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CARBURETOR

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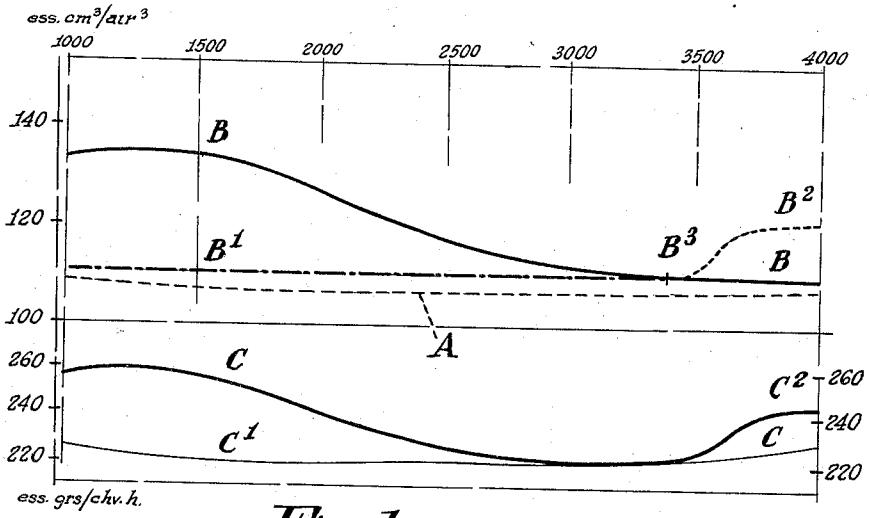


Fig. 1.

Fig. 3.

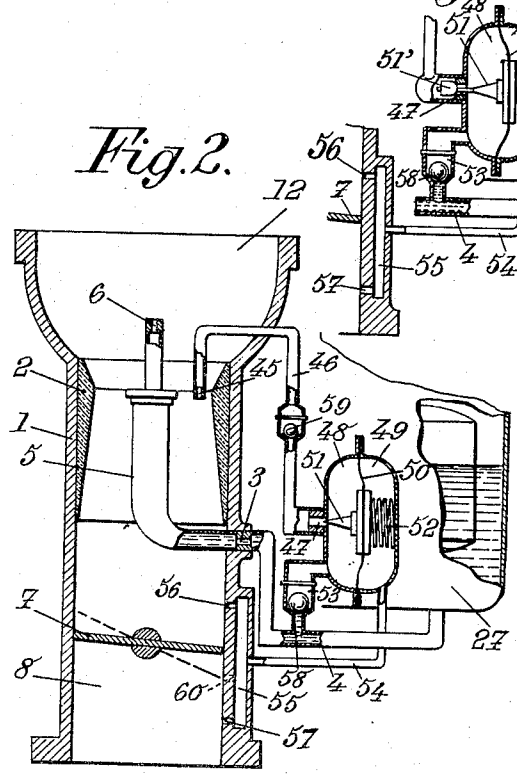


Fig. 4.

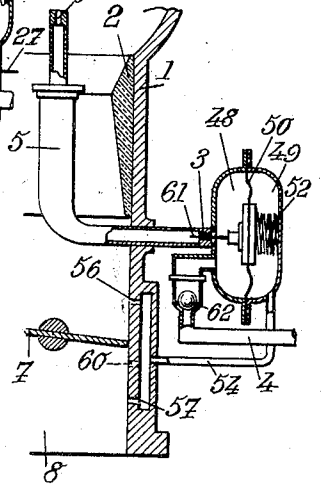


Fig. 2.

INVENTOR
GASTON GRIFFON
BY
Bailey, Stephens & Hunting
ATTORNEYS

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CARBURETOR

Gaston Griffon, Neuilly-sur-Seine, France, assignor to Societe Solex, a society of France

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4 Claims. (Cl. 261—34)

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The invention relates to carburetors for internal combustion engines and more especially engines having a small number of cylinders.

Automatic carburetors, as now in use, permit of obtaining, when the engine is running on full load, a mixture the richness of which is substantially constant for considerable flow rate variations, provided that these carburetors are subjected to a continuous suction effect, as this is the case for tests performed with a centrifugal fan for instance, or when the carburetor is used in connection with an engine including more than four cylinders.

On the contrary, when these same carburetors are used with engines running at high speeds and having a small number of cylinders (from one to four), or on engines having six or four cylinders fed through a duplex carburetor, the richness of the air-fuel mixture is greater at low and mean speeds than at high speeds of the engine.

The object of my invention is to obviate this drawback. For this purpose, I combine a carburetor such as above mentioned with a pick-up pump controlling fuel delivery valve means such that the richness of the mixture delivered when the engine is running with the throttle fully open remains substantially constant at all speeds, despite the small number of cylinders of the engine.

Preferred embodiments of my invention will be hereinafter described with reference to the accompanying drawings, given merely by way of example and in which:

Fig. 1 shows curves illustrating the object of my invention;

Fig. 2 shows, in axial section, a carburetor system made according to an embodiment of my invention;

Fig. 3 shows, in axial section, a modification of a part of this carburetor system;

Fig. 4 shows, in axial section, a modification of the first embodiment.

Fig. 1 shows a series of curves intended to explain the operation of the device according to my invention.

The upper part of Fig. 1 shows several curves corresponding to the richness of the mixture supplied by a conventional automatic carburetor under full load running conditions (with the throttle fully open) and at different speeds of the engine, for instance from 1000 to 4000 revolutions per minute, whereas the lower part of Fig. 1 shows the corresponding specific consumption curves.

Curve A was obtained by fitting a good carburetor of a conventional type on the induction pipe of a centrifugal fan. It shows that the richness

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of the mixture for air flow rates corresponding to those obtained in an engine for speeds ranging from 1000 to 4000 revolutions per minute is substantially constant for all the points of curve A.

Curve B'—B was obtained with the same carburetor and the same adjustment but used in connection with a four cylinder engine. It will be seen that the richness of the mixture is generally too high, being maximum for speeds ranging from 1000 to 1500 revolutions per minute, decreasing as the engine speed increases up to 3200 revolutions per minute approximately (point B^3), and then remaining substantially constant as the engine speed increases up to the highest values. Curve C—C indicates the specific consumptions corresponding to curve B—B.

Curve B^1—B^3—B shows the results obtained when the system according to my invention is used and curve C^1—C gives the specific consumptions corresponding to curve B^1—B^3—B.

Curve B^1—B^3—B^2 shows what can be obtained with a modification of my invention which makes it possible first to change curve B—B^3 into curve B^1—B^3, then, for speeds ranging up from 3500 revolutions per minute, to enrich the mixture in the manner indicated for instance by curve B^3—B^2. The corresponding curve of specific consumptions is shown at C^1—C^2.

To obtain such results, according to my invention, I combine an automatic carburetor of a conventional type with a pick-up pump in a manner which will be hereinafter described. The essential parts of the conventional carburetor are visible on Fig. 2, to wit body 1, choke or venturi 2, calibrated jet 3 provided in the conduit 4 which connects the constant level chamber 27 with nozzle device 5. The latter includes at its upper part a calibrated orifice 6 for the inflow of emulsion air. A throttle valve 7 is provided in the induction pipe 8 of the engine.

With such a carburetor used alone, the richness curve under full load running conditions and for speeds of the engine ranging from 1000 to 4000 revolutions per minute would be similar to curve B—B^3—B of Fig. 1, and the corresponding specific consumption curve would be similar to C—C.

In order to improve this operation, I make use of a pick-up pump to control means for varying the section of a calibrated orifice which serves to deliver fuel, this calibrated orifice being either the main jet or an auxiliary jet.

In the example of Fig. 2, I make use of an auxiliary jet.

This auxiliary jet is constituted by a calibrated orifice 47 provided in a conduit 46 which opens into choke 2 through a calibrated orifice 45. Con-

duit 46 starts from the suction pump, which is constituted by a casing divided into two fluid-tight chambers or compartments 48 and 49 separated by a diaphragm 50.

Compartment 48, which communicates with conduit 46, is fed with fuel through a connection 53 branching off from the conduit 4 which connects the constant level chamber 27 with the main jet 3. A check valve 58 in this conduit 53 prevents back flow of fuel therethrough. Compartment 49 communicates, through a tube 54, with a chamber 55 adjacent to the induction pipe 8 of the carburetor and which communicates with the inside thereof both on the upstream side of throttle valve 7, through an orifice 56, and on the downstream side thereof through an orifice 57.

A check valve 59 in the pump delivery conduit 46 prevents back flow of air into the pump during the suction stroke of said pump.

Diaphragm 50 carries a central needle valve 51 capable of more or less obturating auxiliary jet 47. Diaphragm 50 is urged, on the face thereof opposed to that which carries needle valve 51, by a spring 52 bearing upon the end wall of compartment 49 and which tends to apply needle valve 51 on its seat constituted by the edge of orifice 47.

The carburetor is adjusted through the usual means, that is to say by a suitable choice of jet 3 and emulsion air orifice 6, to obtain, when the engine is running with the throttle fully open and at a speed of about 1500 revolutions per minute, the desired value of the fuel mixture richness (point B_1 of the curve of Fig. 1).

The operation is as follows.

For idling running of the engine and for small openings of throttle 7, the suction is very high in the induction conduit 8 of the engine and, consequently, opposite orifice 57, whereas it is very low opposite orifice 56. Therefore, in chamber 55 and tube 54, there is a vacuum intermediate between the suctions on the upstream and downstream sides of throttle valve 7, which vacuum is transmitted to compartment 49 of the pick-up pump.

The sections of orifices 56 and 57 are determined in such manner that, when the engine is idling or throttle valve 7 little opened, the effort exerted upon diaphragm 50 by the partial vacuum created in compartment 49 overcomes the action of spring 52 and therefore causes diaphragm 50 to move toward the right of Fig. 7. This displacement causes, on the one hand, fuel to flow into compartment 48 and, on the other hand, needle valve 51 to move away from jet 47 and therefore to clear the passage through this jet.

Now if the engine is made to pick up, that is to say if, starting from a low speed of said engine, throttle 7 is suddenly opened, the high vacuum which existed opposite orifice 57 drops to a low value. The vacuum accordingly drops in compartment 49. Diaphragm 50 moves toward the left and causes a certain amount of fuel to be delivered through conduit 46.

At the end of the pick-up pump delivery stroke, needle valve 51 rests upon its seat, preventing the flow of fuel through jet 47. This position of the needle valve corresponds to low speed running of the engine, with throttle 7 fully open. These are the conditions for which, as above stated, the carburetor has been adjusted to have a fuel richness represented by the point B_1 of the curves of Fig. 1. If the carburetor were used alone, i. e. without the pick-up pump and the means it controls, the richness of the mixture would tend to decrease for increasing values of the engine speed, as shown in the portion B—B_3 of the curve B—B_3—B of Fig. 1.

But, as the engine speed increases, the suction increases opposite orifices 56 and 57 so that the vacuum in compartment 49 reaches a value sufficient for again causing diaphragm 50 to move toward the right against the action of spring 52, whereby needle valve 51 again clears the passage through auxiliary jet 47, the rate of flow through said auxiliary jet increasing according to a predetermined law as the speed of the engine increases, to reach its maximum either for a speed corresponding to about 3200 revolutions per minute if it is desired to keep a substantially constant richness, as in the case of curve B_1—B_3—B, or for a higher speed if it is desired to obtain a richer mixture at the highest speeds of the engine, an arrangement which gives a richness curve analogous to B_1—B_3—B_2 of Fig. 1 for instance.

The strength of spring 52 determines the time at which diaphragm 50 starts moving toward the right of Fig. 2 and its flexibility determines the range of displacement of needle valve 51. The profile of said valve 51 determines the richness of the mixture for every speed of the engine inside the range for which the correcting device is brought into play.

When throttle valve 7 is fully opened, the suctions existing opposite orifices 56 and 57 are substantially equal. When throttle 7 is little opened, the suction is very small at 56 and very great at 57. These conditions permit of obtaining, through a suitable choice of the relative sections of these orifices, the desired suctions, both for wide openings of the throttle, with a view to obtaining the correct working of the device according to the invention, and for small openings, with a view to ensuring the operation of the pick-up pump.

It may be advantageous, in some cases, in addition to the effects above described, to reduce the richness of the mixture for lower power running. This result can be obtained by placing orifice 57 nearer to the throttle, at 69 for instance, whereby said orifice passes from the upstream to the downstream side for a certain degree of opening of throttle 7.

I may also, as shown by Fig. 3, move, by means of diaphragm 50, a needle valve 51 provided with a check valve 51' located on the side of calibrated orifice 47 opposed to said needle valve 51 so that said check valve can close said orifice at the end of movement of diaphragm 50 toward the right.

Chamber 49 is then placed in communication either with orifices 56 and 57 as in Fig. 2, or with only orifice 57 that is located on the downstream side of throttle 7 when it is desired to obtain a quick closing of orifice 47 and therefore a reduction of the richness of the mixture for powers close to the maximum power.

The working is the same as that of Fig. 2 concerning full throttle running, which means that under full load running conditions, at low speeds of the engine, diaphragm 50 is pushed toward the left by spring 52 and, consequently, needle valve 51 closes passage 47. For higher speeds, needle valve 51 gradually clears passage 47 whereas check valve 51' moves closer and closer thereto, but without stopping it. For partly closed throttle running, the suction in the pipes reaches values higher than those obtained at high speed and under full load running conditions. Diaphragm 50 therefore keeps moving toward the right and passage 47 gets closed by check valve

51'. This closing may be either gradual or sudden according to the shape given to check valve 51'.

In Fig. 4 I have shown a modification of the device of Fig. 2 according to which a needle valve 61 controls the flow section through the single main jet 3. This needle valve is controlled through pneumatic means as above described, adapted to work also as pick-up pump. It suffices, for this purpose, to provide a check valve 62 in conduit 4, which leads from chamber 27 to the main jet. The injection of fuel during picking-up periods then takes place directly into nozzle device 5.

The present application is a continuation of my application Ser. No. 728,737, filed February 15, 1947, now abandoned.

In a general manner, while I have, in the above description, disclosed what I deem to be practical and efficient embodiments of my invention, it should be well understood that I do not wish to be limited thereto as there might be changes made in the arrangement, disposition and form of the parts without departing from the principle of the present invention as comprehended within the scope of the accompanying claims.

What I claim is:

1. For use in connection with an internal combustion engine, the combination of a carburetor including an induction pipe and a throttle in said pipe, an automatic pick-up pump operative in response to variations of the suction in said pipe on both sides of said throttle, this pump including a part movable in response to variations of this suction from one position corresponding to the minimum value of this suction to another position corresponding to the maximum value of said suction, and a fuel discharge conduit leading from said pump to said pipe, and a metering valve operatively connected with said movable part and located in said fuel discharge conduit, said valve being so shaped and connected with said movable part as to increase gradually the flow section through said conduit in response to displacement of said movable part from said first mentioned position thereof to said second one.

2. For use in connection with internal combustion engine, the combination of a carburetor including an induction pipe, a throttle in said pipe and a fuel conduit opening into said pipe, an automatic pick-up pump operative in response to variations of the suction in said pipe on both sides of said throttle, this pump including a fuel

chamber having a wall movable in response to variations of this suction from one position corresponding to a minimum value of this suction to another position corresponding to a maximum value of said suction, a supplementary fuel discharge conduit leading to said induction pipe, the outlet of said pump opening into said supplementary fuel conduit, and a metering valve operatively connected with said movable wall and located in said supplementary fuel discharge conduit, said valve being so shaped and connected with said movable part as to increase gradually the flow section through said supplementary conduit in response to displacement of said movable part from said first mentioned position thereof to said second one.

3. A combination according to claim 2 further including a check valve carried by said valve means to stop the flow of said supplementary conduit when said movable wall is at the end of its displacement produced by increasing suction on the downstream side of said throttle.

4. For use in connection with an internal combustion engine, the combination of a carburetor including an induction pipe, a throttle in said pipe and a single fuel conduit opening into said pipe, an automatic pick-up pump operative in response to variations of the suction in said pipe on both sides of said throttle, the outlet of said pump opening into said conduit, this pump including a fuel chamber having a wall movable in response to variations of this suction from one position corresponding to a minimum value of this suction to another position corresponding to a maximum value of said suction, and a metering valve operatively connected with said movable wall and located in said outlet, said valve being so shaped and connected with said movable part as to increase gradually the flow section through said outlet in response to displacement of said movable part from said first mentioned position thereof to said second one.

GASTON GRIFFON.

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