Nov. 4, 1930. L. E. KOCH ET AL 1,780,302

ACTUATOR FOR CONTROLLING DEVICES

Filed May 5, 1928

Fig. 1.

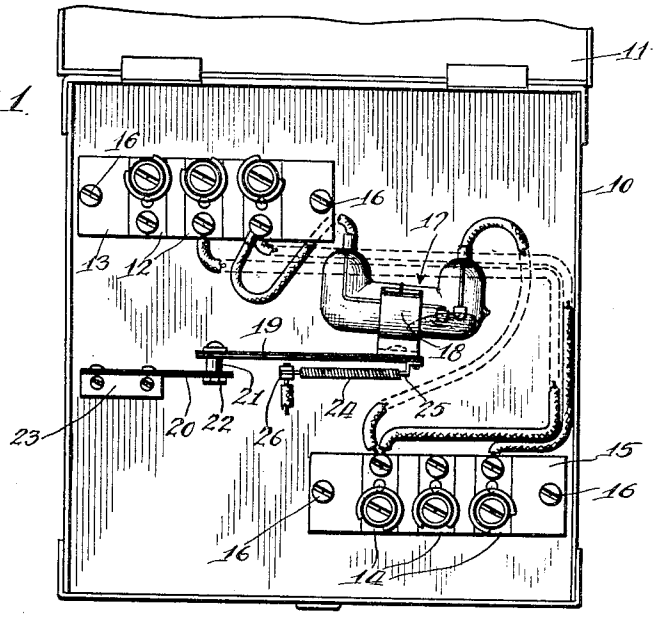


Fig. 2.

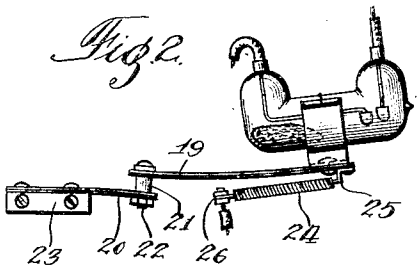
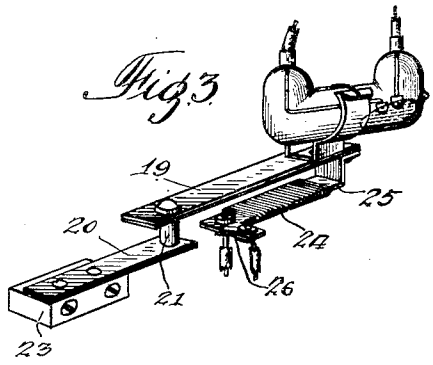


Fig. 3.



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UNITED STATES PATENT OFFICE

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ACTUATOR FOR CONTROLLING DEVICES

Application filed May 5, 1928. Serial No. 275,370.

This invention relates to actuators for controlling devices such as electrical switches and has special reference to a thermally operated actuator which is self compensating for room temperatures.

More particularly, this invention relates to a thermally operated actuator as employed in electrical switches and other controlling means and comprises a pair of bimetallic elements connected together and insulated from each other, one of said elements being operated by an electrical heater and the other of said elements being operated by the heat in a room or other enclosure. The aforesaid bimetallic elements are reversed or opposed with respect to each other; that is, a rise in temperature effects a warping of one of the members in the opposite direction with respect to the other of the members.

Hereinafter, the present invention will be employed as a safety device in an electrical circuit where it is desired to effect a circuit change at a predetermined time, that is, to control the period between the occurrence of a certain event and the time when the switch shall have changed its circuit connections as in connection with an automatic heating system. For example, the actuator for this electrical switch is used in connection with what is commonly known as a stack switch, which latter controls the electrical heating element of the actuator. Upon failure of the heating system, the stack switch, remaining in a "cold" position, will pass an electrical current through the electrical heating element for an undue length of time to heat, and therefore, to warp the actuator into a position to tilt the contactor, which action breaks the main line circuit.

One of the objects of this invention is to provide a thermally operated actuator for operating the switching means of an electrical switch, which actuator is self compensating for room temperatures.

Another object of this invention is to provide a thermally operated actuator which is simple in construction, durable, and inexpensive to manufacture.

Other objects and advantages will hereinafter be more fully described, and for a more complete understanding of the characteristic features of this invention, reference may be had to the following description and accompanying drawings, in which drawings:

Figure 1 is a front elevational view of an electrical switch employing the thermally operated actuator of this invention;

Fig. 2 is a front elevational view of the thermally operated actuator showing one of the positions into which the same may be operated; and

Fig. 3 is a perspective view of the operating mechanism shown in Fig. 2.

Referring now more particularly to the drawings, the construction in which the present invention may be employed comprises a casing 10 with a cover 11 pivotally secured thereto, a plurality of contact strips 12 secured to an insulated terminal block 13 and a second set of contact strips 14 secured to a terminal block 15, both terminal blocks being secured to posts 16, which latter extend from the rear wall of the casing.

A mercury tube contactor switch 17 is mounted in a clip 18, which latter is mounted on the upper side of a bimetallic element 19. The bimetallic member 19 is, in turn, fixedly secured at one end thereof to one end of a second bimetallic element 20, a preferably heat insulated joint being formed therebetween by means of an insulating block 21 having securing means such as bolts and nuts 22 extending therethrough and through the bimetallic elements. The other end of the bimetallic element 20 is secured to an insulating block 23, which latter is, in turn, mounted in the casing 10 and on the back wall thereof by means of suitable securing members.

The mercury tube contactor 17 is of the tiltable type comprising a sealed container having a pair of spaced cooperating electrodes disposed at one end thereof and a body of current conducting fluid such as mercury also disposed therein, the fluid being adapted to bridge the electrodes when tilted in one direction and to flow away from the electrodes when tilted in the opposite direction. One of the electrodes is suitably connected to one of the contact strips 12. The other electrode may, if desired, be connected

through a heating element 24 in any suitable manner, such as shown in Parks Patent No. 1,644,443, and thence to one of the contact strips 14. The contact strips 12 and 14 are thereafter connected in a circuit with various other switches in an electrical system for controlling the operation of the fuel supplying means. It does not seem necessary to describe or show such a complete system in order to understand the operation of this thermally operated actuator, and therefore, the same is omitted.

The heating element 24 preferably comprises a supporting member 25 secured to the underneath side of the free end of the bimetallic element 19 in any suitable manner. The member 25 may be of any material, preferably of brass, and is provided with an insulating member on each side thereof, the latter members preferably being strips of mica around which a resistance wire is wound. The convolutions of the resistance wire are positively held in a spaced-apart relation as by means of coating the same with an asbestos composition which is thereafter permitted to harden. The insulating members prevent the resistance wire from coming into contact with the supporting member 25 and extend beyond the confines of the member 25 in order to receive binding posts 26, the ends of the resistance wire being connected thereon. However, in lieu of the heating element just described, the resistance wire may be wound directly on the bimetallic element as shown particularly in the patent to Parks issued October 4, 1927, No. 1,644,443, or the heating element may be of the form shown in a copending application by Phelan, filed December 22, 1926, and given Serial No. 156,343.

The bimetallic elements 19 and 20 are of the usual type comprising two metals having different coefficients of expansion and which metals are intimately united at their adjacent and abutting surfaces for obtaining a movement of one part thereof relatively to the other part under temperature changes. One of the metals of each of the bimetallic elements will be referred to as being of the higher order and the other metal will be referred to as of the lower order. The metals of the same order of the two bimetallic elements will occupy a reversed position in the composite actuator, that is, the metal of the lower order will be on the lower side of one and on the upper side of the other, whereafter it will be seen that metals of the same order in one instance will face each other and in the other instance will face away from each other. In this condition the element 19 is reversed with respect to the element 20 so that the warping of the former on temperature changes is opposite to the warping of the latter.

In the operation of this switch, when the heating element 24 is supplied with current for an undue length of time the heat thus generated rises and serves to warp or bend the bimetallic element 19 which action tilts the tube 17 and causes the mercury therein to flow in a direction to break an electrical circuit therethrough. The heat thus given off from the heating element 24 is confined to the bimetallic member 19 and does not affect the bimetallic member 20, the latter being affected merely by the changes in temperature of the room or enclosure in which the device is located. Conversely, when the heating element 24 is cooled, the bimetallic element 19 assumes a normal condition to tilt the contactor 17 in an opposite direction to make an electrical circuit therethrough, the bimetallic member 20 not having any part in the operation excepting as the temperature in the room may direct.

In order to fully illustrate the relation of the bimetallic element 20 with the actuation of the bimetallic element 19, it must be remembered that the temperatures of the enclosures in which the device is to be disposed may vary widely. This variation in temperature of the enclosure ordinarily would have an effect upon the bimetallic element 19, for example, if the enclosure is comparatively cool, a greater amount of energy must be expended by the heating coil 24 to tilt the contactor tube 17. Conversely, when the enclosure in which the device is positioned is comparatively warm, a less amount of energy is required by the heating element 24 to actuate the contactor 17. However, by means of reversing the element 20 with respect to the element 19, in the manner aforesaid, the relative positions of the elements 19 and 20 remain unchanged because of the compensation effected as described above, therefore the same amount of energy from the heating element may be expended to actuate a contactor in the instance of a comparatively warm enclosure as would be required to actuate the contactor in the instance of a comparatively cold enclosure.

While but a single embodiment of this invention is herein shown and described, it is to be understood that various modifications may be apparent to those skilled in the art without departing from the spirit and scope of this invention, and therefore, the same is to be limited only by the scope of the prior art and the appended claims.

We claim:

1. In combination with a thermally operated actuator comprising a plurality of bimetallic elements connected together at their ends, one of said bimetallic elements being electrically actuated and controlled, said bimetallic elements being opposed to each other whereby they are self compensating for room temperatures, of a mercury contactor switch

mounted wholly on one of said bimetallic elements and adapted to be tilted thereby.

2. In combination with a thermally operated actuator comprising a bimetallic element fixed at one end thereof and controlled by the temperature of the enclosure in which it is disposed, a second bimetallic element connected to said first mentioned bimetallic element, said second bimetallic element being electrically actuated, said bimetallic elements being opposed to each other whereby they are self compensating for room temperatures, of a mercury contactor switch mounted wholly on the free end of said second bimetallic element and adapted to be tilted thereby.

3. In combination with a thermally operated actuator comprising a straight bimetallic element fixed at one end thereof, a second straight bimetallic element fixed to the free end of said first mentioned bimetallic element, said second bimetallic element being electrically actuated, said bimetallic elements being opposed to each other whereby they are self compensating for room temperatures, of a mercury contactor switch mounted wholly on the free end of said second bimetallic element and adapted to be tilted thereby.

In witness whereof we have hereunto subscribed our names.

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HENRY F. DEVER.