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CARBURETOR

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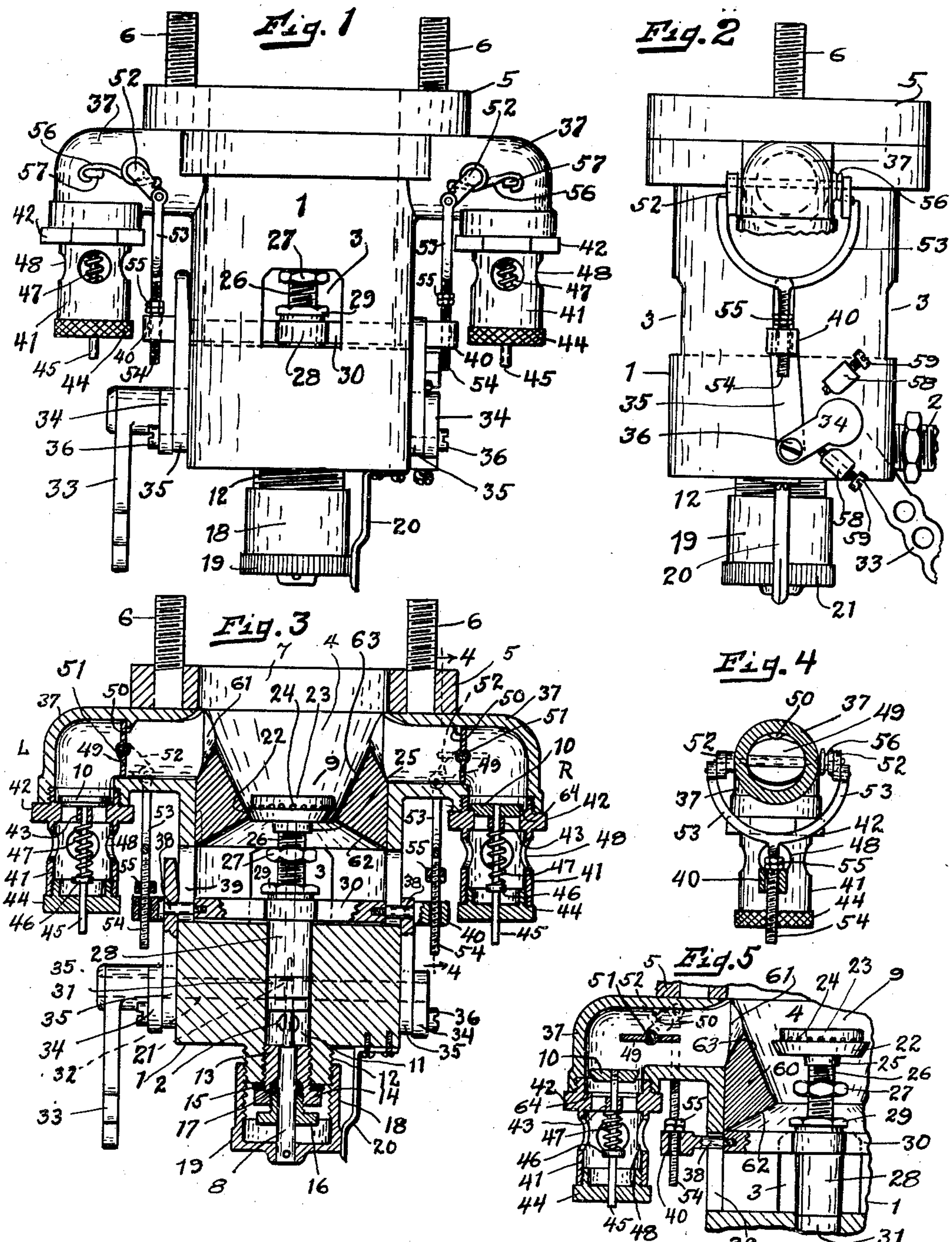

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CARBURETOR

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26 Claims. (Cl. 261—45)

The invention herein relates to an improved carburetor; particularly a carburetor to produce a mixture of vaporized liquid fuel and air for an internal combustion engine.

An object of the invention is to provide a carburetor having a novel arrangement of valves which render the carburetor virtually self-regulating; automatically supplying the correct amount of fuel and air according to the needs of the engine under all working conditions.

Another object of the invention is to provide a carburetor with valves to supply additional air mounted and controlled to open in succession or in unison; and free to close either in the same or reverse order of opening or simultaneously; so that when the engine gets into operation and conditions of load undergo a change, the alteration of the vacuum due to the movement of the main throttle valve of the carburetor, in conjunction with the rate at which air is caused to flow past this valve by the pumping action of the pistons of the engine, will cause at one time a large amount of air in relation to the amount of liquid fuel vaporized in the carburetor to pass into the engine to enable the latter to keep on running under the conditions of speed and load then existing; and at another time will reduce the amount of air and thus increase the relative quantity of liquid fuel when an increase in load or other change in condition of load or speed render a larger quantity of fuel necessary. The engine thus operates at all times with greatest power, smoothness in running, and highest efficiency, on the smallest possible quantity of fuel; the wear is minimized and a great saving in the fuel required, in repairs, and the general cost is effected.

A further object of the invention is to provide a carburetor having one or more auxiliary air valves, mounted to be unseated by a suction or partial vacuum created in the operation of the engine; but nevertheless each controlled as to its opening movement by a separate valve connected to the main valve of the carburetor; each auxiliary valve being so disposed that it can open only when its controlling valve opens, yet is free to close independently whenever a reduction in the volume of inflowing air is desired. Hence, each auxiliary valve is quite certain in its timing and function.

The full advantages and nature of the invention are fully set forth in the following description, taken with the accompanying drawing upon which the preferred form of the invention is illustrated. But the disclosure is of course explanatory only, and I may make alterations in the shape, size and arrangement of the members of the carburetor, without departing from the principle of the invention or exceeding the scope of the appended claims.

On the drawing:

Figure 1 is a side view of a carburetor according to my invention;

Figure 2 is a view of what appears on Figure 1, seen from the right;

Figure 3 is a longitudinal section taken centrally through Figure 2.

Figure 4 is a section on line **4—4** in Figure 3; and

Figure 5 shows a portion of Figure 3 with the parts in a different operative position.

The same numerals identify the same parts throughout.

I illustrate herein a general type of carburetor with my improved arrangement of valves attached; but it is of course understood that my novel arrangement of valves can be utilized on carburetors of a different construction, as well as on the design shown herein.

The carburetor comprises a hollow casing **1**, with a fuel or gasoline inlet **2**. In the sides of the casing at opposite points are air inlet ports **3** and within the casing is a chamber **4**, which opens through the top. The bottom of the casing, however, is closed. At its upper end the casing is flanged, and to this end is attached a flange **5**, which has a central opening in line with the chamber **4**; and through flange **5** are passed screws **6** to enable the casing **1** to be affixed to the flanged end of the intake pipe of the engine on which the carburetor is to be mounted. The central opening or passage through the flange is indicated at **7**, and the screws or bolts **6** may be attached in a suitable manner. Any convenient means may be used to hold the flange and casing together. In the lower end of the casing is a fuel or gasoline valve **8**, and within the chamber **4** is a combined valve and spray nozzle **9**. This valve **9** is a controlling member for the air and fuel; and I provide the carburetor with valves for additional or auxiliary air shown at **10**, one at each side, leading to apertures just above the valve **9**. In the lower part of the casing **1** containing the fuel valve **8** is a space or passage **11** into which the gasoline inlet **2** delivers.

At the lower end of the carburetor is a central boss **12**, which is bored out thru the bottom of the casing **1** to provide the space **11**. This space would communicate with the chamber **4**, but for the presence of the stem of the valve **9**; and the boss 12 is threaded inside to receive an externally threaded sleeve nut 13 with a head 14. Between this head and the boss 12 is a gasket 15. The stem of the valve 8 is mounted in the nut 13 and is made air-tight by a gland 16 and packing 17 in the nut 13, the gland 16 screwing into the nut 13 to compress the packing to a sufficient extent. On the outer end of the stem is a milled head 18 to set the needle 8 in adjusted position. The milling is shown at 19, and is engaged by a spring catch 20 on the bottom of the casing 1. As shown clearly in Figure 3, the stem of the valve 9 projects down into the space 11, and this stem has a duct 21 communicating with the space 11 through the lower end of this duct. Into the lower end of this duct the needle valve 8 always projects more or less so that the quantity of gasoline or other hydrocarbon employed entering the duct can be varied, and the admission thereof properly timed. By turning the head 18, which screws on the exterior threads of the boss 12, the valve 8 can be moved to any desired adjusted position.

Any kind of fuel furnishing a satisfactory motive agent for the engine can be employed.

I make the valve 9 in the form illustrated herein of a disk 22. The outside of this rim is conical, increasing in diameter towards the open end of the casing; and upon this disk is seated a cap or hood 23, the edge of which is secured upon the rim. The cap has perforations 24 extending all around it. The peripheral edge of disk 22 projects beyond the cap 23, forming a small annular ledge. In the middle of the disk is a central boss 25 on the lower face, threaded inside to be screwed upon the upper end of the valve stem 26. This part of the stem has a polygonal portion 27 to enable it to be turned by a tool for purposes of adjustment. At its lower end it screws into the section 28 of the valve stem and this section has a gland 29 threaded into its upper end to directly engage with the threaded lower end of the upper section 26. The lower section 28 of this stem extends down into the space 11, which it must fit snugly, although it is to be moved therein up and down. This section has a guide or crosshead 30 which fits the inside surface of the chamber 4 and ensures that the valve 9 moves smoothly when actuated; and the guide lifts as the valve opens. The lower extremity of the section 28, through which the central duct or channel 21 is continued bears a packing ring 31. Thus gasoline or other fuel entering the space 11 through the fuel inlet 2 can pass up through the channel 21 in the two sections 28 and 26 of the stem of the valve 9 and out through the perforations 24. When the valve is in open position, air coming in through the apertures 3 takes up this fuel, vaporizing it as it issues from the perforations 24 in so many atomized fine jets or sprays, and making an excellent mixture of uniform composition which is dry and burns quickly, to give the engine the maximum power. The purpose of the ring 31 is to make the section 28 leak proof in the bore 11. The holes 24 are in communication with a space inside the valve 9.

The valve 9 is moved up and down to opened and closed position by an arm 33, affixed to a shaft 32, mounted to turn in a transverse bore in the closed bottom of the casing 1. The two ends of the shaft have fixed arms 34 on the outside of the carburetor. The arms 34 are pinned to links 35, screws 36 being used to connect them, and the upper ends of the links are pivotally united to the guide 30.

Therefore, to operate the carburetor, the valve 8 is adjusted to admit enough gasoline for idling when the valve 9 is substantially shut. Thus gasoline flows up through the channel or passage 21 in the stem of the valve and out into the chamber 4 by way of the perforations 24. Though the valve may be practically closed it will admit enough air for idling, this air flowing around the valve and between it and the inside of the casing. As the arm 33 is moved, the valve opens more, lifting the stem from the needle 8 to admit more gasoline to the duct 21. Thus more air and more fuel enter in predetermined ratio, and the increased amount of air atomizes the additional fuel and delivers it from the chamber 4 into the intake of the engine connected to the ring 5. Enough air enters the inlets 3 to vaporize fully whatever gasoline is admitted past the valve 8.

The angle or corner between the disk 22 and lower edge of the cap 23 makes a small space wherein the air flowing past the disk 22 creates a partial vacuum, drawing the fuel more directly out of the valve 9, and more quickly vaporizing it.

The interior of the valve 9 forms a small vacuum chamber. When the fuel issues from the ports 24, it is already vaporized; and therefore mixes more thoroughly with the air passing through the chamber 4, giving a very efficient and substantially dry product. The valve 9, when it is lifted, by the very nature of its construction and manner of mounting, keeps the ports 24 at the point where the air flow is fastest relative to the volume of the air; that is through the annular space around the disk 22 when the valve is open. Hence the vaporizing effect is always a maximum and the pull of the engine or suction on the fuel not only draws it from the valve, but for all positions of the valve 9 is sufficient to lift the fuel to the carburetor even when the fuel tank is considerably below the level of the carburetor, without auxiliary devices of any kind.

To mount and operate the valves 10 to supply additional air and make the operation of the carburetor more efficient and self-regulating, the casing 1 has extensions 37 at its upper flanged end on opposite sides. Each extension opens downward, and is shaped like a goose-neck with its outer end threaded inside. Attached to the outer end of each extension and depending therefrom is a valve holder 41. Each holder has a polygonal portion 42 for a tool to engage the holder and screw it into place. The polygonal collar 42 abuts the extension 37 when the holder is made fast. In the end adjacent the collar 42, each holder 41 has a bearing 43 for the stem of the valve. The lower ends of the holders receive threaded closures 44, perforated to receive the ends of the valve stems 45. Each stem 45 has a collar 46 in the holder and is encircled between the collar and the bearing 43 by a spring 47 normally holding the valve shut. Inlet ports 48 admit air to the holders 41 below the valves 10. The bearings 43 can be integral with the holders, or made separate and secured by any suitable means. They may, for example, be held by radial arms connecting with the inside of the holders, and open spaces between the bearings and the walls of the holders permit the passage of air entering the ports 48.

Each link 35 is attached to the guide 30 by a screw 38. Slots 39 are vertically arranged in the sides of the casing for the screws **38**, and each of these screws has a bearing **40** at its end on the outside of the casing. In each extension **37** is a damper valve **49**, shutting against a stop **50**, and the damper valves are between the valves **10** and chamber **4**. Shafts **51** carry the valves **49**, and project through the sides of the extensions, carrying on their outer ends arms **52**, to turn the shafts and dampers, which are of course affixed to the shafts. To the arms **52** of each shaft **51** is pinned a yoke **53**, the shank **54** of which is slidably received in the adjacent bearing **40**. The shanks are threaded and carry adjustable nuts **55** above the bearings **40**. A spring **56**, on each shaft **51**, engages one arm **52** and a stop **57** on the extension, the springs **56** acting to keep the damper valves closed. These dampers regulate the action of the valves **10**.

Projections **58**, on each side of each arm **34**, carry adjustable screw stops **59** to limit the range of movement of the arms **34**.

In the chamber **4** is a ring **60** with ports **61** in its upper end to establish communication between the chamber **4** and the inside of the extensions **37**. The bottom of this ring is beveled at **62**, giving a contracting conical surface. Above this surface the ring has a conical bore **63** in which the valve **9** seats, at the junction of the bore **63** and surface **62**. Hence, air flowing in through the ports **3** is first constricted in volume when it reaches the surface **62**; flows past the valve **9**, when open, at high velocity, and then expands as it flows through the flaring conical bore **63** and past the ports **61**. Seats for the valves **10** are shown at **64** in the holders **41**.

In operation the springs **47** keep the valves **10** shut, and the springs **56** close the damper valves **49** when the valve **9** is in closed or nearly closed position. As the valve **9** is lifted, the pins **38** move with the guide **30**, and the bearings **40**, as they abut the nuts **55** on the stems **53** of the valves **49**, move the stems **53** upward and these dampers are opened. Then the suction of the engine can lift the air valves **10** against the springs **47**. As shown, the nuts **55** are set to open one damper first and then the other. For example the damper **49** at the left is opened before the one at the right, and the valves **10** are then free to open in the same order. The reverse order can also be chosen.

The function of the valves **10** is to furnish additional air in larger or smaller volume, automatically, as working conditions demand, admitting the additional air and cutting it off according to variations in speed, load, and other factors that affect the operation of the engine and car on which it is mounted. The action of the valve **10** at the left on Figure 3 may be briefly considered. When the throttle valve **9** is closed, the suction of the engine in the main intake pipe is equivalent to about 18 inches of mercury displacement; that is, if a manometer, or U-shaped tube, with both arms of equal length has one arm connected to the engine intake and the other arm open, and enough mercury is put into the manometer the difference of level under the indicated conditions will be about 18 inches; and when the throttle is open and the engine running at top speed, the suction drops to about one-half inch of mercury displacement, or perhaps, more, depending on the fit of the valve **9**. With the valve **9** open to give the car a speed of say 10 miles per hour on a level road, the suction under certain conditions in the manifold through which the air and gasoline pass into the engine is equivalent to say 15 inches of mercury displacement. When the damper **49** at the left is now opened by the pin **38** and bearing **40** engaging the nuts **55** on the adjacent stem **53**, the corresponding valve **10** at the left can open as required. As soon as damper opens, the valve **10** can open when conditions are favorable. From 10 miles per hour onward with valve **10** just beginning to open and with the car still on a level road, the vacuum decreases as the throttle opens further. Were it not for the fact that air velocity increases and now supplements or replaces the vacuum, the valve **10** would close or not open at all. The valve **10** can be set to open at any point, as desired. At top speed of the engine, there is very little vacuum above the valve **9**, but the force of the air at high velocity now tends to open the left hand valve **10** and keep it open so long as the speed of the air is maintained. If however a steep grade is encountered with full open throttle **9**, the car slows down, and the revolutions of the engine are reduced. Hence the air velocity drops, and the force of the spring **47** closes this valve **10**. A richer mixture, due to less air and a greater pull or suction on the fuel, at once results because more gas is admitted in proportion to the quantity of air. Therefore auxiliary air is provided under all ordinary conditions; but is automatically cut out on steep grades and in other situations when the car begins to go slower, or the load changes; or other unfavorable conditions arise.

Springs **47** can of course be mounted to be adjustable. Thus the admission of the auxiliary air can be accurately timed and may be admitted from any position of the valve **9** from idling to near full open position. A full account of the mode of operation of both valves **10** is set forth below.

The valve **10** at the right constitutes another auxiliary air valve, and air of course passes through this valve by entering the ports **48** of the associated valve holder **41**. This valve also cannot open till the valve **9** rises and opens the right hand damper **49**. This right hand valve **10** can be set to open with or after left hand valve **10**, and can shut whenever conditions so demand. On a grade being encountered or the load otherwise increasing the two valves **10** can shut together or separately. The valve **10** at the left may be set to open for instance when the valve **9** begins to open, or shortly afterward, while the valve **10** at the right will begin to open at the same time or otherwise as conditions of vacuum or load bring about, if the damper permits, or the order of opening may be reversed.

The ring **60**, as the valve **9** lifts, keeps the air flow confined close to the edge of the disk **22**, and produces complete vaporization of the fuel. When the speed of the engine is highest, the valve **9** is comparatively close to the apertures **61**; and with the valve **9** in this position, air comes in at one or both valves **10**. The apertures or passages **61** deflect the air from the extensions **37** upward into the air entering by way of ports **3** and passing the valve **9**, and a smooth flow through the carburetor is thus maintained. If desired, the ports **61** can be omitted and the upper end of the ring **60** made smaller, to leave an annular space between it and the inside of the chamber **4**, for air from the extensions **37** to flow through on its way to this chamber.

The valves **10** are dependent upon the air flow to make them lift from their seats; and conditions in the carburetor and the engine cannot affect these valves till the main valve 9 first opens and the connections turn the damper valves 49 to leave the stops 50. Hence the valves 10 are effectively controlled and certain in operation; the exact point of opening being fixed. That is, the valves 10 are enabled to open to supply additional air at the instant when the dampers open; yet are free to close at any instant, singly or together, even though the dampers remain open, when less additional air or no additional air is needed, as when the speed of air flow diminishes. Further, since the damper valves 49 open gradually, the valves 10 are under the influence of the vacuum in the carburetor, and the manifold, whatever this vacuum may be, as soon as the valves 49 begin to open at all. As the valves 49 open more and more, so that air velocity becomes more effective to lift the valves 10, the fast flow of air through the carburetor can always have its full commensurate effect at the apertures 61 to make the valves 10 move to open position. The faster the flow, through the chamber 4, the more valves 10 open; and for lower air velocity these valves of course open less; but the extent of opening is always correct for the prevailing conditions. In consequence, the operation of the valves 10 is always correct and excessive or insufficient opening as regards conditions at any given moment, or other faulty operation, are entirely obviated.

The valves 10 may be either poppet valves or piston valves, or one a piston valve and the other a poppet valve, or any other suitable type may be used.

There is no positive mechanical connection between either damper and its valve, yet the dampers control the operation of the valves 10, as fully as required. The dampers might be omitted and the springs 47 might be so adjusted as to give the valves the mode of operation desired; suitable means being substituted for the dampers to have the same effect, as for example, releasing devices to engage the springs 47 and hold the suction valves shut till the arrival of the time when these valves should open.

In the remainder of this description let the valve 10 at the left of Figure 3 be indicated by the letter L, and the right hand valve 10 by the letter R. The spring 47 of the valve L may be assumed to be stronger than the remaining spring 47. As the damper of the valve L is opened first, the valve L can open before the valve R; and may remain open while the valve R is shut. Under some circumstances, the valve R may be open while the valve L is closed. With but one of these valves shut, a part only of the additional air is cut off, but some additional air is still supplied by the other.

With a single auxiliary valve, conditions bringing about a complete closing would shut off the additional air entirely; and not just restrict the volume, as in the case of two auxiliary valves, with one closed and the other able to remain open.

Assume that a car driven by an engine having a carburetor as set forth herein is climbing an exceptionally long and steep grade with the valve 9 almost fully open or wide open.

Suppose that the grade is such that the car at the beginning of its climb can attain a speed of 30–40 miles per hour with both valves 10 open. Due to the increasing of the load and the lessening of the momentum, the car will gradually slow down, which will result of course in a slower speed of the engine. This latter result will diminish to some extent the velocity of the air flowing through the carburetor.

With the valve 9 in full open position, the vacuum caused directly by the pumping action of the engine is practically negligible; but the velocity of the air flowing through the carburetor is greatest for a given speed; and, of course, were it not for the fact that the supplementary and independent vacuum is created by velocity of the air in the immediate vicinity of ports 24, the carburetor could not pull fuel from below its level under all practical driving conditions.

Under the conditions assumed in this, the valve L having the greater spring tension and therefore requiring a relatively greater air velocity to keep it open, will close first. The closing of this valve results in cutting off the air flowing through it and in the conversion of a comparatively lean mixture into a richer mixture having a decreased proportion of air to gas and more suitable for the development of increased power to meet with the heavier load conditions imposed by the lessening of the rate of the car's travel on the hill. Further, the closing of the valve L tends to cause more air to flow through the ports 3 and directly past the valve 9, to maintain a more effective vacuum in the carburetor, and draw in more fuel through ports 24, thus helping a richer mixture to be produced. The increased power obtained by the enriching of the mixture now prevents further slowing up of the car. Therefore the valve R, with a weaker spring 47, will remain open until either the valve 9 is closed sufficiently to allow seating of the damper of the valve R or until a heavier load is encountered.

Unless the dampers are opened, even though conditions are sufficient for the opening of the valves 10, the latter stay closed. In other words, a closed damper makes the associated auxiliary air valve inoperative and keeps it so until its controlling damper is opened.

It is advantageous to adjust the parts so that the valve L is slightly open when the engine idles. Its use in this manner permits a finer and more sensitive control of engine at idling speed than could be obtained otherwise.

The spring of the valve L must be properly adjusted. If the valve 9 and the damper of the valve L are opened quickly, a very slight spring tension will allow the valve L to snap open. Such action results in a temporarily "air-flooded" condition. But with the spring tension great enough the valve L will open more slowly and the rapid entrance of too much additional air is prevented.

Let the car be started and the valve 9 be partly opened, enough to give a speed of, say, 10 to 15 miles an hour, the damper of the valve L is then slightly opened; the vacuum in the intake pipe above the carburetor is quite pronounced, the engine speed is high, and the flow of air through the carburetor is sufficient to cause the valve L to begin to lift. The other damper and valve R remain closed.

If the gears are shifted from low to second and the valve 9 is opened further, the damper associated with the valve L is opened further. This increased opening of the damper allows a proportionate increase in the opening of the valve L. More air and fuel now enter and pass the valves 9 and L and a greater speed of engine and car results. Valve L remains open.

The valve L now stays open because the engine speed in second gear at 20–25 miles per hour for the car is about equal to the engine speed in low gear. Therefore, although the vacuum in the intake due to the increased opening of valve 9 for the desired 20–25 miles per hour is somewhat lower, the velocity of the moving air is enough to keep the valve L from closing.

Suppose the car is now "in high", and traveling at, say, thirty-five miles per hour. Valve 9 is now open more than before and so is the valve L and its damper 49. If now the valve 9 is still further opened, the other damper 49 will be opened, and at a 40 mile speed, say the valve R can be lifted, so as to permit more additional air to enter the carburetor.

If more speed is desired the valve 9 and both dampers 49 are opened still more. Hence the valves L and R move further from their seats because of the resultant greater velocity of the air passing through the carburetor.

If the load is now increased with the car in high gear, so that a reduction in speed of car and engine takes place, the valve L closes first because its spring is stronger than the spring for the valve R. Hence the valve L will drop as soon as the force of its spring can over balance the energy of the air flowing past the valve L. Valve R may remain open.

A similar action may occur if the car is traveling at the slow rate of 5—8—10—15 miles per hour and the valve 9 is opened suddenly to give quick acceleration; the damper 49 at the left may now be open, but with correspondingly slow engine speed there is little vacuum present and the velocity of air flow is not enough to keep open the valve L.

Suppose the car to be traveling at the rate of 50 miles per hour on a level road with both the valves L and R open. If the valve 9 is now closed sufficiently far to cause the seating of the right hand damper, the air valve R would then, and under this condition only, be the first of the two valves L and R to close.

The four ways in which the valves 10 can operate in relation to each other are as follows: 1. Both valves open. 2. Valve L closed valve R open. 3. Valve L open and valve R closed. 4. Both valves closed.

Both valves 10 can open when the valve 9 is open enough to open both dampers 49 and causes a relatively high speed of the engine, with corresponding working conditions for the opening of the two valves 10. Example: when the car is driven at a high speed, with the valve 9 holding open both the dampers 49.

Operation with the valve L closed and valve R open may take place when the valve 9 is open far enough to cause both dampers 49 to be open. For example: when quick acceleration is attempted, with valve L already open, as above stated, and the valve L cannot stay open, but the velocity of the air or vacuum is still enough to open the valve R. This action may occur under any conditions of medium load, or moderate speed, as when the car tries to tow another car; or when the car is travelling up a hill at moderate speed; or starts up the hill at rather slow speed and the driver then tries to increase the speed.

In short the valve R only will be open when conditions are such that they will not overcome the spring of the valve L, but are sufficient in degree to overcome the spring of the valve R and keep it open, when the damper of the valve R is open.

When the valve 9 is not opened sufficiently far to open the damper of the valve R, but does open the damper of the valve L, the latter valve may open while the valve R stays closed. Conditions sufficient to cause the opening of the valve L with its stronger spring, would cause the opening of the valve R unless the damper of the valve R is kept shut. It is possible to climb a grade with the valve L open, provided the grade is not steep enough to impose a load on the motor that would slow it down and make the valve L drop.

The damper of the valve R must open before the valve R can lift, and as this damper can be set to commence to open at 35 to 40 miles per hour, all lower speeds, provided the valve 9 is not open enough to open the damper of the valve R, result in the valve L only being used.

Both valves 10 will be closed when the engine idles because the valve 9 then does not cause the opening of either damper. The valves 10 will both be closed also when the inflowing air or vacuum has not force enough to overcome either the strong spring tension of the valve L or the weaker spring tension of the valve R. For example: when the car is subjected to an increase of load, as upon a steep hill, causing a marked decrease in car and engine speed resulting in a drop in air velocity and an insufficient vacuum.

It is possible for the valves 10 to close independently of each other; the valve L is then the first to close when the closing is due to a drop in engine speed and vacuum and in velocity of air flow. But if the closing is caused by a reduction in the opening of the valve 9—thus allowing the damper of the valve R to close, the valve R would then close first.

The economy of gasoline with two auxiliary air valves is considerably greater than that obtainable with just one such valve.

Conditions that would cause the single auxiliary air valve to close would not permit a reduction of the volume of additional air, but would stop the additional air entirely, so far as this one valve is concerned. Hence at times when a relatively lean mixture is needed it would not be furnished and gasoline would then be wasted for a short time. But with the two valves, conditions that would not permit the valve L, for instance, with its stronger spring to be open would, however, be sufficient to keep open the other valve with its weaker spring, thereby letting in some additional air and affording a leaner mixture and saving gasoline until such time as the other valve has to close and furnish a richer mixture for the engine. Gasoline is also saved whenever the valve R only is opened and the mixture kept relatively lean by the additional air which the valve R supplies. And with both valves 10 open, the additional air will be sufficient to bring about a greater saving of fuel, because more additional flows through these two valves than through either one.

An important feature of the invention resides in the fact that the valves 10 operate automatically within certain limits, that is, with the valve 9 open and both dampers open, and without change of position of the valve 9 and dampers, the valves 10 can still move independently of the dampers according to variations in conditions. They may, singly or together, move away from their seats or towards their seats, thus letting in more or less air, and producing a rich or lean mixture as above outlined. It is well known that for high speeds, automobile mileage tends to drop and fuel consumption to increase but with my carburetor the arrangement and mode of operation of the valves 10 tends to cure these defects and effect the greatest saving of fuel by ensuring the leanest mixture at high and all other speeds; while at the same time enriching the mixture when load conditions require it.

I claim:

1. In a carburetor, a combined air and fuel valve, an air-suction valve to supply additional air, and a valve having a connection with said air and fuel valve, to be held shut, but opened when the air and fuel valve is moved to open position, to control the suction valve.

2. In a carburetor, a combined air and fuel valve, a valve to be forced open by the air and fuel valve, and an air suction valve disconnected from the aforesaid valves, but dependent upon the position of the second-named valve.

3. In a carburetor, a combined air and fuel valve, the carburetor having a chamber containing said valve, an auxiliary air passage leading to said chamber, a valve in the air passage disposed to be controlled by the main valve, and a second valve in said passage disconnected from the first-named valve therein and the air and fuel valve, but controlled by the first-named valve in said passage.

4. A carburetor having a main air and fuel valve, a plurality of auxiliary air valves, and a separate valve connected to be controlled by the air and fuel valve for each auxiliary air valve, at separated instants.

5. The carburetor according to claim 4, wherein the controlling air valves are normally closed, but are opened when the air and fuel valve opens.

6. The carburetor according to claim 4, wherein the controlling valves are connected to be operated by the air and fuel valve, to allow the auxiliary valves to open in a predetermined order.

7. In a carburetor, a metering pin adjustably mounted therein, to control the flow of fuel to said carburetor, a head rigid on the pin to adjust the latter, the casing having a fixed portion rotatably engaged by said head and a catch to hold the head in adjusted position.

8. In a carburetor a casing, a fuel valve therein with circumferential perforations, the valve having a conical lower rim, and a fixed ring in the casing having a surface against which the rim of the valve fits when closed, the casing having extensions to admit air beyond the valve and the ring having ports communicating with said extensions.

9. The carburetor according to claim 8 wherein the ring has a contracting surface on the intake side of said valve.

10. A carburetor having a main valve, connections for moving said valve to open and close same, suction valves to supply additional air, spring-closed valves to control the suction valves, means comprising rods to open the spring-closed valves, and means providing a sliding connection with the last named valves and the main valve, thru said rods.

11. The carburetor according to claim 10, wherein the connections are so adjusted that one of the spring-closed valves opens after the other has opened.

12. A carburetor having a casing, a main air and fuel valve therein, extensions with downturned ends at opposite sides of the casing, air suction valves in the extensions, damper valves in the extensions between the suction valves and the casing and lost motion connections between the damper valves and the main valve.

13. A carburetor having a casing, a tubular extension on the casing, an air suction valve in the casing, a damper valve in the casing, a shaft for the damper valve, arms on the shaft, a yoke pinned to said arms, the shank of the yoke forming a valve stem, a guide in the casing and a bearing on the guide slidably engaging said stem.

14. A carburetor having a chamber and auxiliary air passages leading to the chamber, a main air and fuel valve in said chamber, a valve in each of said passages, said last-named valves being connected to the main valve to open in succession, an additional valve in each passage controlled by the first-named valve therein but disconnected, and means tending to move the additional valves to closed position.

15. A carburetor having a chamber and auxiliary air passages leading to the chamber, a main air and fuel valve in said chamber, a valve in each of said passages disconnected from the main valve and means of different force to hold the valves in said passages closed, but leaving same free to open and close according to operative conditions.

16. A carburetor having a chamber and auxiliary air passages leading to the chamber, a main air and fuel valve in the chamber, a valve in each passage having sliding connection with the main valve to be opened in succession by the latter and a second valve in each passage, the last-named valves being suction valves disconnected from the other valves, and springs of different tension tending to move said suction valves to closed position, the suction valves being controlled by the valves having sliding connection with the main valve, to open and close in a manner determined by working conditions.

17. A carburetor having a chamber and auxiliary air passages leading to said chamber, means for admitting air and fuel to said chamber, a valve in each of said passages, means normally holding said valves in closed position, and means controlled by the first means to enable the valves to open in predetermined order.

18. In a carburetor, a main air and fuel valve, the carburetor having a chamber for said valve, an auxiliary air passage leading to said chamber, an auxiliary air valve in said passage, means controlled by the main air and fuel valve for holding the auxiliary valve closed when the main air and fuel valve is closed and enabling the auxiliary valve to be opened when the main air and fuel valve is to be opened.

19. In a carburetor, a main air and fuel valve, the carburetor having a chamber for said valve, an auxiliary passage leading to said chamber, an auxiliary valve in said passage, means controlled by the main air and fuel valve for holding the auxiliary valve closed when the main air and fuel valve is closed and enabling the auxiliary valve to be opened when the main air and fuel valve is to be opened, and spring means opposing the movement of the first-named means.

20. In a carburetor, a main air and fuel valve, the carburetor having a chamber for said valve, an auxiliary passage leading to said chamber, an auxiliary valve in said passage, and means controlled by the main air and fuel valve for holding the auxiliary valve closed when the main air and fuel valve is closed and enabling the auxiliary valve to be opened when the main air and fuel valve is opened, said means comprising a member movable during part of the movement of the main valve.

21. A carburetor having a chamber and auxiliary air passages leading to said chamber, means

for admitting air and fuel to said chamber, a valve in each of said passages, means normally holding said valves in closed position, and means controlled by the first means to enable the valves to open in predetermined order, and spring means opposing the movement of the last-named means.

22. A carburetor having a chamber and auxiliary air passages leading to said chamber, means for admitting air and fuel to said chamber, a valve in each of said passages, means normally holding said valves in closed position, and means controlled by the first means to enable the valves to open in predetermined order, the first-named means and the last-named means being movable, and the last-named means being connected to be moved during a part of the time when the first named means is actuated.

23. A carburetor comprising a body having a mixing chamber provided with a main air passage and an auxiliary air inlet in communication with said main air passage and through which only air passes to the mixing chamber, means for feeding fuel to said mixing chamber, a manually operated valve in said auxiliary air passage, a manually operated valve in said main air passage, a connection between said valves to cause said valves to move into closed position, a lost motion between said connecting means and a suction operated valve mounted in said auxiliary air passage.

24. A carburetor having means for supplying air and fuel thereto, an auxiliary air valve, a connection to said valve to enable it to be controlled by said means, a second auxiliary air valve, a connection to enable the second auxiliary air valve to be controlled by said means, said connections being arranged to permit independent operation of said valves.

25. The carburetor according to claim 24, wherein the two auxiliary air valves are free to close upon a change in the operating conditions of the engine to which the carburetor is attached.

26. In a carburetor, a casing, means for admitting air and fuel, the casing having auxiliary air inlets, a reciprocable guide for said means inside the casing, said casing having a slot in its wall, a rotatable shaft, an arm on the shaft, and a link uniting said arm to said guide through said slot.

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