Sept. 5, 1950 P. J. CADE 2,520,906

THERMAL MICROSWITCH

Filed June 22, 1946

Fig. 1.

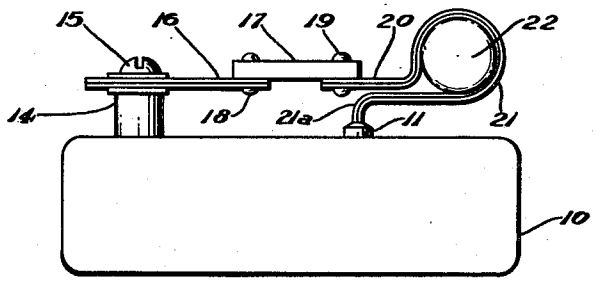


Fig. 2.

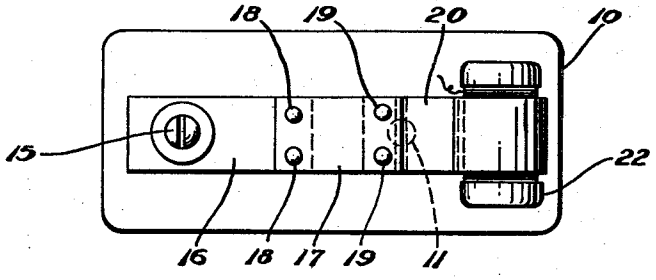


Fig. 3.

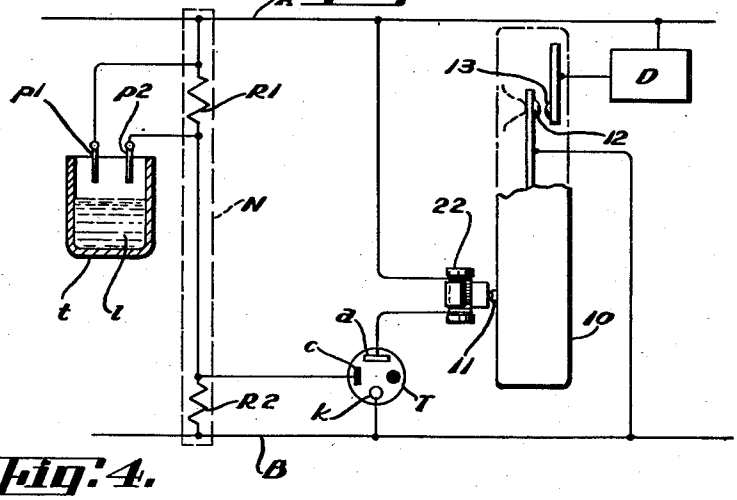
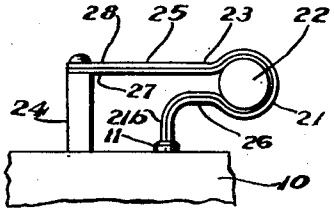


Fig. 4.



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THERMAL MICROSWITCH

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3 Claims. (Cl. 200—122)

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The present invention relates in general to switch actuators and more particularly to thermally operated actuators for use with switches of the snap action type.

The principal object of this invention is to provide an improved snap action switch actuator.

Another object is to provide a snap action switch actuator that is thermally controlled.

Another object is to provide such an improved snap action switch actuator which is unaffected by changes in ambient temperature.

Another object is to provide an actuator of the type above indicated which is so designed that a standard resistor unit of the high resistance type may be easily attached to it and thereby provide a heater means to operate the actuator.

Another object is to provide an improved actuator of the type above indicated which is positive in action and requires only a small amount of power to effect operation.

Another object is to provide an actuator which has an inherent time delay.

Other objects and novel features of the invention will be apparent as the description thereof progresses.

In the drawings illustrating the preferred embodiment of the invention:

Fig. 1 is a side elevation of an actuator device, constructed in accordance with the invention, mounted on the housing of a snap switch of a conventional type;

Fig. 2 is a top elevation of Fig. 1;

Fig. 3 is a diagram of a simple circuit in which the actuator may be used, and

Fig. 4 is a modified form of the actuator shown in Fig. 1.

Referring more in detail to the drawings, 10 indicates a conventional snap action switch, on the outside casing of which the present device is mounted. If preferred, the casing may be removed and a special mounting may be provided for both switch and actuator.

For the purpose of the present application, and to simplify the disclosure it is to be understood that a very slight pressure on the button 11 projecting through the side of the housing of the switch 10 causes the switch contact member 12 to engage with a fixed contact member 13 (see Fig. 3), thereby effecting a closed circuit, as will be more fully described further along in the description.

Mounted on the housing of the switch 10 is a post 14 to which is fastened by means of the screw 15 a strip of bimetal 16. Secured to the bimetal strip 16 is an electrical and heat insulating

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strip 17. Any suitable means, such as rivets 18, may be used to connect these pieces. In a like manner, similar rivets 19, are provided to fasten the opposite end of the insulator strip 17 to another bimetal member 20. The bimetal member 20 is provided with an open loop 21. The free end of the bimetal strip 20 extends rearwardly below the upper portion terminating in a ninety-degree bend 21*a*, the end of which, when properly proportioned and adjusted, very lightly contacts the button 11. The bimetal strips 16 and 20 are of any conventional type and are so proportioned and of such characteristics that when both are subjected to the same ambient temperature the bending of one member compensates for the bending of the other and the position of end 21*a* is not changed.

Fig. 4 discloses a modified form of actuator which is constructed of a single bimetallic strip and so shaped as to be self-compensating. In this embodiment the upper straight portion 25 is approximately equal in length to the combined lengths of lower straight portion 26, and curved portion 21. If it is assumed, for example, that the metal of strip 27 has a greater coefficient of expansion than strip 28, it can be seen that, upon a rise in ambient temperature, the bending of portion 25 tends to move leg 21*b* upward, and the bending of curved section 21 and straight section 26 both tend to move point 21*b* downward. If the switch is proportioned as indicated above these two motions will exactly compensate each other so that no pressure is exerted on button 11. If the loop 21 alone is heated, however, the loop will expand and exert pressure on button 11. In Figs. 1 and 4, a heating resistor 22 which may be of the composition type commonly used in electronic circuits, and preferably has a high resistance value, is held within the bimetallic loop. The bimetals are arranged in both cases so that the loop will expand when heated. It is apparent that when the resistor unit 22 is heated by an electric current the expansion of the loop 21 will depress the end piece 21*a* or 21*b* against the snap switch button 11 thereby causing the contacts 12 and 13 to become engaged. In Fig. 1, the insulating strip 17 prevents conduction of heat away from the loop, thereby ensuring maximum sensitivity of the actuator, and also isolates strip 21 from strip 16 so that strip 16 may be attached directly to one contact member of the switch if desired.

Fig. 3 illustrates a simple circuit in which the present invention may be used. A and B represent the terminals of an alternating current

supply source, to which are connected a potential apportioning network N with impedances R1 and R2, and an electronic discharge device, for example a gas-filled cold cathode tube T, with anode *a*, cathode *k* and starter anode *c*. Impedance R1 may be bridged by variable-impedance detecting device, for example two electrodes or probes *p1*, *p2* associated with a tank *t* for a liquid *l*. The starter anode *c* is connected to a point between impedance R1 and R2.

The heating resistor 22 of the actuator is connected in the plate circuit of tube T. The fixed contact 13 of the snap switch 10 is connected to terminal A through an alarm or control device D and movable contact 12 is connected to the terminal B. The potential apportioning network is so arranged, that, when the probes *p1* and *p2* are above the liquid level and constitute a high impedance, the potential of *c* is low enough to prevent the tube from conducting. The snap switch 10 and the superimposed actuator are so arranged that, with the tube T non-conductive, and no current flowing through heating resistor 22 the button contact end 21*a* or 21*b* of the bimetal member 20 or 23 permits the contacts to assume a normally open position as shown in the drawing. No current then flows in 22 and contact 12 remains in its normally open position. If the water l in the tank *t* rises until probes *p1* and *p2* are conductively connected, the potential drop across impedance R1 will be decreased, the potential of *c* will rise and tube T becomes conductive. The output current flowing through the resistor 22 in the open loop of the bimetal strip 20 heats the resistor. The bimetal loop 21 expands causing the contact end 21*a* and 21*b* to press against the button 11 of the switch 10. Contact member 13 then snaps to the right against contact member 12 and closes the circuit through signalling device D.

It can readily be seen that ambient temperature compensation of the switch actuator is essential to the satisfactory operation of an arrangement of this type. Because of the low power generally available in a tube output circuit it is necessary to use a thermal actuator of high sensitivity and changes in ambient temperature, if not compensated for, might be sufficient to operate the switch and causes false operation of the control or alarm. With respect to Fig. 1 such compensation may be had by making the metal of the lower part of strip 16 (that which is nearer the housing of switch 10) of a higher coefficient of expansion than the metal of the upper part, so that strip 16 behaves similarly to the straight portion 25 in Fig. 4.

Since certain changes may be made in the above-described article and different embodiments of the invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative only and not in a limiting sense.

What is claimed is:

1. In a switch having a stationary and a movable contact member, a thermal actuator for said movable member comprising: a bimetallic strip in the form of a loop with its ends bent into legs of different lengths projecting substantially perpendicularly to each other, the longer of said legs being fixed at its outer end to said switch and the shorter of said legs being arranged to engage said movable member, said loop and said longer leg being so proportioned as to maintain the position of said shorter leg with respect to said switch substantially unchanged when the entire strip is heated to uniform temperature; and a heating coil mounted in intimate heat transfer relationship with said loop but spaced from said legs.

2. A thermostatic switch comprising: a base; a fixed contact attached to said base; a movable contact; a bimetallic strip in the form of a loop with its ends bent into legs of different lengths projecting substantially perpendicularly to each other, the longer of said legs being fixed at its outer end to said base and the shorter of said legs being arranged to engage said movable contact, said loop and said longer leg being so proportioned as to maintain the position of said shorter leg with respect to said base substantially unchanged when the entire strip is heated to uniform temperature; and a heating coil mounted in intimate heat transfer relationship with said loop but spaced from said legs.

3. A thermostatic switch comprising: a base; a fixed contact attached to said base; a snap action element carrying a movable contact; a bimetallic strip in the form of a loop with its ends bent into legs of different lengths projecting substantially perpendicularly to each other, the longer of said legs being fixed at its outer end to said base and the shorter of said legs being arranged to engage said movable contact, said loop and said longer leg being so proportioned as to maintain the position of said shorter leg with respect to said base substantially unchanged when the entire strip is heated to uniform temperature; and a heating coil mounted in intimate heat transfer relationship with said loop but spaced from said legs.

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