

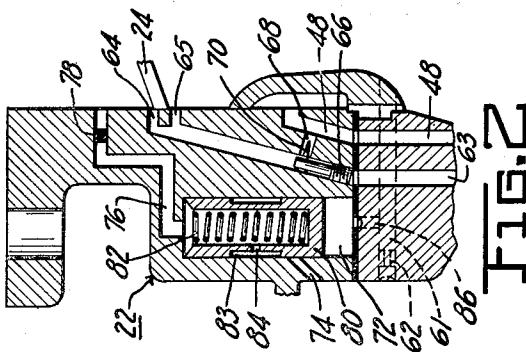
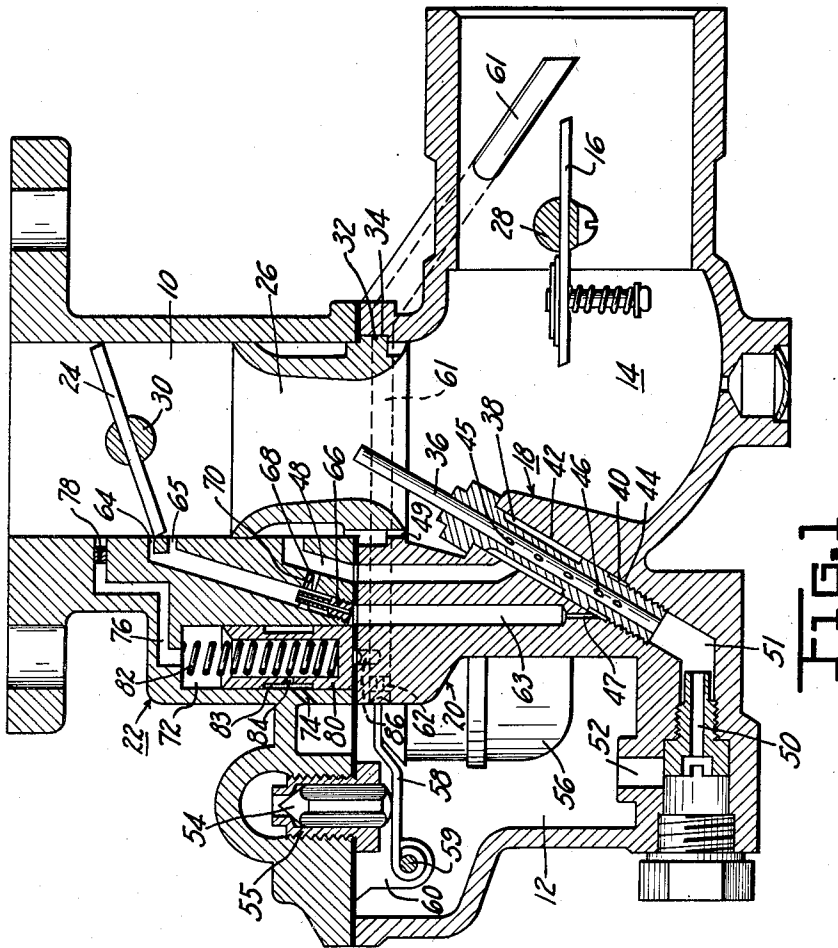
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CARBURETOR BY-PASS CONTROL

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1

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CARBURETOR BY-PASS CONTROL

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The present invention relates to carburetors for internal combustion engines and more particularly to a control system in float type carburetors for varying the idling fuel-air mixture in accordance with engine requirements.

One of the principal objects of the present invention is to provide a carburetor for an internal combustion engine wherein the proper fuel-air mixture is supplied the engine while said engine is idling under varying operating conditions.

Another object of the present invention is to provide a carburetor for the aforesaid engine, wherein the fuel-air mixture for idling is automatically adjusted in response to variations in intake manifold pressure.

Another object of the invention is to provide in an internal combustion engine carburetor, a pressure responsive mechanism for leaning the fuel-air mixture during idling when the intake manifold vacuum becomes abnormally low, such as would occur when the engine is placed under load during idling.

Still another object of the invention is to provide in a carburetor a simple and easily assembled mechanism for varying the quantity of fuel and air in the fuel-air mixture during idling of the engine.

The present invention is primarily concerned with a means for providing the proper fuel-air mixture under varying engine idling conditions by regulating the pressure above the fuel in the fuel bowl in response to changes in intake manifold vacuum. The mechanism for accomplishing the aforementioned objectives consists of a conduit connecting the fuel bowl above the fuel with the induction passage on the engine side of the throttle valve and a valvular means in said conduit adapted to close and open the conduit as the manifold vacuum rises above or falls below a predetermined value. For normal idling operation, the valve in the conduit connecting the fuel bowl with the induction passage remains closed and normal atmospheric or air entrance pressure is maintained in the fuel bowl above the fuel. As engine speed decreases during idling and the manifold vacuum falls to a subnormal value, the valve controlling the conduit opens and permits engine suction to be transmitted to the fuel bowl, thus causing depression of the air pressure above the fuel and consequently a decrease in the fuel delivered by the idling system, as well as providing through said conduit an additional supply of air for said engine. The leaner fuel-air mixture obtained by the decrease in fuel supply and the increase in air supply satisfies the requirements of the engine idling under the aforementioned subnormal speed and manifold vacuum. When the engine speed and intake manifold vacuum return to normal, the valvular means again closes the conduit to provide the normal idling fuel-air mixture.

The present invention may be clearly understood by referring to the accompanying drawings, wherein:

Figure 1 is a vertical cross-sectional view of a carburetor for an internal combustion engine in which certain elements of the carburetor have been rearranged to more clearly illustrate the present invention; and

Figure 2 is a fragmentary cross-sectional view of the carburetor shown in Figure 1 in which the operation of the present invention is further illustrated.

The embodiment of the invention illustrated in the accompanying drawings is shown in combination with a conventional updraft carburetor generally comprising a throttle body 10, a float chamber 12 and an air intake 14 having therein a choke valve 16, a main discharge system generally shown at 18 and the lower section of an idle

2

system generally shown at 20. The throttle body 10 contains the upper section of the idling system and auxiliary idle control 22 together with a conventional throttle valve 24 and venturi tube 26. The induction passage of the carburetor extends through air intake 14 and throttle body 10 and is controlled at the air inlet by choke valve 16 mounted on shaft 28 and at the mixture outlet end by throttle valve 24 mounted on shaft 30 which is manually actuated through a throttle valve lever and linkage (not shown) mounted on one end of said shaft. The venturi tube 26 is mounted in throttle body 12 adjacent the air intake and held in place by an annular rib 32 being clamped in annular recess 34 in the end of said air intake 14.

The main fuel discharge jet 18 extends from near the bottom of the carburetor adjacent the fuel bowl to the throat of the venturi and includes a main discharge tube 36 having annular recesses 38 and 40 which together with the bore for the discharge jet form annular fuel or fuel and air passages 42 and 44 around the main discharge tube. These two passages are connected with the interior of said tube by a plurality of ports 45 and 46 spaced longitudinally along said main tube. Passage 44 communicates with the idling system 20 through duct 47, and passage 42 is connected by conduit 48 with the space behind the venturi tube 26, said space being vented to the induction passage through port 49. The main fuel metering orifice 50 is disposed in main fuel conduit 51 and is connected with the fuel bowl by a conduit 52. The fuel supply to the carburetor is controlled by a needle valve 54 slidably received in a sleeve 55 and a float 56 supported by an arm 58 which is pivoted on a pin 59 secured to bracket 60, said arm being adapted to engage the lower end of said needle valve and to regulate said valve in accordance with the quantity of fuel being withdrawn from the fuel bowl. The fuel bowl above the fuel level is vented to the air inlet of intake 14 by conduit 61 so that the pressure above the fuel may be maintained at substantially atmospheric pressure during normal engine operation. Said conduit is provided with a replaceable restriction 62 which may be used in adjusting air flow through said conduit and consequently the pressure above the fuel in the fuel bowl, as will be more fully explained hereinafter.

The idling system 20 including conduit 63 communicates with the induction passage through ports 64 and 65 on either side of throttle valve 24 and with fuel passage 44 of the main discharge jet through duct 47. The upper portion of conduit 63 contains an idling metering jet 66 and an air bleed duct 68 connecting conduit 63 with conduit 48, said duct having a needle valve 70 therein (only one end of said valve being shown in the drawings) for controlling the quantity of air permitted to bleed into the upper end of conduit 63 on the posterior side of jet 66 and to form therein an emulsion with the idling fuel. The fuel and air emulsion formed at the upper portion of conduit 63 by the air entering said conduit through duct 68 is further emulsified before being discharged through port 64 by air entering port 65 when the throttle valve is in closed or substantially closed position. When the throttle valve is opened, the flow of air into port 65 is interrupted so that only the original fuel-air emulsion is discharged into the induction passage by the idling system.

When the engine speed and manifold vacuum become subnormal during idling as a result of increased load, the fuel-air mixture tends to become excessively rich and a heavy smoke is given off in the engine exhaust. In order to lean the mixture for the slower idling speeds so that said mixture will more nearly satisfy engine requirements, an auxiliary idle control mechanism 22 has been included in the carburetor. This mechanism broadly consists of a passageway connecting the fuel bowl above the fuel with the induction passage on the engine side of the throttle valve together with a pressure responsive valve for opening the passageway when the manifold vacuum falls below a certain predetermined value. The mechanism includes a cylinder 72, a port 74 connecting the central portion of said cylinder with the fuel bowl, and a conduit 76 having a restriction 78 therein connecting the upper portion of said cylinder with the induction passage posterior to the

throttle valve. A reciprocable hollow piston 80 is disposed in said cylinder and is urged to its lowermost position by a calibrated coil spring 82 which reacts between the upper end of cylinder 72 and the internal bottom of said piston. The piston is provided with an annular recess 83 about the central portion thereof which registers with port 74 when the piston is in the lower end of cylinder 72. The annular recess communicates with the hollow interior of piston 80 through one or more calibrated orifices 84 in the central portion of said recess. When piston 80 is in the lower end of cylinder 72, as shown in Figure 1, the float chamber above the fuel level communicates with the induction passage on the engine side of the throttle valve through port 74, annular recess 83, port 84, interior of piston 80, cylinder 72 and conduit 76; and by the effect of engine suction transmitted through said passageway, the pressure above the fuel is decreased to a value appreciably below atmospheric pressure. During normal engine idling operation, piston 80 is drawn into the upper end of cylinder 72, and the lower end of annular recess 83 is moved to a position entirely above port 74 so that the flow of air from the float chamber through said passageway is interrupted until the intake manifold vacuum again falls below a predetermined value and piston 80 has returned to the lower end of cylinder 72. The lower end of cylinder 72 below piston 80 is vented to the atmosphere through duct 86 and conduit 61 to permit free movement of the piston in said cylinder during operation of the engine.

While the passageway is open, air flows through conduit 61, restriction 62 into the space above the fuel and out through the passageway to the induction passage. By correlating the effective size of restrictions 62, 78 and 84 and the calibration of spring 82, a range of pressure depression above the fuel, as well as the time when the piston will open and close the passageway, can be predetermined. The spring and restrictions are preferably so calibrated that the passageway will open when the vacuum in the intake manifold falls below about eighteen inches of mercury.

In the operation of the carburetor described herein, with the engine running at part or wide open throttle, fuel is delivered from the fuel bowl through conduit 52, main metering jet 50, conduit 51 and main discharge jet 18, and thence discharged into the induction passage in the throat of venturi 26. As fuel flows through the discharge jet, air is bled into the fuel stream through ports 45 from annular passage 42 and conduit 48 connecting said passage with the space behind venturi 26. Under certain conditions during normal part and wide open throttle, air is also bled into the fuel stream in the main discharge jet from annular passage 44, the air being supplied by backflow in the idling system. It is sometimes found desirable to include a check valve in the idling system to prevent any appreciable amount of backflow through the idling system, though such an arrangement has not been included in the present embodiment. As the throttle valve approaches closed position, engine suction lowers the pressure in the idling system and causes the fuel to flow through the ports 46 and the annular passage 44 and thence through the idling system into the induction passage adjacent the throttle valve. As the fuel flows upwardly through conduit 63, it passes through idling metering jet 66 and thereafter mixes with the air bled into the idling system through duct 68, forming an emulsion which aids in complete atomization of the fuel as it is discharged through port 64 into the induction passage. Ports 64 and 65 are so arranged adjacent the throttle valve that when said valve is closed, port 64 is posterior to said valve and port 65 is anterior thereto. With this relationship, air is bled into port 65 when the throttle valve is in closed or substantially closed position, thus providing air to further emulsify the idling fuel as well as providing additional air for the combustion of said fuel. When the throttle valve has been opened to a point where port 65 is entirely on the engine side of said valve, only the original emulsion formed in conduit 63 passes through port 64 or through both ports 64 and 65.

While the engine is idling normally, the manifold vacuum is generally maintained above about eighteen inches of mercury, and with this vacuum piston 80 is drawn into and held in the upper end of cylinder 72, as shown in Figure 2, in opposition to the force of spring 82 urging said piston toward the lower end of said cylinder.

With the piston in the upper end of cylinder 72, the annular recess 83 and port 84 are not in communication with port 74 leading to the fuel bowl; the pressure above the fuel in said bowl, therefore, remains at substantially atmospheric pressure as transmitted through conduit 61 from the entrance of air intake 14.

As the speed of the engine is decreased while the engine is idling, such as would occur if the engine were placed under load, the manifold vacuum decreases appreciably, and as a result the idling fuel-air mixture becomes excessively rich for the slower idling speed. When the manifold vacuum decreases to a predetermined value, spring 82 forces piston 80 to its lowermost position in cylinder 72. The recess 83 and port 84 now register with port 74, and the fuel bowl and induction passage are in direct communication with one another through port 74, recess 83, port 84, cylinder 72 and conduit 76. The engine suction transmitted through the foregoing passageway to the space above the fuel in the fuel bowl causes a substantial lowering of the pressure therein and consequently a decrease in the quantity delivered to the idling system from the fuel bowl. The diminished quantity of fuel supplied to the idling system while the piston is in the position shown in Figure 1, together with the air flow through the passageway, leans the fuel-air mixture sufficiently to satisfy engine requirements for the slow idling speed. When the load is removed while the engine is still idling, the manifold vacuum increases sufficiently to lift piston 80 to its uppermost position in cylinder 72 thus closing the passageway between the fuel bowl and the induction passage.

While in the drawings only the main fuel discharge and idling systems together with the present idling control mechanism are shown, it is understood that other fuel systems normally present in conventional carburetors for internal combustion engines, such as the economizing and accelerating systems, are preferably included in the carburetor in which the present invention is used.

It is contemplated that other arrangements of elements comprising the present invention than those shown in the accompanying drawings may be provided without departing from the scope of the present invention; for example, piston 80 may be provided with a multiplicity of annular recesses 83 and ports 84 so arranged that they will register successively with port 74 as piston 80 descends in cylinder 72, and gradually increase the effective size of the passageway as the intake manifold vacuum decreases. Although this modification has not been described in detail herein or illustrated in the accompanying drawings, the changes necessary to construct this modification of my invention will be apparent to those skilled in the art.

I claim:

1. In an engine carburetor having an induction passage with a throttle valve therein: a fuel bowl, a vent of limited flow capacity for said fuel bowl, a main discharge jet, an idling system having a conduit communicating at one end with said discharge jet and at the other end with the induction passage adjacent the throttle, a passageway connecting the bowl above the fuel with the induction passage on the engine side of the throttle, a sliding valve means in said passageway urged upwardly by manifold vacuum in said induction passage, a recess in said valve means adapted to provide communication between said bowl and said induction passage when said valve means is in its lower position, and a spring adapted to urge said valve means downwardly in opposition to manifold vacuum.

2. In an internal combustion engine carburetor having an induction passage with a throttle valve therein: a fuel bowl; an idling system communicating at one end with said fuel bowl and at the other end with the induction passage on the engine side of said throttle valve; a cylinder; a conduit connecting the upper end of said cylinder with the induction passage on the engine side of said throttle valve; a port in the side of said cylinder connecting said cylinder with the space above the fuel in said fuel bowl; a cup-shaped piston in said cylinder having its open end at the top; an annular recess in said piston; a port connecting said recess with the interior of said cup-shaped piston; and a spring adapted to urge said piston to its lowermost position in opposition to manifold vacuum, the recess and port in said piston being adapted to register with the port in said cylinder, when the cylinder is in its lowermost position.

3. In an internal combustion engine carburetor having an induction passage with a throttle valve therein: a fuel

5

bowl; a vent of limited flow capacity for said fuel bowl; a main discharge jet adapted to supply fuel from the fuel bowl to said induction passage; an idling system having a conduit communicating at one end with said discharge jet and at the other end with the induction passage on the engine side of said throttle valve; a cylinder; a conduit connecting the upper end of said cylinder with the induction passage on the engine side of said throttle valve; a port connecting a central portion of said cylinder with the space above the fuel in said fuel bowl; a cup-shaped piston in said cylinder having its open end at the top; an annular recess in said piston about the central portion thereof; a port connecting said recess with the interior of said cup-shaped piston; and a spring adapted to react between said piston and the upper end of said cylinder for urging said piston to its lowermost position in opposition to intake manifold vacuum, the port in said piston and the port in said cylinder being in communication with one another when said piston is in its lowermost position, whereby manifold vacuum is transmitted to the fuel bowl above the fuel to produce a leaning effect on the fuel-air mixture for slow idling.

4. In an internal combustion engine carburetor having

6

an induction passage with a throttle valve therein: a fuel bowl, an idling system communicating at one end with said fuel bowl and at the other end with the induction passage on the engine side of said throttle valve, a cylinder, a conduit connecting the upper end of said cylinder with the induction passage on the engine side of said throttle valve, a conduit connecting said cylinder with the space above the fuel in said fuel bowl, a piston in said cylinder urged upwardly by manifold vacuum in said induction passage, a recess in said piston adapted to provide communication between said conduits when said piston is in the lower part of said cylinder, and a spring adapted to urge said piston downwardly in opposition to manifold vacuum.

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