Oct. 6, 1942. S. CRUM 2,298,110

THERMOSTAT

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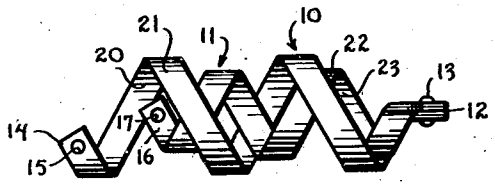


Fig. 1

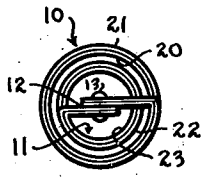


Fig. 2

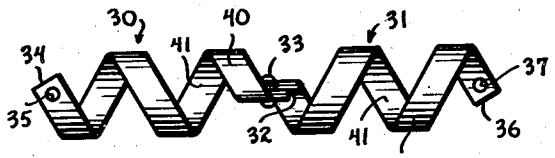


Fig. 3

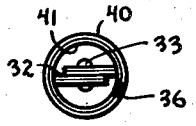


Fig. 4

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2 Claims. (Cl. 297—16)

The present invention relates to a compensated condition responsive element, and more particularly to such an element, and the construction thereof, which is compensated for angular movement.

Condition responsive devices, particularly bimetallic elements, are often wound into helices and utilized to rotate control devices upon changes in temperature. Many devices cannot be readily adapted to the use of rotary motion, and still others could not possibly use it.

An object of the present invention is to provide a simplified temperature responsive element for obtaining straight line motion.

Another object is to provide a compact element as set forth in the preceding object which is formed of bimetallic helices.

A further object is to provide a plurality of suitably mounted bimetallic helices which are oppositely wound as to angular direction and exterior or interior position of the different metals of the bimetallic helices to thereby obtain a thermal element which will expand and contract axially and be compensated for rotary motion.

Other objects will be apparent in the accompanying specification and the appended claims.

In the drawing:

Fig. 1 is an elevational view of one form of my device,

Fig. 2 is a view looking at the right-hand end of Fig. 1,

Fig. 3 is an elevational view of a second form of my device, and

Fig. 4 is a view looking at the right-hand end of Fig. 3.

Referring now more in detail to the drawing, in Fig. 1 a bimetallic temperature responsive element for practical purposes is shown as comprising bimetal helices generally indicated at 10 and 11. The helices 10 and 11 are fastened together at 12 by a rivet 13. The helix 10 has a mounting end 14 which is provided with a screw hole 15 by which the entire element may be mounted to a suitable support. The helix 11 has a motion takeoff end 16 which has a screw hole 17 which may receive a screw to secure a suitable takeoff device.

The two helices 10 and 11 are each composed of two metals having different expansion coefficients. As shown in Fig. 2, the helix 10 has an internal strip 20 and an external strip 21. The helix 11 has an external strip 22 and an internal strip 23. For purposes of illustration, it may be assumed that the strips 20 and 22 are of metals having high expansion coefficients, and the strips 21 and 23 have low coefficients.

It is a well known fact that bimetal helices expand and contract axially and wrap and unwrap in response to temperature changes. It is also well known that, up to a certain angle or pitch, the axial movement is increased as the pitch is increased.

The convolutions of the two helices 10 and 11 are shown as being spaced from each other. In other words, the angle of the pitch of these convolutions is quite great. Upon a temperature variation to which the helices 10 and 11 are subjected because of this pitch, there will be substantial axial movement of these helices as well as rotative or angular movement thereof.

Assuming now that the device is suitably mounted by the mounting end 14 and there is a temperature rise to which the device is subjected. Because the strip 20 has a higher coefficient of expansion than the strip 21, the helix 10 will unwrap and elongate, thus moving the end 12 toward the right. Because the strip 22 has a higher coefficient of expansion than strip 23, the helix 11 will wrap up and shorten, thus moving the motion takeoff end 16 toward the right. Therefore, because the ends joined at 12 were also moved toward the right by the helix 10, the movement of both helices 10 and 11 is added to effect a substantial axial movement of the end 16. When the helix 10 expands to move axially due to its right-hand wind, there is also an unwrapping rotation thereof. When the helix 11 contracts to move axially due to its left-hand wind, there is a wrapping rotation thereof. Hence, it is seen that the two helices 10 and 11 will rotate oppositely. By properly selecting the helices 10 and 11 any effective rotation thereof may be completely compensated, with the result that only axial movement will be taken off at the end 16. Upon cooling, exactly the reverse of the above described action is effected. It will be obvious that the strips 20, 22 and 21, 23 could be reversed without altering the practical operation of the device except to reverse the movement.

Referring now to Fig. 3, a temperature responsive element is shown as comprising a right-hand wound bimetal helix 30 and a left-hand wound bimetal helix 31. The helices 30 and 31 are secured together at 32 by a rivet 33. The helix 30 has a mounting end 34 in which there is a screw hole 35 which may receive a screw to suitably mount the entire thermostatic element. The helix 31 has a motion takeoff end 36 in which

a hole 37 is provided to which a takeoff device may be secured.

The helices 30 and 31 are each made of metals having different coefficients of expansion. Referring to Fig. 4, the different strips of metal 40 and 41 are clearly shown. For purposes of illustration, it may be assumed that the strips 40 are of high expansion material and the strips 41 have a low coefficient of expansion.

Upon a temperature rise, the high expansion metal 40 will expand at a greater rate than the low expansion metal 41 to thereby cause the end 32 of the helix 31 to wrap up and also to contract in length. The helix 30 is also adapted to have its high expansion strip on the outside so that it also will contract when being heated. However, the strip 30 because it is right-hand wound, whereas the strip 31 is left-hand wound, will wrap up in the opposite direction, and in an equal amount to which the helix 31 is rotated. Therefore, it is seen that an element is provided in which similar expansive metals are wound on the exterior of both helices but the two helices have right and left-hand wound convolutions to thereby compensate the angular rotations of each, thus leaving only the additive axial movement of each to move a device. It will be obvious that upon cooling of the entire sensitive element, just the reverse of the above described action will be effected. It will also be understood that the sensitive metals, that is the high and low expansive metals, may be reversed in both of the helices without changing the mode of operation of the device.

While I have shown two forms which my invention may take, it will be clearly understood that many modifications will occur to those skilled in the art. For example, it will be readily apparent that the elements could be formed from a single piece of material rather than from two pieces secured together. Therefore I wish not to be limited by the forms shown and described but by the spirit of the appended claims.

I claim as my invention:

1. In a control element, in combination, a first helically wound bimetal adapted to expand and contract axially and rotate angularly upon a change in temperature, means for securing one end of said first bimetal to a support, a second helically wound bimetal also adapted to expand and contract axially and rotate angularly upon a change in temperature, said first and second bimetals being wound in opposite directions so that they will rotate oppositely in the same degree for a given change in temperature, said bimetals being in axial alignment one within the other, one end of the second bimetal being secured to the free end of said first bimetal whereby the other end of said second bimetal will move in a straight line on temperature changes.

2. A device of the character described comprising, a first bimetal helix coiled in a right-hand direction having its high expansive metal on the outside to cause it to expand and contract axially and rotate angularly upon changes in temperature, a second bimetal helix coiled in a left-hand direction having its high expansive metal on the inside to cause it to expand and contract similarly to said first bimetal but to rotate angularly in an opposite direction to a similar degree, one of said bimetals being arranged within the other bimetal, means securing said first and second bimetals together, mounting means at the distal end of said first bimetal, and straight line motion takeoff securing means at the distal end of said second bimetal.

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