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Groff et al.

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[54] **DIAPHRAGM SEAL WITH FLUID FILLED CAVITY FOR PADDLE OR FLUID FLOW RESPONSIVE SWITCH**

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Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 31,084, April 23, 1970, abandoned.

[52] **U.S. Cl.**.....**200/81.9 R,** 74/18.1, 200/168 G

[51] **Int. Cl.**.....**H01h 35/40,** H01h 9/04

[58] **Field of Search**.....74/18.1; 200/81.9 R, 200/81.9 M, 168 G; 73/228; 340/239 R

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[57] **ABSTRACT**

A flow switch, responsive to variation of fluid flow within a conduit, having an elongated member pivoted within the switch body and penetrating the fluid flow path within the conduit for make or break engagement with an electrical contact in response to fluid flow variations in the conduit. A seal is secured to the member near the pivot and overlaps a surrounding portion of the switch with a cup-shaped retainer urging the seal into engagement with the switch body. A cavity in the switch adjacent the seal is filled with fluid to reduce flexure of the seal and increase its effective life.

6 Claims, 3 Drawing Figures

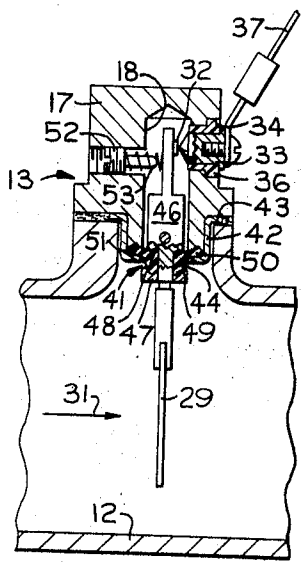

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Fig. 1

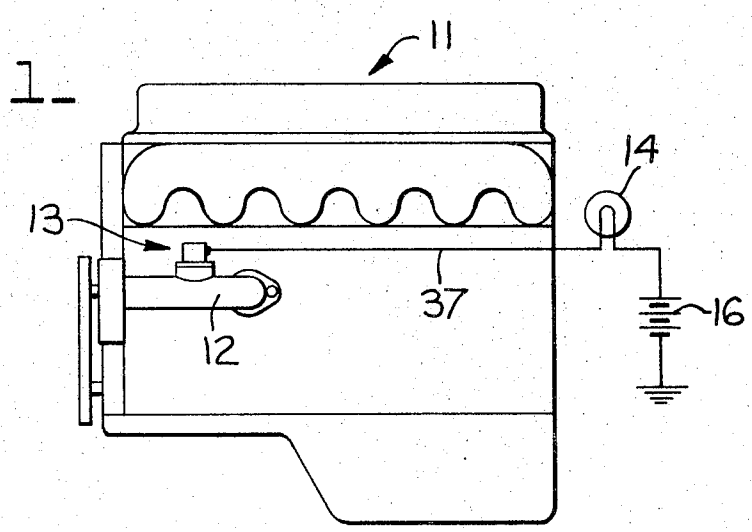


Fig. 2

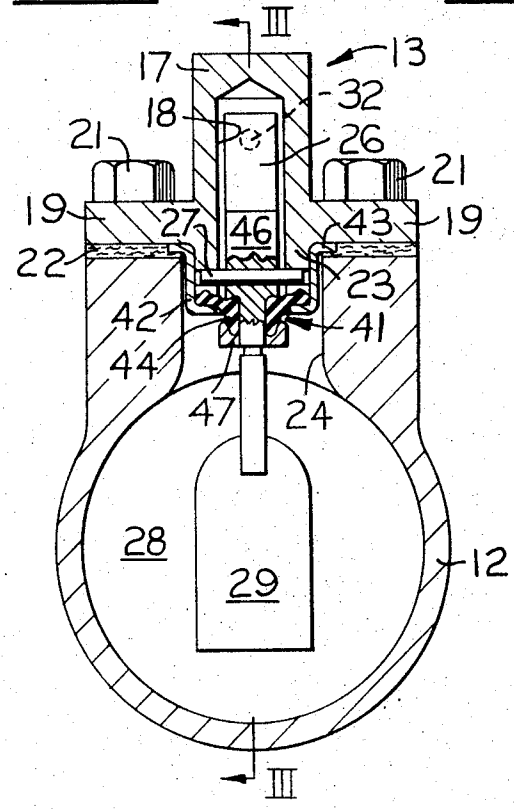
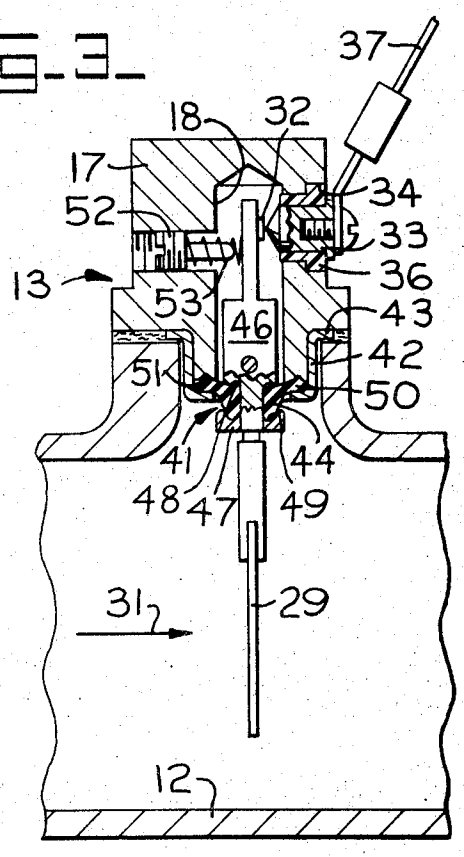


Fig. 3



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DIAPHRAGM SEAL WITH FLUID FILLED CAVITY FOR PADDLE OR FLUID FLOW RESPONSIVE SWITCH

This is a Continuation-in-Part of application Ser. No. 31,084 filed Apr. 23, 1970, now abandoned.

The present invention provides a switch for monitoring flow of a fluid within a conduit while isolating the switch interior from the fluid environment. More particularly, the present switch is adaptable to monitor the flow of coolant in an engine for providing a warning signal upon unacceptable reduction of the rate of coolant flow through the engine.

The flow switch is of a type having an elongated member penetrating the fluid conduit for response to fluid flow variations within the conduit. A seal isolates the switch interior from the fluid in the conduit while a stop and spring means tend to reduce pivotal motion of the member, thereby minimizing flexure of the seal and increasing reliability of the switch.

The present invention provides a flow switch of simple construction for achieving the objects and advantages referred to above. In particular, it is an object of the present invention to provide an effective means of sealing the switch from a fluid environment while minimizing motion of the switch components in response to fluid flow variations for reducing flexure of the seal and increasing reliability of the switch.

To further increase the effective life of the seal, a cavity in the switch adjacent the seal is filled with fluid to minimize flexure of the seal.

Additional objects and advantages of the invention are made apparent in the following description having reference to the accompanying drawing.

In the drawing:

FIG. 1 is a generally schematic view of an engine with the present fluid flow switch associated with one of its coolant conduits;

FIG. 2 is an enlarged view, with parts in section, of the fluid flow switch and collant conduit of FIG. 1; and

FIG. 3 is a view taken along an axis of the conduit in FIG. 2 with the conduit and switch being shown in section to better illustrate construction of the switch.

Referring now to FIG. 1, an engine 11 has a conduit 12 through which cooling fluid is circulated during operation of the engine. To provide a warning in case of a coolant system failure which terminates or unacceptably reduces coolant flow through the engine, a flow switch 13 is associated with the fluid conduit 12 and with a suitable warning circuit represented by the signal lamp 14 and the electrical source 16. To complete the electrical circuit between the flow switch 13, the lamp 14 and the source 16, the flow switch is also an electrical communication with the engine 11 which serves as a ground connection for the circuit.

As illustrated in FIGS. 2 and 3, the flow switch 13 comprises a switch body 17 defining a generally cylindrical cavity 18. The switch body includes flanges 19 which are secured to the conduit by means of cap screws 21. A seal ring 22 is arranged between the flanges and the conduit to prevent leakage. With the flow switch secured in place upon the conduit, a tubular portion 23 of the switch body surrounding the cavity 18 penetrates an opening 24 in the conduit.

An elongated member 26 is arranged within the cavity 18 and is pivoted to the tubular body portion 23 by means of a pin 27. The other end of the member 26 extends into a fluid passage 28 defined by the conduit 12 and has a flat paddle portion 29 arranged perpendicular to the direction of fluid flow, indicated at 31, within the conduit 12.

An electrical point 32 is mounted on the end of the member 26 within the cavity 18 for make and break engagement with an electrical contact member 33 which is supported within an opening 34 in the switch body by means of an insulating member 36. The electrical contact 33 is in communication with the warning circuit by means of an electrical conduit 37 which is also shown in FIG. 1.

As noted above, it is a particular object of the present invention to provide an effective seal for isolating the switch interior from the fluid environment within the conduit 12. To accomplish this purpose, a seal or diaphragm 41 is secured to the elongated member 26 adjacent its pivot 27 and extends radially outwardly to overlap the tubular portion 23 of the switch body 17. A cup-like member 42 urges the seal member into sealing engagement with the tubular body portion 23. The cup-like retainer 42 is maintained in position by means of a flange 43 which extends outwardly between the flanges 19 and the conduit 12.

To secure the seal or diaphragm 41, the member 26 is formed with an enlarged portion 46 through which the pivot pin 27 passes. A corrosion resistant retainer 47 is also secured to the member 26 adjacent the enlarged portion 46. The enlarged portion 46 and the seal retainer 47 form facing annular grooves 48 and 49. The diaphragm 41 has an annular flange or bead adjacent the member 46 which tends to be compressed into the annular grooves 48 and 49 to increase sealing engagement between the diaphragm 41 and the elongated member 26. The diaphragm 50 also includes a relatively thinner, radially extending portion 51 which is secured in place between the tubular body portion 23 and the cup-like retainer 42. This portion of the diaphragm provides an effective seal with the tubular portion 23 while permitting pivotal motion of the elongated member 26.

Sealing engagement between the diaphragm 41 and the tubular body portion 23 is also enhanced by means of an annular groove 51 formed in the tubular body portion 23. As the diaphragm 41 is urged into engagement with the tubular body portion 23 by means of the cup-like retainer 42, it tends to be extruded into the annular groove 51 to thereby improve sealing engagement between the diaphragm 41 and the body portion 23.

Reduced flexure of the diaphragm 41, to provide increased reliability of the diaphragm and switch, is accomplished by means of a variable stop 52 and a spring 53. The stop 52 threadedly penetrates the body 17 to limit motion of the elongated member 26 away from the electrical contact 33. The stop may be adjusted to compensate for varying flow conditions within the conduit 12. The spring 53 is arranged concentrically about the stop 52 and tends to urge the elongated member 26 and electrical point 32 into engagement with the contact 33 when fluid flow drops below an acceptable rate within the conduit 12.

To complete the circuit with the warning lamp 14 and electrical source 16, the elongated member 26, the pivot pin 27 and the switch body 17 are made of electri-

cally conductive material so that the point **32** is in electrical communication with the conduit **12** and the engine which provides a ground return for the warning circuit. To further increase the effective life of the seal or diaphragm **41** the cavity **18** is filled with a fluid to minimize flexure of the diaphragm during operation of the switch. The fluid may be selected from a variety of compositions which are non-corrosive to the metallic and elastomeric components of the switch. A preferred fluid has been found to be a mineral-based oil having a selected chemical structure and additives to prevent corrosion of the metallic components and in the switch, including the diaphragm **41**. Satisfactory examples of such a fluid, identified by common Military Specifications, include MS2014, a **10W** mineral-based oil, and MS2069, a 5W mineral-based oil. The lighter 5W oil may be preferred since it will remain less viscous under lower temperature ambient conditions and, therefor, have less effect on operation of the switch.

What is claimed is:

1. A flow switch responsive to fluid flow variations within a conduit, comprising

a body secured to the conduit about an opening communicating with the conduit interior, the body having a cavity extending from the opening in generally perpendicular relation to fluid flow within the conduit, a tubular portion of the body surrounding the cavity extending into the conduit opening,

an elongated member arranged within the cavity, the member including a paddle arranged within the conduit for reaction to fluid flow therein,

means for pivoting the member upon the body adjacent the opening in the conduit,

an elastomeric diaphragm secured in sealed relation to the member adjacent the pivot and extending radially outwardly to overlap an end of the tubular body portion,

the elongated member having an enlarged portion adjacent the pivot and a spaced apart seal retaining element, the enlarged portion and seal retaining element forming facing annular grooves, the diaphragm having a bead which tends to be compressed into the facing grooves,

a cup-shaped seal retainer for compressing the diaphragm against the end of the tubular body portion, the seal retainer having a flange extending radially outwardly from the opening between the conduit and flow switch body,

an electrical contact supported on the switch body adjacent an electrical point supported on an end of the member within the cavity,

an adjustable stop penetrating the switch body for limiting movement of the member away from the electrical contact,

spring means supported by the body for resisting movement of the member, and

means for interconnecting the electrical contact and electrical point on the member with a warning circuit.

2. The flow switch of claim **1** wherein the cavity formed by the switch body and closed by the diaphragm is filled with a fluid to minimize flexure of the diaphragm.

3. The flow switch of claim **1** wherein the tubular body portion also forms an annular groove into which the diaphragm tends to be compressed by engagement of the cup-like retainer.

4. The flow switch of claim **3** wherein the cavity formed by the switch body and closed by the diaphragm is filled with a generally non-compressible fluid to minimize flexure of the diaphragm, the fluid being of a type which is non-corrosive to metallic components of the switch and prevents deterioration of elastomeric components of the switch.

5. The invention of claim **1** wherein the spring means tends to urge the point on the elongated member into engagement with the electrical contact when fluid flow in the conduit falls beneath an acceptable rate.

6. The invention of claim **5** wherein the electrical contact is insulated from the switch body and is in communication with the warning circuit, the elongated member, the pivot means and the switch body being electrically conductive to provide a ground return for the warning circuit.

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