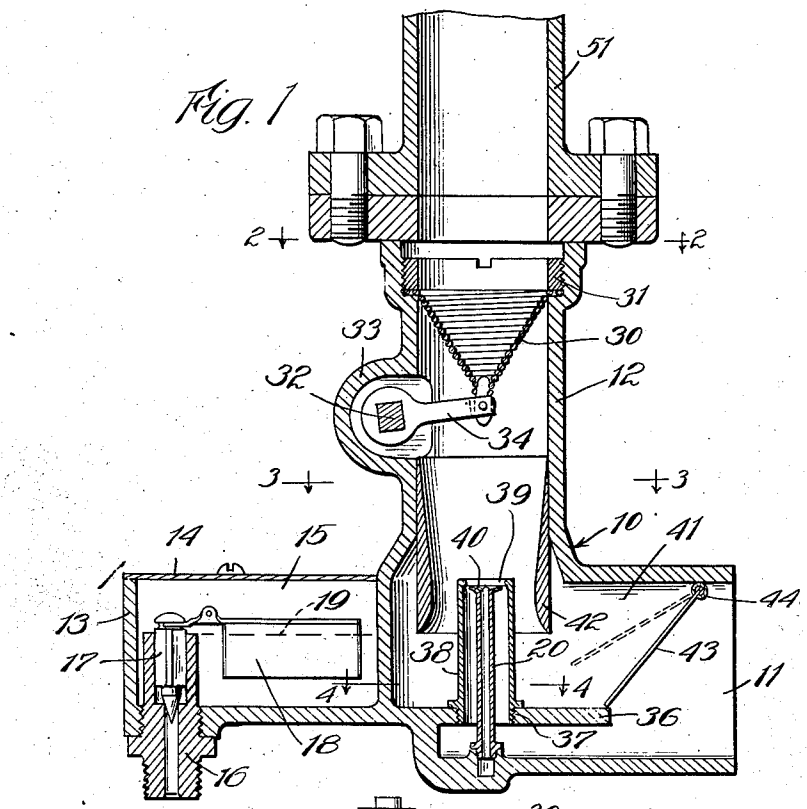
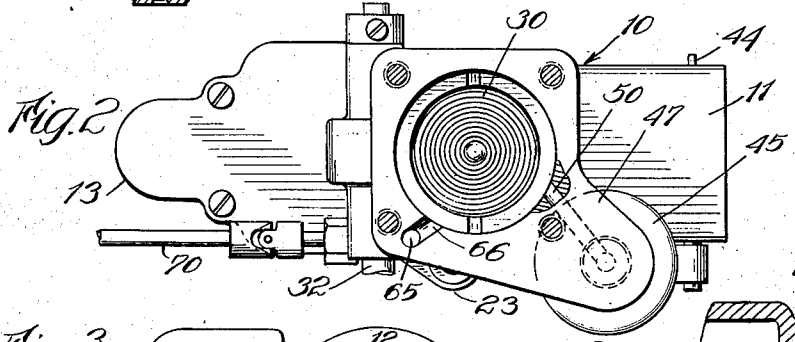
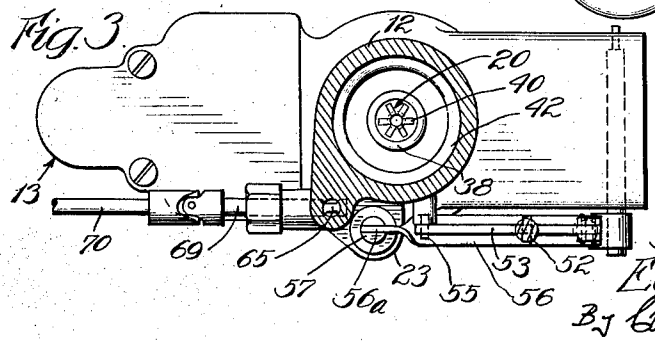
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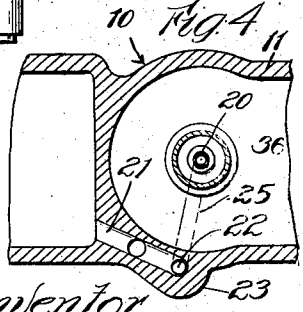
CARBURETOR

Filed March 13, 1930 2 Sheets-Sheet 1









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CARBURETOR

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Fig. 5

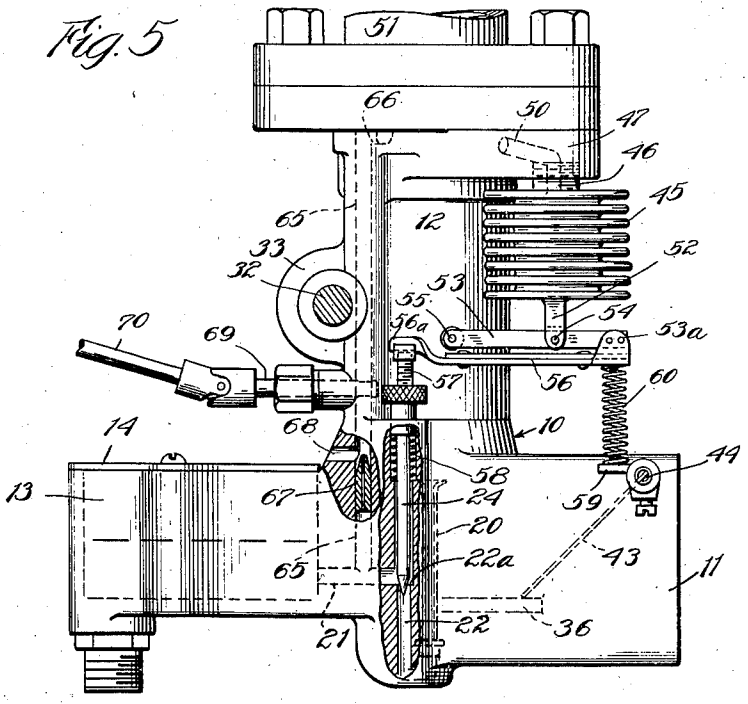


Fig. 6

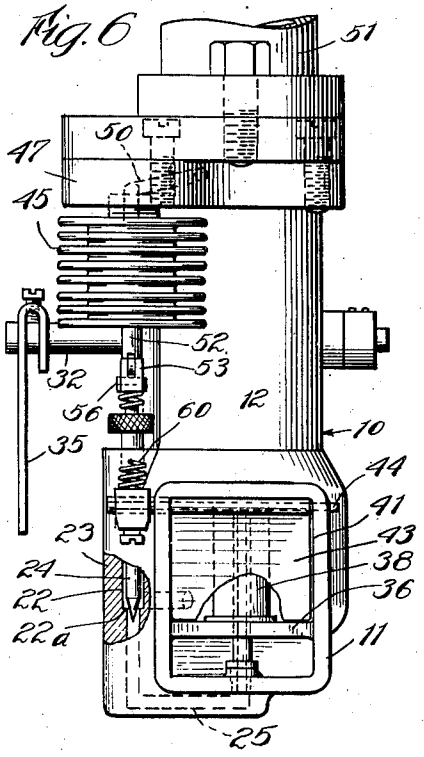
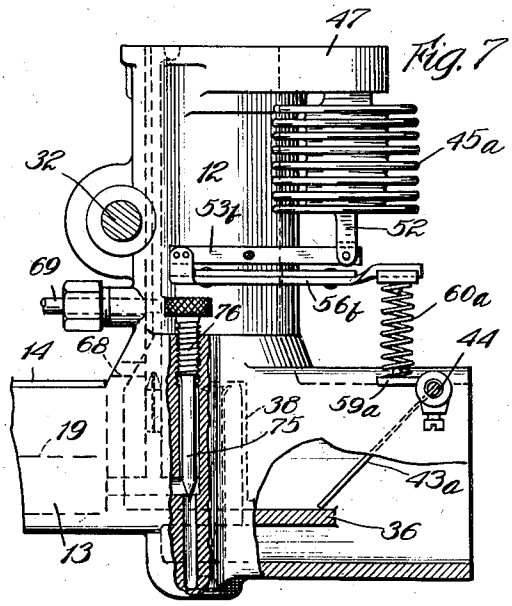


Fig. 7



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2,365,910

CARBURETOR

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Application March 13, 1930, Serial No. 435,394

33 Claims. (Cl. 123—119)

The invention relates generally to carburetors and more particularly to carburetors adapted for use with internal combustion engines such as are used in automobiles.

In the operation of internal combustion engines, the fuel requirements vary with the heat and speed of the engine and with the load applied thereto, and the general object of the present invention is to provide a carburetor embodying new, improved and automatically operable means whereby such varying fuel requirements may be met with greater precision than has heretofore been possible.

Another object is to provide a carburetor having valve means for controlling the fuel mixture governed through automatic means sensitive to both the suction of the engine and the movement of the air through the carburetor and embodying a thermostatic device arranged to modify the action of the automatic control means according to the temperature of the carburetor.

Another object is to provide a carburetor embodying new and improved fuel discharge means arranged to insure proper atomization of the liquid fuel as it passes into the main body of the carburetor.

Other objects and advantages will become apparent from the following description taken in connection with the accompanying drawings in which:

Fig. 1 is a vertical sectional view of a carburetor embodying the invention in its preferred form.

Fig. 2 is a plan view of the carburetor shown in Fig. 1.

Fig. 3 is a sectional view taken along the line 3—3 of Fig. 1.

Fig. 4 is a fragmental plan section taken along the line 4—4 of Fig. 1.

Fig. 5 is a side elevational view of the carburetor, certain of the fuel passages being shown in section.

Fig. 6 is an end elevational view taken from the right in Fig. 1, with parts broken away to show the interior construction.

Fig. 7 is a side elevational view, partially in section, showing an alternative construction of the automatic control mechanism.

While I have shown in the accompanying drawings and will herein describe in detail the preferred embodiment of the invention, together with one alternative embodiment thereof, it is to be understood that this disclosure is given for the purpose of illustrating the invention and is not intended as a limitation of the invention to the constructions disclosed. In the appended claims, I aim to cover all modifications and alternative constructions falling within the scope of the invention.

In the drawings the invention is illustrated as embodied in a carburetor having a hollow body 10 providing an L-shaped passage made up of a horizontal air-intake portion 11 communicating with a vertical mixing and outlet portion 12. On the side opposite from the intake portion 11, the body 10 has an upwardly opening cup-like reservoir 13, closed by a removable plate 14 and providing a float chamber 15 (Fig. 1) for containing a supply of liquid fuel. A nipple 16, screwed into the bottom of the reservoir 13, forms a fuel inlet which may be connected to the supply tank (not shown) and a valve 17 slidable in the nipple 16 and actuated by a pivoted float 18 in the chamber 15 serves to maintain the fuel at a constant level indicated by the dotted line 19 in Figs. 1 and 7.

Within the L-shaped passage of the carburetor a fuel discharge member 20 (Figs. 1, 3, and 4) is mounted which receives liquid fuel from the float chamber 15 through a passage composed of a horizontal bore 21 extending angularly (Fig. 4) through the body 10 from the chamber 15 to a vertical bore 22 extending downwardly through a vertical rib 23 on the intake portion 11. The upper end of the bore 22 opens at one side of the vertical outlet portion 12 of the body 10 and a vertically movable needle valve 24 is mounted in the bore 22 for operation from the outside of the body toward and from a seat 22^a in the bore 22 below the end of the horizontal fuel passage 21. In the bottom of the intake portion 11, a transverse bore 25 (Figs. 4 and 6) is provided, connected at its opposite ends to the vertical bore 22 and the fuel discharge member 20. The fuel discharge member 20, preferably of tubular form, is screwed into the bottom of the portion 11 and extends upwardly beyond the fuel level 19.

To control the amount of suction applied to the discharge member 20 and the amount of air drawn past the member, a valve 30 is mounted in the discharge portion 12 of the body 10, above the member 20 and in its preferred embodiment the valve is in the form of a contractile coiled spring (Fig. 1) of conical form, having its larger outer coils secured in the counter-bored upper end of the portion 12 by a nut 31, and its closed smaller end extending downwardly into the carburetor. For the purpose of opening the valve the spring is adapted to be extended by means of a transverse rock shaft 32 mounted in

a projecting boss 33, and a lever 34 fixed on the shaft 32 and pivotally secured at its end to the pointed end of the valve 30. An operating lever 35 (Fig. 6) is fixed on the shaft 32 outside of the body 10.

The present invention provides means for regulating the proportions of the fuel and air with such precision that they must be mixed thoroughly in order to insure even running of the engine. The coiled spring throttle valve insures this result since it prevents stratification of the fuel and air, and makes it possible, as a practical matter to use automatic proportioning means which provides an unusually lean fuel mixture at all times.

When the valve 30 is opened air is drawn into the carburetor through the intake portion 11 and preferably the intake is formed so that at least a part of this air will be drawn past the end of the fuel discharge member 20 at a comparatively high velocity so as to draw liquid fuel therefrom and vaporize this fuel. To this end a horizontal division wall 36 (Figs. 1, 6 and 7) is provided in the intake portion 11, spaced upwardly from the bottom thereof and having an opening 37 therein through which the fuel discharge member 20 projects. A vaporizing sleeve 38 screw threaded into the opening 37 in the wall 36, extends upwardly about the member 20 in spaced relation thereto, the sleeve terminating a short distance above the top of the member 20 and being flanged inwardly at 39 so as to increase the speed of the air moving therethrough.

In order to promote rapid and efficient vaporization of the liquid fuel drawn from the member 20, the upper end thereof is split to form a plurality of fingers 40 (Figs. 1 and 3) which are bent radially outwardly so as to be in spaced relation to each other. With this construction a part of the liquid fuel will be drawn outwardly along and between the fingers 40 and will thus be directly in the path of the rapidly moving air so as to be picked from the fingers 40 by the air and carried into the main body of the carburetor.

The rich primary mixture of fuel and air thus formed may be mixed with a secondary supply of air so as to form a properly proportioned fuel mixture, and such secondary air may be drawn into the carburetor through a passage 41 (Figs. 1 and 6) formed between the division wall 36 and the top of the intake portion 11. Such secondary air passes upwardly about the sleeve 38, and in order to insure proper mixing of the secondary air and the primary fuel mixture, a Venturi sleeve 42 (Figs. 1 and 3) is fixed in the mixing portion of the body 10 so as to project downwardly about the sleeve 38 in concentric spaced relation thereto.

As hereinbefore mentioned, the liquid fuel supply to the fuel discharge member 20 may be varied by the vertically movable needle valve 24, while the secondary air supply may be varied by means such as a flap type valve 43 (Figs. 1, 6 and 7) mounted for pivotal movement in the passage 41 upon a horizontal rock shaft 44. To permit such movement of the valve 43, the intake passage 11 is preferably made of rectangular cross section as shown in Fig. 6.

The present invention provides for automatically controlling these two valves 24 and 43 by inter-related means whereby to vary the fuel mixture in accordance with the varying requirements of the engine. To this end suction responsive means in the form of a longitudinally collapsible diaphragm or bellows 45 is mounted externally of the carburetor body 10 for connection with the valves 24 and 43, and is arranged to be contracted by the suction of the engine. The bellows 45 is of the sylphon type and tends to expand longitudinally. The lower end of the bellows 45 is closed while at its upper end it carries a threaded nipple 46 screwed into an arm 47 projecting horizontally from the top of the portion 12 of the body 10 as shown in Figs. 2, 5 and 6. Thus, the bellows 45 is supported at the side of and parallel to the portion 12. Within the arm 47 a bore 50 is formed extending from the nipple 46 to the inside of the portion 12 above the valve 30 so that the interior of the bellows 45 will be subjected to the suction of the engine when the carburetor is connected to an engine manifold 51 as shown in Figs. 1, 5 and 6.

At its closed lower end the bellows 45 carries a lug 52 to which a lever member 53 is pivoted at 54 intermediate its ends, one of the ends of the lever 53 being pivoted at 55 upon the side of the body 10. Through the medium of the lever 53 the expansive and contractive movement of the bellows 45 is communicated to the two valves 24 and 43, and this is preferably accomplished by means including a temperature responsive element arranged to modify the effect of the bellows upon one of the valves so as to provide a leaner fuel mixture as the temperature of the engine increases. In the form shown a bimetallic thermostatic element 56 has one end fixed upon the outer end 53a of the lever 53, while the body of the element extends along the lever and beyond the fixed pivot point 55 thereof. At its movable projecting end 56a the element 56 overlies an adjustable screw 57 (Fig. 5) mounted in the top of the valve 24. The valve 24 is pressed upwardly toward an open position and against the overlying end of element 56 by means of a spring 58 surrounding the valve in a counterbored portion of the bore 22.

It will be seen that the thermostatic element 56 and the lever member 53 function together as a single lever, and that by arranging the element so that the inner end 56a bends downwardly when heated, the opening of the valve 24 by the lever will be modified and the amount of fuel flowing past the valve will be varied in an inverse relation to the temperature of the engine.

As hereinbefore mentioned, the lever 53 also has an operative connection with the air valve 43. For this purpose a lever 59 (Figs. 5 and 7) is secured on the end of the rock shaft 44 so as to project substantially horizontally therefrom, beneath the movable outer end 53a of the lever 53. The lever 59 is arranged so that when the outer end thereof is moved upwardly the valve 43 is opened, and a resilient connection between the outer end 53a of the lever 53 and the lever 59 is provided by an expansive spring 60 suitably secured to the two levers.

Thus when the bellows 45 is expanded due to a low degree of suction in the manifold, the outer end 53a of the lever 53 will be in its lowest position so as to compress the spring 60. During idling or periods of slow engine operation, such compression of the spring 60 will hold the air valve 43 closed so that sufficient air will pass through the sleeve 38 to insure proper operation of the carburetor. However, when the engine is being operated at high speed, with the valve 30 open, the spring 60 will be compressed due to the low degree of suction in the manifold, but the yielding connection provided by the spring 60 will permit the air impinging against the valve

43 as it moves toward the bottom of the sleeve 38 to open the valve 43.

By reason of the compression of the spring 60 by the opening of the air valve 43, during such periods of high speed engine operation under a normal load, the outer end 53a of the lever 53 is forced upwardly against the normal expansive tendency of the bellows 45 so that the inner end 56a of the element 56 is lowered and the fuel valve 24 closed slightly so as to provide a comparatively lean fuel mixture for such high speed engine operation.

While the above described controlling means automatically provides a fuel mixture of sufficient richness to start an engine under most conditions, an auxiliary, manually controllable fuel supply is preferably provided for use in extremely cold weather. In the form shown a vertical bore 65 is formed in the body 10, extending upwardly from the horizontal bore 21 of the fuel passage through the wall of the body portion 12, the bore 65 having a lateral extension 66 at its upper end (Figs. 2 and 5) whereby it communicates with the manifold above the throttle valve 30. Within the bore 65 a short distance above the fuel level 19, a jet nozzle 67 (Fig. 5) is positioned and a horizontal bore 68 extending through the body 10 from the bore 65 to the exterior of the body permits air to be drawn into the vertical bore past the nozzle so as to draw fuel therefrom. The operation of the auxiliary fuel nozzle 67 is controlled by a rotatable horizontal valve member 69 positioned in the bore 65 above the air inlet 68 and operable by a rod 70 universally connected thereto. The provision of an auxiliary fuel discharge means, controllable independently of the automatic means is of great importance since it renders it unnecessary to disturb the fine adjustment of the automatic means.

In Fig. 7 an alternative construction is shown having a fuel supply valve 75 having a screw threaded mounting at 76 to permit of manual adjustment thereof. A similar bellows 45a is provided which is connected to a similarly mounted lever 53b. The bellows 45a in this embodiment is arranged to control an air valve 43a through a thermostatic element 56b. The thermostatic element 56b is fixed at one end to the lever 53b and is connected at its other end to the valve lever 59a by means of a spring 60a. The element 56b is arranged so that the compression on the spring 60a is reduced as the engine temperature increases, whereby to vary the fuel mixture.

Operation

When the engine is cold, the inner end 56a of the thermostatic element 56 will be at its highest point and the fuel valve 24 will therefore be opened to its greatest extent. As the engine is cranked, very little suction is created in the manifold so that the bellows 45 will remain in its extended position and the fuel valve 24 will be open to its greatest extent. The air valve 43 will also be held in closed position by the action of the spring 60 which is then compressed by the expansion of the bellows 45. All of the air passing into the carburetor will therefore pass through the sleeve 38 and will be effective in drawing fuel from the discharge member 20.

As soon as the engine begins firing, it will turn over more rapidly, thereby increasing the degree of suction in the manifold and acting through the bellows 45 to move the fuel valve 24 to its idle position so as to reduce the amount of fuel available and thus provide for a lean fuel mixture suitable for idling. It will be understood that the throttle valve 30 will normally be maintained in a slightly opened position to permit the passage of a small amount of fuel for idling purposes. The adjusting screw 57 may be utilized for varying the idling mixture. Since the bellows 45 is contracted during idling of the engine, the spring 60 will be under less compression so that the air valve 43 may be slightly opened by the air passing toward the lower air passage in the intake portion 11. This permits more air to be drawn through the carburetor, but a less amount of air is drawn through the vaporizing sleeve 38 and as a result the fuel mixture will be rendered more lean.

When the car is placed in gear and the clutch engaged so as to put the engine under load, the engine speed of course, is reduced with a corresponding reduction in the engine suction. This permits the bellows to expand, causing the fuel valve 24 to be moved toward its open position and the air valve 43 to be closed. Thus a rich fuel mixture is provided as above described with reference to the engine starting operation.

As more speed is desired, the accelerator is advanced so as to open the throttle valve 30, whereby additional air is permitted to enter the manifold, causing the suction therein to be further reduced so that the bellows 45 may expand and open the fuel valve.

As the car gets under way, the rich fuel mixture becomes unnecessary. Accordingly as the speed of the engine increases, an increased amount of air is drawn into the carburetor. This additional air impinges against the air valve 43 and tends to open it against the compression of the spring 60, and acting through the lever 53 tends to close the fuel valve slightly. Such an action is, of course, desirable since the increased velocity of the air passing the fuel discharge member tends to draw an undue amount of liquid fuel therefrom. As the temperature of the engine increases, the action of the thermostatic element 56 modifies the effect of the bellows 45 so that the fuel mixture is rendered more lean. When the desired speed determined by the setting of the throttle valve 30 has been attained the amount of air which may be drawn through the valve will have reached the maximum and the engine suction will increase so as to contract the bellows 43. Thus the fuel valve 24 will be moved slightly toward closed position so that a relatively lean fuel mixture will be supplied for maintaining the speed attained.

From the foregoing it will be apparent that the invention provides a carburetor having an improved apparatus for automatically varying the richness of the fuel mixture in accordance with the requirements of the engine. It will also be seen that the improved fuel discharge means insures more efficent vaporization of the fuel than heretofore.

It will be apparent that the air control valve is actuated in such a manner that the fuel mixture will be more nearly in accordance with the engine requirements than has heretofore been possible. This is due to the fact that the suction of the engine, taken from above the throttle valve, is applied to the valve through a resilient connection so that the air moving through the secondary air passage may under certain conditions regulate the position of the air valve.

It will also be apparent that through the cooperative functioning of the automatic fuel and air control means and the spiral throttle valve,

the present carburetor furnishes to the manifold a supply of thoroughly mixed fuel and air which is as lean as may be used and which will cause the engine to run evenly.

A portion of the subject-matter herein shown and described is claimed in my copending application Serial No. 212,738, filed June 9, 1938.

I claim as my invention:

1. A carburetor comprising, in combination, a hollow body having intake and discharge openings, a fuel discharge member in said body, a throttle valve for said discharge opening, means providing a primary air passage constantly open during operation of the engine from said intake opening past said member, means providing a secondary air passage from said intake opening into said body, a flap type air valve for controlling said secondary air passage, and means for controlling said flap valve comprising a movable diaphragm adapted to be connected at one side to an engine manifold so that said throttle valve lies between said fuel discharge member and the point of connection of said diaphragm with the manifold, and resilient means forming an operative connection between said diaphragm and said flop valve, and tending yieldingly to move said valve toward closed position when the suction in the engine is reduced.

2. A carburetor comprising, in combination, a hollow body having intake and discharge openings, fuel discharge means in said body, a throttle valve between said fuel discharge means and said discharge opening, means providing a primary air passage constantly open during operation of the engine from said intake opening past said fuel discharge means, means providing a secondary air passage from said intake opening into said body, a valve in said secondary air passage arranged so that suction in said carburetor tends to open said valve, a pressure responsive device mounted on said body and adapted for connection with an engine manifold with said throttle valve lying between said fuel discharge means and the point of connection of said device with the manifold so that the engine suction tends to move said device, and a resilient connection between said device and said air valve whereby said device tends to close said air valve when the engine suction is reduced.

3. In a carburetor having a hollow body with a discharge opening and an air intake opening therein, a fuel discharge member in said body, a pressure responsive device adapted for connection with the intake manifold, means operable to control the relative proportions of air and fuel passing through said intake opening and said fuel discharge member respectively, said means being connected to and actuated by said device to increase the proportion of fuel when the engine suction decreases, and a combined throttle valve and mixing device between said fuel discharge member and said discharge opening comprising a spiral cone-shaped extensible member capable of substantially closing said discharge opening, and extensible to vary the effective area of the opening.

4. A carburetor having, in combination, a hollow body having a discharge opening therein, a fuel discharge member in said body, a valve for controlling the flow of liquid fuel to said member, a pressure responsive device adapted for direct connection with an intake manifold and connected to said valve so as to tend to open said valve when the suction in said manifold decreases, means providing a passage constantly open during operation of the engine from the outside of said body for primary air arranged to direct said air past said discharge member, means providing a passage for secondary air from the outside of said body, automatically operable suction controlled valve means for controlling said secondary air passage, and a combined throttle valve and mixing device mounted between said fuel discharge member and said discharge opening constructed to provide passage for the air and fuel through said combined valve adjacent to the center of the valve as well as through the sides thereof.

5. In a carburetor having a hollow body with intake and discharge openings therein, a fuel discharge member in said body with a fuel supply passage leading thereto, a valve for controlling said passage, a throttle valve operable independently of said fuel control valve and mounted in said body between said fuel discharge member and said discharge opening, suction responsive means communicating with said body between said throttle valve and said discharge opening, means connecting said suction responsive means to said fuel valve operable to close said valve when the engine suction increases, an air valve for controlling said intake opening, and a resilient connection between said suction responsive means and said air valve acting to move said air valve yieldingly toward its closed position as the fuel valve opens under the control of said suction responsive means.

6. In a carburetor having a hollow body with intake and discharge openings therein, a fuel discharge member in said body with a fuel supply passage leading thereto, a fuel valve for controlling said passage, a throttle operable independently of said fuel control valve and mounted in said body between said fuel discharge member and said discharge opening, suction responsive means communicating with said body between said throttle and said discharge opening, means connecting said suction responsive means to said fuel valve operable to move said valve toward closed position as the engine suction increases, an air valve for controlling said intake opening, and a resilient connection between said suction responsive means and said air valve acting to move said air valve yieldingly toward its closed position as the fuel valve opens under the control of said suction responsive means, the connection between the suction responsive means and one of said valves embodying a thermostatic device arranged to modify the action of said suction responsive device upon said one valve.

7. A carburetor having a hollow body with inlet and outlet openings, a fuel discharge member in said body, means providing a fuel passage to said member, a valve for controlling said passage, means in said body providing a primary air passage constantly open during operation of the engine from said inlet opening past said fuel discharge member, and also providing a secondary air passage into said carburetor, a valve of the flap type in said secondary air passage arranged so that suction in said carburetor tends to open said valve, a pressure responsive device mounted on said body normally tending to assume one position and adapted for connection with the manifold so that the engine suction will move said device from said position, means connecting said device to said fuel valve whereby said device permits said valve to move toward its open position when the engine suction is reduced, and a resilient connection between said

air valve and said device whereby movement of said air valve toward its open position acts yieldingly to modify the action of said device upon said fuel valve.

8. A carburetor having a hollow body with inlet and outlet openings, a fuel discharge member in said body, means providing a fuel passage to said member, a valve for controlling said passage, means in said body providing a primary air passage constantly open during operation of the engine from said inlet opening past said fuel discharge member, and also providing a secondary air passage into said carburetor, a valve of the flap type in said secondary air passage arranged so that suction in said carburetor tends to open said valve, a pressure responsive device mounted on said body normally tending to assume one position and adapted for connection with the manifold so that the engine suction will move said device from said position, and a resilient connection between said air valve and said device whereby movement of said air valve toward its open position acts yieldingly to modify the action of said device.

9. In a carburetor having a hollow body with inlet and discharge openings, a fuel discharge member comprising a vertical tube having spaced fingers projecting radially outwardly from the upper edge thereof, and a sleeve surrounding said tube and communicating with said inlet opening, said sleeve extending upwardly beyond the top of said tube and having an annular flange projecting inwardly therefrom so as to overly the ends of said fingers.

10. A carburetor comprising, in combination, a hollow body having an intake and an outlet opening therein and providing a passage therebetween, a fuel discharge member therein, a combined throttle valve and mixing device mounted in said passage between said discharge member and said outlet opening, said valve comprising a spiral, cone-shaped extensible member capable of substantially closing said passage and extensible to vary the effective area of the passage, said member having its pointed end directed away from said outlet opening, and means for operating said member comprising a transverse rock shaft mounted in said body at one side of said passage, and an arm fixed on and projecting from said shaft transversely of said passage and connected to said device.

11. In a carburetor, means forming a mixing conduit, said conduit including an air inlet, a fuel inlet, and a mixture outlet, a manually operated valve for said conduit, a valve for controlling the flow through one of said inlets to enrich or lean out the fuel mixture discharged by said carburetor, a heat responsive device capable of operation independent of suction for operating said valve in accordance with the temperature to lean out the mixture upon an increase of temperature, and means for operating said valve to lean out said mixture upon an increase in suction in the carburetor, said last-named means including a suction conduit connected to a point in the mixing conduit posterior to said manually operated valve.

12. In a carburetor, means forming a mixing conduit, said mixing conduit having a mixture outlet, an air inlet and an air chamber between said inlet and outlet, a manually operable valve between said air chamber and said outlet, means forming a fuel supply conduit, valve means for controlling the richness of the mixture delivered by said carburetor, means responsive to both heat and suction for operating said valve to lean out the mixture at high temperatures and suctions and enrich said mixture at low temperatures and suctions, and a suction connection leading from a point in said mixing conduit posterior to said first-named valve for operating said mixture controlling valve.

13. In a carburetor, means forming a mixing conduit, air and fuel inlets for said conduit, valve means for controlling each of said inlets to enrich the fuel mixture ratio under abnormal operating conditions, one of said valves being responsive to suction and being operable by suction to move it to the normal operating position, and one of said valves being operated in response to temperature changes whereby it will be moved to its normal operating position when the temperature reaches normal.

14. Control mechanism for a carburetor of an internal combustion engine, comprising a pressure-responsive choke valve, yielding temperature-responsive means operative to close the valve, and means responsive to manifold suction to vary the effectiveness of the temperature-responsive means.

15. Control mechanism for a carburetor of an internal combustion engine, comprising a pressure-responsive choke valve, temperature-responsive means tending to close said valve, and means responsive to a fluid pressure generated by the engine for varying the effectiveness of the temperature-responsive means.

16. In combination with an internal combustion engine, a carburetor having a pressure-responsive choke valve, temperature-responsive means yieldingly urging the valve toward closed position, releasable means cooperating with the temperature-responsive means for holding the valve in closed position, and means responsive to a function of engine speed for releasing the releasable means.

17. In a carburetion system for an internal combustion engine, a pressure actuated air valve, means preventing opening of the valve at relatively low pressures, yielding temperature-responsive means tending to close the valve, and suction operated means for rendering the first-named means less effective.

18. In combination with an internal combustion engine having a carburetor and an intake manifold, an adjustable mixture-enriching device for said carburetor, a movable member, temperature responsive means acting between said movable member and said device, and means responsive to variations in the subatmospheric pressure created in said intake manifold by self-operation of the engine for moving said member in one direction when the pressure increases and in the other direction when the pressure decreases.

19. A means for starting an internal combustion engine under various conditions of temperature, which comprises an intake pipe for an engine, carburetor means connected to said intake pipe and subject to the suction in the intake pipe for conducting two fluids into the pipe, namely, fuel and air, a single movable valve means for controlling the flow of one of said fluids relative to the other to vary the fuel to air ratio, a vacuum chamber communicating with said intake pipe and having a movable wall which substantially closes the chamber in all positions of the wall and is operatively connected with said valve means, said chamber being constructed and arranged to urge the wall toward valve

closing position by a pressure intermediate the maximum and minimum subatmospheric pressures created in said intake pipe by the self-operation of the engine, and a thermostat subject to the temperature of the engine for varying the position of said valve.

20. In a carburetor for an internal combustion engine, an induction passage having an air inlet and a mixture outlet, an unbalanced choke valve controlling the inlet, a throttle controlling the outlet, and means for variably biasing said choke valve toward closed position during self-operation of the engine in accordance with variations in engine temperature and also in accordance with variations in pressure in the passage posterior to the throttle.

21. Control means for an internal combustion engine carburetor having an air intake, comprising a valve controlling inflow of air through said air intake and tending to open under the influence of airflow therethrough, means including a temperature responsive member yieldingly urging said valve toward closed position when cold in opposition to the force of the airflow past said valve, and a device responsive to manifold vacuum having a movable wall preventing inflow of air at all positions, said wall being connected to the valve and exerting a force thereon varying from zero to maximum with variations in the manifold vacuum, the effect of an increase in manifold vacuum being to decrease the richness of the mixture, said valve, temperature responsive member, and device being so constructed and arranged as to cooperate in maintaining the valve in partially open positions during the warming up period of self-operation of the engine.

22. In a carburetor, means forming a mixing conduit, said conduit including an air inlet, a fuel inlet, and a mixture outlet, a manually operated valve for said conduit, a valve for controlling the flow through one of said inlets to enrich or lean out the fuel mixture discharged by said carburetor, a thermostat for operating said second valve in accordance with temperature changes to enrich the mixture when the temperature is low, means connected with the mixing conduit and movable by a pressure intermediate the maximum and minimum subatmospheric pressures created in said conduit during self-operation of the engine, and means connecting the last means with the second valve.

23. In combination with an internal combustion engine having a carburetor, an adjustable mixture-enriching device for said carburetor, a movable member, temperature-responsive means acting between said movable member and said device and nonresiliently connected to the latter, and means associated with the engine for moving said member in one direction when the engine is running and in the other direction when the engine stops.

24. In combination with an internal combustion engine having a carburetor, an adjustable mixture-enriching device for said carburetor, a movable member, temperature-responsive means acting between said movable member and said device and nonresiliently connected to the latter, said movable member being movable between two positions in the first of which it adjusts said mixture-enriching device to cause production of a relatively rich mixture and in the second of which it adjusts said mixture-enriching device to cause production of a relatively lean mixture, and means associated with said engine for controlling the position of said movable member and acting to maintain said movable member in said first position when the engine is being cranked and in said second position when the engine is running under its own power.

25. In a carburetor, means forming a mixing conduit, said conduit including an air inlet, a fuel inlet, and a mixture outlet, a throttle valve for said conduit to control the flow of mixture therethrough, a valve in the air inlet to control the richness of the mixture discharged by the carburetor, the last named valve including an eccentrically pivoted valve part so arranged that suction in the carburetor tends to open it, means responsive to temperature operatively connected to the last named valve yieldingly to urge the valve closed with greater force at low than at high temperature, and means movable in response to suction posterior to the throttle valve and operatively connected to the last named valve to lean out the mixture upon an increase in suction posterior to the throttle.

26. In a carburetor, means forming a mixing conduit, said conduit including an air inlet, a fuel inlet and a mixture outlet, a throttle valve for said conduit to control the flow of mixture therethrough, a choke valve in the air inlet to control the richness of the mixture discharged by the carburetor, the choke valve including an eccentrically pivoted valve part which is movable toward open position by direct action of suction thereon, a pivoted lever operatively connected to the choke valve to control it, heat responsive means operatively connected to the choke valve to urge it closed with greater force at low temperature than at high temperature, and means movable in response to suction posterior to the throttle valve and connected to said lever to move it in a direction corresponding to opening of the choke valve upon an increase in suction posterior to the throttle.

27. In a carburetor, means forming a mixing conduit, said conduit including an air inlet, a fuel inlet, and a mixture outlet, a throttle controlling said outlet, a valve for controlling the flow through the air inlet to vary the richness of the mixture generated by the carburetor, a temperature responsive device capable of operation independent of suction for influencing the operation of said valve in accordance with the temperature to decrease the mixture richness upon increase of temperature, and means for operating said valve to decrease said richness upon an increase of suction, said last-named means including a suction conduit connected to a point in the mixing conduit posterior to the throttle.

28. In a carburetor, means forming a mixing conduit, said conduit including an air inlet, a fuel inlet, and a mixture outlet, a throttle valve for said conduit, a pressure-responsive valve for controlling the flow through said air inlet to vary the richness of the fuel mixture generated by the carburetor, temperature-responsive means for influencing the operation of said second valve in accordance with temperature changes to enrich the mixture when the temperature is low, a device connected with the mixing conduit and movable by a pressure intermediate the maximum and minimum subatmospheric pressures created in the conduit during self-operation of the engine, and an operative connection between said device and the second valve.

29. In a carburetor, means forming a mixing conduit, means forming a venturi in said mixing conduit, a main fuel nozzle discharging into said

venturi, a throttle controlling the discharge of mixture from said carburetor, a second fuel nozzle discharging into said mixing conduit adjacent said throttle valve, a valve for controlling the admission of air to said conduit, said valve being movable toward open position by direct action of suction, suction controlled means operatively connected to said valve, a thermostat operatively connected to said valve and tending to close said valve with a force which decreases with increase in temperature, the connection between said thermostat and said valve permitting said thermostat to continue to move after the movement of the valve has been arrested.

30. In a carburetor, an induction passage having an air inlet, a valve controlling the air inlet, a throttle controlling the outlet of the induction passage, a pair of fuel nozzles discharging into the induction passage one discharging adjacent said throttle and the other discharging between said valve and said throttle, a bimetallic thermostat having an overrunning connection with said valve and adapted to close it when cold and to permit it to open when hot, a suction device connected to the induction passage posterior to the throttle and having a movable wall responsive to suction therein, said suction device including yielding means urging said wall in a direction opposite to the force exerted on it by suction, and a one-way actuating connection between the wall and the valve.

31. In a carburetor, means forming a mixing conduit having an air inlet and a mixture outlet, a manually operated throttle controlling the outlet, a valve for controlling the inlet, a temperature responsive device operatively connected with said valve and tending to close the valve with a force increasing with decrease in temperature, a suction responsive device operatively connected with said valve and having a suction conduit connected to a point in the mixing conduit posterior to the manually operated throttle tending to cause opening of the valve upon increase in suction, said temperature and suction responsive devices and valve being so constructed and arranged that the valve closing force of the temperature responsive means is opposed by the valve opening force of the suction responsive means and the valve is positioned in accordance with the equilibrium established by the forces of the temperature and suction responsive means.

32. In a carburetor, a conduit having an air inlet and a mixture outlet, a throttle controlling the outlet, an unbalanced valve controlling the inlet, a thermostat operatively connected to the valve and urging said valve in the closing direction with increasing force as the temperature thereof drops, a suction responsive device connected with the conduit posterior to the throttle and operatively connected with the valve, said device being so constructed and arranged as to actuate the thermostat in such a manner that the closing force of the thermostat and the force of the suction device are opposed and are adapted to reach a state of equilibrium in accordance with attendant temperature and suction conditions, the quantity of air admitted by the valve being determined by said equilibrium established between the temperature and suction responsive device.

33. In a carburetor, means forming a mixing conduit, means forming a venturi in said mixing conduit, a main fuel nozzle discharging into said venturi, a throttle controlling the discharge of mixture from said carburetor, a second fuel nozzle discharging into said mixing conduit adjacent said throttle valve, a choke valve for controlling the admission of air to said conduit, said choke valve including a part which is movable toward open position by direct action of suction, a suction operated device operatively connected to said choke in such a manner as to tend to produce opening of the choke upon increase of suction, and a thermostat operatively connected to said choke.

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