Oct. 4, 1938. C. R. ROBIDOUX 2,131,848

CARBURETOR

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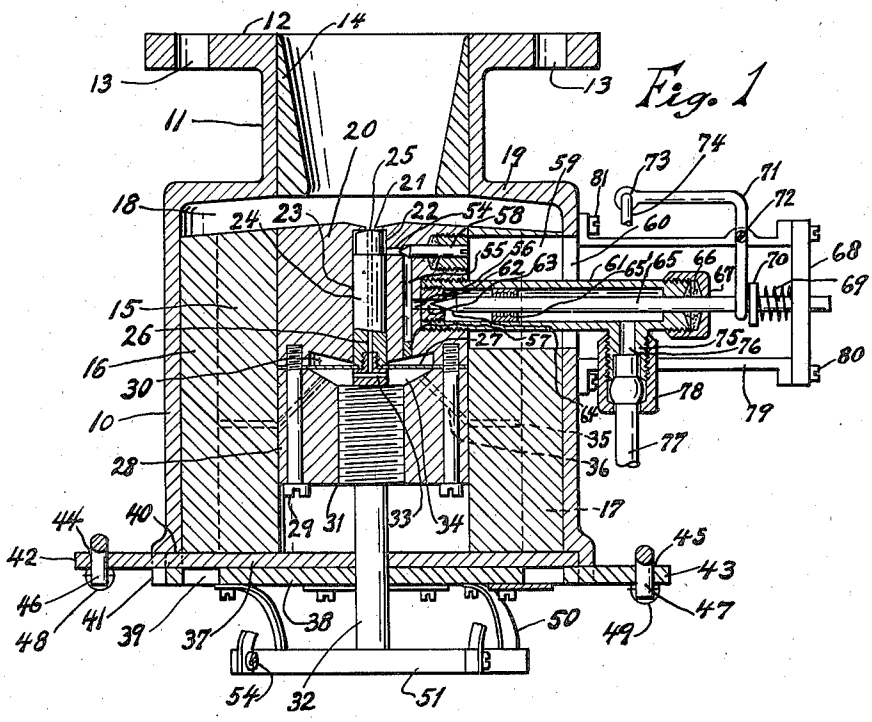


Fig. 1

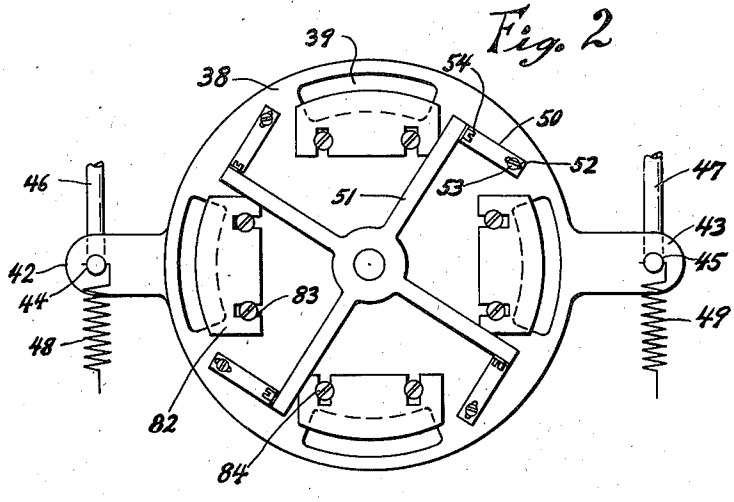


Fig. 2

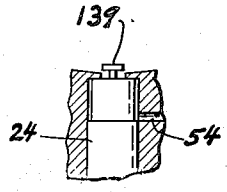


Fig. 9

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CARBURETOR

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Fig. 3

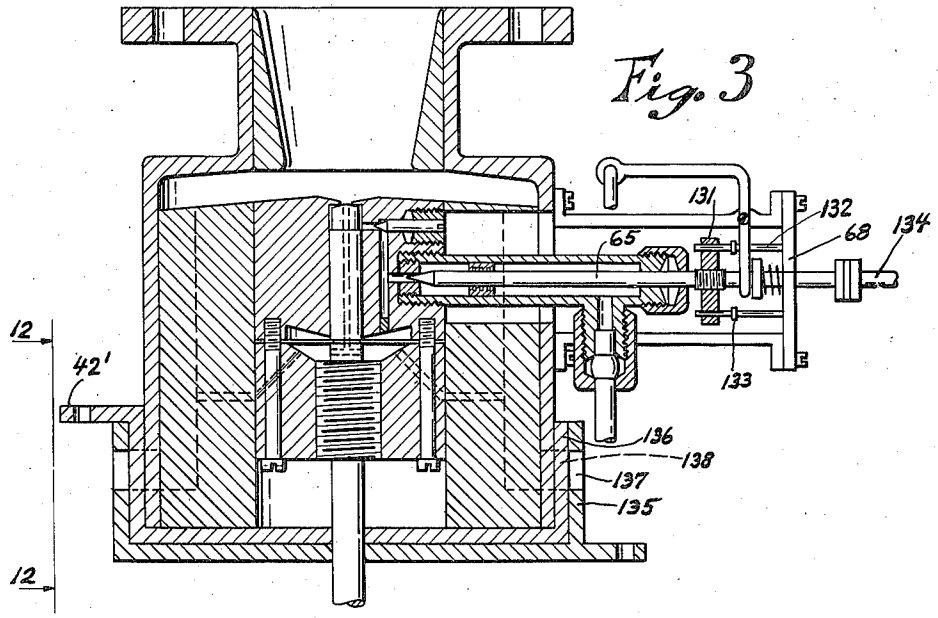
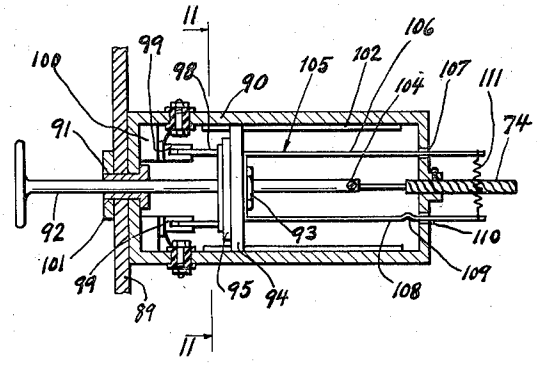


Fig. 10



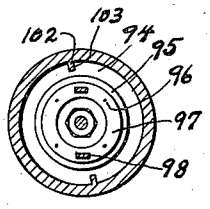
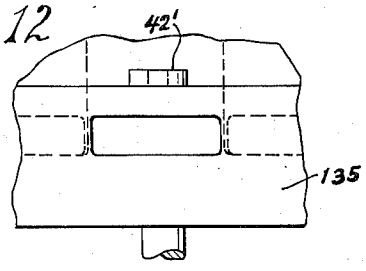


Fig. 11

Fig. 12



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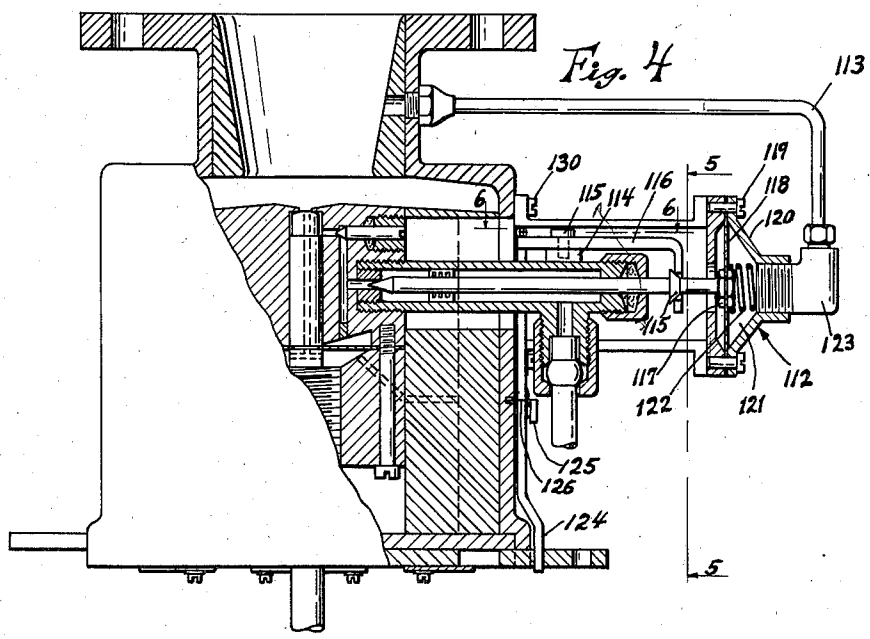
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CARBURETOR

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Fig. 4



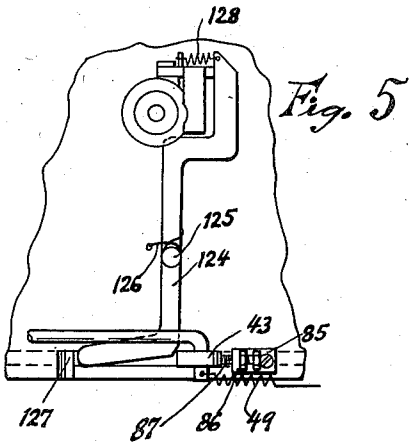


Fig. 5

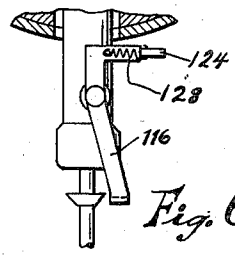


Fig. 6

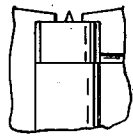


Fig. 7

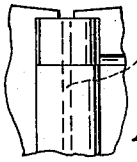


Fig. 8

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Patented Oct. 4, 1938

2,131,848

UNITED STATES PATENT OFFICE

2,131,848

CARBURETOR

Conrad R. Robidoux, West Hartford, Conn.

Application June 16, 1936, Serial No. 85,560

5 Claims. (Cl. 123—119)

This invention relates to improvements in carburetors of the type described and illustrated in my United States Patent No. 2,035,570 granted March 31, 1936 and is particularly concerned with such improvements as will increase the efficiency of operation and facility of control and adjustment of these carburetors.

Carburetors of the type referred to above and disclosed in my patent are deficient in several ways. Where a carburetor of this character is employed of necessity means must be provided without relying upon the conventional float valve whereby the fuel passing through the carburetor is positively shut off when the engine ceases to operate.

Additionally, when carburetors of this character are made as universal carburetors, adapted to be used on manifolds whose throats vary in cross-sectional area, compensating means must be provided whereby the maximum volume of air admitted to the carburetor can be controlled.

Further when metering pins or control valves of this character are used they of necessity must be sealed by a diaphragm to permit their free movement to open and close the discharge orifice. The free movement of the metering pin therefore necessitates sufficient clearance between the metering pin and its confining walls which obviously would permit the gas to flow downwardly around the pin and accumulate to some extent in the diaphragm chamber. Therefore, when carburetors of this character are used on aeroplanes and they are flown in inverted flight, means must be provided for preventing fuel thus accumulated in the diaphragm chamber from flowing down the stem of the metering pin and flooding the discharge orifice.

Auxiliary shut-off valves of the type referred to above for positively closing the passageway through which the fuel flows in the carburetor of necessity must be operated from a remote position when manually actuated, and to reduce the number of operations necessary in starting or stopping an engine, can be combined with the ignition circuit control means. When the auxiliary shut-off valve is made automatic in its operation it can be connected to the intake manifold or throat of the carburetor in such a manner that the valve will be held in open position throughout the period when the motor is operating.

Carburetors of this character when used with aeroplanes when flying at abnormally high altitudes operate inefficiently if no compensation is made for the change in air density, therefore as a result means must be provided whereby the operator can from his instrument board vary at will the maximum amount of fuel allowed to pass through the passageways within the carburetor.

Furthermore to insure proper atomization of the fuel so that it will be readily entrained in the combustion supporting air stream, various shapes of orifices as well as valve heads or metering pin heads have been used but have not proven entirely successful and have resulted in unequal distribution of fuel from the supply orifice which causes an improper mixture in the mixing chamber.

To facilitate the adjustment of the metering pin relative to the movement of the throttle plate means must be provided which are accessible and which may be practically as well as economically assembled and adjusted.

Therefore, an object of this invention is the provision of auxiliary means whereby the fuel supplied to the metering pin or control valve may be positively shut off when the engine is no longer operating.

Additionally this invention has for an object the provision of means whereby the auxiliary means may be actuated without the necessity of employing a float.

This invention further contemplates actuating means for the auxiliary means which are common with the ignition circuit control means and may be actuated simultaneously therewith.

Another object of this invention is the provision of automatic means dependent upon the operation of the engine for shutting off the fuel passing through the passageways leading to the metering pin or control valve within the carburetor.

Still another object of this invention is the provision of means whereby the amount of fuel passing through the carburetor can be varied from a remote point to compensate for changes in the density of the volume of combustion supporting air.

This invention further contemplates means whereby the fuel accumulating in the diaphragm chamber will be prevented from flowing down around the metering pin to the discharge orifice when the carburetor is used on an aeroplane in inverted flight.

Another object of this invention is the provision of a carburetor and means associated therewith whereby the carburetor is made universal and can be used on manifolds of varying cross-sectional areas.

Still another object of this invention is the pro-

vision of additional means whereby the adjusting means associated with the mechanical linkage between the metering pin and the throttle plate is made accessible for purpose of adjustment without dismantling the carburetor.

Another object of this invention is to provide a metering pin or control valve having an axial passageway through it whereby the air drawn into the mixing chamber through the passageway will tend to keep the metering pin cool as well as aid in atomizing the fuel being discharged into the mixing chamber.

Other objects and advantages will appear from the following detailed description when considered in connection with the accompanying drawings, in which:

Fig. 1 is a vertical section of my improved carburetor showing the mechanically controlled auxiliary valve in detail;

Fig. 2 is a bottom view of the carburetor shown in Fig. 1, showing in detail the adjustable means for limiting the maximum volume of air in accordance with different size carburetor throats;

Fig. 3 is a fragmentary vertical section of a carburetor showing the auxiliary valve control means and the means whereby compensations in fuel supplied can be made in accordance with changes in air density encountered at high altitudes;

Fig. 4 is a vertical sectional view of my improved carbureter showing in detail a modified form of control for the auxiliary valve which renders the valve automatic in its operation;

Fig. 5 is a fragmentary vertical sectional view of the carburetor and control means taken along the line 5—5 of Fig. 4;

Fig. 6 is a top sectional view of the control means taken along the line 6—6 of Fig. 4;

Figs. 7, 8 and 9 are detail vertical sectional views of modified forms of metering pins or control valves;

Fig. 10 is a vertical sectional view of my improved ignition circuit control and auxiliary valve actuating means;

Fig. 11 is a cross-sectional view of the device shown in Fig. 10 taken along the line 11—11 of Fig. 10; and

Fig. 12 is a fragmentary elevational view of the bottom of the carburetor shown in Fig. 3 showing the openings in the upturned flanges on the throttle and choke plates.

Referring to the drawings in detail and particularly Fig. 1, 10 refers to the substantially cylindrical casing of the carburetor. Casing 10 is brought inwardly at the top thereof to form a neck portion 11 which extends upwardly and terminates with the integral flange 12 that is adapted to be connected to the intake manifold of an internal combustion engine, not shown, by means of suitable bolts passing through openings 13 which register with corresponding openings in the intake manifold.

Neck 11 of the casing has fixed therein by sweating or other known methods a bushing 14 which is so shaped that the passageway through the bushing is in the form of a Venturi passage.

Disposed within the body portion of casing 10 is a core 15 formed of aluminum, bronze, brass, iron, steel, or other suitable metals and has integrally formed therewith a plurality of radial vanes 16 adapted to fit snugly against the inner surface of the casing 10. These vanes 16 cooperate with the core 15 and the casing 10 to define a plurality of air passageways 17 through which air is conducted to a mixing chamber 18.

Mixing chamber 18 is defined by the top of core 15, which is spaced from the inwardly directed portion 19 of the casing 10, and the casing 10.

Core 15 is provided with an axial bore adapted to have sweated therein a plug 20. Plug 20 is preferably formed of bronze but other tough metals suitable for bearings may be satisfactorily used.

A knife-edge valve set 21 is formed in the top of plug 20 by machining a substantially conical cavity 22 in the center of the top of the plug and then axially boring from the opposite end of the plug until the drill has reached the cavity 22. The bore 23 thus formed serves as a metering pin or control valve chamber.

Disposed within bore 23 is a metering pin 24 which cooperates with the knife-edge valve seat 21 to control the fuel discharged therethrough. The head 25 of the metering pin may be given the shape disclosed in Figs. 1 and 4 or may assume any one of the shapes shown by Figs. 7, 8 and 9.

In order to distribute the fuel evenly around the metering pin so that it will be uniformly atomized at all speeds, the upper end of the body portion of the pin is machined to a reduced diameter. With the pin thus shaped, an annular fuel chamber is formed around the pin at this point.

Metering pin 24 is provided with an axial or longitudinal passageway 26 through which air is drawn to both keep the pin cool and to aid in the atomization of the fuel being discharged into the mixing chamber 18.

Metering pin 24 is secured at its bottom end to a spring diaphragm 27 that is secured in operative position between plug 20 and a second plug 28, with suitable gaskets, by means of bolts 29.

The bottom of plug 20 is machined, as shown in Figs. 1 and 4, to form a recess or chamber 30 above the diaphragm 27. This recess is so formed that fuel that accumulates on the diaphragm will not flow down around the metering pin when the carburetor is used on an aeroplane in inverted flight, but will be held in the top part of the recess 30.

Plug 28 is provided with an axial internally threaded opening 31 adapted to receive an operating pin 32 that is provided with an enlarged threaded portion which is adapted to cooperate with the internal threads in plug 28. Spring diaphragm 27 tends to hold the metering pin in its extreme lowermost position. The top of the operating pin 32 contacts the bottom end of the metering pin 24 and when rotated will be advanced by the threads to close the valve or when rotated in the opposite direction will allow the spring diaphragm to open the valve. The amount of movement of the metering pin for a given number of degrees of rotation of the operating pin can be varied by changing the pitch of the threads used.

That portion of the metering pin 24 which extends through the spring diaphragm 27 is provided with a transverse passageway 33 which will conduct the air from the chamber 34 below the diaphragm 27 into the longitudinal passageway 26 in the metering pin.

Plug 28 is provided with drilled passageways 35 which register at their outer ends with passageways 36 drilled substantially horizontally through the core 15 into the air passageways 17.

The bottom end of the metering pin extends downwardly through openings in choke and throttle plates or valves 37 and 38, respectively,

which fit snugly together and against the bottom of core 15. These plates are provided with openings 39 that are adapted to register in any degree desired with the air passageways 17 in core 15. To provide a bearing for the peripheries of these plates, the bottom edge of casing 10 has a shoulder 40 and a downwardly extending flange 41 machined thereon. The choke and throttle plates are provided with operating handles or ears 42 and 43, respectively. These ears extend substantially horizontally from the plates through openings in the downwardly extending flange 41. These ears 42 and 43 are provided with openings 44 and 45, respectively, adapted to receive operating elements 46 and 47. The choke and throttle plates are biased toward their normal off position by springs 48 and 49, respectively.

Throttle plate 38 is connected to the operating pin 32 by means of leaf springs 50 and a spider 51. Leaf springs 50 being provided at one end with elongated openings 52 adapted to receive screws 53, are adjustably secured to the bottom face of the throttle plate. The other end of these springs are secured by screws 54' to the outer end of the legs of the spider 51. Spider 51 is secured to and adapted to operate the operating pin 32. By using springs 50 to connect the throttle plate 38 to the operating pin, pressure is continuously applied to the plates tending to hold them up tight against the core 15 and shoulder 40 of casing 10.

Plug 20 has formed therein by boring or any other suitable method communicating passageways 54, 55 and 56. If these passageways are made by drilling, then of necessity the bottom end of passageway 56 must be plugged as shown in Fig. 1 at 57.

Disposed at the point in the passageway thus formed where passageway 54 and passageway 55 join, is a valve 58 of the type described in my United States Patent No. 2,035,570 adapted to be set to limit the maximum amount of fuel which may be fed through the passageway.

Core 15 and casing 10 are provided with openings 59 and 60, respectively, by means of which valve 58 is made accessible and a passageway through which an auxiliary valve casing 61 can be passed for engagement with a tapped opening in the plug 20. The opening in plug 20 is positioned in such a manner that the passageway 56 will communicate with the inside of the auxiliary valve casing 61.

Valve casing 61 is substantially cylindrical in form and has threaded or pressed into the inner end thereof a plug 62. Plug 62 has a hole 63 bored axially through it which serves as both a valve seat for a valve head 64 and a communicating passageway between the inside of casing 61 and the passageway 56.

Valve head 64 is carried by a long valve stem 65 which extends through a guide bushing 65', in which passageways are formed then outwardly through the valve casing 64 through packing 66, packing nut 67, to and through a guide and bearing plate 68. The valve stem 65 is biased inwardly by a coil spring 69 which is threaded over the valve stem and bears at one end against the guide and bearing plate 68 and at the other end against a collar 70 fixed on the valve stem.

The valve stem 65 is moved outwardly against the action of the coil spring 69 to open the valve by a bell crank 71. Bell crank 71 is pivoted at 72 and has formed integrally with that end which contacts collar 70, a fork which straddles the valve stem 65. The other end of the bell crank is provided with an opening 73 adapted to receive an operating element 74.

Fuel enters the interior of valve casing 61 through a projecting portion 75 of the valve casing 61. This projection 75 has formed therein a passageway 76 which establishes communication between the interior of valve casing 61 and the fuel supply pipe or conduit 77. Fuel conduit 77 is screwed to the projection 75 by a conventional conduit coupling element 78.

Bearing and guide plate 68 is mounted on legs 79 by screws 80. Legs 79 are rigidly secured to the casing 10 by screws 81.

With the construction as described above, fuel flows from a supply source, not shown, into the valve casing 61 through conduit 77, passageways 56, 55 and 54 and is atomized around the head of the metering pin 25 into the mixing chamber 18 where it is entrained by the air and passes on into the cylinders of the engine for combustion.

To make this carburetor universal, i. e., operate efficiently on engine manifolds having throats of different cross-sectional area, means are provided for limiting the maximum volume of air which can be drawn in through the openings 39 of the throttle plate 38.

Plates 82 are provided with elongated openings 83 through which screws 84 are passed to secure them in adjusted position to the bottom of the throttle plate 38.

To prevent the fuel from being completely shut off by the metering pin 24 when the throttle plate 38 is moved toward its off position by the spring 49, an adjustable stop is mounted on the flange 41 of the casing 10. This stop comprises a metal strap 85 bent at a 90° angle in such a manner that when one end is welded or secured to the flange 41, the other end will project outwardly at an angle of 90°. This end of the strap is provided with a tapped opening 86. Bolt 87 is threaded through the opening 86. This bolt serves as a stop against which the ear 43 will strike. After the bolt has been adjusted for the idling speed of the engine, it may be locked in this position by a jam nut 88.

With the mechanism described above, the auxiliary valve is manually actuated to open or close the passageway through the carburetor. To reduce the operations necessary in starting the engine the operating element 74 is connected with the ignition circuit switch so that when the valve is opened, the ignition will be turned on and when it is closed the same movement will turn off the ignition. A device by which this can be accomplished is illustrated in detail in Figs. 10 and 11 in which 89 is the dash or instrument panel in which the device is mounted.

A substantially cylindrical casing 90 is provided at one end with a mounting bushing 91 which serves as a guide for the operating handle 92. The operating handle has threaded over it and secured to it by nuts 93 a guide washer 94, a fiber insulating washer 95 and a second fiber insulating washer 96 on the face of which is secured a metal ring 97. Metal ring 97 has mounted in electrical contact therewith switch blades 98. These blades on movement of the operating handle 92 are adapted to cooperate with the female contacts 99 to establish an electric circuit. The female contacts 99 are mounted on a fiber insulating washer 100 which is secured in operative position by the bushing nut 101. To prevent the operating handle 93 from turning, guide ribs 102 are provided on the inner surface

of the cylindrical casing 90. These ribs are adapted to slide in peripheral openings 103 in the guide washer 94.

The operating handle 92 at its inner end, by a set screw 104, is secured to the wire of a conventional wire and tube actuating element 74. The other end of the actuating element being secured to the bell crank 71 which actuates the auxiliary valve.

In order to prevent the auxiliary valve from closing after having been opened to its maximum opening, a substantially U-shaped locking element 105 is secured by the nut 93 to the operating handle. Arm 106 of the U-shaped member is straight and adapted to slide freely in an opening 107 in the end of the casing 90. The other arm 108 of the U-shaped member is offset at 109 to form a locking element which will cooperate with an opening 110 to lock the operating handle 92 in its out position. To insure locking, the arm 108 is biased toward the other arm 106 by a spring 111.

A modification of this invention is shown in Fig. 4. In this instance the auxiliary valve is made automatic in its operation. This is accomplished by making its actuation dependent upon a servomotor 112 that is connected into the throat of the carburetor by means of conduit 113.

As shown in Fig. 4, valve casing is very similar to the structure disclosed in Fig. 1 with the exception of a lug 114 formed on the upper side of the casing that is adapted to receive a pivot screw 115'. The valve head of the auxiliary valve and its valve seat are identical to those described in connection with the structure disclosed in Fig. 1 but the valve stem 65 differs in that it has formed on it a cam 115 adapted to cooperate with a pivoted locking lever 116. Locking lever 116 is secured by and pivots about screw 115'. The outer end of valve stem 65 is connected by suitable nuts 117 to a diaphragm 118. Diaphragm 118 is secured in operative position by screws 119 and forms with the casting 120, a chamber 121. Disposed within the chamber 121 is a coil spring 122, one end of which is adapted to bear against the outer end of valve stem 65 or the diaphragm 118, while the other end rests against the end of elbow 123. Elbow 123 having a passageway formed therein establishes communication between the conduit 113 which communicates with the throat of the carburetor, and the chamber 121. While the engine is running at idling speed a substantial vacuum is developed in chamber 121 and, as a result thereof, diaphragm 118 tends to move outwardly carrying with it valve stem 65 of the auxiliary valve which results in the opening of the passageway leading from the chamber within the valve casing 61. Movement of valve stem 65 outwardly carries the cam 115 a distance great enough that the end of the locking lever 116, which is spring-biased toward the valve stem 65, will drop in behind cam 115 and hold the valve open until the locking lever is dislodged.

Referring to Fig. 5, the operating handle of the throttle plate 43 when actuated to open the throttle causes the foot of a second operating lever 124 to be moved with it. Lever 124 is pivoted about a screw 125 mounted on the side of carburetor casing 10, and is held in contact with the operating handle 43 by a conventional coil spring 126 having one end connected to the casing and the other to the operating lever 124. Throttle plate 38 has formed on the periphery thereof a lug 127 adapted to bear against the toe of the foot portion of lever 124 to cause the lever to be moved in the opposite direction when the throttle plate is moved to its off position, that is, against an adjustable stop member 87. As shown in this figure, the throttle plate is biased to its closed position by coil spring 49.

The upper end of operating lever 124 is connected by a coil spring 128 to the locking lever 116. With such an arrangement it is evident that an opening of the throttle will place tension upon the coil spring 128 and bias the locking lever toward the valve stem 65 of the auxiliary valve, and the locking lever, as a consequence, will on development of sufficient vacuum in chamber 121 to cause the stem to move outwardly, drop in behind the cam 115.

As shown in Fig. 6, locking lever 116 is provided at its inner end with a lateral extension which is adapted to bear against the upper end of operating lever 124. When lever 124 is pivoted by the throttle plate being moved to its closed position, the upper end of this lever will contact the lateral extension on the inner end of locking lever 116 and pivot it about the screw 116 to dislodge the locking element from behind the cam 115 and allow the auxiliary valve to close.

The servomotor assembly 112 is mounted on the side of the carburetor through the medium of legs 129 and screws 130.

A modification of the auxiliary valve actuating means as disclosed in Fig. 1 is shown in Fig. 3. In this embodiment of the invention means are provided whereby compensation can be made from a remote point for changes in density of the combustion supporting air, that is, by limiting the maximum amount of fuel that is permitted to pass through the carburetor. This is accomplished by threading a collar 131 on the valve stem 65 of the auxiliary valve. Collar 131 is mounted and adapted to slide freely on guide members 132. These guide members carry stops 133 which may be in the form of collars threaded over and locked on the guides at a predetermined point by means of suitable set screws. The outer ends of the guides are secured to the guide and bearing plate 68. Connected to the outer end of valve stem 65 by means of a suitable flexible coupling is an operating element 134 that is adapted to extend to the instrument panel or dash of an automobile or aeroplane, by means of which rotation of the valve stem 65 is effected by the operator at will. Rotation of valve 65 causes a movement of collar 131 relative to the valve stem. In this manner, the collar can be positioned on the valve stem at any point desired to obtain a predetermined opening of the auxiliary valve. This structure in no way interferes with the actuation of the auxiliary valve as described in connection with Fig. 1.

In Fig. 3 there is disclosed still another modification of this invention. In this instance the throttle and choke plates are provided with upwardly extending flanges 135 and 136, respectively. These flanges are provided with openings 137 and 138, respectively, which communicate with similar openings formed in the casing 10, that in turn communicate with the air passageways 17 within the body of the carburetor. With this design of throttle and choke plates, the flat or body portion of the plate proper is left blank. Extending from the upper edge of the flange on the choke plate is an operating handle or ear 42', which is connected and operated in the same manner as that described in connection with Fig. 1.

In Figs. 7, 8 and 9 are shown modified forms of metering pins which have proven successful in this type of carburetor. The metering pin, as disclosed in Fig. 7, is solid, that is, it has no central passageway but is provided at the valve end with a substantially conical tip which aids in the atomization and equalization of the fuel passing into the chamber. The metering pin disclosed in Fig. 8 is provided with a central passageway 26' and is provided at the valve end with a square head which cooperates with the knife edge seat to control the admission of fuel to the mixing chamber.

In Fig. 9 the metering pin is made solid but the body portion in the proximity of the head is sloped inwardly to taper the head, enough metal being left to bear against the knife edge seat to control the admission of fuel to the mixing chamber. Secured to the end of the metering pin head is a deflector 139 adapted to distribute the atomized fuel in the mixing chamber uniformly.

Although the above described is directed solely toward the construction illustrated by the drawings, I desire it understood that I reserve the privilege of resorting to all mechanical changes to which the device is susceptible, the invention being designed and limited only by the terms of the appended claims.

Having thus described my invention, I claim:

1. In combination with an air and fuel mixing device for an internal combustion engine, means for controlling the supply of combustion supporting air, means operatively connected to said means for controlling the fuel discharged from said device, said last mentioned means comprising a metering pin that cooperates with a knife edge seat to form an atomizing nozzle, said metering pin having a longitudinal passageway axially disposed therein whereby a portion of the combustion supporting air will be drawn into the carburetor through said longitudinal passageway and will effect a cooling of the atomizing nozzle.

2. In combination with an air and fuel mixing device for internal combustion engines, means for controlling the supply of combustion supporting air, means operatively connected with said means for controlling the fuel discharged from said device, auxiliary control means disposed in the fuel passageway within the carburetor adapted to be positively and manually controlled from a remote point, manually operable means for said auxiliary control means comprising in combination an operating handle operatively connected with said auxiliary control means, a pair of male contact elements carried by said operating handle and a pair of stationary female contact elements adapted to receive in contacting relationship the male contacts carried by the operating handle to effect a closing or opening of the ignition circuit when the auxiliary control means is reciprocated.

3. In combination with an air and fuel mixing device for internal combustion engines, a metering pin, means for controlling the supply of combustion supporting air, means operatively connected to said means for controlling the fuel discharged from said device, said last mentioned means being adapted to effect a movement of the metering pin, a spring diaphragm secured to said metering pin, said spring diaphragm defining with the core of said air and fuel mixing device, an annular chamber that has its maximum depth near the periphery thereof whereby fuel flowing downwardly around the metering pin will be retained in said chamber when the carburetor is used on an aeroplane in inverted flight.

4. In combination with an air and fuel mixing device for an internal combustion engine, means for controlling the supply of combustion supporting air, means operatively connected to said means for controlling the fuel discharged from said device, said last mentioned means comprising a metering pin that cooperates with a knife edge seat to form an atomizing nozzle, said metering pin having a longitudinal passageway axially disposed therein, a core in said air and fuel mixing device having a plurality of passageways therein adapted to establish communication between atmospheric air and the passageway in said metering pin whereby a portion of the combustion supporting air will be drawn in to the carburetor through the passageway in said metering pin.

5. In combination with an air and fuel mixing device for internal combustion engines, means for controlling the fuel discharge from said device, choke and throttle plates adapted to limit the volume of air drawn into said carburetor, means operatively connecting said fuel discharge control means and said throttle plate comprising a spider fixed to said fuel discharge control means and adapted to rotate therewith, a plurality of leaf springs fixed to said spider and plate whereby the control and choke plates are retained in a snugly fitting relationship with the bottom of said carburetor.

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