

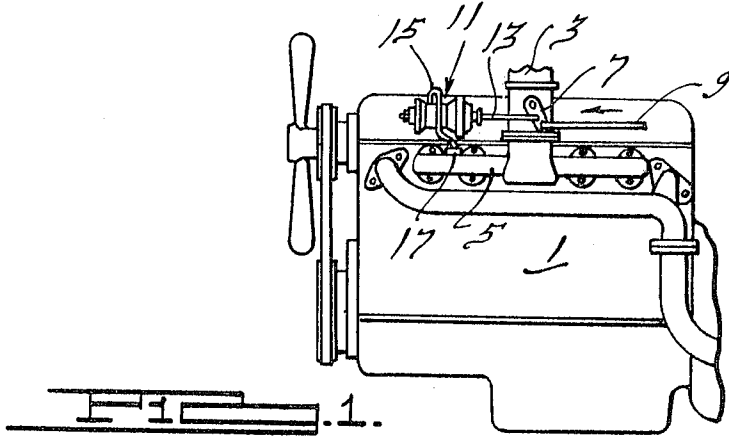
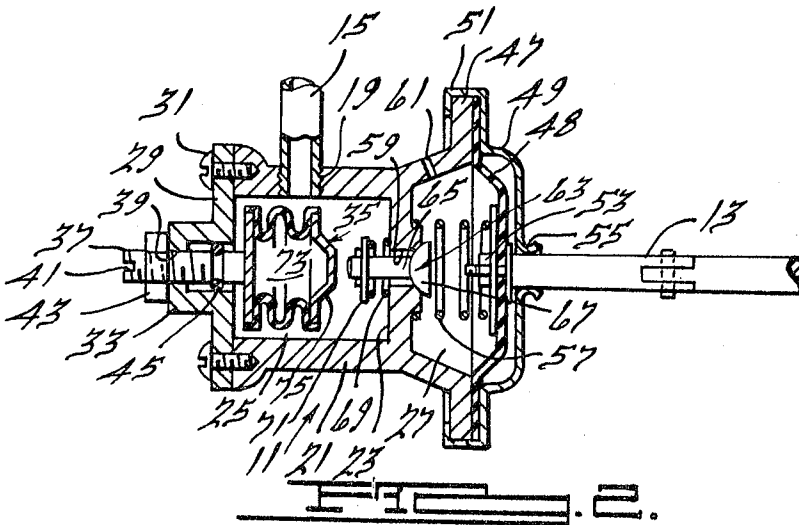
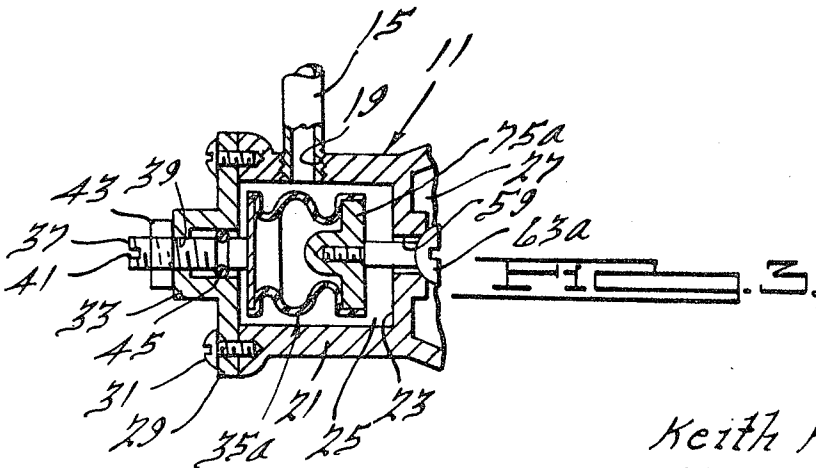
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ALTITUDE COMPENSATION THROTTLE POSITIONER

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3,456,632

ALTITUDE COMPENSATION THROTTLE POSITIONER

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9 Claims

ABSTRACT OF THE DISCLOSURE

A device for determining the position of an internal combustion engine throttle during high manifold vacuum has a shaft for connection to the throttle that is moved by a spring and diaphragm which is exposed through a valve to pressure in the intake manifold. Variations in altitude of the engine are compensated for by a sealed evacuated bellows which corrects the spring force on the valve means.

This invention relates to internal combustion engines and, in particular, concerns control of the quantity of air-fuel mixture supplied to the engine during deceleration conditions of an engine's operation. This application is a continuation-in-part of my copending application, Ser. No. 352,594, filed Mar. 17, 1964, now Patent 3,266,473.

It is the object of the invention to provide a simple device that may be readily attached to an internal combustion engine which will automatically adjust the position of the throttle valve of the carburetor to control the quantity of combustible mixture admitted to the combustion chamber during deceleration operating conditions regardless of the altitude or the environment in which the engine is operating.

The invention accomplishes this and other objects by means of a construction in which an engine vacuum responsive diaphragm motor is connected to the throttle linkage so that vacuum actuated movement of the diaphragm tends to open the carburetor throttle valve. Exposure of the diaphragm to engine manifold vacuum is controlled by a valve member whose position is determined by the resultant of a force system comprising a spring means, engine manifold pressure (actually negative or a vacuum relative to atmospheric pressure) acting in opposition to the spring means, and a standard or reference force which is close to absolute vacuum. As engine vacuum increases (pressure decreases), the spring means unseats the valve member to enable the diaphragm to move under the influence of vacuum to increase the throttle valve opening. The reverse operation occurs as engine vacuum decreases.

The invention is illustrated in the accompanying drawings in which:

FIGURE 1 is a side elevation of an internal combustion engine as used in motor vehicles incorporating an altitude compensator in accordance with the invention;

FIGURE 2 is a longitudinal cross section on an enlarged scale of an altitude compensator as shown in elevation in FIGURE 1; and

FIGURE 3 is a partial section of the device of FIGURE 1 showing an alternate construction for operating the diaphragm control valve.

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The internal combustion engine 1 has a carburetor 3 for controlling the air-fuel mixture to the engine intake manifold 5 and this contains a throttle valve (not shown) whose position is determined by the throttle valve arm 7. The movement of the arm is controlled by a rod 9 which may be connected to an accelerator pedal (not shown). Movement of the rod 9 in the direction of the arrow in FIGURE 1 opens the throttle valve.

In accordance with this invention an altitude compensator device 11 is mounted on the engine 1 and has an output shaft 13 that is connected to throttle arm 7 to position it during idle and deceleration in accordance with the altitude at which the engine is operating. The device 11 receives an input from the engine intake manifold 5 by way of the fluid conduit 15 that is connected at one end 17 to the manifold (downstream of the throttle valve) and at the other end 19 to the device.

The compensator 11 has a tubular housing 21 which contains an internal transverse wall 23 that divides the interior into chambers 25 and 27. The connection 19 of conduit 15 connects the conduit to chamber 25 which therefore operates at a pressure level dependent upon that in the manifold 5. The outer end of the housing 21 and the end of chamber 25 are closed by an end cap 29 that may be attached to the housing by screws 31. Supported in a suitable apertured enlargement 33 in the cap 29 is a flexible metallic bellows 35 of a type available on the open market. The bellows 35 has a shaft 37 threadably extending through tapped hole 39 in the cap, the shaft being slotted at 41 to receive a screw driver and threaded to receive nut 43 whereby the initial setting of the bellows may be adjusted. The chamber 25 is sealed by the O-ring 45 on the shaft 37.

The other end of housing 21 has a radial flange 47 that provides a support face for the outer periphery of a flexible diaphragm 48. A sheet metal cap 49 has its outer periphery 51 turned over the flange 47 and clamps the diaphragm to it as well as substantially closing the end of the housing. The output shaft 13 is secured at 53 to the diaphragm and extends through a non-airtight joint formed by cap flange 55. A coil spring 57 is based against the wall 23 and presses against the inside of the diaphragm 48 to urge it to expand away from the wall 23 and against the inside of the cap 49.

The chamber 27 between the diaphragm and wall 23 is connected to the chamber 25 by means of a relatively large opening 59 in the wall 23. A relatively small opening 61 connects the chamber 27 to atmosphere. A valve member 63 has a stem 65 extending through opening 59 and a head 67 in chamber 27 which is urged by a light spring 69, that acts between wall 23 and a crosspiece 71 on the stem, to seat on the chamber 27 side of wall 23 and close off intercommunication between the chambers by way of opening 59.

The bellows 35 has a sealed internal chamber 73 which has been evacuated to very low pressure (near absolute vacuum) and an end wall 75 that upon expansion of the bellows will engage the end of stem 65 and unseat the valve head 67 so that chamber 27 is connected to chamber 25 through passage 59.

In operation, the position of the end wall 75 of the bellows 35 is determined by the equilibrium of (a) the internal pressure in chamber 73 (extremely low and constant), (b) manifold pressure in chamber 25, and (c) the resiliency of the metal walls of the bellows which try to expand the bellows. When manifold pressure in chamber 25 falls below a predetermined value, the bellows will expand and unseat valve head 67, so that mani-

fold vacuum reaches chamber 27. When the pressure differential on opposite sides of the diaphragm exceeds the pressure of spring 57 air pressure on the right of the diaphragm will move it to the left pulling output shaft 13 with it to open the throttle valve of the carburetor 3. Thus, assuming the throttle valve is set for engine operation at about sea level, the unit will maintain a throttle opening such as to maintain the same absolute pressure of combustible mixture in the intake manifold regardless of whether the engine is moved to higher altitudes.

The setting of the bellows and related parts is preferably about 22½ inches mercury vacuum at sea level or 7½ inches mercury absolute pressure. This absolute pressure setting will not change after the initial setting. Since the mass of oxygen and fuel with the engine's cylinder must remain nearly the same regardless of altitude to idle an engine or decelerate an engine with minimal smog effluent (to overcome friction) the unit 11 effectively altitude compensates.

In an alternate construction of FIGURE 3 the valve 63a is threaded into the end wall 75a of the bellows 35a, thus eliminating the spring 69. Operation of the unit is obviously substantially the same as that of FIGURE 2.

Modifications may be made in the specific structure illustrated without departing from the spirit and scope of the invention.

I claim:

1. A vacuum responsive force applying device comprising an output shaft, vacuum actuated diaphragm means connected to said shaft to move it, chamber means connected to a source of vacuum, valve means for connecting the chamber means to the diaphragm means, a movable standard force applying means operating independently of atmospheric pressure operatively connected to said valve means, and means connecting said force applying means to a source of vacuum so that the position of said force applying means is determined by the level of vacuum.

2. A device for controlling the throttle valve setting of an internal combustion engine in accordance with the altitude of the engine, said device comprising housing means defining in part first and second fluid chambers connected by a fluid passage, a flexible diaphragm extending across the mouth of the first of said chambers, biasing means for urging said diaphragm to a first position, an actuating member supported for movement with said diaphragm, said actuating member being adapted to be connected to a throttle valve of an internal combustion engine and to move said throttle valve in the direction of opening as the diaphragm moves from a first position toward a second position, normally closed valve means in said fluid passage for controlling the communication of pressure between said first and second fluid chambers, an expandible bellows means in said second chamber containing an internal pressure approximately absolute vacuum, means operatively connecting said bellows means to said valve means so that expansion of the bellows means is in a direction to open said valve means, and conduit means interconnecting said second fluid chamber with the induc-

tion system of an engine downstream of the throttle valve for reducing pressure on said bellows means and permitting expansion thereof as the engine operates at higher altitudes.

3. A device as set forth in claim 2 wherein the bellows means is adjustable in position.

4. A device as set forth in claim 3 wherein a cap is affixed to the housing means for forming a part of said second chamber, said bellows means being adjustably supported on said cap.

5. A device for attachment to an internal combustion engine having a carburetor with a control valve and an intake manifold, comprising first means connected to said control valve and actuated by pressure in said manifold for positioning said control valve in accordance with said pressure, spring seated valve means for controlling communication of manifold pressure with said first means, and valve unseating means responsive to pressure in said manifold including altitude compensation means superimposing a corrective force on said valve means that varies in accordance with the altitude of the engine.

6. The invention as set forth in claim 5 wherein said compensation means comprises a sealed evacuated bellows device.

7. A device adapted to position the throttle valve of an internal combustion engine carburetor in accordance with the altitude of the engine, said engine having an intake manifold, comprising a housing having a vacuum chamber for connection to said manifold, a bellows means externally exposed to the chamber vacuum, said bellows means containing internal non-atmospheric pressure providing the bellows with a standard reference force to compensate for changes in altitude, said bellows means being changeable in length as external pressure thereon is changed, a diaphragm motor means communicating with and operated by manifold vacuum, and valve means connected to said bellows means for controlling communication of said diaphragm motor means with manifold vacuum and including a valve member moved in position by changes in length of said bellows means.

8. A device as set forth in claim 7 wherein the internal pressure in said bellows means is materially less than the lowest manifold pressure and said bellows means increases in length as said external pressure decreases.

9. A device as set forth in claim 8 wherein said housing has a transverse wall defining said vacuum chamber and providing a diaphragm chamber, a diaphragm in said diaphragm chamber, said wall having an opening connecting said chambers, said valve means controlling communication between the chambers through said opening.

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