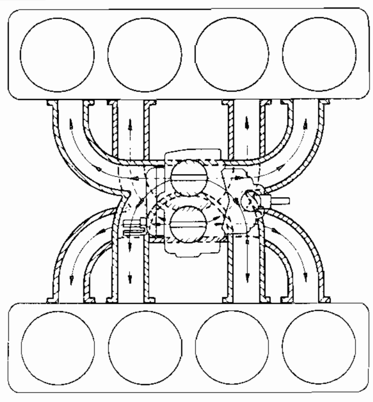
6-cylinder, V, with one dual-barrel, downdraft carburetor (synchronized opening of throttles).



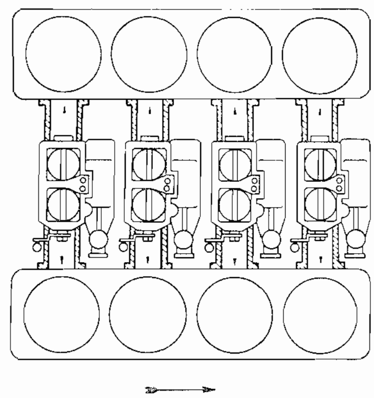
6-cylinder, V, with three dual-barrel, downdraft carburetors (synchronized opening of throttles)



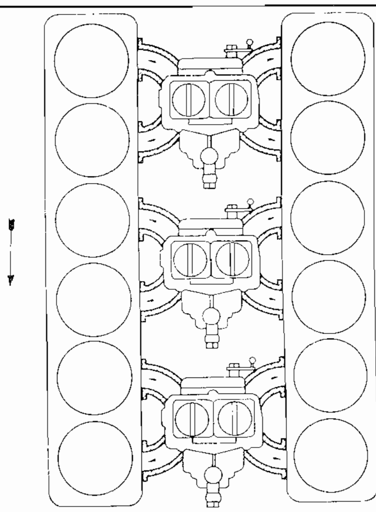
8-cylinder, V, with one dual-barrel, downdraft carburetor (synchronized opening of throttles)



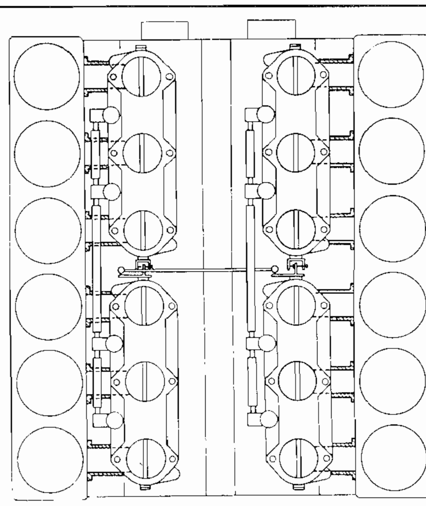
8-cylinder, V, with one dual-barrel, downdraft carburetor (synchronized opening of throttles)



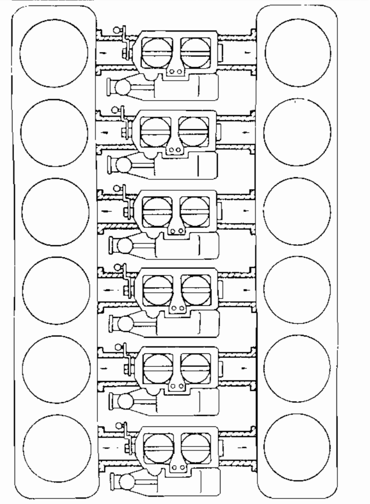
8-cylinder, V, with four dual-barrel, downdraft carburetors (synchronized opening of throttles)



12-cylinder, V, with three dual-barrel, downdraft carburetors (synchronized opening of throttles)



12-cylinder, V, with four triple-barrel, downdraft carburetors (synchronized opening of throttles)



12-cylinder, V, with six dual-barrel, downdraft carburetors (synchronized opening of throttles) plications it is preferable to have the engine bear the air cleaner and in any case it should be connected to the carburetor through flexible sleeve adapters or rubber gaskets, to prevent the transmission of vibrations or other harmful stresses.

A and B in Fig. 48 show some arrangements designed to discharge the fuel vapors that form once engine is switched off and make hot starts difficult, especially in summer. The top section of the air cleaner is provided with openings for the ventilation of vapors while, for the same purpose, a float chamber vent valve is opened at idle speed operation. The intake manifold lowermost portion is sometimes provided with a tube or hole (with bore of **about 1.2 mm**) for draining the liquid fractions of fuel.

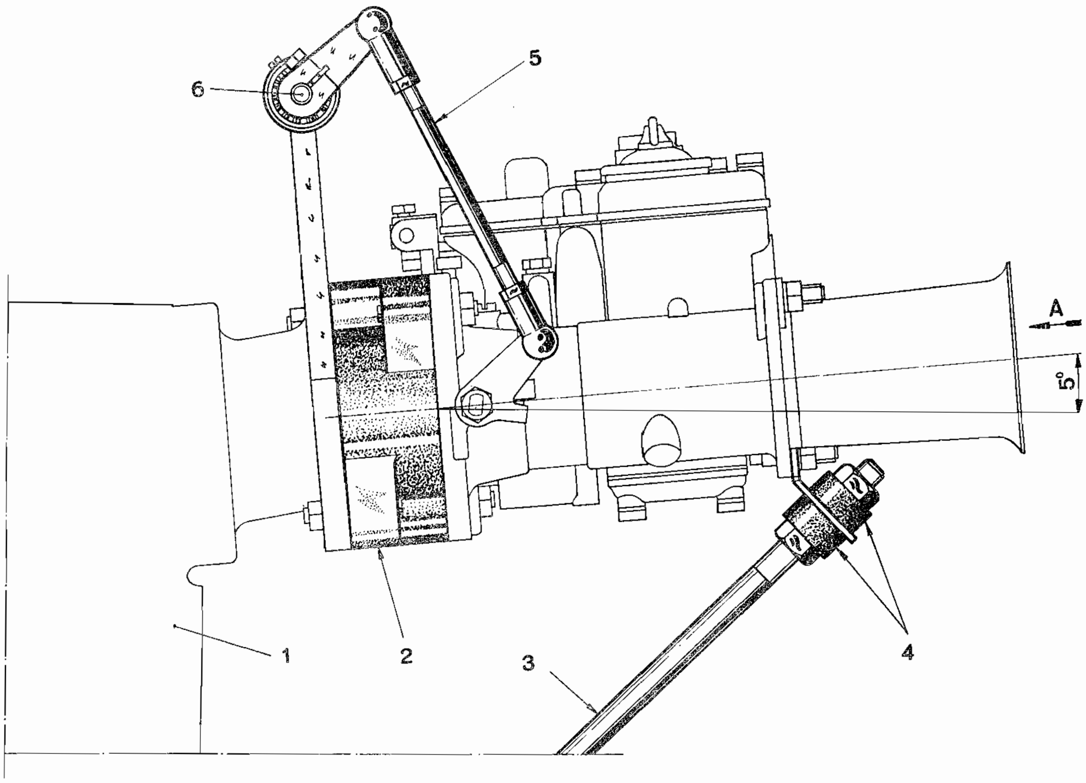


FIG. 50
Installation of two or more sidedraft carburetors.

1 Cylinder head - **2** Two-piece adapter consisting of sheet metal flanges with vulcanized-on gasoline-proof rubber cheeks - **3** Carburetor support rod mounted on engine block - **4** Carburetor support rubber rings - **5** Throttle control rod with both ends threaded (one RH and one LH).
Inclining carburetors up to 5° **(not more)** may prove useful.
All the supports of auxiliary shaft **6** shall be fixed exclusively to engine and not part on engine and part on chassis frame or carburetor.

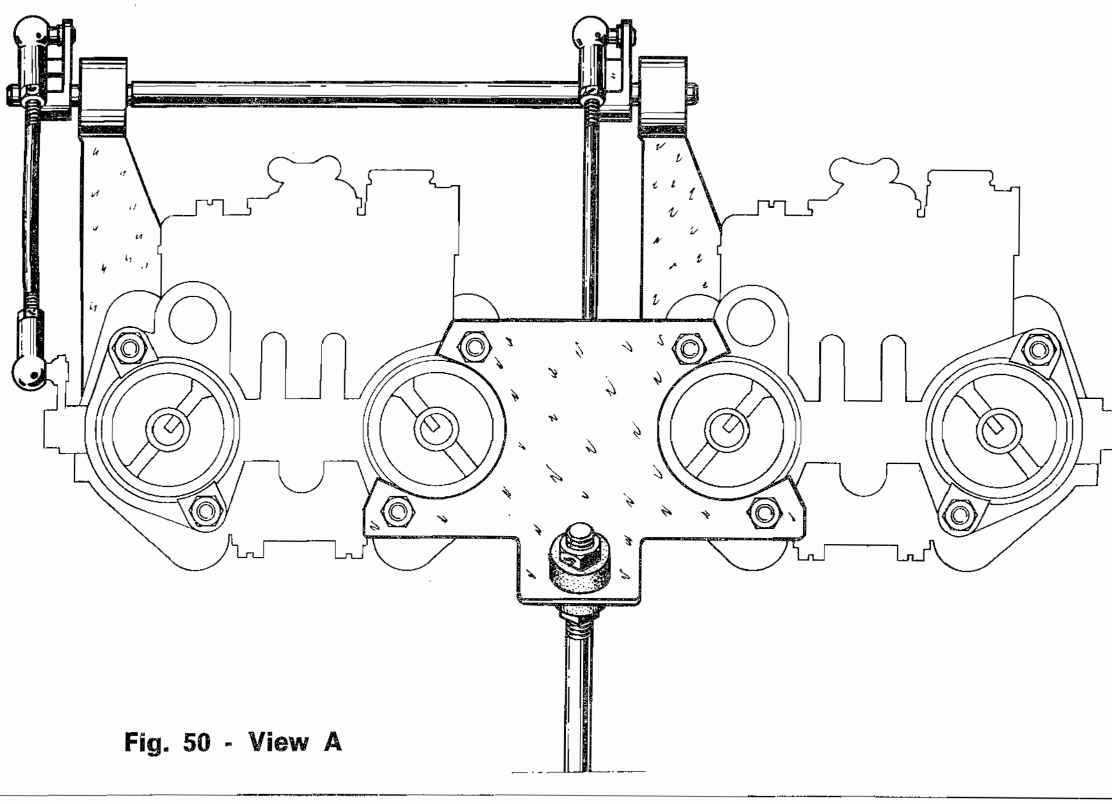


Fig. 50 - View A

Accelerator control

Avoid any bindings or seizures in accelerator control linkages making sure all rods are perfectly aligned and adjusted without occurrence of any excessively wide angles between linkage levers and rods. By actuating the control from the driver's seat make sure that throttles always open and close **completely.** Also check the choke manual control with device fully IN and fully OUT, **Fig. 49**; adjusting the retaining element on the bowden avoid any excessive « tightness » of the flexible cable with choke-OUT because the lever on carburetor must press against its stops for proper operation.

On 2/4 cylinder engines an improper setting of suspension mounts may cause marked vibrations that will result in emulsioning of fuel in the float chamber or a practically uninterrupted emission of fuel from accelerating pump jet, even at low rpm rates: to solve this problem, the simultaneous control of all throttles by a flexible cable (bowden) and the adoption of two-piece rubber adapter flanges between carburetor and cylinder head (**Fig. 50**) may prove useful.

Shown in **Figs. 50-51 A/B/C - 52-53-54** are some throttle control layouts in multi-carburetor applications requiring a uniform, equal and steady control of throttle motions.

The auxiliary shaft transmitting the control to carburetor levers should be mounted on protected and self-aligning ball bearings (**2 or 3 depending on linkage length**) and should have a **10-12 mm** outside diameter both when it is solid or made from tubing. Auxiliary shaft supports should all be mounted on the engine and not part on engine and part on bodywork. All the lever sets fitted on this shaft should have rigorously identical center-to-center distances (between spherical ends and shaft centerline), as shown in **Fig. 53**. It is also **necessary to have the lowest possible** spherical end clearances.

Fuel supply lines - Fig. 51-B

Avoid using all-metal lines because the vibrations and fitting differences develop stresses, and even failures, all the more so on multi-carburetor applications. Main tubes and branches are always set in such a manner that their highest point is at all times their connection point with carburetor. It often proves advisable, particularly on not-too-new engines and on sports cars, to fit a fuel strainer near the carburetor: its size should be proportional to maximum fuel consumption ratings and, when necessary, it may incorporate a pressure regulator.

Carburetor installation on engine

Make sure that when fitted on inclined engines the downdraft carburetors keep their barrels vertical.

Prefer:

— The arrangement with float chamber facing the front end of vehicle to prevent bowl from emptying during accelerations and uphill, and flooding when brakes are applied.

— The orientation of float fulcrum axis not only towards vehicle front end but also parallel to road wheels rolling axis.

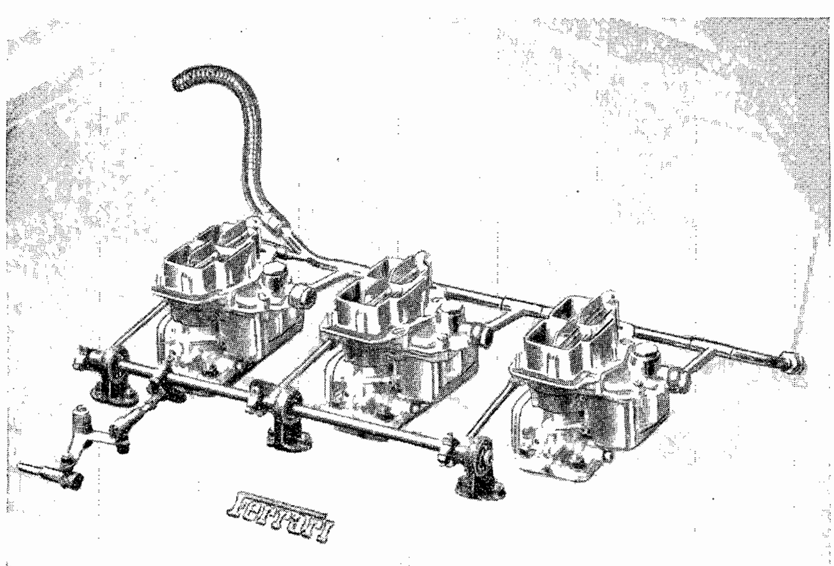
On engines where one carburetor barrel feeds two or more cylinders, the main throttle spindles should normally be parallel to crankshaft axis to avoid uneven distribution of the mixture to cylinders.

On used carburetors check the attachment flanges on manifold or engine block for possible slight distortions and, if necessary, flatten out using a fine-cut file. Always use new and thin gasketing material and proper washers against loosening of carburetor mounting nuts.

The carburetor should always be perfectly clean, especially its inner passages; after accurate **washing in gasoline, all metal parts** should be blown dry with compressed air, except the more delicate parts like the float, needle valve and similar of course.

Checks on engine

Make sure the engine is perfectly efficient in all its electrical and mechanical parts, following the instructions of the Manufacturer.



Arrangement of carburetors on engine: air cleaners are removed for clarity.

FIG. 51-A

The carburetors shown are three dual-barrel, downdraft **40 DFI** units fitted on a 12-V engine (**Ferrari 330 GTC**). Control linkage operates through an **auxiliary shaft with three ball bearing supports.**

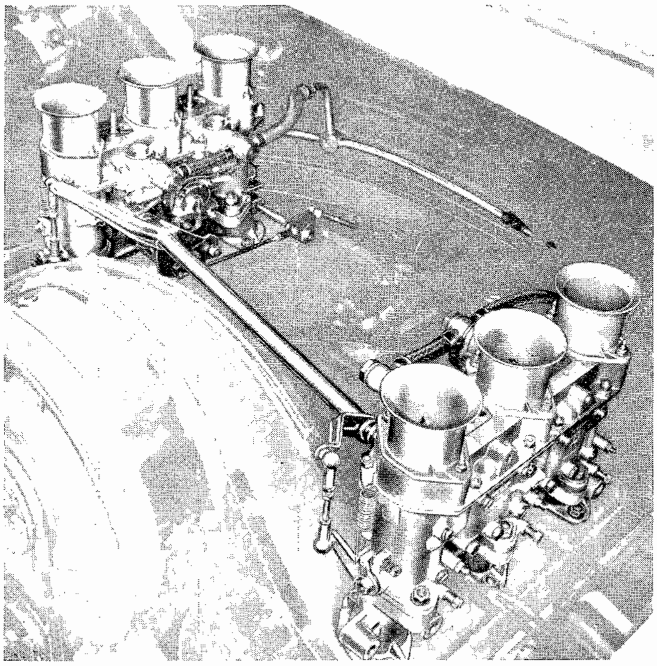


FIG. 51-B

Installation of two **40 IDA 3C** triple-barrel, downdraft carburetors on a 6, opposed-cylinder engine (**Porsche 911**). Note the fuel feed line **not entirely of metal tubing.**

Compression tightness checks. Run engine to rated operation temperature, remove spark plugs and fit successively in their place the special dual--pointer or writing manometer (pressure gauge). Keeping the accelerator open, crank the engine for a few seconds with the electric starter until the gauge gives a maximum reading.

The greatest difference in the pressure values recorded for each cylinder shall never exceed 1 to 1.5 kg/sq.cm. If the pressure in any one cylinder is very low, this will indicate that the valves or piston rings involved do not provide the necessary compression tightness and engine performance will suffer.

The recorded pressure **is not** the compression ratio but these two factors do have a relationship, along with other engine characteristics.

Spark plugs inspection: their appearance is a clue to the prevailing combustion conditions in the engine, provided the spark plug rating is as specified.

Rich mixture - blackened porcelain insulation and black smoke at the exhaust with strong gasoline odor.

Weak mixture - clear, almost white porcelain insulation; engine knocks; slow pick-ups; sputtering engine.

Oil burning - if engine uses up more oil than necessary, the spark plug porcelain and metal parts are coated with dark incrustations; upon accelerating after a stationary period at idle speed, blue smoke (without gasoline odor) is emitted at the exhaust.

On the average, correct spark plug gaps should be of around 0.6 mm.

If there are elements pointing to this need, check valve tappet clearances. Inspect also the ignition distributor and, if the specified breaker gap clearance is not known, adjust contacts to **0.4 mm;** also, make sure there are no excessive plays in the drive shaft and centrifugal weights. Check that the vacuum advance corrector diaphragm is not torn or pierced.

Idle speed rate adjustments on sport engines

Mainly considered here are the applications whe each carburetor barrel feeds a single cylinder and the factory-set idle speed rate is around **1000 rpm.**

The idle speed system is correctly adjusted when the engine, after attaining its rated operation temperature, runs smoothly at the specified rate and every single cylinder receives the same amount of mixture.

To check that each carburetor operates on the same air flow rate when engine runs at or around idle speed, a special instrument known as a **synchronizer**, shown in **Fig. 54**, will prove extremely useful. The synchronization of carburetor idle speed operation may be carried out according to the following procedure, bearing in mind that owing to the extremely diversified throttle connection arrangements it will not be possible to give indications applicable in all cases. At any rate, always abide by the engine Manufacturer recommendations.

— With engine idling at rated operation temperature , and all mechanical and electric parts in perfect order, uncouple the connection between accelerator pedal linkage and the rest of the linkage controlling the different carburetors; this must be done to remove the load contributed by the pedal return springs. Connect an electric tachometer (revolution counter) to the engine.

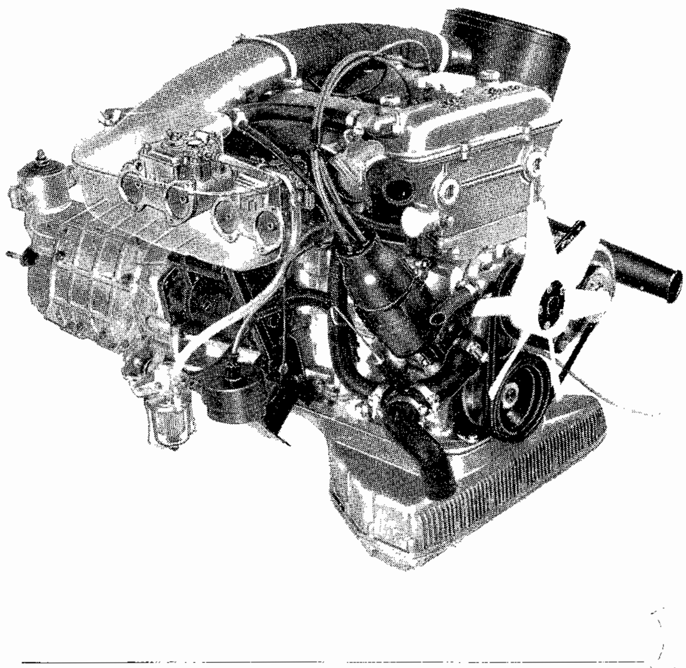


FIG. 51-C

Installation of two 40 DCOE dual-barrel, sidedraft, carburetors inside the intake ducting to air cleaner. 4-cylinder, in-line engine (**Alfa Romeo 1750**). Throttle control system is shown in **Fig. 54.**

— Make sure, by acting on lever (6) that shafts slide freely and carburetor throttles regain idle position.
— Loosen lock nuts and fully tighten, but do not overtighten, the four screws (11) to stop compensation air flow; then retighten lock nuts.
— Carefully tighten the four idle mixture adjusting screws (1), then unscrew **two turns.**
— Unscrew idle speed screw (4) and carburetor coupling adjusting screw (3).

— Depress lever (6) to compress spring of lever (7) and make sure that both carburetor throttles are perfectly closed.
— Retighten the screw (3) to make it contact the end (2) of lever (6).
— Make idle speed adjusting screw (4) contact main lever (6), then screw by **one turn.**
— Replace threaded plugs with connectors (9) of vacuum device (10).

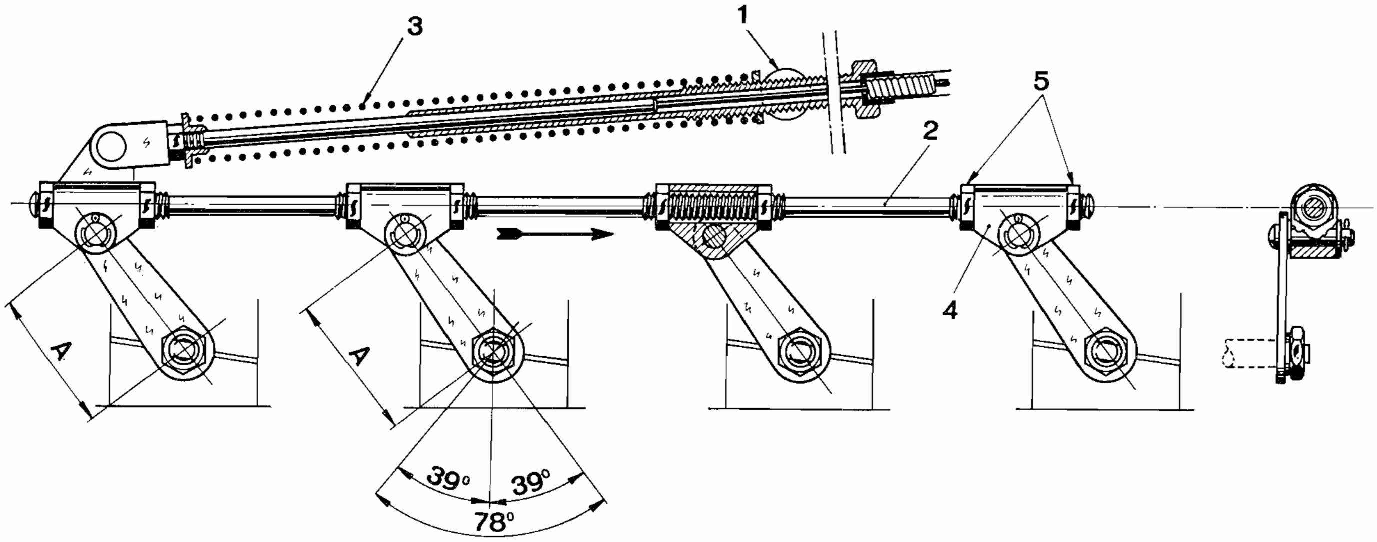


FIG. 52

Throttle linkage for four carburetors having throttles with parallel shafts lying in the same plane.
1 is the spherical mount for the bowden sheath adjuster; the bowden cable pulls on the end of threaded rod **2** against the opposing force of guided spring **3.** - **4** Adjuster block - **5** Jam nuts.
The threaded rod ensures a perfect synchronization of all throttles. All center distances A must be identical: this also applies to all lever mounting angles and positioning angle transmitted to the throttles. Carburetor mounting flanges must all be in the same plane. The arrow points to the direction in which the throttles open.

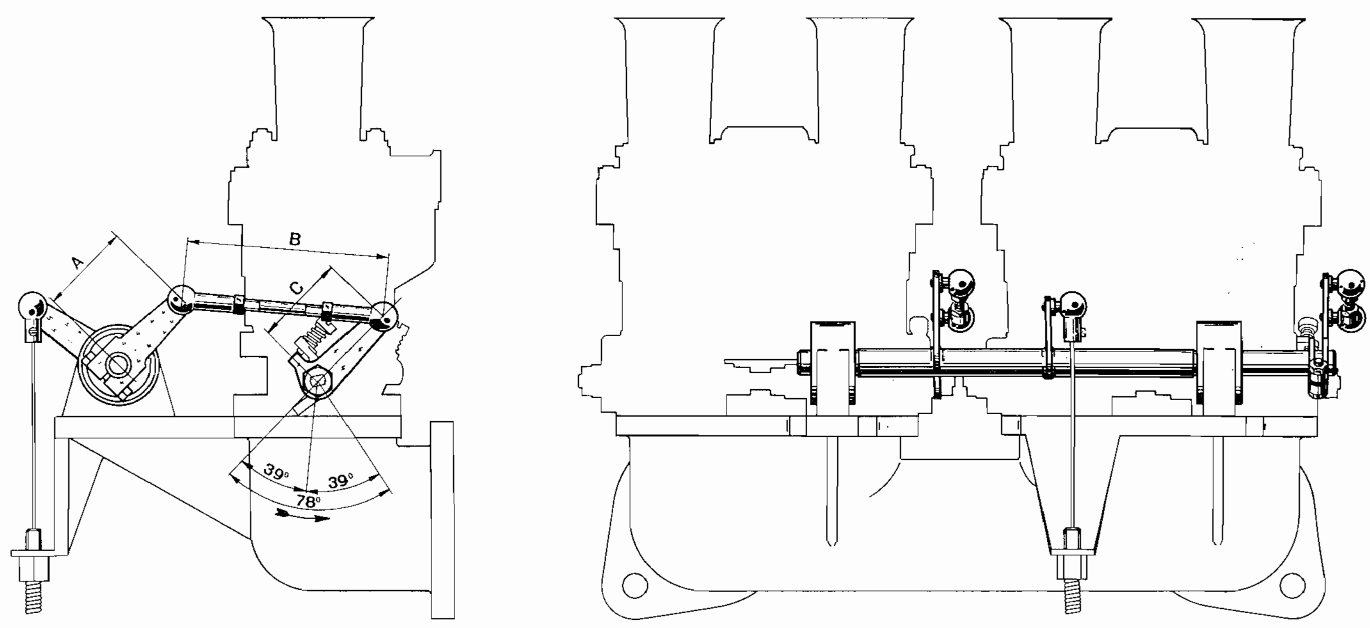


FIG. 53

Throttle control linkage for two or three downdraft carburetors through an auxiliary shaft. All center distances **A** must be identical. The same applies to center distances **B** and **C**. It is advisable for **A** to be slightly greater than **C**. Center distance **B** rods should have one end threaded and one LH threaded. All the mounting angles of the levers on carburetors must be the same: this applies also to the positioning angles transmitted to the throttles. The arrow points to the direction in which the throttles open.

— Start engine and check vacuum gauge pointers of cylinders 1-2 (1st carb.) and 3-4 (2nd carb.); if vacuum values in both ducts of each carburetor are equal, proceed as directed in paragraph c), otherwise equalize as follows:

a) unscrew compensation air adjusting screw (11) of duct corresponding to cylinder where vacuum is higher until the vacuum is the same as that of cylinder corresponding to the other duct of the same carburetor, then tighten lock nut;

b) il necessary, repeat same operation on other carburetor;

CAUTION: one compensation screw (11) of each carburetor must remain fully tightened;

c) balance vacuum between carburetors by acting on screw (3) to have the four vacuum gauges pointing the same value for all ducts;

d) bring (warm) engine rate at approx. **900 rpm/m.** or at the value established by car Manufacturer, by acting on idle speed adjusting screw (4);

e) act on idle mixture adjusting screw (1) to obtain, cylinder per cylinder, the highest and most balanced speed for that throttle position.

When required from anti-pollution laws, make sure that percentage of carbon monoxide, found on the exhaust of the car by using a CO-analyzer, is that prescribed from car Manufacturer. If the value is different, twist the four mixture screws (1) of the same angle, progressively. Reset engine revol tions, if necessary, by acting on idle speed adjus ing screw (4).

If carrying out operations d) and e) vacuum gauge balance is altered, repeat above-mentioned operations, always acting on one of the screws (11) previously opened.

— Replace the four connectors (9) with threaded plugs.

— Connect accelerator linkage to lever (6).

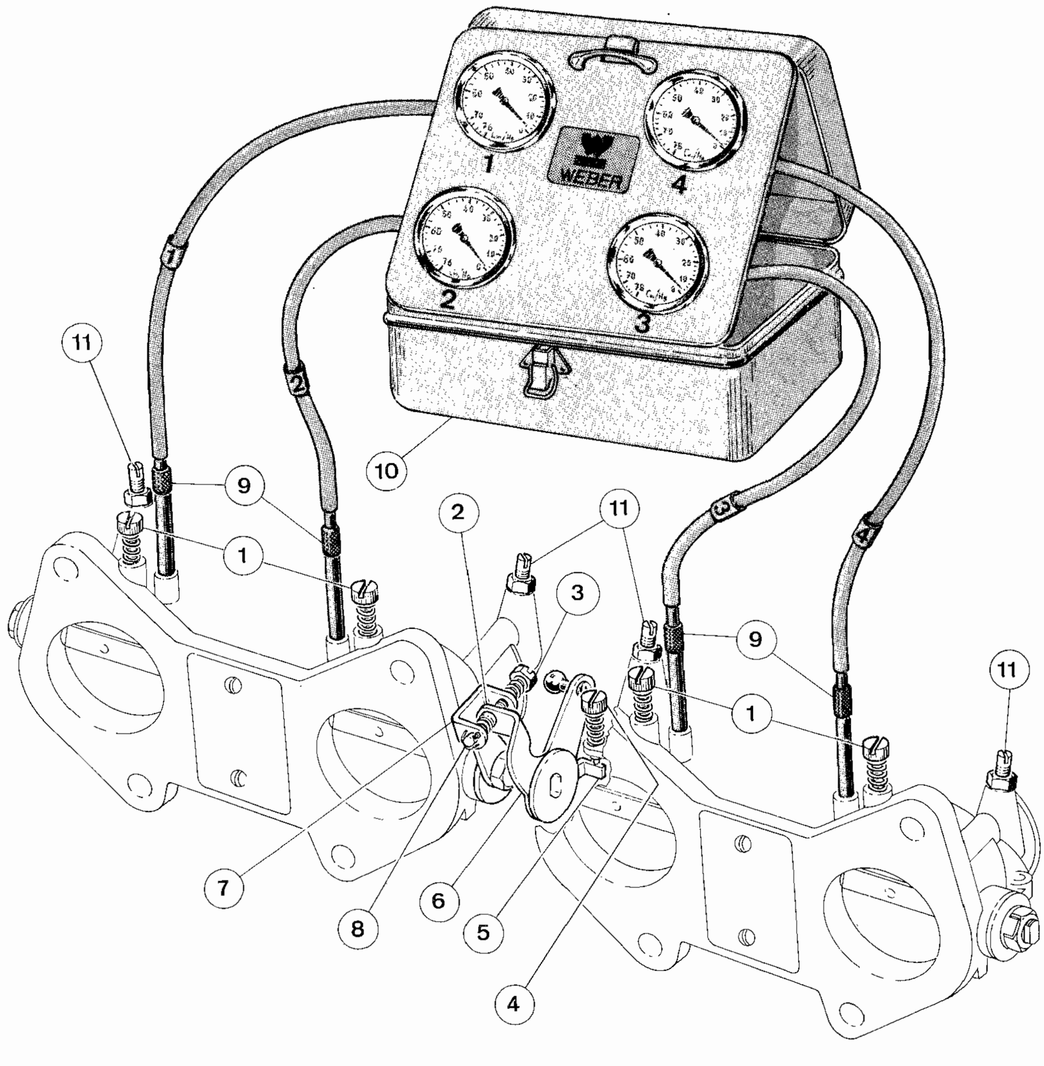


Fig. 54 - Synchronisation of twin-carburetors provided with by-pass air screws.

For a correct idle speed operation adjustment, with some applications it may prove useful to replace the spark plugs with others having a « hotter » rating: this will offset the effects of the original plugs fouled by prolonged operation at idle speed. However, **DO NOT forget to fit back the spark plugs specified by the Manufacturer as soon as the idle speed rate adjustment is over** as the « hot » plugs may damage the engine riously at full power operation.

After having properly set the idle speed rate, proceed to check if the mixture supply from the carburetor main circuits takes place simultaneously: do this by accelerating to increase engine speed until the mixture begins to issue from the auxiliary Venturi spray tubes. Use a flash light to illuminate the observation area.

If timing differences in mixture supply from the spray tubes are noticed this may be due to different float chamber level settings, provided engine is efficient, throttles are synchronized and the car is level.
Check also the accelerating pump jets for simultaneous emission of fuel at each throttle opening.

IMPORTANT

Once the synchronization operations are over, check carefully that accelerator control works smoothly **without tight spots**, all adjusting devices are securely **locked in position** and that for instance, there is no possibility of a spherical connection working loose upon sudden full accelerations. If the accelerator pedal is provided with an end-of-travel adjustment this must be set in such a way as to **prevent** any excessive pressure on carburetor stops and levers.

— Note for carburetors provided with adjustable idle air passage (compensation).
Some carburetor models incorporate a compensating device — shown in **Fig. 55** — which permits easy equalization of the air flow rates in every barrel during idle speed operation, even when throttles are carried on a single shaft. It is always essential to avoid a complete blanking of the barrel by the throttle valves in which case the air needed for idling would come exclusively from the compensating orifices; to overcome this drawback, the following procedure is recommended.
Slacken the jam nuts and turn in to moderate tightening all the **compensation adjusting screws:** to permit engine operation, open the throttles by **tightening the idle speed adjusting screws 1/2 or 1 turn.** Next, synchronize all carburetor barrels by taking as reference the barrel which causes the synchronizer float to rise highest and by turning out the compensation adjusting screws until all flow rates are uniform. To maintain idle speed at the specified rate reduce the opening of throttles without closing them completely: this will provide a uniform opening for correct idle speed and progression system operation.

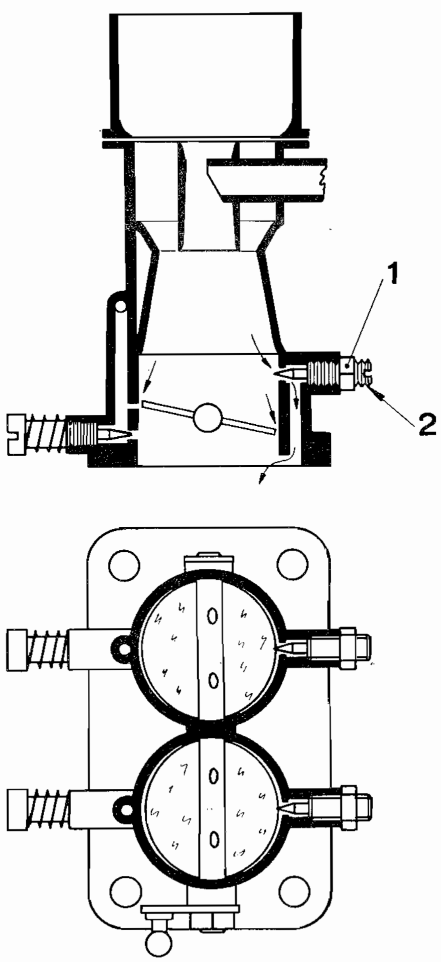


Fig. 55
Compensating air passage schematic layout. - **1** Jam nuts - **2** Taper-pointed adjusting screw.

More commonly used instruments

1) **Manometer - 0 to 0.5 Kg/sq.cm** (0 to 7 psi) scale range, for fuel supply feed pressure measurements; may also be of the wide scale range type measuring also depression (**mano-vacuum-meter**). It must be ducted in proximity of carburetor connection by means of a plastic tube so that the instrument may be kept in driver's compartment and give pressure readings during vehicle operation at high road speeds when pressure drops are more likely.
For the majority of Weber carburetors, normal fuel feed pressure values are the following:

— **Maximum pressure: 0.3 kg/sq.cm** (4.2 psi) measurable when engine operates in the transition (progression) or idle speed stages.

— **Minimum pressure: 0.2 kg/sq.cm** (2.8 psi) measurable on the road around top rated vehicle speed.

2) **Electric tachometer (revolution counter)** - to record engine rpm rates: use preferably a portable type with multi-indication scales for easy reading and temporary connection by spring jumper clamps.

3) **Synchronizer** for carburetors - **Fig. 54** - to be used on engines with multi-carburetor applications.

4) **Stroboscopic lamp** for ignition advance checks with engine operative.

5) **Portable lamp** (or flash-light) for illumination of carburetor interior during checks.

6) **Gasoline sprayer:** consisting of a fuel-resistant, flexible plastic bottle provided with a 0.3-0.4 mm bore metal spray tube.

During engine tests, weak mixtures may be readily detected because any addition of gasoline in air cleaner, using the spray bottle, will cause engine rpm rate to surge. If the mixture strength is correct no rpm increase will occur as the engine may well withstand a moderate enrichening while if the mixture is too strong the rpm will decrease owing to its excessive richness.

When engine idles, the sprayer may be used to locate imperfect sealing areas in intake manifold, carburetor throttle shaft or mounting flange. Simply spray some gasoline in critical points: if sealing is not tight, the gasoline will be sucked in and will cause the engine to slow down or stop owing to an excessively rich mixture.

These operations must be done by skilled servicemen with a fire extinguisher ready at hand.

7) **Special manometer - 3 to 18 kg/sq.cm;** (43 to 256 psi) scale - with maximum reading indication, used for measurements of engine cylinder compression pressures.

8) **Electric exhaust gas analyzer**

9) **Weber servicing tools and equipment** - they include special gauges wrenches, spanners, reamers, etc.

Road Tests

These tests **are affected** by road and atmospheric conditions, tire inflation pressures, vehicle weight, driving habits, etc.

Assuming the engine to be mechanically in order, also other factors influence road tests, namely:

— Modifications or clogging of air cleaner.

— Imperfect sealing between air cleaner and carburetor.

— Modifications, clogging or breakages in the exhaust system.

— Lubricant grade and temperature.

— Pressure variations outside carburetor (o... sports car engines without air cleaner).

The use of a manometer for fuel feed pressure indications is recommended.

With engine running at rated temperature and tire pressures checked to be as specified, start the test to compare carburetor adjustment settings, at brief intervals.

Atmospheric conditions must be good, without wind, the road dry and level, and the test must be conducted with two runs **in opposite directions.**

The more common road tests are:

— Carburetion performance check by depressing accelerator pedal progressively with increasingly higher force, but very slowly, keeping engaged the same transmission gear up to the maximum rpm rate specified for the engine under test. Repeat the same operation for all transmission forward gears, starting always from the lowest speed which the engine is capable of maintaining smoothly in the selected gear and ending with the maximum engine rpm rate or vehicle road speed allowed by that same gear.

Repeat the above tests with the same procedure except that accelerator is depressed suddenly ... full travel, when the vehicle is running at minimum road speed. Run the test also from intermediate road speeds.

Run also a « release » check, namely, with car at speed in any gear release accelerator pedal almost completely: if mixture metering is weak, the amount of gasoline issuing by inertia of the main circuit with throttle slightly open, will enrichen the mixture and result in a brief acceleration or, at least, a dwelling of engine before slowing down; if mixture metering is rich, the acceleration following pedal release will become worse and there will be no dwelling of engine while vehicle slows down.

It is often necessary to check also for operation smoothness with engine at full power and not under acceleration: this may be done, by depressing accelerator pedal down to footboard and brake pedal partly, under adequate foot pressure, thus causing engine to operate briefly at the different rpm rates being tested; avoid, of course, any overheating of brake components. With satisfactory carburetion, the engine should be capable of operating — in the above conditions — starting from the higher rpm rates down to **1000-800 rpm** even in the case of Granturismo sports car applications.

Acceleration capability is also evaluated ov... established distances, for instance, **the standing mile**, or at low speeds with highest gear engaged, using a stop-watch for time recordings over the distance travelled.

It is essential to check carburetion tuning with car at high speed on narrow bends, depressing the accelerator pedal at the beginning or end of the curves.

Also important is to check that engine is capable of operating at and maintaining its idle speed rate under the following conditions:

— Immediately after a hard brake application, ·th car level and on up- or down-grades.

— High longitudinal inclinations, with vehicle heading up- and downhill (**25 %** to **30 %** gradients); also important are the transversal inclinations with car on high cambered or otherwise not level roads.

In the case of sports car applications where, as mentioned earlier, the fuel level in float chamber must be maintained as high as possible, running difficulties are greater.

Finally, check also the possibility of starting the engine at low and high temperatures with car inclined as described above.

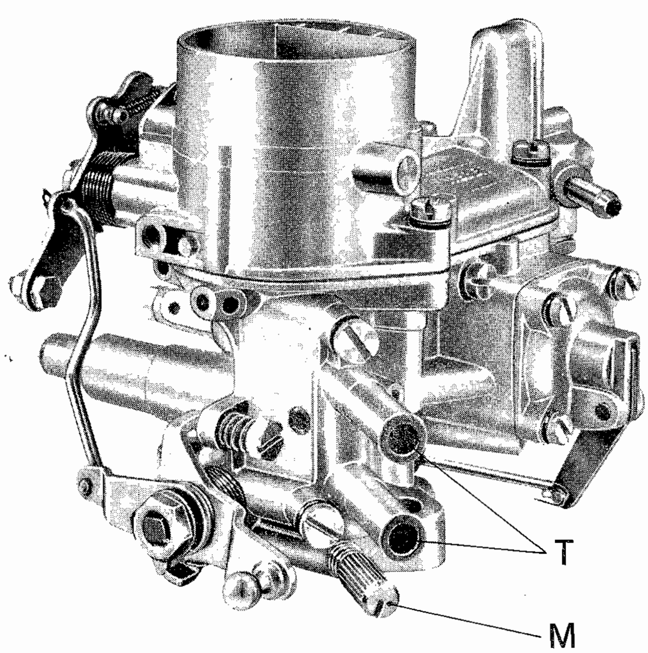


FIG. 57
The type **32 ICR** carburetor incorporating a system for heating the idle speed circuit area by engine cooling water recirculation through tubes **T**. The idle mixture screw is indicated with **M**.

— **Fuel consumption test** - use a supplementary tank filled with fuel from a graduated vessel.

Choose a road where traffic is not heavy and limit the test run to a distance of **not over 20-40 km**, depending on engine specific fuel consumption.

— **Top speed test** - it is run over a known distance between two road reference points, using an ac- rate stopwatch.

Ice formation in carburetors

Ice may form and build up in carburetor, on the throttle valve or Venturis, as a result of temperature drops due to evaporation of the mixture, when intake air temperature is between **0°** and **+10°C** and relative humidity is between **75 and 100% (approx.)**. Icing reduces engine power and pick-up, increases fuel consumption and manifests itself over long runs at steady speeds as a progressive reduction in road speed without any apparent reason; in other cases, the engine will stop at low throttle. A brief stopover with engine switched off will melt the ice and upon resuming travel the trouble is temporarily absent.

The best way to prevent ice formations is to **heat** the intake air by ducting the induction in proximity of the exhaust manifold; heating the intake manifold or carburetor body — **Fig. 57** — may prove inadequate.

It goes without saying that an excessive heating of intake air or carburetor must be avoided in summer.

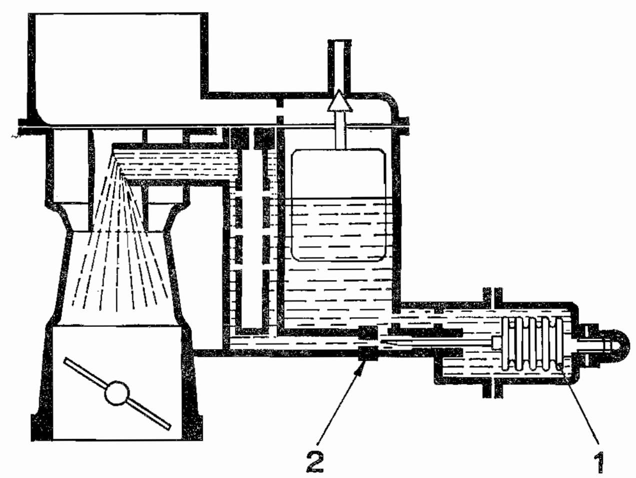


FIG. 58
Schematic representation of a carburetor provided with altitude correction device, operating on the main fuel jet through a needle and aneroid bellows.
1 Aneroid bellows - **2** Main fuel jet.

At temperatures **below 0°C** ice is formed in the feed system if there is some water in the fuel: in such cases the engine will run on a weak mixture, with slow pick-ups and « popping » carburetor. To remedy this condition, the entire fuel feed system must be cleaned by carefully emptying the fuel tank, lift pump and carburetor.

Altitude operation

For engines expected to operate normally at altitudes **above 1200-1500 meters**, the adoption of a smaller size main fuel jet is a practical solution preventing an excessive richness of the mixture due to air rarefactions. This jet diameter reduction is not recommended if altitude operation is discontinuous and limited to a few occasional trips. **Automatic altitude correction devices** employing an **aneroid bellows** - **Fig. 58** - are available for specific requirements.

The following tabulation covers five main fuel jet diameters: for intermediate sizes select the next nearest diameter included in the production range.

AVERAGE ALTITUDE in mts. / in Ft.	1500 - 2000 / 4900 - 6600	2000 - 3000 / 6600 - 9800	3000 - 4000 / 9800 - 13100
AVERAGE MIXTURE RICHNESS %	7 - 9	9 - 14	14 - 18
MAIN FUEL JET DIAMETER IN MM.	N = 1.00 R = 0.97-0.95	N = 1.00 R = 0.95-0.93	N = 1.00 R = 0.93-0.90
	N = 1.25 R = 1.20	N = 1.25 R = 1.15	N = 1.25 R = 1.13
	N = 1.50 R = 1.45	N = 1.50 R = 1.40	N = 1.50 R = 1.35
N = Normal R = Reduced	N = 1.75 R = 1.70	N = 1.75 R = 1.65	N = 1.75 R = 1.60
	N = 2.00 R = 1.95-1.90	N = 2.00 R = 1.85	N = 2.00 R = 1.80

Fuels containing alcohols

The fuels containing alcohols, benzene, toluene and acetone, have a calorific value quite lower than gasoline and a stoichiometric mixture ratio formed by a higher percentage of fuel; as a result, the engine will need a higher consumption in **Lts/hr** or **grams/HP-hr**. Specific gravity and viscosity also differ considerably compared with gasoline. For this reason, the following instructions must be considered as indicative:

— Check and if necessary **raise** the fuel level in float chamber, depending on the fuel's specific gravity.

— Select **larger diameters** for the main fuel jet, idle speed jet, accelerating pump jet and needle valve, in accordance with the criteria specified below. If necessary, change also the emulsion tube, referring to the Table given under **Part Two.**

Examples

— Mixture of 60% methyl alcohol, 20% gasoline and 20 % benzene (by volume) **increase the diameter** of all above jets and needle valve by **about 15%.**

— Mixtures of 94% methyl alcohol, 6% aceto and traces of oil (by volume): **increase** sa diameters by **about 45%.**

Operation Faults

After having performed the checks described previously for the carburetor and engine, the number of possible trouble sources is greatly reduced. Added below is a list of the more common checks referred to applications in which both the carburetor and engine are as specified by the vehicle Manufacturer.

— The battery and electric wiring are in perfect order so that the starter motor **can provide** a cranking speed of over **70-100 rpm** and the ignition system is properly fed.

— The grade of lubricants **is adequate** to cope with seasonal requirements: never mix oils of different grades or brands.

Starting difficulties at low temperatures

— The choke must be **fully-IN** and efficient.

— The accelerator pedal **is not kept** fully depressed.

— The crankcase emission control (CEC) system operates **correctly.**

— The pneumatic advance variator **is not seized:** a minimum advance is necessary at starting.

Starting difficulties with warm engine

— The choke **must not be IN.**

— The winter heating of intake air or carburet is **excluded.**

— The anti-flooding orifice or tube and the float chamber vent valve — **Fig. 48-A/B** page **47** — are operating efficiently.

— It may be necessary to **depress lightly** the accelerator pedal, with a **single steady** stroke to prevent any repetitive action of the accelerating pump: this will facilitate suction by the engine of all gasoline vapors which heating of the carburetor has accumulated in the manifold and air cleaner.

— The high tension current at spark plugs **must** ` adequate.

Slow running difficulties

— With engine operative, check for **no air leakages** past the gasket between manifold and carburetor, the starting device (in the case of offset strangler valve chokes) or the throttle shaft supports, by wetting with gasoline from the sprayer bottle as described earlier. The idle speed jet holder **is properly tight** in its seat.

— The anti-flooding orifice in manifold (when present) is of appropriate size (about **1 to 1.2 mm** in diameter).

— The mixture adjusting screw **is not closed** as otherwise the engine would already be receiving its mixture supply from the transition orifices.

— The throttle closing action **is not impeded** by excessive carbon deposits which may build-up also in the passages and calibrated parts of the idle speed system thus altering its operation.

— The throttles **return** to their idle speed setting **without any drag**, particularly when the carburetor is fitted with a dash-pot device for throttle closure dampening - See **Fig. 59.**

— The ignition system **conforms** to Manufacturer's specifications.

Flooding and fuel losses

— Check needle valve **wear**, fuel filter **efficiency** and fuel level adjustment **setting.**

— Check that float is **not distorted** and is free to move without binding on its fulcrum pin or against chamber walls.
If the metal float is punctured it will be penetrated by fuel that will increase its weight: to check this condition, shake the float in one hand; if the familiar sound of sloshing liquid is heard, discard and **fit a new** float.

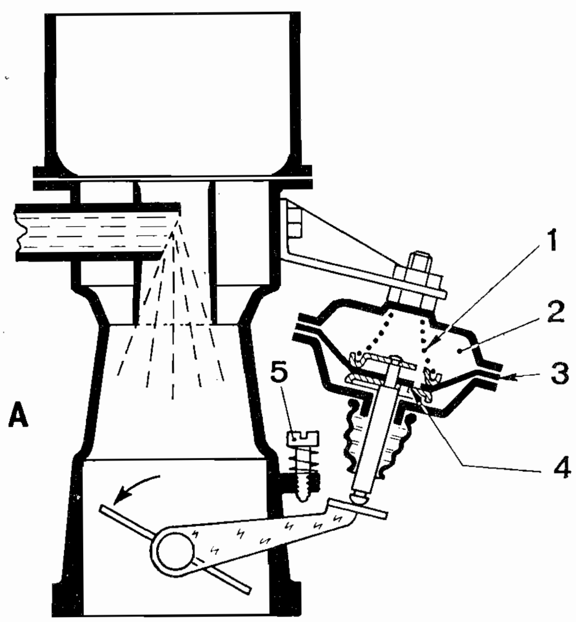
— Check that there **is no leakage** past the fuel filter plug, the main jet holder (if any) and all the other plugs. Fuel feed pressure must be as specified.

Inadequate pick-up and speed
Excessive fuel consumption

— Check carburetor for **perfect cleanliness** and **original adjustment settings**; also, that all engine components work efficiently.

— The accelerating pump is **supplying fuel regularly** at every throttle opening.

— The throttle **opens completely** whenever the accelerator is fully depressed.



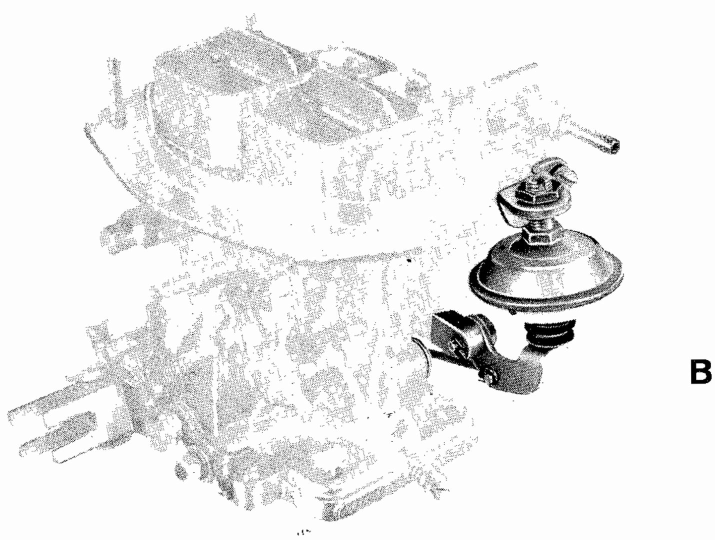
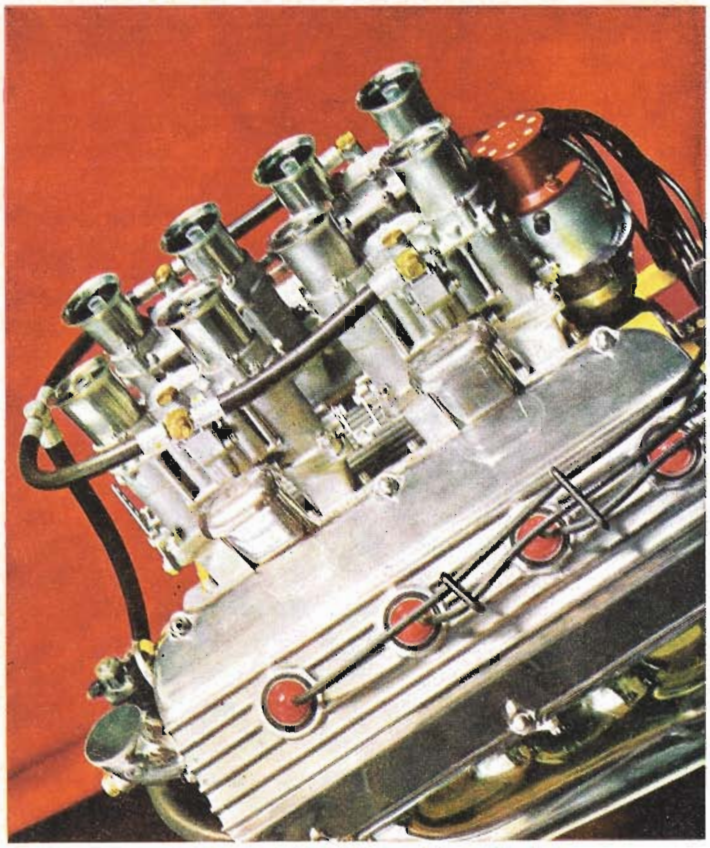
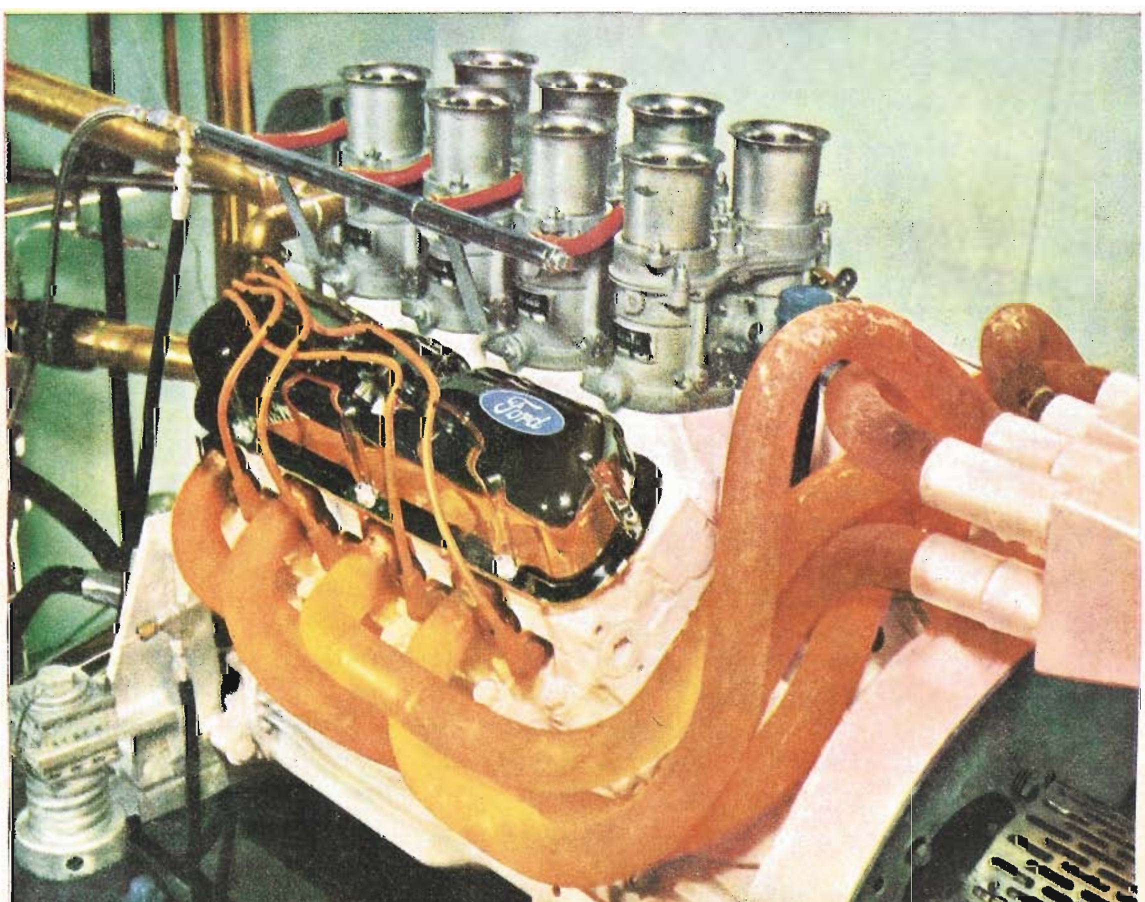


FIG. 59

A represents schematically the application of a throttle closure dampening device, know, as the « **dash-pot** » - **1** Dash-pot return spring - **2** Air compression chamber - **3** Diaphragm - **4** Valve with calibrated bleed of throttle closure dampening air - **5** Idle speed rate adjusting screw - **B** Shows one type of carburetor fitted with a dash-pot.



AMERICAN SPORT ENGINES FITTED WITH WEBER CARBURETORS



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