June 17, 1958 S. H. ADLERSTEIN 2,839,639

THERMAL SWITCH FOR FIRE ALARMS AND THE LIKE

Filed April 23, 1957

FIG. 1

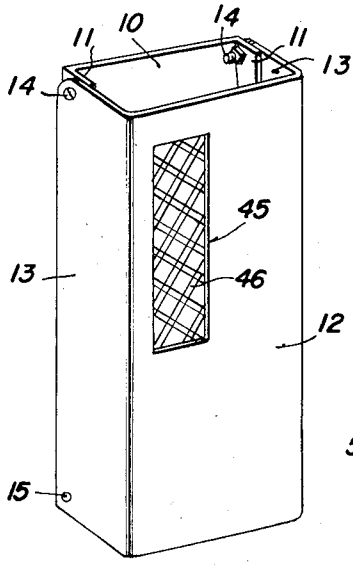



FIG. 2

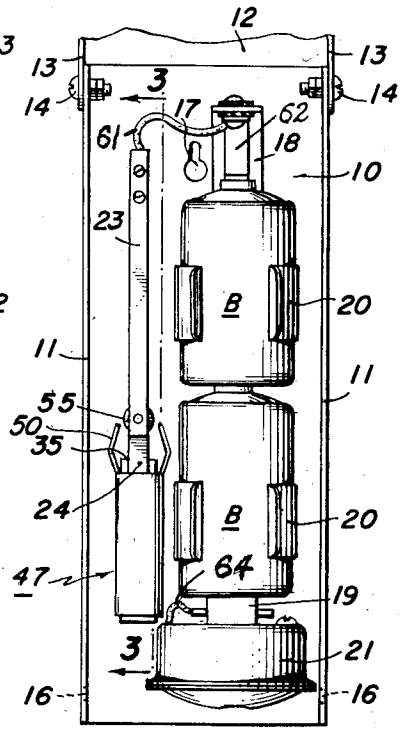



FIG. 4

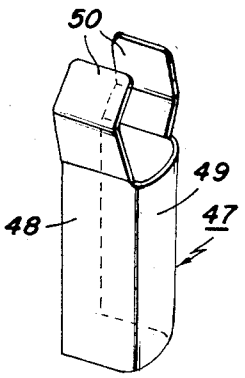



FIG. 3

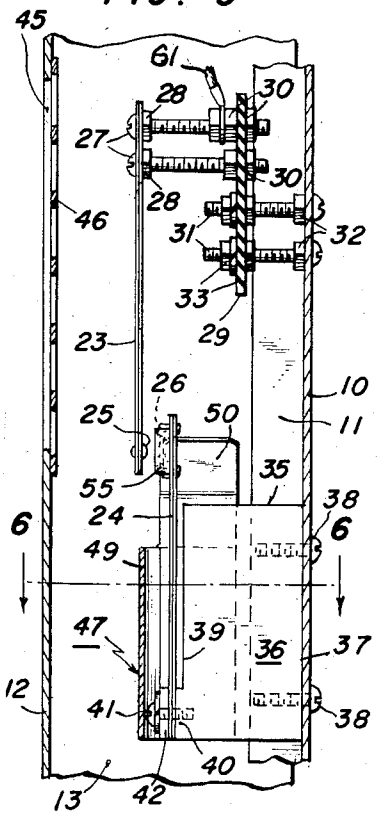



FIG. 5

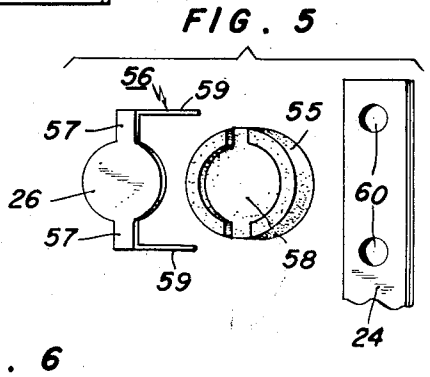
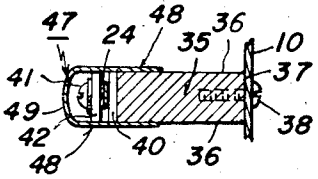



FIG. 6




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# THERMAL SWITCH FOR FIRE ALARMS AND THE LIKE

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9 Claims. (Cl. 200—138)

This invention relates to thermostatically operated switches particularly adapted for fire detecting alarms but useable in other applications where it is necessary to control the rate of speed of temperature variations.

The invention contemplates the use of two straight fast acting bi-metal strips arranged in tandem with coacting electrical contacts on their overlapping free ends, the strips having the same bowing characteristics and being mounted to bow in the same direction to maintain the contacts separated upon any slow or gradual changes in temperature, with one of the strips exposed to ambient air so as to bow quickly upon a fast rise in temperature, while the other strip is closely associated with and mounted upon a heavy slug or body of metal, and also preferably but not necessarily shielded from ambient air circulation, so that the latter strip will bow more slowly than the exposed strip upon a quick rise in temperature, and only when the temperature of the ambient air changes the temperature of said body of metal, the heat of the latter being transmitted to such strip by both conduction and radiation.

One object of the invention is to provide a thermal switch of the above indicated character which is simple, practical and effective in operation, so that when used as a fire detector, for example, it may be used in locations where there are wide differences in normal temperatures without giving an alarm when there is a large but slow rise in the temperature of ambient air, but upon any fast rise in the temperature, such as approximately 15° F. in fifteen minutes over a range of degrees from zero to about 123° F., the alarm circuit will be closed to give an audible, visual or other signal.

Another object of the invention is to provide in a device of this character, a permanent magnet associated with a switch contact on one of the bi-metal strips and coacting with an armature in the form of the coacting contact on the other bi-metal strip to cause a fast and clear cut engagement and disengagement of the contacts, and thus prevent chattering of the latter.

Another object of the invention is to provide in a device of this character removable means for shielding one of the bi-metal strips so that the device may be used with or without the shield.

With the above and other objects and advantages in view, the invention resides in the novel combinations and arrangements of parts and the novel features of construction hereinafter described and claimed, and illustrated in the accompanying drawings which show the present preferred embodiment of the invention.

In the drawings:

Fig. 1 is a perspective view of one form of audible fire alarm device in which the improved thermal switch is embodied;

Fig. 2 is a front view of the device shown in Fig. 1 with the casing cover in raised or open position and partly broken away;

Fig. 3 is a detail section taken on line 3—3 in Fig. 2, on an enlarged scale;



Fig. 4 is a perspective view of the detachable shielding device for the bi-metal strip mounted on the metal block;

Fig. 5 is an exploded perspective view showing one manner of mounting the magnet on its bi-metal strip; and

Fig. 6 is a detail section taken on line 6—6 in Fig. 3.

The illustrated fire detection device has an upright rectangular casing composed of a back or body section 10 with side flanges 11 and a front cover section 12 with sides or flanges 13 to receive between them the flanges 11. The front section is relatively deep and its sides have their upper ends suitably pivoted as at 14 to the flanges 11 so that the cover may swing upwardly to expose the switch and other parts mounted on a support preferably formed by the back or base section 10. The cover may be retained in its closed position by providing the lower portions of its sides with studs 15 to snap into holes 16 in the flanges 11, the two sections of the casing being made of metal. By providing a hole 17 at the top of the back or base 10, the device may be suspended from a nail or screw on a wall or other support. Suitably mounted on the back plate 10 are metal brackets 18 and 19 each of which has spring clips 20 to hold dry cell batteries B, as seen in Fig. 2, the bracket 19 also supporting an electric horn 21 of the vibratory diaphragm type.

The improved thermal switch comprises two fast acting bi-metal strips 23 and 24 arranged in tandem with their free ends overlapping in laterally spaced relation, and carrying coacting electric contacts 25 and 26 respectively. The flat strips 23 and 24 are preferably straight and approximately of the same size in length, width and thickness. They may be made of the same metals and have the same bowing characteristics under the same variations in temperature. They are mounted to bow in the same direction and are disposed longitudinally of the casing adjacent its front wall 12.

While any suitable means may be employed to permanently or adjustably support the upper end of the upper strip 23, I have shown it mounted on two adjustable screws or bolts 27 fixed to the strip by clamping it between the heads of the bolts and nuts 28 thereon. The threaded portions of the bolts pass through openings in an elongated plate 29 of insulating material, the bolts being adjustably fixed therein by nuts 30 engaged with opposite faces of the plate. The plate 29 is in turn adjustably supported from the back wall 10 by two bolts 31, and this adjustment may also be used to adjust the strip 23. As shown, the threaded shanks of the bolts 31 pass through holes in the wall 10, and the latter is clamped between the bolt heads and nuts 32. The bolts 31 also pass through holes in the plate 29 and carry clamping nuts 33 at opposite sides of the latter to provide the adjustment.

The lower bi-metal strip 24 has its lower end mounted on the lower end portion of a large slug or body 35 of metal; and the major portion of the length of one flat face of the strip is disposed in closely spaced relation to one flat face of the metal body so that the heat of the latter will be transferred to the strip by both conduction and radiation. The metal body 35 is preferably in the form of an elongated rectangular block disposed vertically in the lower portion of the casing to extend longitudinally thereof. It has parallel flat side faces 36 and a flat inner or rear edge 37 disposed in contact with the inner face of the metal bottom or back wall 10 of the casing to which it is fastened by screws 38, as seen in Fig. 3. The body or block 35 may be substantially wider than the strip 24; and its front face or edge 39 is straight and flat but at its lower end is formed with a forwardly or outwardly extending enlargement 40. The latter has a flat outer face against which the lower end portion of the

strip 24 is clamped by a screw 41 threaded into the metal body. A flat square or rectangular clamping plate 42 of metal is interposed between the strip and the head of the screw to hold the strip in firm engagement with the projection or enlargement 40 so that the heat of the block will be conducted to the strip. Because of the size of the block 35 its temperature will change slowly, and because the strip 24 is so closely associated with it, and at the lower end is in contact with it, the temperature of the strip will follow closely that of the block. Further the lower portion of the casing around these parts have solid portions and hence there will be little movement of the ambient air. On the other hand the strip 23 is disposed adjacent the open top of the casing and opposite a large opening 45 in the front wall 12, and hence there will be free movement of air around and past the strip 23 to cause it to bow quickly upon a fast rise in temperature of the ambient air. A suitable grating 46 may be used over the opening 45.

To further retard changes in temperature of the strip 24 and its associated block 35 which absorbs heat slowly, I may use a shield 47 which is preferably made readily removable. This shield as seen in Fig. 4, is of channel shape or U-shape in cross section. As shown it has flat substantially parallel sides 48 with a connecting portion 49, the sides at one end being extended to provide curved or angular wings 50. The shield is made of somewhat resilient metal, plastic or other material, and it is so proportioned that its sides may be sprung over and frictionally engaged with the flat sides 36 of the block 35, as seen in Fig. 6. The shield surrounds the major portion of the strip 24 and is longer than the block 35, so that its wings 50 will be disposed along the upper edges of the strip adjacent the contact 26.

The contact 25 may be in the from of a rivet made of a magnetizable metal and provided with a rounded head projecting from the inner or rear side of the strip 23. While the contact 26 may be of the same character, I preferably associate with the strip 24 a permanent magnet 55 to atract the rivet 25 and cause a fast and clear cut engagement and disengagement of the two contacts. The magnet may be of any suitable construction and fastened in any desired manner to either of the two bi-metal strips. As shown, the magnet 55 is in the form of a cylindrical body or disk one face of which is held in contact with the front or outer face of the strip 24 by a generally U-shaped fastening yoke 56. The latter has a circular portion which forms the actual contact 26 that is engaged by the contact or armature 25 and diametrically projecting arms 57 of right angular shape as seen in Fig. 5. The circular portion 26 is adapted to seat in a depression 58 in the magnet and the ends 59 of the arms 57 are adapted to be passed through longitudinally spaced holes 60 in the strip 24 and then bent against the rear face of the latter, as shown in Fig. 3, so that the magnet will be fastened on the strip.

As seen in Figs. 2 and 3, a conductor 61 electrically connects the strip 23 through one of the screws 27 to a leaf spring 62 which is insulated from the bracket 18 and which engages the center contact of the upper battery. The bottom of the lower battery rests upon a contact (not shown) which is insulated from bracket 19 and from which a conductor 64 extends to the interior of the electric horn 21. The metal casing of the latter is grounded to the casing 10 through the bracket 19 and the strip 24 is also grounded to the casing 10 through the slow heating metal block 35. It will thus be seen that the strip 23 is insulated from the housing or casing while the strip 24 is electrically connected thereto, so that when their contacts 25, 26 engage the circuit will be closed to cause the electric horn or other signal to operate.

It will be further noted that because of the construction and mounting of the bi-metal strips and their arrangement in the housing, the strip 23 is completely available to the ambient air and will bow very quickly with sudden changes in temperature, whereas the strip 24, because it is so close to and, at one end, is solidly attached to the metal body 35, will move only when the temperature of the ambient air changes the temperature of the metal body. The device may therefore be used in locations when there are slow or gradual changes in temperature of from zero to 125° F., without sounding an alarm, but if there is a fast temperature rise in ambient air of a predetermined number of degrees, such as 15° in fifteen minutes, the strip 23 will bow quicker than the strip 24 and thus close the alarm circuit. Since the elongated casing is disposed vertically and has open ends, air will move upwardly therethrough assisted by the air entering the front opening 45, and since the bi-metal strips are also disposed vertically with the upper strip 23 disposed near the top of the casing opposite that opening, it will be quickly influenced by any quick rise of temperature, whereas the lower strip 24 will bow more slowly because of its location and its disposition close to and in contact with the heavy block of metal 35.

It will be seen that for a slower or more rapid action by the strip 24, the size of the body of metal may be changed to a larger or a smaller body.

From the foregoing, taken in connection with the accompanying drawing, it will be seen that novel and advantageous provision has been made for carrying out the objects of the invention, and while preferences have been disclosed, attention is invited to the possibility of making variations within the scope of the invention as claimed.

I claim:

1. In a device of the character set forth, the combination of a support, an elongated body of metal mounted on the support and having a flat longitudinally extending face, a first flat bi-metal thermostat strip having a length at least equal to the length of said body and extending in laterally opposed parallel relation to the latter, means connecting one end of said strip in heat conducting relation to one end of said body with the major portion of the strip in closely spaced relation to said flat face of the body, a second flat bi-metal thermostat strip with means supporting it by one of its ends from said support with the free ends of said first and second strips in laterally overlapping but spaced relation, and coacting electrical contacts on said overlapped free ends of the two strips, said first and second strips having the same bowing characteristics and being arranged to bow in the same direction under changes in temperature of the ambient air, and said metal body having such dimensions as to provide a relatively large metal mass the temperature of which will rise slowly upon a sudden rise in the temperature of the ambient air, the size of said metal body, its close proximity to said first strip and the heat-conducting connection between them causing said first strip to bow more slowly than said second strip upon a sudden rise in temperature.

2. The device of claim 1 in which one of said contacts mounted on one of said strips is made of magnetizable metal to serve as a magnet armature together with a permanent magnet associated with the contact on the other of said strips to coact with said one contact.

3. The device of claim 1 together with an elongated channel shaped shield mounted on said metal body and partially enclosing the major portion of said first strip.

4. The device of claim 1 in which said metal body is a rectangular block having substantially parallel side faces, together with a substantially U-shaped shield of resilient material having sides in frictional engagement with said side faces to removably clamp said shield on said block and a connecting portion uniting said sides and disposed opposite the major portion of said first strip.

5. In a device of the character set forth, an upright elongated metal casing with open upper and lower ends to permit air to move upwardly therethrough, a thermostatically controlled switching mechanism in said casing

and including upper and lower bi-metal strips extending vertically in the casing with their adjacent ends in overlapping and laterally spaced relation, said strips having the same bowing characteristics and being arranged to bow in the same direction, and a pair of coacting electrical contacts carried by said adjacent ends of the strips, means in the upper portion of the casing and attached to the upper portion of the upper strip to support the latter vertically in the air passing through the casing, whereby it will bow quickly upon a sudden rise in temperature of the ambient air, and means in the lower part of the casing and attached to the lower end of the lower strip to support the latter and cause it to bow slowly upon a sudden rise in temperature, said means comprising an elongated body of metal disposed vertically in and fastened to the casing, said body having a longitudinally extending flat face disposed in parallel relation to one flat side of the lower strip, and means fastening the lower end of the lower strip to the lower end of said body in heat conducting relation therewith and with the strip in closely spaced relation to said flat face of the metal body, the latter having a length substantially that of the lower strip and having relatively large width and depth to provide a heavy mass of metal which will absorb heat slowly and thereby retard the bowing of the lower strip upon a sudden rise in the temperature of the ambient air.

6. In an alarm device of the character set forth, an upright elongated metal casing having a base section and a cover section with open upper and lower ends, a thermostatically controlled switching mechanism in said casing including a pair of bi-metal strips disposed vertically and arranged in tandem with their adjacent ends in spaced overlapping arrangement and carrying coacting electrical contacts, said strips having the same bowing characteristics and being arranged to bow in the same direction, a plate of insulating material supported from said base section in the upper portion of the casing,



means adjustably supporting the upper end of the upper bi-metal strip from said plate, said casing having in its upper portion an air inlet opening disposed opposite said upper strip, a relatively heavy elongated body of metal disposed vertically in the lower portion of the casing and fastened to said base section in parallel relation and laterally opposed relation to the lower bi-metal strip, and means fastening the lower end of the lower strip to the lower end of said metal body in heat conducting relation thereto, to dispose the major portion of the lower strip in closely spaced relation to metal body.

7. The alarm device of claim 6 in which one of said contacts mounted on one of the bi-metal strips is made of magnetizable metal to serve as a magnet armature together with a permanent magnet associated with the coacting contacts on the other of said bi-metal strips to coact with said one contact.

8. The alarm device of claim 6 together with an elongated channel shaped shield removably mounted on said metal body and partially enclosing the major portion of the lower bi-metal strip.

9. The alarm device of claim 6 in which said metal body is a rectangular block having substantially parallel side faces, together with a substantially U-shaped shield of resilient material having sides in frictional engagement with said side faces to removably clamp said shield on said block and a connecting portion uniting said sides and disposed opposite the major portion of the lower bi-metal strip.

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