

April 13, 1954

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AUTOMATIC MANIFOLD PRESSURE OPERATED
MIXTURE CONTROL VALVE
Filed Feb. 15, 1946

2,675,217

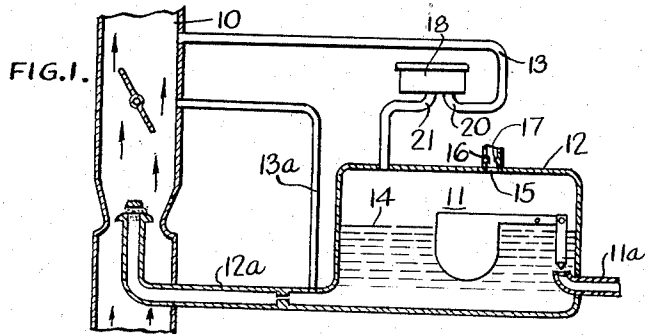
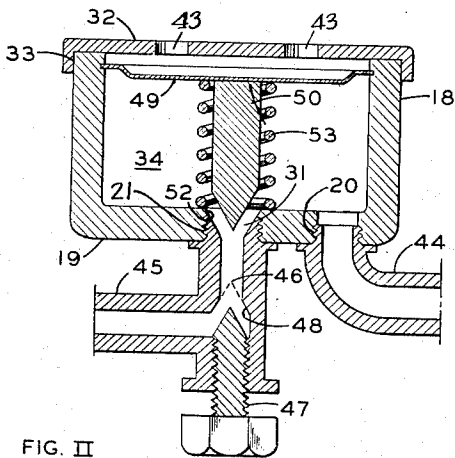


FIG. II

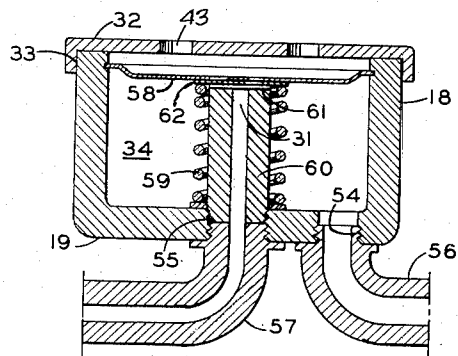


FIG. III

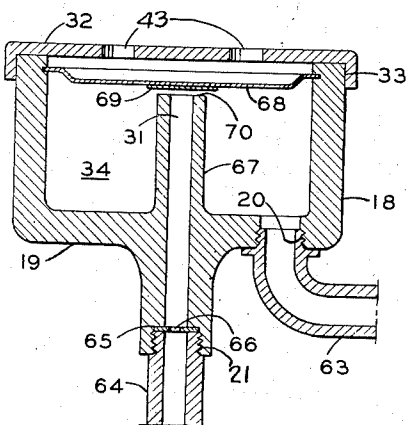


FIG. IV

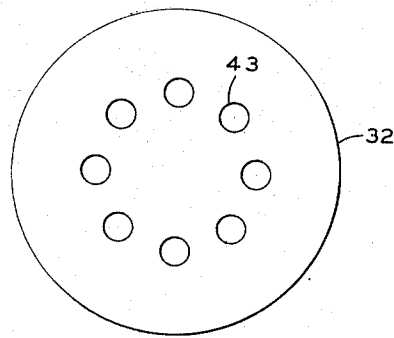


FIG. V

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2,675,217

AUTOMATIC MANIFOLD PRESSURE OPERATED MIXTURE CONTROL VALVE

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Application February 15, 1946, Serial No. 647,985

11 Claims. (Cl. 261—41)

(Granted under Title 35, U. S. Code (1952),
sec. 266)

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This invention relates to improvements in fuel economizers for naturally aspirated internal combustion engines using a carburetor, and is particularly directed to an improvement in "back suction" mixture control devices.

An object of this invention is to provide an improvement in "a back suction" mixture control device which automatically controls the fuel-air ratio, of a carburetor for a naturally aspirated internal combustion engine, by controlling the carburetor in accordance with the speed or load demand of the engine.

A further object of this invention is to provide a device that makes it possible to operate an internal combustion engine continuously at the best fuel-air mixture or at any other mixture leaner than that for which the carburetor is adjusted by virtue of its jet sizes.

Another object of this invention is to provide a device which precludes engine stalling when sharp reductions in throttle openings cause sharp reductions in the absolute manifold pressure.

Other objects and advantages of this invention will become apparent as the discussion proceeds and is considered in connection with the accompanying claims and drawings wherein like parts are designated by like numerals throughout, and wherein:

Fig. I is a diagrammatic view showing the automatic manifold pressure operated cut-off valve 18 embodied in this invention adapted to a vacuum line between the intake manifold and the float chamber of a carburetor of an internal combustion engine.

Figs. II, III and IV are cross-sectional views of various types of automatic manifold pressure operated valves embodied in this invention.

Fig. V is a top plan view of the automatic manifold pressure operated cut-off valve cover embodied in this invention.

Referring now to the drawing, wherein for the purpose of illustration, is shown a preferred embodiment of this invention, a conventional "back suction" mixture control device includes an intake manifold 10 of an internal combustion engine. The numeral 11 designates a carburetor fluid level chamber or bowl having a top member or cover 12. A vacuum line 13 connects the said manifold 10 to the top 12 of the said float chamber, as shown in the illustration in Fig. I, and is adapted to decrease the absolute pressure or "pull" a vacuum on the fluid level 14 of said carburetor. An opening 15, in the said top 12 of the float chamber, is provided with an orifice plate 16 having an orifice 17. A conduit 11a con-

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nects to a supply of fuel, and conduits 12a and 13a lead to a main jet and to an idling jet, respectively. This invention consists of an automatic manifold pressure operated cut-off valve 18, details of which are shown in Figs. II, III and IV, which is inserted in the vacuum line 13 of the conventional "back suction" mixture control device as shown.

Referring now to the details of the valve embodied in this invention, attention is directed to Fig. II, the numeral 18 designates the assembled valve. The numeral 19 designates the base or bottom portion of the said valve 18 having a passage 20 connected to manifold 10 and larger than passage 21 connected to chamber 11 through cover 12 of the chamber, as shown.

A cover or cylindrical cap 32 is machined and slidably fitted to the base 19 at 33. Breather holes 43, provided in the top of the cap, relieve the pressure as the diaphragm pulsates in the said valve.

In operation a vacuum from the intake manifold 10 is "pulled" on the fluid level of the float chamber 11 through the vacuum line 13. This varies the fuel-air ratio of the carburetor in accordance with the absolute manifold pressure of the engine. However, during erratic fluctuations of this absolute manifold pressure, when the intake manifold pressure is greatly decreased as in the case of idling, the flow of fuel to the carburetor will be decreased to such an extent that the carburetor is "starved" out and the engine will stall. To control these erratic variations, the automatic manifold pressure operated cut-off valve of this invention, described in detail above, is put in series with the vacuum line 13 as shown in Fig. I. Intake manifold pressure or vacuum passes through the passage 20 to the chamber 34 (Figs. II, III and IV) and thence out through the passage 21. When the vacuum pull is normal the springs 53 or 59 are set to hold the valve in an open position. However, any sudden surge of vacuum pull on the chamber 34 will overcome the effect of the compression of the springs 53 or 59 and will pull the diaphragms 49 or 58 down, closing passage 21 and the hole 31 and vacuum line to the float chamber. Once the vacuum pull from the manifold returns to normal the compression of the springs 53 or 59 effects the opening of the vacuum line again.

It is to be further noted that the effect of the vacuum pulled on the float level of the carburetor is governed by the relation of the size of the orifice 17, in the float chamber, to the cross sectional area of the vacuum line at its smallest

point. Any variation of this relation will directly affect the fuel-air ratio of the carburetor. The cross-sectional area of the vacuum line should always be larger than the orifice 17.

In the type shown in Fig. II passages 20 and 21 connected to the manifold 10 and to the float chamber 11 respectively are fitted with screw nipples 44 and 45. An adjustable opening 46 is provided in the nipple 45 by means of a threaded needle valve 47 co-acting with a seat 48 provided in the nipple 45, as shown. A diaphragm 49 carries a second needle valve 50 which seats in the base 19 of the housing 13 on a ground seat 52. A compression spring 53 loads the diaphragm 49. The valve embodied in this type of the invention operates in the general manner already described. That is to say, the vacuum from the intake manifold 10 pulls a head on or creates a decreased absolute manifold pressure in the chamber 11 through the valve 18 during normal functioning of the engine but the vacuum line 13 is cut off by the needle valve 50 when an increased vacuum is put on the line 13. The spring 53 opens the needle valve 50 when the vacuum on the line 13 returns to normal. The cross section area of the line 13 is varied by the needle valve 47.

In the type shown in Fig. III the numeral 13 designates the valve housing. The numerals 54 and 55 designate the threaded openings in the case 13 for threaded nipples 56 and 57. A spring loaded diaphragm 58 is affixed to the case 13 in any suitable manner as by soldering or welding and a spring 59 holds the diaphragm against the vacuum set up in the line 13. Cross-sectional area adjustments of the line 13 provided in the valve shown in Fig. II are omitted in this type and the adjustments are provided for by varying the size of the openings in the nipples 56 and 57. A nipple 60 threaded on the lower end is screwed into the thread opening 55, as shown, and carries a ground seat 61 on the top for engagement with a ground seat 52 affixed to the diaphragm 58, as shown. The operation of this type is substantially the same as the operation in Fig. II except that the vacuum to the chamber 11 is cut off when the diaphragm seat 52 is pulled by the vacuum from the manifold 10, down to cover the seat 61 of the nipple 60. The spring 59 returns the said diaphragm seat to its normal position when the vacuum on the line 13 returns to normal.

The type shown in Fig. IV is provided with a case 18, and with threaded openings or passages 20 and 21. The vacuum line 13 as in the other types is fitted in any suitable manner to the valve 18, as by threaded nipples 63 and 64 through the threaded apertures 20 and 21. The threaded nipple 64 provided in the passage 21 holds removable orifice plate 65, having an orifice 66, in place in the passage 21. A nipple 67 communicating with the passage 21 is made integral with the case 18 or may be threaded into the passage 21, as the nipple 60 in the type shown in Fig. III. A resilient diaphragm 68 is affixed to the case 18 in any suitable manner as by welding or soldering and carries a ground seat 69 adjacent a companion ground seat 70 on the nipple 67, for closing of the vacuum line in the same manner as in the other types. The type shown in Fig. IV gives a more simplified valve and is cheaper to manufacture and simpler to operate. The orifice plate 65 is changed to adapt the valve to different types of carburetors.

The invention herein described and claimed

may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

I claim:

1. In a fuel economizer for internal combustion engines using a carburetor having a back suction mixture control, means to pull a vacuum on the fluid level of the fluid chamber of said carburetor including a conduit connecting the chamber to the manifold of the engine downstream of the throttle, a constantly open restricted air vent to atmosphere in said fluid chamber; a normally open valve in said vacuum pulling means including a spring loaded pressure differential diaphragm therein, and adjustable means in said conduit to regulate the amount of vacuum pull on the fluid level of said carburetor.

2. In a fuel economiser for an internal combustion engine using a carburetor having a back suction mixture control, means comprising a vacuum line connected between the intake manifold of the engine downstream of the throttle and the fluid level chamber of the carburetor; a valve chamber in said line having two ports open to the opposite portions of said line for normally keeping said opposite portions in communication, a flexible wall in said valve chamber, and a valve element fixed to said flexible wall and movable to close the port leading to the fluid level chamber in response to suction in said valve chamber.

3. In a fuel economiser for an internal combustion engine using a carburetor having a back suction mixture control, a device including a vacuum line from the manifold of the engine downstream of the throttle to the fluid level chamber of the carburetor; a valve in said vacuum line comprising a chamber, a pair of ports in said chamber each communicating with one portion of the vacuum line, a valve member operable to close the one of said ports connected to the portion of the vacuum line leading to the fluid level chamber, a pressure differential diaphragm in said chamber connected to said valve, and adjustable means in said vacuum line to vary the vacuum in the portion of the vacuum line connected to the fluid level chamber.

4. In a fuel economiser for an internal combustion engine using a carburetor having a back suction mixture control, a device including a vacuum line from the after-throttle portion of the manifold of the engine to the fluid level chamber of the carburetor; a valve comprising a normally open chamber in said line, a port in said chamber connected to the portion of the vacuum line leading to the manifold, a second port in said chamber connected to the portion of the vacuum line leading to the fluid level chamber, a spring loaded diaphragm, a valve seat in said chamber connected to said second port, and valve means secured to said diaphragm cooperative with said valve seat to close said vacuum line against the action of the spring at a predetermined degree of vacuum in the manifold.

5. In a fuel economiser for an internal combustion engine using a carburetor having a back suction mixture control, a device including a vacuum line from downstream from the throttle portion of the manifold of the engine to the fluid level chamber of the carburetor; a normally open valve in said line comprising a chamber, a pair of ports in said chamber one of which is connected to each portion of the vacuum line, a spring-loaded diaphragm, a valve seat in the one

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of said ports connected to the vacuum line portion leading to the fluid level chamber, and a needle valve affixed to said spring-loaded diaphragm adapted to cooperate with said valve seat to close said vacuum line against the action of the spring at a predetermined degree of vacuum in the manifold.

6. In a fuel economiser for an internal combustion engine using a carburetor having a back suction mixture control, a device including a vacuum line from the downstream from the throttle portion of the manifold to the fluid level chamber of the carburetor; a normally open valve in said line comprising a chamber, a pair of ports in said chamber connected one to each portion of the vacuum line, a nipple within said chamber threaded into the port connecting with the portion of the vacuum line leading to the fluid level chamber, a spring-loaded diaphragm forming one wall of said chamber, a valve element on said spring-loaded diaphragm adapted to close the passage through said nipple against the action of the spring at a predetermined degree of vacuum in the chamber.

7. In a fuel economiser for an internal combustion engine using a carburetor having a back suction mixture control, a device including a vacuum line from the manifold downstream of the throttle to the fluid level chamber of the carburetor; a normally open valve in said line comprising a chamber, a pair of ports in said chamber connected one to each portion of the vacuum line, a nipple within said chamber connecting with the portion of the vacuum line leading to the fluid level chamber, a resilient diaphragm forming one wall of said chamber, a valve element on said resilient diaphragm adapted to close the passage through said nipple against the resiliency of said diaphragm at a predetermined degree of vacuum in the chamber.

8. In an engine carburetor having an induction passage with a throttle therein; a 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; a passageway connecting the bowl above the fuel with the induction passage on the engine side of the throttle, a valve means in said passageway adapted to be urged closed by manifold vacuum, and a spring urging said valve toward open position, said valve being adapted to close when the intake manifold vacuum rises above a predetermined value and to open when said vacuum falls below the predetermined value.

9. 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 adapted to supply fuel from

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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 passageway connecting the space above the fuel in said fuel bowl with the induction passage on the engine side of said throttle valve; a valve means in said passageway adapted to be urged closed by manifold vacuum, and a spring urging said valve toward open position, said valve means being adapted to close when the intake manifold vacuum rises above a predetermined value and to open when said vacuum falls below said predetermined value, whereby the fuel-air mixture for idling is enriched when said valve closes and leaned when said valve opens.

10. In an engine carburetor having an induction passage with a throttle therein; a fuel bowl; a passageway connecting the bowl above the fuel with the induction passage on the engine side of the throttle; a valve means in said passageway adapted to be urged closed by manifold vacuum, and yielding means urging said valve toward open position, said valve being adapted to close when the intake manifold vacuum rises above a predetermined value and to open when said vacuum falls below the predetermined value.

11. In an engine carburetor having an induction passage with a throttle valve therein, an idling fuel discharge system connecting the fuel bowl with the induction passage adjacent the throttle valve, a fuel bowl; a vent of limited flow capacity for said fuel bowl; a passageway connecting the space above the fuel in said fuel bowl with the induction passage on the engine side of said throttle valve, a valve means in said passageway adapted to be urged closed by manifold vacuum, and a spring urging said valve toward open position, said valve means being adapted to close when the intake manifold vacuum rises above a predetermined value and to open when said vacuum falls below said predetermined value, whereby the fuel-air mixture for idling is enriched when said valve closes and leaned when said valve opens.

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