July 30, 1946. M. W. HUBER 2,404,843

PRESSURE SWITCH

Filed July 27, 1944

Fig.1

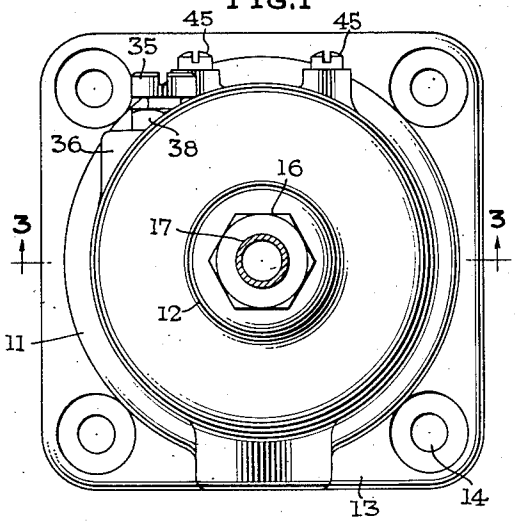


Fig.2

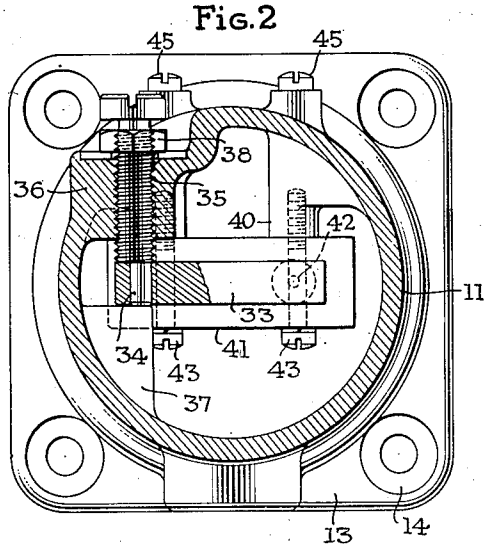


Fig.3

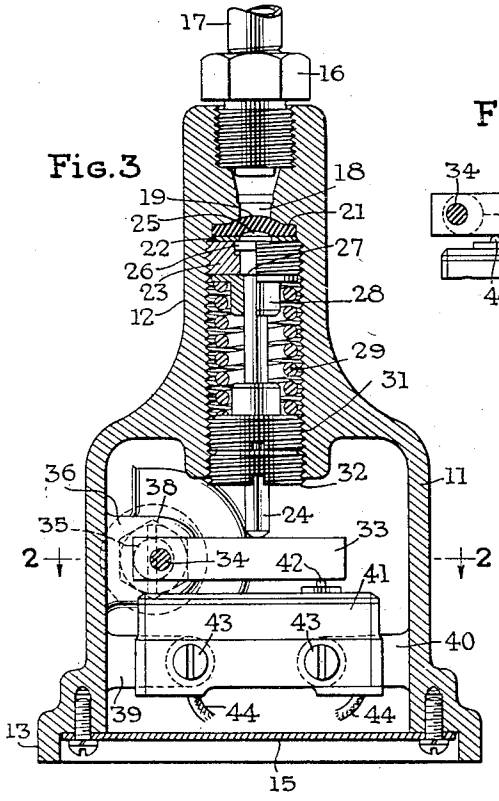


Fig.5

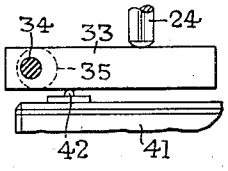


Fig.4

Inventor

Matthew W. Huber

By

Dodge & Jones

Attorneys

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PRESSURE SWITCH

Matthew W. Huber, Watertown, N. Y., assignor to The New York Air Brake Company, a corporation of New Jersey

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3 Claims. (Cl. 200—83)

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This invention relates to pressure switches, and particularly to a pressure actuated switch of the micro-motion type.

There are available several commercial switch mechanisms of the snap action type, which are characterized by the ability to handle rather large currents and which shift reversely in response to motion of the actuating member (usually a plunger) through a very small range.

Fluid pressures up to four or five thousand pounds per square inch are in commercial use today and the trend is upward. A spring loaded abutment subject to such pressures may have a rather small range of motion, say 3/64" and still afford several times the motion required to actuate such a switch. The invention takes advantage of this fact by interposing between the abutment and the switch a variable ratio lever mechanism which changes the distance the abutment must move to trip the switch. If the required motion is small, the sensitivity is said to be high. The ability to adjust sensitivity facilities precise setting of the device for particular conditions.

For large adjustments of sensitivity the switch is shifted relatively to the lever fulcrum. This can be done in various ways but in the example illustrated the switch is simply reversed on its mount changing the point of engagement of the switch plunger with the lever. For smaller changes of sensitivity the fulcrum is shifted. The fulcrum adjustment is so contrived that the trip point of the switch, relatively to the total range of motion of the abutment, can also be adjusted.

The precise form of the device is affected by the pressure to which the switch must respond, the permissible variation of such pressure, the character of the control effected by the switch and similar details, but a switch intended to open and close as pressure shifts across 3,000 pounds per square inch is illustrated in the accompanying drawing as typical.

In the drawing—

Fig. 1 is a plan view.

Fig. 2 is a section on the line 2—2 of Fig. 3.

Fig. 3 is a section on the line 3—3 of Fig. 1.

Fig. 4 is a view similar to Fig. 3 showing the switch reversed to reduce the sensitivity.

Fig. 5 is a fragmentary view similar to a portion of Fig. 4 showing a different adjustment of the fulcrum.

The housing for the switch mechanism might be described as bottle shaped having a cylindrical body 11 which houses the switch mechanism and the neck 12 which houses the pressure responsive mechanism. The body 11 merges into

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a mounting plate 13 with holes 14 for attaching screws. The lower end of the body 11 is closed by a removable plate 15 attached by screws.

The upper end of the neck 12 is threaded to receive a union fitting 16 by means of which the pressure line 17 is placed in communication with the bore 18 above a pressure responsive diaphragm 19. This diaphragm is made of some oil resisting rubber-like plastic and is clamped between a seat 21 and an annular seating disc 22 by means of a member 23 which is screwed into the neck 12 from below and which serves as a clamp for the diaphragm and as a guide for the pressure stem 24.

This stem 24 has a domed head 25 which engages the central portion of the diaphragm 19 and which is limited in its downward motion by a flange 26. A shoulder 27 bears against a spring seat 28. A coil compression spring 29 reacts against the spring seat 28 and against a similar seat held by ring 31 threaded into the lower end of the neck 12. This is locked in its adjusted position by the locking member 32.

The stress on spring 29 is so adjusted that the plunger 24 will respond at the desired pressure, here assumed to be 3,000 pounds per square inch. The stem 24 is guided in the spring seat 31 and extends through the locking member 32. Its lower end engages a lever 33 which is mounted within the body 11 on an adjustable fulcrum.

This fulcrum comprises an eccentric journal 34 formed on the inner end of a screw 35 which is threaded into a boss 36 formed within the body 11 (see Fig. 2). The lever 33 is held in assembled relation with the journal 34 by a second boss 37 formed within the body 11. The screw 35 is locked in its adjusted positions by a check nut 38.

The switch element is an ordinary micro-motion switch whose body appears at 41. It is tripped by depressing a push button or plunger 42 which extends through a guide in its upper surface. The body 41 is mounted against the lug 39 and a companion lug 40 by a pair of screws 43. The leads from the switch are indicated at 44.

As will be apparent from an inspection of Figures 3 and 4 the switch 41 may be mounted in the body 11 in either of two positions. In the position of Figure 3 motion of the plunger 24 is multiplied so that this is a high sensitivity setting. In the position of Figure 4 the motion of the plunger 24 is reduced giving a low sensitivity setting. In either of these positions the trip point 42 of the switch may be coordinated with the

motion of the plunger 24 by turning the screw 35 so as to raise or lower the axis of the journal 34 on which the lever 33 turns.

As indicated in Figure 5 it is also possible to turn the screw 35 180 degrees so as to position the journal 34 to the left of the axis of screw 35 instead of to the right thereof as is indicated in Figures 3 and 4. This adjustment is one of minor effect as compared to reversal of the switch body 41.

In either arrangement it is possible to raise and lower the axis of the journal 34 so as to control the trip point of the switch, and the precise pressure at which it trips.

The screws 45 (see Figures 1 and 2) are merely closure plugs and are needed because tapped holes which receive the screws 43 must be drilled and tapped through from the outside of the case.

The invention provides a vary simple structure which may be manufactured at moderate cost. The stress on the spring 29 may be readily adjusted by adjusting the spring seat 31. By using interchangeable springs 29 of different strengths a very wide range of pressures may be handled. The adjustment of the journal 34 is effected by a very simple means and permits a precise setting of the trip point of the switch. The adjustability of the switch with reference to the lever permits adjustment of sensitivity. While a very simple two position adjustment is shown, it is obvious that any means permitting a shift of the push button 42 in the direction of the length of the lever 33 might be used to adjust sensitivity. The embodiment illustrated is chosen for its simplicity and because it offers a sufficient range of adjustment for ordinary commercial purposes.

What is claimed is:

1. In a pressure switch, the combination of a movable abutment; means for subjecting said abutment in one direction to a variable fluid pressure; yielding means for biasing said abutment in opposition to said pressure; a snap acting switch; a mechanical connection between said abutment and switch, and including a lever having a fulcrum; and means for shifting said fulcrum in a circular orbit.

2. In a pressure-operated switch, the combination of a movable abutment; means for subjecting said abutment to a variable fluid pressure, acting thereon in one direction; a spring serving to bias said abutment in the opposite direction; adjustable means for stressing said spring; a motion transmitting member shiftable by said abutment; means for limiting the motion of said transmitting member; a snap-acting switch having an actuator shiftable past the trip point of the switch in both directions; a lever interposed between said transmitting member and said actuator; and a fulcrum for the lever shiftable to vary the relation of the trip point of the switch to the position of said transmitting member.

3. In a pressure-operated switch, the combination of a movable abutment; means for subjecting said abutment to a variable fluid pressure, acting thereon in one direction; a spring serving to bias said abutment in the opposite direction; adjustable means for stressing said spring; a motion transmitting member shiftable by said abutment; means for limiting the motion of said transmitting member; a snap-acting switch having an actuator shiftable past the trip point of the switch in both directions; a lever interposed between said transmitting member and said actuator; and a shiftable fulcrum for the lever, said fulcrum having at least two settings in which respectively it establishes different motion ratios between the transmitting member and the switch actuator, said fulcrum being shiftable in each setting in a direction to vary the relation of the trip point of the switch to the position of said transmitting member.

MATTHEW W. HUBER.