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Wertheimer et al.

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[54] **PRESSURE RATE CHANGE RESPONSIVE DIAPHRAGM SWITCH WITH RELATIVELY HARD REBOUND PREVENTION MEMBER ON DIAPHRAGM**

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[73] Assignee: **The Bendix Corporation**

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[52] **U.S. Cl.** .....**200/83 R,** 200/166 H

[51] **Int. Cl.**.....**H01h 35/34,** H01h 3/60

[58] **Field of Search**.....200/83 R, 83 T, 83 S, 83 V, 200/83 J, 83 W, 166 H, 83 N

[56] **References Cited**

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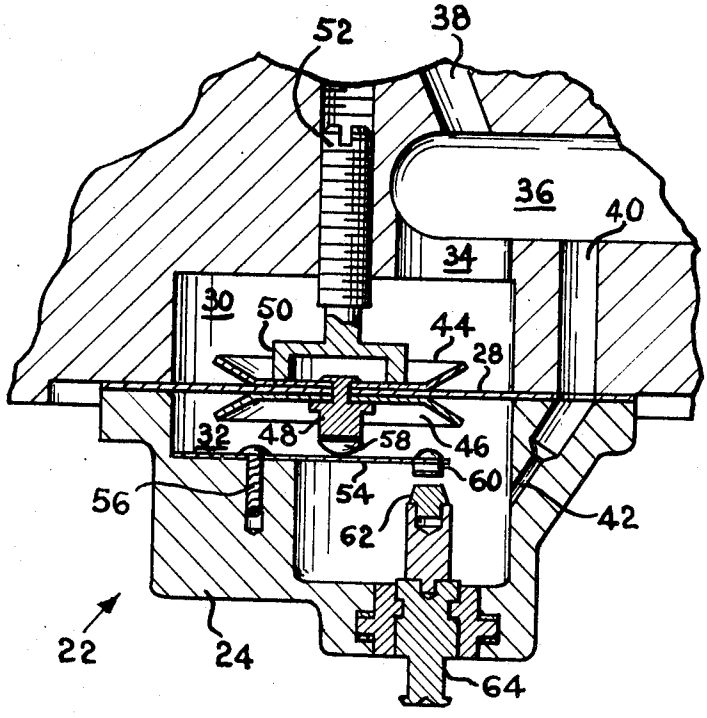
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[57] **ABSTRACT**

A pressure switch arrangement having a diaphragm exposed to a sensed pressure on both sides; one side communicating through a fluid delay restriction so that the delta pressure across the diaphragm is a function of rate of change of sensed pressure. A spring metal blade member bears against the rate diaphragm to provide a spring bias and also operates as an electrical contact support. A hard rubber abutment member forms the contact point between spring blade and diaphragm to dampen and suppress contact bounce.

2 Claims, 2 Drawing Figures



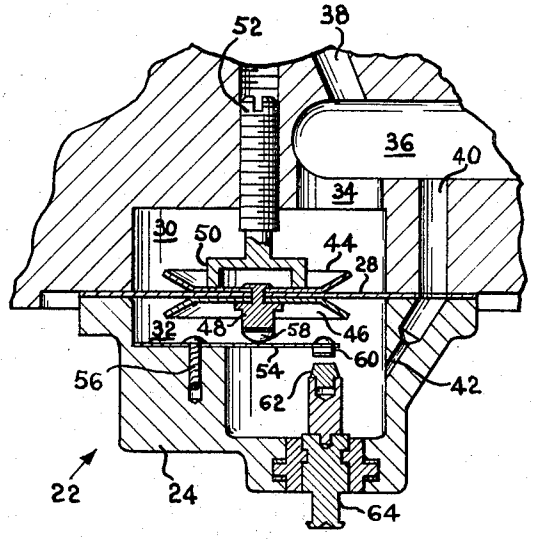


FIGURE 2

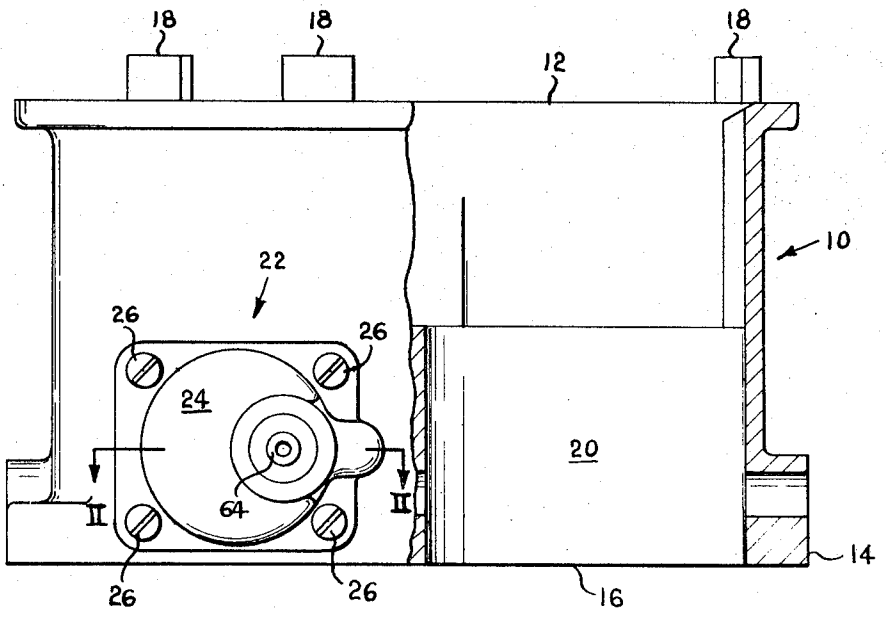


FIGURE 1

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PRESSURE RATE CHANGE RESPONSIVE DIAPHRAGM SWITCH WITH RELATIVELY HARD REBOUND PREVENTION MEMBER ON DIAPHRAGM

BACKGROUND OF THE INVENTION

The present invention relates to a pressure switch specifically intended for use to develop an electrical signal in response to changes in pressure in an intake manifold of an engine which pressure changes would be indicative of an engine acceleration or deceleration condition. The electrical signal is adapted for use by an electronic fuel injection system to augment the fuel being delivered during an acceleration or to cut off fuel delivery during a deceleration.

DESCRIPTION OF THE PRIOR ART

Prior U.S. Pat. Nos. 2,980,090 and 3,106,196 contain good illustrations and descriptions of prior pressure rate change responsive switches for producing an electrical signal for a fuel injection system to produce enrichment signals indicative of acceleration. Such prior switches consist of a rate responsive diaphragm, a coil spring biasing the diaphragm against the direction of movement and electrical contacts which are actuated by diaphragm movement. It is desired to provide an improved switch from those known in the prior art which is lower in cost, has low tendency for contact bounce and provides good contact wiping action.

SUMMARY OF THE INVENTION

The improved switch of this invention eliminates the need for a separate biasing spring applied to the rate diaphragm by utilizing a single leaf or cantilever spring member which doubles as a spring bias and contact support member. The abutment point between cantilever contact and diaphragm is a hard rubber insert which reduces contact bounce. The cantilever mounted contact with abutment point offset from contact produces good electrical contact wiping action.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 illustrates a side view of a throttle body portion of engine induction manifolding which has mounted thereon a rate responsive pressure switch of the present invention; and

FIG. 2 is a cross-sectional view of our pressure switch taken along section line 11—11 of FIG. 1.

DETAILED DESCRIPTION OF THE DRAWINGS

Referring to FIG. 1, there is illustrated a throttle body member 10 which receives air at inlet 12 and has a flange 14 adapted to be connected to engine intake manifolding to supply combustion air thereto out of outlet 16. Lugs 18 on the inlet side serve as mounting lugs for an air cleaner or the like. The throttle body is similar in function to those described in prior U. S. Pat. Nos. 2,980,090 and 3,106,196 and briefly provides a means for controlling engine combustion air flow and a sensing location for determining manifold pressure and other parameters such as throttle position which relate to the proper amount of fuel to be injected to obtain optimum engine performance. The throttle body depicted is of the two-barrel type; one barrel or air passage 20 is revealed by a broken-away section of the

illustration, while the second barrel is hidden by the throttle body wall. The concealed barrel may be considered substantially identical to the illustrated passage 20.

A pressure sensor switch, generally designated by numeral 22, has an exterior housing 24 attached to the exterior side wall of the throttle body housing by screws 26. Referring particularly to FIG. 2, which illustrates cross-sectionally the pressure switch and surrounding portion of the throttle body, a membrane diaphragm 28 forms an impervious wall between chamber 30 formed in the throttle body and chamber 32 formed in the pressure switch housing. The diaphragm is peripherally clamped and held between the mating surfaces of the switch housing and throttle body. Chamber 30 communicates via large opening 34 with plenum chamber 36 which in turn is connected to the air passages or barrels previously described at a point below the main throttles (not shown) through passages, one of which is illustrated by numeral 38. Plenum chamber 36 is additionally connected to chamber 32 via passage 40 which contains restriction 42. Pressure changes in the throttle body barrels downstream of the throttles will be averaged in plenum chamber 36 and immediately transmitted through large opening 34 to chamber 30. Due to the presence of restriction 42 in passage 46, the pressure in chamber 32 will equalize more slowly with the plenum chamber pressure, thus creating a pressure difference across diaphragm 28 which corresponds with the pressure rate of change in the barrels.

Diaphragm 28 has stiffening discs 44 and 46 on opposite sides which are fastened by a centrally located rivet 48. A locator or cup-shaped abutment member 50 holds the diaphragm near its neutral position and is connected to screw 52 through which means it may be adjusted. A cantilever leaf spring 54 is retained at one end by fastener 56 and applies a biasing force through a hard rubber tip or abutment member 58 to the diaphragm assembly to urge the assembly against abutment 50. Leaf spring 54 extends beyond rubber tip 58 and at its remote overhanging end has an electrical contact 60 secured thereto. A fixed mating contact 62 is located a small spaced distance below contact 60 and is held by fixed terminal post 64 which projects through to the exterior of housing 24 where an electrical signal may be transmitted to a utilizing circuit.

OPERATION

During an engine acceleration due to sudden opening of the main throttles, pressure in the barrels will increase sharply and be immediately transmitted via plenum chamber 36 to chamber 30 on the upper diaphragm side. Pressure build-up at the same rate in chamber 32 is prevented by the restricted passages 40,42 so that the net pressure change urges diaphragm 28 downwardly against the bias of leaf spring 54. If the rate of change or acceleration is of sufficient magnitude, leaf spring 54 will be displaced downwardly until the contacts 60 and 62 are made, closing an electrical circuit through the leaf spring to external terminal 64. The action of the leaf spring is such that good wiping action is produced at the contacts from the moment they first touch until they are in full contact. This wiping action is from left to right as viewed in FIG. 2 and gives the contacts long service life with good self-

cleaning action. The leaf spring serves as a spring, a contact support member and an electrical terminal and eliminates a separate spring member as disclosed in the prior art.

Great care must be exercised to produce a switch having the desired sensitivity to small pressure change signals, but does not overreact to large signals to produce excessive bounce at the contacts. Excessive bounce may produce more output signals than desired or may produce signals of insufficient duration. This problem is particularly acute when a leaf spring is utilized for the many purposes described. However, we have found a solution to this problem which is very low in cost and quite satisfactory from a performance standpoint. By placing hard rubber tip **58** at the end of rivet **48** where it forms the contact point with leaf spring **54**, good snubbing action is obtained. The durometer range for the rubber tip is 60 ±10. Hardness substantially above this range provides insufficient damping action, whereas lesser hardness provides too soft a tip which is displaceable by the leaf spring on its rebound strokes during bouncing.

I claim:

1. A pressure switch comprising:

a flexible diaphragm member;

housing means for retaining said diaphragm and forming at least one pressure chamber adjacent thereto;

a cantilever spring member fabricated from electrically conducting material operated to bias said flexible diaphragm member in one direction;

a fixed electrical contact proximate the unsupported end of said cantilever spring member whereby said spring member operates as both a force biasing member and a movable electrical contact member; and

a slightly deformable, relatively hard member connected to said diaphragm member forming the contactive connection between said diaphragm member and said spring member;

said Said contact member being sufficiently hard to resist displacement by the spring member upon rebound and sufficiently soft to dampen the rebound action.

2. The pressure switch as claimed in claim **1** wherein the contact member has a durometer hardness range of 60±10.

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