Part Three

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Installation & Checks on Engine – Adaptations

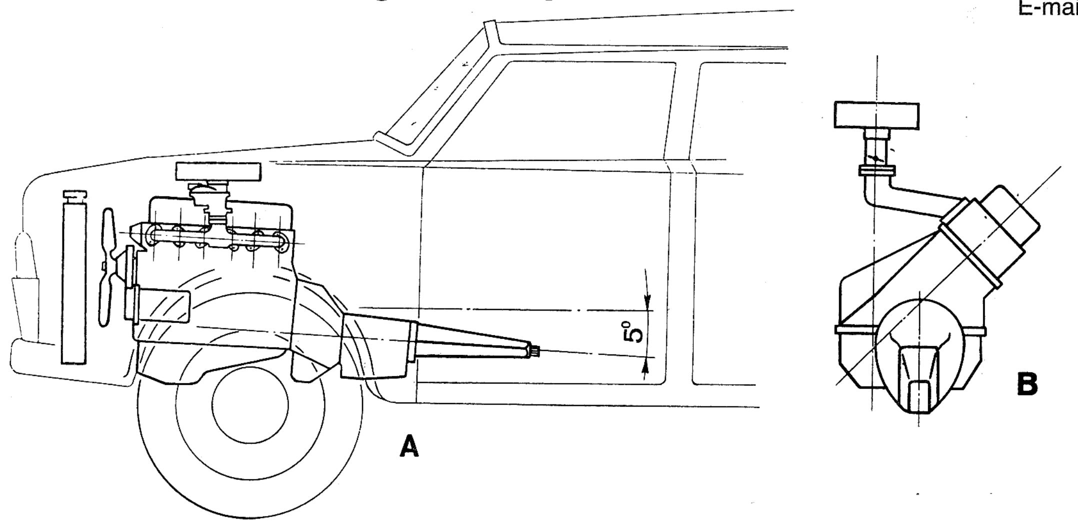


FIG. 46
In A the engine inclination does not ensure a uniform distribution of the mixture to all cylinders. In B the excessive length of the intake manifold is detrimental to proper operation on road bends.

Intake manifold

With the majority of motor vehicles the carburettor 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 carburettor and to favour as much as possible the vapourisation 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**.

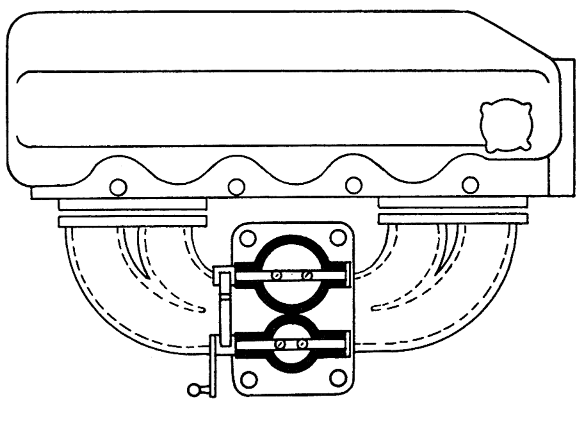


FIG. 47
Dual-barrel, downdraft carburettor with differential opening of throttles installed on an in-line engine.
In this case both carburettor barrels must communicate with a single chamber in manifold from which are branched the cylinder feed ducts.

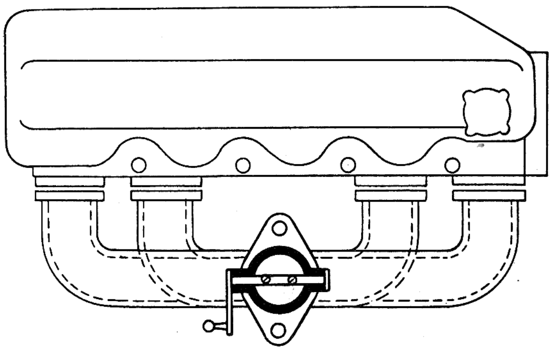


FIG. 47-A
Single-barrel, downdraft carburettor installed on an in-line engine. To prevent uneven mixture distribution to cylinders the throttle shaft must be parallel with engine longitudinal centreline.

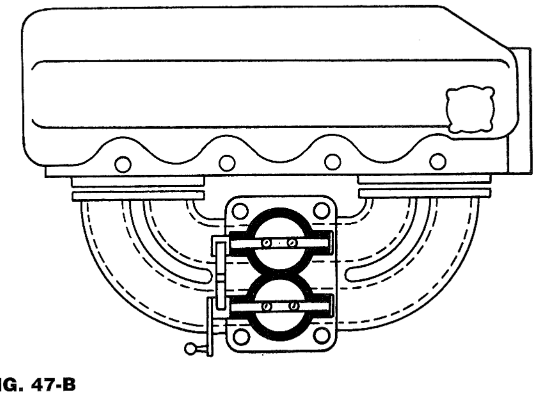


FIG. 47-B
Dual-barrel, downdraft carburettor with synchronised opening of throttles, installed on an in-line engine.
For maximum power each carburettor barrel feeds only two cylinders and the manifold does not have a common chamber under the carburettor.

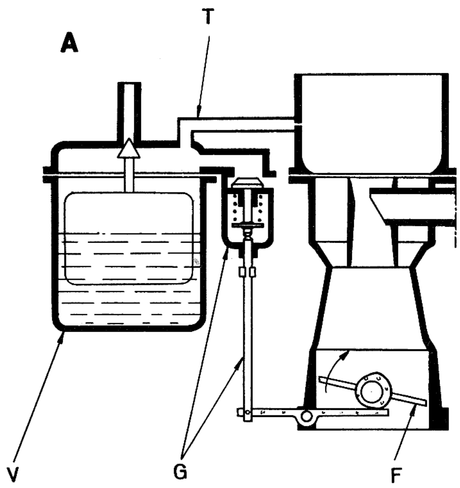
To favour fuel vapourisation, the intake manifold is generally provided with an area which is heated by contact with the exhaust manifold (known as **"hot-spot"**) or by an enveloping cavity through which flows the cooling system water recirculated from the engine. Though without any impairment to the desirable engine volumetric efficiency at high rpm rates, the intake manifold ducts **must be dimensioned** so that even at low rpm the mixture flow will retain enough velocity to avoid liquid depositions 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 centred 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 carburettor layouts and applications.

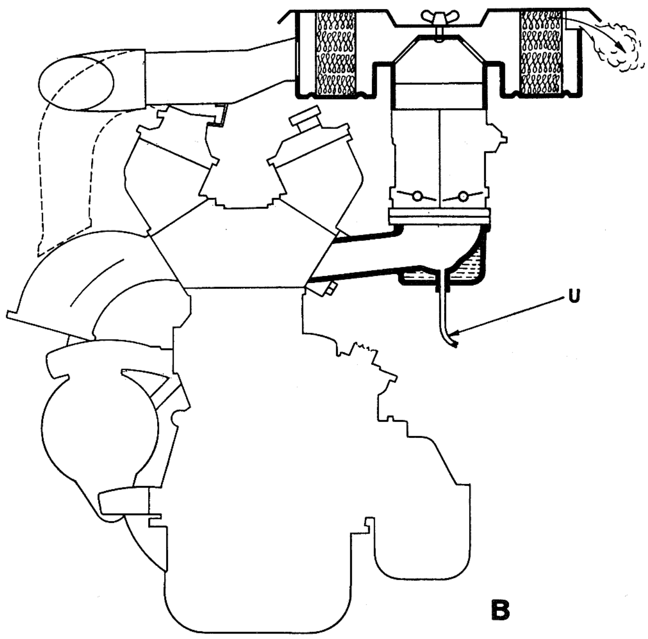
Exhaust system

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 carburettor applications it is preferable to have the engine bear the air cleaner and





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 vapours 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 vapour discharge from air cleaner top and intake manifold liquid fuel drain with stationary engine (tube U with 1.2 mm end bore).

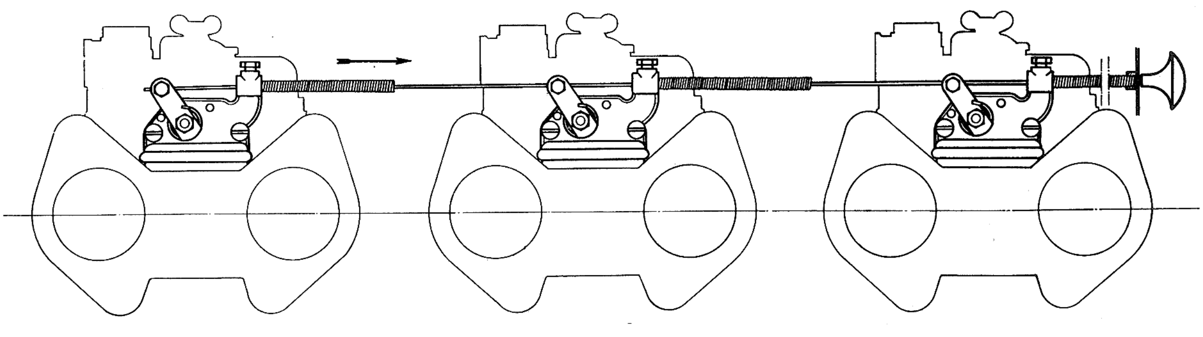


FIG. 49
Illustration of a simultaneous choke control by bowden on a three- carburettor engine.

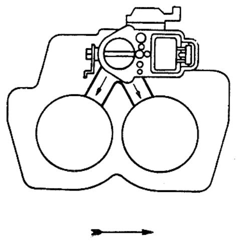
Application Examples

Some illustrative application layouts with pertinent main specifications of engine and carburettor 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.

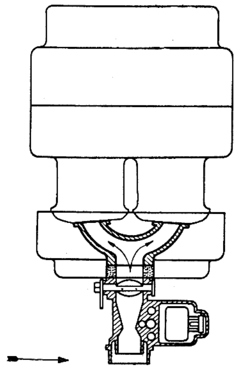
Table 1

2 to 4 Cylinder Engines									
Engine Data					**Weber Carburettor Data**				
Engine Arrangement	Manufacturer & Model	Total Capacity cc	Power HP (DIN)	Speed Rate (rpm)	Number of carburettors installed	Type	Designation	Diameters in mm. Barrels 1° 2°	Diameters in mm. Venturis 1° 2°
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** (s)	40	30
	Alfa Romeo 1750	1779	132 (SAE)	5500	2	**40 DCOE**	**2 barrels, sidedraft** (s)	40	32
	Autobianchi Primula Coupé S	1438	75 (SAE)	5600	1	**32 DFB**	**2 barrels, downdraft** (s)	32	23
	B.M.W. 1800 TI/SA	1773	130	6100	2	**45 DCOE**	**2 barrels, sidedraft** (s)	45	38
	Citroën DS 21	2175	109 (SAE)	5500	1	**28/36 DLE**	**2 barrels, downdraft** (d)	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** (d)	30 30	23 23
	Fiat 1100 R	1089	48	5200	1	**32 DCOF**	**2 barrels, sidedraft** (s)	32	22
	Fiat 124	1197	60	5600	1	**32 DCOF**	**2 barrels, sidedraft** (s)	32	23
	Fiat 124 Sport	1438	90	6500	1	**34 DHS**	**2 barrels, downdraft** (v)	34 34	24 26
	Fiat 124 Special	1438	70	6500	1	**32 DHS**	**2 barrels, downdraft** (v)	32 32	23 23
	Fiat 125	1608	90	5600	1	**34 DCHE**	**2 barrels, downdraft** (v)	34 34	24 24
	Fiat 125 Special	1608	100	6400	1	**34 DCHE**	**2 barrels, downdraft** (v)	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** (v)	34 34	25 25
	Ford Escort G.T.	1298	64	5800	1	**32 DFE**	**2 barrels, downdraft** (d)	32 32	23 24
	Ford Cortina G.T.	1599	82	5400	1	**32 DFM**	**2 barrels, downdraft** (d)	32 32	26 27
	Lotus Elan G.T.	1558	106	5500	2	**40 DCOE**	**2 barrels, sidedraft** (s)	40	30
	Opel Rekord Sprint	1897	106	5600	2	**40 DFO**	**2 barrels, downdraft** (s)	40	32
	Renault Caravelle 1100 S	1108	51	5400	1	**32 DIR**	**2 barrels, downdraft** (d)	32 32	23 24
	Renault 16 TS	1565	83	5750	1	**32 DAR**	**2 barrels, downdraft** (d)	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** (d)	28 36	25 26
4-cyl. opposed	**Lancia** Flavia 1800	1800	105	5200	2	**40 DCN**	**2 barrels, downdraft** (s)	40	32
	Porsche 904 GTS Carrera	1966	180	7000	2	**46 IDA**	**2 barrels, downdraft** (s)	46	40
4-cyl. V	**Ford** Corsair 2000 E	1996	88	5000	1	**32 DIF**	**2 barrels, downdraft** (d)	32 32	26 27
	Lancia Fulvia 2 C	1231	80	6000	2	**32 DOL**	**2 barrels, sidedraft** (s)	32	26

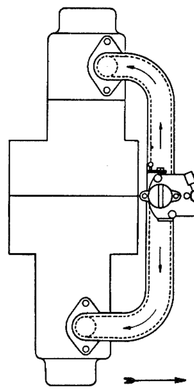
(1) Primary (2) Secondary (s) synchronised (d) differential (v) vacuum



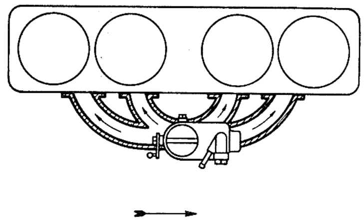
2-cylinder, vertical,
with one
downdraft carburettor



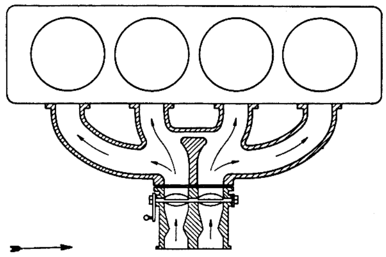
2-cylinder, horizontal,
with one
sidedraft carburettor



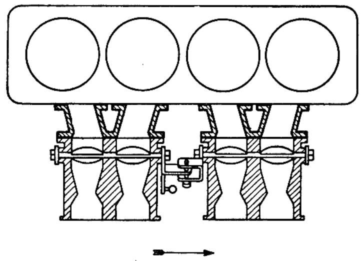
2-cylinder, opposed,
with one
downdraft carburettor



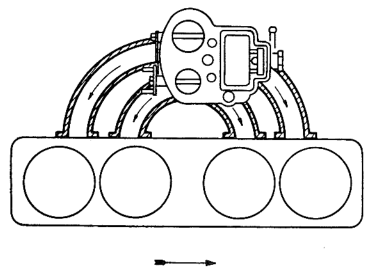
4-cylinder, in-line,
with one
downdraft carburettor



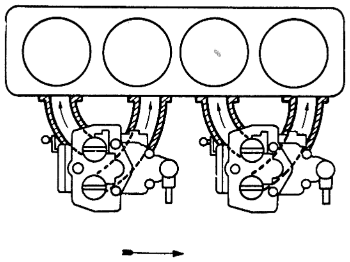
4-cylinder, in-line,
with one
dual-barrel
sidedraft carburettor



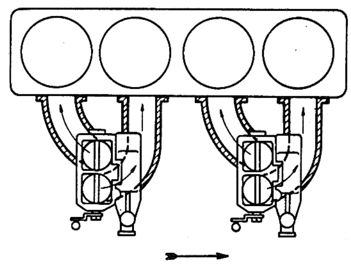
4-cylinder, in-line,
with two
dual-barrel
sidedraft carburettors



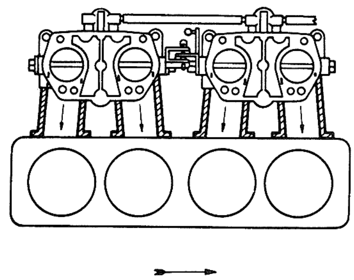
4-cylinder, in-line,
with one
dual-barrel
downdraft carburettor
(differential opening of throttles)



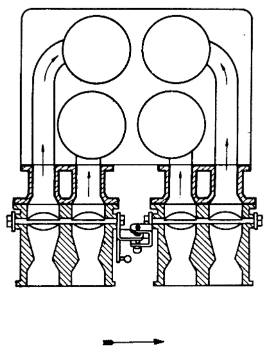
4-cylinder, in-line,
with two
dual-barrel,
downdraft carburettors
(synchronised opening of throttles)



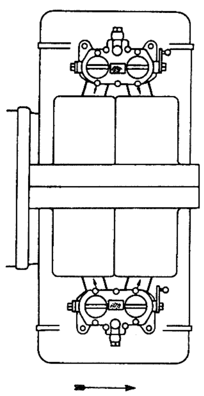
4-cylinder, in-line,
with two
dual-barrel,
downdraft carburettors
(synchronised opening of throttles)



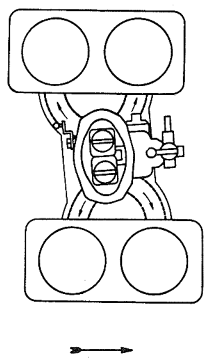
4-cylinder, in-line,
with two
dual-barrel,
downdraft carburettors
(synchronised opening of throttles)



4-cylinder, V,
with two
dual-barrel,
sidedraft carburettors
(synchronised opening of throttles)



4-cylinder, opposed,
with two
dual-barrel,
downdraft carburettors
(synchronised opening of throttles)



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

Application Examples

Table 2

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

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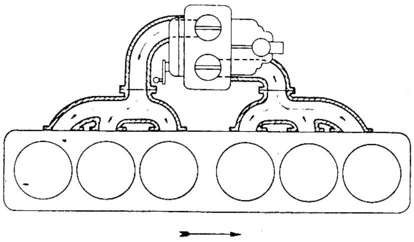
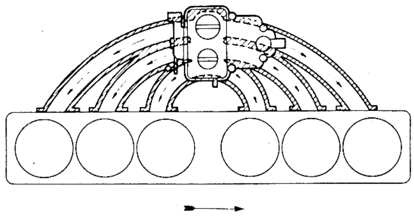
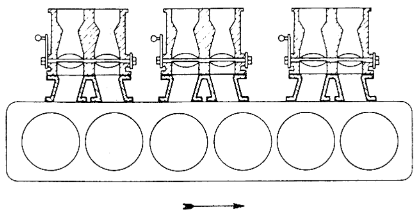


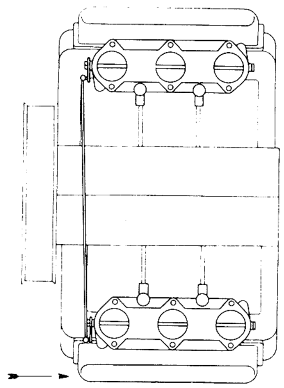
6-cylinder in-line,
with one
dual-barrel, downdraft carburettor
(synchronised opening of throttles)



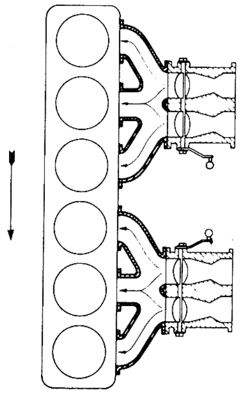
6-cylinder in-line,
with one
dual-barrel, downdraft carburettor
(differential opening of throttles)



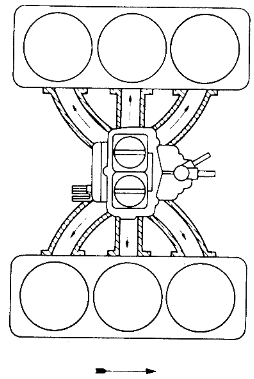
6-cylinder in-line,
with three
dual-barrel, sidedraft carburettors
(synchronised opening of throttles)



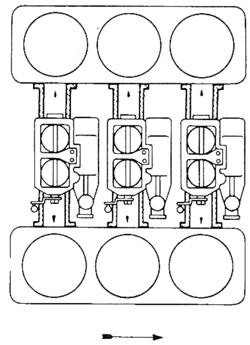
6-cylinder opposed,
with two
triple-barrel, downdraft carburettors
(synchronised opening of throttles)



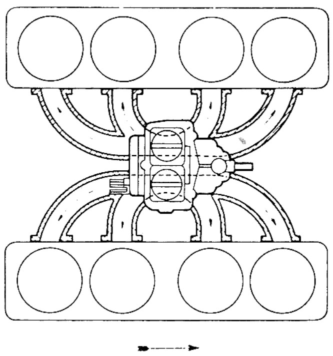
6-cylinder in-line,
with two
dual-barrel, sidedraft carburettors
(synchronised opening of throttles)



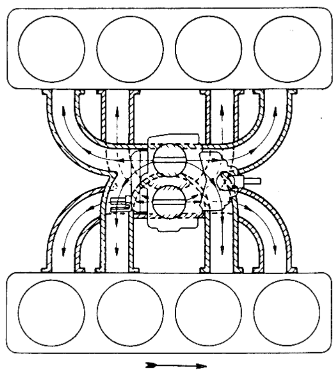
6-cylinder V,
with one
dual-barrel, downdraft carburettor
(synchronised opening of throttles)



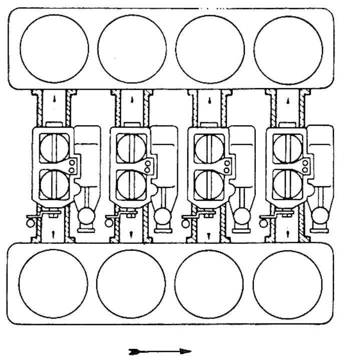
6-cylinder V,
with three
dual-barrel, downdraft carburettors
(synchronised opening of throttles)



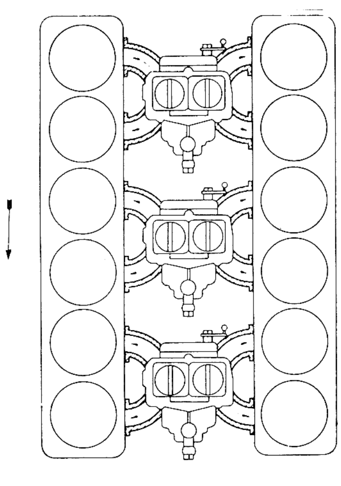
8-cylinder V,
with one
dual-barrel, downdraft carburettor
(synchronised opening of throttles)



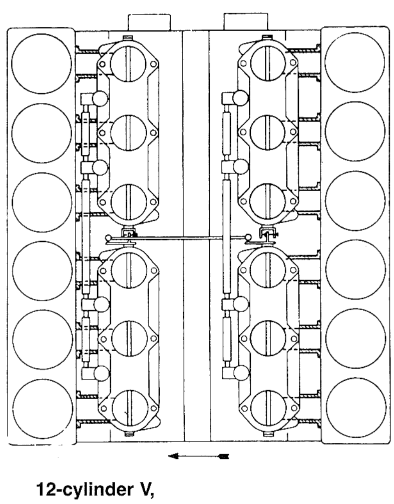
8-cylinder V,
with one
dual-barrel, downdraft carburettor
(synchronised opening of throttles)



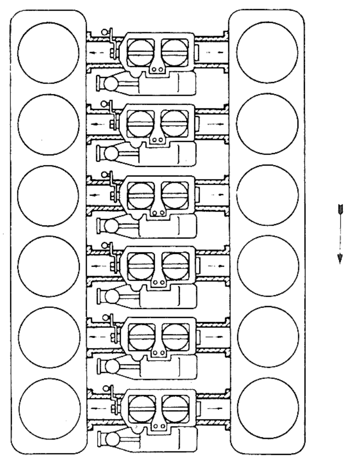
8-cylinder V,
with four
dual-barrel, downdraft carburettors
(synchronised opening of throttles)



12-cylinder V,
with three
dual-barrel, downdraft carburettors
(synchronised opening of throttles)



12-cylinder V,
with four
triple-barrel, downdraft carburettors
(synchronised opening of throttles)



12-cylinder V,
with six
dual-barrel, downdraft carburettors
(synchronised opening of throttles)

in any case it should be connected to the carburettor 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 vapours 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 vapours 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.

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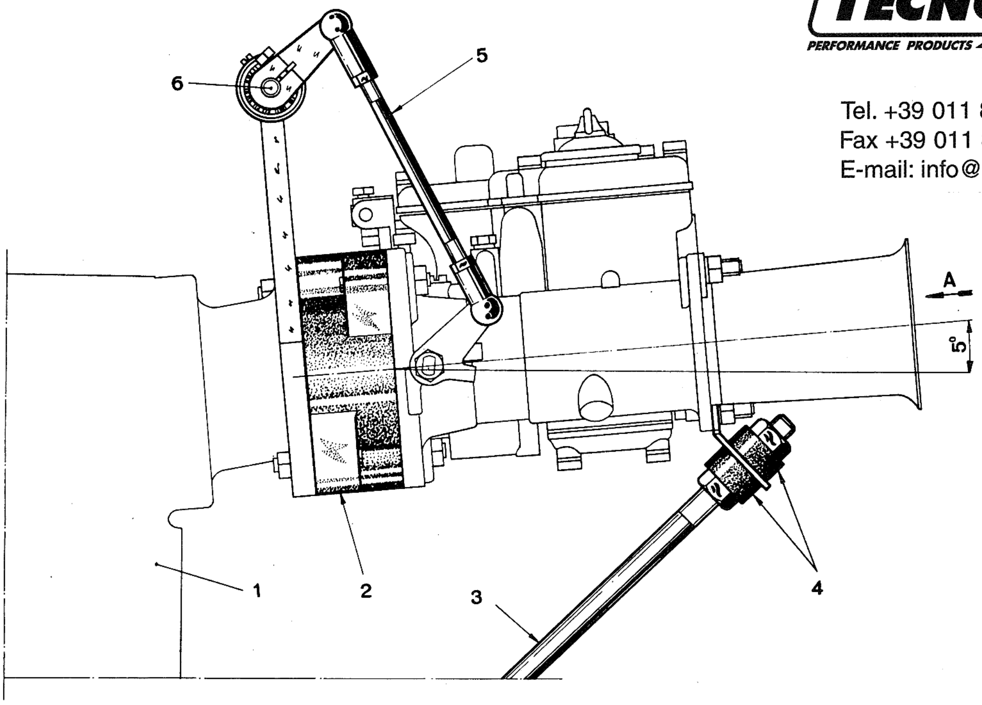


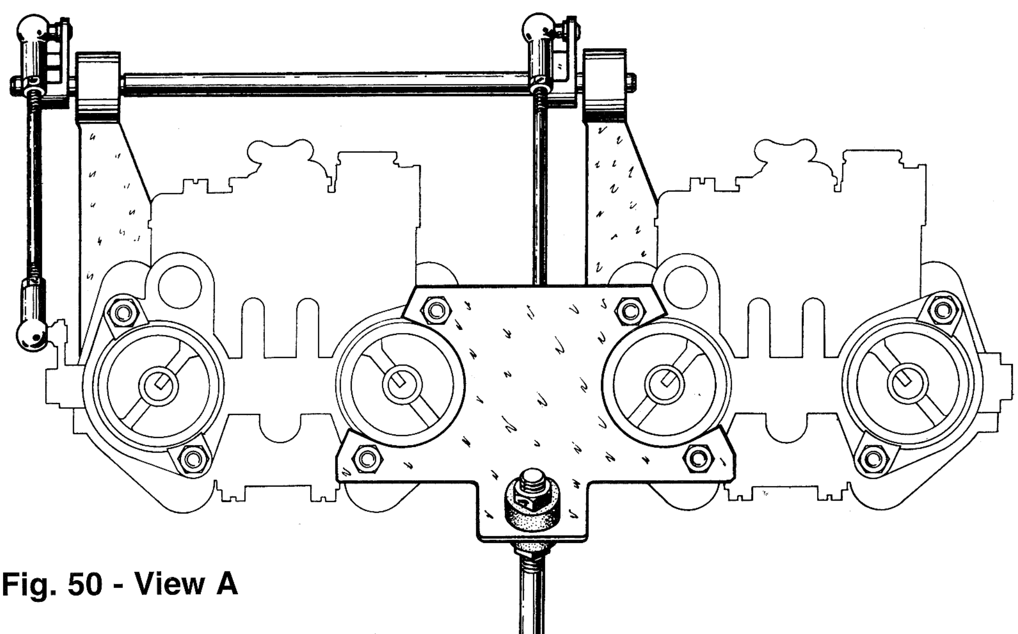


Fig. 50 - View A

FIG. 50
Installation of two or more sidedraft carburettors.
1 Cylinder head - 2 Two-piece adapter consisting of sheet metal flanges with vulcanised-on gasoline-proof rubber cheeks - 3 Carburettor support rod mounted on engine block - 4 Carburettor support rubber rings - 5 Throttle control rod with both ends threaded (one RH and one LH).
Inclining carburettors 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 carburettor.

Accelerator control

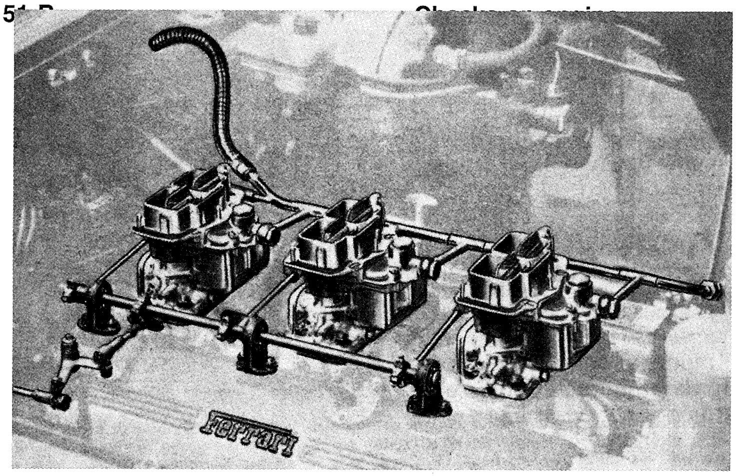
Avoid any bindings or seizures in accelerator control linkages making sure all rods are perfectly aligned and adjusted without occurrence of any excessively wide angles between linkage levers and rods. By actuating the control from the driver's seat make sure that throttles always open and close **completely**. Also check the choke manual control with device fully IN and fully OUT, **Fig. 49**; by adjusting the retaining element on the bowden avoid any excessive "tightness" of the flexible cable with choke-OUT because the lever on carburettor 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 carburettor 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-carburettor applications requiring a uniform, equal and steady control of throttle motions.
The auxiliary shaft transmitting the control to carburettor 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 centre-to-centre distances (between spherical ends and shaft centreline), as shown in **Fig. 53**. It is also **necessary to have the lowest possible** spherical end clearances.

Fuel supply lines - Fig. 5

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

Carburettor installation on engine

Make sure that when fitted on inclined engines the downdraft carburettors 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 carburettor 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 carburettors 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 or carburettor mounting nuts.
The carburettor 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.



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

FIG. 51-A
The carburettors 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.

Make sure the engine is perfectly efficient in all its electrical and mechanical parts, following the instructions of the Manufacturer.
Compression tightness checks. Run engine to rated

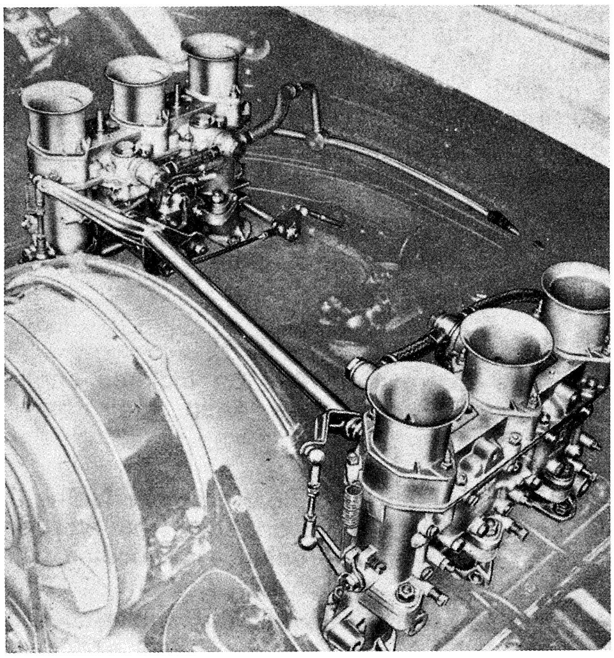


FIG. 51-B
Installation of two 40 IDA 3C triple-barrel, downdraft carburettors on a 6, opposed-cylinder engine (Porsche 911). Note the fuel feed line not entirely of metal tubing.

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 odour.
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 odour) 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 where each carburettor 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 carburettor operates on the same air flow rate when engine runs at or around idle speed, a special instrument known as a **synchroniser**, will prove extremely useful. The synchronisation of carburettor 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 carburettors; this must be done to remove the load contributed by the pedal return springs. Connect an electric tachometer (revolution counter) to the engine.

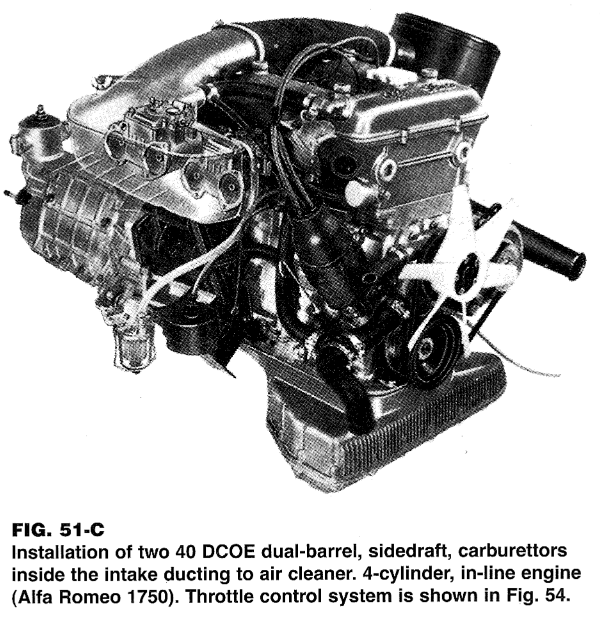


FIG. 51-C
Installation of two 40 DCOE dual-barrel, sidedraft, carburettors inside the intake ducting to air cleaner. 4-cylinder, in-line engine (Alfa Romeo 1750). Throttle control system is shown in Fig. 54.

– Make sure, by acting on lever (6) that shafts slide freely and carburettor 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 carburettor coupling adjusting screw (3).
– Depress lever (6) to compress spring of lever (7) and make sure that both carburettor 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).
– 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 carburettor are equal, proceed as directed in paragraph c), otherwise equalise 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 carburettor, then tighten lock nut;

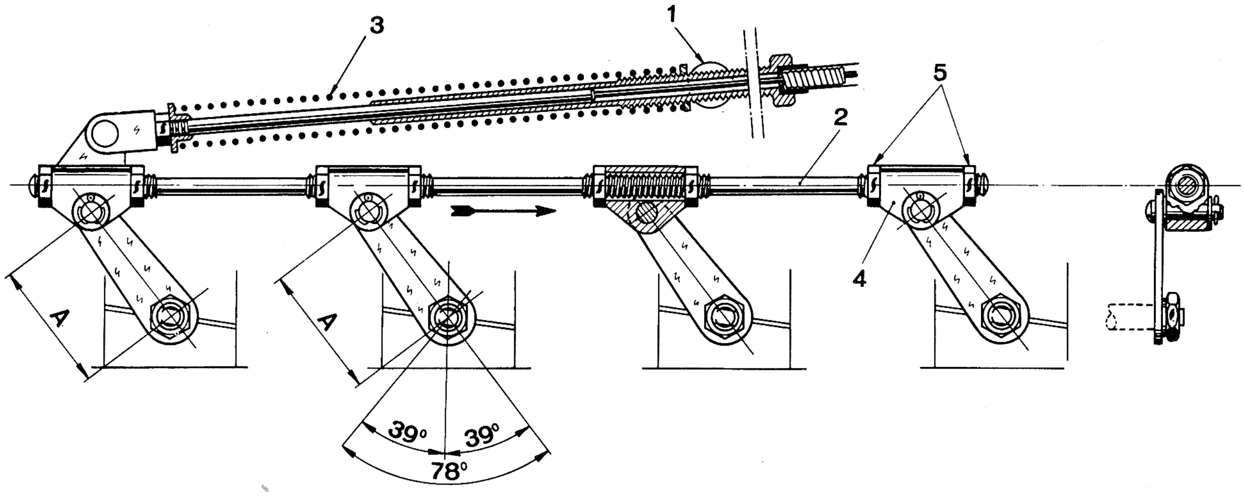


FIG. 52
Throttle linkage for four carburettors having throttles with parallel shafts lying in the same plane.
1 is the spherical mount for the bowden sheath adjuster; the bowden cable pulls on the end of threaded rod 2 against the opposing force of guided spring 3 - 4 Adjuster block - 5 Jam nuts.
The threaded rod ensures a perfect synchronisation of all throttles. All centre distances A must be identical: this also applies to all lever mounting angles and positioning angle transmitted to the throttles. Carburettor mounting flanges must all be in the same plane. The arrow points to the direction in which the throttles open.

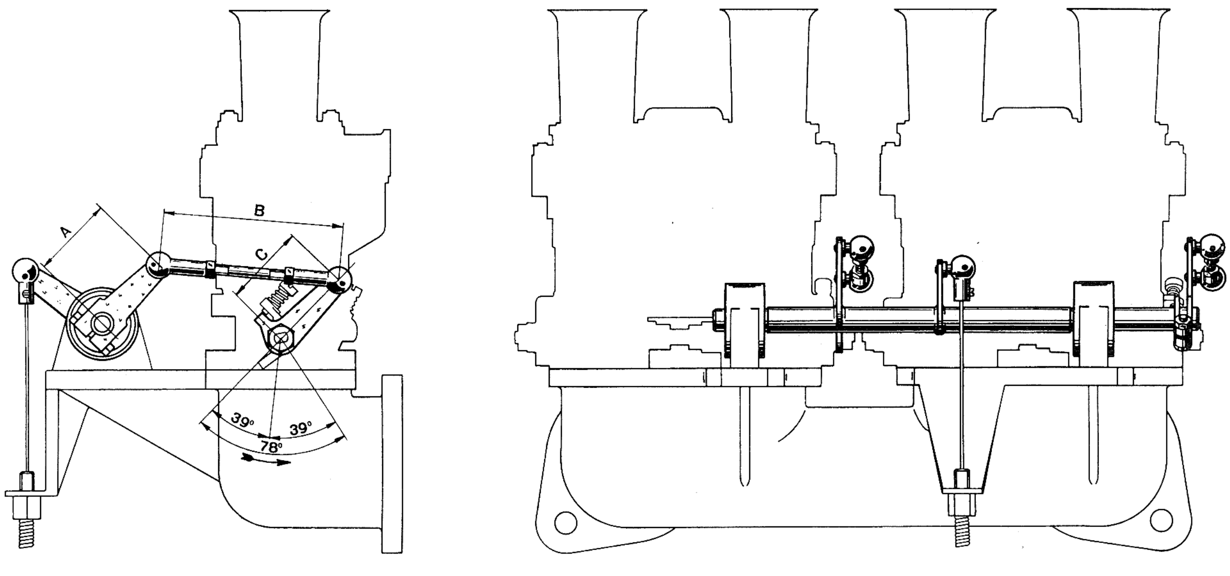


FIG. 53
Throttle control linkage for two or three downdraft carburettors through an auxiliary shaft. All centre distances A must be identical. The same applies to centre distances B and C. It is advisable for A to be slightly greater than C. Centre distance B rods should have one end RH threaded and one LH threaded. All the mounting angles of the levers on carburettors 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.

b) if necessary, repeat same operation on other carburettor;
CAUTION: one compensation screw (11) of each carburettor must remain fully tightened;
c) balance vacuum between carburettors 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-analyser, is that prescribed from car Manufacturer. If the value is different, twist the four mixture screws (1) of the same angle, progressively. Reset engine revolutions, if necessary, by acting on idle speed adjusting 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).

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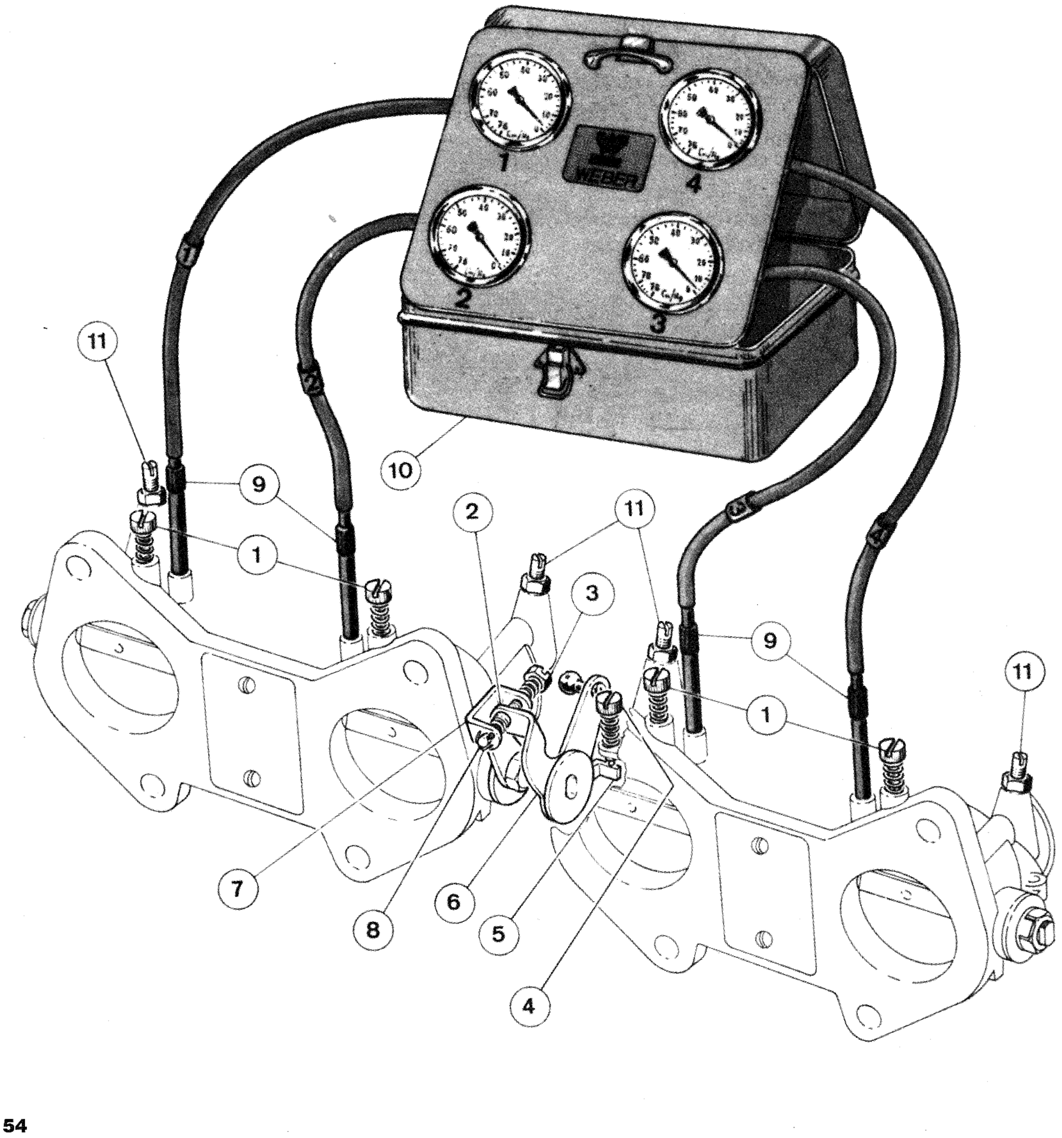

FIG. 54
Synchronisation of twin-carburettors provided with by-pass air screws.

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 seriously at full power operation.
After having properly set the idle speed rate, proceed to check if the mixture supply from the carburettor 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 synchronised and the car is level.
Check also the accelerating pump jets for simultaneous emission of fuel at each throttle opening.

IMPORTANT

Once the synchronisation 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 carburettor stops and levers.

– Note for carburettors provided with adjustable idle air passage (compensation).

Some carburettor models incorporate a compensating device – shown in **Fig. 55** – which permits easy equalisation 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 screw 1/2 or 1 turn**. Next, synchronise all carburettor barrels by taking as reference the barrel which causes the synchroniser 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.

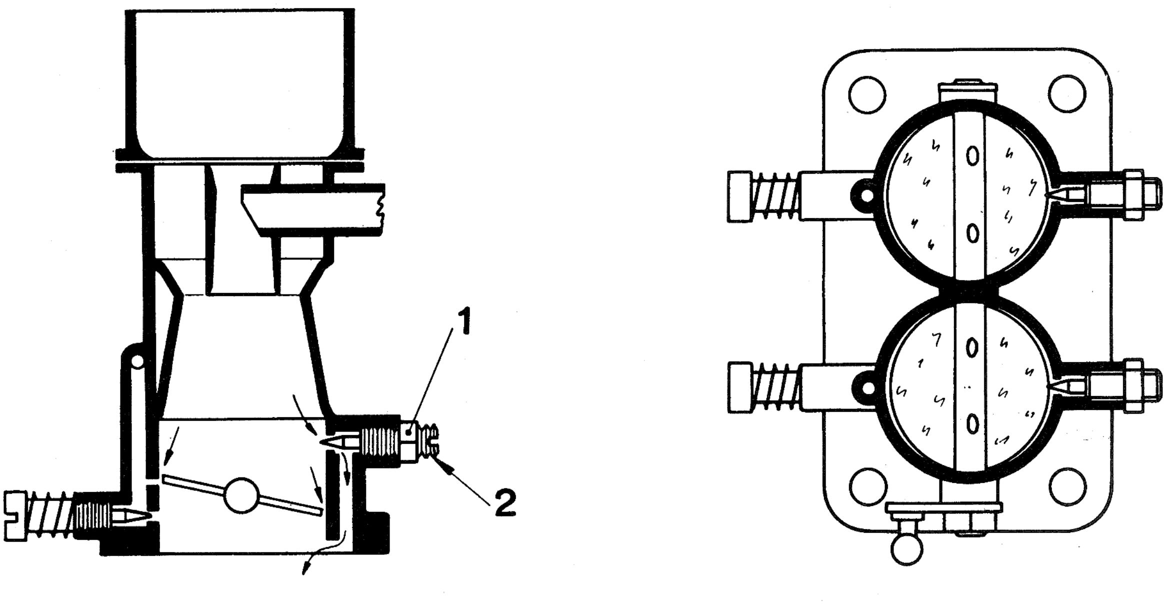

FIG. 55
Compensating air passage schematic layout. - 1 Jam nuts - 2 Taper-pointed adjusting screw.

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 carburettor 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 carburettors, 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) **Synchroniser** for carburettors - **Fig. 54** - to be used on engines with multi-carburettor applications.
4) **Stroboscopic lamp** for ignition advance checks with engine operative.
5) **Portable lamp** (or flash-light) for illumination of carburettor 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, carburettor 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 analyser.**
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 carburettor
– Modifications, clogging or breakages in the exhaust system
– Lubricant grade and temperature
– Pressure variations outside carburettor (on sports car engines without air cleaner).
The use of the manometer for fuel feed pressure indications is recommended.
With engine running at rated temperature and tyre pressures checked to be as specified, start the test to compare carburettor 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:
– Carburation 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 to 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 carburation, 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 over 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.
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, with 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.
– **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 accurate stopwatch.

Ice formation in carburettors

Ice may form and build up in carburettor, 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 carburettor body – **Fig. 57** – may prove inadequate.
It goes without saying that an excessive heating of intake air or carburettor must be avoided in summer.
At temperatures **below 0°C** ice is formed in the feed system if there is some water in the fuel: in such cases

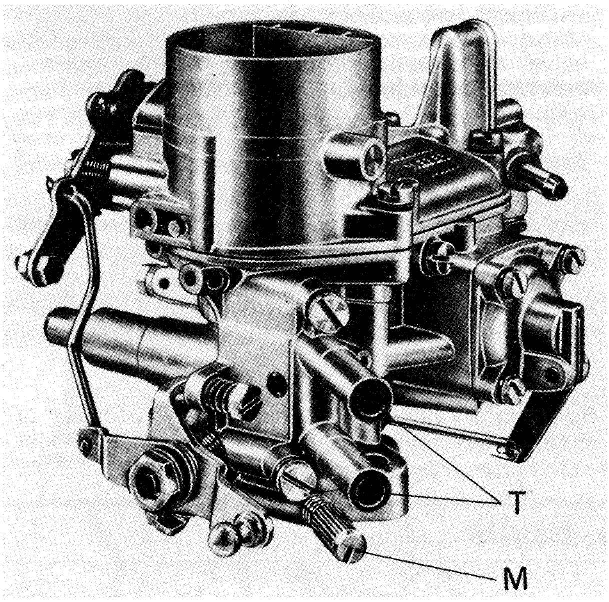

FIG. 57
The type 32 ICR carburettor incorporating a system for heating the idle speed circuit area by engine cooling water recirculation through tubes T. The idle mixture screw is indicated with M.

the engine will run on a weak mixture, with slow pick-ups and "popping" carburettor. To remedy this condition, the entire fuel feed system must be cleaned by carefully emptying the fuel tank, lift pump and carburettor.

Altitude operation

For engines expected to operate normally at altitudes **above 1200-1500 metres**, 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**

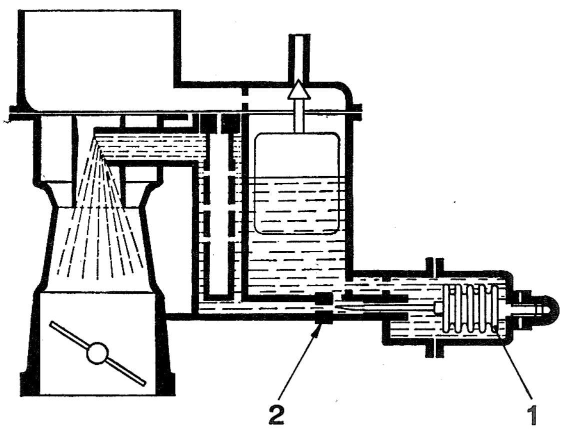

FIG. 58
Schematic representation of a carburettor provided with altitude correction device, operating on the main fuel jet through a needle and aneroid bellows.
1 Aneroid bellows - 2 Main fuel jet.

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 = 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

N = Normal R = Reduced

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% acetone and traces of oil (by volume): **increase** said diameters by **about 45%.**

Operation Faults

After having performed the checks described previously for the carburettor 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 carburettor and engine are as specified by the vehicle Manufacturer.

Starting difficulties at low temperature

– 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
– 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 with warm engine

– The choke **must not be IN**
– The winter heating of intake air or carburettor 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 vapours which heating of the carburettor has accumulated in the manifold and air cleaner
– The high tension current at spark plugs **must** be adequate.

Slow running difficulties

– With engine operative, check for **no air leakages** past the gasket between manifold and carburettor, 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 carburettor 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 carburettor 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.

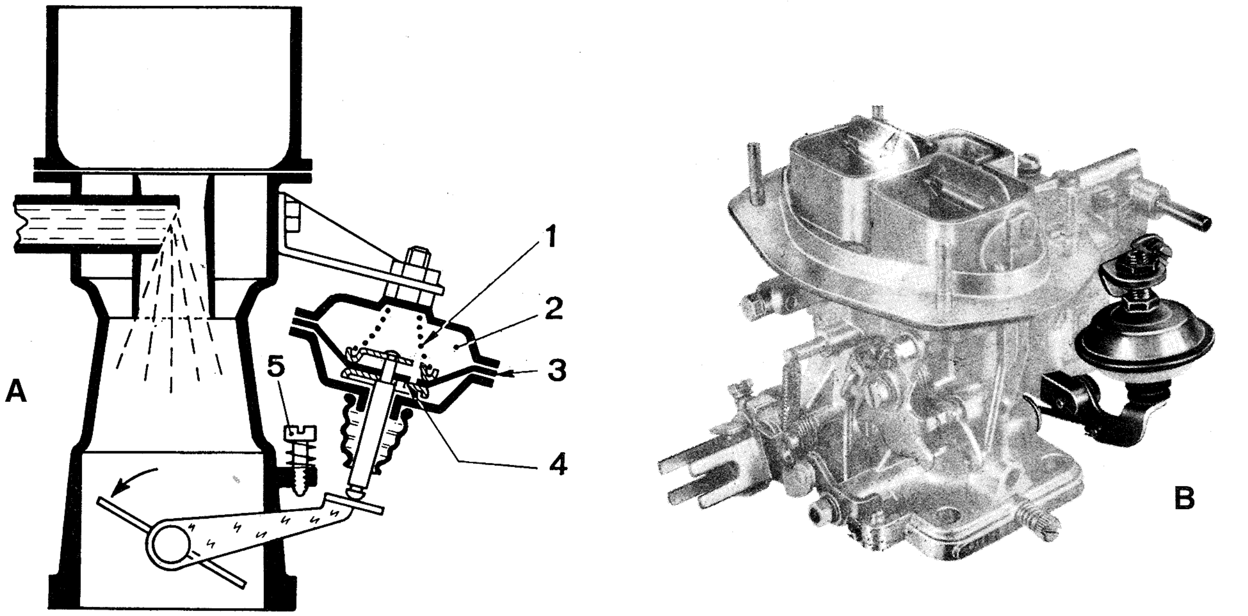

FIG. 59
A represents schematically the application of a throttle closure dampening device, known as the "dash-pot" - 1 Dash-pot return spring - 2 Air compression chamber - 3 Diaphragm - 4 Valve with calibrated bleed of throttle closure dampening air - 5 Idle speed rate adjusting screw - B Shows one type of carburettor fitted with a dash-pot.

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