

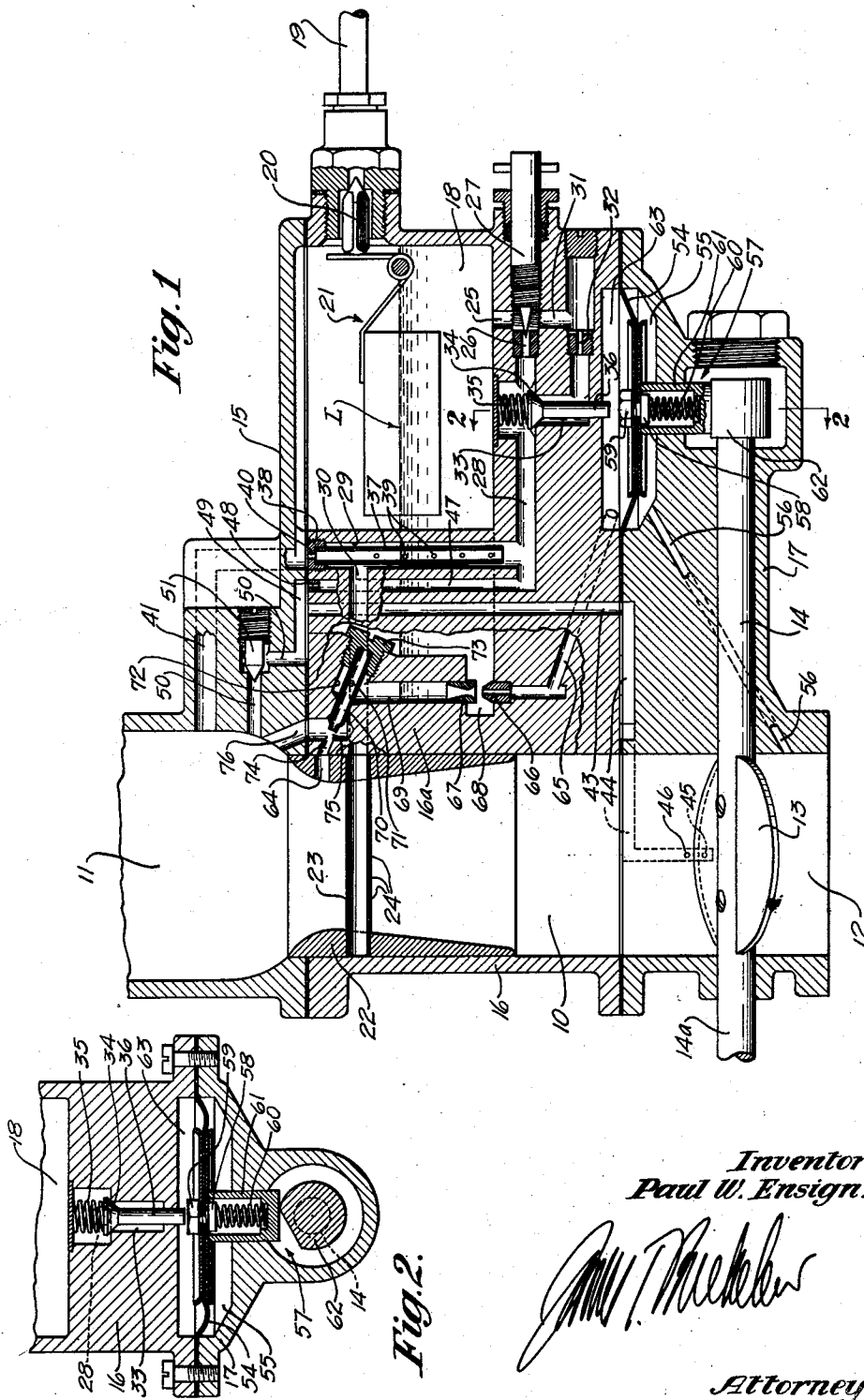
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CARBURETOR

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CARBURETOR

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This invention relates generally to engine carburetors, and is concerned particularly with improvements having to do with systems for supplying the engine with relatively enriched fuel mixtures during operation under acceleration or increased load conditions.

One of my principal objects is to provide for increased delivery of fuel to the carburetor suction passage during acceleration or increased load operations, under control of both the throttle and the suction passage pressure at the outlet side of the throttle. Also I aim to provide such increased fuel delivery independently of the suction passage depression at the point of fuel delivery so that, for example, at the end of the period during which increased fuel is required, its delivery will be discontinued regardless of the depression applied to the final discharge orifice.

In accordance with the invention, fuel for acceleration purposes is supplied from a displacement chamber by movement of a pressure responsive member controlled in accordance with both throttle movements and the suction passage or manifold depression at the outlet side of the throttle. As the throttle is opened to accelerate the engine, a proper amount of accelerating fuel is discharged into the suction passage by throttle actuation of the pressure responsive member from a starting position in which it is maintained by the suction passage outlet pressure. This pressure responsive member is also operable in response to suction passage pressure independently of the throttle, so as to be capable of supplying the necessary extra fuel for engine operation under increased load conditions, at say constant throttle position.

The delivery of increased fuel under the conditions stated is rendered uninfluenced by suction passage depression at the fuel discharge orifice, by maintaining a section of the fuel stream between the displacement chamber and the discharge orifice, at a pressure substantially above the suction passage pressure at the orifice. This effect is obtained, preferably, by passing the accelerating fuel stream through a space or across a gap near the discharge orifice, which gap communicates with the suction passage inlet, so that normally, the suction passage depression at the discharge orifice will be ineffective to draw fuel through the accelerating fuel passage. Consequently, when the flow of fuel therethrough by movement of the pressure responsive member ceases, any continued delivery under the influence of suction passage depression is prevented by the accelerating fuel passage be-

ing maintained at an intermediate point under the suction passage inlet (or substantially atmospheric) pressure.

The above mentioned features of the invention, as well as additional objects and details thereof, will be understood more fully and to better advantage from the following detailed description of the invention in a typical and illustrative form. In the description, reference is had to the accompanying drawing, in which:

Fig. 1 is a sectional view of a typical form of carburetor embodying the invention, certain of the parts appearing in developed view for clarity of illustration; and

Fig. 2 is a fragmentary section on line 2—2 of Fig. 1, showing the parts in changed position.

For purposes of illustration, I have shown a typical form of down-draft carburetor comprising a suction passage 10 having an inlet 11, an outlet 12 adapted to connect with the engine intake manifold, and a throttle 13 carried by the shaft 14. The carburetor body is shown to be formed in sections 15, 16 and 17, section 16 containing the fuel supply chamber 18 to which fuel is admitted from line 19 under control of the usual needle valve 20 operated by the float assembly 21. The suction passage 10 contains a venturi 22 into which fuel is supplied through a suitable main fuel nozzle, shown typically as a transversely extending tube 23 having fuel discharge orifices 24.

Fuel is supplied to the main nozzle 23 from the float chamber 18 by way of passage 25, orifice 26 regulated by needle valve 27, passage 28, a vertically extending bore 29, and a transverse passage 30 connecting with the nozzle. Under certain conditions of operation, as later described, an increased fuel supply to the main nozzle occurs through passage 31, calibrated orifice 32 and passage 33 communicable with passage 28, but normally closed by valve 34. The valve opens against the resistance of coil spring 35 upon engagement of the later described diaphragm assembly, with the lower end of the valve stem 36.

Bore 29 contains a tube 37 suspended from plug 38, the tube containing a series of vertically spaced orifices 39 extending above and below the normal fuel level L. Tube 37 communicates through the calibrated plug orifice 40 with a balance tube or passage 41 connecting the suction passage inlet 11 with the float chamber 18 above the liquid level therein, passage 41 thus maintaining a pressure balance between the float

chamber and suction passage inlet, for purposes known to those familiar with the art. During normal operation, the Venturi depression applied to the nozzle orifices 24, acts to draw fuel upwardly within bore 29 around tube 37 to the level of passage 30 and thence to the nozzle 23. The fuel lifting depression communicated to bore 29 also causes air to be taken into tube 37 through orifice 40 and to be jetted outwardly through the tube openings 39 into the fuel stream to aid in elevating the fuel to the level of the discharge passage 30. As will be understood, withdrawal of fuel through passage 30 at a rate greater than the rate of fuel supply to bore 29, causes the fuel level within tube 37 to become depressed, successively uncovering openings 39 to permit air to be drawn outwardly therethrough into the fuel stream.

The carburetor is provided with the usual idling fuel passage comprising bore 43 and passage 44 leading to the idling orifice 45 at the outlet side of the throttle edge in its closed position. The usual air bleed orifice 46 is provided at the inlet side of the closed throttle. The idling fuel bore 43 is supplied with fuel from passage 28 by way of bore 47, calibrated orifice 48 and space 49, the latter being provided with the usual air bleed communication 50 leading from the suction passage inlet and regulated by needle valve 51.

Under certain conditions, enriched fuel mixture is supplied to the engine by the operation of a pressure responsive member, preferably in the form of a diaphragm 54 clamped between body sections 16 and 17 controlled in accordance with both throttle movement and suction passage pressure at the outlet side of the throttle. Chamber 55 below the diaphragm communicates by way of passage 56 with the suction passage outlet 12 at a suitable point beyond the throttle 13, thus subjecting the diaphragm to the outlet or manifold pressure. The diaphragm is operated in accordance with the throttle movements by means of a cam actuated assembly, generally indicated at 57, comprising a follower 61 containing a coil spring 60 bearing against the head 58 of diaphragm bolt 59 and pressing the follower against cam 62 carried on the outer end of the throttle shaft. As will be understood, the usual attachment, not shown, may be applied to the opposite end 14a of the shaft for manually operating the throttle. It will suffice to note at this point that the diaphragm 54 is movable relative to the cam follower 61, and that at times the depression in chamber 55 is sufficient to pull the diaphragm down against the upper end of the follower, as shown in Fig. 1, while at other times spring 60 acts to move the diaphragm upwardly away from the follower 61 to effect upward displacement of the diaphragm beyond its range of movement under the influence of the cam 62 alone. At a higher part of the range of manifold depression the spring is held fully compressed and the fuel discharging movement of the diaphragm can then only be effected by throttle movement. At a lower part of the depression range spring 60 comes into action to move the diaphragm to discharge fuel as the depression falls.

During periods of acceleration and increased load operation, fuel is discharged from the fuel displacement chamber 63 above the diaphragm to an opening 64 located in the venturi 22 above the main fuel nozzle 23, or at any other suitable point. Fuel displaced from chamber 63 through passage 65, is discharged upwardly and at relatively high velocity through a restricted orifice

nozzle 66 into a small venturi 67, the nozzle and venturi being positioned within recessed portion 68 of the supply chamber 18 so that the fuel jetted upwardly at high velocity from nozzle 66 into the venturi 67, acts to draw additional fuel from the supply chamber into the Venturi passage. The fuel thence is taken through passage 69 into nozzle 70 through an orifice 71 located in the side thereof. The nozzle is inserted within bore 72 drilled from the supply chamber side of the body wall 16a and closed by plug 73 that carries the nozzle.

Fuel is discharged from nozzle 70 into passage 74 and opening 64, across a gap at 75 to which air is supplied from the suction passage inlet through passage 76. The purpose of this arrangement is to render the accelerating fuel delivery under control of the diaphragm 54, substantially uninfluenced by the depression existing in the venturi. By communicating the suction passage inlet pressure, i. e. substantially atmospheric pressure, to the discharge end of the fuel nozzle 70, the delivery of fuel from the nozzle is rendered independent of the depression at the discharge orifice 64. Thus, at no time will that depression be effective in itself to cause fuel discharge from the accelerating fuel passage and nozzle 70.

In considering the operation of the invention, it will be understood that when the engine is running at open throttle position under normal load, fuel will be discharged into the suction passage from the main nozzle 23, at a rate in accordance with the depression existing in the venturi 22. As in the usual carburetor, the idling system operates to discharge fuel through passages 43, 44 and orifice 45 at the outlet side of the throttle when the engine is running at closed throttle position. Discharge of fuel from nozzle 70 into the venturi occurs only during periods of engine acceleration, or increased load operation at open throttle, under which conditions temporary enrichment, over the delivery capacity of nozzle 23, of the fuel mixture flowing to the engine is required.

Assume that the engine is to be accelerated from idling speed by more or less suddenly opening the throttle from the idling position shown in Fig. 1. During idling operation, spring 60 is compressed, the diaphragm 54 is held down against the followers and the follower 61 is held down against the surface of cam 62 by the depression communicated to chamber 55 through passage 56 from the suction passage outlet. As the throttle is opened, cam 62 forces the diaphragm 54 upwardly a total distance corresponding to the full throw of the cam, displacing fuel from chamber 63 through passage 65 to the nozzle 66. The high velocity fuel stream jetted into the venturi 67 from the nozzle draws added fuel from the float chamber into passage 69, from which the fuel is discharged by nozzle 70 into the venturi through opening 64. Diaphragm 54 is moved upwardly beyond the range of movement under the influence of cam 62 alone, by the action of spring 60. Thus, after the depression in chamber 55 has been relieved by opening of the throttle, the spring moves the diaphragm away from the upper end of the follower 61, causing additional fuel displacement into the accelerating fuel passage. The spring 60 acts also to bring bolt 59 into engagement with the lower end of valve stem 36, unseating the valve 34 and establishing communication between passages 33 and 28 to give increased fuel supply, over that normally flowing through the needle valve controlled orifice 26, to the main fuel nozzle 23.

The flow of fuel to the accelerating nozzle 70 continues throughout the period of fuel displacement from chamber 63 under the influence of the diaphragm 54. At the end of that period, further fuel discharge from the nozzle 70 immediately stops. The Venturi depression is ineffective to cause continued fuel discharge from the nozzle 70 due to communication, by way of passage 76, of the relatively high suction passage inlet pressure to the nozzle outlet. It may be observed that during acceleration, preliminary atomization of the fuel being discharged by nozzle 70 is aided by air drawn from passage 76 into the fuel stream being projected into bore 74 and opening 64.

Assume now a condition under which the engine load is suddenly increased with the engine running at above idling speed, as when, for example in the operation of an automobile, the engine initially is running under no load at partly open throttle, and the clutch then is engaged putting the engine under load. The throttle may be partly opened, say to a position under 30° beyond idling, with the cam rotated to the position shown in Fig. 2, in which the diaphragm 54 will have been moved upwardly a corresponding distance, but below the uppermost position to which it is movable by the cam. Assuming that the clutch is engaged without change in throttle position, the resultant increased load on the engine reduces its speed, causing the suction passage outlet pressure to increase to a point at which the pressure differential on the diaphragm 54 will no longer overcome the expansion force of spring 60. As a result, the spring will lift the diaphragm above the position shown in Fig. 2, displacing fuel from chamber 63 to the nozzle 70 and simultaneously unseating valve 34 to supply added fuel to the main nozzle 23. Thus under the last described conditions, the diaphragm operates to supply added fuel under control of the suction passage outlet pressure, and independently of the throttle movement.

After accelerating or increased load operation as described, the diaphragm 54 is returned to its lower position when the throttle is closed to a point at which the pressure differential on the diaphragm is sufficient to comprise spring 60. The displacement chamber 63 then fills with fuel through the orifice of nozzle 66 and passage 65.

I claim:

1. In a carburetor containing a suction passage having an inlet, an outlet and a throttle in the passage; a movable fuel displacement member having a fuel displacement stroke, a fuel chamber at one side of said member and from which chamber fuel is displaced throughout the fuel displacement stroke, means forming a fuel discharge passage leading from said chamber to the suction passage, means applying to said fuel displacement member a force, dependent on the depression occurring in the suction passage at the outlet side of the throttle, tending to move said member in a direction opposite to the direction of its fuel displacement stroke, and means for moving said displacement member through its fuel displacement stroke including an actuating member which in its normal position acts

as a stop to limit movement of the fuel displacement member by the depression force and adapted to be moved by throttle opening movement to move the displacement member through a part of its stroke, and a yielding actuating member carried by said first mentioned actuating member and acting to move the displacement member through the remainder of its stroke.

2. In a carburetor containing a suction passage having an inlet, an outlet and a throttle in the passage; a movable fuel displacement member having a fuel displacement stroke, a fuel chamber at one side of said member and from which chamber fuel is displaced throughout the fuel displacement stroke, means forming a fuel discharge passage leading from said chamber to the suction passage, means applying to said fuel displacement member a force, dependent on the depression occurring in the suction passage at the outlet side of the throttle, tending to move said member in a direction opposite to the direction of its fuel displacement stroke, and means for moving said displacement member through its fuel displacement stroke including a throttle actuated cam, a follower engaging the fuel displacement member to limit its movement by the depression force and actuated by the cam upon opening movement of the throttle and adapted to push against the displacement member to move that member through a part of its fuel displacement stroke, and a spring carried by the follower and also pushing against the displacement member and acting to move the displacement member through the remainder of its said stroke.

3. In a carburetor containing a suction passage having an inlet, an outlet, a throttle in said passage, and a constant level liquid fuel reservoir; a movable fuel displacement member, a fuel chamber at one side of said member; means forming a fuel discharge passage leading from said chamber to the suction passage, said means including a vertically extending liquid fuel well into which fuel is free to flow from the reservoir and which extends above the normal fuel level, means actuated by discharge of fuel from said fuel chamber to increase the fuel liquid head in said well, a nozzle communicating with the upper end of said well and through which fuel is ejected when the fuel head in the well is sufficiently increased, and means forming a normal air pressure gap across which said nozzle discharges; means rendering said member responsive to pressure increases occurring within a lower part only of the total depression range in the suction passage at the outlet side of the throttle, to discharge fuel through said discharge passage by virtue of pressure increases within said part range, and means for actuating said member independently of depression actuation in accordance with throttle opening movements within a lesser open part only of the full opening range of the throttle, to discharge fuel through said fuel passage.

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