

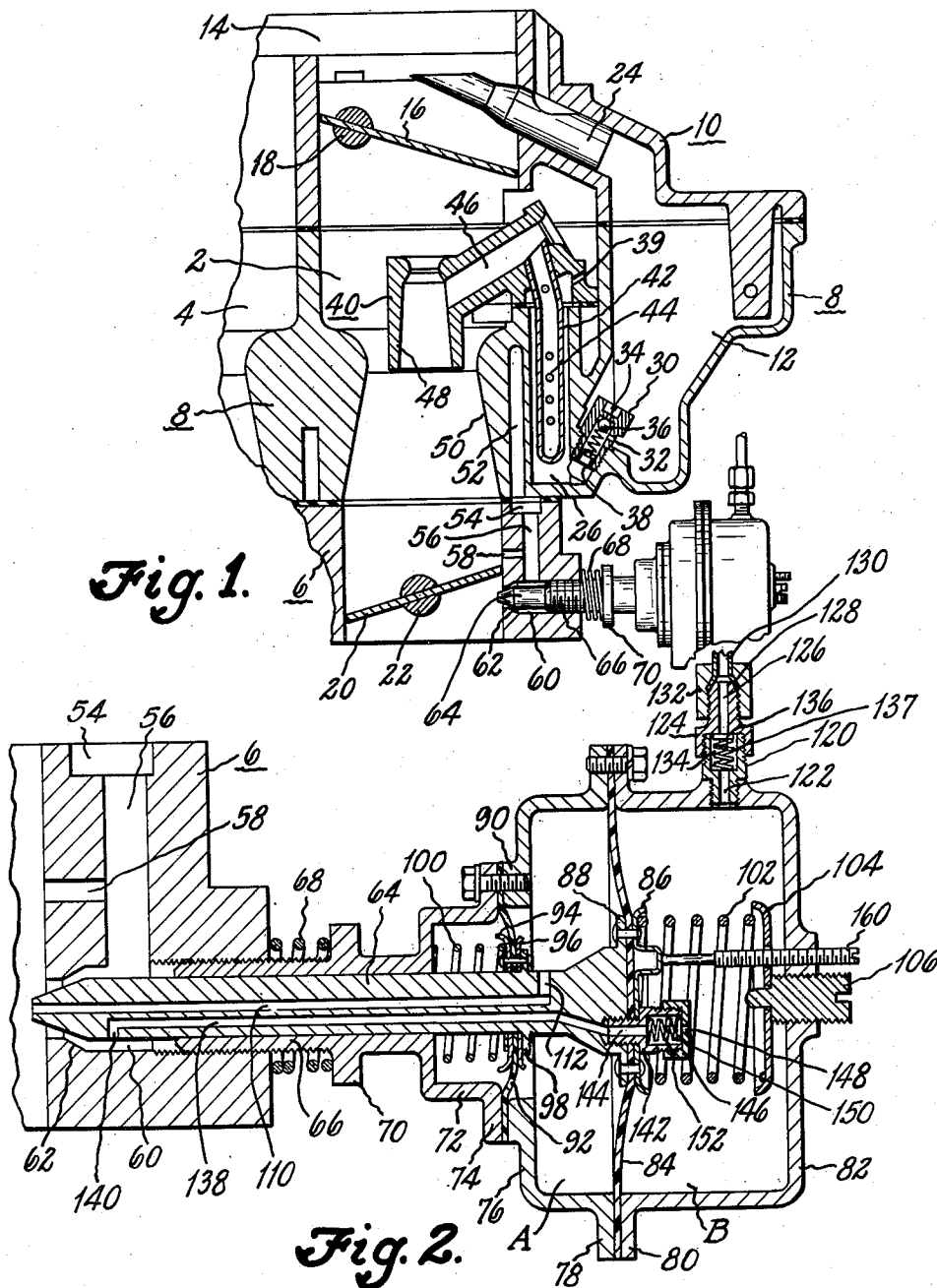
Feb. 25, 1958

H. H. DIETRICH

2,824,725

CARBURETOR

Filed Nov. 17, 1955



INVENTOR.
HOWARD H. DIETRICH

BY *Ray V. Johnston*

ATTORNEY

1

2,824,725

CARBURETOR

Howard H. Dietrich, Rochester, N. Y., assignor to General Motors Corporation, Detroit, Mich., a corporation of Delaware

Application November 17, 1955, Serial No. 547,404

6 Claims. (Cl. 261—34)

This invention relates particularly to carburetors for internal combustion engines used in automotive vehicles and is directed primarily to means for controlling the supply of idling mixture delivered to the intake passage posterior to the carburetor throttle under certain operating conditions.

In carburetors when idling mixture is supplied to the intake passage between the throttle and the engine, when the throttle is moved toward closed position for deceleration and the engine is being driven by the vehicle, the idling fuel supply passage is subjected to a much higher vacuum than that to which it is subjected when the engine is operating at normal idling and this vacuum is gradually reduced as the vehicle slows down. As long as the vacuum is greater than the normal idling vacuum, a larger quantity of fuel will be introduced into the intake passage than will be burned, resulting in the discharge of a considerable amount of unburned fuel into the atmosphere through the exhaust conduit. Obviously, this causes waste of fuel and contamination of the atmosphere by the unburned fuel.

Devices have been provided for preventing the discharge of fuel from the idling fuel supply into the intake passage during deceleration, when the vacuum is greater than the normal idling vacuum and which will be rendered ineffective when the vacuum drops to that normally maintained at idling. In devices of this kind, the idling fuel system becomes effective to supply fuel as soon as the vacuum drops to that normally maintained at idling operation. However, there is some delay in the resumption of normal operation by the engine, either idling or operation under load, for the reason that during deceleration, all of the fuel which is normally in the manifold and intake pipe during engine operation has been drawn into the engine during deceleration, so that when deceleration ends, there is no fuel in the entire intake system and walls of the intake pipe and manifold are dry. When the idling system and/or the main fuel inlet starts to function after deceleration, it takes an appreciable time interval for the fuel supplied thereby to reach the combustion chambers in proper quantity for satisfactory engine operation. This delay in resumption of normal engine operation is objectionable, causing the engine to run improperly and tending to cause the engine to stall.

It is accordingly the primary object of the present invention to provide a carburetor having means for automatically stopping the flow of fuel from the carburetor into the intake system of the engine during deceleration when the suction of the engine at points posterior to the throttle equals or exceeds a predetermined suction, means which will automatically cause the supplying of fuel to the intake system to be resumed when said suction of the engine falls to or below a predetermined suction and which is also provided with means to automatically minimize, as far as possible, delay in resumption of normal engine operation when the engine suction is no longer effective to cut off the flow of fuel into the intake system.

2

According to the present invention, this object is attained by the provision of an automatically operable suction actuated valve which is moved to a position to close the idling fuel passage whenever the throttle is closed to effect deceleration and whenever the suction posterior to the throttle equals or exceeds a predetermined suction, for example, 20" Hg. Movement of the valve to closed position is opposed by a spring which is compressed when the valve is closed, so that when closed, the spring exerts a force tending to open the valve which is overcome by the suction when the latter gets as high as above-indicated. When the suction falls below the figure indicated, as it does when normal idling suction is reached, the spring expands, opening the fuel valve to permit the idling fuel supply passage to again become effective and at the same time a diaphragm to which the fuel valve is connected and which forms one wall of a fuel chamber is also moved by said spring. Movement of the diaphragm forces fuel from this chamber under pressure into the intake passage through the idling fuel inlet, in addition to the normal idle fuel supply, much as the conventional accelerator pump supplies additional fuel during acceleration. This supply of additional fuel reduces the delay in resumption of normal engine operation after deceleration.

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 form of the present invention is clearly shown.

In the drawings:

Figure 1 is a fragmentary vertical section of a carburetor in which the present invention is embodied; and

Figure 2 is an enlarged section of the mechanism for controlling the fuel supply in accordance with the present invention.

In Fig. 1 a part of a four-outlet carburetor is shown in vertical section, one entire primary mixture passage, designated 2 in its entirety, being shown and a part of a secondary mixture passage 4. It will be understood that in a four-outlet carburetor there are two primary mixture passages 2 and two secondary passages 4, but if the carburetor is a dual outlet device, there is only one primary and one secondary mixture passage. Since the specific construction of the carburetor is entirely immaterial to the present invention and the particular carburetor appearing in the drawings is shown merely for illustrative purposes, the carburetor structure will be very briefly described.

The carburetor shown in the drawings is formed of three castings, positioned one above the other, and separated by suitable gaskets, these castings being a throttle body casting 6, a fuel chamber casting 8 immediately above the casting 6 and an air inlet casting 10 immediately above the fuel chamber casting. A fuel chamber 12, in which fuel is maintained at a substantially constant level, by means not shown, is formed in casting 8 and an air inlet opening 14 is formed in the casting 10.

A choke valve 16 secured to a rotatable shaft 18 controls admission of air to the mixture passage 2 and this valve may be controlled either manually or automatically, as desired, so far as the present invention is concerned. A throttle valve 20 secured to a rotatable shaft 22, which may be operated by any conventional means, not shown, controls the quantity of combustible mixture which is supplied to the engine in order to control the speed. A vent tube 24 extending into the mixture passage adjacent the air inlet maintains nearly atmospheric pressure in the fuel chamber in a well known manner.

Fuel is supplied by chamber 12 to a well 26 through a metering plug 30 which is screwed into a passage in casting 8 connecting the chamber 12 and the well. The plug has

a constantly open fuel passage 32 and another passage 34 normally closed by a spring held check valve 36 which is opened at high speed operation. The fuel passing through both passages 32 and 34 flows through an opening in a fuel metering member 38 at the outlet end of metering plug 30. The well is vented as indicated at 39.

A small casting 40 is secured in any suitable way to the casting 8, as shown in Fig. 1, above the well 26 and a fuel supply tube 42 having a closed lower end and a series of openings 44 therein extends down from the casting 40 into the well 26 and supplies fuel emulsion to a passage 46 formed in casting 40 and delivering such emulsion to a small venturi tube 48, that is also formed in casting 40, where the emulsion is mixed with additional air to form a primary mixture. This primary mixture is discharged into a large mixture tube 50 formed by the wall of casting 8, which constitutes the main mixing chamber and in which the primary mixture is mixed with additional air to form a fuel-air mixture of the desired combustible proportions.

An idling fuel well, not shown, supplies fuel for idling to the passage 52 formed in the wall of casting 8 and this passage connects with a channel 54 in the upper face of the casting 6, which leads to a vertical bore 56 also formed in casting 6. A bore 58 connects passage 56 with the mixture passage 2 at a point anterior to the throttle and a passage 60 connects the passage 56 with the mixture passage at a point posterior to the throttle. The bore 56 is primarily an air bleed while the passage 60 is a fuel supply passage which delivers fuel for idling to the mixture passage posterior to the throttle. The mechanism so far described is substantially similar to that fully shown and described in application Serial No. 264,136 of Olson et al., filed December 29, 1951, now Patent No. 2,771,282, granted November 20, 1956, and reference may be had to that application for a complete description of the carburetor.

The passage 60 has a tapered seat 62 adjacent its discharge end and cooperating with this seat to control the flow of fuel mixture for idling is a tapered valve 64 which is slidable in a sleeve 66 which is screwed into a threaded opening in the wall of the casting 6. This sleeve can be adjusted as desired by rotation and is held in any adjusted position by a spring 68 which surrounds the sleeve between the casting 6 and a flange 70 that extends outwardly from the sleeve. At the right end of the sleeve 66, as seen in the drawings, it is enlarged to form a cup-shaped chamber 72 through which the valve 64 extends and which is provided with an outwardly extending flange 74. Bolted to flange 74, as shown in Fig. 2 is a cup-shaped housing member 76 which forms part of a diaphragm chamber and which is provided with an outwardly extending flange 78. Between this flange and a similar flange 80, which extends from another cup-shaped member 82 is clamped a diaphragm 84 of suitable flexible material, the members 76 and 82 forming a chamber which is divided by the diaphragm into two chambers A and B. The diaphragm 84 at its center is connected to the valve 64 so that the diaphragm and valve move together, the diaphragm being clamped between the end of the valve and a washer 86 by any suitable means such as bolts or rivets which extend through the washer and a flange 88 which extends from the valve immediately adjacent the end of the valve.

Clamped between the flange 74 and a raised surface 90 on the member 76 is a diaphragm 92 of smaller size than the diaphragm 84 and through which the fuel valve 64 extends. The central part of this diaphragm is positioned between two metal washers 94 and 96, and the assembly, comprising the diaphragm and the two washers, is secured to a flange 98 integral with and extending from valve 64, by suitable bolts or rivets. The diaphragms are secured in position in such a way that the chambers A and B are fluid tight. A spring 100 positioned in the cup-shaped chamber 72 between the washer 94 and the closed end of

said chamber normally holds the parts in the position shown in Fig. 2 and the action of this spring is opposed by a somewhat weaker spring 102 which is positioned in chamber B between the washer 86 and another washer 104 which engages an adjustable stop member 106 which is screwed into the wall of the housing member 82 and can be adjusted therein to vary the force exerted by the spring 102 in opposition to that exerted by spring 100. The force of the spring 100 must be overcome by suction, which is communicated in a manner described later to chamber A, and the amount of suction necessary to effect closing of the valve may be regulated within limits by adjustment of the stop member 106, so as to vary to some extent the suction which must be maintained in the intake passage posterior to throttle 20, in order to effect closing of valve 64.

To communicate suction to the chamber A, the valve has a central bore 110 to which the suction of the intake passage posterior to the valve 20 is communicated and this bore connects with a short transverse passage 112 which communicates directly with the chamber. Thus, at all times, whether the valve 64 is open or closed, the suction or partial vacuum which is maintained in the intake passage between the throttle and the engine is communicated to the chamber A. If that suction is sufficient to overcome the force exerted by the spring 100 tending to open the valve, the valve will be moved to closed position and will be held in closed position as long as the force exerted by the suction is greater than that exerted by the spring. It will be understood, of course, that suction tends to pull the small diaphragm 92 to the right so that this diaphragm really aids the spring 100 in its action but, since the diaphragm 84 is much larger than diaphragm 92, the net effect of suction is to move the diaphragms and the valve 64 to the left. As soon as the suction in the intake passage posterior to valve 20 drops below that necessary to hold the valve closed, the spring 100 will move the valve to the right, opening the idling fuel supply passage 62 so that fuel for idling is again supplied to the intake passage.

When the valve 64 is moved to its closed position, fuel is drawn into the chamber B. To this end a nipple 120, having a fuel passage 122 therein, is screwed into the wall of the housing member 82 and a coupling member 124 having a fuel passage 126 therein has threaded engagement with the outer surface of the nipple 120, so that when the coupling member is tightened, a leak-proof joint is formed between said member and the nipple. The flared end 128 of a fuel conduit 130, which may be copper or any other suitable material, is clamped between a tapered end of the coupling member 124 and a suitable clamping nut 132 which is screwed on the end of the nipple to form a leak-proof connection. Within the nipple is a chamber 134 with which the passage 122 connects and in this chamber is a check valve 136 which is normally held in position to close the passage 126 by a spring 137.

Extending axially of the fuel valve 64 is a passage 138 which is connected with the passage 60 by a bore 140. At the right end, as seen in the drawings, the passage 138 connects with a small recess into which a nipple 142 is screwed. The nipple has a fuel passage 144 therein, while a cap member 146, which has an opening 148 therein, connecting with chamber B, has threaded engagement with the outer surface of the nipple. The passage 144 connects with a chamber in the nipple in which a check valve 150 is positioned and this valve is normally held in position to close the opening 148 by a spring 152.

A stop screw 160 which has threaded engagement with the wall of housing member 82 is adjustable to vary the normal position of the valve 64 and diaphragm 84 to vary the normal size of the idling fuel inlet as desired.

The operation of the valve 64 and the mechanism for actuating it is very simple. When the engine is idling normally a certain partial vacuum or suction, for example

5

18" Hg, is maintained in the intake passage posterior to valve 20. This suction, although communicated to the chamber A, is insufficient to close the valve 64 and the parts are in the position shown in the drawings. When the throttle is closed to effect deceleration, the engine operates for a time at higher than idling speed, because the engine is being driven by the vehicle. Due to this operation at high speed, the suction in the intake at points posterior to the throttle gets considerably higher than the suction during normal idling, for example, 22" or 23" Hg. This increase in suction effects complete closing of the valve 64 so that no fuel is supplied by the idling fuel inlet during deceleration until the speed drops to such extent that the suction is no higher than that maintained during normal idling. When the suction drops to that extent, the valve will open and idling fuel will again be supplied through the passage 60. Since the vacuum is not in excess of the normal idling vacuum, however, the fuel supplied will not be in excess of that which is burned, and unburned fuel will not be discharged into the atmosphere.

As previously indicated during the period of time the valve 64 is closed during deceleration, any fuel mixture which may be in the intake passage or manifold, as well as any liquid fuel which has been on the walls of such passage and manifold will have been eliminated and the entire intake passage and manifold will be substantially free of fuel and dry. Under such conditions when resumption of fuel flow through the idling fuel passage 60 takes place, a perceptible time interval will be required to get enough fuel into the cylinders for the engine to fire. This delay in the resumption of normal engine operation, after deceleration, is not only undesirable, it may actually tend to cause stalling of the engine. To minimize this period of delay, it is desirable that fuel in addition to the normal quantity of fuel supplied for idling be discharged into the intake passage simultaneously with the opening of the fuel valve 64. To effect this result when the spring 100 moves the valve 64 to open position, it also moves the diaphragm 84 to the right and this diaphragm acts as a pump, forcing fuel from the chamber B past the check valve 150 through passage 138 and bore 140 into passage 60. This fuel being forced under pressure through these passages is injected into the intake passage much as is the fuel from the conventional accelerator pump. The check valve 136 is, of course, closed when the diaphragm is moved to the right by reason of the pressure of the fuel thereon.

The chamber B is kept filled with fuel at all times because when the diaphragm 84 is moved to the left as valve 64 is closed, suction is created in chamber B which draws fuel into such chamber through the conduit 130 past check valve 136.

Adjustment of the member 106 will, as pointed out previously, vary to some extent the degree of suction necessary to effect closing of valve 64 and adjustment of the stop member 160 will modify the normal open position of the valve.

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 adapted to supply a mixture of fuel and air to an internal combustion engine, a throttle valve for controlling the quantity of mixture supplied thereto, means for supplying fuel and air to the mixture passage including a fuel conduit for supplying fuel to said passage at a point posterior to the throttle valve for idling and a fuel chamber supplying fuel to said conduit, means for controlling flow of fuel from said conduit into the mixture passage during deceleration upon movement of the throttle toward closed position, said last named means comprising a suction operated fuel valve movable to a position to prevent flow of fuel through said conduit when a predetermined suc-

6

tion is reached or exceeded in the mixture passage posterior to the throttle, means for moving said valve to open position when the suction in the mixture passage falls below said predetermined suction and a pump formed as a part of and operable by the valve as it is moved to open position to inject additional fuel into the mixture passage posterior to the throttle.

2. In a carburetor having a mixture passage adapted to supply a mixture of fuel and air to an internal combustion engine, a throttle valve for controlling the quantity of mixture supplied thereto, means for supplying fuel and air to the mixture passage including a fuel conduit for supplying fuel to said passage at a point posterior to the throttle valve for idling and a fuel chamber supplying fuel to said conduit, a fuel valve movable to a closed position to prevent flow of fuel from the idling fuel conduit during deceleration upon closing of the throttle valve, a second fuel chamber, a flexible diaphragm connected to the second fuel valve and forming one wall of said second fuel chamber, means for communicating the suction of the mixture passage posterior to the throttle to said diaphragm, so as to effect closing of the fuel valve when a predetermined suction is reached or exceeded, means for moving the valve to open position when the suction falls below the predetermined suction, and a fuel delivery passage extending to the mixture passage and through which fuel is forced from said second fuel chamber by the diaphragm when the fuel valve is opened.

3. In a carburetor having a mixture passage adapted to supply a mixture of fuel and air to an internal combustion engine, a throttle valve for controlling the quantity of mixture supplied thereto, means for supplying fuel and air to the mixture passage including a fuel conduit for supplying fuel to said passage at a point posterior to the throttle valve for idling and a fuel chamber supplying fuel to said conduit, a fuel valve for controlling the flow of fuel from the idling fuel conduit during deceleration upon closing of the throttle, a second fuel chamber, a flexible diaphragm movable in response to variations in suction in the mixture passage posterior to the throttle to effect closing and opening of said fuel valve, said diaphragm forming one wall of said second fuel chamber whereby movement of the diaphragm upon opening of the fuel valve will force fuel from said chamber, and a passage for conveying such fuel from said second fuel chamber into the mixture passage.

4. In a carburetor having a mixture passage adapted to supply a mixture of fuel and air to an internal combustion engine, a throttle valve for controlling the quantity of mixture supplied thereto, means for supplying fuel and air to the mixture passage including a fuel conduit for supplying fuel to said passage at a point posterior to the throttle valve for idling and a fuel chamber supplying fuel to said conduit, a fuel valve for controlling the flow of fuel from the idling fuel conduit during deceleration upon closing of the throttle, a second fuel chamber, a flexible diaphragm movable in response to variations in suction in the mixture passage posterior to the throttle to effect closing and opening of said fuel valve, said diaphragm forming one wall of said second fuel chamber, a fuel supply passage communicating with said second fuel chamber and effective to supply fuel thereto upon movement of the diaphragm to close the fuel valve and a fuel delivery passage connecting said second fuel chamber with the mixture passage, and effective to deliver fuel to the mixture passage when the diaphragm is moved to open the fuel valve.

5. In a carburetor having a mixture passage adapted to supply a mixture of fuel and air to an internal combustion engine, a throttle valve for controlling the quantity of mixture supplied thereto, means for supplying fuel and air to the mixture passage including a fuel conduit for supplying fuel to said passage at a point posterior to the throttle valve for idling and a fuel cham-

7

ber supplying fuel to said conduit, a fuel valve for controlling the flow of fuel from the idling fuel conduit during deceleration upon closing of the throttle, a suction operated member connected to the fuel valve and movable in response to variations in suction in the mixture passage posterior to the throttle, said member being movable to close the fuel valve when a predetermined suction is equalled or exceeded in the mixture passage and movable to open the fuel valve when the suction falls below said predetermined suction, a passage formed in the fuel valve for communicating the suction of the mixture passage to said suction operated member, a second fuel chamber from which fuel is forced by movement of said suction operated member when the valve is opened, and a second passage in the fuel valve for delivering such fuel to the mixture passage.

6. In a carburetor having a mixture passage adapted to supply a mixture of fuel and air to an internal combustion engine, a throttle valve for controlling the quantity of mixture supplied thereto, means for supplying fuel and air to the mixture passage including a fuel conduit for supplying fuel to said passage at a point posterior to the throttle valve for idling and a fuel chamber supplying fuel to said conduit, a housing, a flexible diaphragm dividing said housing into two fluid-tight cham-

8

bers on opposite sides of the diaphragm, a fuel valve extending into said housing and connected to the diaphragm, means for communicating the suction of the mixture passage posterior to the throttle to one of said chambers so as to move the diaphragm sufficiently to close the fuel valve when a predetermined suction is equally or exceeded, means for introducing fuel into the other of said fluid-tight chambers when the diaphragm is moved to close the fuel valve, means for moving the fuel valve to open position when the suction in the mixture passage falls below said predetermined suction and for simultaneously moving the diaphragm in a direction to force fuel from said other fuel-tight chamber into the mixture passage.

References Cited in the file of this patent

UNITED STATES PATENTS

2,134,667	Leibing	Oct. 25, 1938
2,162,056	Bracke	June 13, 1939
2,212,936	Hoof	Aug. 27, 1940
2,315,715	Leibing	Apr. 6, 1943

FOREIGN PATENTS

800,897	France	May 11, 1936
---------	--------	--------------