

Jan. 28, 1958

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2,821,592

PRESSURE ACTUATED SWITCH

Filed Feb. 20, 1956

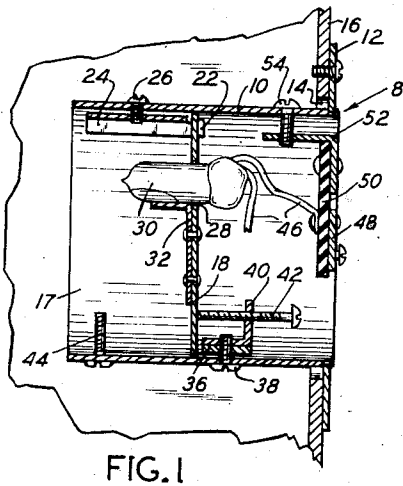


FIG. 1

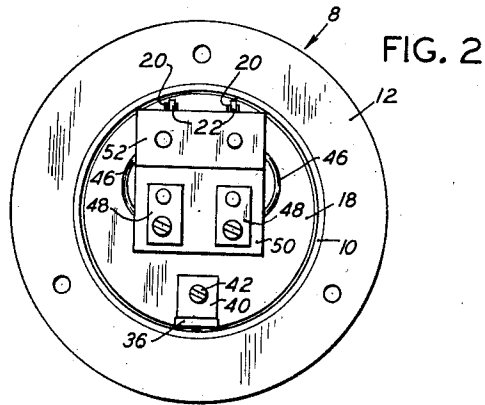


FIG. 2

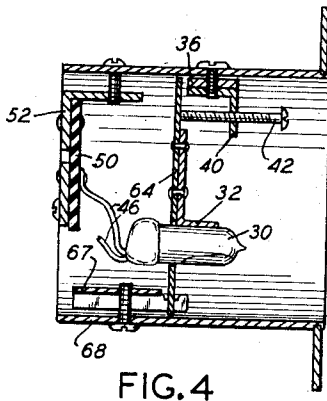


FIG. 4

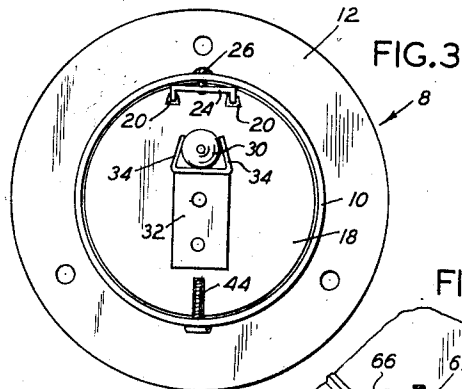


FIG. 3

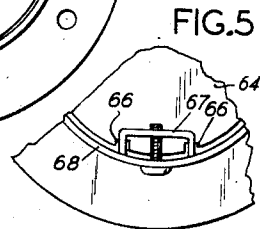


FIG. 5

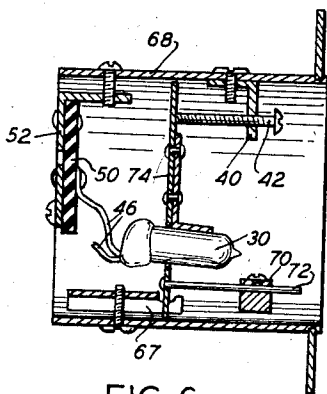


FIG. 6

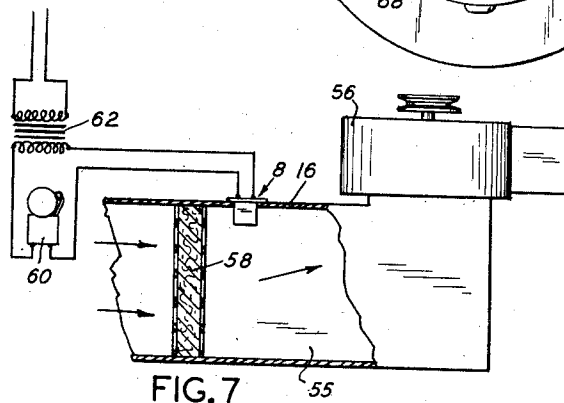


FIG. 7

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2,821,592

PRESSURE ACTUATED SWITCH

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Application February 20, 1956, Serial No. 566,443

4 Claims. (Cl. 200—81.9)

This invention relates to a pressure actuated switch and more particularly to a simple and inexpensive switch which is capable of being actuated by slight pressure differentials and which can be accurately adjusted so as to be actuated by a predetermined pressure differential. The switch of the present invention has particular utility in air conditioning and heating systems for sounding an alarm when air filters become clogged but also has utility in any environment where it is desired to sound an alarm or actuate a control when a predetermined pressure differential has been reached between two different gas or air filled spaces.

Pressure actuated switches of the prior art which are sufficiently sensitive to be actuated by very small pressure differentials, have either included diaphragms of large area connected to switch elements through complicated linkages or have included pivoted vanes or plates of large size with the switch element carried by a projecting pivot shaft or connected thereto by a linkage mechanism. Such switches have required diaphragms or vanes of relatively large size since relatively large actuating forces were necessary to overcome friction and to insure proper functioning of the switch.

In accordance with the present invention, a mercury switch element is mounted directly on a plate member or vane positioned in the passage between spaces containing gas or air at different pressures, the plate member substantially closing the passage when in normal position and being pivoted about an axis extending transversely of the passage and eccentric to the pressure areas of the plate member. A simple pivot structure may be employed imposing substantially no friction forces resisting movement of the plate member by such differential pressure. A biasing force may be provided by a suitable mechanism, such as a weight or a spring, for holding the plate member in a normal position but a preferred structure includes a permanent magnet adjacent the plate member. By adjusting the distance between such magnet and the plate member when the plate member is in its normal position, a simple structure is provided having a rapid action when the forces due to the pressure differential exceed the magnetic force on the plate member. The value of the pressure differential required to actuate the plate member and thus tip the mercury switch to open or close, a circuit can be adjusted by varying the distance between the plate member and the permanent magnet and the pressure differential required to hold the plate member in its actuated position is less than that required to initially actuate the plate member.

It is therefore an object of the invention to provide an improved pressure actuated switch which is operative by small pressure differentials and which is simple and reliable in operation.

Another object of the invention is to provide a pressure actuated switch which is simple and inexpensive in construction and which will open or close an electric circuit to sound an alarm or initiate the actuation of a con-

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trol when subjected to a predetermined pressure differential.

A further object of the invention is to provide a pressure actuated switch in which a plate member is positioned in a passage in a housing and pivoted about an eccentric axis extending transversely of the housing and carries a mercury switch element mounted directly upon the plate element so that pivoting of such element by a predetermined pressure differential causes actuation of the switch.

A still further object of the invention is to provide a switch mechanism in which a mercury switch element is mounted directly upon a pivoted plate member subjected to a pressure differential and in which the value of such pressure differential required to tip said plate and actuate the switches may be adjusted by varying the distance between a permanent magnet and an edge of the plate member.

Other objects and advantages of the invention will appear in the following description given in connection with the attached drawings of which:

Fig. 1 is a vertical section taken approximately through the center of a switch in accordance with the present invention and showing the switch structure mounted in the wall of an air or gas chamber or conduit.

Fig. 2 is a front elevation of the switch of Fig. 1;

Fig. 3 is a rear elevation of the switch of Fig. 1;

Fig. 4 is a view similar to Fig. 1 with the wall of the conduit or chamber omitted and showing a modified form of switch;

Fig. 5 is a fragmentary rear elevation of the lower portion of the switch of Fig. 4;

Fig. 6 is a view similar to Fig. 4 showing a further modified form of switch; and

Fig. 7 is a diagrammatic view showing one type of system in which the switch of the present invention can be advantageously employed.

Referring more particularly to the drawings, the switch 8 shown in Figs. 1, 2 and 3, includes a switch casing 10, preferably of circular, tubular form open at both ends and having a radially extending flange 12 at one end. The flange 12 serves as a mounting means for mounting the housing 10 in an aperture 14 in the wall 16 of an air or gas chamber or conduit, such as a plenum chamber or duct of an air conditioning or heating system. Preferably, the housing 10 extends into the interior of the chamber or duct but it is apparent that the housing can extend to the exterior of such chamber or duct. The passage 17 through the housing 10 has a plate member 18 positioned therein so as to extend across and substantially fill such passage. In Fig. 1 the plate member 18 is shown as being pivoted adjacent its upper edge. Such plate member has a pair of laterally spaced apertures 20 near its upper edge which receives hook members 22 formed on the downwardly bent forwardly projecting edges of a support member 24 secured to the upper interior portion of the housing 10 by a screw 26.

The plate member 18 has an aperture 28 therein of sufficient size to receive the body portion of a mercury switch element 30, such switch element substantially filling the aperture 28. The switch element is held in position by a spring clip member 32 having a body portion suitably secured to the plate member 18 and provided with spring arms 34 engaging the switch element 30 and holding it firmly against a rearwardly bent portion of the body portion of the spring clip member. The plate member 18 is of magnetic material and a small permanent magnet 36 is positioned adjacent the lower edge of the plate member 18, that is, opposite its pivotal connection to the support member 24. The permanent magnet 36 is secured to the housing 10, by a screw 38 which extends through an aper-

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ture in the magnet and also secures in position a bracket 40 receiving an adjusting stop screw 42 which engages the surface of the plate member 18 to set the normal distance between the plate member 18 and the magnet 36. It will be apparent that the plate member 18 is held against movement in a direction toward the magnet 36 by a stop screw 42 but that it is free to pivot away from the magnet 36 until its lower end strikes another stop screw 44. Suitable flexible electrical conductors 46 extend from the mercury switch element 30 to terminal members 48 mounted upon a terminal strip 50 of electrical insulating material secured to a bracket 52 in turn secured to the interior of the housing 10 by the screw 54.

The operation of the switch of Figs. 1 to 3 should be apparent from the above description. The plate member 18 may move from its normal position, shown in Fig. 1, about its pivotal support on the member 24 to a second position in which the lower edge of the plate member engages against the stop screw 44. It is held in the normal position, shown in Fig. 1, by the force of gravity and also by magnetic forces provided by the permanent magnet 36. The amount of the latter forces can be adjusted by rotating the stop screw 42 to vary the distance between the lower edge of the plate member 18 and the magnet 36. A pressure differential, of a predetermined magnitude, on opposite sides of the plate member 18 and in a direction urging the plate member from the normal position shown toward a position against the stop 44 will cause such movement of the plate member to tip the mercury switch element 30. The switch can be calibrated to operate at pressure differentials over a considerable range by adjusting the stop screw 42. Tipping of the plate element carrying the switch element 30 causes closing of the electric circuit through the mercury switch element 30 but it is obvious that such element can be reversed and the terminal strip 48 placed at the other end of the housing so that tipping of the plate member 18 from its normal position will break the electric circuit.

A system in which the pressure actuated switch of the present invention finds utility is shown in Fig. 7, and may be an air conditioning or heating system for a residence or commercial building. In Fig. 7, the switch 8 is shown as being positioned in the side wall 16 of a duct or plenum chamber leading to a motor driven fan indicated at 56. An air filter 58 is placed across the duct or chamber on the inlet side thereof so that a slight partial vacuum is produced in the chamber 55 by the fan 56. As the filter 58 becomes progressively clogged, the vacuum in the chamber 55 increases, that is, the pressure in the duct or chamber lowers to increase the pressure differential across the switch 8. At a predetermined differential pressure determined by the position of the stop screw 42, the switch operates to sound an alarm 60, which may be an electric bell energized from a step down transformer 62, the bell 60 and switch 8 being in series in the secondary circuit of the transformer. The pressure differential between the interior and exterior of the chamber 55 will ordinarily be of the order of a few inches of water, even when the filter 58 is sufficiently clogged that it should be changed, so that the force available for actuating the plate member 18 of the switch is of the order of a few ounces. The switch of the present invention, however, consistently operates at a definite pressure differential within the range indicated, which pressure differential can be preset by adjusting the stop screw 42.

The switch of Figs. 4 and 5 is similar to that of Figs. 1 to 3, except that the modified plate member 64 is pivoted at the bottom edge instead of at its top edge. Thus, the plate member 64 may have notches 66 in its lower edge received in notches in forwardly extending, downwardly bent edge portions of a pivot support member 67 secured to the housing 68. A mercury switch element 30 of the same type employed in the switch of Figs. 1 to 3 is likewise positioned in an aperture 28 in the plate member and held in position by a spring clip member 32. The

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remainder of the structure of the switch of Figs. 4 and 6 may be identical to that of the switch of Figs. 1 to 3, except that the stop screw 44 is omitted. That is to say, the switch of Figs. 4 and 6 may include the permanent magnet 36, bracket 40 and stop screw 42 and may also include the terminal strip 50 and bracket 52, the bracket 52 serving as a stop for the plate member 64 instead of the stop screw 44 of Fig. 1.

A further modified switch is shown in Fig. 6 which may be the same as the switch shown in Figs. 4 and 5, except that a biasing weight 70, which is adjustably secured on a bar 72 extending substantially at right angles to the plate member 74, is employed to bias the plate member 74 toward its normal position instead of a permanent magnet. The operating pressure of the switch of Fig. 6 can be adjusted by moving the weight 70 along the bar 72 and the switch of Fig. 6 is satisfactory for certain purposes, although in general, its operating pressure cannot be so accurately predetermined as the switches of Figs. 1 to 5, inclusive.

I claim:

1. A pressure actuated switch comprising a housing having a passage therethrough, a plate having a normal position in which said plate extends across and substantially closes said passage, said plate being pivoted about an axis extending transversely of said passage and adjacent one edge of said plate, a stop preventing movement of said plate in one direction past said normal position, said plate being movable in the other direction about said axis between said normal position and a second position, a mercury switch element mounted directly on said plate adjacent said axis for closing an electric circuit when said plate is in one of said positions and opening said circuit when said plate is in the other of said positions, said plate being of magnetic material, a permanent magnet supported in said housing adjacent the other edge of said plate and positioned to urge said plate in said one direction against said stop, means to adjust said stop and said magnet relative to each other to vary the distance between said magnet and said plate when said plate is in said normal position so that said plate is moved from said normal position to said second position when the pressure differential in said other direction between opposite sides of said plate reaches a predetermined value depending upon said distance.

2. A pressure actuated switch comprising a housing having a passage therethrough, a plate having a normal position in which said plate extends across and substantially closes said passage, said plate being pivoted about an axis extending transversely of said passage and adjacent one edge of said plate, a stop preventing movement of said plate in one direction past said normal position, said plate being movable in the other direction about said axis between said normal position and a second position, said plate having an opening therethrough adjacent said axis, a mercury switch element mounted in and substantially filling said opening, said switch element closing an electric circuit when said plate is in one of said positions and opening said circuit when said plate is in the other of said positions, said plate being of magnetic material, a permanent magnet supported in said housing adjacent the one edge of said plate and positioned to urge said plate in said other direction against said stop, said stop being adjustable to vary the distance between said magnet and said plate when said plate is in said normal position so that said plate is moved from said normal position to said second position when the pressure differential in said other direction between opposite sides of said plate reaches a predetermined value depending upon the position of said stop.

3. A pressure actuated switch comprising a housing having a passage therethrough, a plate having a normal position in which said plate extends across and substantially closes said passage, said plate being pivoted about an axis extending transversely of said passage and adjacent

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one edge of said plate, a stop preventing movement of said plate in one direction past said normal position, said plate being movable in the other direction about said axis between said normal position and a second position, said plate having an opening therethrough, a mercury switch element mounted in and substantially filling said opening, said switch element closing an electric circuit when said plate is in one of said positions and opening said circuit when said plate is in the other of said positions, said plate being of magnetic material, a permanent magnet supported in said housing adjacent the other edge of said plate and positioned to urge said plate in said one direction against said stop, said stop being adjustable to vary the distance between said magnet and said plate when said plate is in said normal position so that said plate is moved from said normal position to said second position when the pressure differential in said other direction between opposite sides of said plate reaches a predetermined value depending upon the position of said stop.

4. A pressure actuated switch comprising a housing having a passage therethrough, a plate having a normal position in which said plate extends across and substantially closes said passage, said plate being pivoted for movement about an axis extending transversely of said passage, a stop preventing movement of said plate in one direction past said normal position, said plate being movable in the other direction about said axis between said

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normal position and a second position, an aperture extending through said plate, an elongated mercury switch tube mounted in and substantially filling said aperture in said plate, said tube extending transversely of said plate and projecting laterally thereof on both sides so that the mercury therein may occupy alternate positions beyond the plane of the plate, said switch element closing an electric circuit when said plate is in one of said positions and opening said circuit when in the other of said positions, bias means urging said plate in said one direction against said stop, said axis being eccentric of said plate so that said plate is moved from said normal position to said second position when the pressure differential in said other direction between opposite sides of said plate reaches a predetermined value.

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