

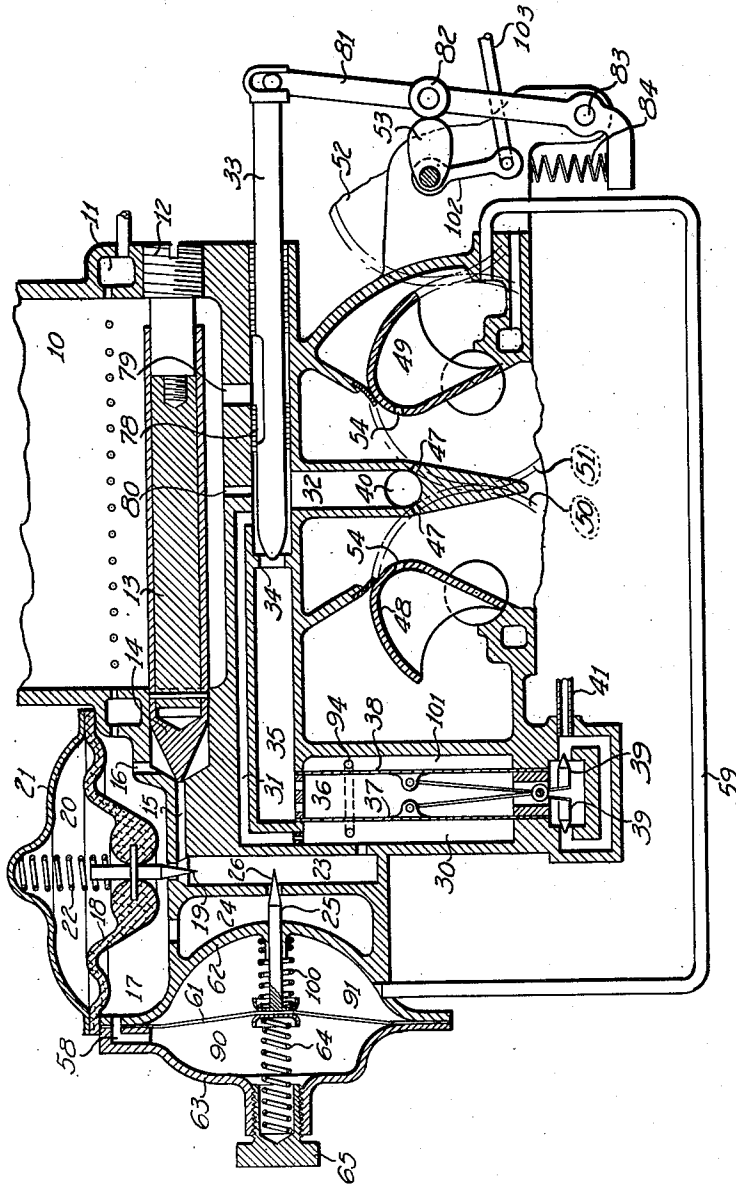
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MIXTURE CONTROL

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MIXTURE CONTROL

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3 Claims. (Cl. 261—39)

This application is a continuation in part of my co-pending application Serial No. 224,959, filed August 15, 1938, for Mixture control which issued December 2, 1941, as Patent No. 2,264,347.

The object of this invention is to improve the operation of an airplane carburetor so that the mixture ratio is maintained at the correct figure in spite of changes in:

- (a) Temperature of the air in the air entrance to the carburetor;
- (b) Pressure of the air in the air entrance leading to the carburetor, commonly known as altitude;
- (c) Changes in the air flow at any given throttle position, otherwise known as changes in load.

The specific form of carburetor to which this invention relates is one in which two streamlined throttles form variable Venturi passages, one on each side of a streamlined partition with which they both engage. In the throat of the variable venturi thus formed fuel is discharged from a horizontal passage located in the streamlined partition, through openings in both sides of the passage. The discharge of this fuel is controlled by a needle valve moved by a cam. The two throttles and the cam operating the needle valve are all geared together so that as the throttles open, the needle opens the fuel passage.

Description

In the air entrance 10 of the carburetor is located an air pressure equalizing ring 11. Immediately below is located a thermostatic needle 12. This needle contains a core 13 which has a relatively high co-efficient of expansion (a plastic material similar to hard rubber is suitable). By this means, the needle point 14 moves to the left when the temperature increases and to the right when the temperature decreases. This needle controls the flow of air through the small passage 15 which is connected through a passage 16 to a chamber 17 which is in free communication with the air pressure equalizing ring 11.

The upper wall of the chamber 17 consists of a flexible diaphragm 18 which carries a needle valve 19. This diaphragm forms the lower wall of the chamber 20, the upper wall of which is formed by a stamped wall 21. A spring 22 is provided between the cover 21 and the flexible diaphragm 18. The chamber 20 is evacuated so that the diaphragm 18 and spring 22 carry the fuel atmospheric pressure. The movement of the needle 19 thus responds to changes in the atmospheric pressure in the air entrance or, if super-

charger pressure is used in the air entrance, then to the pressure in the air entrance.

The air flowing past the needle valve 19 passes into a passage 23 into which also discharges the air flowing past the needle valve 14. There is a second chamber 24 in which is located a third needle 25 which controls a third opening 26 which also admits air to the passage 23 from the air pressure equalizing ring 11. The passage 23 thus communicates with the chamber 30 which communicates with the restricted passage 31 which is in communication with a fuel needle chamber 32 which surrounds the movable needle 33, which controls the fuel flow through a fuel orifice 34 which is located at the right hand end of the fuel passage 35, which passage communicates with the upper portion of the fuel diaphragm chamber 36.

This diaphragm chamber 36 is bounded on the left by a flexible diaphragm 37 which forms the right hand wall of the air chamber 30. The diaphragm 38 forms the left hand wall of the chamber 101 which is in communication with the chamber 30 through a passage 34. The diaphragm chamber 36 and its two diaphragms 37 and 38 operate the two fuel needle shut-off valves 39, 39 through the usual fuel needle valve mechanism. These fuel needle valves control the flow of fuel from a high pressure fuel passage 41.

The needle valve 25 is carried by the diaphragm 61 which forms the left hand wall of the chamber 91 and the right hand wall of the chamber 90. Springs 64 and 100 in chambers 90 and 91 oppose each other so that the needle 25 moves in response to pressure differences between the chambers 90 and 91. An adjustment 65 regulates the pressure exerted by the spring 64. 63 is the left hand wall of the chamber 90 and the right hand wall of the chamber 91 is numbered 62. The chamber 91 communicates through the pipe 59 with the back of the throttle 49 which communicates through the opening 54 with the throat of the variable venturi. The chamber 90 communicates through the passage 58 with the chamber 17.

The carburetor is of the variable venturi type, namely, the two streamlined throttles 48 and 49 are geared together by means of the gears 50 and 51. 51 is geared with 52 which carries the cam 53 which engages with a roller 82 which moves a lever 81 which engages with a needle valve 33, which controls the metering orifice 34. The spring 84 keeps the lever 81, or rather the roller 82 carried by the lever 81, in contact with the cam 53. The lever 81 is mounted on the

fulcrum 83. By this means, when the cam is rotated, the throttles 48 and 49 are opened and the needle 33 is opened.

Although the low speed operation is no part of this invention, it is shown on the drawing in order to complete the description. The slot 78 in the needle 33 communicates with the chamber 32 and opening 79 when the throttle is closed. Thus air is admitted to the fuel outlets 47 and thus the suction on the orifice 34 is reduced by the venting that occurs when air flows through 79 and along the passage 78 to the fuel outlet 47. In addition to the venting that occurs during idle when the needle 33 moves to the left and permits air to flow through 79 to the outlet 47, there is at all times a flow of air through the vent 80 into the outlet 47. The opening 40 indicates that there is a series of holes 47 and therefore the passage 40 extends below and above the plane of the drawing, extending across the whole width of the carburetor.

The suction back of the throttles 48 and 49 is the suction existing in the throat of the variable venturi because there is a free communication through the openings 54 and 54 between the Venturi throat and the back of the throttles. The result is that the pipe 59 imposes the Venturi suction in the chamber 91.

In the variable Venturi carburetor, at part throttle position, excessive suction occurs in the throat of the venturi which causes an excessive flow of fuel for the reason that air expands freely. In order to cancel this effect the needle valve 25 responds to any excessive pressure differential between the pressure in the throat of the venturi and the pressure existing in the air entrance. The diaphragm 61 moves to the right under the influence of this pressure differential compressing the spring 100 which normally balances the spring 64, the balance being adjusted by the adjustable spring seat 65 which is threaded into the cover 63, the other cover 62 communicating through the passage 59 with the back of the venturi 49.

By this means, when the suction in the throat of the venturi becomes excessive, the needle 25 closes and the flow of atmospheric air past 25 is restricted and to that extent the mixture becomes leaner than it otherwise would become. On the other hand, if the engine slows down under a heavy load, that is to say, if the propeller is adjusted to have a large pitch, which is the position of a propeller to give maximum economy, then the suction in the venturi is not great, and the needle 25 moves to the left, atmospheric pressure is admitted to the passage 23 and a slight enrichment of the mixture results. This is commonly known as the load control.

In order to adjust for load control independently of altitude and of temperature control, the opposed springs 64 and 100 are provided and the adjustment screw permits the adjustment of the

responsiveness of the diaphragm independently of throttle position.

What I claim is:

1. In an airplane carburetor an air entrance, a throttle valve therein adapted to form a variable Venturi passage in the air entrance, a fuel nozzle discharging into the throat of said venturi, a fuel supply chamber having a flexible wall and connected to said nozzle, a fuel supply valve and an air chamber associated with said wall, said wall, valve and air chamber being adapted to control the head on the fuel nozzle, a restricted passage connecting the air chamber with the throat of the variable venturi, a second passage connecting the air chamber with the air entrance, two restricted entrances to said passage, the first one controlled by a pressure responsive valve adapted to respond to the pressure of the air in the air entrance, the second entrance controlled by a pressure responsive valve, a movable wall connected to said valve, means to apply to one side of said wall the pressure in the air entrance and to the other the low pressure of the air in the throat of said variable venturi said valve being adapted to close with a decrease of pressure in said throat.

2. A device as set forth in claim 1 in which there is also a third restricted entrance to said passage, a temperature responsive valve, means for moving said valve towards its closing position in response to an increase in temperature, said means being so located as to respond to the average temperature of the air in the air entrance independently of the temperature of the walls of the air entrance.

3. In an airplane carburetor an air entrance, a throttle valve therein adapted to form a variable Venturi passage in the air entrance, a fuel nozzle discharging into the throat of said venturi, a fuel supply chamber having a flexible wall and connected to said nozzle, a fuel supply valve and an air chamber associated with said wall, said wall, valve and air chamber being adapted to control the head on the fuel nozzle, a restricted passage connecting the air chamber with the throat of the variable venturi, a second passage connecting the air chamber with the air entrance, two restricted entrances to said passage, the first one controlled by a pressure responsive valve adapted to respond to the pressure of the air in the air entrance, the second entrance controlled by a pressure responsive valve, a moveable wall connected to said valve, opposed springs supporting said wall, means for adjusting one of said springs independently of throttle position, means to apply to one side of said wall the pressure in the air entrance and to the other the low pressure in the throat of said variable venturi, said wall being adapted to close said valve when the pressure in the throat of said venturi falls.

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