

Feb. 26, 1957

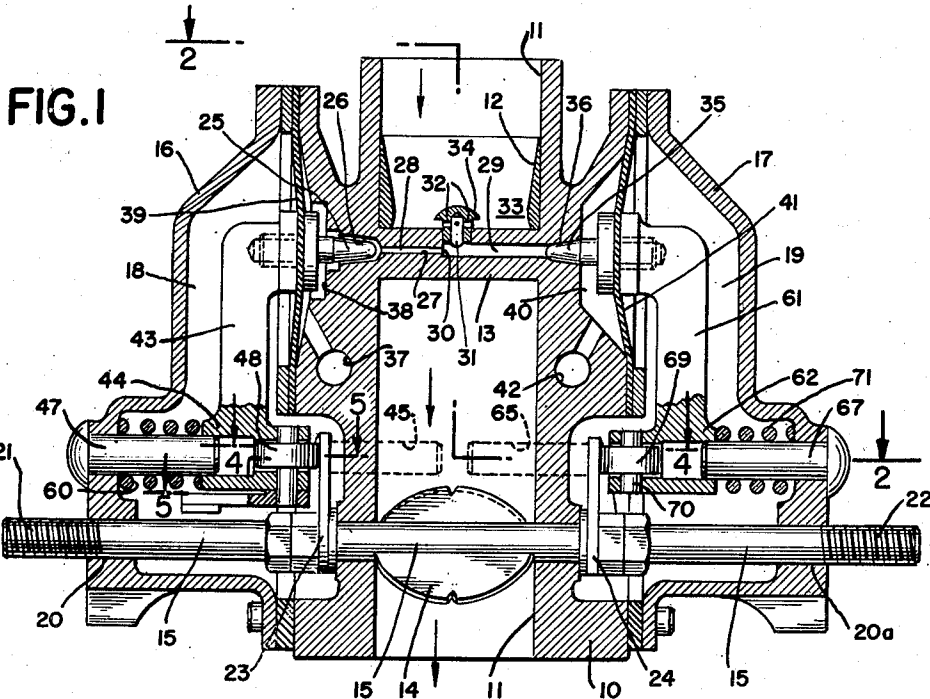
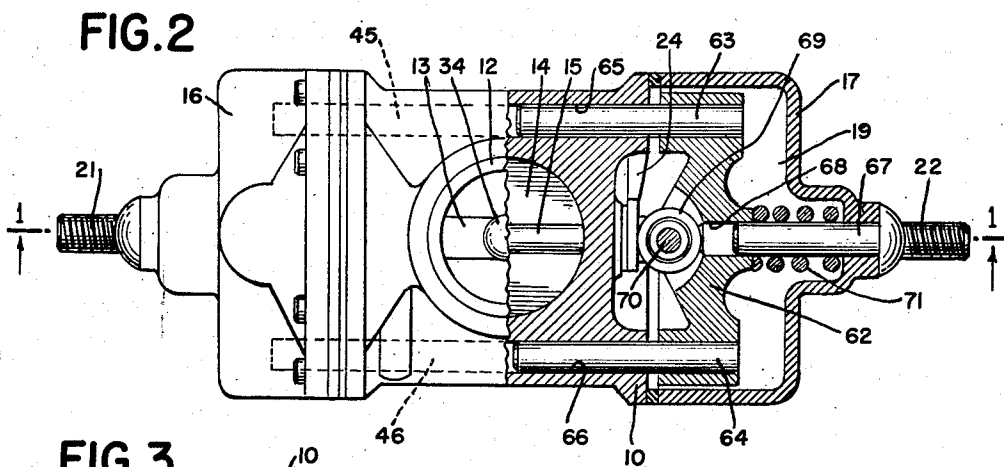
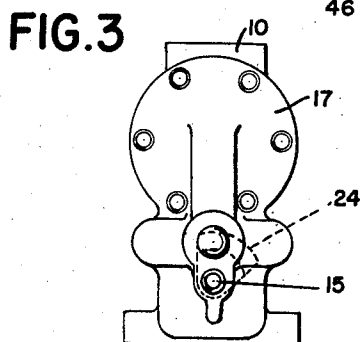
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2,783,033

FLOATLESS CARBURETOR

Filed March 8, 1954

2 Sheets-Sheet 1



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FIG. 4

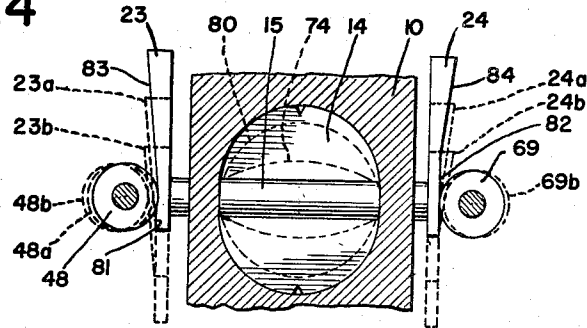


FIG. 5

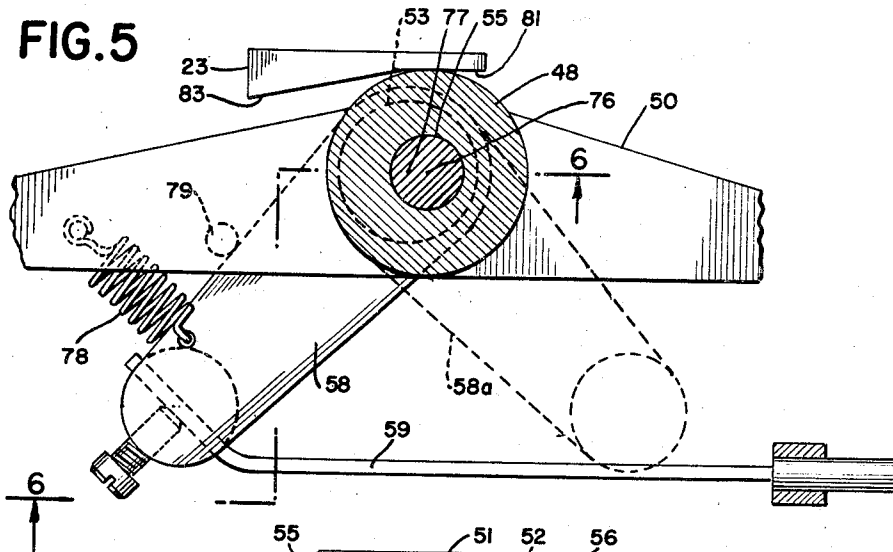
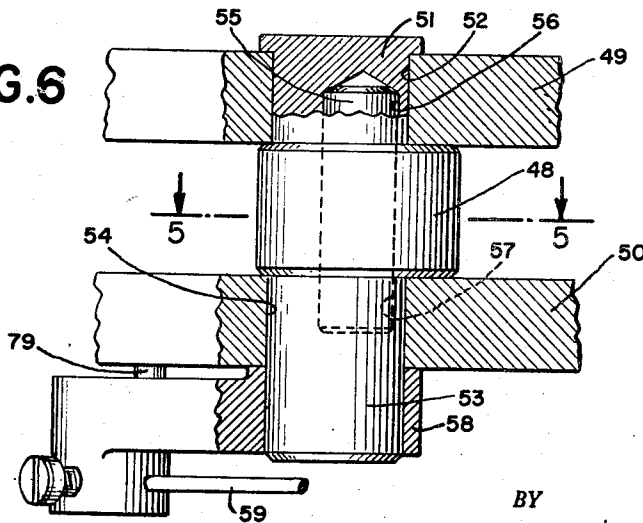


FIG. 6



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FLOATLESS CARBURETOR

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Application March 8, 1954, Serial No. 414,537

10 Claims. (Cl. 261—36)

This invention relates to a float-less carburetor for internal combustion engines, more especially a carburetor for use in vehicles.

Float-less carburetors, as heretofore made, have been characterized by the use of diaphragms responsive to small pressure differentials, and by needle valves requiring weak springs which fatigue easily. In carburetors of this type, the presence of fine dirt particles in the passages and jets tends to impair usefulness; proportioning of fuel supply to engine-suction alone tends to cause oversupply of fuel at full throttle, and proportioning of fuel supply to throttle-opening alone tends to cause stalling when the load increases without change in throttle-opening.

A carburetor according to the present invention, besides assuring an adjustably constant fuel supply for idling, proportions fuel supply to throttle-opening in the lower ranges of throttle-opening, and to engine suction in the higher ranges of throttle-opening. In addition, by means of pressure drop in a continuously flowing stream of fuel adjacent the point of delivery to the venturi, the carburetor according to this invention balances a counter-suction within the feed-line against engine-suction in the higher ranges of throttle-opening, thereby preventing over-supply of fuel at full throttle operation.

In order to disclose the invention, a carburetor is here shown which embodies the preferred features of design, and is here shown for purposes of illustration only.

Referring to the drawings annexed to and forming part hereof—

Fig. 1 is a vertical longitudinal section through the carburetor in the plane 1, 1 of Fig. 2.

Fig. 2 is in part a plan, and in part a horizontal section in the plane 2, 2 of Fig. 1, of said carburetor.

Fig. 3 is an end elevation of the same.

Fig. 4 is a partial diagrammatic horizontal section in the plane 4, 4 of Fig. 1 illustrating in solid lines the idling position, and in dotted lines the half open and fully open positions of cams 23, 24, rollers 48, 69 and throttle 14.

Fig. 5 is a partial horizontal section in the planes 5, 5 of Fig. 1, showing the eccentric mounting of roller 48.

Fig. 6 is a vertical elevation, with some parts in section, of the elements appearing in Fig. 5.

Referring to these drawings—

A central casting 10 contains a cylindrical bore 11 containing a Venturi sleeve 12, a fuel bridge 13 and a throttle valve 14 secured upon shaft 15. Air enters at the top of bore 11, moves downwardly through Venturi sleeve 12 where fuel is injected and vaporized, and the resulting explosive mixture then passes downwardly to the cylinders of the engine (not shown).

Secured to opposite sides of casting 10 are casing members 16 and 17 shaped to form chambers 18 and 19, respectively, one on each side of central casting 10, each of which contains a portion of the valve operating mechanism hereinafter described.

Shaft 15 is rotatably supported in the wall of casting 10 at each side of throttle valve 14, projects in each direction through the lower portions of chambers 18 and 19,

penetrates the exterior walls thereof in bearings 20, 20a, and has screw-threaded ends 21 and 22 exposed at each end of the carburetor. Secured upon shaft 15, to rotate therewith, are a pair of oppositely facing arcuate cams 23, 24 which serve to actuate the fuel valves in response to throttle opening as hereinafter described.

Casing 16 encloses and protects the actuating mechanism for fuel inlet valve 25 adapted to register with seat 26 formed at one end of a passageway 27 extending across bridge 13. Passageway 27 comprises a portion 28 of restricted diameter and a portion 29 of larger diameter, these two portions meeting at point 30. A lateral fuel passageway 31 communicating with the portion 29 of larger diameter immediately adjacent point 30 is adapted to conduct fuel from portion 29 to a series of discharge openings 32 where liquid fuel may be discharged into the vaporizing chamber 33 defined by Venturi sleeve 12. A head 34 serves to protect discharge openings 32 from air pressure which might tend to resist the discharge of fuel into chamber 33.

Casing 17 encloses and protects the actuating mechanism for fuel outlet valve 35 adapted to engage with seat 36 which defines the end of portion 29 of larger diameter of the fuel passageway 27.

Liquid fuel, for example gasoline, is fed to the carburetor through passageway 37 and thence to fuel chamber 38 defined by drillings in the wall of casting 10 and by diaphragm 39 at the center of which inlet valve 25 is mounted. Diaphragm 39 is suitably secured around its marginal edges to prevent escape of liquid fuel from chamber 38. Excess fuel passing between valve 25 and its seat 26, through passageway 27, and then between outlet valve 35 and its seat 36, enters chamber 40 defined by drillings in the wall of casting 10 and by diaphragm 41 at the center of which valve 35 is mounted. Diaphragm 41 is suitably secured around its marginal edges to prevent escape of fluid from chamber 40.

From chamber 40 excess fuel passes to passageway 42 and thence is returned to the source. An engine driven fuel pump (not shown) continually provides a supply of liquid fuel under pressure through passageway 37 to chamber 38, while the engine is operating, and excess fuel not used in the carburetor but passing across bridge 13 into chamber 40, is continually returned to the source through passageway 42. Thus, when both of valves 25 and 35 are open, the carburetor operates under constant recirculation of fuel supply.

Valve 25 is mounted, as hereinafter described, in such manner that its opening is responsive to the opening of throttle valve 14. More particularly, the arrangement is such that when throttle 14 begins to open, valve 25 moves away from seat 26 and the response is mechanically direct throughout the opening of valve 14. However, valve 25 never completely closes. In the position in which this valve is shown in Fig. 1, the minimum valve opening permits sufficient fuel to pass the valve for engine idling purposes. Valve 25 is supported at the upper end of movable arm 43 projecting upwardly from and integral with a frame 44 slideable upon a pair of lateral guide rods 45, 46 (Fig. 2) and a fixed guide rod 47. At its end nearest to casting 10, frame 44 supports an eccentrically mounted roller 48, the details of which are shown in Figs. 5 and 6.

Referring more particularly to Figs. 5 and 6, frame 44, at the place where roller 48 is mounted, consists of an upper plate 49 and a lower plate 50. A headed disc 51 is rotatably mounted within a bore 52 in upper plate 49. A stub shaft 53 is rotatably mounted within a bore 54 in lower plate 50 which said bore is coaxial with bore 52. Roller shaft 55, of smaller diameter than disc 51 and shaft 53, is firmly driven into bores 56 and 57 in the ends thereof so as to make a tight non-rotatable connection therewith. Shaft 55 is thus positioned eccentrically with

respect to disc 51 and shaft 53 which are coaxial with each other. Roller 48 is mounted upon shaft 55 and is free to rotate thereon, being secured against endwise displacement by the contact of its ends respectively with disc 51 and shaft 53. Lever 58 secured upon the lower end of stub shaft 53 has fastened to its outer end a Bowden wire 59 by means of which lever 58 can be rocked manually or automatically from the position shown in solid lines in Fig. 5 to the position 58a shown in dotted lines. Thus the center of rotation 76 of roller 48 may be swung through an arc about the center of rotation 77 of shaft 53, for a purpose to be explained. A spring 78 secured to frame 44 tends to pull arm 58 against the tension of Bowden wire 59 against a stop pin 79.

Spring 60 (see Fig. 1), preferably coiled about guide rod 47 and having its ends interposed between the interior of casing 16 and an exposed surface of frame 44, is adapted to urge frame 44 yieldingly in a direction such as to press roller 48 into engagement with cam 23. Thus, movement of cam 23 so as to transmit pressure against roller 48 tends to move frame 44, and hence to move valve 25 away from its seat 26. The eccentric mounting of roller 48 permits relative adjustment between the position of throttle valve 14 and of fuel valve 25, in their respective traverses. Thus, idling adjustment may be made by means of Bowden wire 59.

Fuel outlet valve 35 is secured at the upper end of movable arm 61 which in turn is secured to and integral with movable frame 62. Frame 62 carries a pair of guide rods 63, 64 which respectively engage within a pair of parallel bores 65, 66 in the lower portion of casting 10. Fixed guide rod 67 secured in casing 17 slideably engages within a socket 68 in frame 62, thereby further helping to guide frame 62 in its linear path of travel. At its end nearest to casting 10, frame 62 carries a roller 69 freely rotatable upon a shaft 70 fixed in frame 62. A helical spring 71 interposed between casing 17 and a surface of frame 62 yieldingly urges roller 69 into engagement with cam 24. The arrangement is such that movement of cam 24 tending to transmit pressure against roller 69 moves frame 62 and movable arm 61 in a direction away from casting 10, and hence moves fuel outlet valve 35 away from its seat 36.

Cams 23 and 24 are shaped (see Fig. 4) to have low portions 81 and 82, and sloping portions 83 and 84, respectively, but of differing lengths as will be explained. When throttle valve 14 is in closed (idle) position as shown in Fig. 4, roller 48 and 69 rest in contact with low portions 81 and 82 respectively of the cams. When throttle valve 14 has been moved partway towards open position, for example, to the intermediate position shown in dotted lines 80, and both cams have been moved to the respective positions indicated at 23a and 24a, the sloping portion 83 of cam 23 engages roller 48 and displaces it laterally, for example, to the position shown in dotted lines 48a. Since the low portion 82 of cam 24 is longer than the low portion 81 of cam 23, this movement of the cams is insufficient to bring sloping portion 84 of cam 24 into engagement with roller 69. Accordingly, at this stage, roller 69 remains undisplaced while roller 48 is displaced to position 48a. When, however, throttle valve 14 has been moved still further towards open position, for example, to the position shown in dotted lines 74, and both cams have been moved to the respective positions indicated at 23b and 24b, the sloping portion 83 of cam 23 displaces roller 48 to the position indicated in dotted lines at 48b, and the sloping portion 84 of cam 24 engages roller 69 and displaces it laterally to the position indicated in dotted lines 69b.

Thus, movement of the cams, which is mechanically and directly related to movement of throttle valve 14 at first causes roller 48 to be partly displaced while roller 69 remains undisplaced, and thereafter causes both rollers to be displaced. In each case displacement of the roller 48

or 69 causes equal displacement, i. e., opening, of the corresponding valve 25, 35.

Operation.—When the engine is not running, fuel inlet valve 25 and fuel outlet valve 35 are normally in the positions shown in Fig. 1. That is, fuel inlet valve 25 is slightly open and fuel outlet valve 35 is closed. At this time throttle valve 14 is very nearly or almost at its closed position, the low points of cams 23 and 24 are respectively in contact with the peripheries of rollers 48 and 69, and frames 44 and 62 are spring pressed to their extreme inward positions nearest to central casting 10, all as shown in Fig. 1.

When the engine has been started and brought to idling speed, the parts of the carburetor will normally remain substantially in the positions already described. The running of the engine causes a pump (not shown) to deliver gasoline through passageway 37 to chamber 38 and thence past slightly open valve 25 to passageway 27 including portion 29 thereof of larger diameter. Since, at this position of the parts, valve 35 remains tightly closed, all fuel which passes valve 25, except the amount required to fill passageway 27, is discharged under pump pressure through passageway 31 and discharge openings 32 into the vaporizing chamber 33, defined by Venturi sleeve 12. In order to adjust the amount of fuel which will be delivered through valve 25 under these conditions, the axial position of roller 48 in relation to frame 44 may be adjusted by means of a Bowden wire 59 which rocks lever 58. As the engine warms up lever 58 is moved towards position 58a (Fig. 5) either manually or by a thermostat (not shown).

When the throttle is to be opened in order to supply more fuel to the engine, shaft 15 may be rocked by any suitable means in a counter-clockwise direction as seen in Fig. 3. This may be done, for example, by means of a lever engaged upon either end 21 or 22 of shaft 15. Rotation of shaft 15 causes throttle valve 14 to move from its almost closed position shown in Figs. 1, 2 and 4, towards open position. It also causes cams 23 and 24, which are secured to shaft 15, to rotate about their respective centers and thus to move the low portions of these cams past rollers 48 and 69 respectively. As the cams move together (downwardly as seen in diagrammatic Fig. 4) roller 48 begins to ride the incline 83 of cam 23 while roller 69 remains on low portion 82 of cam 24. Thus, during the initial stages of the opening of throttle valve 14, fuel inlet valve 25 is being progressively opened while fuel outlet valve 35 remains closed. Thus, during this phase of the operation, increase of fuel supply through openings 32 is governed by increased opening of valve 25.

When the engine is being operated under conditions of a still larger throttle opening, as for example, that indicated in dotted lines 74, each of rollers 48 and 69 will be in contact with inclined portions 83 and 84 of cams 23 and 24, respectively. As the throttle approaches full opening, the rollers climb to the tops of these inclines respectively. Thus, roller 69 is moved outwardly and with it frame 62, arm 61 and fuel outlet valve 35 all of which are connected to roller 69. Movement of valve 35 away from its seat 36 permits liquid fuel to flow continuously through passageway 27. Thus, during the phase of operation, when valve 35 is open, the supply of fuel in passageway 27 constitutes a continuously circulating supply maintained by the pump and fed from a source of supply (not shown) through passageway 37 and chamber 38, thence through passage 27 to chamber 40, and returning to the source of supply through passageway 42. Under these conditions fuel is flowing continuously at high velocity through portion 28 of restricted diameter into portion 29 of larger diameter, and thereby experiences a substantial change in pressure and in velocity at the point 30 where the change in diameter occurs. Lateral fuel passageway 31 is so located as to communicate with larger diametered portion 29 of the passageway immediately adjacent point 30. Thus, when valve 35 is open and a continuously

flowing stream of fuel is passing through passage 27 across bridge 13, the feed of liquid fuel through openings 32 to vaporizing chamber 33 is no longer dependent on direct fuel pump pressure (governed by the degree of opening of valve 25) but is now dependent on the difference in pressure existing in vaporizing chamber 33 and at point 30 in the flowing stream of fuel. For all greater degrees of throttle opening, beyond that required to initiate the opening of valve 35, feed of liquid fuel to the Venturi is governed by Venturi-pressure and the pressure at point 30. Since the pressure at point 30 depends on the fall in velocity of the flowing stream at that point, the result is that, when engine and fuel pump speeds increase and consequently the speed of flow in the circulating fuel line increases, the pressure at 30 is diminished. Consequently the carburetor is automatically correlated to the relative pressures of the flowing liquid fuel and the pressure in the vaporizing chamber at high speed, and thus permits a more efficient use of the fuel.

By the means aforesaid, there is provided a floatless carburetor in which the feed of fuel at lesser degrees of throttle opening (while valve 35 is closed) is positively provided by the force of the fuel pump under control of valve 25 which may be adjusted by means of Bowden wire 59. However, at larger degrees of throttle opening, when valve 35 is opened the feed of fuel to the vaporizing chamber is dependent upon the suction in the vaporizing chamber defined by Venturi 12 and fuel is drawn from a continuously circulating supply thereof which is passing across bridge 13 through passageway 27 in the interior thereof. During the latter phase of operation, fuel is being pumped into the carburetor through passageway 37, excess fuel is being returned from the carburetor to the source of supply through passageway 42, and the amount of fuel drawn is dependent upon the relative pressures in passageway 27 and in vaporizing chamber 33. Additionally, there is provided, according to this invention means to modify the pressure of the flowing fuel in passageway 27, consisting of a transition point 30 between where fuel issues from a portion 28 of passageway which is of smaller diameter into a portion 29 of larger diameter. At this point a substantial change in pressure occurs. When the velocity of flow of fuel through passageway 27 increases, the pressure in the fluid as it passes point 30 changes inversely to the changes in velocity. Hence, a relation is preserved between the pressure and velocity of the fuel inside bridge 13 and the air inside the Venturi 12, resulting in economy in the use of fuel.

Since a carburetor made according to this invention is not dependent upon gravity for the feeding of fuel, or for the maintenance of desired pressure, the carburetor is adapted to be installed in any desired axial relation to the vertical, and if installed vertically will perform with equal facility when the engine to which it is attached has been tipped or tilted in any manner.

What is claimed is:

1. In a device of the character described comprising a floatless recirculating carburetor having a vaporizing chamber and throttle for controlling the flow of vaporized combustible mixture and means for feeding fuel to the carburetor, in combination, a fuel conduit, a nozzle for discharge of fuel from said conduit into an air stream flowing in said vaporizing chamber, an inlet valve adapted to control the flow of liquid fuel to the conduit, an outlet valve controlling the flow of excess fuel from the conduit, and means responsive to partial opening movement of the throttle to open the inlet valve while holding the outlet valve closed, and on further opening movement of the throttle to open both said valves, whereby the feed of fuel is positively provided by the pressure of the fuel supply at lesser degrees of throttle opening and by the relative pressures of the flowing liquid fuel and the vaporizing chamber at greater degrees of throttle opening.

2. In a device of the character described comprising a floatless recirculating carburetor having a vaporizing

chamber and throttle for controlling the flow of vaporized combustible mixture and means for feeding fuel to the carburetor, in combination, a fuel conduit, a nozzle for discharge of fuel from said conduit into an air stream

5 flowing in said vaporizing chamber, an inlet valve member adapted to control the flow of liquid fuel to the conduit, means movable with the throttle valve to move said inlet valve member towards and away from closed position when the throttle valve is moved, an outlet valve member adapted to move towards and away from closed position for controlling the flow of excess fuel from the conduit, and means interconnected with the throttle to hold said outlet valve member in closed position when the throttle is partly open and to move said outlet valve member from closed to open position when the throttle is fully opened, whereby the feed of fuel is positively provided by the pressure of the fuel supply at lesser degrees of throttle opening and by the relative pressures of the flowing liquid fuel and the vaporizing chamber at greater degrees of throttle opening.

3. In a device of the character described comprising a floatless recirculating carburetor having a vaporizing chamber and throttle for controlling the flow of vaporized combustible mixture and means for feeding fuel to the carburetor, in combination, a fuel conduit, a nozzle for discharge of fuel from said conduit into an air stream flowing in said vaporizing chamber, an inlet valve member adapted to control the flow of liquid fuel to the conduit, means movable with the throttle to move said inlet valve member towards and away from closed position when the throttle is moved, an outlet valve member controlling the flow of excess fuel from the conduit, a rotatably-mounted control shaft by which said throttle is moved, and cam means secured to said shaft and adapted to hold said outlet valve closed when the throttle is partly open and to move the outlet valve to open position when the throttle is fully opened, whereby the feed of fuel is positively provided by the pressure of the fuel supply at lesser degrees of throttle opening and by the relative pressures of the flowing liquid fuel and the vaporizing chamber at greater degrees of throttle opening.

4. In a device of the character described comprising a floatless recirculating carburetor having a vaporizing chamber and throttle for controlling the flow of vaporized combustible mixture and means for feeding fuel to the carburetor, in combination, a member having a fuel passageway, a nozzle for discharge of fuel from said passageway into an air stream flowing in said vaporizing chamber, an inlet valve adapted to control the flow of liquid fuel to the fuel passageway, means including an outlet valve for controlling the flow of excess fuel from said fuel passageway to said fuel feeding means, and means interconnected with the throttle to hold said outlet valve closed when the throttle is partly open and to move said outlet valve to open position when the throttle is fully opened, whereby the feed of fuel is positively provided by the pressure of the fuel supply at lesser degrees of throttle opening and by the relative pressures of the flowing liquid fuel and the vaporizing chamber at greater degrees of throttle opening.

5. In a device of the character described comprising a floatless recirculating carburetor having a vaporizing chamber and throttle for controlling the flow of vaporized combustible mixture and means for feeding fuel to the carburetor, in combination, a member having a fuel passageway of predetermined relatively small cross-sectional area and a second fuel passageway of predetermined relatively larger cross-sectional area communicating with said first-mentioned passageway and adapted to receive fuel therefrom through an orifice, a nozzle for discharge of fuel from said second fuel passageway into an air stream flowing in said vaporizing chamber, an inlet valve adapted to control the flow of liquid fuel to said first named passageway, means including an outlet valve controlling the flow of excess fuel from the passageway of relatively

larger cross-sectional area to said fuel feeding means, and means interconnected with the throttle to hold said outlet valve closed when the throttle is partly open and to move the outlet valve to open position when the throttle is fully opened, whereby the feed of fuel is positively provided by the pressure of the fuel supply at lesser degrees of throttle opening and by the relative pressures of the flowing liquid fuel and the vaporizing chamber at greater degrees of throttle opening.

6. In a device of the character described comprising a floatless recirculating carburetor having a vaporizing chamber and throttle for controlling the flow of vaporized combustible mixture and means for feeding fuel to the carburetor, in combination, a member having a fuel passageway of predetermined relatively small cross-sectional area and a second fuel passageway of predetermined relatively larger cross-sectional area communicating with said first-mentioned passageway and adapted to receive fuel therefrom through an orifice, a nozzle for discharge of fuel from said second fuel passageway into an air stream flowing in said vaporizing chamber, an inlet valve adapted to control the flow of liquid fuel to said first-named passageway, means movable with the throttle to move said inlet valve towards and away from closed position when the throttle is moved, an outlet valve controlling the flow of excess fuel from the passageway of relatively larger cross-sectional area, and means interconnected with the throttle to hold said outlet valve closed when the throttle is partly open and to move the outlet valve to open position when the throttle is fully opened, whereby the feed of fuel is positively provided by the pressure of the fuel supply at lesser degrees of throttle opening and by the relative pressures of the flowing liquid fuel and the vaporizing chamber at greater degrees of throttle opening.

7. In a device of the character described comprising a floatless recirculating carburetor having a vaporizing chamber and throttle for controlling the flow of vaporized combustible mixture and means for feeding fuel to the carburetor, in combination, a member having a fuel passageway, a nozzle for discharge of fuel from said passageway into an air stream flowing in said vaporizing chamber, an inlet valve adapted to control the flow of liquid fuel to the fuel passageway, a pressure modifying orifice in said passageway, a fuel discharge opening communicating with said passageway on the side of the orifice remote from said inlet valve, means movable with the throttle to move said inlet valve towards and away from closed position when the throttle is moved, an outlet valve controlling the flow of excess fuel from the passageway, and means interconnected with the throttle to hold said outlet valve closed when the throttle is partly open and to move the outlet valve to open position when the throttle is fully opened, whereby the feed of fuel is positively provided by the pressure of the fuel supply at lesser degrees of throttle opening and by the relative pressures of the flowing liquid fuel and the vaporizing chamber at greater degrees of throttle opening.

8. In a device of the character described comprising a floatless recirculating carburetor having a vaporizing chamber and throttle for controlling the flow of vaporized combustible mixture and means for feeding fuel to the carburetor, in combination, a fuel conduit, a nozzle for discharge of fuel from said conduit into an air stream flowing in said vaporizing chamber, an inlet valve member adapted to control the flow of liquid fuel to the conduit, a movable carriage supporting said member, an outlet valve

member adapted to control the flow of excess fuel from the conduit, a second movable carriage supporting said last-named member, a rotatably-mounted control shaft by which said throttle is moved, and a pair of cams secured to move with said shaft and adapted to bear against said carriages respectively, whereby movement of the throttle under control of said shaft is accompanied by movement of said inlet and outlet fuel valves to open the inlet valve while holding the outlet valve closed and on further opening of the throttle to open both of said valves, whereby the feed of fuel is positively provided by the pressure of the fuel supply at lesser degrees of throttle opening and by the relative pressures of the flowing liquid fuel and the vaporizing chamber at greater degrees of throttle opening.

9. In a device of the character described comprising a floatless recirculating carburetor having a vaporizing chamber and throttle for controlling the flow of vaporized combustible mixture and means for feeding fuel to the carburetor, in combination, a fuel conduit, a nozzle for discharge of fuel from said conduit into an air stream flowing in said vaporizing chamber, an inlet valve member adapted to control the flow of liquid fuel to the conduit, a movable carriage adapted to support said valve member and to move the same towards and away from closed position, a roller eccentrically mounted upon a rock-shaft supported by said carriage, means to rock said rock-shaft, cam means interconnected with the throttle and adapted to engage said roller whereby to cause said carriage to move when the throttle is moved, an outlet valve controlling the flow of excess fuel from the conduit, and means interconnected with the throttle to hold said outlet valve closed when the throttle is partly open and to move the outlet valve to open position when the throttle is fully opened, whereby the feed of fuel is positively provided by the pressure of the fuel supply at lesser degrees of throttle opening and by the relative pressures of the flowing liquid fuel and the vaporizing chamber at greater degrees of throttle opening.

10. In a device of the character described comprising a floatless recirculating carburetor having a vaporizing chamber and throttle for controlling the flow of vaporized combustible mixture and means for feeding fuel to the carburetor, in combination, a fuel conduit, a nozzle for discharge of fuel from said conduit into an air stream flowing in said vaporizing chamber, an inlet valve member adapted to control the flow of liquid fuel to the conduit, a movable carriage supporting said inlet valve member, and having a roller whose center of rotation may be moved for purposes of adjusting the valve opening means for moving the center of rotation of said rollers, an outlet valve controlling the flow of excess fuel from the conduit, a second movable carriage supporting said outlet valve member and having a second roller, and a shaft supporting the throttle and also supporting cam means engageable with said rollers when the shaft is rotated whereby the feed of fuel is positively provided by the pressure of the fuel supply at lesser degrees of throttle opening and by the relative pressures of the flowing liquid fuel and the vaporizing chamber at greater degrees of throttle opening.

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