Oct. 5, 1937. R. ABELL 2,094,864

CARBURETOR

Filed Jan. 17, 1933

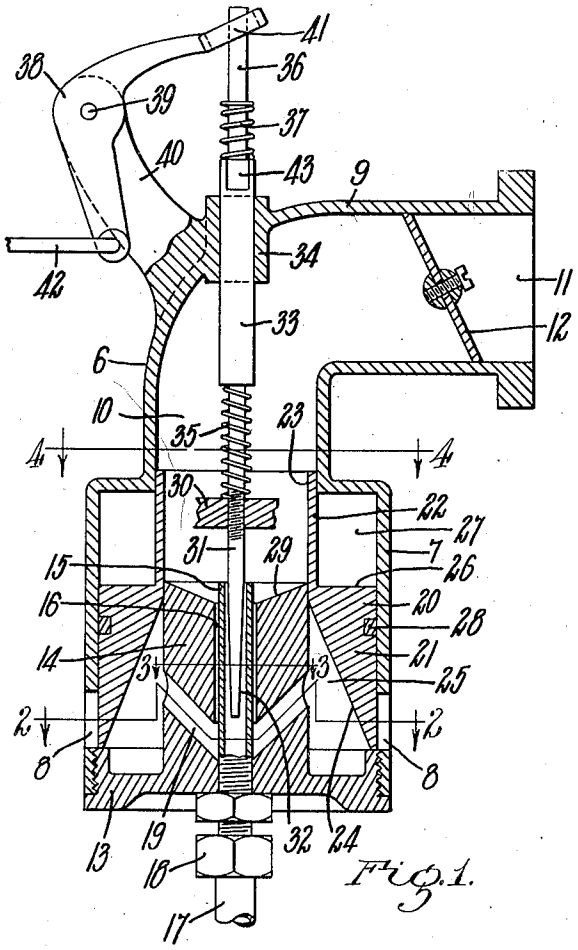


Fig. 1.

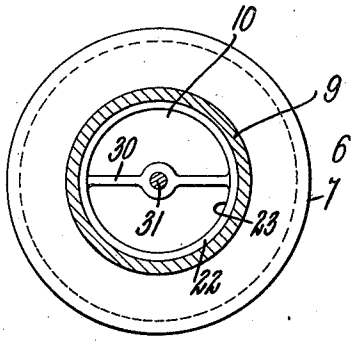


Fig. 4.

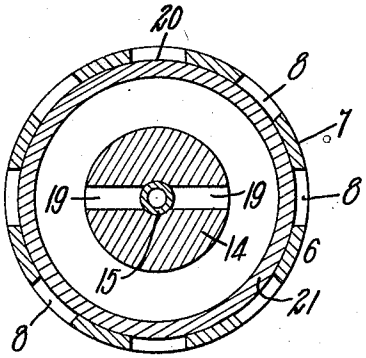


Fig. 2.

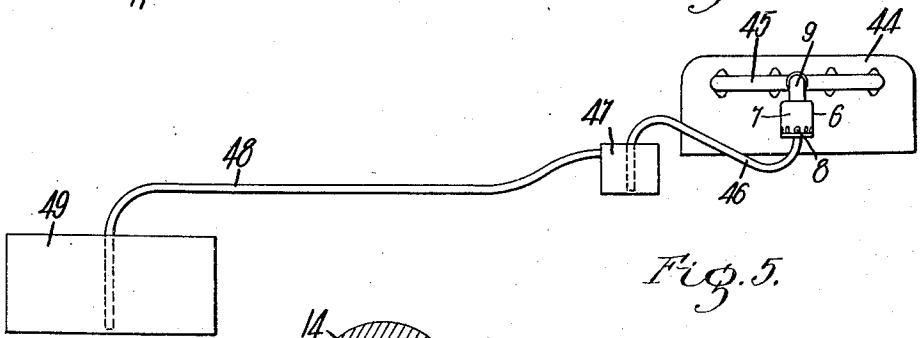


Fig. 5.

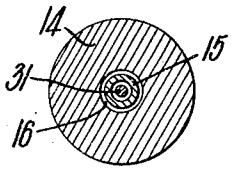


Fig. 3.

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Patented Oct. 5, 1937 2,094,864

UNITED STATES PATENT OFFICE

2,094,864

CARBURETOR

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Application January 17, 1933, Serial No. 652,179

17 Claims. (Cl. 261—49)

This invention relates to improvements in carburetors and particularly to a carburetor of the type that has the constant vacuum or gravity air valve principle embodied therein.

The primary object of the invention is to provide a carburetor which does not require a float and also does not require a fuel pump or other mechanism of any description to feed the fuel thereto, said carburetor being so constructed and arranged as to be capable of lifting its own fuel from a storage tank at any speed or load by reason of the fact that the vacuum is constant irrespective of other variable conditions which may exist.

Another object of the invention is to provide a carburetor having an air valve embodied therein which is capable of functioning to feed air at a constant vacuum at all loads and speeds; that is capable of feeding air at an accurate and predetermined rate at any position of its movement; that functions as both a mechanical and air friction dash pot to maintain stability of the mixture ratio under quick throttle changes and improves the acceleration of an internal combustion engine for which it may be provided by preventing the mixture from becoming too lean on a sudden opening of said throttle, it not being necessary to resort to a throttle operated acceleration pump as is common on high-priced carburetors; and finally, it carries a metering pin that controls the fuel flow and has sufficient movement so that it is not difficult to maintain uniform accuracy of the angle of the air valve or the taper of the metering pin.

Another object of the invention is to provide a manually actuated cold weather starting device operable from the dash in the usual well-known manner, said mechanism being of such construction that it will be impossible to choke or flood the engine to such a degree that it will not operate.

Still another object of the invention is to provide a carburetor in which it is necessary to make but one adjustment that being for low speeds, it being possible to so accurately control the mixture ratio through the use of the metering pin that no high speed adjustment is required.

Finally, it is still further the object of the invention to provide a carburetor of small size and simple construction and capable of being manufactured at small cost.

The invention consists in a carburetor as set forth in the following specification and particularly as pointed out in the claims thereof.

Referring to the drawing:

Fig. 1 represents a central vertical sectional elevation of a carburetor embodying my invention.

Fig. 2 is a detail horizontal section taken on the irregular line 2—2 of Fig. 1.

Fig. 3 is a detail horizontal section taken on the line 3—3, Fig. 1.

Fig. 4 is a detail horizontal section taken on the line 4—4 of Fig. 1.

Fig. 5 is a diagrammatic view illustrating a preferable relationship between a carburetor of this invention and a fuel storage tank including an auxiliary tank and the pipe connections.

Like numerals refer to like parts throughout the several views of the drawing.

In the drawing, 6 represents a carburetor casing embodying therein a main cylindrical portion 7 provided with a plurality of air openings 8 which extend through the wall thereof at points adjacent to the lower end thereof. Formed integral with the body portion 7 of the casing 6 is a reduced angular portion 9 in the interior of which is a mixing chamber 10 which merges into a gas fuel outlet passage 11. A throttle valve 12 is provided for the outlet passage.

The lower extremity of the body portion 7 of the casing 6 is closed by means of a bottom member 13 which has a cylindrical central portion or column 14 formed integral therewith. A spray nozzle 15 is rigidly secured in the bottom member 13 and projects upwardly through a passage 16 which is provided in the column 14, there being a narrow space provided between the periphery of the spray nozzle 15 and the bore of the column which functions as a primary air passage. A liquid fuel supply pipe 17 is secured at the lower extremity of the spray nozzle 15 by means of a union 18. The column 14 is provided with several small air passages 19 which are positioned radially therein and incline downwardly from the periphery of the column toward the center thereof and communicate with the primary air passage 16. These passages not only function as air passages but also act to collect and retain any liquid fuel which may not have become vaporized and which might flow downwardly from the mixing chamber 10 through the air passage 16.

Slidably mounted in the casing 6 is a piston 20 constituting an air valve and embodying therein a cylindrical body portion 21 which is mounted in the portion 7 of said casing. The piston 20 has a tubular portion 22 formed integral therewith and projecting upwardly therefrom into the upper portion 9 of said casing, and a cylindrical

passage 23 provided at the upper portion of said piston co-operates with the adjacent interior portion of the casing 6 in forming the mixing chamber 10. The lower portion of the piston 20 is internally tapered or frusto-conical at 24 and co-operates with the periphery of the column 14 to provide a tapered passage 25 therebetween. The piston 20 has a shoulder 26 formed thereon at the point where the upstanding portion 22 joins the main body portion 21 thereof, and a space 27 is provided between this shoulder and the surface of the casing portion 7 which is located therebetween, said space surrounding the upstanding portion 22 of said piston. During the operation of the mechanism the piston 20 has a reciprocatory motion in the casing 6 and the space 27 functions as an air cushion or air dash pot.

A piston ring 28 is mounted in the main body portion 21 of the piston 20 and acts to retard the movement of the piston.

The upper extremity of the column 14 is countersunk at 29 in order that unvaporized fuel may be deflected downwardly toward the passage 16 and not collect upon the top of said column.

Mounted in a cross arm 30 carried by and within the tubular portion 22 of the piston 20 is a metering pin 31, the lower portion of which is tapered at 32. The metering pin 31 has screw-threaded engagement with the cross arm 30 and is, therefore, adjustable vertically in said arm. The metering pin 31 has an enlarged portion 33 formed thereon which is slidably mounted in a bearing portion 34 of the casing 6. A spring 35 surrounds the metering pin 31 and is interposed between the cross arm 30 and the shouldered portion 33 of said pin. The pin, furthermore, has a reduced portion 36 formed at its upper end upon which a spring 37 is mounted. A bellcrank lever 38 is pivotally attached at 39 to an arm 40 which is formed integral with the casing 6, and a forked portion 41 of the lever 38 straddles the upper portion 36 of the metering pin and is adapted to engage the upper extremity of the spring 37. An operating rod 42 is connected to the depending arm of the bell-crank lever 38. The metering pin 33 is flattened at 43 in order that it may be engaged by a suitable tool when it is necessary to make adjustments.

In Fig. 5 I have illustrated diagrammatically the preferable relationship between the carburetor of this invention and the main liquid fuel supply tank and an auxiliary supply tank which may be used if necessary. In this view 44 represents the cylinder head of an internal combustion engine and 45 an intake manifold to which the casing 6 of the carburetor is attached in a well-known manner. The carburetor is connected by means of a tube 46 to an auxiliary air tight fuel supply tank 47, which is positioned at a point just below the level of the carburetor and the tank 47 is connected by means of a tube 48 to a main supply tank 49, and the tanks 47 and 49 are so positioned with relation to the carburetor that in all of the positions that an automobile may assume when being operated, as for example, in climbing very steep inclines, there will never be any extreme height to which it will be necessary for the carburetor to lift the liquid fuel. There will always be a reserve supply of fuel at a level near the level of the carburetor providing there is fuel in the main supply tank.

The general operation of the mechanism hereinbefore specifically described is as follows:—It is assumed that the carburetor is attached to the intake manifold of an internal combustion engine, that the fuel supply pipe 17 is attached to a fuel tank, and that the operating rod 42 extends to a location where it will be convenient for the operator as, for example, the dash of an automobile. When the engine is started, either by the starter mechanism or by cranking the engine, and a suction is created by the pistons, this suction is transmitted to the mixing chamber 10, whereupon liquid fuel will be drawn upwardly from the spray nozzle 15 through the space therein surrounding the periphery of the metering pin 31. At the same time air will be drawn upwardly through the primary air passage 16. This air will mix with the fuel issuing from the spray nozzle causing the latter to be vaporized and thereby forming a gas which is drawn into the engine cylinders by means of the pistons. After the engine is started and the suction increases, the air valve or piston 20 will be influenced by the suction and start to rise, thereby moving the tapered portion of said valve above the upper extremity of the stationary column 14. This opens up the passage 25 between the tapered surface of the air valve and the outer periphery of the stationary column and causes the passage to communicate with the mixing chamber 10, and the higher the air valve rises the wider the space becomes between the air valve and the column. At the same time that the air valve rises, the air openings 8, which at the start of the operation of the carburetor were substantially closed, will begin to open, thereby permitting more air to enter the carburetor and eventually reach the mixing chamber. As the air valve continues to rise, its movement will be retarded somewhat by the piston ring 28 and as the valve approaches its uppermost position air within the space 27 will act to cushion the reciprocating movements of the valve. If the throttle valve 12 is opened suddenly, there are three factors which will prevent the air valve 20 from jumping beyond its proper position. The first of these factors is the weight of the valve itself, the second is the friction caused by the presence of the piston ring 28 engaging the inner wall of the cylinder, and the third is the air cushion or dash pot.

In cold weather the manually actuated choke mechanism is utilized, at which time the bell-crank lever 38 upon being actuated will cause the forked portion 41 thereof to be depressed into engagement with the upper extremity of the spring 37, whereupon the metering pin 31 and air valve 20 may be yieldingly held in their depressed positions in order that a rich mixture may be obtained for a longer period of time. When the engine finally starts to accelerate, the choke rod 42 is released, whereupon the air valve will start immediately to function as hereinbefore mentioned. If during the operation of the carburetor some of the liquid fuel fails to vaporize, this fuel will be deflected downwardly into the air passage 16 through which it will flow into the air passages 19 which are arranged in such a manner that this liquid will be trapped therein. This fuel may be utilized in a subsequent starting operation.

The device of this invention is capable of automatically providing an accurate mixture ratio at all speeds of the engine. It maintains a high vacuum at low speed and a low vacuum at high speed. But one adjustment is necessary, that being the adjustment of the metering pin 31, to vary the size of the opening of the spray nozzle

15. An internal combustion engine equipped with this carburetor is capable of maintaining a very low idling speed and a relatively high top speed. A more efficient acceleration is obtained due to the inertia and friction of the air valve. No float feed is necessary and no fuel pump or other mechanism of any description is required to feed the liquid fuel to the carburetor. The suction which is constant in the carburetor is transmitted through the tube 46 to the auxiliary tank 47 and from thence through the tube 48 to the tank 49 and a supply of fuel is therefore always available in the tank 47 near the level of the carburetor.

The auxiliary air-tight, or vacuum tank 47 is first filled to a desired level in any suitable manner and subsequent creation of a vacuum within the carburetor will draw fuel from said tank through pipe 46, which in turn will create a vacuum in the upper portion of the tank and the fuel level therein will drop slightly until all air is withdrawn from pipe 48 whereupon fuel from tank 49 will begin to enter vacuum tank 47 in exactly the same amount that is being drawn out through pipe 46; hence, while the carburetor is in operation the fuel level in tank 47 remains constant.

It will be clear that when there is no vacuum present in the carburetor, tank 49 may be raised to a level above it and fuel will not flow by gravity from tank 49 to tank 47; hence, the vacuum tank also serves, in this instance, as a check valve to prevent flooding the carburetor when an automobile is located on a down grade with the engine stopped.

I claim:

1. In a constant-vacuum floatless carburetor, the combination of a cylindrical casing having bores of different diameters, a vacuum operated air-valve piston member arranged to engage and be guided by the wall of the larger bore, a column integral with said piston member arranged to engage the wall of a smaller bore to form an air cushioning chamber between the air-valve and said casing, at least one air inlet port in said casing, and radially expansible means positioned intermediate the air cushioning chamber and said air inlet port, whereby the action of said air-valve is rendered less sensitive to engine pulsations and will respond only to vacuum changes of a predetermined degree.

2. In a constant-vacuum floatless carburetor, the combination of a casing forming a mixing chamber, ports in said casing for admitting air to said chamber, a primary air passage, a piston-valve adapted to be lifted by suction and fitted to leave minimum openings to said ports substantially as large in area as said primary air passage, an annular surface on said piston-valve arranged to cooperate with an annular surface presented by said casing to form a dash-pot checking means for the piston-valve, and a piston ring element arranged intermediate the ports in said casing and the dash-pot checking means, whereby the effect of engine pulsations upon said piston-valve will be reduced to a minimum degree.

3. A floatless fuel-feed system for internal combustion engines comprising in combination, a carburetor casing arranged to form a mixing chamber adapted for communication with an engine cylinder, a vacuum raised and gravity seated air-control valve mounted within said casing, liquid fuel control means associated with the air-control valve, a plurality of floatless fuel receptacles positioned remote from the carburetor and at different levels with respect to each other and the carburetor, and fuel supply tubes connecting the receptacles in series with said fuel-control means, at least one of said supply tubes being arranged to form a fuel trap.

4. In a carburetor having a casing arranged to form a suction and mixing chamber, in combination, an air-control piston valve having a central bore and arranged to reciprocate within the casing, a removable header member arranged to maintain the piston valve within the casing, an upstanding column carried by the header member arranged to slidingly engage the bore of the piston valve, and a centrally disposed fuel inlet member carried by the column and extending at least to the upper end thereof in one direction and passing through the header member in the opposite direction for connection with a source of fuel supply; the said piston-valve-bore being in part cylindrical for the said sliding engagement with the column when the air valve is closed, and during initial opening travel, and being in part frusto-conical, with the conical bore positioned to coact with the end of the column to change the area of air valve opening at a rate of change greater than the linear rate of travel of the air valve.

5. In a carburetor having a suction-operated air-and-fuel control valve, a cylindrical axial bore in said control valve arranged to merge into a frusto-conical form extending to the lower edge of the valve, means to engage the lower edge of the valve when in lowermost position to substantially close the frusto-conical chamber to atmospheric pressure, and a fixedly mounted cylindrical column arranged to previously close said cylindrical bore to the atmosphere, the relative closing point of each bore being controlled by valve dimensions predetermined.

6. In a constant vacuum floatless carburetor, the combination of a casing arranged to provide a mixing chamber with which an engine is adapted to communicate, an engine control valve, a fuel valve, a suction-operated air-valve provided with a cylindrical bore, a fixedly mounted column arranged to cooperate with the bore in said air-valve to form a secondary air passage to the mixing chamber, the positioning of said bore relative to the fixed column being arranged to substantially prevent the passage of air therebetween until said air-valve has been raised a predetermined amount, and a primary air passage in the fixed column arranged to provide for communication between the mixing chamber and the atmosphere, the proportions of said primary air passage being such that said air-valve will begin to rise when the engine control valve is in engine idling position.

7. In a self-feeding carburetor having a mixing chamber, the combination of a gravity operatd air-control valve, a fuel-control element arranged to cooperate with the air-control valve to maintain a constant vacuum within the mixing chamber, a fuel supply receptacle, normally positioned at a predetermined level below the carburetor, a fuel stabilizing chamber positioned at an intermediate level relative to the carburetor and said supply receptacle, and fuel passageways connecting the supply receptacle, the stabilizing chamber and the carburetor in series, said stabilizing chamber being arranged to maintain a constant level of fuel therein at all times irrespective of variations either way from said predetermined level of the supply receptacle.

8. In a self-feeding carburetor having a mixing

chamber, the combination of a gravity operated air-control valve, a fuel-control element arranged to cooperate with the air-control valve to maintain a constant vacuum within the mixing chamber, a fuel supply receptacle normally positioned at a predetermined level below the carburetor, a fuel stabilizing chamber positioned at an intermediate level relative to the carburetor and said supply receptacle, and fuel passageways connecting the supply receptacle, the stabilizing chamber and the carburetor in series, said stabilizing chamber being air-tight and arranged to provide an air lock cooperating with said passageways to prevent the flow of fuel through the chamber when said supply receptacle is raised to a level above the carburetor and there is no vacuum therein.

9. In a fuel feed system for an internal combustion engine, in combination, a fuel supply receptacle, a self-feeding carburetor, a vacuum-operated fuel container positioned below the carburetor, fuel conducting means leading from the supply receptacle to the fuel container, and separate fuel conducting vacuum means leading from said container to the carburetor.

10. In a constant vacuum carburetor, the combination of a casing arranged to provide a mixing chamber with which an engine is adapted to communicate, a throttle valve, a fuel valve having open small inlet for fuel and primary vaporizing air, a suction-operated secondary air-valve provided with a frusto-conical bore, a fixedly mounted column arranged to cooperate with the bore in said air-valve to form the principal air passage to the mixing chamber, the positioning of said bore relative to the fixed column being arranged so that the air-passage area therebetween at the smaller end of the frustum is so small in cross section that the suction will cause the air-valve to rise and function even when the throttle valve is in engine idling position, and the conical part of the frustum is positioned so that it coacts with the column, when the valve has risen, in determining the secondary air-passage area.

11. In a constant-vacuum floatless carburetor, the combination of a casing containing a mixing chamber adapted to be connected with the intake of an internal combustion engine, a throttle valve in the outlet from said chamber, a suction operated air valve mounted in said casing with capacity for rise and descent and having a frusto-conical bore of which the sides converge in the upward direction, a column fixedly mounted in the casing within said bore and arranged to cooperate therewith in providing a secondary air passage to the mixing chamber, of which passage the area increases with progressive rise of said air valve, a fuel metering element carried by said air valve and a cooperating fuel metering element arranged through said column to coact with one another in controlling delivery of fuel to the mixing chamber; said column having a primary air passage leading from the space within said conical bore and extending adjacent to said fuel metering elements to the mixing chamber, the primary air passage being so restricted as to cause the air valve to be substantially floated by the air column when said throttle valve is in its engine-idling position.

12. In a constant-vacuum carburetor, in combination, a casing constructed to provide a mixing chamber in its interior, a throttling valve controlling the outlet from said mixing chamber, a suction operated air valve having a frusto-conical bore mounted to rise and descend in said chamber, a fixedly mounted column in the chamber arranged to cooperate with said bore to form the principal air passage to the mixing chamber, a fuel conduit rising through said column, and a tapered fuel valve carried by the air valve and projecting downwardly into said conduit; the respective portions of taper of the fuel valve and of taper of the conical bore which are co-acting, at each position of travel of the air valve, being related to each other in contour and dimensional proportions which make a fuel mixture in proportions which have been predetermined as being substantially the optimum for the feed of delivery to which that position corresponds.

13. In a carburetor of the metering pin type, the combination of a casing forming a mixing chamber and having a central upstanding column in its interior, an air valve mounted to rise and descend in said casing and having a frusto-conical bore surrounding said column, having a diameter substantially equal to the diameter of the column at the upper end of the latter, and having a progressively enlarging diameter below such upper end, the main supply of air to the carburetor being admitted to the lower part of such conical bore; there being also a metering pin mounted to rise and be set with the air valve, a liquid fuel supply container at a lower level, and an unobstructed passage thence to the metering pin permitting the suction in the mixing chamber to control freely the level and flow of liquid fuel to the metering pin.

14. In a carburetor of the metering pin type, a casing enclosing a mixing chamber in its upper portion and having air inlet provisions in its bottom part, a fixed column rising from the bottom of said casing centrally therein having a central air passage in its upper part and a lateral inlet to such passage at a lower level, a fuel supply conduit extending upwardly through said column within said central passage and located to permit flow of air between it and the bounding wall of the passage, an air valve fitted to slide in said casing longitudinally of the column, having a downwardly enlarging frusto-conical bore arranged to be substantially obstructed by the upper end of said column when the valve is in its lowest position and to provide an annular passage of progressively larger area as the valve is progressively raised, and a fuel metering pin of downwardly convergent taper carried by the air valve and extending downwardly into said fuel conduit; the flow of the air for the mixing chamber being received through the two said passages, the one within and the other without the said column, and the inner of these being a primary atomizing air current too small to operate the engine to which the carburetor is attached.

15. In a carburetor of the metering pin type, the combination of a casing forming a mixing chamber and having a central column in its interior forming part of the fuel and air metering means, an air valve guided in said casing to travel lengthwise of the column, having a frusto-conical bore substantially fitting the extremity of said column only when the valve is in its lowermost position and being of progressively enlarging diameter in the direction toward the base of the column, and a tapered fuel metering pin carried by the air valve in position to cooperate with the fuel supplying portion of said column; said conical bore being arranged to control all of the air passing through the carburetor including that

required to provide a combustible mixture suitable for the idling speed of an internal combustion engine; a fuel supply tank at a lower level, and a floatless and unobstructed connection thence to the fuel supplying portion of said column.

16. A floatless carburetor having a mixing chamber in its interior and air inlet means at one end, air controlled means by which substantially all of the air supplied to the mixing chamber is controlled, comprising a valve member fitted to move in the casing, having a conical bore of convergent taper in the direction from the air inlet means toward the mixing chamber, and a stationary column extending from the air inlet end of the casing toward the mixing chamber within such bore, formed to obstruct such bore at its extremity only, and only when the air valve is in a position of near approach to the air inlet end of the casing; the relation of the air valve to the column being that when the air valve is fully at the air inlet end of its travel the said column projects through and laps a little beyond the small end of the conical bore of the valve.

17. The combination with a constant-vacuum floatless self feeding carburetor, of a fuel receptacle located at a level below that of the carburetor, a valveless vacuum fuel container located at a level intermediate those of the receptacle and carburetor, a fuel conduit leading from the receptacle to the container, and a separate conduit leading from the container to the carburetor; the container being thereby so arranged as to form a fuel trap to maintain a substantially constant level of fuel in reference to the carburetor and prevent back flow of fuel from the carburetor to the receptacle.

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