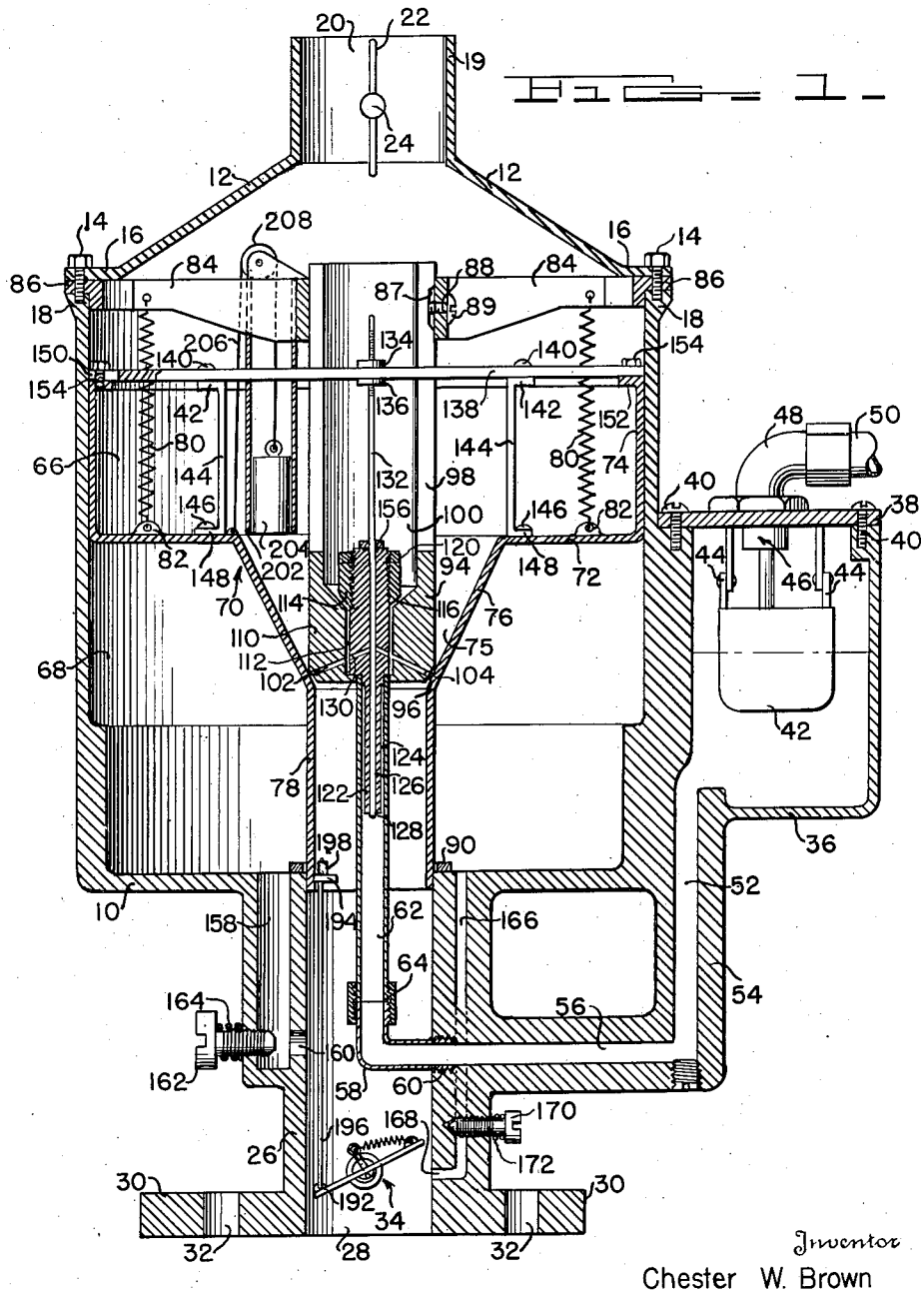
May 10, 1949. C. W. BROWN 2,470,014

CARBURETOR

Filed Dec. 23, 1946 3 Sheets-Sheet 1



Inventor
Chester W. Brown

By Raymond A. Ackerman
Attorney

May 10, 1949. C. W. BROWN 2,470,014

CARBURETOR

Filed Dec. 23, 1946 3 Sheets-Sheet 2

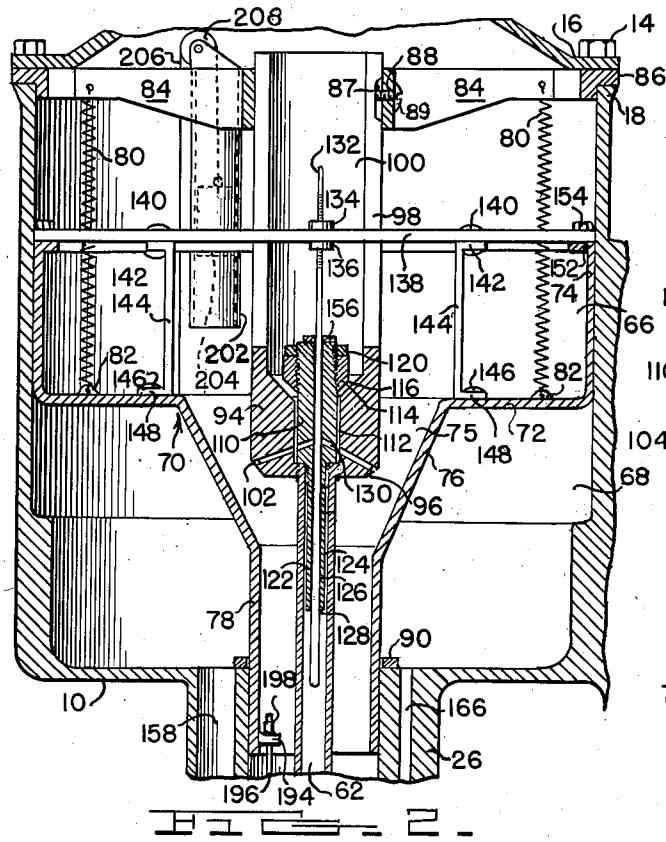



FIG. 2.

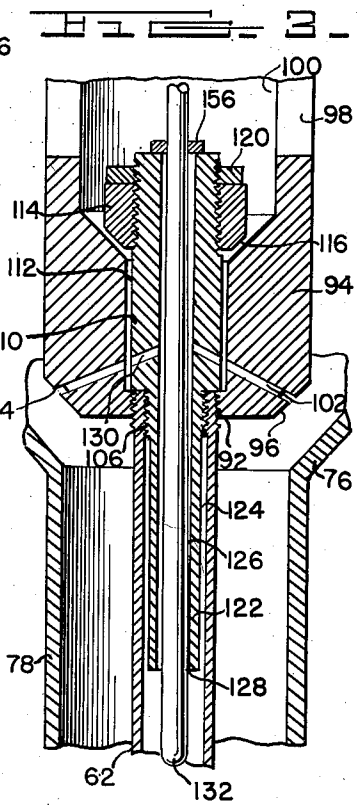



FIG. 3.

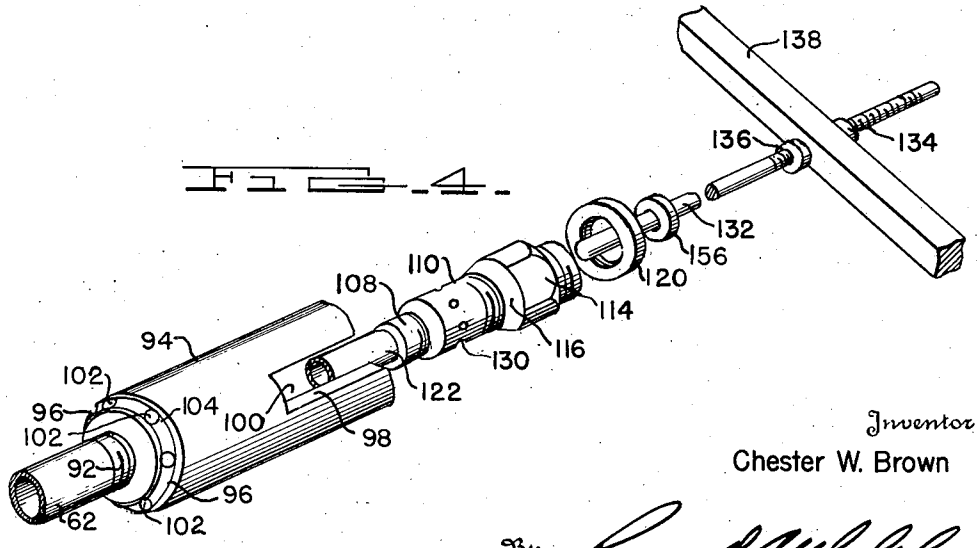



FIG. 4.

Inventor
Chester W. Brown

By Raymond A. Wahl.

Attorney

May 10, 1949. C. W. BROWN 2,470,014

CARBURETOR

Filed Dec. 23, 1946 3 Sheets-Sheet 3

Fig. 5.

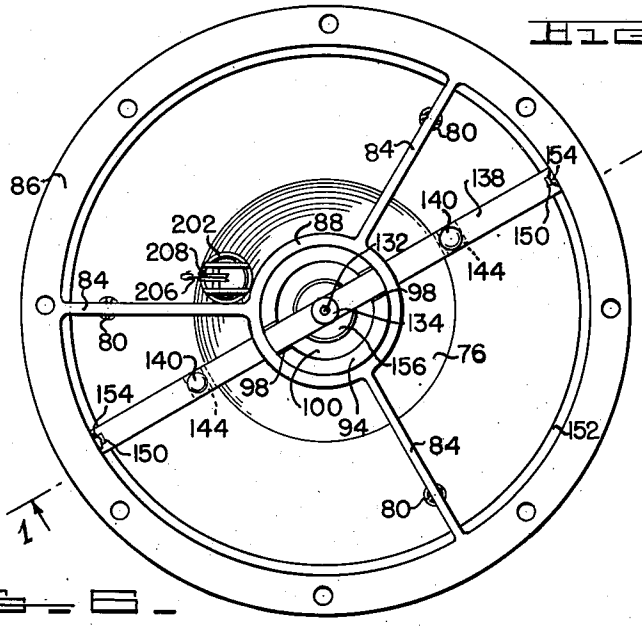



Fig. 6.

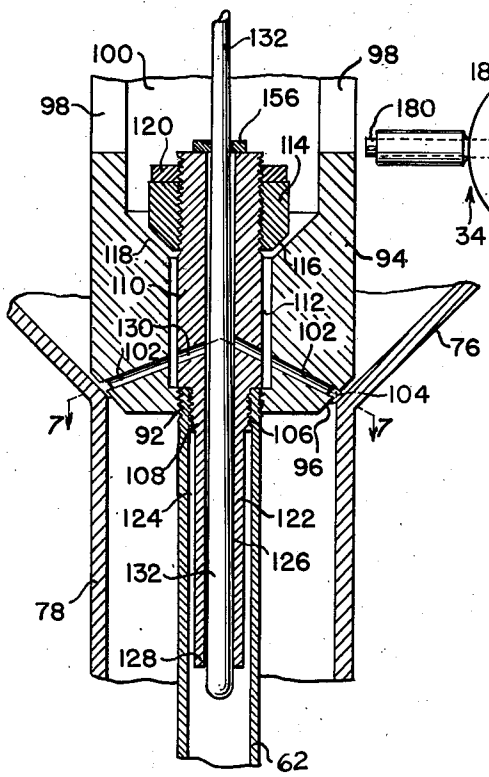



Fig. 8.

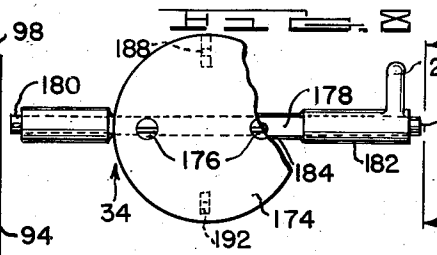



Fig. 9.

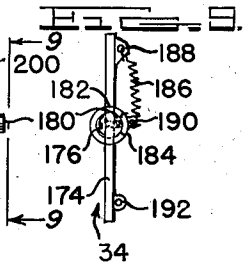
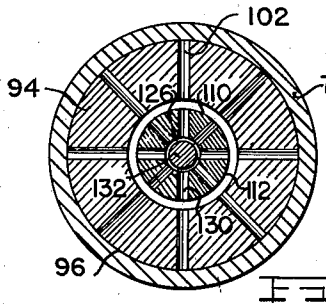



Fig. 7.




Inventor

Chester W. Brown

By Raymond Alcabak.

Attorney

Patented May 10, 1949 2,470,014

# UNITED STATES PATENT OFFICE

2,470,014

## CARBURETOR

Chester W. Brown, Linton, Ind.

Application December 23, 1946, Serial No. 718,049

20 Claims. (Cl. 261—44)

1

The present invention relates generally to the carburetor art.

More particularly this invention relates to certain new and useful improvements in carburetors of the downdraft type adapted to supply proportioned quantities of vaporized liquid fuel and air mixture to the intake manifold of an internal combustion engine.

In the normal course of operation of the majority of automotive vehicles in which the modern internal combustion engine finds its greatest utility, relatively large variations in engine power and speed requirements are encountered as a matter of course. The necessary flexibility of engine operation thus required has been achieved in various ways, one of the most important of which has been through various refinements and improvements in engine carburetors. In the case of an automobile, for example, when the engine is first started a relatively rich mixture is desirable; as the engine warms up the mixture must be leaned out for proper operation; and, finally, each different load condition which may be occasioned by the vehicle traveling up and down hills must be correlated with the throttle setting for the particular engine speed at the time, thus necessitating continuous mixture changes to secure theoretically correct fuel-air ratios.

In the past, in an effort to solve the problem of maintaining a correct fuel-air ratio under different operating conditions of engine load and speed, numerous refinements have been made in the various carburetor designs until the modern automotive carburetor has become an extremely complicated mechanism involving, as it generally does, numerous passageways, valves, and individual jets, each of which is specifically designed principally to improve engine operation for some one or at most a narrow range of engine operating conditions. Inasmuch as each such additional jet, valve, or other refinement is superimposed upon an existing fundamental carburetor circuit designed to function at all times, each has necessitated further adjustments and corrections in the other related circuits so that the final result in practically all cases has been in the nature of a compromise which approaches a correct mixture within specified operating ranges but which is actually not entirely correct for any particular set of conditions.

Accordingly the principal object of the present invention is to provide a carburetor which will automatically insure a correct fuel-air mixture under substantially all conditions of engine operation.

2

Another object of the invention is to provide a carburetor of the type described wherein a correct fuel-air ratio is maintained under various engine operating conditions by simultaneously varying the air and fuel inlets in such manner as to meter the quantity of liquid fuel supplied to the carburetor jet in accordance with the volume of air supplied thereto, while at the same time maintaining the air pressure in pounds per square inch in the venturi substantially constant.

An additional object of the invention is to provide a carburetor of the type described wherein a correct carburetor adjustment for engine idling speed is obtained by control means operatively associated with the main or high speed carburetor jet.

Yet another object of the invention is to provide a carburetor for an automotive vehicle engine incorporating separate devices for adjusting the mixture to prevent overloading under acceleration or deceleration by introducing a time delay in variation of the air inlet opening, at least one of said devices being independent of and another dependent upon momentum forces produced by the vehicle.

A still further object of the invention is to provide a carburetor of the type described embodying an interconnection between the throttle valve and the means for varying the air inlet to prevent damage to the engine caused by too rapid throttle opening and also to improve the engine stalling characteristic under load.

Additional objects of the invention reside in the provision of an adjustable mechanism for varying the carburetor mixture to uniformly compensate for variations in vacuum conditions under both light and heavy loads both of a steady and temporary character; to provide automatic temperature compensating devices for varying the fuel-air mixture in accordance with the engine and operating air temperature as well as fuel vaporization effect; and to provide a cushioning device for smoothing the operation of the fuel metering mechanism and acceleration pump action.

A particularly important object of this invention is to provide a carburetor of the type described wherein the various features of adjustability and compensation specifically referred to in the preceding objects are all either incorporated or have their effect upon a single jet.

The foregoing as well as other and further ob-

jects and advantages of the invention together with a clearer understanding of the precise nature thereof will become more readily apparent to one skilled in the art from a consideration of the following detailed description taken in conjunction with the accompanying drawings illustrating a preferred embodiment thereof wherein similar reference numerals refer to corresponding parts throughout the several views, and wherein:

Fig. 1 is a longitudinal cross-sectional view through a completely assembled carburetor in accordance with the present invention;

Fig. 2 is a longitudinal cross-sectional view similar to but illustrating only a portion of the carburetor of Fig. 1 and showing certain of the parts in another operating position;

Fig. 3 is a longitudinal cross-sectional view to an enlarged scale illustrating in detail the preferred form of jet structure shown in Figs. 1 and 2;

Fig. 4 is an exploded perspective view showing the relationship of certain of the jet elements;

Fig. 5 is a top plan view of the carburetor of Fig. 1 with the top cover removed;

Fig. 6 is a detail view similar to Fig. 3 but illustrating another operating position of the parts;

Fig. 7 is a transverse cross-sectional view through the jet taken substantially along the line 7—7 of Fig. 6;

Fig. 8 is a top plan view of a preferred form of throttle valve constituting an important part of the present invention; and

Fig. 9 is a side elevational view of the throttle valve of Fig. 8.

Referring now specifically and in detail to the various figures of the drawings and in particular to Fig. 1 thereof, the improved carburetor in accordance with the present invention is seen to comprise a housing in the form of a substantially vertical cylinder 10, preferably formed as a steel casting or the like, having a cover 12 mounted on its upper end in any suitable manner as by means of the bolts 14 extending through flanges 16 on the cover and into suitably threaded apertures formed in the upper rim 18 of the cylinder 10. The main portion of the cover 12 is tapered inwardly and upwardly and terminates at its upper end in a cylindrical portion 19 constituting an air inlet 20 open to the interior of the cylinder 10 under the control of a choke mechanism illustrated as a conventional butterfly valve 22 pivotally mounted as at 24 within the air inlet 20. At its bottom end the cylinder 10 is provided with a generally cylindrical portion 26 of reduced diameter constituting a mixture outlet 28 provided at its bottom end with a flange 30 having apertures 32 therein and adapted to be attached to the intake manifold of an internal combustion engine. A throttle valve designated generally by reference numeral 34 is pivotally mounted within the mixture outlet 28 for controlling the passage of the fuel-air mixture therethrough to the intake manifold. The construction of the throttle valve 34 involves a number of novel features and will be hereinafter more fully described.

Referring again to Fig. 1, it will be noted that the right-hand side of the cylinder 10 is provided with a float chamber 36 preferably cast integrally there with and closed at its top in any convenient manner as by means of a cover plate 38 held in position by means of a plurality of screws 40. The float chamber 36 is adapted to provide



a substantially constant level of liquid fuel such as gasoline therein at all times and to that end is provided with a suitable float 42 depending from pivot arms 44 and operatively connected to a suitable needle valve mechanism of any well-known type designated generally by reference numeral 46. The valve mechanism 46 in turn controls in the usual manner the admission of fuel to the float chamber 36 through an elbow 48 and conduit 50, the latter being connected to any convenient source of supply. The interior of the float chamber 36 is open adjacent its bottom portion to a vertical passage 52 formed in a projection 54 of the cylinder casting 10 which is connected in turn to a similar horizontal passage 56 opening at its opposite end to the interior of the mixture outlet 28. An elbow fitting 58 is threaded or otherwise suitably secured as at 60 to the end of the passage 56 and is provided at its other end with a tubular conduit 62 connected in any convenient manner thereto as by means of a threaded collar 64. The conduit 62 which is preferably made of copper or brass extends axially upward adjacent the center of the cylinder 10 and serves to supply fuel to the carburetor through its connection to the float chamber 36 by means of the passages 52 and 56.

As illustrated in Figs. 1 and 2, the space within the interior of the cylinder 10 is divided into upper and lower working chambers 66 and 68, respectively, by means of a piston designated generally by reference numeral 70. The piston 70 is preferably constructed of a very lightweight material so as to have a relatively small mass and is seen to comprise a cup-shaped portion having a floor 72 and a vertical wall portion 74, the latter being adapted to closely engage the inner wall of the cylinder 10 but being relatively freely reciprocable therein. The piston 70 also includes a downwardly and inwardly tapered intermediate section 76 depending from the inner edge of the floor 72 and constituting the carburetor venturi 75, and a tubular skirt 78 depending from the bottom of the tapered portion 76 and reciprocable in pressure-tight relation within the outlet 28.

The piston 70 is resiliently supported within the cylinder 10 as by means of a plurality of springs 80, preferably three in number, attached at their bottom ends to lugs 82 formed on the upper surface of the piston floor 72, and at their upper ends to the arms 84 of a hanger or spider structure having an outer shouldered rim 86 adapted to be engaged and held in position between the rim 16 of the cover 12 and the upper rim 18 of the cylinder 10 by means of the bolts 14. The arms 84 extend generally radially of the cylinder 10 and are provided adjacent the center of the latter with a generally cylindrical bushing 88 having a key 87 attached to the inner periphery thereof as by means of a screw 89 for a purpose which will hereinafter be more fully explained. A ring 90 of a relatively heavy or dense material loosely surrounds the skirt 78 and rests upon the inside bottom of the cylinder 10. The ring 90 constitutes a momentum responsive acceleration control and the operation thereof will also be described in detail below.

Referring now particularly to Figs. 1, 3, 4, and 6, there is illustrated a preferred form of jet structure for the improved carburetor in accordance with the present invention. As shown in these figures the top end of the conduit 62 is threaded exteriorly as indicated at 92 for engagement with

similar internal threads provided at the lower central portion of a generally cylindrical piston stop 94 extending upward from the top of the conduit 62 axially of the cylinder 10. The bottom edge of the piston stop 94 is beveled as indicated by reference numeral 96 to form a downwardly and inwardly tapering surface having approximately the same incline as the tapered piston section 76 and adapted to closely engage the latter in one position of the parts to substantially completely close the venturi 75. The top portion of the piston stop 94 is slidably received within the bushing 68 and is provided with a pair of diametrically opposite grooves 98 in its side walls one of which slidably receives the key 87 to prevent rotation of the stop. The interior of the stop 94 is largely hollow providing a central cavity 100 therein which is reduced in size at its bottom portion and is connected to the throat of the venturi 75 by means of a plurality of downwardly inclined radial apertures 102 opening into a groove 104 in the beveled edge 96 of the stop. As shown particularly in Fig. 7, I have provided eight such apertures 102 in the preferred form of apparatus disclosed herein although any suitable number may be provided, and it will also be particularly noted that the outlet groove 104 is adapted to be substantially completely closed by the inner face of the tapered piston section 76 when the parts are together as shown for example in Figs. 1, 6, and 7.

The inside of the top end of the conduit 62 is also threaded as indicated by reference numeral 106 in Figs. 3 and 6 for engagement with similar threads formed on the outer periphery of the reduced center portion 108 of a generally cylindrical jet body 110 which extends axially upward within the cavity 100. The upper portion of the jet body 110 is of slightly smaller external dimensions than the cavity so as to form an annular space 112 therebetween. The top of the jet body 110 is externally threaded to receive a large nut 114 having a tapered lower edge 116 adapted to cooperate with a similarly tapered surface 118 formed within the cavity 100 for controlling the admission of air from the inlet 20 to the annular space 112 and apertures 102. A suitable locknut 120 is provided above the nut 114 for securing the latter in position after the desired adjustment has been made.

The jet body 110 is provided at its lower end with a further reduced portion 122 extending downwardly within the conduit 62 so dimensioned as to provide an annular chamber 124 therebetween adapted to trap and to retain a certain volume of air or other gas therein. The interior of the jet body 110 is provided with an axial bore 126 extending completely therethrough and providing a metering orifice 128 at its bottom end. A plurality of downwardly inclined radial jets 130 are formed in the body 110 and serve to connect the bore 126 to the annular space 112. It will be noted that jets 130 are preferably equal in number to the apertures 102 and are positioned in such manner as to open directly into the latter.

The metering orifice 128 at the bottom of the bore 126 is under the control of a tapered plunger 132 which extends upwardly through the bore 126 and is adjustably secured at its top portion by means of a pair of nuts 134 and 136 to a transverse plunger bar 138. The plunger bar 138 in turn is attached preferably at four points to the piston 70 for movement with the latter and as shown particularly in Figs. 1 and 2 is mounted as by means of suitable screws 140 upon the top flanges 142 of generally channel shaped supports or brackets 144 preferably formed of brass, copper, or the like, having similar flanges 146 at their lower ends for attachment to the upper surface of the piston floor 72 as by means of screws 148. The outer ends of the bar 138 are preferably slotted as indicated at 150 for attachment to flanges 152 formed at the top edge of the vertical wall portion 74 of the piston 70 as by means of suitable screws 154. The cylindrical upper portion of the plunger 132 is freely slidable within an aperture formed in a washer 156 which rests upon the top surface of the jet body 110 and thus serves to practically close the bore 126 in the latter against the admission of air thereto.

From the description thus far it will be apparent that the piston 70 is reciprocable within the cylinder 10 and that as it does so, the tapered intermediate section 76 of the piston moves relative to the piston stop 94 which is mounted in relatively fixed position by means of the conduit 62. As the piston 70 reciprocates it carries with it the plunger 132 which moves through the bore 126 to vary the amount of opening at the metering orifice 128 in accordance with the position of the piston 70. The working chamber 66 within the cylinder 10 above the piston 70 is of course open to atmospheric air pressure from the inlet 20 at substantially all times except when the choke valve 22 is closed.

In order to effect reciprocation of the piston 70 the working chamber 68 of the cylinder 10 below the piston is connected to the mixture outlet 28 by means of a relatively large passage 158 preferably formed integrally with the cylinder casting 10 and having an opening 160 into the mixture outlet 28 above or on the upstream side of the throttle valve 34. The effective size of the opening 160 is capable of adjustment by means of a threaded needle valve 162 provided with a spring 164 and movable in or out to provide a variable restriction in the passage 158. A similar passage 166 also preferably formed integrally at the right-hand side of the lower part of the cylinder casting 10 and having an opening 168 into the mixture outlet 28 serves to connect the working chamber 68 below the piston 70 with the outlet 28 at a point below or on the downstream side of the throttle valve 34. The passage 166 is also provided with a variable restriction therein preferably in the form of a needle valve 170 pressed outwardly as by means of a spring 172 but, as will be explained in the description of the operation of the device as set forth in detail below, the function of the passage 166 is substantially different from that of the passage 158. In both cases, however, these passages 158 and 166 serve to connect the working chamber 68 below the piston 70 to the suction or vacuum produced in the intake manifold of the internal combustion engine upon which the carburetor is mounted and thus provide for downward movement of the piston 70 under atmospheric pressure introduced through the inlet 20 to the working chamber 66 above the piston.

As indicated above, the mixture outlet 28 is under the control of a throttle valve designated generally by reference numeral 34 the specific structural details of which are best illustrated in Figs. 8 and 9. As shown in these views the throttle valve 34 is seen to comprise a generally circular disc or plate 174 attached in any convenient manner as by means of a pair of screws 176 to a flattened portion 178 of a shaft 180. The shaft 180 is rotatably mounted within a con-

centric outer shaft 182 having its central portion cut away throughout the major extent of its periphery to leave a connecting part 184. The cut away portion of the outer shaft 182 provides a relatively large gap or opening to accommodate considerable relative rotational movement of the value plate 174 and its associated shaft 180 therein. The valve plate 174 is yieldably connected to the part 184 of the outer shaft 182 by means of a spring 186 extending between a lug 188 on the plate 174 and a similar lug 190 on the connecting part 184 of the outer shaft 182.

The throttle valve plate 174 is also provided with another lug 192 similar to the lug 188 but at the opposite side of the concentric shafts 180—182. The lug 192 as shown in Fig. 1 is connected to a projecting ear 194 formed at the lower edge of the tubular skirt portion 78 of the piston 70 by means of a tie rod 196 which passes through a suitable aperture in the ear 194 and is provided with a stop nut 198 at its top end constituting a one-way abutting connection between the tie rod 196 and the ear 194. The outer shaft 182 of the throttle valve is provided with an arm 200 (Fig. 8) adapted to be connected in any suitable manner to the accelerator or other similar throttle control means of the engine with which the carburetor is to be used, and it will now be apparent that as long as the piston 70 is in a lowered position so that the tie rod 196 is free to move downwardly relative to the ear 194, rotation of the outer shaft 182 by means of the arm 200 will result in corresponding movement of the throttle valve plate 174 by means of the interconnecting spring 186. In the event the piston is fully elevated in the position as shown in Fig. 1 it will be clear that rotation of the outer shaft 182 merely results in tensioning the spring 186 so that the throttle valve cannot be opened suddenly unless the piston 70 has first been substantially lowered.

As it is intended that the improved carburetor in accordance with the present invention may be employed in substantially any type of automotive installation it may be desirable in certain cases where extremely rough operation and relatively severe vertical loads are imposed upon the structure to provide some means for counterbalancing the piston 70. Thus in certain cases, as for example where the carburetor is to be mounted upon a tractor engine, I have provided a generally tubular guide 202 securely attached in a generally vertical position in any suitable manner as by welding or the like to one of the arms 84 and in which a weight 204 is adapted to freely reciprocate. The weight 204, which is suitably selected to approximately equal the weight of the piston assembly, is attached to one end of a cable or flexible line 206 which extends over a sheave 208 rotatably mounted at the top of the guide 202, and the opposite end of the line 206 is connected to the piston 70 at any convenient point such as for example the screw 148. The weight 204 thus serves to counterbalance any momentum effect of the piston 70 under vertical forces imposed in a downward direction.

The mode of operation of the device described above may now be set forth in broad terms as follows: Referring particularly to Figs. 1 and 6 the various parts are illustrated in the position which they occupy when the engine is at rest or not operating. It will be noted that the piston 70 is in its upper limit position with the tapered



intermediate section 76 thereof resting against the beveled edge 96 of the piston stop 94, being held in that position by the tension of the springs 80. The level of liquid fuel within the float chamber 36 is just slightly below the level of the jets 130, and the passages 52 and 56 as well as the conduit 62 and annular space 126 are filled with the liquid fuel up to this same level.

When the engine is started in operation, the various movable parts of the carburetor generally assume the positions as illustrated in Figs. 2 and 3. At this time a certain amount of vacuum from the engine is applied through the passages 158 and 166, respectively above and below the throttle valve 34, to the lower working chamber 68 of the cylinder 10 so that the piston 70 is moved downwardly a slight amount in response to the atmospheric pressure of air admitted through the inlet 20 to the upper working chamber 66. At the same time atmospheric air admitted through the inlet 20 commences to flow through the Venturi passage 75 formed between the tapered intermediate piston section 76 and the piston stop 94, creating a low-pressure area at the space between the beveled edge 96 of the stop 94 and the tapered section 76 in accordance with the usual and well-known principles of fluid flow. Liquid fuel from the float chamber 36 is thus induced to flow through the passages 52 and 56, the conduit 62, past the metering orifice 128, through the annular space 126, the jets 130, and the apertures 102 to the groove 104 adjacent this region of low pressure. At this point the liquid fuel is vaporized and mixed with the air and subsequently passes downwardly through the tubular skirt 78 and mixture outlet 28 to the engine. As mentioned previously a substantially constant level of liquid fuel is maintained in any suitable manner within the float chamber 36 so that as long as the engine is operating and suction is maintained thereby within the lower operating chamber 68 of the cylinder a continuous mixture of liquid fuel and air will take place within the venturi 75 and be supplied to the engine for combustion.

The foregoing explanation of the method of operation of my improved carburetor constitutes a rather general statement of operation, whereas in the following description the various refinements and improvements which I have provided will be referred to in greater detail. Assuming the engine to be cold prior to starting, the temperature compensating devices are effective to provide an enriched mixture in the following manner. As mentioned above the conduit 62 on which the piston stop 94 is mounted is preferably made of a material such as brass or copper having a relatively high coefficient of expansion as compared to the steel cylinder 10. Accordingly, when both the carburetor and engine are relatively cold the conduit 62 will be contracted axially or longitudinally of the cylinder 10 to a slightly greater extent than normal, thus lowering the piston stop 94 and jet body 110 and with the latter the jets 130. Thus one effect of the slight extra contraction of the conduit 62 is to lower the position of the jets 130 relative to the liquid fuel level within the float chamber 36 to thereby increase the effective operating head of the liquid fuel and so enrich the mixture.

At the same time such contraction of the conduit 62 relative to the cylinder 10 results in a lowering of the piston 70 through the abutting contact of the tapered intermediate section 76 with the beveled edge 96 of the piston stop 94,

This lowering of the piston 70 results in a slight stretching of the springs 80 causing the latter to operate over a different range which in accordance with the usual characteristics of such springs has the effect of slightly increasing the tension thereof. The effect of increasing the tension of the springs 80 is to require more vacuum within the lower working chamber 68 in order to produce the required downward movement of the piston 70 so that as a result the volume of air which can flow between the beveled edge 96 and the tapered section 76 will be reduced in comparison to the volume of liquid fuel discharged through the jets 130 thus also enriching the mixture.

Although the temperature compensating effect produced by expansion and contraction of the conduit 62 relative to the cylinder structure will be found to be adequate in certain installations, I have also provided additional temperature compensating means in the form of the brackets 144. As mentioned above, these brackets 144 are also preferably formed of brass, copper, or some other material having a relatively high coefficient of expansion relative to the piston and cylinder structure. Thus when the engine is cold the brackets 144 are in a slightly contracted condition causing the plunger bar 138 to be drawn slightly downward relative to the piston 70 and consequently relative also to the piston stop 94. Such downward movement of the plunger bar 138 carries with it the plunger 132, causing the latter to move downward relative to the reduced portion 122 and orifice 128 which in turn results in increasing the effective area of the latter due to the taper of the plunger 132. This increase in the effective area of the metering orifice 128 operates to increase the proportion of liquid fuel available at the jets 130 or in other words has a tendency to enrich the mixture supplied to the cold engine.

In the preferred embodiment of the carburetor in accordance with the present invention I have disclosed the temperature compensating effects of the conduit 62 and brackets 144 as being jointly and simultaneously operative to provide an enriched mixture when the engine is cold although it will be clear that either of these devices may be employed alone to produce a similar result. The reverse of this compensating action, that is to say, the production of a leaner mixture as the engine operating temperature gradually increases, is automatically attained in each case. Accordingly, as the engine commences to warm up the conduit 62 tends to expand at a greater rate than the cylinder 10 which results in simultaneously raising the level of the jets 130 relative to the fluid level of the float chamber 36 to decrease the effective head of fuel and to raise the stop 94, thus permitting the springs 80 to contract slightly and so operate within a lower tension range or in effect decreasing the spring tension. In similar manner as the engine warms up the brackets 144 also tend to expand at a greater rate than the piston 70 so that the plunger 132 is moved slightly upward relative to the metering orifice 128 to reduce its effective area and thus produce a leaner mixture.

It should also be noted in connection with the temperature compensating effect of the conduit 62 that the temperature of the mixture as it passes downward around the conduit serves to produce a considerable cooling effect upon the latter due to the latent heat of vaporization of the fuel, the amount of which will vary in accordance with the amount of fuel and air being consumed by the engine. Inasmuch as the quantity of the fuel-air mixture being consumed varies almost directly with the amount of work being done by the engine, it will be apparent that as the engine load increases the conduit 62 will be subject to an increased cooling effect. This increased cooling effect upon the conduit 62 thus operates to provide a relatively richer mixture under heavy engine loads and to lean out the mixture under relatively light loads by the same mechanical action which occurs in compensating for ordinary temperature changes.

In arriving at the proper design criteria for the various elements of my improved carburetor it must be borne in mind that the relative dimensions of the parts, the tension of the springs, and the taper of the piston, piston stop, and plunger should be determined in accordance with the fundamental concept of providing a correct fuel-air mixture for any given set of conditions of constant engine speed and load throughout the range from idling to full speed and no load to maximum load. Thus the taper of the plunger 132 will depend in a given case upon the size of the opening between the piston 70 and the piston stop 94 which in turn will vary with the tension of the springs 80 and the weight of the entire piston assembly. The initial adjustment to attain this correct fuel-air ratio is obtained by properly setting the nuts 134 and 136 to position the plunger 132 within the metering orifice 128 in such manner as to properly meter the flow of liquid fuel through the latter under a particular set of constant load and speed conditions. The taper of the plunger 132 will then properly vary the effective area of the metering orifice 128 in accordance with the position of the piston 70 which in turn is determined by the particular load and speed requirements of the engine at any given time. After this adjustment has once been made the metering action of the plunger 132 is entirely automatic and although the pressure within the venturi 75 will vary only slightly during operation, the volume of air drawn therethrough will of course vary greatly and will determine the extent of the fuel metering action by controlling the position of the plunger 132 in accordance with the position of the piston 70.

In order to permit proper adjustment of the position of the plunger 132 by means of the nuts 134—136 without regard to engine idling requirements, I have provided an auxiliary idling adjustment which may be independently set subsequent to the plunger adjustment. This idling adjustment is made by setting the nut 114 and locking it in adjusted position by means of the locknut 120 in such manner as to control the relatively small volume of air flowing between the inclined surfaces 116 and 118 and through the annular space 112 to the apertures 102. Since this volume of auxiliary air is relatively small compared to the volume of air passing through the venturi 75 under practically all operating conditions, the idling adjustment may be made subsequent to the adjustment of the plunger 132 without substantially affecting the operation of the latter. The auxiliary air admitted past the idle adjusting nut 114 is suitably proportioned relative to the effective area of the metering orifice 128 to provide for smooth engine operation at idling speed or when the throttle valve 34 is practically closed, and it is to be particularly noted that this idling adjustment is accomplished entirely by modification of the basic or high speed jet circuit without

requiring any additional idling or low speed jet circuit.

During normal carburetor operation under any particular fixed set of conditions or at constant engine speed and load the air-fuel ratio of the carburetor is determined by the position of the piston 70 which controls the amounts of the Venturi air opening, and effective area of the metering orifice 128 and is in turn controlled by the amount of suction or vacuum transmitted from the engine through the passages 158 and 166 to the lower working chamber 68 of the cylinder 10. The piston 70 under such fixed engine operating conditions accordingly will assume a position such as to provide a balance between the difference in air pressure in the chambers 66 and 68 above and below the piston, respectively, and the tension of the springs 80. In the event the engine vacuum should gradually increase or decrease, the piston 70 will move slightly in response to the new conditions and will readjust itself automatically to provide the proper fuel-air ratio. However, in the event the engine vacuum should increase, for example, and the piston 70 should be restrained against its automatic movement to a new balanced position for the altered engine operating conditions, it will be apparent that due to the relatively inelastic nature of the liquid fuel as compared with the relatively highly elastic air a greater volume of fuel will be delivered at the jets 130 in comparison to the volume of air flowing past the venturi 75 under such increased vacuum. Stated in more general terms, it is thus possible to superimpose a mixture variation upon the carburetor over and above that automatically provided by the balanced position of the piston and plunger by any means which tends to restrain the piston 70 against such automatic movement.

One of the principal reasons for superimposing an additional controlled effect upon the movement of the piston 70 is to provide a slightly enriched mixture during engine acceleration. As one means of accomplishing this result, I have provided the adjustable needle valve 162 which presents a variable restriction within the passage 158 connecting the lower working chamber 68 of the cylinder 10 with the mixture outlet 28 above the throttle valve 34. As the throttle valve 34 is opened for acceleration the vacuum above the throttle valve is momentarily increased thus tending to produce a relatively larger air flow through the venturi 75 which in turn produces a higher suction at the Venturi throat and a greater flow of liquid fuel through the jets 130 and apertures 102. However, because of the restriction presented by the needle valve 162, this increased vacuum is not immediately effective upon the piston 70 so that a time delay is introduced in the downward movement of the latter. The amount of this time delay is of course determined by the amount of the restriction imposed by the needle valve 162 within the passage 158 and is so calculated as to provide for an increase in the volume of liquid fuel flow as compared to the volume of air flow for a sufficient interval of time to permit the enriched mixture to be effective during the period of acceleration. The increased engine vacuum will of course gradually become fully effective within the lower working chamber 68 of the cylinder 10, thus causing the piston 70 to ultimately assume a new balanced position wherein the fuel-air ratio is determined by the respective size of the openings of the venturi 75 and the metering orifice 128.

The passage 166 opening at 168 into the mixture outlet 28 below the throttle valve 34 is intended primarily to function as a load regulating device. Thus when the throttle valve is substantially fully closed there will be practically no vacuum thereabove so that the passage 158 despite its large size will be relatively ineffective to move the piston 70 downward. A very small suction effect is accordingly provided through the passage 166 under the control of the needle valve 170 so that under any constant engine load and speed a slight additional suction is operative upon the piston 70. It will be apparent that when the throttle is substantially fully closed the vacuum below the throttle valve is relatively very high as compared with the vacuum above the throttle valve so that the additional suction effect produced by the passage 166 will be relatively high under no load engine conditions. On the contrary, when the engine is under heavy load and the throttle valve 34 substantially fully opened the vacuum differential above and below the throttle valve is quite small so that the additional suction effect of the passage 166 is negligible. It will thus be apparent that the passage 166 operates as a load control having an effect upon the piston 70 such as to produce a slightly richer mixture under high engine load conditions than under low engine load conditions. An additional effect of the passage 166 should be noted in connection with its effect upon the piston 70 under acceleration. When the throttle valve 34 is opened suddenly the pressure within the outlet 28 below the throttle valve tends to increase so that during the acceleration period a relatively smaller degree of suction will be transmitted through the passage 166 with the result that the piston 70 will not be urged downwardly thereby at as great a rate as under closed throttle conditions.

As my improved carburetor is particularly adapted for use upon an automotive vehicle it will be apparent that the motion of the vehicle itself during sudden acceleration will tend to introduce a time lag in operation of the piston 70 due to the greater friction effect of the latter caused by its inertia. In addition to this inertia effect, I have also provided the ring 90 of a relatively heavy or dense material which surrounds the depending tubular skirt 78 of the piston and which will be moved due to its inertia upon vehicle acceleration to increase the effective weight of the piston 70 and thus mechanically impose a further delay or time lag upon movement of the latter during the acceleration period.

All of the factors mentioned above as having a control effect upon the piston 70 to enrich the carburetor mixture during acceleration are equally effective under conditions of deceleration to provide a leaner mixture during such period. In other words, the effect of each of the instrumentalities described above during deceleration is substantially equal and opposite to its effect under acceleration conditions.

Disregarding for a moment the various factors tending to restrict the motion of the piston 70 under acceleration it will be noticed that as the throttle valve 34 is opened causing the piston 70 to move downward the plunger 132 also moves downward into the conduit 62 and in this respect operates somewhat similarly to the usual acceleration pump provided in conventional carburetors. However, as the requirements for liquid fuel is suddenly increased at this time, there is a certain amount of inertia in the fuel itself

which tends to delay its action in reaching the jets 130. At this time the air or other gas trapped within the annular space 124 lying between the reduced bottom portion 122 of the jet body and the conduit 62 operates to cushion and smooth the operation of the fuel circuit due to the elasticity of the gas therein which permits it to expand. The air or gas within the annular space 124 is ordinarily trapped therein from the usual air or gas bubbles occluded with the liquid fuel during normal carburetor operation and is thus continuously replenished.

It will be apparent from a consideration of the control effects described in connection with the above instrumentalities which operate to enrich the carburetor mixture under acceleration conditions that under certain circumstances such, for example, as a very rapid opening of the throttle valve at very low speed the mixture might be unduly richened thereby wasting fuel and adversely affecting acceleration. In order to guard against this eventuality I have provided the impositive throttle valve mounting having a one-way abutting connection with the piston 70. The effect of this throttle valve arrangement is to prevent the throttle valve from opening too wide before the engine speed has increased sufficiently. Thus at very low engine speeds and corresponding high manifold vacuum, operation of the arm 200 by the engine accelerator rotates the outer shaft 162 and by means of the spring connection 186 tends to rotate the valve plate 174 upon its shaft 180. However, the valve plate 174 is prevented from rotating (counterclockwise in Fig. 1) when the piston 70 is in raised position due to the fact that the stop nut 198 abuts against the ear 194 which restrains the valve plate 174 by means of the tie rod 196. The effect of a sudden throttle opening is thus to open the throttle valve slightly and impose a tension upon the spring 186, the valve plate 174 opening somewhat more gradually as the piston 70 moves downward.

An additional operational advantage of my improved throttle valve structure is found in the fact that it provides for automatic engine stalling under extreme or harmful load conditions. The throttle valve and tie rod dimensions are so proportioned that when the valve is open a substantial amount, the piston 70 must be down a certain distance sufficient to accommodate such opening. Thus if the engine should slow down under extremely heavy load while the throttle valve is retained in approximately wide open position, the piston 70 will gradually move upward in the cylinder 10 to a point where it will engage the stop nut 198 and start to close the valve plate 174. If the overload upon the engine is maintained the throttle valve will eventually be substantially completely closed in this fashion so that the engine will be unable to operate.

It will be noted that in the operation of the jet structure of my improved carburetor the liquid fuel admitted through the conduit 62 and jets 130 is subjected to a slight mixing action within the apertures 102 by the auxiliary air admitted through the annular passage 112. In addition to this mixing action the fuel as it leaves the groove 104 in the beveled edge 96 is relatively widely dispersed about the sharp edge of the latter and accordingly will be more finely vaporized as it mixes with the air in the Venturi throat than is the case where a single jet is employed. My improved jet structure in addition to giving a more completely vaporized mixture also tends to retain the richer portion toward the center of the outlet 28 and thus tends to discourage condensation on the sides thereof.

Obviously numerous other modifications, alterations, and deviations from the specific structure disclosed herein as a preferred embodiment solely for the purpose of illustration will occur to one skilled in the art and it is to be understood that numerous changes can be made in size, materials, and arrangement of parts without departing from the principles of this invention as set forth in the appended claims.

Having thus described my invention, what I claim as novel and desire to secure by Letters Patent of the United States is:

1. A downdraft carburetor comprising, a cylinder having an air inlet at its upper end and a mixture outlet at its lower end provided with a throttle valve therein and adapted to be connected to the intake manifold of an internal combustion engine, a piston reciprocable within said cylinder including a tapered intermediate section having a depending tubular skirt reciprocable within said outlet, a plurality of springs supporting said piston from the upper portion of said cylinder, a float chamber formed at one side of said cylinder and providing a substantially constant level of liquid fuel therein, a tubular conduit connected to said float chamber and mounted in said outlet to extend axially upward adjacent the center of said cylinder, a generally cylindrical piston stop mounted on the top of said conduit having a beveled lower edge and including a central cavity having a plurality of radial apertures extending therefrom to said beveled edge, a generally cylindrical jet body secured in said cavity with a reduced diameter lower portion extending downwardly into said conduit including an axial bore therein having a metering orifice at its lower end and a plurality of radial jets connected to said bore and opening into said apertures, a plunger bar mounted on said piston, a tapered plunger adjustably secured to said bar and extending through said orifice, and an air passage interconnecting the interior of said cylinder below said piston and said outlet above said throttle valve whereby said piston may move in response to the pressure differential between said inlet and said outlet.

2. A carburetor comprising, a cylinder having an air inlet and a mixture outlet provided with a throttle valve therein and adapted to be connected to the intake manifold of an internal combustion engine, a piston reciprocable within said cylinder including a tapered intermediate section and a depending tubular skirt reciprocable within said outlet, resilient means for supporting said piston within said cylinder, a conduit mounted to extend axially adjacent the center of said cylinder, means for supplying liquid fuel to said conduit, a generally cylindrical piston stop mounted on the top of said conduit having a beveled lower edge and including a central cavity having a plurality of radial apertures extending therefrom to said beveled edge, a generally cylindrical jet body secured in said cavity with a reduced diameter lower portion extending downwardly into said conduit including an axial bore therein having a metering orifice at its lower end and a plurality of radial jets connected to said bore and opening into said apertures, a plunger bar mounted on said piston, a tapered plunger adjustably secured to said bar and extending through said orifice, and an air passage interconnecting the interior of said cylinder below said piston and said outlet above said

throttle valve whereby said piston may move in response to the pressure differential between said inlet and said outlet.

3. A carburetor comprising a cylinder having an air inlet and a mixture outlet provided with a throttle valve therein and adapted to be connected to the intake manifold of an internal combustion engine, a piston reciprocable within said cylinder including a depending tapered section, resilient means for supporting said piston within said cylinder, a conduit mounted to extend axially adjacent the center of said cylinder, means for supplying liquid fuel to said conduit, a piston stop having a beveled lower edge and including a central cavity connected to said conduit and having a plurality of radial apertures extending therefrom to said beveled edge, a jet body secured in said cavity with a reduced diameter lower portion extending downwardly into said conduit including an axial bore therein having a metering orifice at its lower end and a plurality of radial jets connected to said bore and opening into said apertures, a plunger bar mounted on said piston, a tapered plunger adjustably secured to said bar and extending through said orifice, and an air passage interconnecting the interior of said cylinder below said piston and said outlet above said throttle valve whereby said piston may move in response to the pressure differential between said inlet and said outlet.

4. A carburetor comprising, a cylinder having an air inlet and a mixture outlet provided with a throttle valve therein and adapted to be connected to the intake manifold of an internal combustion engine, a piston reciprocable within said cylinder including a depending tapered section, resilient means for supporting said piston within said cylinder, a conduit mounted to extend axially adjacent the center of said cylinder, means for supplying liquid fuel to said conduit, a piston stop having a beveled lower edge and including a central cavity connected to said conduit and having a plurality of radial apertures extending therefrom to said beveled edge, a jet body secured in said cavity with a reduced diameter lower portion extending downwardly into said conduit including an axial bore therein having a metering orifice at its lower end and a plurality of radial jets connected to said bore and opening into said apertures, a tapered plunger having mechanical connection with said piston and extending through said orifice, and an air passage interconnecting the interior of said cylinder below said piston and said outlet above said throttle valve whereby said piston may move in response to the pressure differential between said inlet and said outlet.

5. A carburetor comprising, a cylinder having an air inlet and a mixture outlet provided with a throttle valve therein and adapted to be connected to the intake manifold of an internal combustion engine, a piston reciprocable within said cylinder including a depending tapered section, a conduit mounted to extend axially within said cylinder, means for supplying liquid fuel to said conduit, a piston stop having a beveled edge and including a central cavity connected to said conduit and having a plurality of radial apertures extending therefrom to said beveled edge, a jet body secured in said cavity and forming with the latter an annular space connecting said apertures to said air inlet, adjustable means for controlling the admission of air to said space, said body further including a lower portion extending downwardly into said conduit of smaller diameter than the latter to form an air chamber therebetween, an axial bore in said body providing a metering orifice in said lower portion, and a plurality of radial jets opening from said bore into said apertures, a tapered plunger having mechanical connection with said piston and extending through said orifice, resilient means urging said tapered section against said beveled edge, and an air passage interconnecting the interior of said cylinder below said piston and said outlet above said throttle valve whereby said piston may move in response to the pressure differential between said inlet and said outlet.

6. A carburetor comprising, a cylinder having an air inlet and a mixture outlet provided with a throttle valve therein and adapted to be connected to the intake manifold of an internal combustion engine, a piston reciprocable within said cylinder including a depending tapered section, a conduit mounted to extend axially within said cylinder, means for supplying fuel to said conduit, a piston stop having a beveled edge and including a central cavity connected to said conduit and having a plurality of radial apertures extending therefrom to said beveled edge, a jet body secured in said cavity and forming with the latter an annular space connecting said apertures to said air inlet, adjustable means for controlling the admission of air to said space, an axial bore in said body having a metering orifice therein and a plurality of radial jets opening from said bore into said apertures, a tapered plunger having mechanical connection with said piston and extending through said orifice, resilient means urging said tapered section against said beveled edge, and an air passage interconnecting the interior of said cylinder below said piston and said outlet above said throttle valve whereby said piston may move in response to the pressure differential between said inlet and said outlet.

7. A carburetor comprising, a cylinder having an air inlet and a mixture outlet provided with a throttle valve therein and adapted to be connected to the intake manifold of an internal combustion engine, a piston reciprocable within said cylinder including a depending tapered section, a conduit mounted to extend axially within said cylinder, means for supplying fuel to said conduit, a piston stop having a beveled edge and including a plurality of radial apertures connected to said conduit and extending therefrom to said beveled edge, means forming a metering orifice between said apertures and said conduit, a tapered plunger having mechanical connection with said piston and extending through said orifice, resilient means urging said tapered section against said beveled edge, and an air passage interconnecting the interior of said cylinder below said piston and said outlet above said throttle valve whereby said piston may move in response to the pressure differential between said inlet and said outlet.

8. A carburetor comprising, a cylinder having an air inlet and a mixture outlet provided with a throttle valve therein and adapted to be connected to the intake manifold of an internal combustion engine, a piston reciprocable within said cylinder and having an opening in its center portion, a conduit mounted to extend axially within said cylinder, means for supplying fuel to said conduit, a piston stop adapted to contact said piston adjacent said opening and including a plurality of radial apertures connected to said conduit and extending therefrom

to the contact region of said piston and said stop, means forming a metering orifice between said apertures and said conduit, a tapered plunger having mechanical connection with said piston and extending through said orifice, resilient means urging said piston against said stop, and an air passage interconnecting the interior of said cylinder below said piston and said outlet above said throttle valve whereby said piston may move in response to the pressure differential between said inlet and said outlet to cause said plunger to variably meter the quantity of fuel flow through said orifice in accordance with the volume of air flow past said apertures to automatically maintain a correct fuel-air ratio at various engine speeds.

9. A carburetor comprising, a cylinder having an air inlet and a mixture outlet provided with a throttle valve therein and adapted to be connected to the intake manifold of an internal combustion engine, a piston reciprocable within said cylinder and having an opening in its center portion, a piston stop adapted to contact said piston adjacent said opening and including a plurality of radial apertures therein, means for supplying fuel to said apertures, a metering orifice interposed between said fuel supplying means and said apertures, a tapered plunger having mechanical connection with said piston and extending through said orifice, resilient means urging said piston toward said stop, a first air passage extending from the interior of said cylinder below said piston to said outlet above said throttle valve, adjustable means for restricting flow through said first passage, a second air passage extending from the interior of said cylinder below said piston to said outlet below said throttle valve, and adjustable means for restricting flow through said second passage, said piston and plunger being simultaneously movable in response to vacuum transmitted through said first passage to maintain a correct fuel-air ratio at various engine speeds and being simultaneously movable in response to vacuum transmitted through said second passage to vary said fuel-air ratio under varying conditions of engine load.

10. A carburetor comprising, a cylinder having an air inlet and a mixture outlet provided with a throttle valve therein and adapted to be connected to the intake manifold of an internal combustion engine, a piston reciprocable within said cylinder having an opening in its center portion, a piston stop adapted to contact said piston adjacent said opening and including a plurality of radial apertures therein, means for suppiying fuel to said apertures, a metering orifice interposed between said fuel supplying means and said apertures, a tapered plunger having mechanical connection with said piston and extending through said orifice, means urging said piston toward said stop, a first air passage extending from the interior of said cylinder below said piston to said outlet above said throttle valve, adjustable means for restricting flow through said first passage, and a second air passage extending from the interior of said cylinder below said piston to said outlet below said throttle valve, said piston and plunger being simultaneously movable in response to vacuum transmitted through said first passage to maintain a correct fuel-air ratio at various engine speeds and being simultaneously movable in response to vacuum transmitted through said second passage to vary said fuel-air ratio under varying conditions of engine load.

11. A carburetor comprising, a cylinder having an inlet and an outlet provided with a throttle valve therein and adapted to be connected to an internal combustion engine, a piston reciprocable within said cylinder having an opening in its center portion, a piston stop adapted to contact said piston adjacent said opening and including a plurality of radial apertures therein, means for supplying fuel to said apertures, a metering orifice interposed between said fuel supplying means and said apertures, a tapered plunger having mechanical connection with said piston and extending through said orifice, means urging said piston toward said stop, a passage extending from the interior of said cylinder below said piston to said outlet above said throttle valve, and adjustable means for restricting flow through said passage, said piston and plunger being simultaneously movable in response to vacuum transmitted through said passage to maintain a correct fuel-air ratio at various engine speeds.

12. A carburetor comprising, a cylinder having an inlet and an outlet provided with a throttle valve therein and adapted to be connected to an internal combustion engine, a piston reciprocable within said cylinder having an opening therein, a piston stop adapted to contact said piston adjacent said opening and including an aperture therein, means for supplying fuel to said aperture, a metering orifice interposed between said fuel supplying means and said aperture, a tapered plunger having mechanical connection with said piston and extending through said orifice, means urging said piston toward said stop, and a passage extending from the interior of said cylinder below said piston to said outlet above said throttle valve, said piston and plunger being simultaneously movable in response to vacuum transmitted through said passage to maintain a correct fuel-air ratio at various engine speeds.

13. A carburetor comprising, a cylinder having an outlet adapted to be connected to an internal combustion engine, a piston reciprocable within said cylinder including a tubular skirt reciprocable within said outlet and defining an opening in said piston, a piston stop engageable with said piston to vary the size of said opening and including an aperture therein, means for supplying fuel to said aperture, a metering orifice interposed between said fuel supplying means and said aperture, a tapered plunger having mechanical connection with said piston and extending through said orifice, means urging said piston toward said stop, a counterbalance connected to said piston for resisting vertical inertia forces thereon, a ring of heavy material loosely surrounding said skirt and engageable with the latter by inertia to increase the effective weight thereof under horizontal acceleration loads, a throttle valve in said outlet, means impositively interconnecting said skirt and said valve to limit opening movement of the latter in accordance with the position of said piston, and a passage extending from the interior of said cylinder below said piston to said outlet above said valve whereby said piston and plunger may move simultaneously in response to vacuum transmitted through said passage to maintain a correct fuel-air ratio at various engine speeds.

14. A carburetor comprising, a cylinder having an outlet adapted to be connected to an internal

combustion engine, a piston reciprocable within said cylinder including a tubular skirt reciprocable within said outlet and defining an opening in said piston, a piston stop engageable with said piston to vary the size of said opening and including an aperture therein, means for supplying fuel to said aperture, a metering orifice interposed between said fuel supplying means and said aperture, a tapered plunger having mechanical connection with said piston and extending through said orifice, means urging said piston toward said stop, a ring of heavy material loosely surrounding said skirt and engageable with the latter by inertia to increase the effective weight thereof under horizontal acceleration loads, a throttle valve in said outlet, means impositively interconnecting said skirt and said valve to limit opening movement of the latter in accordance with the position of said piston, and a passage extending from the interior of said cylinder below said piston to said outlet above said valve whereby said piston and plunger may move simultaneously in response to vacuum transmitted through said passage to maintain a correct fuel-air ratio at various engine speeds.

15. A carburetor comprising, a cylinder having an outlet adapted to be connected to an internal combustion engine, a piston reciprocable within said cylinder including a tubular skirt reciprocable within said outlet and defining an opening in said piston, a piston stop engageable with said piston to vary the size of said opening and including an aperture therein, means for supplying fuel to said aperture, a metering orifice interposed between said fuel supplying means and said aperture, a tapered plunger having mechanical connection with said piston and extending through said orifice, means urging said piston toward said stop, a throttle valve in said outlet, means impositively interconnecting said skirt and said valve to limit opening movement of the latter in accordance with the position of said piston, and a passage extending from the interior of said cylinder below said piston to said outlet above said valve whereby said piston and plunger may move simultaneously in response to vacuum transmitted through said passage to maintain a correct fuel-air ratio at various engine speeds.

16. A carburetor comprising, a cylinder having an outlet adapted to be connected to an internal combustion engine, a piston reciprocable within said cylinder having an opening therein, a piston stop engageable with said piston to vary the size of said opening and including an aperture therein, means for supplying fuel to said aperture, a metering orifice interposed between said fuel supplying means and said aperture, means having mechanical connection with said piston for varying the effective size of said orifice, means urging said piston toward said stop, and a passage extending from the interior of said cylinder below said piston to said outlet whereby said piston may move in response to vacuum transmitted through said passage to maintain a correct fuel-air ratio at various engine speeds.

17. A carburetor comprising, a cylinder having an outlet adapted to be connected to an internal combustion engine, a piston reciprocable within said cylinder having an opening therein, a fuel supply conduit secured to said cylinder, a piston stop mounted on said conduit and engageable with said piston to vary the size of said opening, said stop including an aperture opening into said conduit, a metering orifice in said conduit, a tapered plunger operatively associated with said orifice for varying the effective size thereof, bracket means mounting said plunger on said piston, means urging said piston toward said stop, and a passage extending from the interior of said cylinder below said piston to said outlet for applying vacuum to said piston to simultaneously vary the size of said opening and of said orifice, said conduit and said bracket means being made of a material having a coefficient of expansion different from that of said piston and cylinder whereby slight relative movements between said plunger and orifice are effected in response to temperature changes to automatically vary the fuel-air mixture in accordance therewith.

18. A carburetor comprising, a cylinder having an outlet adapted to be connected to an internal combustion engine, a piston reciprocable within said cylinder having an opening therein, a fuel supply conduit secured to said cylinder, a piston stop mounted on said conduit and engageable with said piston to vary the size of said opening, said stop including an aperture opening into said conduit, a metering orifice in said conduit, means for varying the effective size of said orifice, means urging said piston toward said stop, and a passage extending from the interior of said cylinder below said piston to said outlet for applying vacuum to said piston to simultaneously vary the size of said opening and of said orifice, said conduit being made of a material having a coefficient of expansion different from that of said cylinder whereby slight relative movements between said plunger and orifice are effected in response to temperature changes to automatically vary the fuel-air mixture in accordance therewith.

19. A carburetor comprising, a cylinder having an inlet and an outlet provided with a throttle valve therein and adapted to be connected to an internal combustion engine, a piston reciprocable within said cylinder having an opening therein, a piston stop adapted to contact said piston adjacent said opening and including an aperture therein, means for supplying fuel to said aperture, a metering orifice interposed between said fuel supplying means and said aperture, a plunger having a substantially cylindrical upper portion and a variably tapered lower portion, said plunger having mechanical connection with said piston and extending through said orifice, a washer surrounding the cylindrical portion of said plunger for preventing the admission of air to said orifice, means urging said piston toward said stop, and a passage extending from the interior of said cylinder below said piston to said outlet above said throttle valve, said piston and plunger being simultaneously movable in response to vacuum transmitted through said passage to maintain a correct fuel-air ratio at various engine speeds.

20. A carburetor comprising, a cylinder having an inlet and an outlet provided with a throttle valve therein and adapted to be connected to an internal combustion engine, a piston reciprocable within said cylinder having an opening therein, a piston stop adapted to contact said piston adjacent said opening and including an aperture therein, means for supplying fuel to said aperture, a metering orifice interposed between said fuel supplying means and said aperture, a plunger having a substantially cylindrical upper portion and a variably tapered lower portion, said plunger having mechanical connection with said piston

and extending through said orifice, means urging said piston toward said stop, and a passage extending from the interior of said cylinder below said piston to said outlet above said throttle valve, said piston and plunger being simultaneously movable in response to vacuum transmitted through said passage to maintain a correct fuel-air ratio at various engine speeds.

CHESTER W. BROWN.




## REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

| Number | Name | Date |
|---|---|---|
| 1,995,110 | Wahlmark | Mar. 19, 1935 |
| 2,393,118 | Oswald | Jan. 15, 1946 |