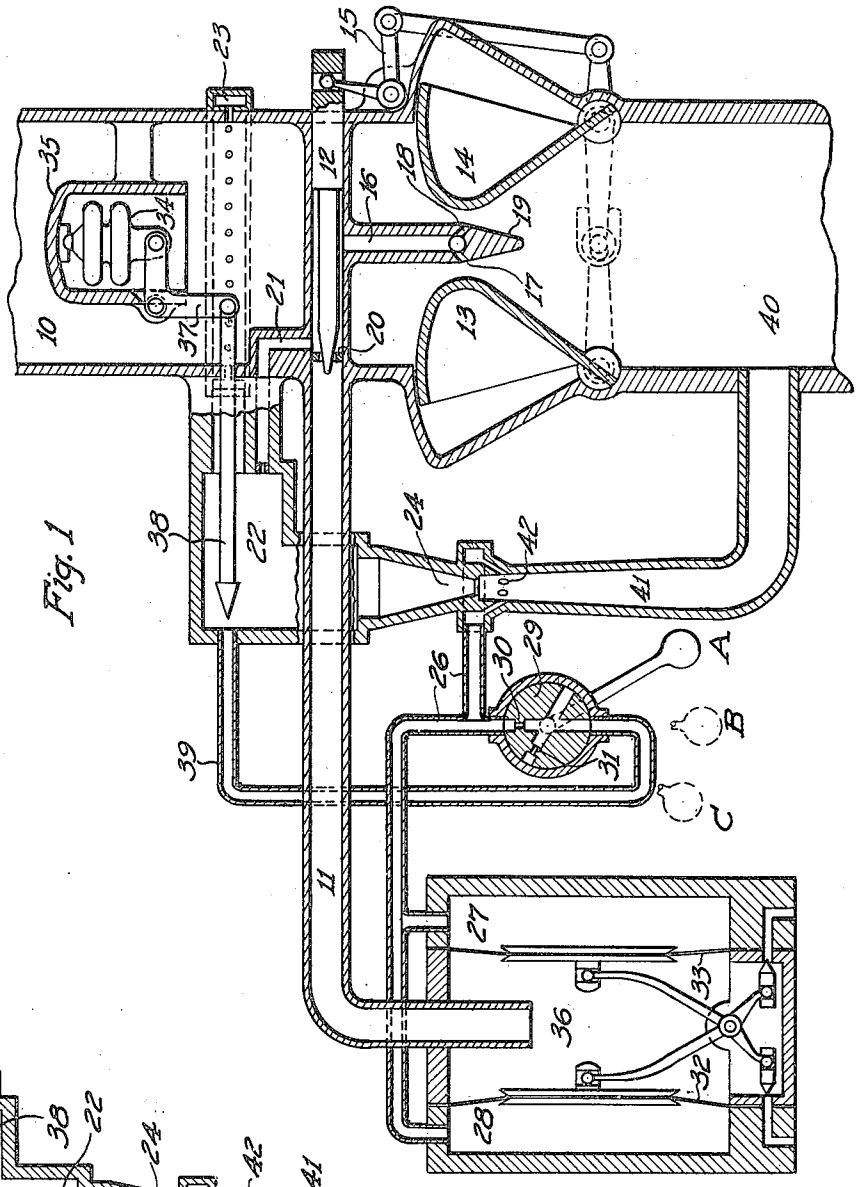
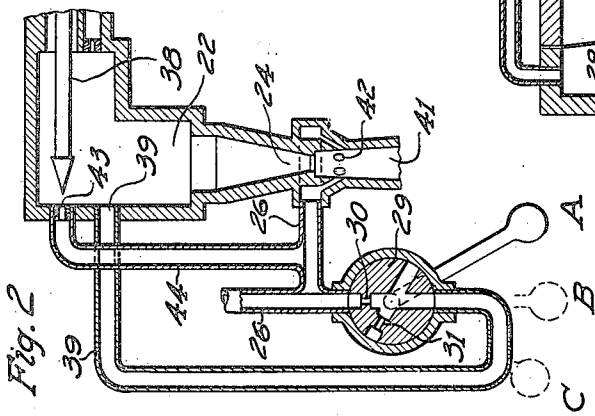
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CARBURETOR

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CARBURETOR

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1 Claim. (Cl. 261—39)

The object of this invention is to obtain improved load and altitude compensation with a variable venturi aircraft carburetor in which the variable venturi forms the throttle. With such a variable venturi carburetor (in which the needle is moved with the throttle) if, when the engine is rotating at a high rate, the load on the engine is increased when the throttle is held in the partly closed position, the revolutions per minute will be reduced and the air flow will decrease and the mixture will then have a tendency to become lean.

On the other hand, if the air flow increases greatly, because of a decrease in load with a fixed throttle, the revolutions per minute will increase and the mixture will have a tendency to become rich because of an excessive drop in the throat of the variable venturi.

This invention utilizes the carburetor drop in pressure, that is the suction below the throttle, to correct for this inherent defect in all variable venturi carburetors, which defect shows up at the extreme air velocities, to secure which is one of the reasons for using a variable venturi carburetor.

In the drawing:

Fig. 1 shows diagrammatically the general arrangement of my invention.

Fig. 2 shows diagrammatically a modification of my invention.

In the drawing, 10 is the air entrance; 11 is the fuel passage controlled by a movable needle valve 12 which is interconnected with the throttles 13 and 14 through the bell crank lever 15. The variable venturi is formed between throttles 13, 14 and a streamlined bridge or partition 19 which contains the air and fuel passage 16 and the rich mixture outlets 17 and 18. These outlets discharge into the throat of the variable venturi formed between the throttles 13, 14.

Adjacent to the downstream side of a fuel restriction 20 is an air vent or passage 21 which communicates with a chamber 22 which is in communication with an annular piezometer ring 23. This ring communicates through a large number of small holes with the air entrance 10 and thus records the average pressure in the air entrance 10 immediately before the air flows by the partition 19 and before the air enters the variable venturi.

A venturi 24 connects the chamber 22 with the mixture outlet 40. Thus, the flow from the chamber 22 to the mixture outlet at 40 is due to the pressure drop across the carburetor. The flow through the venturi 24 is accelerated by the fact that the air converges in a 25° funnel into the throat of a venturi having a .120" diameter (.0112 sq. in.). This throat suddenly enlarges to a diameter .147" (.0177 sq. inch=60% increase) and at the point of enlargement there enter tangentially 6 openings #56 drill=.0465" diameter (.0101 sq. in. total), one of them having the reference character 42. The air stream then enlarges in a funnel 41 having a 6° included angle. A passage 26 connects these holes 42 with the air chambers 27, 28, which determine the pressure in the fuel chamber 36 which is bounded on the left by the diaphragm 32 and on the right by the diaphragm 33. These diaphragms control the inlet valve mechanism in a well known manner.

A pressure control valve 29 is provided with three positions A, B and C, A being the full rich position, in which case an opening 30 of .085" (.00565 sq. in. in area) bleeds air into the passage 26 and to that extent reduces the suction established by the 6 openings 42 of #56 drill size. When the lever is in the position B, the restriction 31 becomes operative. This restriction has an .060" diameter (.00284 sq. in.) and B is the cruising lean position. The smaller the opening the leaner the mixture and when the valve 29 is thrown into the position C, we have a zero opening and hence we have an idle cut off position as the vacuum in the venturi 24 is transferred to the chambers 27 and 28. The suction is thus controlled by the valve 29.

A temperature responsive capsule 34 is housed under a cover 35 and is connected by a bell crank lever 37 with the needle valve 38 which controls the entrance to a passage 39, which admits air from the chamber 22 to the restriction 30, 31 in the valve 29. The air in the chamber 22 is at the same pressure as the pressure of the air in the piezometer ring 23, namely, the pressure of the air in the air entrance.

The capsules 34 are made to respond primarily to temperature, but may respond also to the atmospheric pressure or altitude. However, I have discovered that with this arrangement very little correction for altitude is needed. It appears that the venturi 24 with air of low density maintains its efficiency and creates a relatively larger suction in the chambers 27, 28, than does the venturi formed by the throttles 13, 14.

The flow of fuel into the variable venturi in determined by the efficiency of the shape of the throttle 13, 14, and these shapes are not as efficient as the 6° outlet 41 of the venturi 24, and the relative inefficiency of the throttle 13, 14 be-

comes more pronounced as the air becomes less dense and the more inefficient the throttle 13, 14 becomes the bigger the drop causing flow through venturi 24. By efficiency is meant the recovery of pressure in an air venturi after the air has been through the throat of the venturi, in which throat its velocity has been raised and its pressure lowered. If air at 30" Hg falls to 29", then there is a 97% recovery and the venturi is 97% efficient.

Hence as the air becomes less dense the venturi 24 becomes relatively more effective to hold fuel back than the variable venturi 13, 14, 19 are to cause fuel to flow.

In the modification shown in Fig. 2, the needle valve 38 controls an orifice 43 which communicates through the pipe 44 with the air chambers 27, 28. Hence the opening 43 admits air in parallel with either the air admitted through 30 or 31. Hence the areas of 30 and 31 are correspondingly decreased. The reason for the modification is to avoid having two restrictions in series which complicates the control.

Operation

In the operation of the carburetor, the throttles 13 and 14 are opened at the same time that the needle 12 moves to the right and the bell crank lever 15 rotates clockwise. There immediately follows an increased flow of air and fuel. In the event that a light load is imposed on the engine as is possible with a variable pitch propeller, the engine tends to rotate rapidly at a wide open throttle and with this type of carburetor, there is a tendency for the mixture to become rich assuming that the mixture ratio is correct at wide open throttle low engine speed. In order that the mixture should remain constant regardless of load, the air pressure in chambers 27 and 28 is made to respond to these variations of load as follows:

The pressure in the chambers 27 and 28 is controlled by the pressure in the passage 26 which communicates through the opening 42 with the downstream side of the throat of the small fixed venturi 24.

Obviously, when the airflow increases through the variable venturi 13—14 the airflow through the venutri 24 also increases and thus the tendency for the mixture to become rich is checked by the depression in the throat of the fixed venturi 24 which depression is communicated to the chamber 27—28 through 26.

Altitude control

Discussing first, Fig. 2, means are shown for adding atmospheric pressure to modify the depression in the chambers 27 and 28 at low altitude. Under such circumstances, the barometric element 34, Fig. 1) is compressed, bell crank lever 27 moves counterclockwise, altitude valve 38 moves to the right and air at substantially atmospheric pressure flows from chamber 22 through passage 44 and modifies the effect of the suction in the venturi 42 so that an increase in air density increases the airflow down passage 44 and therefore the desired altitude compensation results from the increased pressure in 27 and 28. For the same reason, mixture is corrected for temperature.

In Fig. 1, the altitude compensation valve 38 is put in series with the mixture control valve 29 whereas in Fig. 2, the altitude control valve 38 is placed in parallel with mixture control valve 29 so that in Fig. 1, the effect of the altitude control valve 38 is influenced by the valve 29. In any event, the rotation of mixture control valve 29 provides for three mixture ratios, positions A, B, and C. In position A, the mixture is controlled by virtue of the restriction 30, in position B by virtue of the restriction 31 and in position C, there is no opening whatsoever through the valve 29. The larger the opening through the valve 29, the less influence has the venturi 24 on the pressure in the chamber 27—28.

What I claim is:

In a variable Venturi carburetor of the type in which the variable venturi is formed by a movable throttle, a fuel nozzle discharging into the throat of said variable venturi, a fuel chamber associated therewith, pressure regulating means for maintaining the fuel in said chamber at a sub-atmospheric pressure, said pressure being higher than that in the throat of the variable venturi, means for creating said sub-atmospheric pressure comprising a fixed venturi having an air entrance in communication with the air entrance to the carburetor and having an exit in the mixture outlet from the carburetor, a passage connecting the throat of the fixed venturi to the pressure regulating means in said fuel supply chamber, a device responsive to the pressure and to the temperature of the air in the air entrance leading to the carburetor, a valve controlled thereby, a restricted air vent controlled by said valve and a passage communicating with the throat of the fixed venturi and adapted to supply air from said vent, to reduce the suction created by said fixed venturi.

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