May 22, 1934. H. H. HUBER 1,960,109

CARBURETOR

Filed March 25, 1932 3 Sheets-Sheet 1

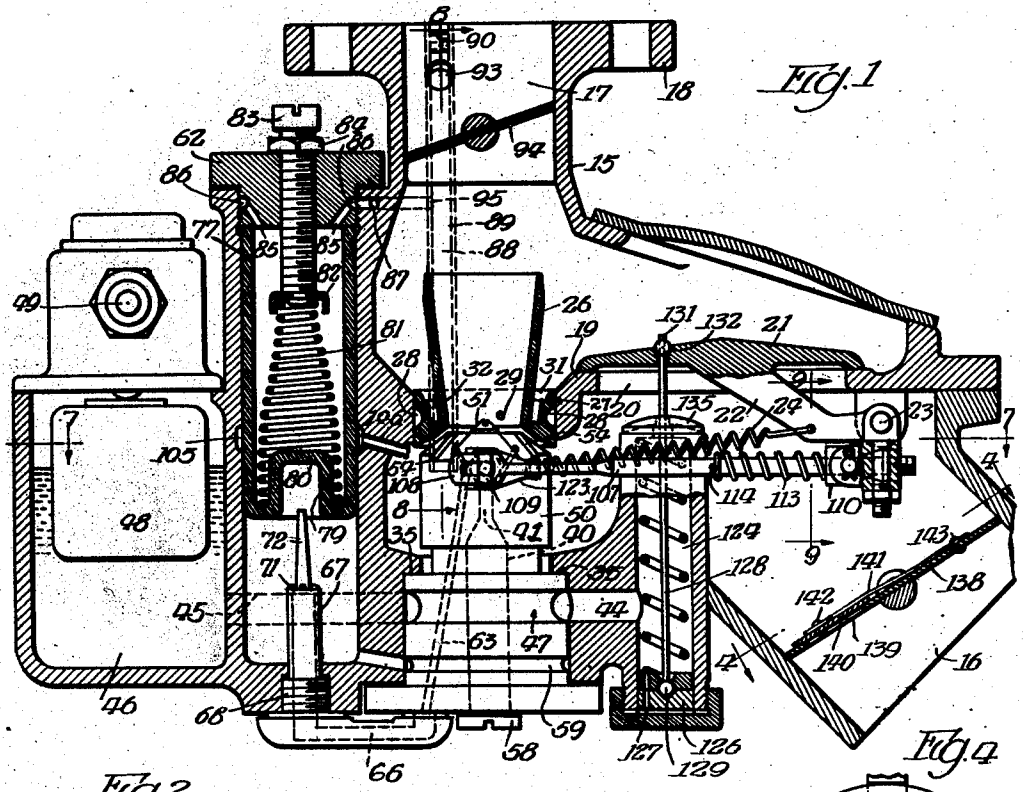

Fig. 1

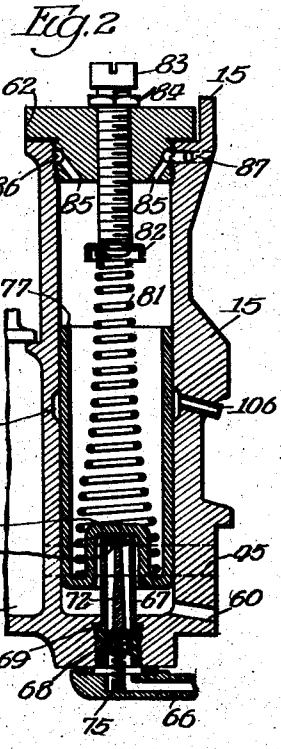

Fig. 2

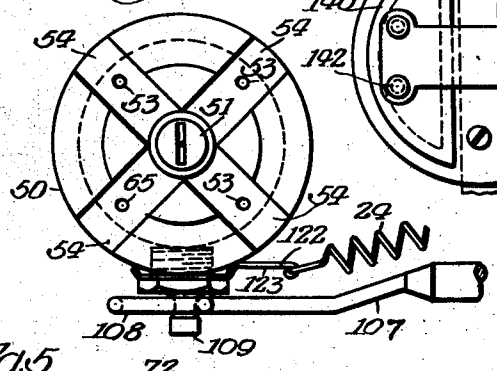

Fig. 3

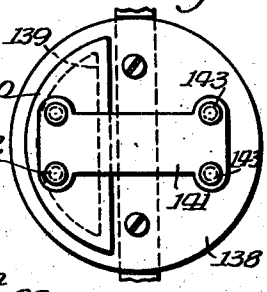

Fig. 4

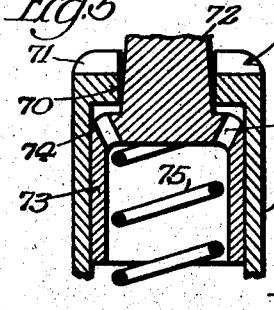

Fig. 5

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CARBURETOR

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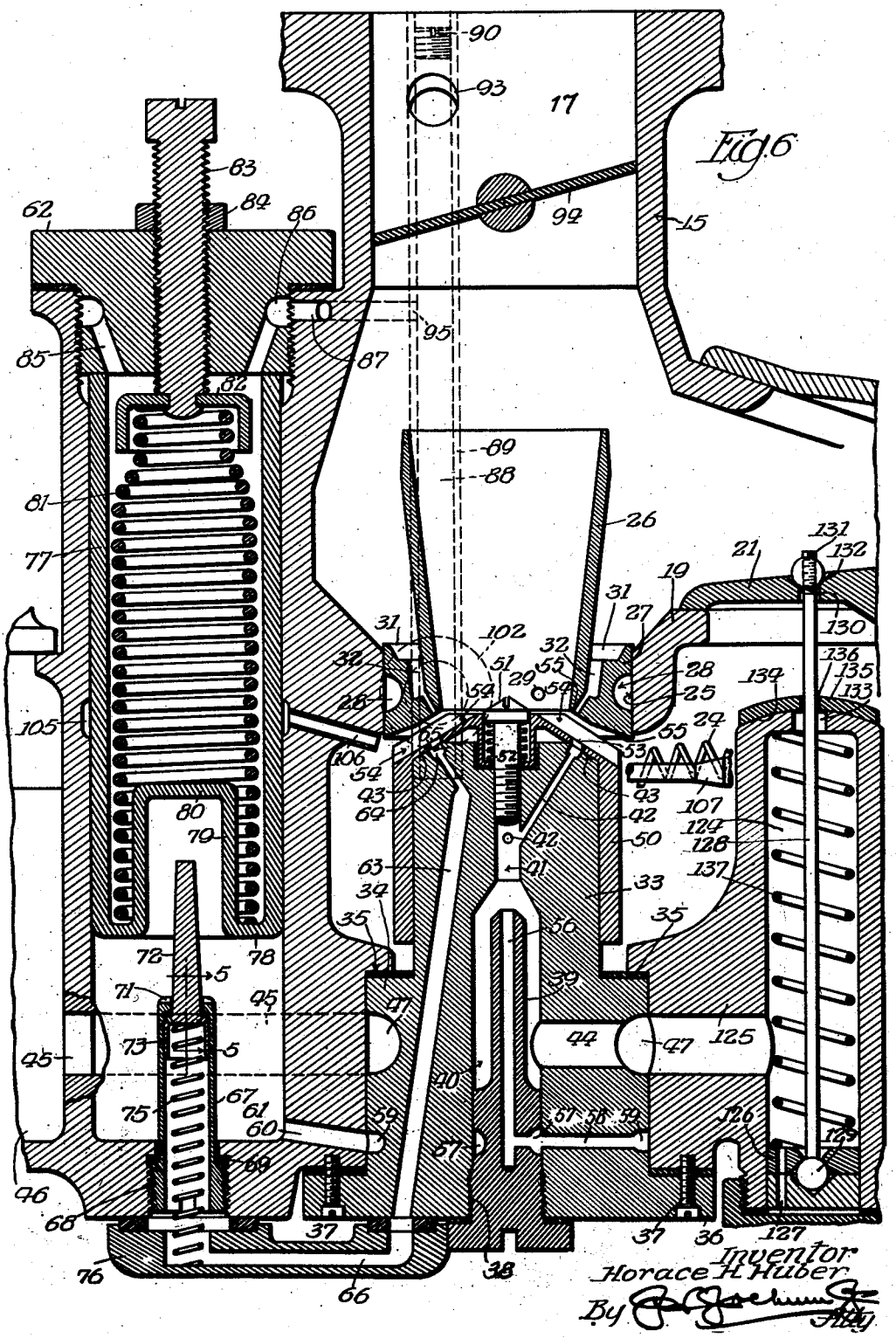

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CARBURETOR

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Fig. 7

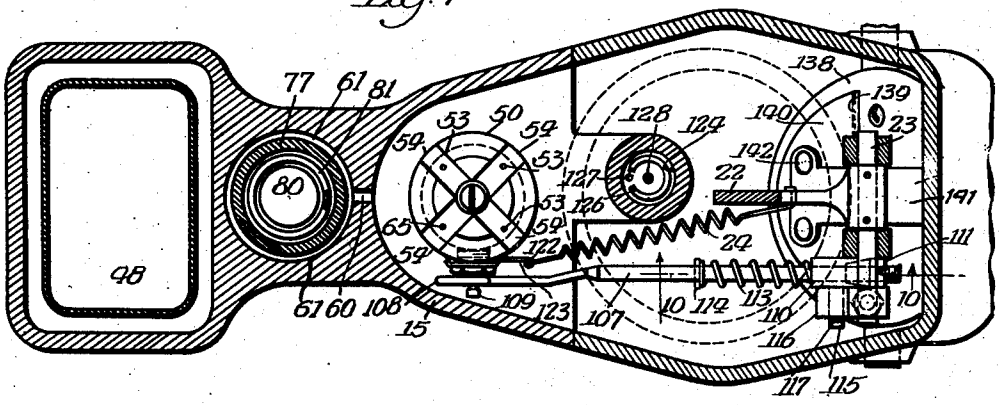


Fig. 8

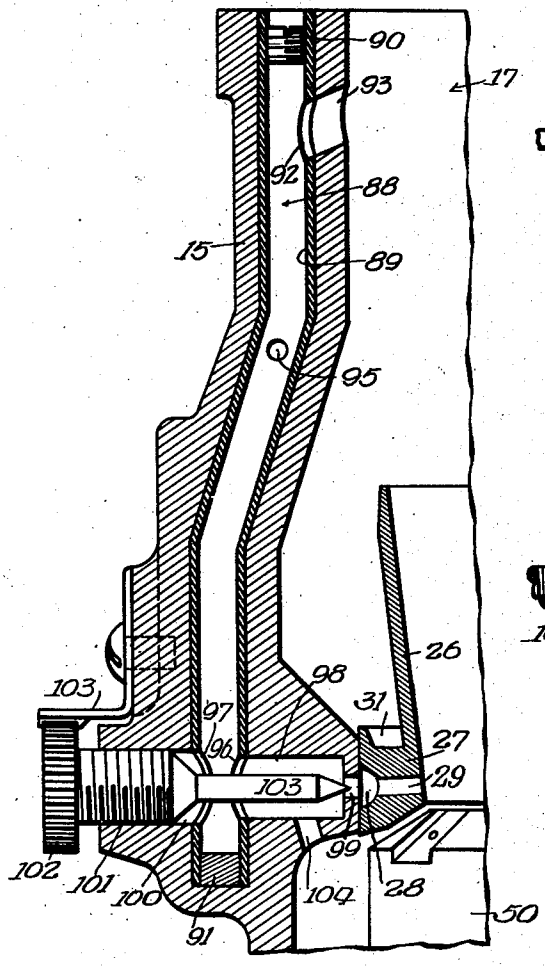


Fig. 9

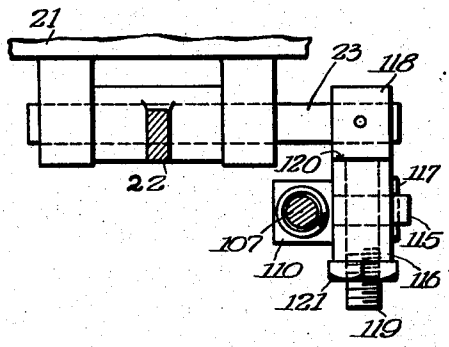
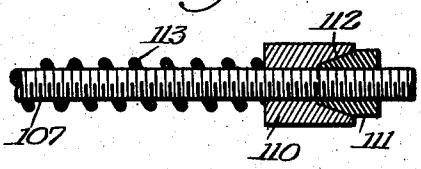


Fig. 10



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Patented May 22, 1934 1,960,109

UNITED STATES PATENT OFFICE

1,960,109

CARBURETOR

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Application March 25, 1932, Serial No. 601,186

16 Claims. (Cl. 261—34)

This invention relates to improvements in carburetors, and one of the objects of the invention is to provide a highly efficient atomizing device and controlling means therefor, whereby the oil or liquid fuel is reduced to particles so small as to be readily kept in suspension in and uniformly mixed with the air during the delivery of the charge to the engine, so that a maximum proportion of volatile constituents of the fuel are formed within a mixing chamber prior to introduction into the chamber, and the remaining non-volatile constituents will be in a state of subdivision favorable to complete combustion thereof after ignition and during expansion of the ignited charge.

In the operation of an automobile two requisites are required of the carburetor, economy of fuel and maximum amount of power. It has been found in obtaining the maximum amount of power, it is necessary to use a richer mixture than when operating under road loads or steady running on level roads with part throttle. The proportion of richness of mixture should vary in proportion to the load that is put upon the engine. For example, in accelerating from a very slow speed to forty miles per hour in order to have a quick acceleration with a wide open throttle, the mixture of fuel should be rich, and as the car attains the forty mile per hour speed, the throttle is gradually closed, then the engine requires a leaner mixture to maintain that speed; and again, in accelerating from a very slow speed to forty miles per hour by opening the throttle to the forty miles per hour point, and maintaining that throttle position until and after the car attains the said forty miles per hour speed, it is desirable to have a proportion of richness of mixture in direct relation to load under which motor is laboring. It is manifest that the motor would be under a much heavier labor at the lower speeds gradually decreasing its labor, as it gains speed under aforesaid throttle position. Therefore it is desirable to have a device to automatically decrease the richness of mixture in direct proportion to the decreased labor under which the motor is working. The leanest mixture required by the motor should always be of a proportion to maintain a good combustible ratio.

In order to accomplish these results, it is an object of the present invention to provide an automatic controlled device to regulate the mixture ratio, independent of the throttle, to meet the demands required, and by means of which these various mixture ratios will be obtained accurately and automatically in the device through the medium of the use of the differences of vacuum that occur on the engine or suction side of the throttle valve.

To the attainment of these ends and the accomplishment of other new and useful objects as will appear, the invention consists in the features of novelty in substantially the construction, combination and arrangement of the several parts, hereinafter more fully described and claimed and shown in the accompanying drawings illustrating this invention, and in which

Figure 1 is a vertical, longitudinal, sectional view of a carburetor of this character, with parts in elevation, parts broken away and parts omitted, constructed in accordance with the principles of this invention.

Figure 2 is a detail sectional view of a portion of the mechanism showing the pump for discharging an additional supply of fuel through the nozzle with the parts of the pump in a different position from the position shown in Figure 1.

Figure 3 is a detail top plan view of the fuel supply nozzle and a portion of the operating mechanism therefor, and on an enlarged scale.

Figure 4 is a detail sectional view taken on line 4—4, Figure 1.

Figure 5 is an enlarged detail sectional view of a portion of the valve for controlling the additional supply of fuel through the nozzle.

Figure 6 is a view in vertical section similar to Figure 1, on an enlarged scale, and with parts omitted.

Figure 7 is a sectional view taken on line 7—7, Figure 1.

Figure 8 is an enlarged detail sectional view taken on line 8—8, Figure 1.

Figure 9 is a sectional view, on an enlarged scale, taken on line 9—9, Figure 1.

Figure 10 is an enlarged detail sectional view taken on line 10—10, Figure 7.

Referring more particularly to the drawings the numeral 15 designates generally the casing of the carburetor, having an inlet opening 16 and a discharge outlet 17, which latter is connected by means of the usual flange 18 with the intake manifold of the engine. Within the casing is a partition 19 having an opening 20 through which air from the inlet 16 may pass. A valve 21 forms a closure for the opening 20 and is preferably provided with an arm 22 pivoted at 23 to a support for swinging movement. The valve 21 is adapted to be opened by engine suction against the stress of a spring 24, one end of the spring being secured to the arm 22.

The partition 19 is provided with an additional

opening 25 and projecting into the opening is a sleeve 26, which is open at both ends. The body portion of the sleeve 26 is reduced externally so as to form a base 27 which fits within the opening 25, and this base is provided with a circumferential recess 28 extending thereabout and opening through the periphery thereof so as to be closed by the wall of the opening 25. Any desired number of openings 29 extend through the wall of the sleeve to form communication between the interior of the sleeve 26 and the groove 28, for a purpose to be set forth. The sleeve 26 gradually increases from the base to the top thereof. In the upper face of the bottom 27 of the sleeve is arranged a groove or channel 31 and leading through the bottom of the channel and discharging through the base are openings 32 which form drains for any fuel which may be deposited upon the base 27 so as to direct such accumulation to a point where the incoming air will carry the fuel into the sleeve 26.

The nozzle of the carburetor consists of a stationary member 33 having a base portion 34 which is of a larger diameter than the nozzle proper and fits within a recess in the casing, the recess being provided with a shoulder 35 against which the top surface of the base abuts and is held in position preferably by means of a flange 36 held in position by means of screws 37. A screw 38 having a reduced portion 39 forms an injector nozzle which fits within a recess 40 in the nozzle element 33, and communicating with this recess 40 is a passage 41 having branches 42 that extend through the surface of a conical portion 43 of the member 33. The diameter of the passage 41 is considerably smaller than the recess 40 and the extremity of the portion 39 of the screw 38 terminates short of the bottom of the passage 41 so as not to close the latter, and the external diameter of the portion 39 of the screw is considerably less than the internal diameter of the recess 40.

The element 33 is provided with a passage 44 which communicates with the recess 40 and forms communication between said recess and a passage 45 and a float chamber 46 through the medium of a circumferential groove 47 in the periphery of the portion 34 of the member 33, and from which float chamber fuel is supplied to the passage 40. Fuel flows from the float chamber through the passage 45, into the groove, thence through the passage 44 into the recess 40, to flow through the passage 41 and thence through the branch passages 42, just beneath the lower open end of the sleeve 26 and out of the direct line of suction through the sleeve 26.

A float 48 is arranged in the float chamber 46 and fuel is supplied to the chamber 46 from a suitable source through a pipe 49 which communicates with the chamber 46. Rotatably supported by the member 33 of the nozzle is a cap 50 which may be held in position preferably by means of a screw 51 passing through the cap and into the element 33, a spring 52 causing the inner surface of the cap to be maintained in contact with the periphery of the tapered portion 43 of the element 33. The cap telescopes with the member 33 and is provided with openings 53 adapted to be moved into and out of register with the openings or passages 42 and is also provided with air passages 54 in its outer periphery, with which the openings 53 communicate and these passages 54 incline toward the apex of the cap 50 to substantially meet at the base of the sleeve 26, and the inner wall of the lower open end of the sleeve 26 is inclined as at 55, and through which clined surface the openings 32 pass.

The reduced end 39 of the injector nozzle 38 is provided with an opening 56 which is in alinement with the passage 41 in the element 33 and at the base of the reduced portion there is provided a circumferential groove 57 which communicates with a passage 58 through the base 34 of the element 33 and which passage 58 communicates with a peripheral passage 59, which in turn has communication by means of a passage 60 with the cylinder or chamber 61, into which latter the liquid will run through the communicating openings between the nozzle and fuel chamber 46, through the following course, i. e., from the fuel chamber 46, through the passage 45, groove 47, passage 44, recess 40, passage 56 in the reduced end 39 of the screw 38, peripheral groove 57, passage 58, peripheral groove 59, through passage 60 into the cylinder or chamber 61. The cylinder 61 is arranged in an upright position and is provided with a top 62 and a closed bottom adjacent which latter the opening 60 is arranged so as to form communication between the cylinder 61 and the injector nozzle 39.

Within the element 33 is a passage 63 which opens through the conical portion 43 at the end of the member 33 as at 64, and which latter opening has communication with an opening 65 in the conical portion of the cap 50, the opening 65 having communication with one of the air passages 54. Connected to the inlet end of the passage 63 is a passage 66, the other end of which has communication with a valve casing 67 that extends into the cylinder or chamber 61 through the bottom thereof, being held in position preferably by means of threads 68 on an enlarged portion of the valve casing which is threaded into a recess 69. This valve casing is of any desired internal diameter and projects for any suitable distance into the cylinder or chamber and is provided with an open lower end and a closed upper end having an opening 70 therethrough (see particularly Figure 5), the upper face of the valve casing 67 being provided with radial grooves or recesses 71, for a purpose to be set forth.

A tapered valve 72 operates in the opening 70 in the valve casing 67 and is provided with a hollow, open lower portion 73 of an external diameter greater than the external diameter of the valve 72. Openings 74 are provided through the top of the base of the valve and the valve 72 is preferably of an extended length. A coil spring 75 is arranged within the valve casing 67, one end of the spring abutting a surface 76, and the other end of the spring projects into the hollow base 73 of the valve 72 and abuts the bottom wall thereof. The normal tendency of the spring 75 is to move the valve 72 in a direction to close the opening or passage 70, and it will be manifest that as the valve 72 is tapered and as the opening 70 is of substantially the same diameter throughout its length, the closing of the opening 70 will be effected by a portion of the periphery of the valve 72 engaging the lower edge of the wall of the opening 70.

Arranged within the cylinder 61 is a plunger or piston 77 which is open at the top and provided with a closed bottom 78 and is preferably provided with an upwardly projecting portion 79 extending into the cylinder, and which portion is open at the bottom and closed at the top as at 80, the diameter of the open portion being considerably greater than the diameter of the valve 72, and into which open portion the valve is adapted to

project. A spring 81 is arranged within the piston, one end of the spring encompassing the portion 79 of the piston and resting upon the bottom 78 and the other end of the spring rests against a disc or inverted cup shaped member 82. The tension of the spring may be varied by means of an adjusting screw 83 passing through the top 62 of the cylinder and being connected with the disc or cup shaped member 82. A lock nut or collar 84 is provided for maintaining the screw 83 in its adjusted position.

Leading through the top 62 and communicating with the interior of the piston 77, are passages 85 which have communication with a peripheral groove 86 in the top 62 and the groove 86 has communication with an outlet 87, for a purpose to be hereinafter set forth.

The inlets of the passages 85 in the top 62 of the cylinder 61 are disposed within the area of the open end of the piston 77 so that when the piston is in the position as shown in Figure 6, it will form a seal or closure for such openings. Arranged within the wall of the carburetor casing 15 is a passage 88, see particularly Figure 8, which may be formed in any suitable manner but preferably by means of a tube 89 suitably shaped and preferably cast or molded into the carburetor casing when the latter is being formed. The tube is open at both ends and is closed by means of suitable plugs or closures 90—91. A lateral opening 92 is provided in the tube which has communication with an opening 93 in the wall of the carburetor casing 15 communicating with the discharge outlet 17 on the engine or suction side of a throttle valve 94 (see also Figures 1 and 6). The tube 89 forming the passage is also provided with an opening 95 in the wall thereof, and with which latter opening the outlet passage 87 communicating with the groove 86 in the top 62 of the cylinder 61 has communication. At the lower end of the passage 88 the tube is provided with openings 96—97, the opening 97 being preferably of a larger diameter, through the wall thereof, and the opening 96 communicates with a chamber 98 in the casing 15 of the carburetor and is provided with a restricted outlet 99 which communicates with the peripheral groove 28 in the base 27 of the sleeve 26. The opening 97 communicates with a recess 100, in which latter is threaded the body portion 101 of a needle valve 102, which latter extends through the openings 97—96 into the chamber 98 and into a position to control the opening 99. The head of the needle valve by means of which it may be adjusted is preferably serrated, and a locking spring 103 is provided for maintaining the needle valve in its adjusted position.

The passage 88 serves a double purpose, first as a means for supplying fuel to the engine while idling and when the throttle 94 is closed or open only to a slight degree as the suction of the engine will be manifested in the passage 88, thereby drawing thereinto fuel from the nozzle through the openings 29 in the wall of the sleeve 26, peripheral groove 28, passage 99, recess 98, through the tube 89 and through the passage 93. The richness or leanness of the mixture thus supplied for idling purposes is controlled by the adjustment of the needle valve 102, to regulate the size of the opening or passage 99, outside air being supplied to the recess 98 to be mixed with the fuel or charge drawn through the opening 99, through an opening 104.

The passage 88 also serves the purpose of controlling the operation of the piston 77 as when the engine is in operation, that is when there is a suction created in the engine, the suction will be manifested in the cylinder 61 above the piston 77, through the opening 95, passage 87, peripheral groove 86 in the top 62 of the cylinder 61 and passages 85, and when this suction or vacuum is sufficient to overcome the stress of the spring 81, the piston will be elevated to the position shown in Figures 1 and 6, so that the fuel which is supplied from the tank or reservoir 46 seeking its level in the cylinder 61, will fill the space beneath the piston 77. Obviously, by adjusting the screw 83 and by varying the stress of the spring 81 the degree of suction necessary to move and hold the piston 77 in this position will be varied.

As long as the suction or vacuum overcomes the stress of the spring 81, the piston will be held elevated, but when the vacuum or suction in the engine drops for any cause, such as the result of the operation of the throttle valve 94, through the medium of the usual operating bar or rod (not shown), the stress of the spring 81 will immediately force the piston 77 downwardly until the bottom 80 of the portion 79 of the piston contacts with the upper end of the valve 72, and a further movement of the piston under the stress of the spring 81 will depress the valve 72 or move the same so as to open the passage or outlet 70 of the valve casing 67 by moving the valve 72 against the stress of the spring 75. Thus, upon a further movement of the piston 77 under the stress of the spring 81, after the valve 72 has been unseated, will result in the piston forcing fuel out of the cylinder 61 through the passage or opening 70 in the valve casing 67, through the openings 74 in the hollow portion 73 of the valve 72, thence out of the valve casing 67, through the passage 66, into the passage 63, to be discharged therefrom through the outlet 64 through the opening 65 in the cap 50 of the nozzle element, and into one of the air passages 54 in the conical top of the valve cap 50 to be discharged and atomized into the sleeve 26, when the opening 65 is in register with the outlet opening 64 of the passage 63.

It will thus be manifest that the passage 63 will be employed to enrich automatically the mixture at heavier loads, as the outlet of the passage 63 is controlled in the same manner as the outlets of the branch passages 42 of the passage 41 in the nozzle element 33. That is, the additional supply or enriching mixture thus delivered through the nozzle will be atomized and metered in the same manner as the supply of fuel from the nozzle is atomized and metered during the running or operation of the motor.

As the throttle 94 is opened to a greater extent or as the motor or engine slows down under a heavier load, the tension of the spring 81 overcomes the vacuum or suction upon the piston 77 and the latter will move downwardly. The amount of fuel discharged by the piston 77 is controlled by its extent of movement in the cylinder 61 and also the position of the valve 72. The valve 72 may be of any desired taper to admit the proper amount of fuel in respect to its movement, assuring the proper mixture.

When the throttle is wide open at slow engine speeds, under very heavy loads, the piston 77 will be in the position as shown in Figure 2, with the passage 70 open to its fullest extent, and fuel will then be delivered from the passage 63 by suction. The motor, because of its slow speed of operation under such conditions, would not require all of

the extra fuel that would be available through the opening 70, and by reason of the valve 72 being open to the fullest extent, but by reason of the fact that the discharge outlet of the passage 63 is controlled by the operation of the valve 21 the discharge outlet of the passage 63 would only be slightly opened, resulting in the desired amount of fuel being delivered from the passage 63. This is due to the fact that the cap or element 50 of the supply nozzle is oscillated about the element 33 by the operation of the valve 21 in one direction under the influence of engine suction and in a manner to be hereinafter described.

As soon as the engine suction increases and the the stress of the spring 81 is overcome, the piston 77 will be again raised to the position shown in Figures 1 and 6, and the passage 85 will be sealed by piston 77. As the piston 77 rises, the spring 75 will again seat the valve 72 and the inlet to the passages 66—63 will then be closed.

As a further means for preventing any of the fuel from leaking past the piston 77 between the walls of the piston and the cylinder, and into the passage 88 which it would normally have a tendency to do by reason of the vacuum or suction manifested through the passage 88, it is necessary to break the vacuum or suction between the cylinder wall and the piston. This is accomplished by providing a circumferential groove or recess 105 in the cylinder wall which is closed by the periphery of the piston 77 and a passage 106 in the casing of the carburetor which has communication with the carburetor casing below the partition 19, so that air admitted through the inlet 16 will flow through the passage 106 into the groove or recess 105, filling the latter and thereby forming a fluid seal against such flow of the fuel. The opening 106 also serves as an escape for fuel which might find its way between the piston and cylinder wall when the piston is depressed to force fuel through the passage 66—63, and any fuel flowing through the opening 106 will be delivered into the air streams and discharged into the carbureting chamber.

The cap 50 is rotated when the valve 21 is opened and closed, to control the outlets of the passages 42 and 63, and for that purpose there is provided a rod 107 which is preferably provided with an eye 108 at one end adapted to receive the head of a member 109 that is threaded or rotatably connected with the cap 50 to project laterally therefrom. Preferably, the head of the element 109 is positioned to pass through the eye 108 of the rod 107 during the assembling of these parts and then rotated to the position shown in Figure 1 to extend across the slot in the eye for securing the two together. The other end of the rod is yieldingly connected with the valve 21 through the medium of a member 110 through which the rod 107 loosely passes. The rod is threaded on the end which passes through the member 110 and has mounted thereupon a conically shaped nut 111 (see particularly Figures 9 and 10) which is adapted to be seated in a conical seat 112 in the member 110.

A coiled spring 113 encompasses the rod, and one end thereof rests against the member 110, and the other end rests against a pin 114 carried by the rod 107, the tension of the spring 113 serving to hold the conical nut 111 seated in the seat 112. Connected with the member 110 is a trunnion 115 which is journaled in a bearing carried by a sleeve 116 and is fixed against displacement in any suitable manner such as by means of a cotter pin 117.

Secured to the pivot 23 of the valve 21 is a member 118 which is provided with a depending threaded bar 119, and this bar 119 passes loosely through the sleeve 116, the sleeve being held against a shoulder 120 carried by the bar 119, and a nut or collar 121, so that when the valve 21 is rocked, the member 118 and bar 119 will be accordingly rocked, but as the member 110 is pivotally mounted upon the sleeve 116, it will be manifest that the member 110 will rock with respect to the member 118, and during this rocking movement the rod 107 will be moved longitudinally by reason of the pressure of the member 110 against the spring 113, which in turn presses against the pin 114. At all times the spring 113 tends to move the rod 107 in a direction to hold the nut 111 seated in the seat 112.

The nut 111 serves as a means for adjusting or varying the set position of the openings 53 and 65 in the nozzle cap 50 with relation to the respective passages 42 and 64 in the nozzle member 33, thus determining the amount of fuel taken in through the passage 42—63 into the sleeve 26. The tension of the spring 113 should be sufficiently strong to hold the nut 111 against the surface 112 so that the nut 111 will not turn of its own accord on the rod 107.

It will be thus manifest that each time the valve 21 is opened and closed, the cap 50 will be correspondingly rotated. The other end of the spring 24 which tends to close the valve 21, is anchored as at 122 (see particularly Figure 3) through the medium of a clip or member 123 secured to the cap member 50 of the nozzle, and this spring also serves to maintain the parts to which it is connected, in tight working condition, and thereby overcome any looseness which might be caused by the wear of the parts or vibrations imparted thereto. The spring 24 also operates to move the cap 50 in a direction about its pivot, to cause the head of the member 109 to stand in proximity to one end of the opening of the eye 108 at the end of the rod 107 so that when the valve 21 is opened the cap 50 will be rotated. The spring 24 also operates to close or seat the valve 21.

As a means for preventing fluttering of the valve 21 a dash pot may be provided embodying a cylinder or casing 124 (see particularly Figures 1 and 6) which receives a supply of liquid from the float chamber 46, through the passage 45, peripheral groove 47 in the base 34 of the valve member 33, and a passage 125 communicating with the groove 47 and also with the chamber or cylinder 124. A piston 126 reciprocates in the cylinder 124 and is provided with an opening 127 therethrough. A piston rod 128 is connected preferably by means of a ball and socket joint 129 with the piston 126, and the other end of the piston rod passes loosely through an opening 130 in the valve 21 and is provided preferably with a ball 131 on such end suitably connected thereto and adapted to be seated in a recess 132 opening through the top of the valve 21. The top of the cylinder 124 is provided with an enlarged opening 133, through which the piston rod 128 passes, and the opening is of a diameter considerably greater than the diameter of the rod. The upper extremity of the cylinder 124 is preferably convexed as at 134 and a cap or plate 135 convexed in configuration, engages and rests upon the top of the cylinder 124 and is provided with an opening 136 therethrough only slightly larger than the diameter of the piston rod 128. The plate or cap 135 is adapted to slide over the top of the cylinder

124 by the rocking movement of the piston rod 128 with respect to the piston 126, and thereby insure a closure for the opening 133 without interfering with the operation of the valve 21 or piston 126.

When the valve 21 is opened by engine suction, the piston 126 will be raised in the cylinder 124, thereby retarding the opening movement of the valve 21. During the operation of deacceleration of the motor it is desirable that the valve 21 shall close as rapidly as possible, and for this reason the spring 24 is provided. However, when the cylinder and piston 124—126 are connected with the valve, it will be manifest that the liquid in the cylinder would retard the quick closing movement of the valve 21 even under the stress of the spring 24. Therefore, in order to permit the valve 21 to close rapidly and so that its closing operation will not be retarded by the piston 126, the piston rod 128 is loosely connected to the valve 21 so that the valve 21 will close rapidly and independently with respect to the descent of the piston 126. As a means for facilitating the return of the piston 126, a coil spring 137 may be provided within the cylinder 124, one end of which spring rests against the piston 126 and the other end against the closed end of the cylinder 124.

When the motor is choked in starting and as the motor begins to run its speed of operation is sufficient to pull in too rich a charge of fuel through the fuel valve nozzle, because of the closed condition of the air inlet passage 16. A means is therefore provided, to automatically admit air as the motor speed increases the suction in the carburetor before the main portion of a choke valve 138 (see particularly Figures 1 and 4) is normally opened, so that it will be impossible to flood the motor with a too rich mixture even with the choke valve in a normally manually closed position.

This is accomplished by providing in the valve 138, preferably within the confines of the edges thereof, an opening 139 which passes therethrough and which opening may be of any desired size and configuration. A valve or member 140 covers this opening and preferably rests against the face of the valve 138. A spring 141 of any desired shape, but preferably of the leaf type is secured by one end as at 142 to the member 140, and by its other end as at 143 to the face of the valve 138, the spring 141 normally operating to hold the member 140 in a position to close the opening 139. The stress of the spring 141 is such that when the motor starts to operate and the member 140 will be displaced against the stress thereof to permit air to flow through the opening 139 before the valve 138 is operated.

It is thought that the operation of the carburetor will be fully understood from the foregoing, but briefly stated, it is as follows. Assuming the parts to be in the position shown in Figure 1 and with the choke valve 138 open, and the engine idling, suction will be manifested in the passage 88 and fuel will be atomized into the passage from the fuel nozzle through the openings 29 into the peripheral groove 28, thence through the opening 99, past the needle valve 102. At the same time air will be drawn into the opening 104 to mix with the fuel. The suction will also be manifested upon the piston 77 to hold the latter elevated. As soon as the throttle 94 is opened, the suction in the engine will be manifested upon the valve 21 and the latter will be opened, thereby rotating the cap member 50 of the supply nozzle to control the outlets 42 and 64. As the engine operates air being drawn in through the opening 16, the valve 138 being opened to admit air, the air currents will be discharged through the passages 54 across the fuel outlets, thereby atomizing the fuel into the sleeve 26 to be discharged into the engine.

If the engine suction is decreased gradually the valve 21 will close with the return movement of the piston 126 in the cylinder 124. If at the same time the throttle 94 is gradually opened or under heavier load conditions, the spring 81 controlling the piston 77 will gradually overcome the suction upon the piston and lower the piston 77 gradually, and any fuel which is discharged from the cylinder 61 by this gradual lowering of the piston 77 will flow through the passage 60, the circumferential groove 59 in the member 33 of the nozzle, thence through the passage 58, through the passage 56 in the nozzle element 39, into the passage 41, to be atomized across the fuel nozzle into the sleeve 26.

In the event that the throttle 94 is closed the engine suction upon the valve 21 is decreased suddenly, the valve 21 will move towards a closing position independently of the piston 126. At the same time the engine suction will be manifested upon the piston 77 to raise the latter in the cylinder 61. When however, the throttle 94 is opened, suction in the cylinder 61 and the piston 77, will be decreased and the piston will be forced downwardly by the spring 81 causing the bottom 80 of the portion 79 of the piston to abut the valve 72 and unseat the latter rapidly against the stress of the spring 75, thereby opening the passage 70 in the valve casing 67. As soon as the passage 70 is opened the movement of the piston will suddenly force a supply of fuel therethrough out of the valve casing 67 into the passage 66 and through the passage 63 into one of the air passages 54 in the fuel nozzle cap to be discharged or atomized into the sleeve 26, thereby supplying an additional amount of fuel and enriching the mixture to be delivered to the engine. At the same time the piston 77 will force a supply of fuel to the passages 42.

Obviously, with the manner of connection between the valve 21 and the piston rod 128, the valve 21 will at all times and under all conditions be adapted to close quickly and independently with respect to the piston 126 and piston rod 128, thereby avoiding all hazards which result from "back fire."

It will be manifest that there will therefore be what might be termed a dual control of the supply of fuel delivered by the piston 77 through the injector nozzle, one of the controls being the valve 72 and the other control being the cap 50 influenced by the valve 21, which latter actuates the cap 50 of the nozzle and thereby controls the outlet 64 of the passage 63, so that the fuel discharged through the passage 63 will be metered and will be atomized to the engine in the same manner as the fuel is metered and atomized from the branch passages 42 of the passage 41 in the nozzle.

Therefore, the control of the mixture ratio is such that the mixture will never be richer than is necessary for the maximum power and never leaner than the most efficient economical mixture, regardless of engine speed or engine load; the rich mixtures being used on very heavy loads and the lean mixtures on light loads, and a variable mixture on intermediate loads, respectively.

Obviously, by adjusting the needle valve 102, the mixture supplied to the engine while idling may be varied and controlled.

It will be manifest that the size of the open-

ings 93 in the passage 88 and the fuel opening 99 and air opening 104 through which the passage 88 is supplied, may be of the necessary and desired proportions with respect to each other and the requirements of the operating conditions of the engine.

While the preferred form of the invention has been herein shown and described, it is to be understood that various changes may be made in the details of construction and in the combination and arrangement of the several parts, within the scope of the claims, without departing from the spirit of this invention.

What is claimed as new is:—

1. A carburetor embodying fuel atomizing means including a fuel nozzle, means for supplying fuel to the nozzle, a throttle valve, means responsive in its operation to the drop in engine suction caused by the operation of the throttle, for displacing a portion of the fuel and causing the same to be ejected through the fuel nozzle, and means responsive in its operation to engine suction for automatically controlling both of the supplies of fuel through said nozzle.

2. A carburetor embodying fuel atomizing means including a fuel nozzle, means for supplying fuel to the nozzle, a throttle valve, means responsive in its operation to the drop in engine suction caused by the operation of the throttle, for displacing a portion of the fuel and causing the same to be ejected through the fuel nozzle, an air supply valve operated by engine suction, and means responsive in its operation to the operation of said air supply valve for controlling said supply and said displaced portion of the fuel delivered through the nozzle.

3. A carburetor embodying fuel atomizing means embodying a mixing chamber, a fuel nozzle having fuel outlet ports, means for directing air currents across said ports for atomizing the fuel into said chamber, means for supplying fuel to certain of said ports, means controlled by engine suction for supplying an additional amount of fuel to one of said ports, a valve element for simultaneously controlling all of said ports, and means for controlling the operation of said valve element.

4. A carburetor embodying fuel atomizing means embodying a mixing chamber, a fuel nozzle having fuel outlet ports, means for directing air currents across said ports for atomizing the fuel into said chamber, means for supplying fuel to certain of said ports, means controlled by engine suction for supplying an additional amount of fuel to one of said ports, a valve element for simultaneously controlling all of said ports, and means controlled in its operation by engine suction for controlling the operation of said valve element.

5. A carburetor embodying fuel atomizing means embodying a mixing chamber, a fuel nozzle having fuel outlet ports, means for directing air currents across said ports for atomizing the fuel into said chamber, means for supplying fuel to certain of said ports, means controlled by engine suction for supplying an additional amount of fuel to one of said ports, a valve element for simultaneously controlling all of said ports, an air supply valve controlled in its operation by engine suction, and means whereby the operation of said air valve will operate the said valve element.

6. A carburetor embodying a nozzle having a fuel discharge outlet, means for supplying fuel to said nozzle, means for causing the fuel to be atomized from said nozzle, there being an additional fuel discharge outlet from the nozzle, means whereby upon drop in engine suction, fuel will be forced through said additional discharge outlet, and means common to said discharge outlets for automatically controlling them.

7. A carburetor embodying a nozzle having a fuel discharge outlet, means for supplying fuel to said nozzle, means for causing the fuel to be atomized from said nozzle, there being an additional fuel discharge outlet from the nozzle, means whereby upon drop in engine suction, fuel will be forced through said additional discharge outlet, and means common to said discharge outlets and controlled in its operation by engine suction for automatically controlling the said outlets.

8. A carburetor embodying a nozzle having a fuel discharge outlet, means for supplying fuel to said nozzle, means for causing the fuel to be atomized from said nozzle, there being an additional fuel discharge outlet from the nozzle, means whereby upon drop in engine suction, fuel will be forced through said additional discharge outlet, means operating automatically for controlling the delivery of fuel to said additional discharge outlet, and means common to said discharge outlets for automatically controlling them.

9. A carburetor embodying a nozzle having a fuel discharge outlet, means for supplying fuel to said nozzle, means for causing the fuel to be atomized from said nozzle, there being an additional fuel discharge outlet from the nozzle, means whereby upon drop in engine suction, fuel will be forced through said additional discharge outlet, means controlled by engine suction for controlling the delivery of fuel to said additional discharge outlet, and means common to said discharge outlets for automatically controlling them.

10. A carburetor embodying a nozzle having a fuel discharge outlet, means for supplying fuel to said nozzle, means for causing the fuel to be atomized from said nozzle, there being an additional fuel discharge outlet from the nozzle, means whereby upon drop in engine suction, fuel will be forced through said additional discharge outlet, means controlled by engine suction for controlling the delivery of fuel to said additional discharge outlet, and means also controlled by engine suction for automatically controlling the said discharge outlets.

11. A carburetor embodying a nozzle having a fuel discharge outlet, means for supplying fuel to said nozzle, means for causing the fuel to be atomized from said nozzle, there being an additional fuel discharge outlet from the nozzle, means whereby upon drop in engine suction, fuel will be forced through said additional discharge outlet, means embodying a metering valve controlled in its operation by engine suction for controlling the delivery of fuel to said additional discharge outlet, and means common to said discharge outlets for automatically controlling them.

12. A carburetor embodying a nozzle having a fuel discharge outlet, means for supplying fuel to said nozzle, there being an additional fuel discharge outlet from the nozzle, means for causing the fuel to be atomized from said discharge outlets, means whereby upon drop in engine suction fuel will be ejected through said additional discharge outlet, and means controlled in its operation by engine suction for controlling the discharge of fuel through said fuel discharge outlets.

13. A carburetor embodying fuel atomizing

means comprising a fuel nozzle, means for supplying fuel to the nozzle, means for atomizing the fuel from the nozzle, said nozzle embodying co-operating nozzle elements one of which is oscillatable, an air supply valve operated by engine suction, an adjustable connection between said air valve and said oscillatable nozzle element, whereby the extent of movement of the nozzle element by the air valve may be varied, said connection embodying a rod pivotally connected with one of the elements, a bearing pivotally connected with the other element and through which bearing the rod loosely passes, a collar threaded upon the rod and resting against the bearing, and a spring for maintaining said collar seated against the bearing element.

14. A carburetor embodying fuel atomizing means comprising a fuel nozzle, means for supplying fuel to the nozzle, means for atomizing the fuel from the nozzle, said nozzle embodying co-operating nozzle elements one of which is oscillatable, an air supply valve operated by engine suction, an adjustable connection between said air valve and said oscillatable nozzle element, whereby the extent of movement of the nozzle element by the air valve may be varied, said connection embodying a rod pivotally connected with one of the elements, a bearing pivotally connected with the other element and through which bearing the rod loosely passes, a collar threaded upon the rod and resting against the bearing, and a spring for maintaining said collar seated against the bearing element, one of the contacting faces of the collar and bearing being substantially conical and the other contacting face being provided with a recess to receive said conical portion.

15. In a carburetor, a fuel supply nozzle, means for atomizing the fuel from the nozzle, an air supply valve controlled in its operation by engine suction, a cylinder and piston element for retarding the opening movement of the air valve, means supplying fluid to the cylinder, and a piston rod connected with the piston, passing through and loosely connected to said valve whereby the valve may close independently with respect to the movement of the piston.

16. A carburetor embodying a fuel nozzle, a plurality of separate supplies of fuel for the nozzle, passages individual to the supplies, separate from each other and leading through the nozzle, means for causing fuel through one of said passages to be atomized from said nozzle, means whereby upon a drop in engine suction fuel will be forced through the other of said passages and ejected from the nozzle to augment the normal supply to the nozzle, means also controlled in its operation by engine suction for controlling the said augmenting supply of fuel, the last said means embodying a metering valve normally closing the second recited passage, resiliently yielding means for holding the valve in a position to close the last recited passage and an element influenced in its operation by engine suction and movable into engagement with said valve to move the latter against the stress of said resiliently yielding means to open the passage, an air valve, and means whereby said air valve will, upon operation, control both of said passages.

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