United States Patent

Weaver

[15] **3,673,369**

[45] **June 27, 1972**

[54] DIAPHRAGM PRESSURE SWITCH WITH INTEGRAL STOP MEANS FOR DIAPHRAGM SEALING

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[22] Filed: **Nov. 25, 1970**

[21] Appl. No.: **92,558**

[52] **U.S. Cl.**.....**200/83 B,** 73/278, 92/102, 200/83 V

[51] **Int. Cl.**.....**H01h 35/34**

[58] **Field of Search**.....200/83 R, 83 B, 83 H, 83 V; 73/278; 92/98 R, 102

[56] **References Cited**

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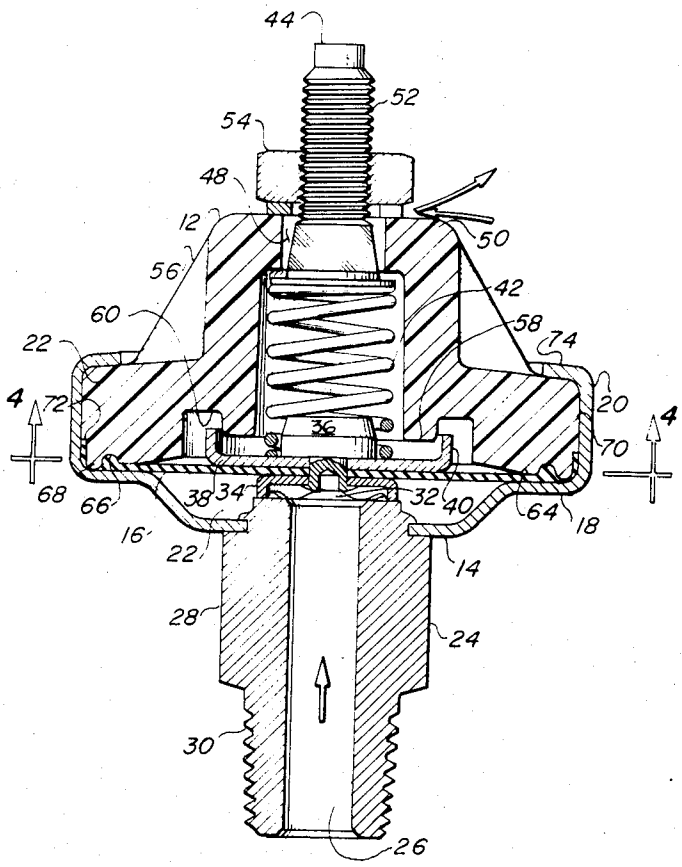
[57] **ABSTRACT**

A diaphragm pressure actuated switch comprising two housings sandwiching the diaphragm therebetween. Integral circumferentially spaced stops with a length less than the diaphragm thickness project from one housing, and extend through the diaphragm into contact with the other housing, thereby preventing fracture of the diaphragm upon the application of excessive clamping forces.

2 Claims, 6 Drawing Figures



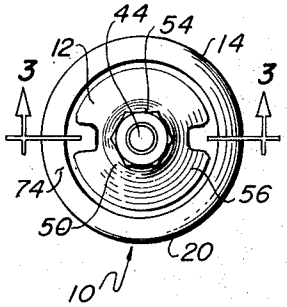


FIG. 1.

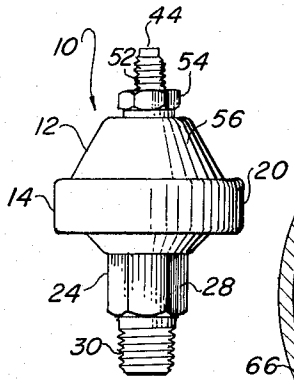


FIG. 2.

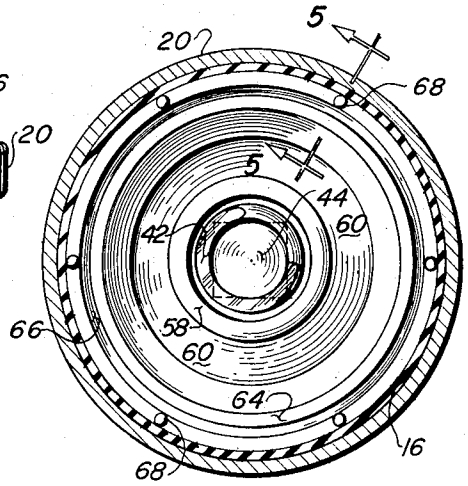


FIG. 4.

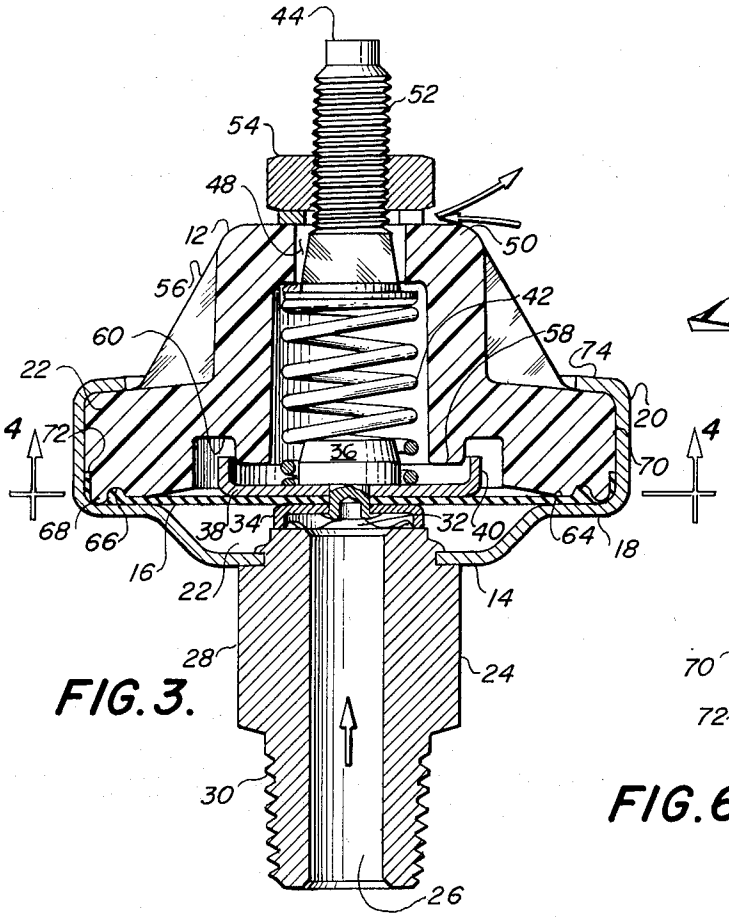


FIG. 3.

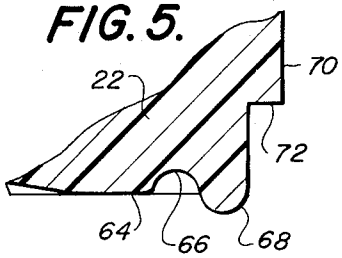


FIG. 5.

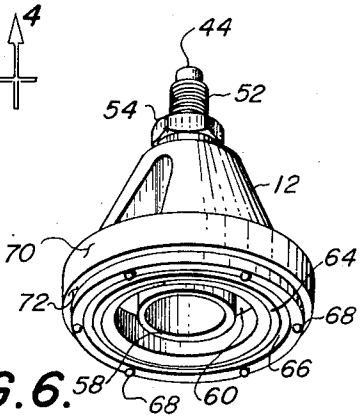


FIG. 6.

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DIAPHRAGM PRESSURE SWITCH WITH INTEGRAL STOP MEANS FOR DIAPHRAGM SEALING

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates in general to diaphragm pressure switches and more particularly to an economical diaphragm pressure switch of improved reliability.

2. Description of the Prior Art

The general practice in the manufacture of diaphragm pressure switches is to clamp the diaphragm between two cup-shaped housings or shells in a press under a desired degree of pressure and secure the two housings together. The housings are usually secured together by forming the metal wall of one housing about a radial wall of the other housing; however, both the thickness of the metal and the tensile strength vary within wide limits of their nominal values. This often results in either failing to clamp the diaphragm with sufficient pressure or shearing of the diaphragm during assembly or a short time after the switch is placed in use. The problem of clamping the diaphragm under the proper degree of pressure is further complicated by the necessity of holding the press pressure within proper limits.

SUMMARY OF THE INVENTION

The present invention proposes to solve the above problem by moulding a plurality of circumferentially spaced integral projections, nibs or stops on the end face of a rim wall of a moulded plastic housing used in the switch. The stops can be repetitively molded with great accuracy and project a distance less than the thickness of the diaphragm for con-trolling the pressure under which the diaphragm is held. The two housings or shells with the diaphragm therebetween and the stops abutting the diaphragm are assembled and pressed together until the stops pierce the diaphragm to engage the other housing to terminate further movement and ensure that the diaphragm is held under the proper degree of pressure with the two housings secured to each other.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top elevational view of a diaphragm pressure switch incorporating the principles of the present invention;

FIG. 2 is a side elevational view of the diaphragm pressure switch shown in FIG. 1;

FIG. 3 is a sectional view taken generally along the line 3—3 in FIG. 1;

FIG. 4 is a sectional view taken generally along the line 4—4 in FIG. 3;

FIG. 5 is a fragmentary sectional view of a portion of the plastic shell and stop taken generally along the line 5—5 in FIG. 4; and

FIG. 6 is an isometric view of the moulded plastic shell and stops.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings, a pressure switch is indicated in FIGS. 1 and 2 by the reference character 10. The switch comprises a generally cup-shaped plastic shell 12 of nylon with a glass filler in engagement with a generally cup-shaped metal shell 14 with a diaphragm 16 therebetween, as best seen in FIG. 3.

The shell 14 is conventionally formed with a radial wall 18 having a rim wall 20 in nested engagement with a radial wall 22 at one end of shell 12. Wall 18 engages the diaphragm 16 adjacent the diaphragm rim and is dished in a direction away from the diaphragm 16 from the position of engagement toward the central axis of the diaphragm to form a chamber 22 between the wall 18 and the diaphragm. An elongate fitting 24 is staked at one end to the wall 18 along the central axis thereof to communicate fluid under pressure to the chamber 22 by means of a passageway 26 in the fitting. A hexagonal exterior wall 28 and threads 30 facilitate the fastening of a conduit or hose to the fitting 24 and, if desired, to a support structure.

The end of fitting 24 is engaged by the edge of a rim wall 32 of a metal cup 34 with the rim wall 32 having a plurality of openings therein to pass fluid from the fitting passageway 26 into chamber 22. The back wall of cup 34 is staked to the diaphragm adjacent the central axis by means of a staking and centering pin 36, which has a shoulder for sandwiching the diaphragm between the back wall 38 of a cup-shaped guide member 40 and the back wall of cup 34.

The staking and centering pin 36 guides one end of a coiled or helical spring 42 with the end of the spring 42 seating against the back wall 38 of cup member 40. The other end of the spring 42 seats against a headed stud 44. Stud 44 has a non-circular shank engaging in a correspondingly shaped opening 48 in the back wall 50 of shell 12 and projects therethrough. Threads 52 are formed on the projecting end of stud 44 for the purpose of receiving a nut 54 and fasten an electrical lead to stud 44.

The back wall 50 of shell 12 has a rim wall 56 with a generally conical peripheral surface formed thereon and encircling the spring 42. The wall 22 projects radially from the end of wall 56 opposite back wall 50 and extends radially inwardly to a position coincident with the internal periphery of wall 56 to form a generally end surface for wall 56. The radial wall 22 has a short circular coaxial projection 58 thereon encircling and adjacent the spring 42 for nesting in the rim wall of cup member 40 with a circumferential recess 60 formed in wall 22 directly encircling projection 58 to receive the rim wall of the cup member 40.

Radially outwardly of the recess 60 the rim wall 22 tapers radially outwardly towards diaphragm 16 to a flat radial circumferential surface portion 64. A circumferential recess 66 approximately 0.01 inch deep and 0.02 inch wide is formed in the surface portion 64 at a diameter of substantially 1.125 inch and about 1/16 inch radially inwardly of the outer periphery of surface 64. A plurality of six circumferentially equally spaced spherical stops or projections 68, each having a diameter of substantially 0.040 inch at surface 64 and a height between 0.015 inch and 0.019 inch, are formed at a diameter of 1.2 inch on the portion of surface 64 between the recess 66 and the periphery of wall 22. The diaphragm is substantially 0.022 inch thick so that the stops 68 project a predetermined distance less than the diaphragm thickness. A circumferential flange 70 formed on wall 22 and spaced axially from the end of wall 22 defines a short circumferential recess 72 approximately 0.02 inch wide and 0.29 inch deep.

The switch 10 is assembled with the shells 12 and 14 arranged with radial wall 22 nested within the rim wall 20 of shell 14 and the diaphragm 16 carrying the cup members 34 and 40 and staking pin 36 sandwiched therebetween. The stud 44 and spring 42 are assembled in the cup 12 prior to the assembly of shell 12 to shell 14. Pressure is then applied to force shell 12 towards shell 14 until the stops 68 engage the back wall 18 of shell 14 to limit the movement and the end portion 74 of the rim wall 20 is formed over radial wall 22 to clamp or secure the housings to each other. The number of the stops is sufficient to evenly support the load and their height is a predetermined value less than the thickness of the diaphragm so that the diaphragm is grasped with a desired degree of pressure. The diaphragm 16 is held under a desired degree of pressure between the flat surface portion 64 and wall 18 with a portion of the diaphragm 16 being extruded into recesses 66 and 72 so that the rim portion of the diaphragm 16 is further held between the rim wall 20 and wall 22 to increase the engaged surface areas and provide transverse wall engagement.

Fluid under pressure is applied through passageway 26 and through the openings in rim wall 32 to chamber 22. When the fluid pressure reaches a predetermined value, the diaphragm 16 moves against the pressure of spring 42 to carry the cup member 34 from engagement with the fitting 24 and thereby open an electrical circuit extending from ground at the fitting through spring 42 to terminal 44 and the electrical load connected thereto for signalling the described condition.

The foregoing constitutes the description of an improved diaphragm pressure switch whose inventive concepts are believed set forth in the foregoing description and accompanying claims.

What is claimed is:

1. A pressure switch comprising a plastic cup-shaped housing having a rim wall terminating in a radial end wall with a radial face, a metal cup-shaped housing having a rim wall nestingly receiving said radial end wall, the back wall of said metal housing having a radial face aligned with said end wall radial face, a diaphragm located between the faces on said radial wall and the back wall of said metal housing, means for passing fluid under pressure through said metal back wall to one side of said diaphragm for moving said diaphragm towards said plastic housing, means extending an electrical connection from said one side of said diaphragm through said diaphragm and plastic housing and biasing said diaphragm toward said metal housing, said connection being opened in response to the application of said fluid to said diaphragm one side moving said diaphragm toward said plastic housing, and a plurality of circumferentially spaced stops integrally formed on said plastic housing radial face projecting from said plastic housing radial face less than the thickness of said diaphragm and extending through said diaphragm for engaging said metal housing radial face in response to the application of axial pressure to said housings in a direction for moving said radial faces towards each other with said stops terminating said movement to thereby control the pressure clamping said diaphragm between said radial faces, and means integrally formed on said metal housing for clamping said plastic housing against said diaphragm with said stops engaging said metal housing radial face to control the space between said radial faces and the pressure clamping said diaphragm.

2. The pressure switch claimed in claim 1 in which said means for biasing said diaphragm and extending an electrical connection includes a coil spring axially aligned with said diaphragm and said stops are spherical and located radially outwardly of said coil spring with said stops being circumferentially equally spaced along a diameter of substantially 1.2 inches and protrude from said plastic housing radial face between 0.015 inch and 0.019 inch, said diaphragm has a thickness of substantially 0.022 inch, and said radial face has a circumferential recess both radially inwardly and outwardly adjacent the juncture of said stops and plastic housing radial face.

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