March 4, 1941. P. X. A. GISTUCCI 2,234,001

ALTIMETRIC CONTROL DEVICE FOR CARBURETORS

Original Filed Aug. 22, 1935 3 Sheets-Sheet 1

Fig. 1

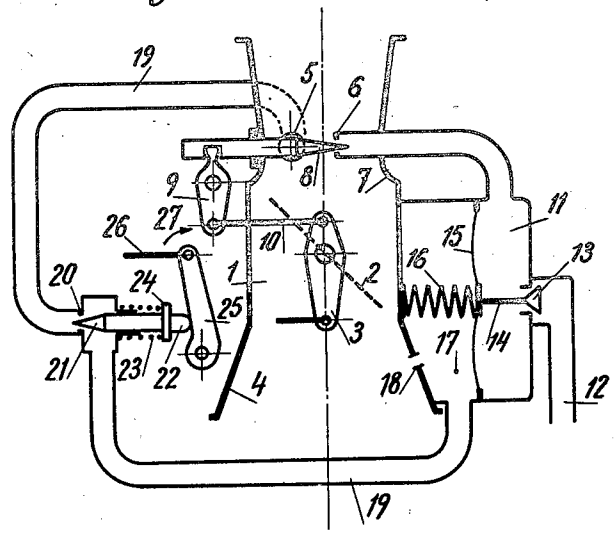
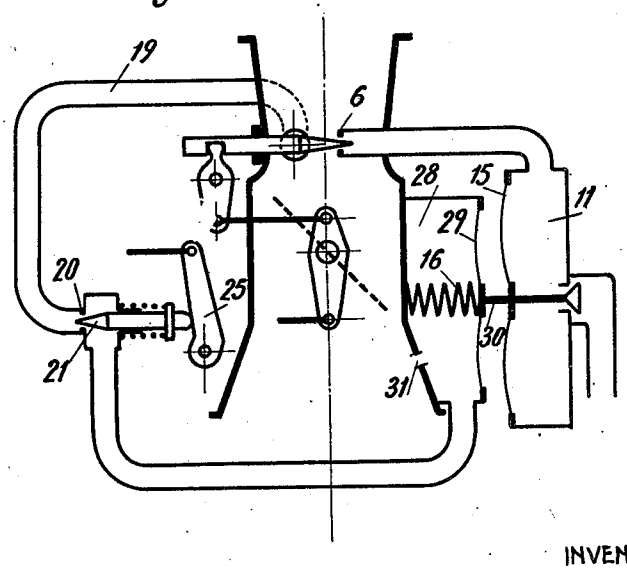


Fig. 2



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Original Filed Aug. 22, 1935 3 Sheets-Sheet 2

Fig. 3

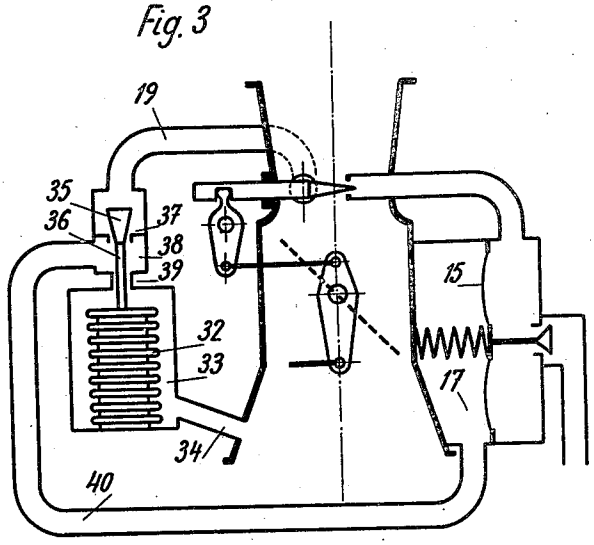
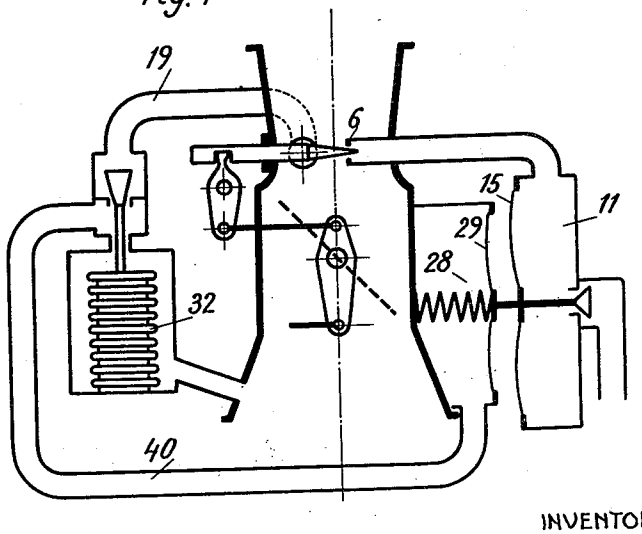


Fig. 4



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Original Filed Aug. 22, 1935 3 Sheets-Sheet 3

Fig. 5

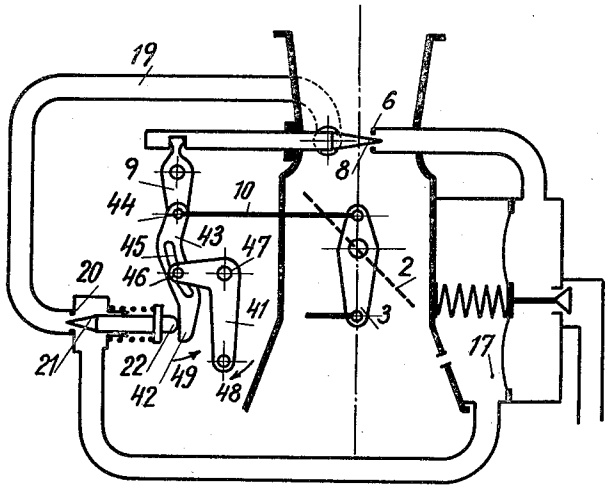
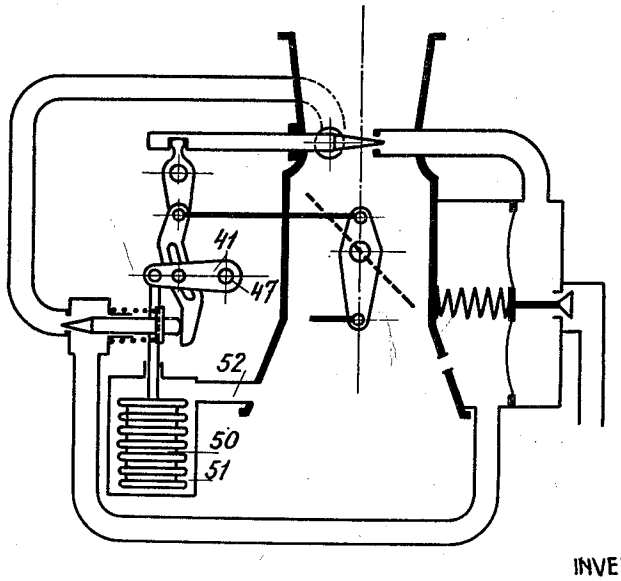


Fig. 6



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UNITED STATES PATENT OFFICE

2,234,001

ALTIMETRIC CONTROL DEVICE FOR CARBURETORS

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Application August 22, 1935, Serial No. 37,274. Renewed October 4, 1939. In Belgium August 30, 1934.

18 Claims. (Cl. 261—39)

The present invention relates to an altimetric control device applicable to carburetors fed with fuel from a fuel chamber in which the pressure is adjusted by means of a diaphragm forming one of the walls of said chamber and operatively connected with the valve that controls the inflow of fuel to said chamber.

The altimetric control device according to the present invention comprises a chamber connected both with the induction passage of the carburetor and with the atmosphere or the air intake of the carburetor through two respective passages the relative sections of which can be varied by means of a manually or barometrically controlled valve. This chamber is separated from the fuel chamber by the diaphragm above referred to, or by a movable wall (diaphragm or piston) which is mechanically connected with said diaphragm.

Adjustment of the mixture richness to compensate for changes in air density due to altitude changes is accomplished by actuating said movable wall in accordance with the pressure in the induction passage adjacent the main fuel jet, said pressure being modified by the position of the valve. Certain subject matter herein disclosed is being claimed in applicant's copending application Serial No. 288,278, filed August 4, 1939.

The following description, with reference to the appended drawings, given merely by way of example, will explain how the invention may be carried out.

Figs. 1 to 6 are diagrammatical views of different embodiments of the present invention, respectively.

The carburetor shown in Fig. 1 is of the anterior-throttle-type and includes an intake pipe 1 controlled by a throttle valve 2 actuated through a lever 3. This pipe 1 is fed with air through an air intake 4, and with fuel through a fuel outlet 6 opening into the venturi 7 posterior to the throttle 2. The fuel outlet 6 is controlled by a needle 8 the position of which is controlled by a lever 3 through a lever 9 and a connecting rod 10. This fuel outlet is fed with fuel through a conduit 70 connected to the outlet of chamber 11.

The chamber 11 is fed with fuel through a conduit 12, the inflow of fuel to said chamber being controlled by a valve 13. This valve 13 is connected through a rod 14 with the diaphragm 15 which serves to control the fuel pressure in chamber 11. The diaphragm 15 is loaded by a spring 16, and separates the chamber 11 from a chamber 17: This chamber 17 is connected on the one hand with the air intake 4 through an orifice 18, and on the other hand with the induction passage of the carburetor through a conduit 19. The conduit 19 opens at 5 into the venturi close to the fuel outlet 6. The end 5 of the conduit 19 is thus subjected to a suction which is substantially the same as that acting on fuel outlet 6. In the conduit 19 there is provided an orifice 20 controlled by a needle 21. The head 22 of the needle 21 is subjected to the action of a spring 23 bearing upon a collar 24 so as to urge said head 22 against a lever 25 which can be operated by the pilot through a cable 26.

The operation of the device takes place as follows:

The fuel outlet 6 is fed under the pressure existing in the chamber 11 and its rate of feed depends upon this pressure. The pressure existing in the chamber 11 itself depends on the pressure existing in the chamber 17, since the diaphragm 15 and the valve 13 take a position of equilibrium for which the pressure exerted by the fuel of chamber 11 on diaphragm 15 balances the combined action of the pressure exerted by the air present in the chamber 17 on the outer face of the diaphragm 15 and of the spring 16.

The conduit 19 transmits a suction to the chamber 17, but this suction is lower than the suction at point 5 of the venturi, due to the provision of the orifice 18 between the chamber 17 and the atmosphere. The suction transmitted to the chamber 17 is the higher as the relative section of the orifice 20 is greater with respect to the section of the orifice 18. By operating the lever 25 in the direction of the arrow 27, the pilot therefore increases the suction transmitted to the chamber 17 and therefore reduces the fuel pressure in the chamber 11, which produces a reduction of the rate of feed through the fuel outlet 6. When the altitude increases, the operation of the lever 25 in the direction of the arrow 27 therefore reduces the rate of feed of fuel and therefor the mixture strength in accordance with variations of the altitude.

In the embodiment of Fig. 2, the suction is transmitted through the conduit 19 to the chamber 28 closed by a diaphragm 29. The diaphragm 29 is connected through a rod 30 with the diaphragm 15 that closes the fuel chamber 11. The chamber 28 communicates

through an orifice 31 with the air intake of the carburetor.

It is obvious that by varying the relative section of the orifice 20 with respect to that of the orifice 31 the suction transmitted to the chamber 28 and to the diaphragm 29 is modified. Therefore the force exerted on the diaphragm 29 is modified and as this force is transmitted to the diaphragm 15 through the rod 30, the pressure existing in the chamber 11, and therefore the rate of feed through the fuel outlet 6, are modified. The device shown by Fig. 2 therefore permits of obtaining the altimetric control of the mixture in a manner similar to that of Fig. 1.

The device shown in Fig. 2 has the following advantage over the device shown in Fig. 1.

The diaphragm 29 may be made of an area different from that of the diaphragm 15. If, for instance, the diaphragm 29 is of smaller area than the diaphragm 15 it is necessary, in order to obtain the same pressure in the chamber 11 as with the apparatus shown in Fig. 1, to transmit to the diaphragm 29 a suction greater than the suction transmitted to the diaphragm 15 of Fig. 1, that is to say it is necessary to give the orifice 20 a larger section of flow. Conversely, if the area of the diaphragm 29 is greater than that of the diaphragm 15, the section of flow through the orifice 20 must be smaller than in the apparatus of Fig. 1. The arrangement of Fig. 2 therefore makes it possible to increase or to reduce the section of flow to be given to the orifice 20, and thus permits of choosing this section in such manner as to render its adjustment by needle 21 easier or more accurate.

Furthermore, as the relative sections to be given to the orifices 18 and 20 of Fig. 1 and to the orifices 31 and 20 of Fig. 2 for transmitting the same force to the diaphragm 15 are different, it follows that the suction transmitted to the chamber 17 of Fig. 1 and the suction transmitted to the chamber 28 of Fig. 2 do not vary according to the same law when the needle 21 occupies a fixed position and the suction in the Venturi tube 7 varies either as a result of the displacement of the throttle 2 or in consequence of a variation of the speed of the engine. The rate of feed of fuel and the richness of the mixture fed by the carburetor therefore do not vary in the same manner under these conditions in the apparatus of Figs. 1 and 2 respectively. The choice of the area of the diaphragm 29 therefore permits of controlling the variations in the richness of the mixture when the conditions of working of the engine vary for any given altitude and position of the control lever 25.

In Fig. 3, the suction transmitted to the chamber 17 is automatically regulated in accordance with the altitude through a barometric bellows or capsule 32. The capsule 32 is disposed in a chamber 33 connected to the air intake of the carburetor through a passage 34. A valve 35, connected through a rod 36 with the capsule 32 controls the section of flow through an orifice 37 connecting the suction conduit 19 with an intermediate chamber 38. The chamber 38 further communicates with the chamber 33 and therefore with the air intake through an orifice 39 through which extends the rod 36. Finally, the chamber 38 is connected through a conduit 40 with the chamber 17 which is closed by the diaphragm 15.

The pressure in the chamber 33, which acts on the capsule 32, varies with the altitude. The corresponding deformations of the capsule 32 move the valve 35 and therefore modify the section of flow through the orifice 37. The suction transmitted to the chamber 38, which depends on the relative sections of the orifices 37 and 39, thus varies in accordance with the altitude and so does the suction transmitted to the chamber 17. The profile of the valve 35 is so determined that the mixture fed by the carburetor may have the proper composition at any altitude.

The capsule 32, instead of being mounted in a chamber 33 connected with the air intake, could be subjected directly to the atmospheric pressure.

Fig. 4 shows the same arrangement of deformable capsule and valve as Fig. 3, as applied to the regulation of the suction transmitted to the chamber 28 of a carburetor similar to the carburetor shown by Fig. 2.

In Fig. 5, the needle 21 that controls the section of flow through the orifice 20 is adapted to be controlled jointly by the lever 3 that controls the throttle valve and the needle 8, and by the independent lever 41.

The head 22 of the needle 21 is actuated by the lower end of a lever 43 pivoted at 44 to the connecting rod 10 and the lever 9. The lever 43 is provided with a slot 45 in which is engaged a pin 46 carried by the lever 41. As for the lever 41, it is pivoted about a pin 47.

When the lever 41 occupies a fixed position and the pilot actuates the lever 3 in the direction that closes the trottle valve 2, the movement of the lever 3 is transmitted through the connecting rod 10, on the one hand to the lever 9 that produces the displacement of the needle in the direction that reduces the section of the fuel outlet 6, and on the other hand to the lever 43. This lever pivots about the pin 46 in such manner as to permit the needle 21 to move away from the orifice 20, under the action of its spring, thus increasing the section of flow through said orifice 20. An increased depression is thus transmitted to the chamber 17.

When the pilot operates the lever 41 in the direction of the arrow 48, the pin 46 moves in the slot 45, causing the lever 43 to pivot about the pivot pin 44 in the direction of the arrow 49. The needle 21 is moved in the direction that increases the section of flow through the orifice 20 and the suction transmitted to the chamber 17 increases. This operation therefore corresponds to an increased altitude. The reverse operation would correspond to a reduced altitude.

At the same time as the pin 46 moves in the slot 45 and therefore causes the needle 21 to be moved away from its seat, it modifies the ratio of the two arms of lever 43 on either side of the pin 46. It therefore modifies the axial displacement of the needle 21 that corresponds to a given displacement of the throttle valve 2. The modification of this ratio is such that, when the position of the lever 41 has been adjusted for a given altitude, the composition of the mixture remains correct for all positions of the throttle valve at that altitude.

In Fig. 6, the lever 41 is automatically controlled according to the altitude by means of a barometric capsule 50 mounted in a chamber 51 connected to the air intake of the carburetor through a passage 52.

The invention is obviously not limited to any particular form of carburetor or of diaphragm chamber, as these elements are known in them-

selves and are not included in the invention. Although there is shown a carburetor in which the liquid fuel is fed to a single fuel outlet mechanically controlled in accordance with the position of the throttle valve and located posterior to said throttle valve, the invention can also be applied to other kinds of carburetors, for instance to carburetors having one or more fuel outlets, fed either with liquid fuel or with aerated fuel located either anterior or posterior to the throttle, and which may have no mechanical regulating means.

In a like manner, the fuel chamber may include several diaphragms connected with one another and with the fuel valve through suitable mechanical connections. Although the diaphragm has been shown as subjected to the action of a spring, this spring may be done away with.

Finally, the invention is not limited to the specific embodiments shown in the drawings. The mechanical connections, the shape of the expansible capsules or of the members that control the variable sections of flow may be modified in various manners without departing from the principle of the invention. For instance, instead of varying the section of the orifice of communication with the suction pipe of the carburetor, as shown by the drawings, the section of the passage of communication with the atmosphere or the air intake, or both of these passages simultaneously, may be varied.

What I claim is:

1. A charge forming device for an internal combustion engine, including an air supply passage, a throttle therein for variably restricting the passage, a fuel chamber closed by a diaphragm, a fuel duct leading from the chamber to the passage at a region of depression at least partially created by the restricting effect of said throttle, a throttle controlled variable restriction in said duct, means actuated by the diaphragm for controlling the admission of fuel to the fuel chamber, and a mixture control device comprising a suction chamber closed by a diaphragm connected to said controlling means, conduits connecting said suction chamber respectively with the air passage anterior to the throttle and with the air passage at said region of depression, a control element for varying the relative effective cross sections of said conduits, means for actuating said throttle, and separate means for actuating said control element and adapted to modify the richness of the mixture independently of throttle position.

2. A charge forming device for an internal combustion engine, including an air supply passage, flow restricting means including a throttle in said passage, a fuel chamber closed by a diaphragm, a fuel duct leading from the chamber to the passage at a region of depression created by said flow restricting means, means operated by said diaphragm for controlling the admission of fuel to the fuel chamber, and a mixture control device adapted to regulate the flow of fuel to compensate for variations in atmospheric pressure comprising an air chamber closed by said diaphragm, conduits connecting said air chamber respectively with the air passage anterior to the throttle and with the air passage at a region of depression created by the flow restricting means, and a manometric capsule responsive to variations in pressure resulting from change in altitude for varying the relative effective cross sections of said conduits.

3. A charge forming device for an internal combustion engine, including an air supply passage, a throttle therein, a fuel chamber closed by a diaphragm, a fuel duct leading from said chamber and discharging into the passage at a point subject to the restricting effect of the throttle, a throttle controlled valve in said duct, means positioned by said diaphragm for controlling the admission of fuel to the fuel chamber, and a mixture control device adapted to regulate the flow of fuel in accordance with the density of the air entering the charge forming device comprising an air chamber closed by said diaphragm, a conduit connecting said air chamber with the air passage at a point subject to the restricting effect of the throttle, a second conduit connecting said air chamber with a source of air at a relatively higher pressure, and a barometric device operable in response to variations in the air pressure anterior to the throttle for adjusting the relative flow capacities of said conduits to thereby control the pressure in said air chamber.

4. A charge forming device for an internal combustion engine, including an induction passage, a throttle therein, a fuel chamber, means for discharging the fuel from said chamber into the passage, and a mixture control device for regulating the richness of the mixture comprising an air chamber, a valve for controlling the admission of fuel to the fuel chamber, pressure responsive means subjected to the pressures in said fuel and air chambers for controlling said valve, a conduit connecting said air chamber with the passage posterior to the throttle, a second conduit connecting said air chamber with a source of air at a relatively higher pressure, and a manometric device for controlling the relative effective cross sections of said conduits in response to variations in altitude.

5. A charge forming device for an internal combustion engine, including an air supply passage, a throttle therein, a fuel chamber having a flexible wall, means for discharging the fuel from said chamber into the passage, an air chamber closed by another flexible wall, the area of said walls having a predetermined ratio, means operated by said walls for controlling the admission of fuel to the fuel chamber, a conduit connecting said air chamber with the passage posterior to the throttle, a second conduit for admitting air to said air chamber and a barometric device controlling at least one of said conduits in response to the air pressure anterior to the throttle.

6. A charge forming device for an internal combustion engine, comprising an air passage, a throttle therein, a fuel duct receiving fuel from a source and discharging in said air passage, a fuel chamber in said duct having a flexible wall, a valve connected to said wall for controlling the rate of fuel flow through said duct, and means for varying the richness of the mixture to compensate for changes in altitude comprising an air chamber including said flexible wall, conduits connecting said air chamber to the air passage respectively anterior and posterior to the throttle, and means for varying the section of one of said conduits automatically in response to the air pressure anterior to the throttle.

7. A charge forming device for an internal combustion engine, comprising an air passage, a throttle therein, and means for supplying fuel to said passage posterior to the throttle including a fuel chamber closed by a diaphragm, means operated by the diaphragm for controlling the

admission of fuel to the fuel chamber, and means for varying the pressure of the fuel in said chamber in response to variations in the pressure of the air admitted to the device, including an air chamber closed by a diaphragm operatively connected to the first named diaphragm, conduits connecting said suction chamber respectively with the air passage posterior and anterior to the throttle, and means for variably restricting one of said conduits automatically in response to variations in the air pressure anterior to the throttle.

8. A charge forming device for an internal combustion engine including an induction passage, a throttle therein, a fuel chamber closed by a diaphragm, a fuel duct leading from the fuel chamber to the induction passage, a throttle controlled variable restriction in said duct arranged to be subjected to suctions derived from the restricting effect of the throttle, and a mixture control device adapted to modify the richness of the mixture at substantially any throttle position comprising an air chamber closed by said diaphragm, a valve connected to said diaphragm for controlling the rate of fuel flow through said duct, air passages connecting said air chamber respectively to the induction passage anterior to the throttle and to a point adjacent said variable restriction whereby said last named air passage and said restriction are subjected to substantially equal suctions, and a device movable independently of the throttle for controlling the relative effective areas of said air passages.

9. A carburetor comprising an air passage, a throttle therein, a fuel nozzle having an outlet in the air passage in a region of suction at least partially created by the restricting effect of the throttle, a throttle controlled valve for controlling the rate of fuel discharged by said nozzle, a pressure regulator feeding fuel to said outlet comprising a fuel chamber, means for controlling the fuel pressure in the fuel chamber, and a mixture control device comprising an air chamber, calibrated passages connecting said air chamber respectively with the air passage at a region of suction at least partially created by the restricting effect of the throttle and with a source of air at a relatively higher pressure, means for varying the effective cross sectional area of one of said calibrated passages in response to variations in the pressure in one of said passages, and pressure responsive means subjected to the pressures in the air and fuel chambers for actuating said controlling means.

10. A charge forming device for an internal combustion engine, including an air supply passage, flow restircting means including a throttle in said passage, a fuel nozzle discharging in said air passage, a fuel chamber supplying fuel to said nozzle and provided with an inlet, and means for variably restricting the inflow of fuel to said chamber to control the richness of the mixture comprising a valve in said inlet, a variable pressure air chamber, diaphragm means subjected to the pressures in said fuel and air chambers for actuating said valve, means for transmitting suction from a region of depression in said air passage to the variable pressure air chamber, means for bleeding air into said air chamber, and means including a sealed chamber having a yielding wall subjected to the pressure in the air supply passage for varying the relative effectiveness of said transmitting means and said bleeding means to control the pressure in the air chamber.

11. A carburetor comprising an induction pipe, a throttle in said pipe, and a mixture control device adapted to vary the richness of the mixture at substantially any throttle position comprising a variable pressure air chamber, restricted passages connecting said air chamber to the induction pipe on opposite sides of the throttle, a valve adapted to be moved independently of the throttle for varying the relative effectiveness of said passages to thereby control the pressure in said air chamber, a liquid fuel chamber having an inlet and an outlet passage leading to the induction pipe, a throttle controlled variable restriction in said outlet passage, a fuel control valve in said inlet, and movable wall means urged in one direction by the pressure of the fuel in the fuel chamber and in the other direction by the pressure of the air in the air chamber for actuating said fuel control valve.

12. In a charge forming device for an internal combustion engine, an induction passage, a throttle in the induction passage, a liquid fuel duct discharging into said induction passage in a region of depression created by said throttle, a throttle controlled variable restriction in said duct, a fuel chamber communicating with said duct, and a mixture control device adapted to vary the fuel flow to compensate for changes in mixture richness accompanying changes in altitude comprising a variable pressure chamber, a conduit for bleeding air into said variable pressure chamber, a second conduit leading from the variable pressure chamber and having an outlet adjacent the throttle controlled variable restriction whereby said outlet and said variable restriction are subjected to substantially equal or proportional suctions, means movable independently of said throttle for varying the relative effectiveness of said conduits to thereby control the pressure in said variable pressure chamber, and means subjected to the pressures in the fuel chamber and in the variable pressure chamber for controlling the inflow of fuel to the fuel chamber.

13. In a charge forming device for an internal combustion engine, an induction passage, means including a throttle for creating a region of depression in said induction passage, a liquid fuel passage discharging into said region, a throttle controlled variable restriction in said fuel passage and subjected to suction derived from said region, a fuel chamber communicating with said fuel passage, a variable pressure chamber, a conduit connecting the variable pressure chamber with a source of substantially atmospheric pressure, a second conduit leading from the variable pressure chamber and having an outlet in one of said passages whereby the variable restriction and said outlet will be subjected to substantially proportional suctions, a mixture control valve adapted to be moved without corresponding movement of the throttle for varying the effective cross section of one of said conduits, and means responsive to the pressures in the fuel chamber and in the variable pressure chamber for controlling the inflow of fuel to the fuel chamber.

14. In a charge forming device for an internal combustion engine, an induction passage, flow restricting means in said induction passage including a venturi and a throttle, a liquid fuel duct discharging into the induction passage in a region subject to the restricting effect of said flow restricting means, a throttle controlled valve

in said duct, a fuel chamber communicating with said duct, and a control device adapted to regulate the fuel flow to compensate for changes in mixture richness accompanying changes in altitude comprising a variable pressure chamber, a conduit connecting said variable pressure chamber to the induction passage adjacent the throat of the venturi, a second conduit connecting the variable pressure chamber to the induction passage anterior to the throttle, means movable without corresponding movement of the throttle for varying the effective cross section of one of said conduits, and means for controlling the admission of fuel to the fuel chamber including an inlet valve for said fuel chamber, and a spring loaded diaphragm connected to said valve and jointly responsive to the pressures in the variable pressure chamber and in the fuel chamber.

15. In a charge forming device, an induction passage including a venturi, a throttle controlling the induction passage, a liquid fuel duct supplied with fuel under positive pressure and discharging into the induction passage posterior to the throttle, a throttle controlled valve in said duct, a fuel chamber in said duct anterior to said valve, a variable pressure chamber, pressure conduits connecting said variable pressure chamber to the induction passage respectively anterior and posterior to the throttle, a mixture control device adapted to regulate the fuel flow to compensate for changes in mixture richness accompanying changes in altitude comprising a member movable independently of the throttle for varying the effective cross section of one of said conduits, a fuel valve controlling the flow of fuel through said fuel duct, a diaphragm subjected on one side to the pressure in the fuel chamber and on the other side to the pressure in the variable pressure chamber and operably connected to said fuel valve, and a spring yieldingly urging the fuel valve toward open position.

16. In a charge forming device, an induction passage including a venturi, a throttle anterior to the venturi for controlling the induction passage, a liquid fuel duct supplied with fuel under positive pressure and discharging into the induction passage substantially at the throat of said venturi, a fuel chamber communicating with said duct, and a mixture control device adapted to vary the richness of the mixture at substantially any throttle position comprising a variable pressure chamber, conduits connecting the variable pressure chamber to the induction passage anterior to the throttle and to the venturi substantially at the throat thereof, means movable without corresponding movement of the throttle for varying the relative flow capacities of said conduits, and means for controlling the admission of fuel to the fuel chamber, including a diaphragm subjected to the pressure in the variable pressure chamber and to the pressure in the fuel chamber.

17. In a charge forming device, an induction passage, means including a throttle for creating a region of depression in said induction passage, a liquid fuel duct discharging into said region, a fuel chamber communicating with said duct, a variable pressure chamber, a spring loaded valve controlling the admission of fuel to the fuel chamber, diaphragm means subjected to the pressures in said fuel and variable pressure chambers for actuating said valve, conduits connecting said variable pressure chamber to the region of depression in the induction passage and to a source of substantially atmospheric pressure, and a mixture control device adapted to vary the richness of the mixture with the throttle in a fixed position comprising a member movable independently of the throttle for varying the relative effective flow capacities of said conduits.

18. In a charge forming device, an induction passage including a venturi and a throttle, a liquid fuel duct discharging into the induction passage posterior to the throttle, a fuel chamber communicating with said duct and having a flexible wall, a variable pressure chamber having a flexible wall of different effective area from that of the first mentioned flexible wall, a valve controlling the admission of fuel to the fuel chamber and actuated by said flexible walls, conduits connecting said variable pressure chamber to a point of depression in the induction passage and to a source of substantially atmospheric pressure, a mixture control valve for varying the relative effective cross sections of said conduits, and means to adjust the mixture control valve independently of the throttle to determine the richness of the mixture throughout the throttle operating range.

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