

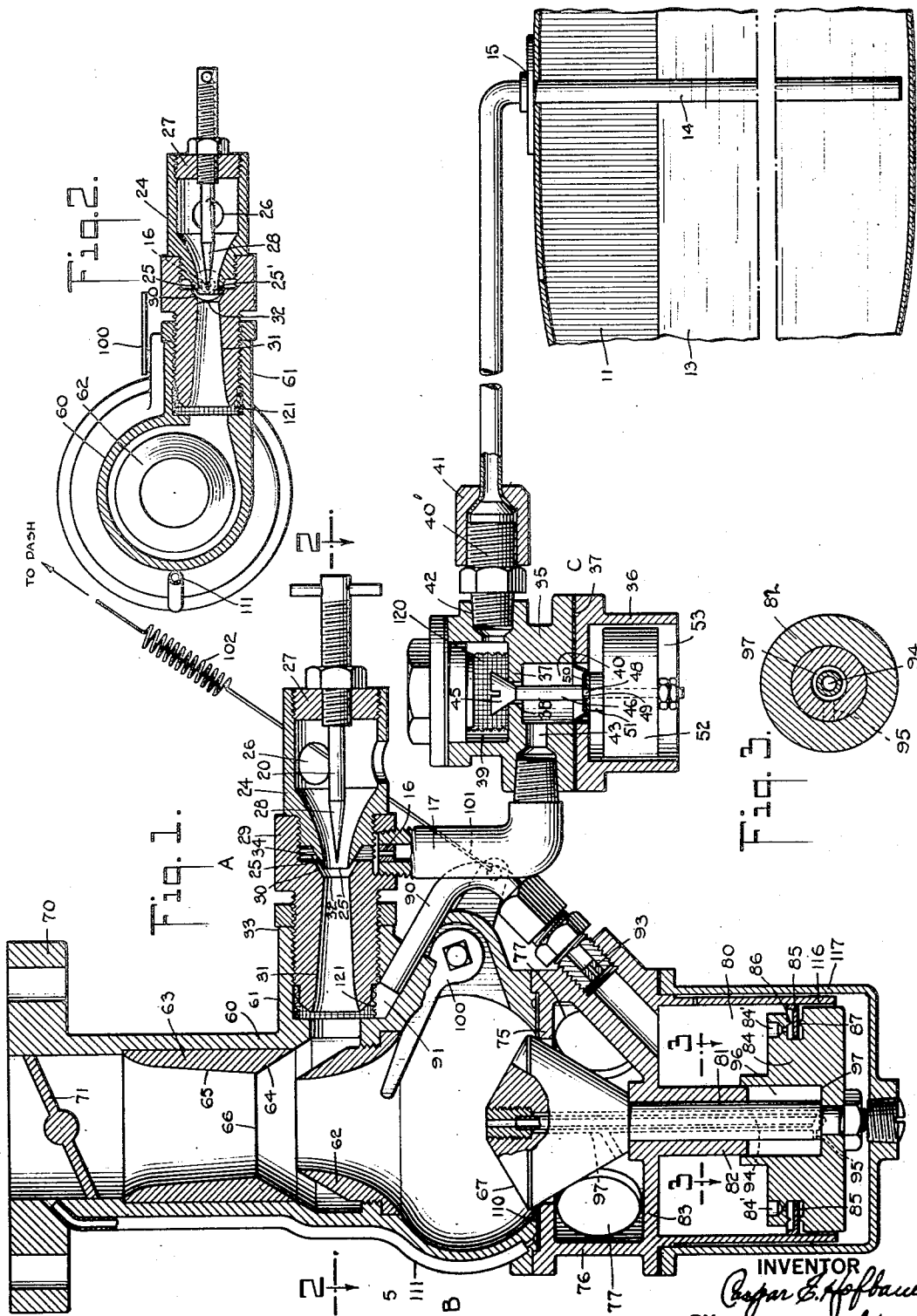
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CARBURETOR SYSTEM

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CARBURETOR SYSTEM

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My invention generally relates to an arrangement whereby a mixture of air and gas having a constant ratio is supplied to the engine under all running conditions and in accordance with the requirement of such conditions and in one of its phases, relates to an arrangement whereby the variation in the fuel level of the tank incident to gas consumption or to operating conditions is eliminated as a variant factor in the fuel feed.

In another of its phases, my invention relates to a carbureting system and has particular reference to means for supplying fuel for internal combustion engines and co-ordinately involves an arrangement whereby fuel normally positioned at a low level is automatically fed to the point of combustion in accordance with the requirements of the engine operation, and during its passage thereto is converted into a combustible mixture of fuel and air, and more particularly relates to a carbureting system of the character set forth in which the variation of the liquid level in the fuel tank is eliminated as a variant factor of the carbureting system.

While I will herein describe and illustrate the first-mentioned phase of my invention as associated with and incorporated as part of my novel fuel feeding system because it serves markedly to improve the feeding of fuel under the conditions and circumstances and in the manner herein disclosed, it will be understood that this phase serves a much wider field of utility, and that as to its broader features, the disclosure of a compensating device of the character herein described in connection with my fuel feeding system is to be interpreted merely as illustrative of one of its applications and not as limitative unless otherwise specifically set forth in the claims.

In a fuel feeding system, for example, of the character herein illustrated, one of the factors affecting the feed of fuel from a tank, particularly from a tank at a low level, is the change in the fuel level incident not only to running conditions, but also to lowering of the level as the fuel is consumed; and one of the important objects of my invention is the provision of an arrangement whereby the ef-

fect of the work done in lifting the fuel from the tank is uniform regardless of the varying distances the fuel has to be lifted as the fuel level changes or drops.

As to the carbureting system herein disclosed, the flow induced by the induction in the intake manifold is proportioned between air and fuel so that a mixture is produced which will move from a point of fuel supply, which may be at a lower level, and a feature of the operation of my fuel supply system is such that the diminished pressure head resulting from the minimum induction in the intake manifold at operating conditions of an automobile engine will form what I term a primary mixture capable of retaining its characteristics due to a partial mixture therewith in the manner to be set forth of a quantity of air also initially induced by the pressure in the intake manifold.

In the embodiment of the invention herein disclosed wherein conditions exist so that the rate of flow induced by the intake manifold is that of the speed of varying operating conditions, the parts of my system are so arranged and constructed that this primary mixture contains a proportion of fuel and air which falls short of forming a mixture adaptable for normal engine operation, but contains a sufficient air content to maintain the fuel in its pre-determined condition of comminution and vaporization during its traverse from the point of initial admixture to the point of predetermined modification to provide the most efficient operating mixture.

Another feature of the operation of the apparatus herein disclosed comprises an arrangement whereby the inductive effect of the manifold intake is proportioned as between air and fuel so that it causes not only a flow of the primary mixture but also an admixture of additional air therewith so as to change the primary mixture to a more perfect combustible charge, and with an increase in the inductive effect above the minimum there will be an acceleration in the flow of both the primary mixture and the additional air, so proportioned and related as to produce a correctly proportioned mixture suitable for and responsive to all running condi-

tions. In the specific embodiment herein disclosed, this arrangement is such that with the acceleration in flow of the primary mixture, in accordance with the variations in the running conditions and with its modification to a more efficiently combustible charge by increasing the ratio of air to fuel, the mixture so formed will be automatically predetermined as to the ratio of the air to the fuel, and will be supplied in accordance with running requirements.

Further features of my apparatus include the construction and arrangement of parts to control the air flowing toward an engine cylinder, to proportionately meter the air and cause the air to receive and become mixed with the amount of fuel it can support, means being provided to cause a proportioning of air to fuel or air to a fuel mixture under all conditions. These conditions include those involving a pulsating flow and those which involve rapid changes in the rate of flow as a change from low speeds to high speeds and vice versa. The mixture is free from the defects normally encountered due to the inertia of either any moving parts controlling the ratio of air to fuel or of portions of a fuel mixture.

My invention further contemplates the provision of apparatus which will proportion the flow induced by the intake manifold as between an air supply and fuel, or an air supply and a fuel mixture and in the combination therewith of means for attaining such admixture, comprising fuel mixing means, which eliminates the inertia due to movement of a liquid fuel, the parts being so constructed and arranged that the air stream and the fuel mixture stream are responsive without material and relative lag between them to produce an explosive combustion mixture under all conditions normally encountered in an automobile engine.

An important object of the invention is the provision of means for automatically modifying the primary mixture so as to provide a proportioning of air and fuel under all working conditions, which gives maximum results.

Another important object of the invention is the provision of means which automatically modifies the primary mixture and at the same time automatically controls the quantity thereof in correct proportion, thus producing a substantially correct final mixture.

Still further, more specific embodiments of my invention contemplate the provision in a carbureting system of a primary fuel supply and of means to correct the mixture so formed including an air control automatically variable, in accordance with requirements, there being combined therewith additional means to accelerate the supply of fuel when an instantaneous full throttle opening is made.

In the specific embodiment of my invention, illustrated in the drawings, the parts of my carbureting system are so constructed and arranged as to produce a turbulent eddying of the fuel or of the fuel mixture in relation to the flow of a stream of air to produce a substantially complete change of the fuel from a liquid to a gaseous condition and to produce a fuel mixture more nearly resembling in characteristic that of the air supply, for perfecting it for combustion purposes so that the flow induced by the intake manifold may be proportioned between the fuel mixture and air without material and relative lag in responsiveness of the supply.

For eliminating the variations or changes in the fluid level in the tank as a varying factor, so as to provide for a constant and uniform level in the fuel fed therefrom under predetermined suction conditions, I have illustrated in connection with the carbureting system above referred to, the provision whereby not only is the fuel fed from what is in fact, a constant level, but the fuel is fed to the engine under a constant reduced pressure head regardless of the pressure conditions present in my system and incident to the operation of the engine.

As one of the objects of my invention is to provide for this, without any necessity of in any way modifying the standard fuel tank with which automobiles are supplied, it is an object of my invention to position this arrangement exteriorly of the tank, and in accordance with the embodiment of my invention herein illustrated, this arrangement comprises in a general way a member so arranged as to maintain on one side thereof the predetermined reduced pressure under which it is desired that the fuel be fed to the engine and on the other side, the required suction lift necessary to lift the fuel from the tank.

Although I have illustrated and shall describe my fuel feeding system and level standardizing means as applied to internal combustion engines of the character generally associated with an automobile, nevertheless it will be understood that numerous phases and features of my invention will have a much larger field of utility, and it is not my intention to limit myself to a use of this character nor to structural features which are peculiar to or necessary for such an application.

One of the important features of my invention resides in the fact that in the formation of the mixture incident to the lowered pressure head in the intake manifold, the correct proportioning of the air and the gas is predetermined wholly by an air control responsive to pressure conditions in the intake manifold so that there is attained all the advantages which arise where the air factor is the only factor that is variably controlled.

Among the specific objects of my invention,

briefly stated, are: the provision of an arrangement whereby the control by a moving element is limited to the air factor in the production of an air fuel ratio; the provision of an arrangement whereby a primary mixture too rich to be employed for ordinary vehicle purposes, and of a substantially predetermined or fuel ratio is formed under all engine operating conditions; the provision of an arrangement whereby the control of the air factor to convert the primary mixture into the final mixture is operative under all engine operating conditions and automatically responsive thereto; the provision of an arrangement whereby the flow of fuel from the rear tank responsive to all engine operating conditions is so automatically controlled as to eliminate the changing level in the fuel tank as a variant and to give the effect of a constant fuel tank level; the provision of an arrangement whereby the mixture of the air in the gas is so controlled at the point of mixture so as to cause the production of an intimate mixture of air with the fuel in the finely comminuted state.

The objects, generally, of my invention are to provide a carbureting system which will be peculiarly efficient wherein the character of the mixture is maintained at maximum efficiency at all running conditions and the quantity of the mixture supplied for combustion purposes are automatically controlled in a manner to give maximum operative conditions with a minimum of waste and wherein the necessity for frequent precise adjustments are absent, the apparatus comprising relatively simple parts, inexpensive to manufacture and assemble, necessitating no time consuming or expensive, accurate designing or manufacture and extremely unlikely to be defective or mal-adjusted after once having been installed and operated.

For the attainment of the foregoing objects and such further objects as may appear herein or be hereinafter pointed out, I make reference to the accompanying drawing illustrating one form of my invention in which:

Figure 1 is a cross sectional elevation through the main elements of my carbureting system, certain parts being omitted for the sake of clarity of illustration;

Figure 2 is a fragmentary cross sectional plan view taken on the line 2—2 of Figure 1; and

Figure 3 is a section taken in line 3—3 of Figure 1.

Referring to the drawings, and particularly to Figure 1, I have shown the main elements of my system comprising a primary lifting and mixing device (portion A) Figure 1) and a secondary control and mixing mechanism associated in relatively close proximity to and adjacent the engine (see portion B, Figure 1) and a connecting conduit between these portions of the system.

Referring now to the portion A, it will be observed that I have shown the fuel tank 11 with a supply of liquid fuel such as gasoline 13 therein. Mounted within the tank and extending downwardly into the fuel is a pipe or conduit 14 open at the bottom and terminating short of the lowermost portion of the tank. This pipe 14 may be suitably mounted in the tank by means of a flanged collar 15 or the like, to which the upper end of the pipe 14 is attached.

Referring now to the primary aspirating and mixing device A, one embodiment contemplates the provision of an air intake element 24 provided with a forwardly projecting nozzle 25, a portion of the outer walls of the latter being externally threaded to engage within the fitting 29. It is contemplated that atmospheric air will enter into the element 24 and will be drawn through the nozzle 25.

Although the detailed construction of the element 24 will be more or less optional, I illustrate it in the drawings as in the form of a substantially cylindrical element having a number of openings 26 in its walls and provided at its outer end with a closure element 27. Preferably, I provide a tapering adjusting element 28 in the form usually found in a needle valve having bearing within the closure 27, for movement along the axial line thereof and which is adjustable by screw threaded engagement for the purpose of establishing a means of adjustment and control of the area within the nozzle for purposes that will more fully be pointed out.

There is provided a separate fitting 29 having a bore therethrough which comprises two conical portions 30 and 31 converging towards the central portion to a more restricted junction 32 which however presents a slightly smaller opening than the restricted discharge 25' through the element 25. The fitting 29 is suitably externally threaded at its one end so that one end thereof may make engagement with the element 24, and is also threaded externally at its opposite end so that a suitable union 33 may be made to engage over such threaded end of the fitting 29 to establish connection between the latter and the main casing. It will be observed that the bore through the fittings 24 and 29 gives a change of velocity to any material flowing therethrough, and for this purpose, in my preferred form, this bore is made in the form of a Venturi tube. This venturi is made up in part of the nozzle 25 and of the bore 31. That conical portion of the venturi which is disposed toward the fitting 25 is more abrupt in angularity and shorter than the other portion 31 which communicates with the main casing. It will be observed that the nozzle 25 is so constructed as to be spaced from and project into the conically bored portion 30. It will be further observed that an annular

chamber 34 is thereby produced encircling the end of the nozzle 25 and communicating with the space between the constricted portion 25' of the nozzle and the constricted portion 32 of the Venturi member 29.

Before proceeding with the more detailed description of the other elements of the carbureting device, the operation of the primary lifting means and of the primary aspirating device will be elaborated. The invention contemplates the provision of a substantial suction and flow through the venturi. This flow not only draws air inwardly through the openings 26 and into and through the nozzle 25, but it serves to draw fuel in liquid condition up through the pipe 17 into the primary mixing chamber.

The fuel level in the tank will vary not only with running conditions, but also will gradually be lowered as the fuel is consumed. The distance the fuel has to be lifted will therefore vary, depending upon the tank level. The pressure or suction head, on the other hand, is dependent wholly upon the engine condition at the intake manifold. The fuel feed from the rear tank will therefore not be predetermined and uniform and one of the objects of my invention is the provision, which I will now explain, for eliminating this variation in the fuel level as a variant effecting the feed of the fuel.

At "C" in Figure 1, I show a casing made up of two parts 35 and 36 between which is securely held a diaphragm 37 which may be made of silk treated with oil or with bakelite, although it will be understood that while these materials are preferred by me, the use of these particular characters of materials is not essential to the operation of my carbureting system. The casing part 35 is divided into two halves by the partition 37 having the passageway or opening 38 there-through, thus forming two chambers 39 and 40 connected by this passageway. The pipe 14 discharges into the upper chamber 39 through the tube 40' to which it is locked by means of the nut 41. The tube 40 in turn is threaded into the opening 42 which leads into the chamber 39. The lower chamber 40 which is closed by the diaphragm 37 discharges through the opening 43 into the threaded mouth of the tube 17.

A valve 45 controls the opening 38. Depending from the valve is the stem 46 which is locked to the top portion 47 of the diaphragm in any preferred or desired manner. In the illustrated embodiment, I do this by narrowing the stem as shown at 48 to provide the shoulder 49, the cut part 48 of the diaphragm being received between the washer 50 below this shoulder and the widened annulus 51. Carried by the lower end of the stem is the piston 52 moving freely in the chamber 53 formed in the lower part of the

casing 36, and open to the atmosphere so that the piston is also open to the atmosphere.

The reduced pressure in the chamber 40 is predetermined by the amount of suction required to lift the valve 45 from off its seat and which, for example, in an apparatus that I have constructed, is the suction necessary to lift gasoline 36". The pressure in the chamber 39 and in the line to the tank is predetermined by the suction lift required by the level in the fluid of the tank and any decrease in the flow of the fluid in the line from the tank to the chamber 39 will tend to build up a pressure in the chamber 40 beyond that stated which will be broken by the valve being lifted to a wider open position. The reverse conditions will be true where the level of the tank rises for any reason whatsoever. My carbureting system is so constructed and devised that it will deliver a pressure under all operating conditions of the engine, which will be sufficient to maintain in the chamber 40 the constant pressure referred to which is sufficient to lift the gasoline from the rear tank under the lowest possible tank level. By my system therefore the fuel is lifted from the tank into the chamber 39 which thus becomes a constant level chamber and then is fed from this chamber in accordance with engine requirements under the constant reduced pressure of the chamber 40. It will be understood of course that the system as a whole, is so arranged that it will operate to lift fuel from the tank under all possible running conditions.

The fuel passing through the pipe 17 is then drawn to the restricted opening 16 and into the chamber formed between the fittings 24 and 29. This chamber, as will be observed, is so formed as to cause the fuel to take the form of a hollow inclined annulus which is discharged into the venturi at the point 32 which is the narrowest part of the venturi, and there meets with and is accelerated by the flow of the column of a solid column of air through the nozzle 25. As a result of this arrangement, to which I apply the expression "primary lifting and aspirating means", not only is a mixture of air and gas formed of a substantially uniform character, but the fuel is caused to assume a finely comminuted condition and to be mixed with the air in a manner so as to form a stable primary mixture. The parts of my carbureting system are so arranged and constructed that this primary mixture of air and gas is of a character too rich to be employed for ordinary engine operation, and I will now proceed to describe the manner in which this primary mixture is converted into a mixture which is uniform as to its ratio of gas to air, and which is fed to the engine at a rate in accordance with engine requirements under all running conditions.

Referring now more particularly to the

left hand portion "B", of Figure 1, it will be observed that the forward end of the Venturi fitting 31 is suitably associated with and connected to a main casting or member 60 by being threaded into an internally threaded neck 61, integral with the casting 60.

The neck 61 is so arranged with respect to the casting 60 as to direct the primary mixture into an annular chamber similar to, but larger than the primary mixing chamber 34, the mixture being preferably lead into the annular chamber in a direction tangential to the periphery. (See Figure 2.) This chamber will be hereinafter referred to as the secondary mixing chamber, and constitutes a portion of the secondary mixing or controlling device hereinbefore referred to tending to perfect the mixture first formed.

The secondary mixing chamber is constituted by an upwardly disposed member 62 mounted within an inwardly directed annular flange integral with the casting 60 and arranged slightly below the neck 61. The member 62 tapers upwardly and is of a length preferably to completely block the direct path of the fuel mixture coming in through the neck 61. Within the upper portion of the casting 60, there is arranged a bushing or fitting 63 having a bore which comprises two inwardly converging portions 64 and 65 in a manner similar to the portions 30 and 31 of the fitting 29. The lower of these portions 64 is more steeply conical than the upper, and merges with the upper portion 65 at a constricted junction 66. The member 62 is designed and arranged to project slightly into and nest within the portion 64 and is shown in the drawings as having its discharge end smaller than and spaced from the constricted part 66, and arranged so as to discharge concentrically therethrough. Above the bushing 63, the casting 60 is provided with a flange 70 adapted for connection to the intake manifold of the engine in any of the number of well-known ways; and within the upper portion of the casting 60, the usual throttle valve 71 is provided.

Before describing in detail the automatic operation of the elements, it may be explained that it appears that under all conditions of operation additional air is drawn upwardly through the members 62 under controlled conditions by the suction produced within the intake manifold. This air attains a great velocity at the upper end of the member 62, and it will be readily understood that the fuel mixture which has been caused to swirl around the secondary mixing chamber will be picked up and directed upwardly through the fitting 63 along with this additional air entering through member 62. Additional mixing and vaporizing will occur as the mixture passes through the constriction 66.

The controlling device comprises a conical valve 67 normally resting by gravity upon and

closing an opening produced by an internal flange 75 below the member 62. The flange 75 constitutes the upper wall of an air intake element 76 which is substantially cylindrical and is provided with openings 77 for the admission of air. The intake element 76 is considerably larger than the intake element 24, as are the openings 77 with respect to the openings 26, and it will be understood that the main portion of the air necessary for the formation of a proper mixture is supplied through the element 76.

The valve 67 is more or less controlled in its movement by the dash-pot arrangement shown as carried below the element 76. More particularly, I prefer to provide a chamber 80 adapted to contain liquid, and I have shown the valve 67 provided with a downwardly projecting stem 81, the latter being slidably mounted within a bearing portion 82 depending from the lower wall 83 of the chamber 76. At its lower end, the stem 82 is provided with a piston 84 or the like, presenting an increased area to the liquid whereby the movement of the valve 67 will be suitably retarded and dampened.

The dampening piston 84 has associated therewith a secondary piston 85 in the form of a thin disc of large diameter and arranged to prevent a greater retarding surface and has a lost motion connection with the stem 82 as follows: The secondary piston 85 is received in a reduced portion of the piston 84 so as to permit of a free limited movement of the secondary piston 85. Spacing circular spurs or ridges 86 and 87 serve to hold the disc 85 away from contact with the primary piston 84. The effect of this two part damper is to provide a greater initial retardation of the upward movement of the valve 67, than on the downward movement thereof, because on the upward movement of the valve 67 the pistons 84 and 85 will move together from the time of initiation of such movement, whereas on the downward movement of the valve 67, the stem 82 and the piston 84 will move relatively to the piston 85 at the beginning of the movement.

The disc piston 85 as will be observed upon viewing Figure 3 of the drawing has its inner edge so dimensioned and arranged as to fit loosely on the piston 84 so as to provide a clearance between this edge and the adjacent wall of the piston. The outside edge of the piston 85 is however so arranged as to provide a rather close fit inside of the wall or skirt 116 of the chamber 80. Inside of the upper circular ridge 86, the piston 84 is provided with one or more openings 84', therethrough.

As a result of this arrangement, it will be understood that not only is the disc piston 85 self-aligning and always true as to its position in the chamber 80 but also upon the unsetting of the disc piston 85 from its position

as shown in the drawings, which occurs on the downward movement of the piston 84, a free passage is provided through the opening or openings 84' and through the clearance around the inner edge of the piston 85 to beneath the piston 84. In this way, the downward movement of the piston is caused to be made more quickly than the upper movement under the same character of impulse.

It is of course desirable that the starting mixture have an increased richness, and in order to control the continuation of this supply of relatively rich mixture, the valve 67 may be arranged and constructed to permit manual control thereof. For this purpose, I may employ a manually controllable lever 100, the outer end of which may be operated by a lead 101 of which a spring 102 forms a part from a suitable point on the dashboard so that it may be controlled. The inner end of the lever is arranged to engage the upper end of the valve 67. In this manner, what amounts to an increased weight may be given the valve.

Once the engine has started, the suction will immediately operate to lift the valve 67 off of its seat. This lifting movement will be initially retarded by the piston 84, and the amount of opening produced by the valve 47 will depend upon the speed of the engine. At any constant rate of speed, the valve 67 will flutter or float at a predetermined point, to permit the admission of a predetermined amount of air through the openings 77. It will be understood that the valve 67 will remain off its seat in all conditions of engine operation.

It will therefore be seen that a vacuum will be serving to provide a primary or basic, somewhat vaporous mixture throughout the running period of the engine. The parts are so proportioned and arranged that this initial mixture is richer than that required for normal automobile engine operation, and it will be observed that the secondary mixing chamber accomplishes the function, among other things, of reducing the richness of the mixture.

It will be further observed that the final richness is controlled by the amount of air supplied through the openings 77 instead of by a needle valve of the usual type which controls the amount of gasoline. Inasmuch as a suitable mixture comprises proportions of air and fuel in the neighborhood of 13 to 1, it will be obvious that the control of the "14" factor instead of the "1" factor will render inaccuracies of design and maladjustment of parts less effective in causing defective operation. I consider this an important feature of my invention.

Another feature which I consider of great importance is the arrangement whereby fuel in sprayed or vaporized condition is picked

up from an annular chamber by air passing through said chamber in an axial direction. This feature will be clearly observed in connection with both the primary and secondary mixing chambers, and it will be obvious to those skilled in the art that an arrangement of this character is fundamentally different from that employed in connection with the ordinary carburetor in that conditions are attained wherein the flow induced by the intake manifold is more accurately proportioned between air and fuel or air and fuel mixture because each agent is conditioned or prepared to be more readily responsive in supply.

A particular feature of the present invention resides in utilizing gasoline as the retarding liquid within the chamber 80. For this purpose, a conduit 90 is made to communicate with the bottom of the neck 61, the latter being enlarged so that a chamber 91 is provided which will collect any condensed excess vaporized fuel which may have reached this point. The conduit 90 communicates at its lower end with a chamber 80 through the restricted passage 93.

A particular advantage which is gained by utilizing gasoline as the retarding fluid lies in the fact that this fluid may be utilized in modifying the richness of the mixture at certain critical periods of the running of the engine. Thus, in the embodiment shown, I have shown the valve 67 and its stem 81 as provided with a longitudinal bore or passageway 94 opening through the valve 67 at its upper end. The passageway 94 communicates at its lower end through the transverse connecting channel 95 with the interior of the chamber 96 formed between the fixed lower end of the depending bearing 82 and the interior of the chamber 97 formed in the upper end of the piston 84. When the engine is suddenly accelerated, the valve 67 will tend to leap upward with a certain amount of suddenness. Normally, this would tend to produce a momentary unduly lean mixture. While a too sudden upward movement of the valve is retarded by the piston 84 and plate 85, the richness required for this quick acceleration is attained by me as follows: As the valve moves upward quickly, a small amount of fuel is forced from the chamber 96, through the passageway 94 and into the member 62. This temporarily increased richness is extremely advantageous inasmuch as it will be noted that this increase in richness occurs at exactly that period of running when it is most needed, namely, during rapid or instantaneous acceleration. It will also be noted that this temporary raising of additional rich liquid fuel will be but momentary. To overcome any tendency of forcing too rich a primary fuel through the passageway 94 upon sudden acceleration, I show a passage 97 formed longitudinally of the

valve 67 and concentric with, and exteriorly of the passage 94. This passage, at its upper end, connects with the air supply through the chamber 76. At its lower end, it connects with the transverse passage 95. The primary fuel supplied through the passage 94 is thus mixed with air.

Correspondingly, when the engine throttle is suddenly closed, the retarding effect of the piston 84 will prevent choking of the engine by a possible sudden increase in richness due to the shutting off of the air supply.

Inasmuch as it is important to prevent a sudden rise of the valve when the throttle is suddenly thrown wide open, than it would be to prevent a sudden fall, I have provided the aforementioned lost motion effect between the two part piston 84 and 85.

It will be obvious that in its passage to the point of consumption, the mixture may be preheated as by the exhaust of the engine, thereby preheating the mixture and producing advantages which will be obvious. It will be understood that numerous other arrangements and constructions of parts may be made to fulfill equivalent purposes, and I do not mean to limit myself to the particular structural features illustrated and described. Many changes in the details as herein described and illustrated may be made by those skilled in the art without departing from the spirit and scope of the invention as expressed in the appended claims. It is therefore intended that these details be interpreted as merely illustrative, and not in a limiting sense.

The manner in which the fuel is fed by suction from the rear tank to the pipe 17 is such as to give the result of the suction always acting upon a constant liquid level regardless of the height of the fuel in the rear tank.

The production of a satisfactory primary mixture is assisted materially by the manner in which the fuel feed from the pipe 17 directed so as to change the direction of the fuel feed from the pipe 17 and its co-action with the air column through 25 with the consequent beneficial results in atomization, and this is still further assisted by the provision of a constriction 60 at the terminal end of the pipe 17.

By the arrangement herein disclosed, I find that I attain a primary mixture in which the air and fuel are mixed together so as to provide a mixture which not only is itself stable, but the stability of which is still further increased in its travel to the point of consumption.

One of the important features of my invention is an arrangement whereby a fuel mixture of maximum efficiency is at all times supplied for combustion purposes, and the proportion of fuel and air contained therein is maintained substantially constant regardless of running conditions, the proportion

being such as to give the aforementioned maximum efficiency.

Another important feature of my invention is the employment of a gravity valve such as that shown at 67 as the main controlling factor of the character of mixture to be produced because, not only does it control, as already stated, the air which is the large factor of the mixture, but a gravity valve presents a constant load regardless of suction conditions, and therefore moves exactly in accordance with and proportional to the variation in such suction conditions.

The shape of the valve 67 which is herein illustrated as top-like in character, possesses features of advantage in so controlling and directing the flow of air as to cause it to serve its purposes with great efficiency in connection with the directing of the flow of air so that a maximum mixing effect with the fuel mixture is produced. It will also be observed that I herein show this valve 67 as positioned relatively close to the constricted passageway through 61 and relatively close therefor to the point at which the primary fuel mixture is introduced from the neck 61 which also I have found possesses features of advantage.

In order to catch any liquid gasoline that may form above the valve 67, I have provided a space 110 adjacent the valve seat which vents above the throttle 71 by means of the tube 111 so that the gasoline settling in this space 110 thus works its way up into the pipe 111 and into the chamber.

Upon viewing the lower part wall of the chamber 80, it will be observed that there is a space 115 between the skirt 116 and the outer wall 117. There is thus provided a clearance so as to eliminate any question of actual fitting and also to prevent warping or distorting of the parts when they are assembled or disassembled, and to allow for errors in manufacture.

I provide strainers 120 in the part "C", and 121 in the part "A" for the well-understood purposes which strainers serve in this relationship.

Having thus described my invention and illustrated its use, what I claim as new and desire to secure by Letters Patent is:

1. In a fuel feeding system arranged to supply fuel from a storage tank positioned at a distance from an internal combustion engine and operable by the induction thereof, the flow so induced being continuously distributed and proportioned between primary fuel mixing means and secondary mixing means, air control means for automatically proportioning the flow over a wide range of running conditions, dampening means for said air control means, and fuel enriching means for said secondary mixing means responsive to rapid acceleration, said fuel enriching means being operable by said damp-

ening means and comprising a pair of pistons, one of which has a lost motion effect relative to the other.

2. In a fuel feeding system, for an internal combustion engine operable by the engine induction, a low level fuel tank, and a mixing nozzle operated by the engine induction, said mixing nozzle including an air inlet and a fuel inlet, said latter inlet being circumferentially disposed to said former inlet and a secondary mixing nozzle adjacent said engine intake, said secondary nozzle including an air inlet and a fuel inlet, said former inlet being tangentially disposed to said former inlet so as to give a whirling movement at the point of intersection of the two inlets.

3. In a carbureting system for internal combustion engines, a fuel container, means for causing the engine suction to act directly upon the fuel to lift the fuel from the container and means positioned exteriorly of the container for controlling the flow of fuel from the container so as to give the effect of a lift from a constant level in the container, said means comprising an inlet chamber open to the container, an outlet chamber open to the reduced pressures below the intake manifold, a diaphragm forming a closure for said outlet chamber, a passageway connecting said chambers, a valve controlling said passageway, said valve being seated on said diaphragm.

4. In a carbureting system for internal combustion engines, a fuel container, means for causing the engine suction to act directly upon the fuel to lift the fuel from the container and means positioned exteriorly of the container for controlling the flow of fuel from the container so as to give the effect of a lift from a constant level in the container, said means comprising an inlet chamber open to the container, an outlet chamber open to the reduced pressures below the intake manifold, a diaphragm forming a closure for said outlet chamber, a passageway connecting said chambers, a valve controlling said passageway, said valve being seated on said diaphragm, said valve normally closing the passageway.

In witness whereof, I have hereunto signed my name.

CASPAR E. HOFBAUER.

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