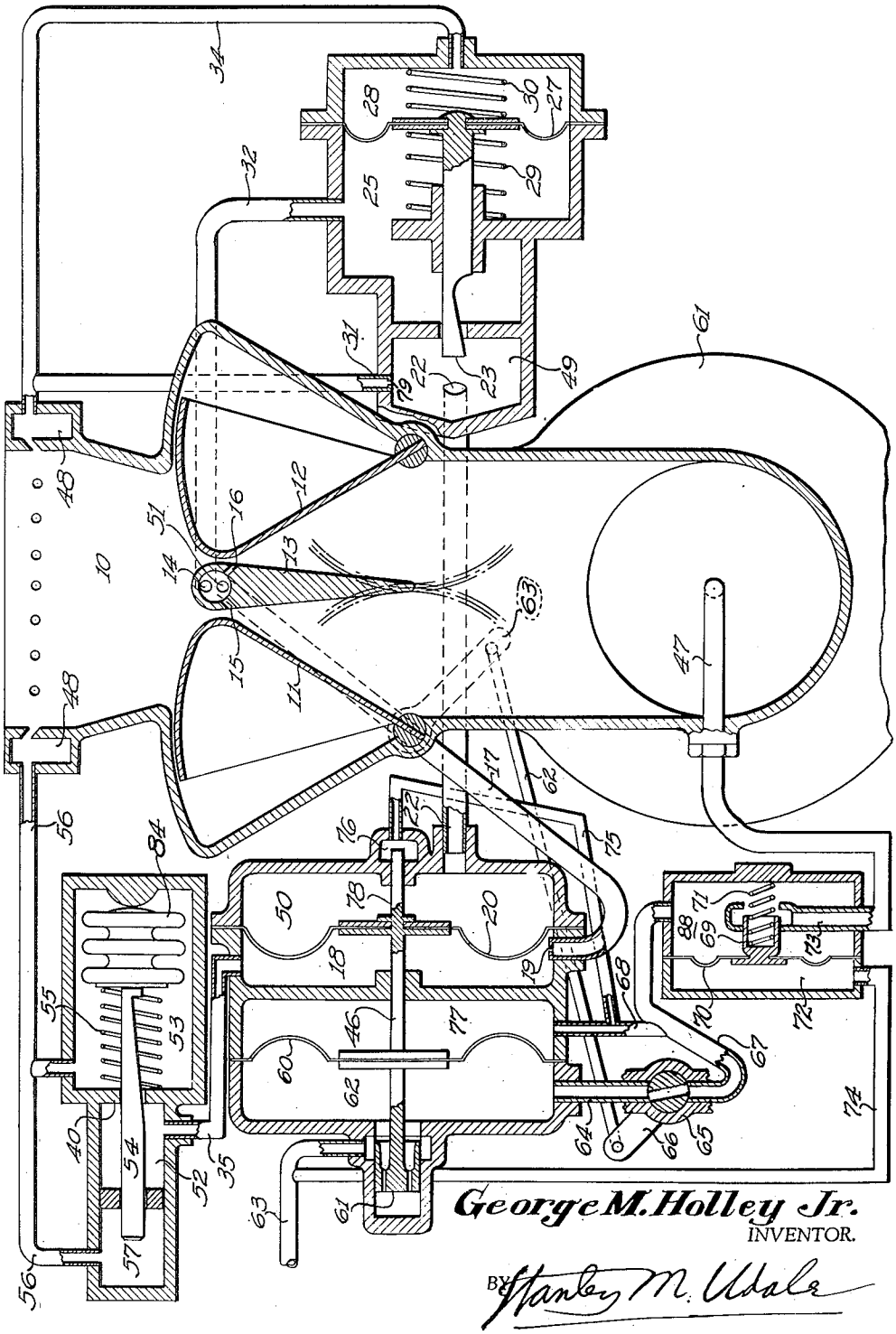
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LOAD AND ALTITUDE CONTROL

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LOAD AND ALTITUDE CONTROL

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The object of this invention is to improve the art of carburetion and particularly to improve the measurement of fuel responsive to airflow by means of a venturi in the air stream. The principles in my invention are applied, to a device designed to deliver the correct amount of fuel to an engine; however, the application of this invention is not limited to this one device.

There is a tendency, at high airflow, for the density of the air at the throat of a venturi to fall to such a degree that it introduces an error in the metering characteristic of the venturi. Thus, when due to the elasticity of the air, the density falls at the throat of the venturi at high velocity, the venturi will no longer follow the theoretical square root curve called for in the equation $V=c\sqrt{2gh}$ where V is the velocity and h the drop in pressure due to the velocity and c is a constant.

One object of my invention is to correct the metering characteristics of a fixed or variable venturi, to provide a device which automatically corrects the actual curve of pressure drop versus air flow to the theoretically correct curve for that venturi taking into account the air density of the entering air and the changes in density at the throat of the venturi due to the elasticity of air at high air velocities.

In an attempt to avoid the necessity of making this correction for flow through the air venturi with fixed venturi there has been a tendency to make fixed venturi so large that they are not responsive to low airflows.

The diagrammatic sketch shows a conventional pressure type carburetor of the variable venturi type with the improvements mentioned above incorporated therein.

The drawing shows diagrammatically the essential elements of my invention. In the drawing 10 is the air entrance 11 and 12 and the throttles which form the walls of the variable venturi. 13 is the metering channel casting containing the passages 14, 15 and 16 and 51. The passages 15 and 16 communicate with the throat of the variable venturi. Passage 14 communicates through a pipe 32 with the chamber 25 in the entrance to which is located a contoured valve 23. Two springs 29 and 30 maintain the valve 23 in the position shown. A diaphragm 27 is connected to the valve 23 and is supported by the two springs 29 and 30. Diaphragm 27 thus separates the chamber 25 from the chamber 28. Chamber 28 communicates through a pipe 34 with the annular chamber 48 which communicates with the air entrance 10 at a large number of openings so as to give a fair average of the pressure. This annular chamber 48 is also connected through a pipe 31 with a chamber 49 located in the left hand side of chamber 25 and the pressure in this chamber 49 is determined by the flow of air from annular chamber 48 to the chamber 25 and hence is determined by the position of the valve 23. It will be noted that the pipe 31 has a restricted communication 79 with chamber 49. Chamber 49 also communicates through pipe 22 with a chamber 50 located on the right hand side of a diaphragm 20. Chamber 18 is located on the left hand side of the diaphragm 20 and communicates through a restricted opening 19 and a pipe 17 with the channel 51.

The chamber 18 also communicates through the pipe 35 with a chamber 52, which chamber communicates with a chamber 53 through a restricted opening, this communication being controlled by a metering valve 54 which slides through an opening in the partition 40 between the two chambers 52 and 53. The chamber 53 contains a barometric element 84 and a spring 55 and communicates through the pipe 56 with the annular chamber 48 in the air entrance 10. The end of valve 54 is subjected to atmospheric pressure by means of the chamber 57, which is connected to the pipe 56, that is to say to the atmospheric pressure existing in the air entrance 10.

The pressure differential across diaphragm 20 is transmitted to a second diaphragm 60 through a pin 46. This pressure differential causes a valve 61 to open the fuel entrance from a passage 63 into a chamber 62 and from there through a pipe 64 to a variable restriction or valve 65. The size of the restricted opening through the valve 65 is controlled by means of a lever 66, link 62 and lever 63, which is attached to the Venturi throttle element 11. Fuel pressure on the discharge side of valve 65 is applied to a chamber 77 through a pipe 68. Fuel from valve 65 is delivered to a balanced exit valve 69 through pipe 67. The exit valve 69 is attached to a diaphragm 70. Chamber 72 is balanced to inlet pressure through pipe 74. By the proper calibration of a spring 71 which engages with diaphragm 70 pressure equal to the pressure in the fuel entrance less a constant is maintained in chamber 88 so that there is always a constant pressure drop across the entire fuel system, hence the pressure drop across the valve 65 will change with air flow at any given throttle opening. From the exit valve, fuel is delivered to the engine through pipe 73 and 47. The differential pressure acting on the diaphragm 60 must always equal the pressure acting on the dia-

phragm 20. Whenever there is an unbalance, fuel valve 61 is either opened or closed and hence the fuel flow varies automatically with the air flow.

In order that diaphragm 60 may be affected by equal areas on either side pin 78 equal in diameter to pin 46 is subjected to fuel pressure in chamber 76 through a pipe 75 equal to that in chamber 77.

It will be seen from studying the diagrammatic sketch that a group of parts—valve 23, springs 29, 30, diaphragm 27—together with passages 34, 32 and 22 apply a corrective pressure to chamber 50. The amount of this correction is determined by differential pressure between venturi and the vent ring 48 so that this valve compensates for changes in density at the nozzle bar. A group of parts—valve 54, spring 55, aneroid bellows 84—and passages 56 and 35 modify the pressure in chamber 18 for changes in density at the inlet of the venturi. This valve 54 at high altitudes admits more air to chamber 18 and raises the pressure therein.

The pressure difference across diaphragm 20 can be adjusted so as to be the theoretically correct pressure differential for the particular venturi and air flow because chamber 18 can be corrected for changes in density at the air entrance, and chamber 50 can be corrected for changes in density at the Venturi restriction.

It is the differential pressure between the annular chamber 48 and 15 which responds to Venturi suction which causes the change in density at 15, therefore, since valve 23 is subject to this pressure, it can be made to properly correct the pressures. Exit valve 69 and diaphragm 70 control the fuel pressure drop through the entire fuel metering system.

Operation

Valve 54 is actuated by a set of bellows 84 responsive to density changes at the vent ring 48 and modifies the pressure in chamber 18 to compensate for changes in density at the inlet of the carburetor. Valve 23 is actuated by diaphragm 27 and modifies the pressure in chamber 50 for changes in density at the air metering orifice 16. Diaphragm 27 is moved by a differential pressure between the air entrance pressure in annular chamber 48 and the pressure in the throat of the variable venturi as transmitted through the opening 15.

The variable opening through the valve 65 varies with the throttle opening by means of the linkage 63, 62, 66. Hence, at any given air venturi opening between 11 and 12, there is a definite fuel restriction through the valve 65. A given pressure drop across the valve 65 at a given position therefore, corresponds to a definite fuel flow.

The outlet through pipe 67 creates in chamber 78 a definite pressure below the pressure in the fuel entrance 63 because the pipe 74 transmits maximum fuel pressure to the left hand side of diaphragm 70.

Hence, air flow is balanced against fuel flow and the air flow is corrected for both altitude and for velocity of air flow through the venturi.

What I claim is:

1. A carburetor having an air entrance a variable Venturi throttle therein, a fuel entrance, fuel metering means therefor comprising an air chamber, a moving wall therein dividing said air chamber into two, a passage connecting the first half of said air chamber with the throat of said venturi, a second passage connecting the second half of said air chamber with the said air entrance, a second air chamber, a second moving wall therein dividing said second air chamber into two halves, a pipe connecting the first half of said chamber with the air entrance so as to establish air entrance pressure therein at all times, a pipe connecting the second half of said second chamber with the throat of said variable venturi, a third air chamber communicating with said second chamber through a restricted opening, a valve means connected to said second moving wall, said valve being adapted to control the said restricted communication, said second passage connecting said third air chamber with the air entrance through a restricted opening and with the said second half of said first air chamber so as to modify the pressure difference acting on said first mentioned moving wall in response to changes in the depression in the throat of said venturi, a fuel chamber, a 3rd moving wall therein dividing said fuel chamber into two, a valve admitting fuel under pressure to the 1st half of said chamber, a restricted outlet from said fuel chamber, a control valve therefor, adapted to be opened by said variable Venturi throttle. a passage connecting the 2nd half of said fuel chamber with the downstream side of said restriction, said 1st-3rd moving walls being connected together and adapted tc control said fuel admission valve so as to balance fuel flow against air flow.

2. A carburetor as set forth in claim 1 in which there is a 4th air pressure regulating chamber, a restricted communication between said 4th air chamber, and the first half of said first air chamber, barometric means located in said 4th air chamber, a valve connected thereto, said valve being adapted to control said restricted connection, an unrestricted passage connecting said 4th chamber with the pressure existing in said air entrance.

3. A carburetor as set forth in claim 1 in which there is a 4th air pressure regulating chamber, a restricted communication between said 4th air chamber and the first half of said first air chamber, barometric means located in said 4th air chamber, a valve connected thereto, said valve being adapted to control said restricted connection, an unrestricted passage connecting said 4th air chamber with the pressure existing in said air entrance, means for maintaining a constant pressure drop between the pressure of the entering fuel and the pressure of the fuel as it issues from said metering means into said air passage of said carburetor including a 2nd fuel chamber, a 4th moving wall therein dividing said fuel chamber into two, a passage connecting the 1st half of said chamber with the fuel entrance, a passage connecting the restricted outlet of said 1st fuel chamber with the second half of said 2nd fuel chamber, an outlet therefrom, a valve in said outlet connected to said 4th moving wall.

4. A carburetor having an air entrance, a variable Venturi throttle therein, a fuel entrance, fuel metering means therefore comprising a chamber, a moving wall therein dividing said chamber into two, a passage connecting the first half of said chamber with the throat of said variable venturi, a second passage connecting the second half of said chamber with said air entrance so as to establish air entrance pressure therein at all times, a second chamber, a second moving wall therein dividing said chamber into two halves, a pipe connecting the first half of said chamber with the air entrance, a pipe connecting second half of said second chamber with throat of said variable venturi, a third chamber

communicating with said second chamber through a restricted opening, valve means connected to said second moving wall, said valve being adapted to control the area of said restricted communication, said second passage connecting said third chamber with the air entrance through a restricted opening and with the said second half of said first chamber which communicates with the air entrance so as to modify the pressure difference acting on said first mentioned moving wall in response to changes in the depression in the throat of said variable venturi, a fourth chamber, a third moving wall therefor dividing said fourth chamber into two halves, fuel metering means connected to said third moving wall and to said first mentioned moving wall, said fuel metering means being adapted to admit fuel to create a pressure difference on said third moving wall so as to balance said first mentioned moving wall, a restricted outlet from the fuel chamber, a control valve therefor, adapted to be opened by said variable Venturi throttle.

5. A carburetor as set forth in claim 4 in which there is a fifth air pressure regulating chamber, an unrestricted communication between said air chamber and the first half of said first air chamber, barometric means located in said fifth air chamber, a valve connected thereto, said valve being adapted to control said unrestricted connection, an unrestricted passage connecting said fifth air chamber with the pressure existing in said air entrance, means for maintaining constant pressure drop between the pressure of the entering fuel and the pressure of the fuel as it issues from said metering means into said air passage of said carburetor, including a 2nd fuel chamber, a 4th moving wall therein dividing said fuel chamber into two, a passage connecting the 1st half of said chamber with the fuel entrance, a passage connecting restricted outlet of said 1st fuel chamber, with the 2nd half of said 2nd fuel chamber, an outlet therefrom, a valve in said outlet connected to said 4th moving wall.

6. A carburetor having an air entrance, a venturi therein, a fuel entrance, fuel metering means therefor comprising an air chamber, moving wall therein dividing said air chamber into two, a passage connecting the first half of said air chamber with the throat of said venturi, a passage connecting the second half of said air chamber with the said air entrance, a second air chamber, a second moving wall therein dividing said second air chamber into two halves, a pipe connecting the first half of said chamber with the air entrance, a pipe connecting the second half of said second chamber with the throat of said variable venturi, a third air chamber communicating with said second chamber through a restricted opening, a valve means connected to said second moving wall, said valve being adapted to control the said restricted communication, a passage connecting said third air chamber with the air entrance through a restricted opening and with said second half of said first air chamber which communicates with air entrance so as to modify the pressure difference acting on said first mentioned moving wall in response to changes in the depression in the throat of said venturi, a fuel chamber, a 3rd moving wall therein dividing said fuel chamber into two, a valve admitting fuel under pressure to the 1st half of said chamber, a restricted outlet from said fuel chamber, a passage connecting the 2nd half of said fuel chamber with the downstream side of said restriction, said 1st and 3rd moving walls being connected together and adapted to control said fuel admission valve so as to balance fuel flow against air flow, means for maintaining a constant pressure drop between the pressure of the entering fuel and the pressure of the fuel as it issues from said metering means into said air passage of said carburetor including a 2nd fuel chamber, a 4th moving wall therein dividing said fuel chamber into two, a passage connecting the 1st half of said chamber with the fuel entrance, a passage connecting the restricted outlet of said 1st fuel chamber with the 2nd half of said 2nd fuel chamber, an outlet therefrom, a valve in said outlet connected to said 4th moving wall.

7. A carburetor as set forth in claim 1 in which there is a fourth air pressure regulating chamber, a restricted communication between said fourth air chamber and the first half of said first air chamber, barometric means located in said fourth air chamber, a valve connected thereto, said valve being adapted to control said restricted connection, an unrestricted passage connecting said fourth air chamber with the pressure existing in said air entrance, means for maintaining a constant pressure drop between the pressure of the entering fuel and the pressure of the fuel as it issues from said metering means into said air passage of said carburetor including a second fuel chamber, a fourth moving wall therein dividing said fuel chamber into two halves, a passage connecting the first half of said chamber with the fuel entrance, a passage connecting the restricted outlet of said first fuel chamber with the second half of said second fuel chamber, an outlet therefrom, a valve in said outlet connected to said fourth moving wall.

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