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POSITIVE DISPLACEMENT FLOW SWITCH

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POSITIVE DISPLACEMENT FLOW SWITCH
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This invention relates to electrical switches and more particularly to the type of switch that is responsive to a predetermined amount of fluid flow.

It is an object of the present invention to provide an electrical switch responsive to the flow of conductive or nonconductive fluids.

It is another object of the present invention to provide a flow, fluid responsive switch adapted to work in conjunction with an indicator circuit that will provide a visual representation of fluid movement.

It is still another object of the present invention to provide a switch that can be easily inserted into the path of fluid flow and will be impervious to the effects of the fluid coming into contact with interior portions of the switch.

It is a further object of the present invention to provide a switch that is sensitive to a predetermined amount of fluid flow that is adaptable for use in the cooling system of an automobile.

It is still another object of the present invention to provide a switch responsive to the flow of either conductive or nonconductive fluids that will apprise the operator of an automobile of the lack of fluid flow in its cooling system.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawing wherein a preferred embodiment of the present invention is clearly shown.

In the drawing:
The single figure drawing is a diagrammatic representation of a switch made in accordance with this invention situated in a fluid system and in an electrical system, the switch being shown in enlarged section.

Referring now to the drawing, a pump 10 draws fluid from a sump 12 and drives this fluid through a passage 14 and back to the sump. A typical function provided by a system of this sort would be to cool an area surrounding said passage by the flow of water therethrough.

A body 16 of the switch, generally designated by the numeral 18, has a threaded portion 20 cooperating with a threaded portion 22 of the fluid passage 14. A typical mounting would involve the threaded portion 20 being of a pipe thread variety to allow a seal between the switch 18 and the fluid passage 14 capable of withstanding pressures of approximately 15 to 30 p.s.i. Disposed through one wall of the switch body 16 is a terminal 24 mounted in insulated relationship to the switch body by being passed through an insulator 26. The insulator 26 is held in its operative position by being wedged between a flange 28 of the switch body 16 and a peened-over lip 30 of the switch body. The terminal 24 extends through the insulator 26 and has a portion of slightly smaller diameter forming a fixed contact 32 within the switch body.

A resilient seal 34 is wedged between the insulator 26 and the flange 28 as the insulator is mounted in the switch body to firmly hold the seal in its operative position. The seal 34 has a cylindrical portion 36 with a substantially bellows portion 38 covering the fixed contact 32 and movable contact 40. This resilient seal can be composed of any well-known elastomeric material, such as rubber. The diameter of the cylindrical portion 36 of the seal 34 is of a slightly smaller diameter than that of the contacts 32 and 40 and is stretched when mounted thereon, causing the point at which the contacts meet to be free of moisture. The movable contact 40 forms an end of an actuator rod 42 which extends through an aperture 44 in the opposite end of the switch body 16 from which the terminal enters said switch body. The actuator rod is held in biased engagement with the fixed contact 32 by means of a spring 46 being slightly depressed between a wall 48 of the switch body and the flange 50 of the actuator rod 42. The actuator rod 42 carries a flow plate 52 in sliding engagement therewith, said flow plate being biased away from a part 54 firmly attached in any well-known manner to the opposite end of the actuator rod 42 by a spring 56. The flow plate 52 can be of a diameter or shape slightly less than the overall diameter or shape of the fluid passage in which it reposes. In a preferred form, the flow plate 52 is located at a point in a fluid passage 14 where a slight depression of the flow plate against the spring 56 will push said flow plate into a portion of the fluid passage having a substantially greater cross-sectional area than that of the flow plate. Such an area is designated by an enlarged fluid passage portion 58.

The drawing illustrates a typical electrical system in which a positive displacement fluid switch could be located. An electrical current from a battery 60, having one end to ground, is caused to flow through an ignition switch 62, through a tell-tale lamp 64, through the terminal 24 of the switch 18, through the series of contacts into the actuator rod which is in sliding engagement with the switch body 16, the switch body 16 being grounded through the wall of the fluid passage.

In operation, the switch 18 would be mounted at an appropriate location in the water cooling system of an automobile comprising the pump 10, the fluid sump 12 and the fluid passage 14. Electrically, the switch would be connected as described in the circuit hereinbefore described. In the beginning of the cycle, it would involve the closing of the ignition switch 62; in which case, the tell-tale lamp would light, indicating to the operation of the vehicle that no fluid was flowing in the system as the movable contact 40 is normally in biased engagement with the fixed contact 32. In the example used, the automobile is one of a common design having a pump that is belt driven by the engine. As the engine is started, the pump will begin to cause water to flow through the cooling system of the automobile under normal operating conditions.

Referring to the drawing, this would cause the fluid to flow in the passage 14 in the direction indicated by the arrow. As fluid flowed in the passage, it normally would come into contact with a surface 66 of the flow plate 52. Sufficient fluid flow would cause the flow plate 52 to be moved toward the flange 54 against the force of the spring 56. Depending on the amount of designed pressure in the spring 56 and the spring 46, continued fluid flow would cause the actuator rod 42 to move in the direction of fluid flow and would thereby move the movable contact 40 out of its engagement with the fixed contact 32. This movement causes the bellows portion 38 of the seal 34 to draw in towards the space created when the two contacts separate. As these contacts separate, the system previously described is interrupted. As long as the fluid continues to flow in the fluid passage, the tell-tale lamp 64 will remain dark. If, during the course of operation of the engine, flow is stopped in said passage, for example, by the breaking of a belt to the water pump, the pressure on the surface 66 of the flow plate 52 will diminish and the attached actuator rod 42 will move toward the fixed contact 32 in response to spring pressure from the spring 56. In this manner, the movable contact 40 and the fixed contact 32 will be reengaged and the circuit to the tell-tale lamp 64 will again be established.
The utility of this invention becomes apparent in a situation where a fan belt of an engine of common design breaks and the water in the engine cooling system ceases to circulate. While it is true that a water temperature gauge or light exists on most modern automobiles, this indication is delayed until an overheat condition already exists. Any driving of the automobile after an overheat light goes on or an overheat condition is indicated is usually discouraged because very great damage could result to an engine driven under these conditions.

This invention provides the operator of an automobile with a warning of an impending overheat condition and, once alerted, the driver can continue to drive for a period of time that would enable him to repair the damage to the belt before the overheat condition comes into existence.

This invention is also useful in any application where the flow of a fluid is imperative to the functioning of the device. This device has the added advantage of being responsive to a volume of fluid flow and, hence, can be calibrated to function only when fluid flow decreases below a minimum acceptable level. This calibration can be accomplished by increasing or decreasing the compressive strength of the spring 46, by increasing or decreasing the compressive strength of the spring 56, the length of the spring 56 or the relative position of the plate 52 to an enlarged area of the flow passage 58 as illustrated in the preferred embodiment.

While the embodiments of the present invention, as herein disclosed, constitute preferred forms, it is to be understood that other forms might be adopted.

What is claimed is as follows:

1. An electrical switch comprising, a body having two compartments therein, a plurality of contacts carried in said body and cooperating to cause a switching action, and an actuator means carrying one of said contacts, one of said compartments being fluid-tight and housing said plurality of contacts, another of said compartments having an opening through which a portion of said actuator means is disposed, biasing means engaging another portion of said actuator means and biasing said actuation means against fluid flow and being responsive to a predetermined amount of fluid flow to cause a separation of said plurality of contacts.

2. The combination of an automobile cooling system including an indicating system therefor and a positive displacement flow switch comprising, a body, a plurality of contacts disposed within said body, and an actuator means, said contacts being enveloped in a moisture-proof shroud, a first of said contacts being one end of a terminal extending through one wall of said body, a second of said contacts being attached to one end of an actuator shaft extending through an opposite wall of said body, said actuator being in biased disposition to said body keeping said contacts in biased engagement, said actuator having a portion extending into a fluid passage of the water cooling system carrying a biased flow plate, said flow plate offering a resistance to fluid flow in said passage and being adapted to separate said contacts as fluid flow in said passage reaches a predetermined level thereby breaking said indicating circuit.

3. The combination of an automobile cooling system including a tell-tale lamp indicating circuit therefor, and a positive displacement flow switch arranged to be mounted in said automobile cooling system, said switch comprising a body having a threaded portion, a terminal lead insulatedly mounted through one wall of said body, an actuator means having a portion in sliding disposition to the opposite wall of said body, said terminal lead carrying a contact in opposed and adjacent relationship to a contact carried by said actuator means, said actuator means carrying contact being biased toward said terminal lead contact, said opposed and adjacent contacts being surrounded by an elastomeric means for rendering said contacts moisture free during the operation thereof, said actuator means having a portion extending into a fluid passage, said portion carrying a biased plate, said plate being calibrated to a predetermined volume of fluid flow to cause the separation of said opposed contacts on the stimulus of said predetermined volume of fluid flow thereby causing a switching action in said tell-tale lamp circuit.

4. A positive displacement flow switch comprising an insulated switching means and an actuator means, said actuator means including an actuator rod, and a flat flow plate in biased engagement with said actuator rod, said actuator means being disposed in a fluid passage of substantially the same cross-sectional dimensions as said flow plate, said fluid passage having a portion of a greater cross-sectional dimension into which said flow plate is moved when fluid flow through said passage reaches a predetermined volume.

References Cited by the Examiner

UNITED STATES PATENTS

1,706,523 4/1929 Churcher
1,856,584 5/1932 Parkhill
2,166,264 7/1939 Piper
2,848,167 8/1958 Matthews

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