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CARBURETOR

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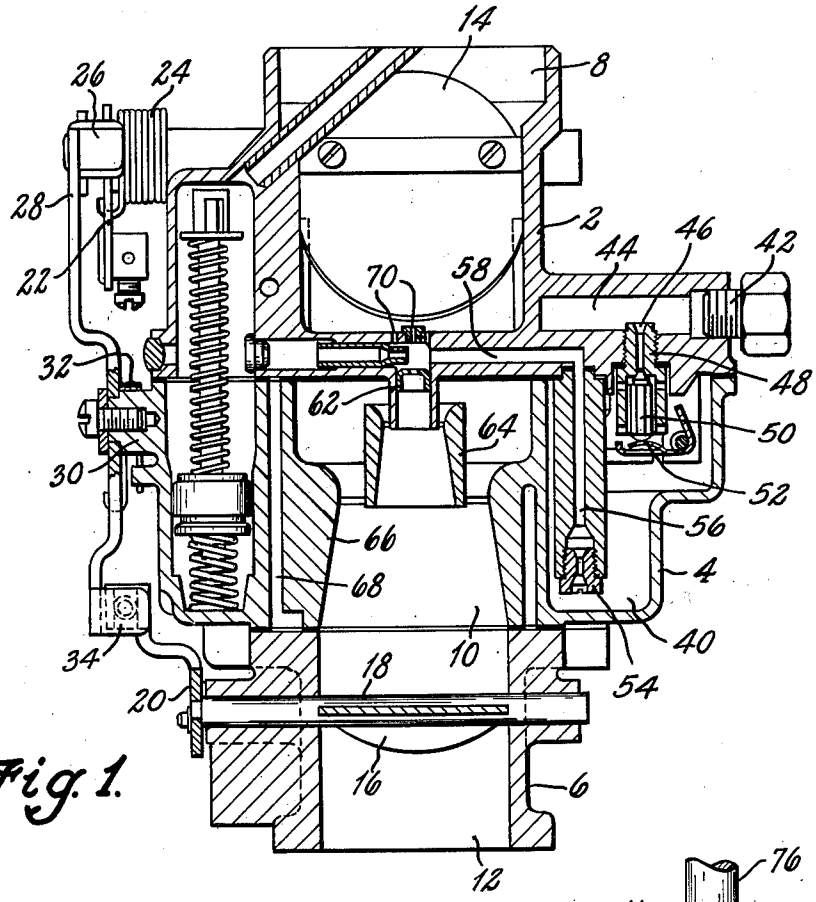


Fig. 1.

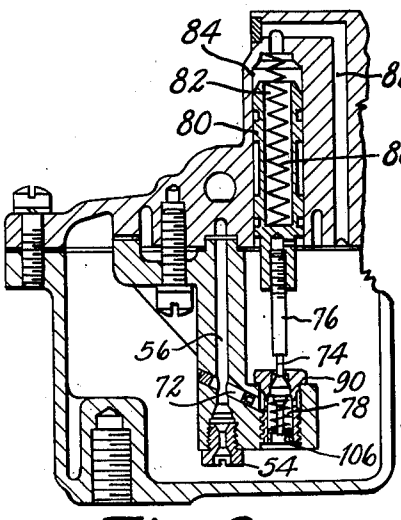


Fig. 2.

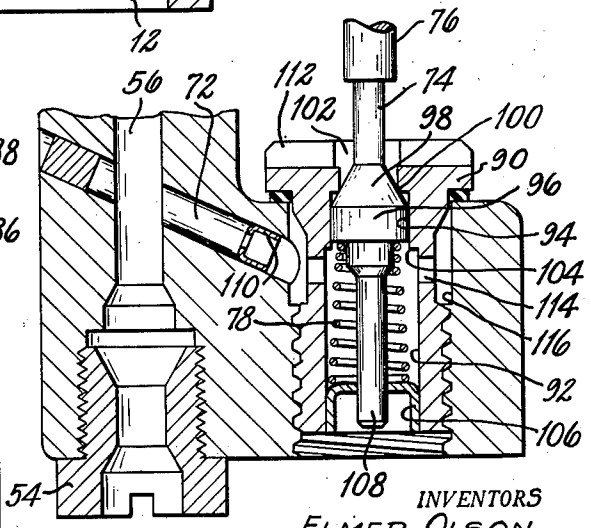


Fig. 3.

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CARBURETOR

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2 Claims. (Cl. 261—69)

This invention relates to carburetors for internal combustion engines, most particularly those for automotive use and is primarily concerned with means for supplying fuel to the carburetor under certain operating conditions.

It has long been the practice in carburetors to provide a constantly open main fuel feeding and metering orifice of sufficient capacity to supply enough fuel for most engine operation with a partially open throttle and, in addition, an auxiliary fuel feeding orifice which is closed during most engine operation when the throttle is only partly open, but is opened to supply additional fuel as the throttle approaches full open position, when more fuel is needed for increased power. It has generally been the practice to control this auxiliary orifice by a valve operated in response to variations in manifold vacuum and held in position to close the orifice as long as the vacuum exceeds some predetermined selected minimum. If the vacuum falls below such predetermined amount, a spring operated rod opens the valve to render the auxiliary fuel feeding orifice effective. As the throttle is moved toward open position the manifold vacuum decreases and at some position of the throttle the vacuum will decrease enough to permit the rod to be operated as described to open the fuel valve. The position of the throttle when this occurs will vary somewhat, depending on the load and the engine speed. If the load is light and the engine operating relatively fast, the throttle will open further before the auxiliary fuel feeding orifice becomes effective than when the load is heavy and the engine operating at relatively low speed.

In some installations it has been found desirable to provide an auxiliary fuel supply which is stepped up when the throttle is opened to a relatively great extent and the engine is operating relatively slowly under a relatively heavy load, and it is the primary purpose of the present invention to provide an auxiliary fuel feeding means which is effective to supply a considerably increased amount of fuel under these operating conditions.

According to the present invention, this object is accomplished by the provision of a fuel feeding passage having two valve seats of different area and a valve which normally engages the smaller seat to close the passage, but as the throttle is moved toward open position and the vacuum decreases below some predetermined selected vacuum, the valve is moved off of such seat to permit a flow of fuel through the passage, while if the vacuum falls far enough, either as the result of throttle opening or an increase in the load on the engine, the valve is moved far enough, it cooperates with the second valve seat of larger area in order to control the fuel flow. When this takes place, the passage through which fuel flows is of greater size and the amount of fuel supplied by the auxiliary passage is correspondingly increased.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred embodiment of the present invention is clearly shown.

In the drawings:

Figure 1 is a vertical section through a carburetor in which the present invention is embodied;

Figure 2 is a fragmentary vertical section through the auxiliary fuel feeding passage and the control means therefor; and

Figure 3 is an enlarged view of a part of Figure 2.

The present invention is shown as embodied in a carburetor such as illustrated in application Serial No. 109,347 of Elmer Olson, filed August 9, 1949, now Patent No. 2,694,560, issued November 16, 1954, and since the present invention is concerned only with the construction of an auxiliary fuel supply means operable under certain operating conditions, the carburetor is not shown in its entirety and the structure which is shown other than that which constitutes the present invention is not described in great detail.

The carburetor, which is of down-draft type, comprises three separate castings 2, 4 and 6, positioned one above the other. The casting 2, which constitutes the air inlet, is supported on top of the casting 4 in which the fuel chamber and the mixing chamber are positioned, and the casting 4 is supported on the casting 6 in which the throttle valve which controls the quantity of fuel mixture supplied to the engine is rotatably mounted. Suitable gaskets are positioned between the castings 2 and 4, 4 and 6. The air inlet passage is indicated at 8 and this communicates with the mixing chamber 10 in casting 4, from which combustible mixture is delivered to the outlet passage 12 in casting 6.

The admission of air through the passage 8 is controlled by a manually controlled but unbalanced choke valve 14 secured to a shaft which is rotatably mounted in the casting 2, and the quantity of combustible mixture supplied to the engine is controlled by a throttle valve 16 secured to shaft 18 rotatably mounted in casting 6.

The operating connections for the throttle and choke valves constitute no part of the present invention and can be of any suitable construction. However, some of the connections are shown in Fig. 1 and are, therefore, very briefly described hereinafter. The throttle is operated by the arm 20 secured to one end of shaft 18 and connected by an operating connection (not shown) to the usual accelerator pedal. The choke valve is operated by an arm 22, through a manual connection (not shown) extending to an operating member on the instrument panel. The arm 22 is movable on the choke valve shaft and the shaft is operated through the medium of a torsion spring 24 in the manner described in the previously mentioned parent application. The arm 22 has a cam surface formed thereon which engages a laterally extending ear 26 integral with a lever 28 pivotally mounted on a boss 30 and engaged by a torsion spring 32, which is a return spring. At the lower end of lever 28 there is a projecting ear 34 which is engaged by an adjustable screw on the operating arm 20 to determine the normal idle position of the throttle and also is moved by ear 34 when arm 22 is actuated to fully close the choke, so as to open the throttle slightly to effect faster than normal idling when the choke is fully closed at low temperatures.

Fuel is supplied to a chamber 40 in the casting 4 through a conduit 42 connecting with a passage 44 in casting 2.

A passage 46 in a nipple 48 connects passage 44 with chamber 40, and flow through the passage 46 is controlled by a valve 50 which rests on an arm 52 operated by the usual float (not shown), in the conventional manner to maintain a constant fuel level in chamber 40.

Fuel flows from the chamber 40 to main and idling fuel inlets through a metering plug 54 to a vertical passage 56 which connects at its upper end with a horizontal passage 58 formed in a tubular part of the casting 2 which extends across the mixture passage. Fuel flows from this passage through a restricted nozzle 62 which

terminates in a small venturi tube 64 discharging into a large venturi tube 66 formed by the wall of the mixing chamber.

The passage 58 extends all the way across the mixing chamber and at the left end connects with a vertical passage 68 in the casting 4, which leads to the idling fuel inlet (not shown). A plurality of openings 70 admit air to the passage 58 to form an emulsion of fuel and air therein.

Fuel is also supplied to the passage 56 through an auxiliary passage 72, the effectiveness of which is controlled by a valve 74 which is usually held closed during engine operation when the throttle is only partially open, but is opened when the vacuum maintained posterior to the throttle decreases sufficiently. To control the operation of the valve a rod 76 which is positioned immediately above the valve is caused to move downwardly to open the valve and when the rod is held in its upper position, the valve is held closed by a spring 78 which pushes upwardly on the valve.

The rod 76 has threaded connection with a piston 80 which is in the form of a sleeve having a cylindrical recess 82 and slidable in a cylinder 84. The piston is urged downwardly by a spring 86 positioned in the recess 82 between the lower closed end thereof and the top of the cylinder 84. Connecting with the top of cylinder 82 is a suction passage, designated generally by the reference number 88, which is not shown in its entirety herein, but which connects with the outlet passage 12 at a point below or posterior to the throttle valve 16, so that when the engine is in operation whatever degree of vacuum is maintained at the point posterior to the throttle where the passage 88 connects with the intake passage is communicated to the cylinder 84 above the piston and tends to lift the piston against the pressure of spring 86.

The spring 86 is a stronger spring than spring 78 so that whenever the engine is inoperative, the rod 76 will be moved downwardly and the valve opened. Also, whenever the vacuum or engine suction posterior to the throttle drops to a point where it is insufficient to overcome the pressure of spring 86, the latter will move the piston 80 and rod 76 downwardly and effect opening of the valve. During most engine operation, when the throttle is not open to a very considerable extent, the vacuum effective on the piston 80 is enough to overcome the pressure of spring 86 and spring 78 will hold valve 74 closed, but as the throttle moves toward open position the vacuum effective on the piston falls and at some position of the throttle will become insufficient to overcome the force of spring 86. When this occurs, the piston will drop and the valve 74 will be opened to supply additional fuel through passage 72 for the purpose of obtaining increase in power. The position of the throttle when this occurs is, as already stated, somewhat variable as the suction effective on the piston is controlled in part by engine speed and load as well as by throttle position. If the load is heavy, as when the vehicle is ascending a hill, the valve will open with the throttle in more nearly closed position than when the load is lighter.

The mechanism so far described is substantially the same as that disclosed in the above-mentioned copending application, but in such application the valve controlling the supply of additional fuel is merely a ball check valve and does not exert a variable control on the supply of fuel which is either cut off completely or, when the valve is open, the fuel flows through a passage of substantially constant area.

As stated earlier, it is desirable in some installations to materially increase the amount of fuel supplied through the auxiliary passage when the throttle approaches relatively wide open position and the vacuum posterior to the throttle is relatively low. The means for accomplishing this function will now be described.

The valve 74 is positioned in a valve housing or cage designated generally by the reference numeral 90. This housing has a bore 92 which is of reduced diameter at 94 and in this part of the bore a cylindrical part 96 of the valve 74 is normally received, being slightly spaced from the bore so that fuel can pass between such part of the valve and the bore when the valve is unseated. Normally, when the engine is running with the throttle open to a relatively slight extent, a tapered part 98 of the valve is held in engagement with a shoulder 100 formed at the junction of the reduced part 94 of the bore 92 and an opening 102 through which the stem of the valve 74 extends, as shown in Fig. 3. When the valve is in this position, the auxiliary fuel supply passage is closed and no fuel is permitted to flow through such passage.

At the point where the main part of the bore 92 joins the reduced part 94 a shoulder 104 is formed which, under certain operating conditions cooperates with the tapered surface 98 of the fuel valve to control the flow of fuel through the auxiliary fuel passage, as will be more fully described later.

The spring 78 is positioned in the bore 92 between a shoulder formed by the part 96 of the valve and a closure member 106 which is press fitted or otherwise retained in the bore and a stem 108 depending from the valve extends through an opening in the member 106 and guides the valve in its vertical movements.

A metering plug 110 is retained in the passage 72 in any suitable way and controls the flow through such passage and grooves 112 in the top of the valve housing 90 permit fuel to flow from the chamber 40 to the opening 102 when the rod 72 moves downwardly far enough to engage the top of the housing 90.

Openings 114 in the valve housing 90 permit flow of fuel from bore 92 into the annular space 116 with which the fuel passage 72 connects.

The operation of this mechanism should be apparent from the foregoing description. When the engine is not running, the valve 74 is open because spring 86 is stronger than spring 78. When the engine is started, the throttle is not as a rule opened very far and as soon as the engine becomes self-operative the rod 76 will be pulled upwardly by the engine suction and the valve 74 will be moved by spring 78 to the Fig. 3 position, closing the passage 102 and it will remain in this position during a large part of the engine operation when the throttle is opened partially. As the throttle moves toward open position, the suction effective on piston 80 ultimately becomes insufficient to overcome the force of spring 86 and the piston will move downwardly until the force of spring 86 is balanced by the suction plus the force of spring 78. This will effect opening of the valve, and under most operating conditions the valve will not move far enough to bring the tapered part 98 of the valve into cooperative relation with the shoulder 104 so that the rate of fuel flow will be determined by the area of the very small space between the cylindrical surface 96 and the part 94 of the bore in which the valve slides.

As already stated, the extent of throttle opening when the valve 74 is opened is somewhat variable, depending in part on the speed of the engine which is controlled by the load as well as by throttle opening. For example, if the throttle is 30° open and the vehicle ascending a steep grade, the suction effective on the piston will be less than if the throttle was open to the same extent and the vehicle descending a grade because, under the latter condition, the engine speed would be much greater. Therefore, some given opening movement of the throttle might be enough to effect an opening of valve 74 under some conditions while the valve would remain closed with the same throttle movement under other conditions. In any event, under most operating conditions the valve 74 is not opened far enough to bring the surface 98 into cooperative relation with the shoulder 104.

However, under some circumstances, as when the

throttle approaches wide open position and the load is heavy enough for the engine speed to be relatively low, the suction effective on piston **80** falls to such an extent that spring **86** moves rod **76** downwardly far enough to move the valve **74** to a position where the surface **96** cooperates with the shoulder **104** and the surface **96** is below such shoulder. When in such position, the shoulder **104** constitutes what might be termed a second valve seat and the space between the surface **98** and such shoulder defines a passage which controls the rate of fuel flow, rather than the space between surface **96** and the wall **94** of the bore **92**. When the valve **74** is moved to this position, the flow of fuel is considerably stepped up to supply the excess fuel necessary to give the additional power required for satisfactory operation under such conditions.

It will be understood that after the valve has moved to such a position, the area of the passage between surface **98** and shoulder **104** exceeds the area of the opening in metering plug **110**, the rate of fuel flow is controlled by the area of such opening.

While the embodiment of the present invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted.

What is claimed is as follows:

1. In a carburetor having a mixture passage for conveying a combustible mixture of fuel and air to an internal combustion engine, fuel and air inlets for supplying fuel and air to said mixture passage, a fuel chamber and a fuel passage for conveying fuel from said chamber to said fuel inlet; an auxiliary fuel passage for supplying additional fuel under certain operating conditions and means for controlling flow of fuel from said fuel chamber into said auxiliary passage including a valve housing having a passage therein with a restricted opening connecting with the fuel chamber and progressively increasing diameters forming a plurality of shoulders of different diameters on the wall of said passage, a fuel valve movable in said passage and having a tapered surface adapted to cooperate successively with said shoulders during opening movement of said fuel valve to control the flow of fuel into said housing, a spring operable to hold the tapered surface against one of said shoulders so as to prevent flow of fuel into said housing under certain operating conditions, and means operable in response to variations in engine suction to open the valve upon a predetermined decrease in suction and to move said fuel valve far enough to position the tapered surface thereof adjacent a second and larger shoulder upon a further decrease in suction in order to increase the amount of fuel supplied by the auxiliary fuel passage.

2. In a carburetor having a mixture passage for conveying a combustible mixture of fuel and air to an internal combustion engine, fuel and air inlets for supplying fuel and air to said mixture passage, a fuel chamber and a fuel passage for conveying fuel from said chamber to said fuel inlet; an auxiliary fuel passage for supplying additional fuel under certain operating conditions and means for controlling flow of fuel from said fuel chamber into said auxiliary passage including a valve housing having a passage therein with a restricted opening connecting with the fuel chamber and progressively increasing diameters forming a plurality of shoulders of different diameters on the wall of said passage, a fuel valve movable in said passage and having a tapered surface adapted to cooperate successively with said shoulders during opening movement of said fuel valve to control the flow of fuel into said housing, a spring operable to hold the tapered surface against one of said shoulders so as to prevent flow of fuel into said housing under certain operating conditions, a second spring normally urging the valve toward open position, a suction operated member preventing opening of the valve by said second spring when the suction effective on said member exceeds a predetermined suction and movable to permit opening of the valve by said second spring when the suction is less than said predetermined suction and movable upon a further drop in suction to move the valve far enough to position the tapered surface thereof in cooperative relation with a second and larger shoulder, in order to increase the fuel flow.

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