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F. D. JOESTING

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TEMPERATURE RESPONSIVE DEVICE

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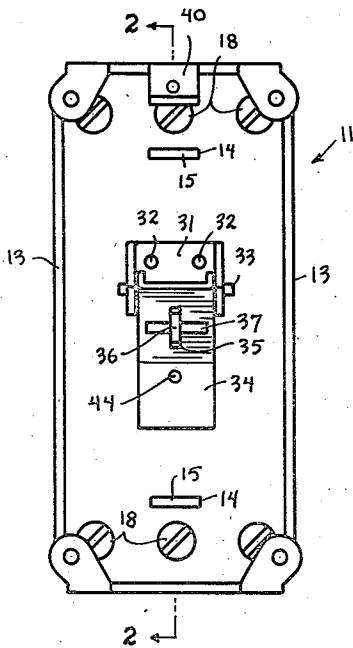


Fig. 1

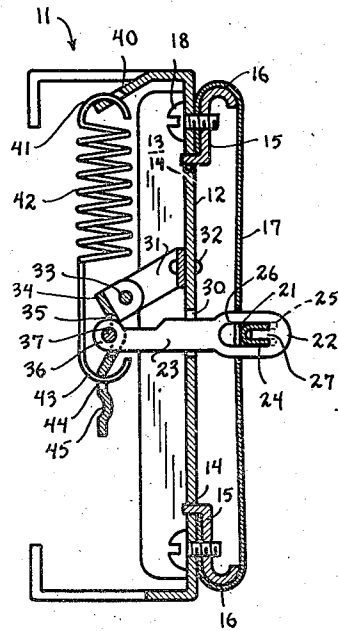


Fig. 2

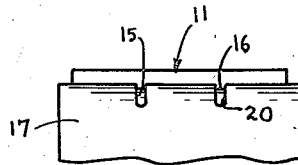


Fig. 3

Inventor
Frederick D. Joesting

By *George H. Fisher*
Attorney

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TEMPERATURE RESPONSIVE DEVICE

Frederick D. Joesting, Chicago, Ill., assignor to
Minneapolis-Honeywell Regulator Company,
Minneapolis, Minn., a corporation of Delaware

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4 Claims. (Cl. 297—11)

This invention is directed broadly to a temperature sensitive device and more particularly to a ribbon type of device which is adapted to respond to radiant heat. The amount of work which can be derived from an expansible metal ribbon depends to a great extent upon the manner in which biasing forces are applied to it. If the ribbon is under an initial tension when it is cold and no biasing forces are applied, then the expansion due to an increase in temperature will go chiefly to relieving the tension and substantially no work will be accomplished by the ribbon.

One of the main objects of this invention is to bias the ribbon for bending in one direction upon expansion thereby placing it under an initial tension, and to automatically maintain that tension constant for all temperatures whereby the maximum amount of work may be obtained from the ribbon.

Another object is to actuate a motion multiplying lever by the ribbon so that the relatively small movement of the ribbon may be considerably amplified in order to perform the desired work.

Still another object is to make the ribbon in the form of an elongated strip of expansible metal, to mount the ends of the strip over rounded surfaces of a pair of bearing members, and to split the ends of the strip longitudinally to relieve any stresses in the strip due to assembly or to expansion of the strip crosswise. A further object is to clamp the ends of the strip to a support by these same bearing members.

These and other objects will readily become apparent as the following specification is read in the light of the accompanying drawing in which

Figure 1 is an elevational view looking at the back of the supporting member, the biasing spring being removed,

Figure 2 is a section taken along the line 2—2 of Figure 1 with the biasing spring in place, and

Figure 3 is a detail view of the ribbon mounting showing one of the split ends.

Referring to Figures 1 and 2 of the drawing, the reference numeral 11 indicates generally a supporting member having a face plate 12 and two rearwardly extending sides 13 for stiffening the member. The face 12 of the supporting member is provided with a pair of holes 14 in which are mounted one end of a pair of generally S shaped supporting brackets 15. These brackets are provided with rounded surfaces 16. An elongated substantially rectangular ribbon 17 of expansible metal is stretched across the brackets 15. The ends of this ribbon are supported by

the rounded portions 16 of the brackets and these ends reverse upon themselves and extend between the brackets 15 and the face 12 of the supporting member. A series of screws 18 are screw-threaded through the face 12 of the supporting member, the ribbon 17, and the supporting brackets 15 thereby securely clamping the ends to the ribbon 17 between the face 12 of the supporting member and the inner face of the brackets 15. The brackets 15 extend transversely of the ribbon 17 and are of the same width as the ribbon so that the ribbon is carried snugly and evenly by the brackets. In order to relieve any stress which may be set up in the ends of the ribbon when they are clamped in position by the brackets 15 and screws 18, they are slit as shown at 20 in Figure 3. By slitting the ends of the ribbon any tendency of the ribbon to wrinkle is reduced.

An additional function of these slits is to reduce stress in the ribbon due to crosswise expansion. The ribbon and support being of different materials will expand differently on changes in temperature and these slits break up the distance and reduce the amount of sliding between the ribbon and support on expansion.

The ribbon 17 is provided with a center vertical slot 21 as shown in Figure 2 through which is inserted one end 22 of a connecting link 23. An elongated U shaped bearing member 24 extends transversely of the ribbon at its mid portion and the rounded bottom of the U bears against the ribbon. This bearing member 24 is provided with a slot at its mid portion as indicated in dotted lines at 25. The end 22 of the link 23 is provided with an opening 26 which is adapted to receive the bearing member 24 and the edge 27 of the opening 26 is inserted in the slot 25 in the bearing member to prevent it from moving laterally. Lateral movement of the link 23 is prevented by the sides of the slot 21.

The face 12 of the supporting member is provided with a slot 30 through which the link 23 extends. Just above the slot 30 the support 11 carries a U shaped bracket 31 by any suitable means such as the rivets 32. The two legs of the U shaped bracket 31 carry an axle 33 on which is pivotally mounted a lever 34. This lever is provided with a hole 35 through which the other end 36 of the link 23 is inserted. This end of the link carries a cross pin 37 which rides in a depression in the lever 34 so that when the lever 34 rotates in a clockwise direction it pulls the link 23 with it.

The upper portion of the supporting member

11 is provided with a downwardly extending ear 40 in which is hooked one end 41 of a tension spring 42. The other end 43 of this spring is looped through a hole 44 in the lever 34, this hole being on the opposite side of the axle 33 from the ear 40. The portion 45 of the lever 34 which is farthest from the axle 33 is adapted to operate a switch actuating member of any desired form.

The above described device is intended to be mounted in some such manner as the device disclosed in the copending application to Daniel G. Taylor Serial No. 284,007 filed July 12, 1939, so that the ribbon 17 looks directly into the combustion chamber of a furnace. The ribbon 17 is to respond to the radiant heat of combustion and the surface is therefore blackened in order that it may more readily absorb such radiant heat.

It will be noted that the spring 42 is so connected to the ear 40 and the lever 34 that it continuously tends to rotate the lever 34 in a clockwise direction so that the link 23 is constantly pulling toward the left on the ribbon 17 which gives it an initial tension. In the cold position the ribbon 17 is substantially straight and on heating it will expand thus permitting the spring 42 to rotate the lever 34 and pull the link 23 toward the left bending the ribbon. As the lever 34 is rotated in a clockwise direction the angle between this lever and the spring 42 is increased, thereby increasing the rotative effect which this spring has upon the lever. The result is that the more the ribbon 17 expands the greater will be the force exerted thereon by the link 23. The spring and lever are arranged in this manner so that the tension of the ribbon 17 will remain substantially the same at all temperatures. It will be appreciated that when the ribbon 17 is nearly straight a relatively small force exerted thereon by the link 23 is sufficient to produce a predetermined initial tension but that as the ribbon expands and bows a much larger force is required to maintain that same tension due to the different angular relationship between the link 23 and the ribbon 17.

If the same tension were not maintained in the ribbon for all temperatures, the device would not operate at its greatest efficiency. For example, if the ribbon 17 were under a predetermined initial tension and the temperature caused the ribbon to expand, the immediate effect would be to reduce the tension on the ribbon due to the expansion which in turn would reduce the amount of work which the ribbon was capable of doing. In other words, part of the ribbon expansion would be taken up in relieving the tension on the ribbon instead of in doing useful work. By my novel arrangement of the spring and lever, however, the tension on the ribbon remains substantially the same so that all of the expansion is used to perform useful work.

When combustion within the furnace ceases to exist and the ribbon 17 cools, it contracts and straightens which reduces the angle between the spring 42 and the lever 34 and the parts return to the position shown in Figure 2.

Another advantage of the present device is that the lever 34 amplifies the motion of the central

portion of the ribbon 17 so that the switch actuating rod which is connected to the lever 34 at 45 may have a greater motion per degree temperature change than the ribbon 17.

As certain changes and modifications of this device will occur to those who are skilled in the art, I wish it to be understood that I am to be limited only by the scope of the appended claims and not by the specific embodiment disclosed.

I claim as my invention:

1. A temperature responsive device comprising in combination, a relatively non-expandable support, a relatively expandable elongated one-piece metal ribbon, and a pair of mounting members having rounded surfaces over which the ends of said metal ribbon are stretched, said ends being split to relieve internal stresses which may be set up in them due to mounting or dimensional variations due to temperature changes.

2. A temperature responsive device comprising in combination, a relatively non-expandable support, a relatively expandable elongated one-piece metal ribbon, a pair of clamps mounted on said support and having oppositely directed rounded surfaces, the ends of said metal ribbon extending over said rounded surfaces and reversing in direction to extend between said clamps and said support, and screw means cooperating with said clamps for tightening them against said support to securely hold the ends of said metal ribbon, the ends of said ribbon being split to relieve the stress which may be set up in them due to mounting or dimensional changes caused by temperature variations.

3. A temperature responsive device comprising in combination, an expandable ribbon, a pivoted lever, a link operatively connecting said ribbon and lever, and a spring connected at one end to a fixed support and at the other end to said lever at a point on the other side of the pivot for said lever from said support, said spring exerting a rotative force on said lever which places said ribbon under an initial tension, expansion of said ribbon due to a rise in temperature permitting said spring to rotate said lever in a direction to increase the angle between said lever and said spring, said angle being of such size that as the angle is increased upon expansion of said ribbon the increased rotative force exerted by said spring on said lever is sufficient to maintain said ribbon under a substantially constant tension.

4. A temperature responsive device comprising in combination, an expandable ribbon, a pivoted lever operatively connected at an intermediate portion thereof with a movable portion of said ribbon, means exerting a substantially constant force on the free end of said lever at an acute angle with respect to said lever whereby said ribbon is placed under tension and biased for movement in one direction upon expansion thereof, said angle being so chosen that upon expansion of said ribbon said angle increases the effective lever arm of said lever, and hence the force exerted thereby on said ribbon, sufficiently rapidly to maintain said ribbon under a substantially constant tension.

FREDERICK D. JOESTING.