May 6, 1952 C. R. SNYDER 2,595,721

CARBURETOR

Filed Oct. 21, 1948 2 SHEETS—SHEET 1

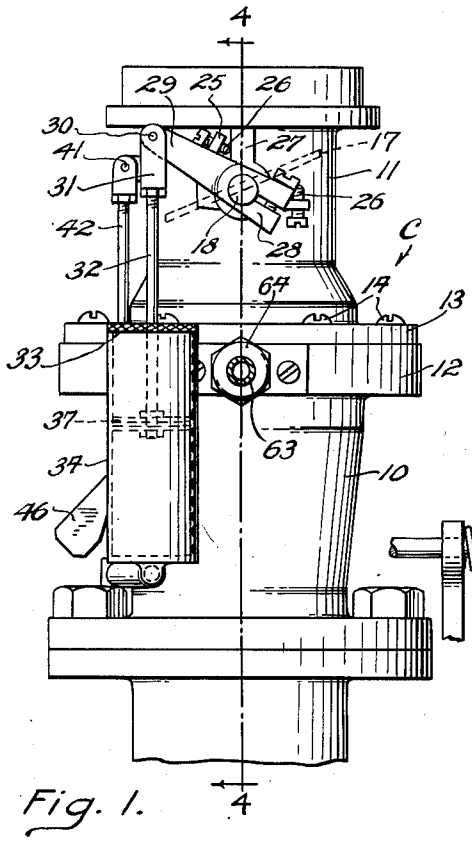


Fig. 1.

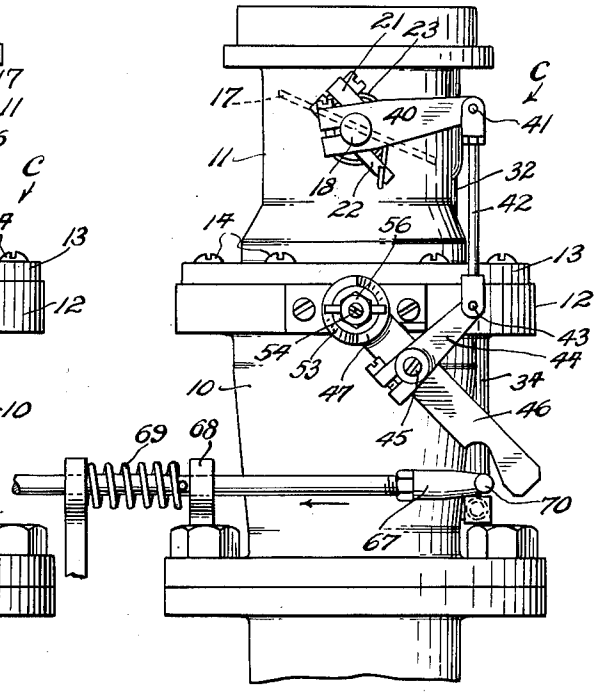


Fig. 2.

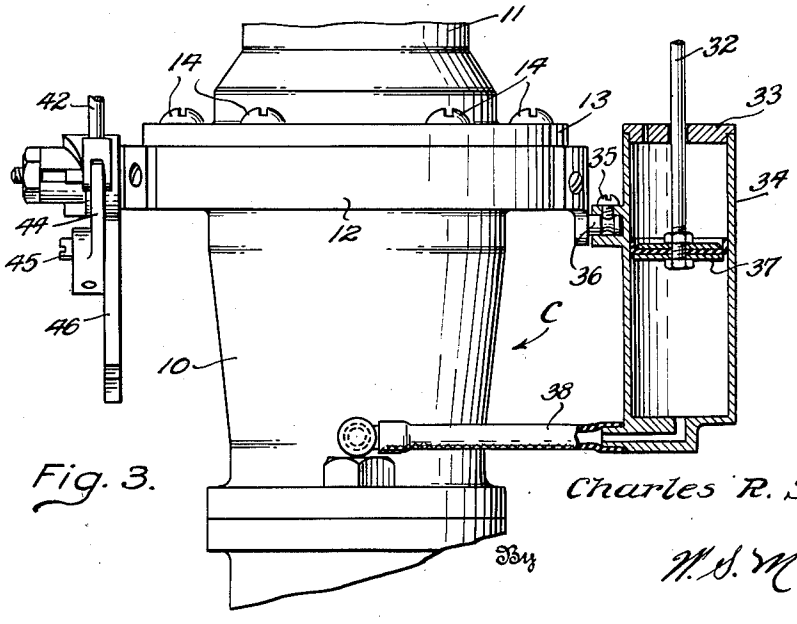


Fig. 3.

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May 6, 1952 C. R. SNYDER 2,595,721

CARBURETOR

Filed Oct. 21, 1948 2 SHEETS—SHEET 2

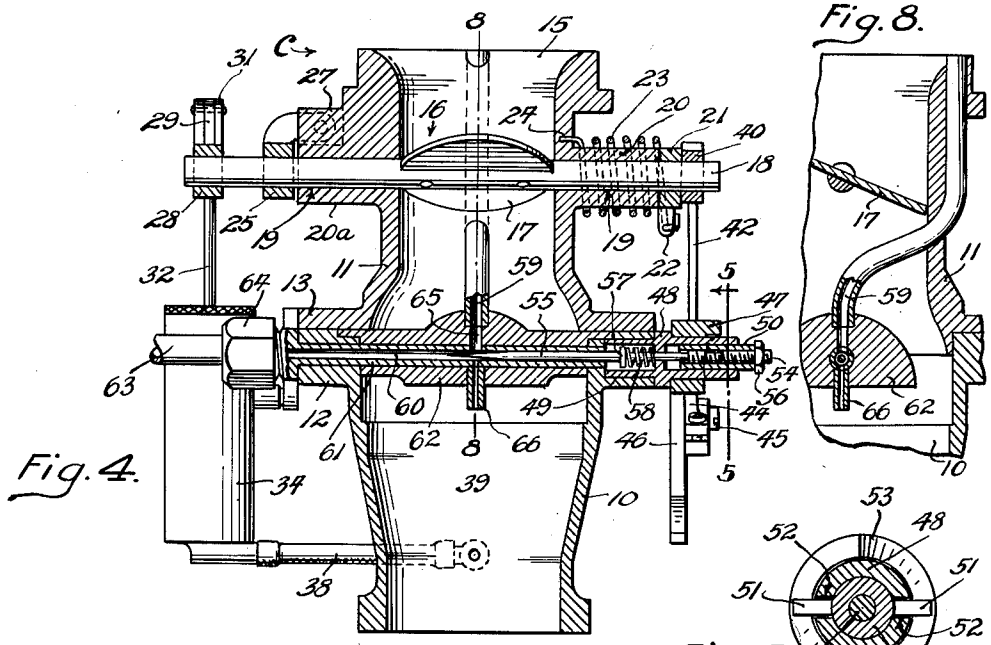


Fig. 4.

Fig. 8.

Fig. 5.

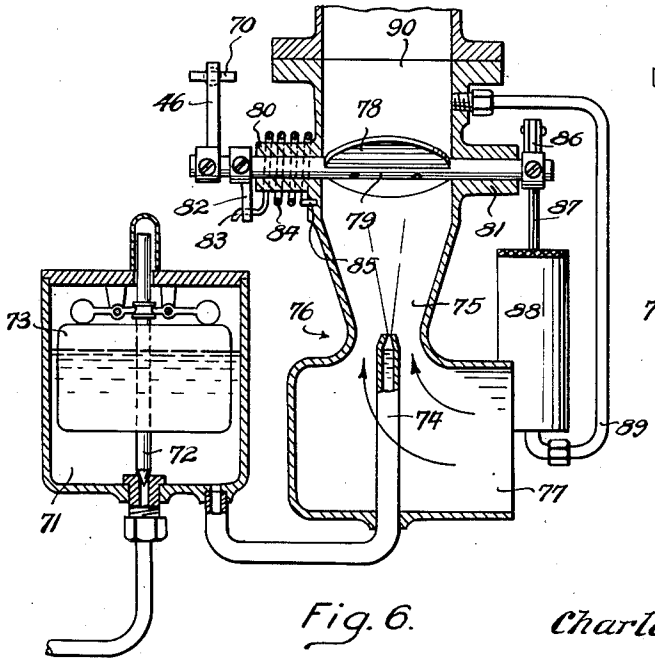


Fig. 6.

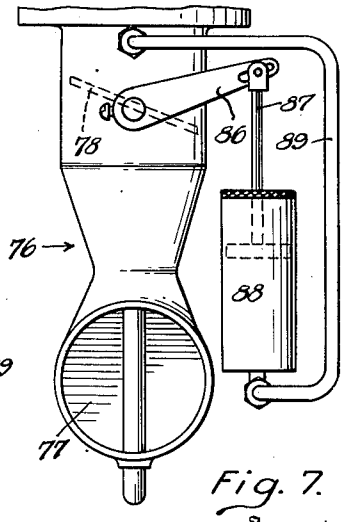


Fig. 7.

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CARBURETOR

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Application October 21, 1948, Serial No. 55,711

6 Claims. (Cl. 261—50)

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This invention relates to improvements in carburetors of the type employed for supplying an explosive mixture, composed of a vaporizable normally liquid hydrocarbon and atmospheric air, to the cylinders of internal combustion engines.

Such carburetors embody customarily a casing having an internal chamber in which is located one or more fuel-introducing jets, the chamber communicating at one end with the atmosphere and at its other end with a fuel intake manifold of an associated engine.

In the outlet of the chamber, there is arranged a manually operated throttle valve for governing fluid flow through said chamber. The operating positions of the throttle valve are under direct manual control. Usually in a motor vehicle, this is accomplished by the operation of the conventional foot pedal accelerator mechanism. Since the amount of liquid fuel drawn into an engine from its carburetor depends upon the partial vacuum conditions created in the carburetor chamber by the displacement of the engine pistons and the operating positions of the throttle valve, it is a matter of frequent occurrence in motor vehicle engine operation that the throttle valve is manually operated to move the same to a fully opened position, one which the valve should assume when the associated engine is operating at top speed, when as a matter of proper operation, the valve, in accordance with the speed and fuel demands of a laboring engine, should be but partly open for the transmission of the correct amount of fuel to the engine.

It is believed, therefore, that reliance should not be placed on the vehicle operator in controlling the operating positions of the carburetor throttle, since by so doing, it most frequently occurs that undesired volumes of carburetted fuel enter the engine, and also fuels containing unsuitable proportions of liquid fuel to air.

Accordingly the present invention has for an object to provide a carburetor having a movable throttle valve with improved actuating means which respond automatically and entirely to the operation of the associated engine in the matter of moving the valve between opened and closed positions in the chamber of the carburetor occupied by the valve.

It is another object to provide a carburetor throttle valve actuating mechanism which functions automatically to open and close an associated throttle valve in accordance with variable partial vacuum conditions established within a carburetor through the operation of a cooperative engine.

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Another object is to provide a carburetor in which provision is made, under all conditions of engine operation, for maintaining a uniform proportion of the fuel and air constituents of the explosive fuel mixture produced by the carburetor for delivery to the cylinders of an associated engine.

It is another object of the invention to provide a carburetor having a pivotally movable throttle valve with which is associated spring means which tend to move the valve in one direction and with vacuum-responsive means for moving the valve in a direction opposed to that produced by said spring means, the two opposing forces serving, during operation of the engine, and the establishment of varying vacuum conditions within the carburetor, to maintain said valve automatically in a position properly proportioning and metering the flow of carburetted fuel to the engine cylinders in accordance with the actual fuel needs of the engine.

It is a further object of the invention to provide in such a carburetor manually controlled movable stop means for limiting the extent of movement of the throttle valve in its automatic response to engine fuel demands.

A further object of the invention is to provide in a carburetor automatic means for producing a metered flow of carburetted fuel to the cylinders of an associated engine during both speed-increasing and decreasing requirements on the part of said engine.

This application constitutes a continuation-in-part of my prior application, Serial No. 710,388 filed November 16, 1946.

For a further understanding of the carburetor forming the present invention, including additional objects, working principles and advantages thereof, reference is to be had to the following description and the accompanying drawings, wherein:

Fig. 1 is a front elevational view of a carburetor formed in accordance with the present invention;

Fig. 2 is a rear elevational view of the carburetor;

Fig. 3 is a side elevational view view thereof, with the vacuum cylinder shown in vertical cross section;

Fig. 4 is a vertical transverse sectional view taken through the carburetor on the plane indicated by the line 4—4 of Fig. 1;

Fig. 5 is a detail vertical transverse sectional view on the line 5—5 of Fig. 4;

Fig. 6 is a detail vertical sectional view taken through a modified form of carburetor;

Fig. 7 is a side elevational view of the carburetor disclosed in Fig. 6;

Fig. 8 is a detail vertical sectional view taken on the line 8—8 of Fig. 4.

Referring more particularly to the drawings, and to the form of my carburetor illustrated especially in Figs. 1 to 5, inclusive, the said carburetor comprises a casing which is designated in its entirety by the letter C. While the casing may be formed in different ways, in this instance the same has been shown as comprising a base section 10 and a superposed top section 11, the upper part of the base section 10 being flanged as at 12, which acts as a seat to receive a similar flange 13 formed on the bottom of the top section 11, the flanges 12 and 13 being preferably united by means of the removable fastening elements 14.

The top section 11 is provided with a main air-admitting open-ended passage 15. Located in this passage is an air flow-controlling or throttle valve 16, the same comprising advantageously a disk body 17 which is fixed to the center of a transversely extending mounting shaft 18, the latter being journaled for oscillation in bearing openings 19 formed in boss extensions 20 and 20a, which constitute a part of the top section 11.

One end of the shaft 18 projects beyond the extension 20 and has clamped thereto the hub 21 of a crank arm 22. Surrounding the hub extension 20 is a coil spring 23, one end 24 of which being secured to the casing of the top section 11, as shown in Fig. 4, while the other or free end of the spring is engaged with the outer end of the crank arm 22, the arrangement and mounting of the spring 23 being such that its normal tendency when unopposed is to maintain the disk-like body 17 of the throttle valve in a position obstructing to its maximum extent air flow through the passage 15. It will be understood that air may enter the top of the passage 15 directly from the atmosphere or after being passed through a conventional dirt and dust-removing filter, not shown.

Such a position of the body of the throttle valve may be maintained by providing the opposite end of the shaft 18 which extends beyond the boss 20a with a crank member 25 having oppositely extending arms which carry at their outer ends adjustable screws 26, the latter being spaced for contact with a stationary web 27 forming a part of the top section 11, the spacing of the ends of the screws 26 thereby controlling the extent of oscillation of the shaft 18.

Beyond the boss 20a of the top section 11, the shaft 18 has fastened thereto the split hub 28 of a crank 29. The outer end of the crank 29 is pivoted as at 30 to the upper end of a bracket 31 carried by a piston rod 32. This rod extends through an opening provided axially in a closure cap 33 positioned in the upper end of a vacuum cylinder 34, the latter being secured as at 35, (see Fig. 3) to a pivoting stud 36 formed with and projecting laterally from the flange 12 of the base section 10.

Within the cylinder 34, the lower end of the piston rod 32 carries a piston 37, the latter being movable in the cylinder in response to differential gaseous pressures exerted on the opposite sides of the piston, the pressure on the upper side of the piston being normally that of the atmosphere while the pressures below the piston are variable in accordance with vacuum conditions created through the operation of reciprocatory pistons of an associated internal combustion engine.

The bottom of the cylinder 34 is formed with an opening which communicates by means of a flexible pipe line 38 with a mixing chamber 39, the latter being formed in the base section 10 of the carburetor casing and constitutes a continuation of the air passage 15 of the top section 11. With the pistons of the associated engine in motion in their respective cylinders, atmospheric air is drawn into the carburetor through the passage 15 and, as will be presently described, is admixed with finely divided liquid fuel particles and drawn by the vacuum created in the chamber 39 into the engine cylinders.

When vacuum or negative pressures exist in the chamber 39, the condition is transmitted to the lower part of the cylinder 34 through the open pipe line 38, unbalancing the pressures on the opposite sides of the piston 37 so that the latter descends, rocking the shaft 18 in a direction to move the valve disk 17 toward open position, that is, a position in which the flow of air through the passage 15 is permitted up to a maximum degree. This opening movement of the throttle valve as effected by the vacuum cylinder is resisted by the action of the coil spring 23, with the result that the throttle valve reaches a position of balance or equilibrium, its exact position in the air passageway being dependent upon the R. P. M. of the associated engine. If the engine is turning over slowly, the throttle valve opens to but a limited extent, but as the operational speed of the engine is increased and the degree of partial vacuum in the cylinder 34 becomes greater, the throttle valve opens wider, but in any such operating position, it is more or less balanced by the opposing action of the coil spring.

In this manner, there is a proper delivery of a required amount of the fuel mixture to maintain desired operation of the associated engine under all load conditions imposed thereon during running thereof. The throttle valve responds to the speed of the engine and is not subject to capricious manual variations in position as obtains in the orthodox construction and operation of carburetors. The throttle valve is maintained automatically in its proper position of operation for securing a required flow of carburetted fuel to an associated engine and, as stated, the position of the throttle valve is governed by the speed of the engine and not directly by the automobile driver.

Adjacent to the boss extension 20 and the crank arm 22, the shaft 18 carries another crank member 40. To the outer end of this member there is pivoted as at 41 the upper end of a connecting link 42, the lower end of said link being pivoted as at 43 on the outer end of a crank arm 44 which is pivotally mounted as at 45 on an intermediate portion of a crank arm 46. The hub 47 of the arm 46 is mounted for free turning movement on an outer surface of a sleeve member 48, which is stationarily supported in a socket 49 formed in the flange 12 of the base section 10.

The sleeve member 48 has slidably mounted therein a short tube section 50, the latter being formed with laterally projecting pins 51, (see Fig. 5) which are slidably received in slots 52 provided longitudinally in the sleeve member 48. The other ends of the pins 51 engage with arcuate cam surfaces 53 provided on one side of the hub 47 of the crank arm 46, so that as the latter oscillates in response to movement imparted thereto by the crank member 40 and the link 42,

longitudinal sliding movement is imparted to the tube section 50.

This tube section receives the enlarged threaded end 54 of a needle valve 55, the end 54 being equipped with an adjustable stop nut 56, while the stem of the needle valve is formed intermediately of its length with a collar 57 with which engages one end of a coil spring 58, the other end of the last-named spring being engaged with an internal wall of the sleeve member 48. The tapering forward end of the needle valve is arranged normally in the planes of intersection of a supplemental air passageway 59 and a liquid fuel-admitting passageway 60, the latter being formed in a horizontally positioned tube 61 carried by the flange 12 and also in a transversely extending web member 62 disposed at the bottom of the main air passage 15 and clamped between the sections 10 and 11.

A fuel delivering pipe line 63, which leads from any suitable source of liquid fuel supply, not shown, is connected with one end of the tube 61 by means of the detachable coupling nut 64. The supplemental air passage 59 is formed in connection with the walls of the top section 11 and air delivered to the upper end of the carburetor is by-passed in part through the passage 59, traveling around the throttle valve 16 in a confined flow stream and delivered to a vertical passage 65 in the web member 62, the passage 65 intersecting at right angles the liquid fuel passage 60 and continues by way of a discharge nipple 66 into the mixing chamber of the base section 10.

Thus, as the throttle valve 16 oscillates in response to fluid displacement effected by the reciprocating pistons of an associated engine, not shown, the movement of the throttle valve is imparted through the linkage described to the fuel flow controlling valve which, in the particular embodiment of my invention under consideration, assumes the form of the needle valve 55. As the throttle valve opens to more freely admit of air flow from the atmosphere through the passage 15, corresponding movement is imparted to the fuel valve in which the latter is caused to move outwardly, to the right as it is viewed in Fig. 4, thus further opening the passage 60 to provide for a proportionately increased flow of the liquid fuel.

This flow is further affected by the restricted air stream which travels through the passages 59 and 65 so that a finely divided body of liquid fuel is discharged from the nipple or nozzle 66 into the mixing chamber 39 of the base section 10. In the mixing chamber, the liquid fuel particles in a discrete form are admixed with the main body of air drawn from the atmosphere and pass through the passage 15. It will be understood that the member 62 comprises merely a web or spider and does not interfere to any particular extent with the main travel of air through the carburetor.

As above explained, the operation of the throttle valve depends upon the speed of the engine associated with the carburetor and the operating positions of the throttle valve are virtually automatically obtained so as to assure at all times properly proportioned delivery of carburetted fuel to the engine cylinders in accordance with the load conditions operatively imposed on the engine. However, manual regulation is present in the provision of a manually controlled adjustable stop 67 which is slidably mounted in one or more guides shown at 68 and is adapted to be connected with an accelerator pedal or other similar manual control, not shown, of a motor vehicle.

The stop member, conveniently, is in the form of a rod which slides in the guide or guides 68 and is urged forwardly by a coil spring 69 so that the stud 70 on the forward end of the rod will be arranged in the path of movement of the outer or lower end of the crank arm 46.

It will be seen that by manually actuating the stop member or rod 67 by sliding the same against the resistance offered by the spring 69, the stud 70 may be removed from physical engagement with the outer end of the crank arm 46, as suggested by the spacing between these parts disclosed in Fig. 2 of the drawing.

As the engine increases in speed, the crank arm 46 swings toward the position of adjustment occupied by the stud 70 until it finally engages the stud, at which time further movement of the crank arm is prevented through such contact or engagement and the engine operated at the desired speed. If it should be desired that the speed be increased, the rod 67 is moved against the resistance of the spring 69 to again separate the stud 70 from the crank arm 46, allowing an additional increment of movement on the part of the crank arm 46 and the throttle valve 16. When retardation is desired, the vehicle operator releases the rod 67 either partially or fully so that the force of the spring 69 moves the crank arm 46 to desired positions to effect the necessary control of the throttle valve 16. In both acceleration and retardation of the engine, a uniformly carburetted mixture of liquid fuel and air is fed automatically to the cylinders of the engine in volumes proportionate to the speed of the engine and the working loads thereon. For instance, if the engine is laboring under a heavy load, as when a motor vehicle is ascending a steep hill or incline, the throttle valve remains automatically in but a partial open position in the passageway 15 and will remain in this position until the speed of the engine is increased as may be quickly accomplished by the vehicle operator in shifting to a lower gear ratio in the vehicle transmission.

In the conventional carburetor, the throttle valve moves to different positions through the operation of the accelerator pedal, which is manually performed. Thus when a motor vehicle is ascending a steep hill, the tendency for the operator is to push down on the accelerator and fully open the throttle valve, causing the formation of an overly rich fuel mixture and one improperly proportioned to obtain optimum operation under the conditions specified. In my improved carburetor, such a condition can not be obtained since the throttle valve is at all times under the control of the vacuum produced in the carburetor during the operation of the engine. The manual control provided by the stop 67 merely limits the opening movement of the throttle valve but it does not actually execute such opening movement, as that depends on engine operation.

While my improvements are particularly applicable to the improved carburetor of the type shown in Figs. 1 to 5, inclusive, of the drawings, nevertheless, the principles thereof are also applicable to the more orthodox type of carburetor illustrated in Figs. 6 and 7. In these latter figures, the carburetor comprises a chamber 71 containing a valve 72 actuated by a float 73 by which a predetermined level of liquid fuel may be main-

tained in the chamber 71, the liquid fuel entering said chamber from a suitable source of supply under a flow head necessary to fill the chamber 71 to a level permitted by the float valve mechanism. Liquid fuel is withdrawn from the bottom of the chamber 71 and enters a vertical nozzle 74, which is disposed within the Venturi chamber 75 of a carburetor 76. The bottom of the carburetor includes an air-admitting opening 77 providing for the flow of air from the atmosphere through the carburetor and over the outlet of the nozzle 74, creating an aspirating action by which the liquid fuel within the nozzle 74 is liberated and delivered in a finely divided form into the chamber 75, where it is admixed with air and passed on to the cylinders of the associated engine. The flow of the carburetted mixture is regulated however, by the throttle valve 78 which is mounted for turning movement on a transverse shaft 79 journaled in the casing walls of the carburetor.

The shaft 79 projects beyond the casing walls and the boss extensions 80 and 81 thereof. The end of the shaft 79 which projects beyond boss extension 80 carries a crank 82 which is engaged with one end 83 of a coil spring 84, said spring being wrapped around the extension 80 and has its other end fixed as at 85 to the carburetor casing, the normal tendency of the spring 84 being to rock the shaft 79 in a direction in which the throttle valve 78 will obstruct fuel mixture flow through the carburetor.

The opposite end of the shaft 79 projects beyond the extension 81 and carries a crank 86 which is pivotally connected at its outer end by means of a rod 87 with a sliding piston arranged in a vacuum cylinder 88, in a manner corresponding to that of the cylinder 34 and piston 37, previously described. The bottom of the cylinder 88 is joined by means of a pipe line 89 to the vacuum passage 90 of the carburetor which leads to the engine cylinders.

It will be observed that in this modified construction also, the throttle valve responds to the speed of the associated engine in regulating the volumetric flow of the fuel mixture to the engine cylinders. As the engine turns over, partial vacuum is produced in the passage 90 of the carburetor and this vacuum is transmitted through the pipe line 89 to the bottom of the cylinder 88, drawing the piston therein downwardly and moving the throttle valve 78 toward its open position against the resistance of the coil spring 84. At a certain stage in the operation of the engine, the effects of the partial vacuum within the cylinder 88 and the spring 84 will neutralize or balance each other, thereby holding the throttle valve in a definite operating position and this position of equilibrium may be reached even though the accelerator control as provided by the stop member 67 is so positioned that it is independent of or spaced from the throttle controls of the carburetor.

As the speed of the engine increases, the throttle valve opens since a greater degree of vacuum is present in the passage 90 and the action of the coil spring is overcome thereby. The throttle valve may continue such opening until its movement is stopped by the throttle control indicated by the members 67 and 70 or stopped by the equilibrium obtained in the forces exerted on the throttle valve by the opposing actions of vacuum and spring force.

In both acceleration and retardation, the same uniformity and control obtains so that the associated engine is not choked at any stage in its operation with either too rich a fuel mixture or a too lean one and, moreover, the uniform fuel mixture is supplied at all times to the engine cylinders in quantities automatically metered to obtain optimum engine operation under the working conditions imposed thereon.

I claim:

1. A carburetor for combustion engines, comprising a casing formed with an internal conduit having a mixing chamber, said conduit communicating at one of its ends with the atmosphere and its other end with the cylinders of an associated engine, an air-flow control valve mounted in said conduit for rocking movement adjacent to the end thereof communicating with the atmosphere, a stationary cross member extending transversely of said conduit intermediately of its length, said member being formed with a longitudinally extending passage communicating at its outer end with a source of liquid fuel supply, said passage at its inner end being in communication with an air opening extending axially of said conduit and directly through said cross member from one side to the other, an air-conducting tube leading from said opening to the air inlet side of said conduit beyond said air-flow control valve, a fuel-metering valve arranged for longitudinal movement in said member in controlling the flow of fuel from said passage into said opening and thence into said mixing chamber, motion-transmitting means linking together said air-flow control valve and said fuel-metering valve for movement in unison in all their operating positions, spring means coacting with said valves to apply forces thereto which when unopposed causes said valves to assume positions substantially obstructing the flow of air through said casing and the introduction of motor fuel into said chamber, a cylinder and piston means responsive constantly to intake manifold pressures throughout all stages of engine operation for moving said valves in opposition to the forces exercised thereon by said spring means, whereby to cause said valves to assume operating positions providing for air and fuel flow into said chamber in amounts directly proportionate to said manifold pressures, a manually operated stop member cooperative with said motion-transmitting means for variably limiting opening movement of said valves in their response to the actuation of said cylinder and piston means, and spring means operating on said stop member to move the same in a direction opposed to that effected by its manual operation in obtaining an automatic return of said valves to their flow-obstructing positions.

2. In a carburetor, a casing provided internally with a passageway communicating on one side with the atmosphere and on its other with the cylinders of an associated engine, a movable air-flow controlling throttle valve positioned in said passageway, valve means for introducing regulated quantities of a vaporizable hydrocarbon fuel into said passageway for carburetting admixture with air traveling therethrough, means interconnecting said valves, spring means coacting with said throttle valve to apply constantly effective forces thereto throughout the full range of operation of an associated engine which when unopposed move the valves into positions substantially obstructing air and fuel flow therethrough, means responsive constantly to engine intake manifold pressures in all stages of engine operation for moving said air and fuel-controlling valves in opposition to forces exercised thereon by said spring means, whereby to cause

said valve to assume operating positions admitting of air and fuel flow into said passageway in quantities proportionate to said manifold pressures, a manually operable stop member coacting with said throttle valve limiting variably the opening response of the valve to said manifold pressures, and spring means cooperative with said stop member to cause movement of the latter upon cessation of manual forces thereto in producing operation of said valves to effect their closure to fluid flow.

3. In a carburetor for internal combustion engines, a casing formed with an internal passageway, a throttle valve positioned in said passageway for movement therein between positions substantially obstructing and unobstructing air flow therethrough, means responsive to intake manifold pressures developed by the operation of an associated engine in producing partial vacuum conditions in said passageway for moving said valve automatically between its positions obstructing and unobstructing the passageway to air flow, said last-named means embodying a movable vacuum-displacement member, motion-transmitting means uniting said member with said throttle valve to effect movement of the latter in proportion to the degree of movement of the vacuum displacement member, spring means opposing the action of said vacuum displacement member on said valve, means for introducing a vaporizable liquid fuel into said passageway, including a movable fuel-metering valve, means linking said throttle and fuel-metering valves for movement in unison, and a manually controlled stop device regulating the extent of movement of said valves in response to operating forces produced thereon by said manifold pressure means.

4. In a carburetor for internal combustion engines, a casing formed with an internal longitudinally extending open-ended induction conduit, an air flow control valve positioned in said conduit, an operating shaft for the valve mounted for rocking movement in opposite walls of the casing, the ends of the shaft projecting beyond said walls, a stationary cross member extending from one side to the other and disposed transversely of said conduit intermediately of its length, said member being formed with a passage communicating at one end with a source of liquid fuel supply and at its other end with the interior of said conduit, a fuel-metering valve movably positioned in said cross member for controlling the flow of fuel through said passage, said fuel-metering valve at one end thereof extending exteriorly of said casing, crank arms carried by adjoining exterior ends of the rock shaft and said fuel-metering valve, means responsive to engine manifold pressures communicating with said conduit between said cross member and the engine-communicating end of said conduit, said manifold pressure-responsive means including a movable element, means linking said element with the rock shaft of said air flow control valve, means linking the crank arm of said air flow control valve and said fuel metering valve together for substantially synchronous

movement, spring means cooperative with said valves and tending to maintain the same in positions obstructing air flow through said conduit and fuel flow through said cross member passage and into said conduit, and an adjustable manually actuated stop member coacting with the outer end of the crank arm of said fuel-metering valve, said stop member serving to limit variably movement of said valves in their response to the actuation produced by said manifold pressure means.

5. A carburetor as defined in claim 4, comprising a coil spring cooperative with said stop member and placed under compression when said member is manually actuated to open said valves, and to expand and move said member to an extent closing said valves when said member is manually released.

6. A carburetor comprising a casing formed with an internal chamber having an air inlet and a carburetted fuel outlet, a rock shaft journaled in the walls of said casing, a movable air-flow-controlling valve mounted in said chamber on said shaft adjacent the air inlet, a liquid fuel supplying means entering said chamber between said valve and said outlet, a metering valve controlling the flow of fuel through said supply means to said chamber, an oscillatory crank arm mounted on one end of said rock shaft, an oscillatory crank arm for actuating said flow-metering valve, means directly linking the outer end of said crank arms to effect substantially synchronous movement of said valves, automatic means including a cylinder and piston assembly responsive to predetermined engine manifold pressures developed in said chamber for moving said valves substantially from positions of closure to fully open positions, a stop member manually operated and engageable with said valves to arrest variably their opening response to the automatic operation of said manifold pressure means, and spring means cooperative with said valves for counteracting the operation thereon of said cylinder and piston assembly in moving the valves toward their positions of closure when said stop member is released.

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