May 23, 1939. M. MENNESSON 2,159,173

CARBURETOR FOR INTERNAL COMBUSTION ENGINES

Filed Nov. 28, 1936 3 Sheets-Sheet 1

Fig. 1

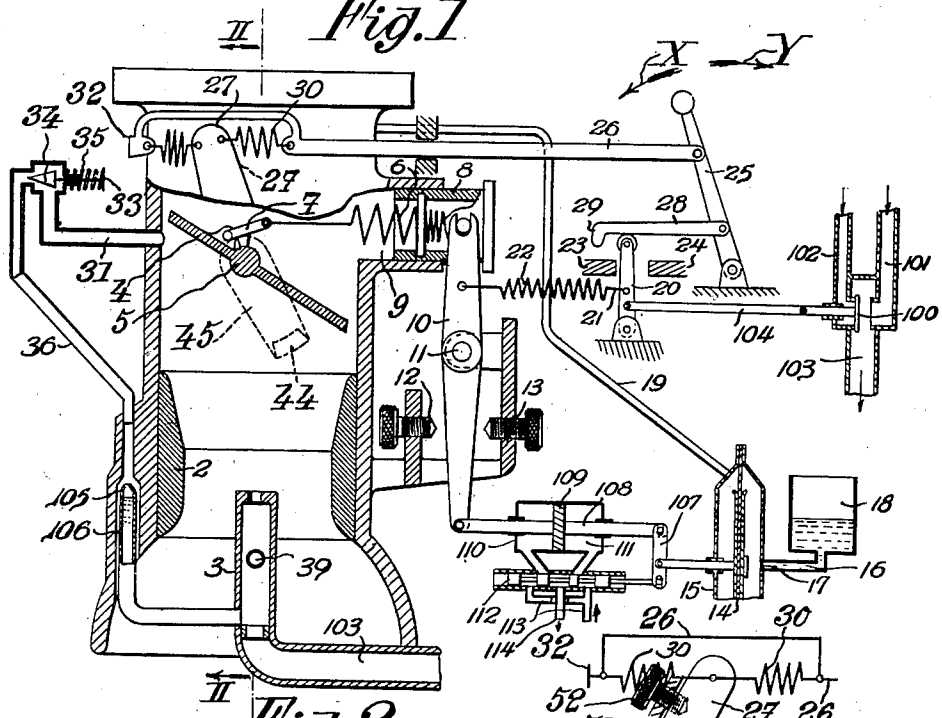


Fig. 2

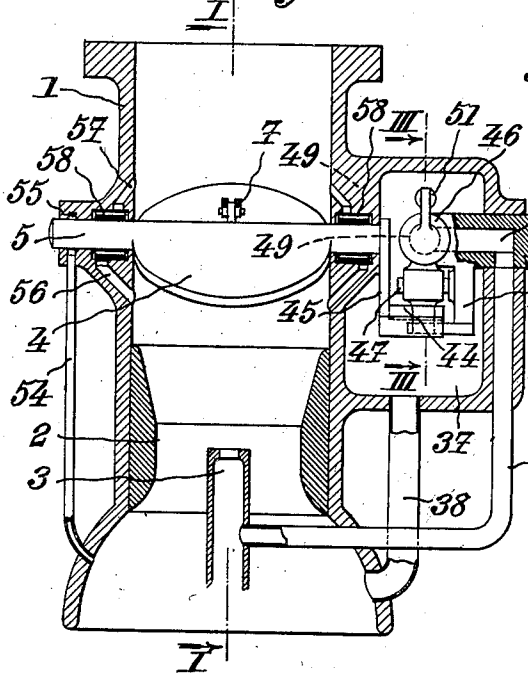


Fig. 3

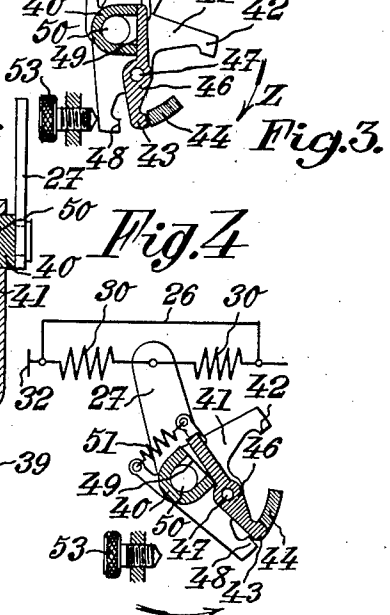


Fig. 4

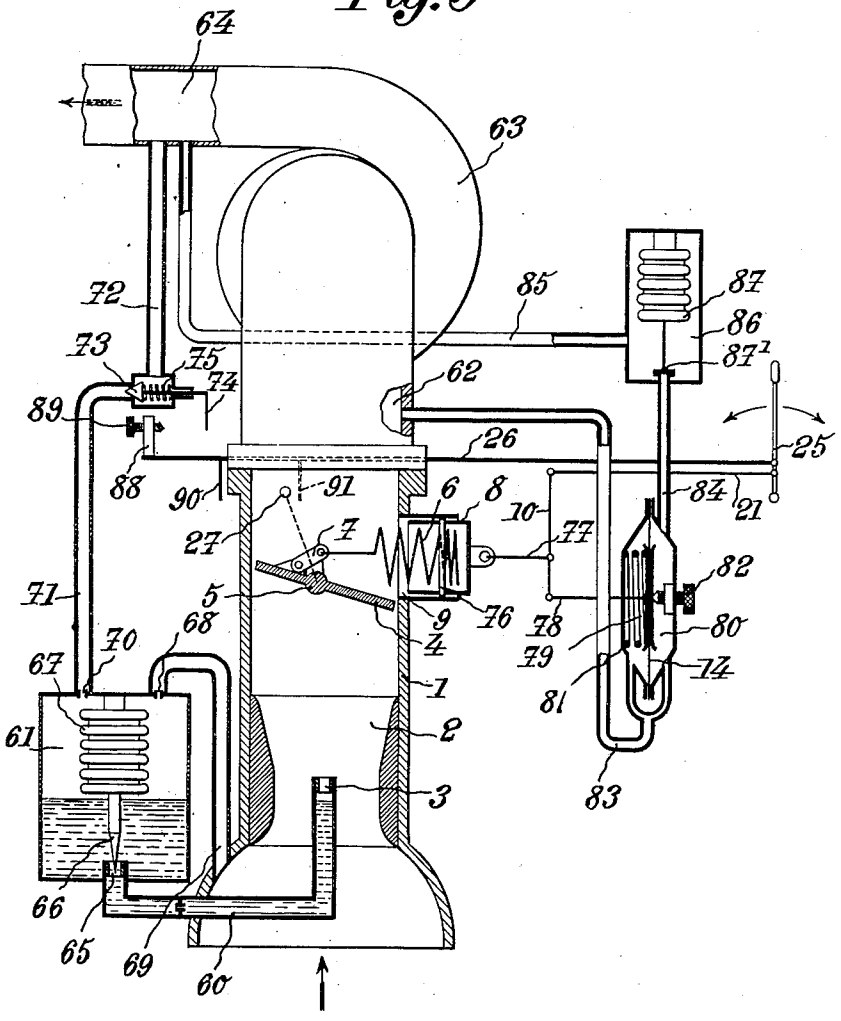
Inventor:
Marcel Mennesson,
Bailey & Pearson
Attorneys

May 23, 1939. M. MENNESSON 2,159,173

CARBURETOR FOR INTERNAL COMBUSTION ENGINES

Filed Nov. 28, 1936 3 Sheets-Sheet 2

Fig. 5



Inventor:
Marcel Mennesson,

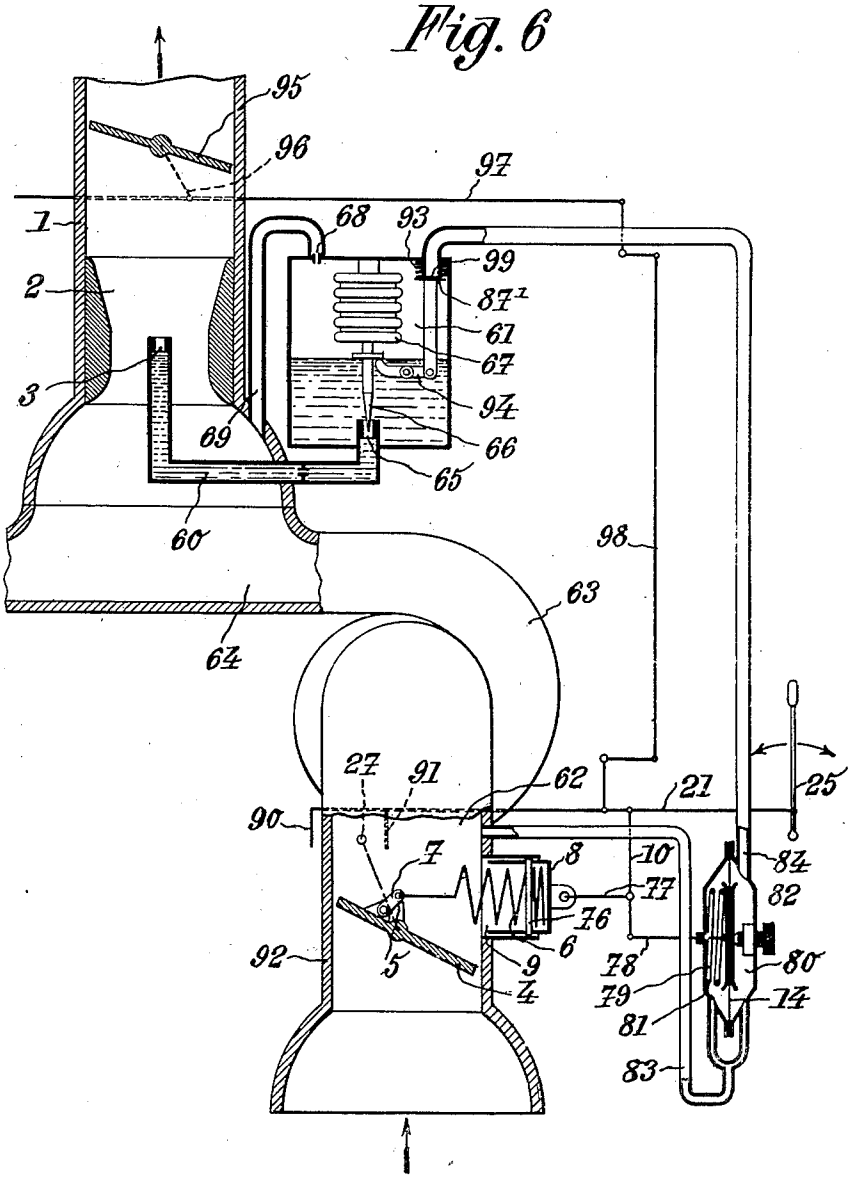
Bailey & Carson
Attorneys

May 23, 1939. M. MENNESSON 2,159,173

CARBURETOR FOR INTERNAL COMBUSTION ENGINES

Filed Nov. 28, 1936 3 Sheets-Sheet 3

Fig. 6



Inventor:
Marcel Mennesson,

Bailey & Carson
Attorneys

Patented May 23, 1939

2,159,173

UNITED STATES PATENT OFFICE

2,159,173

CARBURETOR FOR INTERNAL COMBUSTION ENGINES

Marcel Mennesson, Neuilly-sur-Seine, France, assignor to "Société Anonyme Solex," Neuilly-sur-Seine, France, a corporation of France

Application November 28, 1936, Serial No. 113,245
In France December 5, 1935

16 Claims. (Cl. 261—65)

The invention relates to regulating arrangements for internal combustion engines, of the kind comprising a throttle valve for the gases which regulates automatically the quantity of carbureted mixture admitted to the engine by the action of the suction of the engine on the said throttle valve, and more particularly but not exclusively to those for aircraft engines, especially those provided with a supercharging compressor.

It is known to limit the speed of internal combustion engines by utilising a regulating arrangement constituted by a throttle valve acting on the flow of the admitted gaseous current, the operation of this regulating arrangement being based on the effect of the pressure which the gaseous current can itself exert on the throttle valve, which pressure acts in opposition to a mechanical arrangement independent of the speed of the gaseous current. As set forth in a Patent No. 2,139,841, dated December 13, 1938, it is advantageous to regulate the gases by the butterfly valve of the carburetor, this patent having particularly for its object an arrangement for limiting the speed of an engine for an automobile vehicle.

The present invention concerns improvements particularly applicable to the object of the patent mentioned above but which can also be applied to any other known regulating arrangement, based on the same principles.

In general the invention comprises arrangements for causing a limitation of the supply to the engine—preferably with a limitation of the speed of the engine—by a displacement of desired working parts, acting in opposition to the current of gases on the throttle valve, as a function of the pressure which exists in the induction pipe of the engine and/or as a function of the atmospheric pressure.

Apart from this general arrangement, the invention comprises other arrangements hereafter referred to and particularly an arrangement adapted to cause the richness of the mixture to vary automatically as a function of the supply of fuel mixture to the engine, in such a way as to enrich this mixture when the supply of fuel mixture exceeds a certain value, by utilising to this end the relative displacements between the throttle valve for the gases and the control arrangement of this member put at the disposal of the driver.

Another object of the invention consists in connecting the control member, placed at the disposal of the driver for regulating the supply of combustible mixture to the engine, in a permanent manner to the means, mentioned above, by which a limitation of the value of the supply of fuel mixture to the engine automatically is obtained.

Another arrangement according to the invention consists in arranging the devices of the kind in question in such a way, when the engine is so arranged as to give, for a maximum limit of the predetermined supply of fuel mixture, excessive power at a given speed of rotation, that the value of the supply of fuel mixture is compelled to fall below this limit when the speed of rotation increases due to any cause whatever.

Another arrangement, more especially relative to the case where an engine provided with a super-charging compressor is utilised—consists in utilising the fluid under pressure, delivered by the compressor, automatically to actuate the devices which cause the composition of the mixture to vary as a function of the supply of fuel mixture to the engine.

Another object of the invention consists in adding to the means, mentioned above and by which a limitation of the value of the supply of fuel mixture to the engine is automatically obtained, manometric or barometric devices which act directly or through the intermediary of a servomotor on the means above-mentioned, which devices can have been provided for other purposes, particularly as automatic altitude correctors, as automatic mixture enrichers, or otherwise.

In order that the nature of the invention may be more clearly understood, reference will now be made to the accompanying drawings, in which:

Figs. 1 and 2 show respectively in axial section according to I—I Fig. 2 and in axial section according to II—II Fig. 1, a carburetor provided with a regulating arrangement constructed according to the method of carrying the invention into effect.

Figs. 3 and 4 show, both in transverse section according to III—III Fig. 2, this same carburetor, the parts indicated occupying different characteristic positions respectively on these two figures.

Fig. 5 shows, in diagrammatic vertical section, an arrangement constructed according to the invention and forming part of a carburetor located upstream of a supercharging compressor.

Fig. 6 shows, similarly, an analogous arrangement but for which the carburetor is placed downstream of a compressor which charges several carburetors of which one only is shown on Fig. 6.

The carburetor proper may be of any suitable form and as shown is constituted by including

therein a body 1 in which opens, in a restricted passage 2, an atomising nozzle 3 of any suitable type for the delivery of the combustible, this carburetor also comprising an obturator 4 of which the axis 5 is not in the plane of symmetry of the body 1.

One extremity of a spring 6 is connected to a small connecting rod 7, jointed to the throttle valve 4, in such a way that the said spring constantly urges this latter towards its position of opening and the other extremity of the said spring is fixed to a socket 8 engaged in a housing 9 provided on the body 1 of the carburetor.

In said Patent No. 2,139,841, a similar spring is employed connected to a socket which—while its position is regulatable—remains fixed during the operation of the engine.

According to the present invention, this socket, on the contrary, is capable, during the operation of the engine, of sliding axially in its housing, to cause a variation of the tension of the spring 6, under the control of a lever 10, mounted on an axle 11 and the free extremity of which is coupled to a barometric or manometric arrangement.

The movement of the lever 10 and consequently of the socket 8, is limited by two abutments 12 and 13, preferably regulatable.

The barometric or manometric arrangement can be constituted by a flexible diaphragm 14 separating a chamber 15 into two compartments, one of which is connected by a conduit 16 to a receptacle 18 filled with air at atmospheric pressure or at a predetermined pressure. The outer compartment is connected, by a conduit 19, to such part of the induction pipe of the engine as is thought necessary to effect the required corrections the most efficaciously.

In the example shown in Figs. 1 to 4, the conduit 19 opens into the body 1 of the carburetor downstream of the throttle valve 4, it being understood that this conduit could just as well be connected to the said body 1 upstream of the obturator or at the same time downstream and upstream in such a way that a differential pressure would act on the diaphragm 14.

It is advantageous to cause the pressure, existing in the receptacle 18, to act on the diaphragm 14 by the intermediary of a liquid by causing this liquid to pass through a calibrated orifice 17 in such a way as to limit the speed of displacement of the diaphragm or the like 14.

There is provided, between the lever 10 and a hand-lever 20 on which the driver can act, a connection, advantageously resilient, such as a rod 21 with a spring 22, so that the driver can modify at will the position of the lever 10, between the limits fixed by the abutments 12 and 13 and regardless of the automatic control of the said lever 10 by the diaphragm 14, the amplitude of the displacements of the hand-lever being limited by abutments 23 and 24, fixed or regulatable.

The lever 10, the hand-lever 20 or the pedal 25 on which the driver acts to control, through the intermediary of the rod 26 and of the arm 27, the throttle valve 4 of the carburetor, can comprise, as shown, a rod 28 terminated by a finger 29 adapted to be put into contact with the hand-lever 20 in such a way that the driver or pilot can in certain cases and as explained hereafter, modify the position of the socket 8 through the intermediary of the control member 25.

It is advantageous to couple the arm 27, which controls the throttle valve 4, to the lever 25 by a resilient device constituted by two springs 30 and permitting the driver or pilot, by exerting a supplementary thrust either in the direction of opening (arrow Y) or in the direction of closing (arrow X) of the said obturator 4, to act on certain elements of the carburetor. In the example shown the arrangement makes it possible, by exerting on the lever 25 a supplementary effort in the direction of closing, to interrupt the delivery of the slow running arrangement of the carburetor.

To this end, when the driver pushes the lever 25 to the end in the direction of the arrow X which corresponds to the closing of the throttle valve 4, the extremity 32 of the rod 26 bears against the push-piece 33 of a valve 34, normally held open by a spring 35, which valve closes the conduit 36 supplying fuel to the passage 31.

This arrangement has for its object to avoid any tendency to self-ignition when the engine is slow running, self-ignition which permits the engine to continue to rotate even when the ignition current is broken. This is caused by the fact that when valve 34 is closed no fuel is supplied to the engine so that there is nothing to burn therein.

It is to be noted that the manual control devices such as indicated above must only function on condition that the pilot makes a specially intended operation to ensure that the lever 25 passes its normal end position and that only the compression and expansion of the springs 30 permits the supplementary movement of the abutment 32. In other words, when lever 27 stops in its closed position, lever 25 must be moved further in direction X to engage and close valve 34. This further movement is made possible by springs 30.

The advantage of the arrangement described is, with a single control put at the disposal of the pilot:

I To be able to control the throttle valve 4 for the gases in the usual manner;

II To be able to interrupt, if he so desires, the delivery of the combustible at slow running, on condition of exerting a supplementary effort on the lever 25 in the direction of closing (arrow X);

III To be able to cause to vary at will, by exerting a supplementary effort on the lever 25 in the direction of opening of the throttle valve 4 (arrow Y), the tension of the spring 22 coming between the hand-gear 20 and the lever 10 and, for that reason, to increase the degree of filling of the engine with carbureted mixture.

Other arrangements can be employed to act on the supply of fuel mixture to the engine, by putting out of action at the will of the pilot any element whatever of the regulating device or again the pressure exerted on the diaphragm by the admission gases for example by means of an appropriate flow of air in the conduit 19.

The device described functions as follows:

The suction of the engine acts on the throttle valve 4 which, in consequence of the axle 5 being offset, comprises unequal surfaces on either side of this axle.

Under the effect of the suction, the throttle valve 4 has a tendency to close, whilst the opposing spring 6, acting on the small connecting rod 7, tends to open it.

The result of these two effects, acting in opposite directions, is to ensure, if all the proportions are judiciously chosen, a substantially constant supply of carbureted mixture to the engine, at least up to a predetermined altitude.

If the pilot desires to cause the supply of fuel mixture to the engine to vary, he operates the

hand-lever 20 in such a way as to cause, by the intermediary of the spring 22, the effort exerted by the socket 8 on the spring 6 to vary.

The pilot can thus add at will the effect of the spring 22 to that of the spring 6 or curtail these two effects which causes the effort exerted on the throttle valve 4 to vary and, consequently, modifies the degree of supply of fuel mixture to the engine.

According as one tends to increase the supply of carbureted mixture to the engine, it is necessary to increase at the same time the richness of the said mixture.

This increase of the richness can be obtained automatically as a function of the degree of supply of fuel mixture by the intermediary of the auxiliary means more particularly shown in Figs. 2, 3 and 4 which show means by which the modification of the richness of the mixture takes place by an addition of air to the atomising nozzle 3.

It may be taken as a fact that the maximum permissible supply of fuel mixture is effected when the throttle valve 4 tends to close by the pressure of the gaseous current. The apparatus is constructed for whatever may be the maximum permissible delivery of the mixture which, by its action on the throttle valve 4, determines the closing thereof.

Consequently, it is when the throttle valve 4 is closed by the action of the gaseous current, as explained above, that the richness of the mixture must be the maximum.

To this end a chamber 37, located laterally in the body 1 of the carburetor, communicates with the air inlet of the carburetor by a conduit 38. A second conduit 39 connects the said chamber 37 to the atomising nozzle 3 in such a way that a complement of air, coming from the chamber 37 through the conduit 39, diminishes, in a known manner, the richness of the mixture delivered by the atomising nozzle 3.

The control arm 27, on which the pilot acts by the lever 25 and the rod 26, is connected, through the intermediary of an axle 40, with a second lever 41 which can act by one or other of the abutments 42 and 43 on a finger 44 provided on the free extremity of a lever 45 connected to the axle 5 of the obturator 4.

The abutment 43 forms part of a rocker 46 which can oscillate around an axle 47 solid with the lever 41. The amplitude of the displacement of the rocker 46 is itself limited by an abutment 48 also forming part of the lever 41.

The rocker 46 can obturate an orifice 49 located in the lever 41 and communicating, by a channel 50 within the axle 46, with the conduit 39 opening into the atomising nozzle 3.

A spring 51 tends to maintain the rocker 46 in its closing position.

An abutment 52, preferably regulatable, limits the stroke of the lever 41 in order to prevent the total closing of the throttle 4 whilst, in the other direction, the stroke of the lever 41 is limited by an abutment 53.

The finger 44, which terminates the lever 45, which latter is integral with the throttle valve 4, can oscillate freely between the two abutments 42 and 43, in such a way that the throttle 4 can be displaced under the opposing actions, on the one hand, of the gaseous current and, on the other hand, of the spring 6, as explained above.

The positioning of the lever 45 on the axle 5 of the throttle 4 is such that this latter determines the supply of fuel mixture of the motor which corresponds substantially to an admissible maximum when the finger 44 comes into contact with the abutment 43 as shown on Fig. 3.

On the other hand, the abutment 42 occupies a position such that it allows the finger 44 to oscillate freely in such a way that its contact with the abutment 42 corresponds to such a position of the throttle valve 4 that, in any case whatever may be the pressure of the compressor, the total supply of fuel mixture to the engine cannot fall below a predetermined value. Between the two abutments the supply of fuel is automatically regulated.

In these circumstances, the finger 44 has the possibility of being displaced freely between the abutments 42 and 43 in order to limit automatically the introduction of the gaseous mixture.

It will be seen that for the whole distance between the abutments 42 and 43, the air inlet 49 (which can cause the chamber 37, connected by the conduit 38 to the air suction space of the carburetor, to communicate with the atomising nozzle 3) is obturated (Fig. 3). Consequently, as long as the finger 44 oscillates between the abutments 42 and 43, the mixture delivered by the spraying nozzle 3 is rich.

If the supply of fuel mixture of the engine is no longer assured, due to the lowering of the atmospheric pressure, the throttle valve 4 tends to open fully under the action of the spring 6. At this moment the lever 45 is displaced in the direction of the arrow Z (Fig. 3) and comes into contact, by its finger 44, with the rocker 46; this latter opens the air inlet 49 in pivoting around its axle 47. A certain quantity of air then passes through this inlet into the conduit 39 and acts on the atomising nozzle 3 in such a way as to impoverish the mixture.

The spring 51, preferably regulatable, permits of predetermining the pressure which the finger 44 must exert on the abutment 43 to cause the rocking of the member 46 and in consequence, the admission of air to the atomising nozzle 3 with a view to the impoverishment of the mixture.

All the foregoing supposes that the pilot has placed the arm 27 in the position which corresponds to the maximum power which can be obtained from the engine.

In the case where the pilot wishes to reduce the power of the engine, he acts, by the intermediary of the control lever 25 and of the rod 26, on the arm 27 in such a way as to displace it in the direction of the arrow W (Fig. 4). The abutment 52 limits the position of closing, in such a way that the engine always maintains a rather high speed, which is, however, the "slow running" position.

By such a displacement of the arm 27 there is obtained the angular displacement of the lever 41 which is integral with it and of the rocker 46 which is applied against the lever 41 by the spring 51. At a given moment the abutment 43 of the rocker meets the finger 44 of the lever 45 and the resistance of the finger diverts the rocker which rests on the abutment 48; thus the chamber 37 is put into communication with the atomising nozzle 3 by the intermediary of the conduit 39, which causes an impoverishment of the mixture supplied by the engine.

Consequently, it is seen that when the pilot reduces voluntarily the supply to the engine by acting on the arm 27 in the direction of closing (arrow W), the action of the finger 44 acting on the rocker impoverishes the mixture, which corresponds to the required conditions, since the supply of fuel mixture to the engine, at the pilot's

desire, no longer being full, it is not necessary to supply the engine with a rich mixture.

It may be advantageous, in order to avoid friction as much as possible, to mount the axle 5 of the throttle valve 4 on ball or roller bearings such as 53 and, on the other hand, it may also be advantageous—particularly in the case of a high pressure carburetor—to put the free extremity of the axle 5 at the pressure of the admission air of the carburetor by the intermediary for example of a tube 54 opening into a throat 55, in such a way as to create an air current directed from the extremity of the axle towards the interior of the carburetor. In effect, in this case the pressure in the throat 55 is always higher than that of the interior of the carburetor body. Two channels 56 and 57 ensure the lubrication, by the carburant, of the roller bearings.

It may be advantageous, in the case where the pilot has several carburants at his disposal, to conjugate the action of the hand-lever 20 (Fig. 1) with that of the opening of one or the other of the supply conduits for these carburants. In this way he can, at will, modify the value of the degree of supply of fuel mixture to the engine, taking into account the different properties of the carburants utilised, particularly their detonating power.

The lever 20 is connected by a rod 104 to a valve 100 with two faces arranged between two passages 101 and 102 connected to two different sources of fuel, one or the other of these passages being placed in communication with the conduit 103, which feeds the nozzles 3 and 105, in accordance with the position occupied by the lever 20.

In this manner when the position of the pedal 25 corresponds to idling speed the lever 20 is applied on its shoulder 23 and the motor is fed with fuel furnished by the passage 101 (position shown in Fig. 1), this fuel having for example a slight anti-knock power.

If the pedal 25 occupies a position which corresponds to the full speed of the motor, the lever 20 is applied on the shoulder 24 and the valve 100 closes the passage 101. The motor is now fed by the passage 102, which supplies fuel of high anti-knock power.

It is obvious that between the two extreme positions of the valve 100 the composition of the fuel passes progressively from one of low anti-knock power to one of high anti-knock power by the variation in the mixture of the two fuels supplied respectively by the two passages 101 and 102.

The variation of the tension of the spring 6 is of course controlled by the diaphragm 14 submitted on one side to the pressure in the induction pipe and on the other to a predetermined pressure existing in the receptacle 18. Preferably the control is accomplished through suitable servo-motor means of well known type. For example, as shown in the drawings the lever 10 is connected to the rod 108 of a piston 109 sliding in a cylinder having spaces 110 and 111 on opposite sides of the piston 109. A valve 112 controls the supply of a fluid under pressure through passages 113 to chamber 110 and 111 respectively, while passage 114 permits the escape of the fluid. The valve 112 and piston rod 108 are connected to a lever 107 which is in turn connected to the diaphragm 14. This type of servo-motor control is well known, and the details thereof form no part of the invention.

The carburetor, shown on Fig. 5 is by way of example, of the constant level type and is provided with a body 1, a Venturi tube 2 and a conduit 60 proceeding from a constant level chamber 61 and delivering combustible by a calibrated orifice 3, into the said Venturi tube. The carburetor is mounted on the inlet 62 of a compressor 63 of which the outlet 64 is connected to the engine to be supplied. The carburetor comprises an automatic altitude corrector constituted by a calibrated orifice 65, provided at the inlet of the conduit 60 and which can be closed more or less by a needle 66 of which the displacement is controlled by a barometric capsule 67 located in the chamber 61, communicating by a calibrated orifice 68 and a channel 69 with the exterior air, for example with the air inlet of the body 1 of the carburetor. This chamber 60 is also made to communicate by a calibrated orifice 70 and a channel with the outlet 64 from the compressor 63. Between the two sections 71 and 72 of this channel is located a needle 73 provided with an abutment 74 and which is normally applied on its seat by a spring 75.

The carburetor comprises, moreover, the arrangement described above and shown on Figs. 1 to 4 that is to say a throttle valve 4 of which the axis 5 is eccentric with respect to the body 1 of the carburetor and carries a lever 27. The said valve is connected by a link 7 to a spring 6 of which the other extremity is made integral, for example with the aid of a transverse pin 76 with a socket 8 capable of sliding axially in a housing 9.

This socket 8 is connected, by a small connecting rod 77, to a swing bar 10 articulated at one extremity to a rod 21 made integral with the gas lever 25. The other extremity of the swing bar is articulated to a rod 78 integral with a diaphragm 14 which separates a chamber into two compartments 79 and 80. In the compartment 79 is located a spring 81 which tends to apply the diaphragm on to a regulatable abutment 82.

The two compartments are made to communicate, by a channel 83, with the inlet 62 to the compressor 63. On the other hand, a channel is located between the compartment 80 and the outlet 64 from the said compressor, the two sections 84 and 85 of the said channel being connected between themselves by a chamber 86 in which is accommodated a manometric capsule 87 to control a valve 87' which permits of closing the section 84 of the said channel.

The gas lever 25 can act also, by a rod 26, on the needle 73 through the intermediary of an abutment 88 with regulating screw 89 and on the lever 27 of the valve 5 through the intermediary of two abutments 90 and 91, located on both sides of the said lever 27.

The arrangement thus constituted operates as follows:

When the engine is running at a horsepower normally utilised, for example at a power called "cruising", the manometric capsule 87 is regulated in such a way that the pressure, at the outlet from the compressor 63 and which is transmitted into the chamber 86 by the channel 85, closes the channel 84 by the valve 87'. In this way, as the pressure transmitted by the channel 83 subjects the diaphragm 14 to the same pressure on its two faces, the spring 81 applies this diaphragm on the screw 82 and as a result the rod 78 is maintained immovable.

When valve 87' is opened, fluid under pressure is admitted to compartment 80, but because of the small size of the branches of compartment 83 the effect on compartment 79 is relatively slight, so

that a difference in pressure in the two compartments is produced.

The direction of offsetting of the axis 5 of the valve 4 is such that the current of gas drawn in tends to close this valve. On the other hand, the coupling 7 of the spring 6 is arranged in such a way that the spring resists this closing. In this way, for a given position of the gas lever 25, the valve 4 takes a position of equilibrium since, on the one hand, the current of gas tends to close this valve and, on the other hand, the spring 6 tends to open it. This position of equilibrium thus limits the quantity of mixture introduced into the compressor 63 and, in consequence, into the engine and therefore limits the value of the supply of fuel mixture.

If the tension of the spring 6 is modified by displacing the socket 8 by the action of the gas lever 25, it is seen immediately that the position of equilibrium becomes different and, in consequence, that the supply of fuel mixture is modified. As a result the supply to the engine is a function of the position of the socket 8 and, in consequence, of the position of the gas lever 25, and this remains true in particular whatever may be the physical state of the air admitted into the carburetor, that is to say—in the particular case where the arrangement is applied to an aircraft engine—whatever may be the altitude at which this engine operates.

This property can be utilized to solve various problems. In particular, it is known that, for the taking-off of an aeroplane provided with supercharged engines, a device is generally provided which consists in putting the pressure regulator out of normal order, in such a way as to obtain, at the outlet of the supercharging device, a greater pressure than the maximum normal pressure, this greater pressure corresponding to a power equally greater than the normal maximum power and which can be called the excess horsepower. Naturally, the operation of the engine at excess horsepower causes great load and there is every advantage in shortening this period of operation as much as possible.

This, according to an object of the invention, is effected in the following manner:

In effect, in order to obtain this excess horsepower at the moment of taking-off, the pilot must stretch the spring 6 to the maximum, which has the effect of giving to the engine, when the aeroplane is still stationary on the ground, a certain speed. As soon as the taking-off is effected and when the aeroplane has acquired a certain speed, the resistance of the air on the propeller being less, the speed of the engine will have a tendency to increase, at the same time increasing the speed of the supercharging device and, in consequence, the delivery pressure thereof. But, since this delivery pressure increases, it acts on the capsule 23, in such a way as to cause the relaxation of the spring 6, which has the effect of slightly closing the valve 4 and making the pressure at the outlet of the supercharging device fall again to an acceptable value. Consequently, this device prevents the pilot from maintaining the engine in its excess horsepower condition.

Finally, when the engine is utilised in the neighbourhood of its maximum power and, still more so, when excess supply of fuel mixture is effected, it is necessary to enrich the carbureted mixture introduced into the engine.

The arrangement shown on Fig. 5 satisfies all these conditions. In effect, if the gas lever 25 is fully opened, the spring 6 acquires a maximum tension and if it is supposed that this tension has been suitably regulated previously, the valve 4 occupies a position of equilibrium which gives to the engine, when the aircraft is at ground level, a value suitable for excess supply of fuel mixture.

When the aircraft has left the ground and gathered speed, the speed of rotation of the engine and, in consequence, that of the compressor increases and the action of the current of air on the valve 4 tends to close this latter slightly. As a result, the value of the supply is stabilised at a value lower than that which existed when the aircraft was at ground level. It is therefore seen that, owing to this arrangement, it is impossible for too high a pressure to exist in the induction pipe of the engine. Moreover, when the engine is about to function in the neighbourhood of the power at which it has need of an enrichment of the carbureted mixture and, in particular, in the case of the excess supply of fuel mixture mentioned above, the screw 89, displaced by the gas lever 25, forces back the abutment 74 while diverting the needle 73 from its seat, which permits the pressure, existing at the outlet 64 of the compressor, to act in the chamber 61 in order to compress the capsule 67. To this end, the calibrated orifices 70 and 68 are formed in such a way that a suitable increase of the pressure in the chamber 61 is produced, this increase acting on the delivery of the fuel in two different ways; on the one hand, by compressing the capsule 67 an increase in the effective section of the orifice 65 is obtained and, on the other hand, by increasing the pressure on the free surface of the fuel in the constant level chamber 61.

By a judicious choice of the orifices 70 and 68 and by a suitable form of the needle 66, arrangements can therefore be made that the richness of the mixture, admitted to the engine, is always adapted to the pressure which exists in the induction pipe of the engine, downstream of the compressor 63.

If, by displacing the gas lever, the supply of fuel mixture to the engine is made to fall to such a value that the enrichment becomes useless, the screw 89 leaves the abutment 74 and the needle 73 is applied again on its seat by the spring 75. In this case only the pressure, which exists in the air inlet and which is transmitted by the channel 69, is established in the chamber 61.

In the case where there is produced, for any reason whatever a sudden decrease in speed when the engine is giving full power, the valve 4 tends to be opened in consequence of the lessening of the current of gas drawn in and, consequently, an inadmissible super pressure can be established in the induction pipe. At this moment, this super pressure, by acting on the manometric capsule 87, raises the valve 87^1 by opening the orifice of the channel 84 and causes an excess pressure to act in the compartment 80. The spring 81 has such a stress that it is compressed by this excess pressure, which causes, in consequence, the displacement of the rod 78 in a direction for which a diminution of the tension of the spring 6 is obtained.

The dimensions and the strokes of the parts are such that this diminution of tension produces a closing of the valve 4 which re-establishes, in the induction pipe, the admissible pressure. It is to be understood that this automatic regulating arrangement functions whatever may be the reason for the increase of pressure at the outlet 64 of the compressor 63.

On the other hand, the lever 27 of the valve 4

is displaced, during the movements of this latter, between the two abutments 90 and 91 controlled by the gas lever 25. The abutment 91 assures a positive control of the valve 4 by the lever 25, when it is desired to make the engine run for a certain very low value of the supply, such as slow running. In this case in effect, an automatic limitation of the supply is no longer imposed and an easier regulation is obtained by making the hand lever 25 act directly on the valve 4.

The abutment 90 connected to the gas lever 25 acts in the following manner:

If it is supposed that, for one reason or another, the spring 6 or its coupling happens to break, it is immediately seen that the valve 4 closes, immediately causing the stopping of the engine.

In order to be able to obviate this disadvantage, it is necessary for the pilot to be able to maintain, by any means whatever, a sufficient power to be able to fly. The smallest opening of the valve 4 which permits flying to take place is the opening which corresponds to cruising speed at an altitude near that of the ground. Consequently, in order to have security, the abutment 90 is such that when the gas-lever 25 is at the "full gas" position, the lever 27 has its position fixed by the position of the abutment 90 giving a valve opening corresponding to cruising speed, at an altitude near the ground. Naturally, this abutment is not inconvenient in normal flight since when normally the gas lever is in the "full gas" position, the valve 4 has a greater opening than that which it takes in the case indicated above. Naturally, the abutments 90 and 91 occupy positions with respect to the lever 27 such that, in spite of their connection to the gas lever 25, they do not hinder the correct operation of the valve 4 when the whole of the arrangement described above is utilised.

The arrangement, shown by way of example on Fig. 6, comprises the same essential elements as those described above although arranged in a slightly different manner. In effect, the arrangement according to Fig. 6 corresponds to the case where a compressor 63 simultaneously supplies several carburetors. It is then advantageous to place the arrangement forming the object of the invention at the air inlet 62 of the compressor, in such a way as only to have a single one of these arrangements for the whole of the engine, instead of having one for each carburetor. Naturally, if the engine only comprises one carburetor, placed after the compressor, the whole of the arrangement described above could be located on the body of the carburetor.

Fig. 6 shows therefore the body 1 of such a carburetor, provided with a venturi 2 in which an orifice 3 is adapted to deliver fuel, which comes from the constant level chamber 61, through the intermediary of the channel 60.

The arrangement is such that the carburetor is provided with an automatic altitude corrector, constituted by a calibrated orifice 65 forming the inlet of the channel 60, this orifice being able to be more or less closed by a needle 66 of which the displacement is controlled by a barometric capsule 67. The constant level chamber 61 is in communication with the air inlet of the carburetor by a channel 69 provided with a calibrated orifice 68. The air inlet 92 of the compressor 63 is provided with a valve 5 controlled by a device similar to that described above with regard to Fig. 5.

As explained, the location of eccentricity of the axis 5 of the valve 4 is such that the current of gas, drawn in by the compressor 63, tends to close this valve whilst, on the contrary, the spring 6 tends to open it.

As for the preceding example, the inlet 62 of the compressor communicates by a conduit 83 with two compartments 79 and 80, separated by a diaphragm 14, the compartment 79 serving as a housing for a spring 81 which tends to apply the said diaphragm 14 on a regulatable abutment 82.

The compartment 16 communicates, on the other hand, by a channel 84 with the constant level chamber 61 of the carburetor, in such a way that it can be subjected to the pressure existing at the outlet 64 of the compressor this pressure being transmitted into the chamber 61 by the channel 69.

The channel 84 is closed by a valve 87^1 which a spring 93 tends constantly to open and of which the movement is controlled by the barometric capsule 67 through the intermediary of a rocker 94 or the like.

The carburetor properly speaking comprises also a throttle valve 95 provided with a lever 96 and which is displaced by the gas lever 25 through the intermediary of the rod 21 and of the levers 97 and 98.

The operation of the arrangement, according to Fig. 2, is as follows:

When the engine is utilised at a normal horsepower, such as cruising power, the moving of the valve 87^1 by the capsule 64 is arranged in such a way that this valve closes the orifice 99 of the channel 84. In this way, since the channel 83 subjects the diaphragm 14 to the same pressure on its two faces, the spring 81 applies this diaphragm against the screw 84 and, in consequence, the rod 78 is held from movement.

It is evident, for the reasons set forth with regard to Fig. 5, that the valve 4 occupies a position of equilibrium which determines the pressure at the outlet 64 of the compressor and, in consequence, the value of the supply of fuel mixture to the engine.

For the same reasons also, this supply of fuel mixture is a function of the position of the gas lever 25.

In the case of Fig. 6, the enrichment of the mixture admitted to the engine, when running in the neighborhood of the maximum power is attained, is obtained in the following manner.

If the pressure increases at the outlet of the compressor, it acts on the capsule 67 in raising the needle 66 which has for effect to increase the passage section of the orifice 65 and, consequently, the proportion of the fuel supplied to the engine.

The form of the needle 66 is such that the richness of the mixture is appropriate to the pressure which exists at the outlet of the compressor. It is therefore seen that, as in the case of Fig. 5, a supply of fuel mixture to the engine is obtained which is a function of the position of the gas lever 25.

One can therefore obtain the enrichment of the carbureted mixture when the supply of fuel mixture increases and this enrichment can be adapted to the pressure existing at the outlet 64 of the compressor.

There is equally the advantage, already indicated with regard to Fig. 5, that the arrangements permit of obtaining a super pressure when the aircraft is at ground level, of which super pressure the value decreases automatically when the aircraft attains speed.

Finally, safety is also attained when the pressure at the outlet 64 of the compressor exceeds a value which can be predetermined. In effect, if, for any reason, the valve 4 opens abnormally and produces an excess pressure at the outlet 64 and, consequently, in the constant level chamber 61, this excess pressure acts on the capsule 67 by driving the valve 87¹ through the intermediary of the rocker 94. In this way the orifice 99 of the channel 84 is opened, which has the effect of causing the pressure, at the outlet 64 of the compressor, to act in the compartment 16. For the same reasons as in the case of Fig. 5, the stress of the spring 6 then diminishes in such a way as to bring back the pressure to a normal value.

Finally, the abutments 90 and 91 act on the valve 4 exactly in the same way as explained above. The valve 53 simply permits the obtaining of a satisfactory operation of the carburetor, in particular at slow running, but the connections with the gas lever 25 are such that the supply of fuel mixture to the engine is, preferably, determined by the position of the valve 4.

It is understood that the invention is not limited in any way to the device described and it is easy to imagine various mechanisms based on the same principles and giving to a carburetor-regulator a similar operation in order to obtain the limitation of the supply of fuel mixture to the engine as well as the variation of richness of the mixture supplied to the said engine.

In particular, the devices for causing the richness of the air-carburant mixture to vary can be based, not on the introduction of a certain quantity of air into the atomising nozzle, but on any other known device, to cause, in carburation devices, the richness of the mixture to vary. Thus the device could act on the pressure of the carburant in the constant level chamber, on the delivery of the carburant itself by the intermediary of a throttle established at an appropriate point of the path followed by the carburant in the carburetor.

What I claim is:

1. A carburetor for internal combustion engines comprising an induction pipe, an offset throttle valve pivoted in said induction pipe, spring means connected at one end to said valve and maintaining said valve against the action of suction in said induction pipe, a movable member operatively connected to the other end of said spring means said member being movable independently of movements of said throttle valve, and means responsive to the pressure existing in said induction pipe to act on said movable member in order to regulate the supply to the engine of carbureted mixture.

2. A carburetor for internal combustion engines comprising an induction pipe, fuel supply means in said induction pipe whereby a carbureted mixture is formed therein, an offset throttle valve pivoted in said induction pipe, spring means connected to said valve and maintaining said valve against the action of suction in said induction pipe, a movable member operatively connected to said spring means, said member being movable independently of movements of said throttle valve, a control arrangement for said throttle valve at the disposal of the driver, pressure-responsive means to act on said movable member in order to regulate the supply to the engine of carbureted mixture, means to cause the richness of the mixture to vary automatically as a function of the supply of the engine with carbureted mixture, in such a way as to enrich this mixture when the supply to the engine of carbureted mixture exceeds a certain value, and means controlled by the relative displacements between said offset throttle valve and said control arrangement to operate said last means.

3. A carburetor for internal combustion engines comprising an induction pipe, an offset throttle valve pivoted in said induction pipe, fuel supply means in said induction pipe whereby a carbureted mixture is formed therein, spring means connected to said valve and maintaining said valve against the action of suction in said induction pipe, a movable member operatively connected to said spring means, said member being movable independently of movements of said throttle valve means automatically responsive to the pressure in said induction pipe to act on said movable member in order to regulate the supply to the engine of carbureted mixture, and a regulable abutment for limiting the displacement in one direction of said movable member.

4. A carburetor for internal combustion engines comprising an induction pipe, an offset throttle valve pivoted in said induction pipe, spring means connected to said valve and maintaining said valve against the action of suction in said induction pipe, a movable member operatively connected to said spring means said member being movable independently of movements of said throttle valve, a chamber, a diaphragm operatively connected to said movable member and separating said chamber into two compartments, a receptacle filled at a given pressure, and means connecting one of said compartments to said receptacle and the other to said induction pipe of the engine whereby variations in the suction in said induction pipe cause movement of said diaphragm to vary the tension of said spring means.

5. A carburetor for internal combustion engines comprising an induction pipe, an offset throttle valve pivoted in said induction pipe, spring means connected to said valve and maintaining said valve against the action af suction in said induction pipe, a movable member operatively connected to said spring means said member being movable independently of movements of said throttle valve, a chamber, a diaphragm operatively connected to said movable member and separating said chamber into two compartments, a receptacle filled at a given pressure, and means connecting one of said compartments to said receptacle and the other to said induction pipe of the engine downstream of said throttle valve, whereby variations in the suction in said induction pipe cause movement of said diaphragm to vary the tension of said spring means.

6. A carburetor for internal combustion engines comprising an induction pipe, a compressor in said induction pipe, an offset throttle valve pivoted in said induction pipe, spring means connected at one end to said valve and maintaining said valve against the action of suction in said induction pipe, a movable member operatively connected to the other end of said spring means said member being movable independently of movements of said throttle valve, a chamber, a diaphragm operatively connected to said movable member and separating said chamber into two compartments, means connecting one of said compartments with said induction pipe of the engine downstreamward of said compressor and means connecting the other of said compartments with said induction pipe upstream of said compressor.

7. A carburetor for internal combustion engines comprising an induction pipe, fuel supply means in said induction pipe whereby a carbureted mixture is formed therein, an offset throttle valve pivoted in said induction pipe, spring means connected at one end to said valve and maintaining said valve against the action of suction in said induction pipe, a movable member operatively connected to the other end of said spring means said member being movable independently of movements of said throttle valve, a control arrangement for said throttle valve at the disposal of the driver, means automatically responsive to the pressure in said induction pipe to act on said movable member in order to regulate the supply to the engine of carbureted mixture and means connecting permanently said movable member and said pressure-responsive means to said control arrangement.

8. A carburetor for internal combustion engines comprising an induction pipe, fuel supply means in said induction pipe whereby a carbureted mixture is formed therein, a slow running passage abutting in said induction pipe, an offset throttle valve pivoted in said induction pipe, spring means connected to said valve and maintaining said valve against the action of suction in said induction pipe, a movable member operatively connected to said spring means said member being movable independently of movements of said throttle valve, a control arrangement for said throttle valve at the disposal of the driver, means automatically responsive to the pressure in said induction pipe to act on said movable member in order to regulate the supply to the engine of carbureted mixture, a valve in said slow running passage, and means operated automatically when said control arrangement is displaced beyond the complete closing position of said throttle valve to close said last valve.

9. A carburetor for internal combustion engines comprising an induction pipe, a fuel conduit abutting in said induction pipe, an offset throttle valve pivoted in said induction pipe, spring means connected to said valve and maintaining said valve against the action of suction in said induction pipe, a movable member operatively connected to said spring means said member being movable independently of movements of said throttle valve, a control arrangement for said throttle valve at the disposal of the driver, means automatically responsive to the pressure in said induction pipe to act on said movable member in order to regulate the supply to the engine of carbureted mixture, an air feed conduit branched on said fuel conduit, and an air distributor connected to said air fed conduit and automatically controlled by the movement of said throttle valve in order to modify the richness of the mixture supplied to the engine.

10. A carburetor for internal combustion engines comprising an induction pipe, a compressor in said induction pipe, an offset throttle valve pivoted in said induction pipe, spring means connected to said valve and maintaining said valve against the action of suction in said induction pipe, a movable member operatively connected to said spring means said member being movable independently of movements of said throttle valve, a chamber, a diaphragm operatively connected to said movable member and separating said chamber into two compartments, means connecting one of said compartments with said induction pipe of the engine downstream of said compressor, a manometrically controlled valve in said connecting means, and means connecting the other of said compartments with said induction pipe upstream of said compressor.

11. A carburetor for internal combustion engines comprising an induction pipe, a compressor in said induction pipe, an offset throttle valve pivoted in said induction pipe, spring means connected to said valve and maintaining said valve against the action of suction in said induction pipe, a movable member operatively connected to said spring means said member being movable independently of movements of said throttle valve, and means responsive to the pressure existing in said induction pipe to act on said movable member in order to regulate the supply to the engine of carbureted mixture, a closed fuel chamber, a fuel conduit abutting in said induction pipe, a calibrated orifice at the entrance of said conduit, a needle obturating partially said orifice, a manometric device located in said chamber and controlling said needle, and conduit means connecting said chamber to said induction pipe downstream of said compressor so as to vary the composition of the supplied mixture as a function of the supply of fuel mixture to the engine.

12. A carburetor for internal combustion engines comprising an induction pipe, a compressor in said induction pipe, an offset throttle valve pivoted in said induction pipe, spring means connected to said valve and maintaining said valve against the action of suction in said induction pipe, a movable member operatively connected to said spring means said member being movable independently of movements of said throttle valve, and means responsive to the pressure existing in said induction pipe to act on said movable member in order to regulate the supply to the engine of carbureted mixture, a closed fuel chamber, a fuel conduit abutting in said induction pipe, a calibrated orifice at the entrance of said conduit, a needle obturating partially said orifice, a manometric device located in said chamber and controlling said needle and conduit means connecting said chamber to said induction pipe downstream of said compressor, a valve in said conduit means, means operated by the driver to open said valve when the throtttle valve is in the neighbourhood of its position which gives a supply of fuel mixture in the neighbourhood of the maximum admissible and other conduit means establishing communication between said chamber and the free air.

13. In a carburetor according to claim 9, said air distributor comprising a member mounted for rocking movement, means controlled by the position of the throttle valve to move said member, and means operated by said member to close the said air conduit whereby to increase the richness of the mixture supplied to the engine.

14. In a carburetor according to claim 9, said air distributor comprising a member mounted for rocking movement, means operatively connected to the throttle valve and the control arrangement to vary the position of said rocking member, and means controlled by said rocking member to close the said air feed conduit so as to increase the rickness of the mixture supplied to the engine.

15. In a carburetor according to claim 9, said control arrangement including two spaced shoulders between which said throttle valve may move under the action of the suction in the induction pipe and said spring means, said air distributor comprising a member mounted for rocking move-

ment, means controlled by the position of the throttle valve to move said member, and means operated by said member to close the said air conduit whereby to increase the richness of the mixture supplied to the engine.

16. In a carburetor according to claim 9, said control arrangement including two shoulders between which said throttle valve may move under the action of the suction and the spring means, said air distributor comprising a member mounted for rocking movement, means on said rocking member to close the said air feed conduit to increase the richness of the mixture supplied to the engine, means operatively connected to said throttle valve and operable when said valve reaches a position close to one of said shoulders to move said rocking member to a position to open said air feed conduit.

MARCEL MENNESSON.