June 9, 1959 H. A. CARLSON ET AL 2,890,031

SECONDARY FUEL CONTROL FOR TWO-STAGE CARBURETOR

Filed Feb. 20, 1956

2 Sheets-Sheet 1

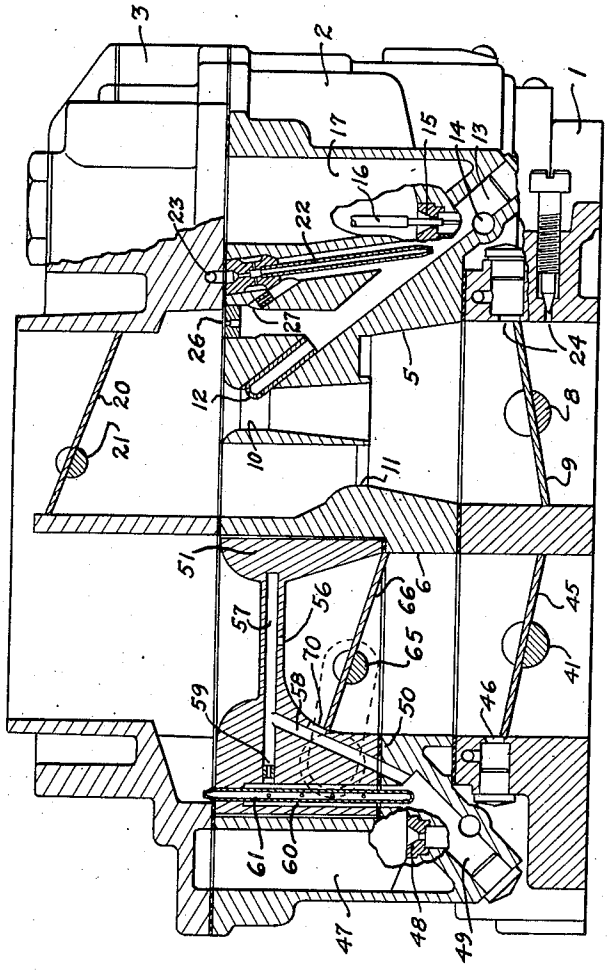


FIG. 1.

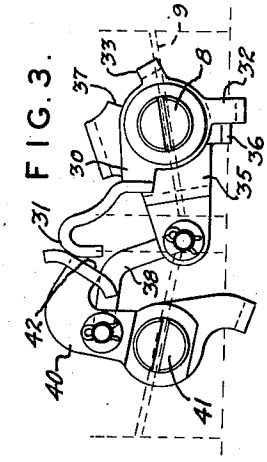


FIG. 3.

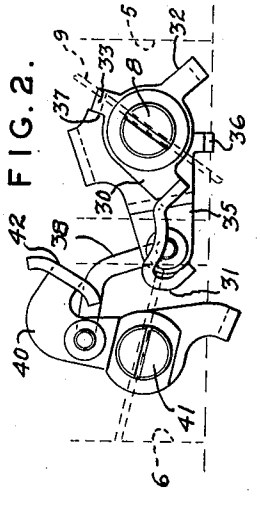


FIG. 2.

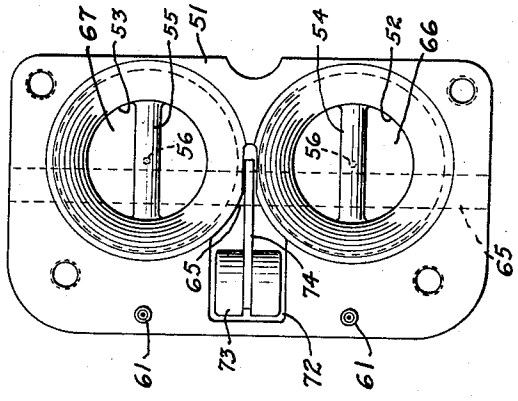


FIG. 4.

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SECONDARY FUEL CONTROL FOR TWO-STAGE CARBURETOR

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2 Sheets-Sheet 2

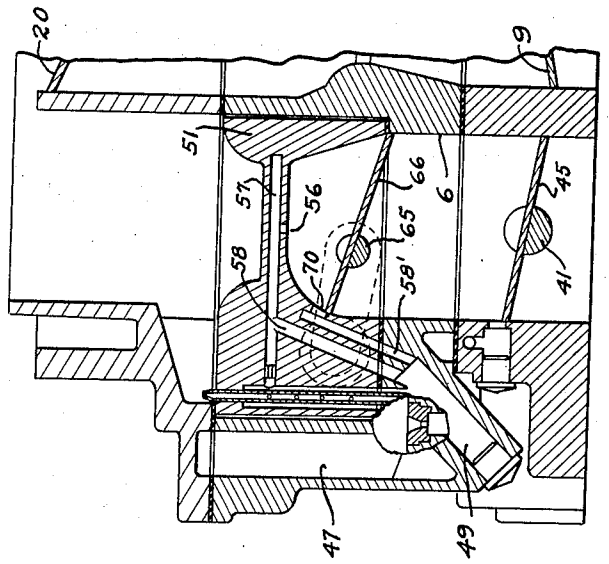


FIG. 5.

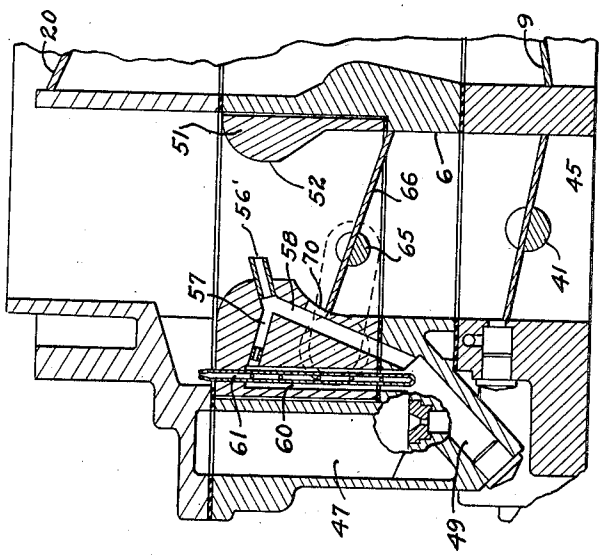


FIG. 6.

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SECONDARY FUEL CONTROL FOR TWO-STAGE CARBURETOR

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9 Claims. (Cl. 261—23)

This invention relates to a fuel system for a carburetor, and, more specifically, to a fuel system having a plurality of fuel nozzles which operate progressively as the throttle is opened.

The invention is shown applied to the secondary stages of a multi-stage, multi-barrel carburetor of the four-barrel type in conjunction with which it is deemed especially useful and beneficial, for reasons appearing hereinafter.

The advantages of multi-barrel, multi-stage carburetors such as the usual four-barrel type are generally stated in many patents, such as Kishline 2,193,533, Braun 2,434,-192, Ericson et al. 2,269,930, and others. A reference to these particular patents will fully acquaint those skilled in the art with sufficient background to understand the present invention.

One of the reasons for the adoption of the four-barrel carburetor was to obtain higher engine torque output over a larger range of engine speeds than was possible with the single or dual carburetor. From the operator's point of view, however, any lack of smoothness in the transition from single to multiple-stage operation in the four-barrel carburetor is objectionable, which means that multi-stage performance of the four-barrel carburetor in this respect must be comparable with that of the single or dual. Many different expedients in carburetor structure have been proposed and tested as solutions for this problem. Some have considerable merit.

The present invention is aimed at the solution of this problem by attacking the basic fault, which has been found to be a lag in the operation of the fuel system in the secondary stages in response to opening movement of the secondary throttle.

According to this invention, the secondary stages of the carburetor are controlled by two pairs of throttles one of which is mechanically actuated from the primary throttle, and the other of which is automatically responsive to suction and velocity in the air flow through the secondary stages. Combined with these two pairs of throttles in the secondary mixture stages is a fuel system including low, intermediate, and high speed nozzles. The operation of the low speed nozzles is controlled by the mechanically actuated throttles. The operation of the intermediate and high speed nozzles is controlled by the automatically operated throttles.

The invention includes other novel features, one of which is an integral unit containing the fuel nozzles and velocity throttle, which is separately constructed and adapted for assembly in the carburetor as a unit. This feature adds versatility to the construction, permitting a ready means of interchangeability for required changes in flow capacity to meet different conditions of different engines.

Further objects and advantages of the invention will become apparent as this description proceeds, when taken with the showing in the accompanying drawings, in which:

Fig. 1 is a side elevation, partly in section, of a conventional four-barrel carburetor showing the construction of the primary and secondary stages and illustrating an embodiment of the invention.

Figs. 2 and 3 illustrate the mechanism for mechanical operation of the secondary throttles from the primary throttles.

Fig. 4 is a top view of the removable nozzle unit.

Fig. 5 is a side elevation, in section, of a carburetor partly broken away to illustrate a modified form of the invention disclosed in Fig. 1.

Fig. 6 is a side elevation of a carburetor, partly in section, broken away to illustrate a still further modification of the invention disclosed in Fig. 1.

Fig. 1 illustrates a part of a four-barrel carburetor. The section is taken through the primary and secondary barrels of one side thereof. Since the carburetor as a whole forms no part of the present invention, it will not be described except to state that the invention can be applied to any carburetor, and especially to any four-barrel type of carburetor of the multi-stage type such as shown in greater detail by the patent to Carlson et al. 2,715,522 of August 16, 1955.

The carburetor shown in Fig. 1 has a throttle body **1**, a float bowl section **2**, and an air horn **3** secured in superimposed relation, as is conventional in the art. These parts are so constructed as to provide a pair of primary mixture conduits **5**, one of which is shown, and a pair of secondary mixture conduits **6**, one of which is shown. The primary mixture conduits within the throttle valve body **1** mount a rotatable primary throttle shaft **8** to which is secured primary throttles **9**. Within the primary mixture conduits **5** in the float bowl section **2** are primary and secondary venturis **10** and **11**. Fuel nozzles **12** project within the primary venturi **10**, and are supplied with fuel by way of main mixture passages **13**, cross fuel passage **14**, and metering jets **15** controlled by step metering rods **16**. The jets **15** are located within the fuel bowl **17**, which supplies both primary fuel nozzles **12**. Mixture conduits **5** also mount a choke valve **20** on a choke shaft **21**. The fuel system also includes idle tubes **22** supplying fuel by way of passages **23** to the idle ports **24** adjacent throttles **9**. The fuel system may also be equipped with the usual air bleeds **26** and **27**.

The structure so far described is conventional carburetor structure, and a further detailed description of its construction and operation will serve no useful purpose here.

Referring to Figs. 2 and 3, one end of the throttle shaft **8** carries a fixed lever **30** which rotates with the shaft **8**. On the lever **30** is a cam **31** and arm **32**, and a laterally extending lug **33**. Rotatably mounted on the shaft **8** is an operating lever **35** carrying a forwardly extending lug **36** and an abrupt shoulder **37**. A link **38** connects lever **35** with a similar lever **40** fixed to the secondary throttle shaft **41**. A cam surface **42** formed on the lever **40** cooperates with the cam surface **31** on the lever **30**.

The portion of the mixture conduits **6** within the throttle body **1** has throttles **45** secured to and operated by secondary throttle shaft **41**. The secondary throttles **45**, in turn, control like idle ports **46** supplied with fuel from fuel bowl **47** by way of metering jets **48** and suitable passages similar to the passages **23** on the primary side. Main fuel supply passages **49** extend upwardly to ports formed in a shoulder **50** extending completely around the periphery of both secondary mixture conduits **6**. Seated on the shoulder **50** is a block **51** in which is formed a pair of venturi nozzles **52** and **53** (see Fig. 4). Each venturi has a fuel nozzle bar **54** and

55 which are identical in construction, so that the description of one will serve for both.

Returning to Fig. 1, fuel bar 54 has a fuel nozzle 56 connected by suitable passages 57 and 58 with a port in the bottom of the block 51 registering with the passage 49. In the fuel passage 57 is a metering restriction 59 for controlling the connection with a well 60 containing vent tube 61. The well 60 is supplied with fuel from the main fuel passage 49.

Returning to Fig. 4, the block 51 is transversely bored for supporting a throttle shaft 65 eccentrically mounted with respect to the venturi 52 and 53 and the secondary mixture conduits 6. This shaft supports a pair of unbalanced throttle plates 66 and 67 so mounted that one edge of each controls a fuel port 70 connecting with the passages 58.

Within the block 51 is a recess or slot 72 which receives a weight 73 secured on an arm 74 and, in turn, rigidly fixed to the throttle shaft 65. The weight 73 tends to retain the throttles 66 and 67 closed against the force of suction acting upon the unbalanced throttles.

The block 51 containing the venturi 52 and 53 is secured in place within the float bowl section 2 by the float bowl cover on the air horn 3. It is thus readily removable and replaceable, and may be manufactured in varying sizes to fit any carburetor, so that in each carburetor the size of the secondary fuel passages is readily variable by means of the interchangeability provided.

Operation

As shown in Fig. 2, opening movement of the primary throttles 8, which are usually manually controlled, moves the lug 33 into contact with the shoulder 37 at the same time cam surface 31 is moved with respect to cam surface 42. Further opening movement of the primary throttle from the position shown in Fig. 2 is transmitted to the secondary throttle shaft 41 through the link 38. This connection is so constructed that both throttles, primary and secondary, will reach a wide-open position simultaneously.

During the reverse action, the closing movement of the primary throttle shaft engages the cam surfaces 31 and 42 to move the secondary throttle shaft 41 in a direction to close the secondary throttles 45. During closing movement, lug 36 is engaged by arm 32 so as to positively close the secondary throttles.

When the engine is operating with both throttles closed, fuel will be fed to the engine by way of idle ports 24 in the primary mixture conduits 5 and idle ports 46 in the secondary mixture conduits 6. With both the primary and secondary throttles open, the degree of suction present will determine the position of the velocity throttles 66 and 67, which will be yieldingly urged to the closed position by the weight 73 on the arm 74. However, when the velocity throttles 66 and 67 begin to open, they immediately uncover a portion of the fuel ports 70, so that even though the secondary throttles 45 have passed beyond the idle ports 46, and these ports are no longer functioning stronger for this reason, fuel will be immediately available from the fuel port 70 at the edge of the throttles 66 and 67 due to the presence of suction below these throttles, since engine suction is necessary to open these throttles for the passage of air. The fuel ports 70 will continue to function strongly until after the unbalanced throttles 66 and 67 have reached a position far enough to effect a fuel flow directly from the main fuel nozzles 56.

The embodiment illustrated in Fig. 5 differs from that shown in Figs. 1 and 4 only to the extent that the fuel nozzles 56 and 70 are interconnected with the main fuel supply passages 49 by separate passages, one indicated as 58 and the other as 58'. Otherwise the construction is identical, and a further description is deemed unnecessary for a complete understanding of the particular construction.

Operation

Separate passages 58 and 58' are desirable to prevent the operation of the fuel ports 70 from interfering with the flow of fuel to the main fuel ports 56. Since both passages 58 and 58' extend to a point below the level of fuel in the fuel bowl 47, it is quite obvious that the operation of one will be completely independent of the operation of the other.

In the modification shown in Fig. 6, the construction is identical with that above described except that the main fuel nozzles 56' open directly into the throat of the venturi 52 and 53. Otherwise the modification has the fuel ports 70 and similar passages 58 and 57 connecting with main fuel passages 49 and with wells 60, all as above described.

Operation

The operation of Fig. 6 is similar to that already described above, and can be clearly understood from the preceding detailed description.

A construction has been described which will fulfill all the objects of the invention set forth above, but it is contemplated that still other modifications will occur to those skilled in the art which come within the scope of the appended claims.

We claim:

1. In a multi-stage, multi-barrel carburetor, the combination comprising, primary and secondary mixture conduits, manually controlled throttle valves in said primary and secondary mixture conduits, a venturi nozzle in said secondary mixture conduit anterior of said throttle valve, a suction operated valve controlling the flow through said venturi, and a fuel supply system for said secondary mixture conduit including, a source of fuel, an idle port supplied from said source and located adjacent the edge of said manually operated throttle, a high-speed fuel nozzle connected to said source and discharging in said venturi, and a low-speed nozzle supplied from said source and located at the upper edge of said suction operated valve so as to be exposed to the effect of differential pressures acting to open said suction operated valve.

2. The combination defined in claim 1, including a nozzle bar extending transversely of said venturi in which said high-speed nozzle is located.

3. The combination defined in claim 1 in which said low-speed nozzle is supplied from said source through said connection between the high-speed nozzle and said source.

4. In fuel systems for engines, the combination comprising, valve means opening responsive to increases in air requirements of said engine, first discharge means for delivering fuel through a range of relatively low fuel consumption, second discharge means for delivering fuel through a range of relatively high fuel consumption when said valve means is open a given minimum amount, said first discharge means functioning independently of said valve means, and third discharge means responsive to opening of said valve means less than said given amount to provide an intermediate amount of fuel until said valve means has opened said given amount and said second discharge means is brought into operation.

5. In fuel systems for engines, the combination comprising, air valve means opening responsive to increases in air requirements of said engine, first discharge means for delivering fuel through a first range of relatively low fuel consumption, second discharge means for delivering fuel through a second range of relatively high fuel consumption when said air valve is open a given minimum amount, said first discharge means functioning independently of said air valve, and third discharge means responsive to opening of said air valve less than said given amount and to suction downstream of said air valve to provide an intermediate amount of fuel until said air valve has opened said given amount and said second discharge means is brought into operation.

6. A fuel supply system for an internal combustion engine comprising, an air duct, a main throttle valve in said duct, main and idling fuel supply passages discharging into said duct through ports located respectively upstream and downstream of said valve when in its idling position, an auxiliary throttle valve between said main fuel discharge port and said main throttle valve, an auxiliary fuel supply port in a portion of the wall of said duct traversed by the edge of said auxiliary valve and connected to said main fuel passage, and means responsive to variation of speed of the associated engine for actuating said auxiliary valve, said auxiliary supply port being positioned relative to said auxiliary valve so as to be exposed to engine suction downstream of said auxiliary valve during initial opening of said auxiliary valve to cause the feeding of fuel through said auxiliary port before said main fuel port starts to feed.

7. In a carburetor, a fuel chamber, an induction conduit, a main fuel discharge nozzle in said induction conduit discharging fuel responsive to a given minimum flow of air through said induction conduit, a velocity valve in said induction conduit, a manually controlled throttle valve in said induction conduit downstream from said nozzle and said velocity valve, idle fuel discharge means for discharging fuel when said throttle valve is substantially closed, an intermediate fuel discharge port in said induction conduit adjacent to and upstream from said velocity valve when closed, a fuel supply passage between said fuel chamber and said main discharge nozzle, and a fuel supply connection between said intermediate port and said passage.

8. In a multi-stage, multi-barrel carburetor, the combination comprising primary and secondary mixture conduits, manually controlled throttle valves in said primary and secondary mixture conduits, a venturi in each said primary and secondary mixture conduits anterior to said throttle valves, a suction operated valve controlling the flow through the venturi in said secondary mixture

conduit, and a fuel supply system for said carburetor including a source of fuel, idle ports in said mixture conduits supplied from said source and located adjacent the edge of each of said manually operated throttle valves, high speed fuel nozzles connected to said fuel source and discharging into said venturis, and a low speed nozzle supplied from said source and located at the edge of said suction operated valve in said secondary mixture conduit so as to be exposed to the effect of differential pressure acting to open said suction operated valve.

9. In a multi-stage, multi-barrel carburetor, the combination comprising primary and secondary mixture conduits, manually controlled throttle valves in said primary and secondary mixture conduits, a venturi in each said primary and secondary mixture conduits anterior to said throttle valves, a suction operated valve controlling the flow through the venturi in said secondary mixture conduit, and a fuel supply system for said carburetor including a source of fuel, idle ports in said mixture conduits supplied from said source and located adjacent the edge of each of said manually operated throttle valves, high speed fuel nozzles connected to said fuel source and discharging into said venturis, and a low speed nozzle located between the idle ports and the high speed fuel nozzles, said low speed nozzles being supplied with fluid from said source and located adjacent the edge of the suction operated valve in said secondary mixture conduit.

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