July 1, 1958 C. W. BONDURANT 2,841,014

THERMAL RESPONSIVE DEVICE

Filed Sept. 7, 1954

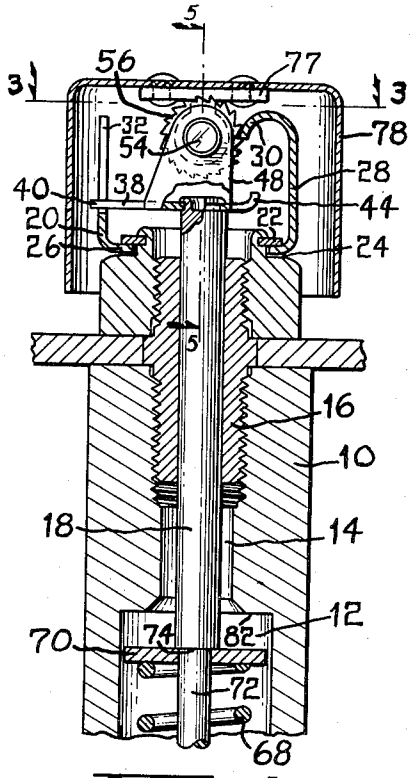


Fig. 1

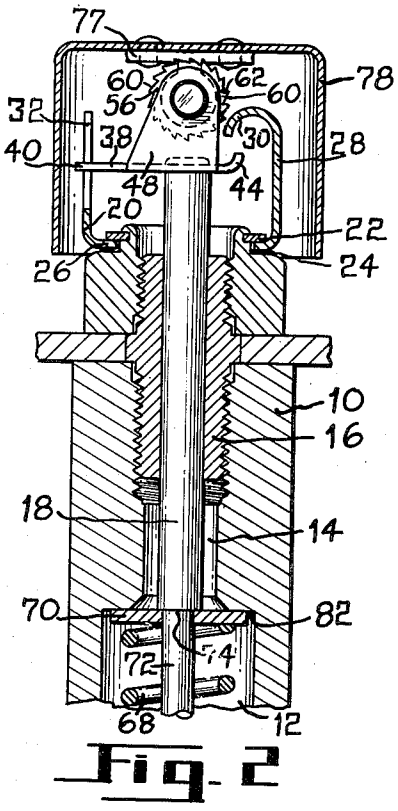


Fig. 2

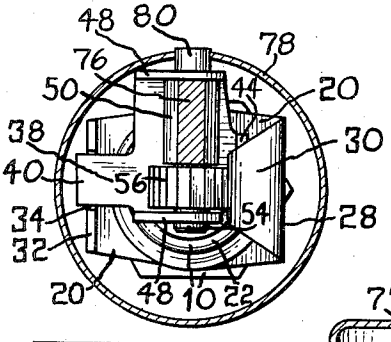


Fig. 3

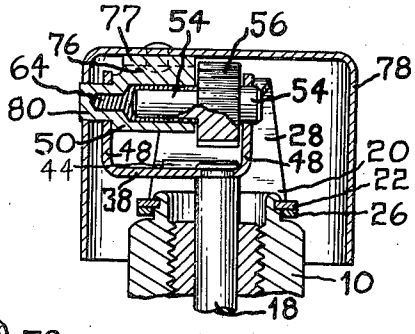


Fig. 5

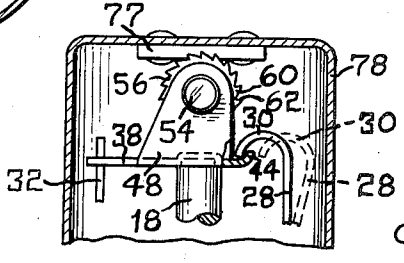


Fig. 4

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THERMAL RESPONSIVE DEVICE

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4 Claims. (Cl. 74—2)

This invention relates to a thermal responsive device. The invention relates more particularly to a device which is automatically actuated upon subjection to a predetermined abnormal temperature. The invention relates still more particularly to a thermal responsive device which is adapted to actuate signal means or control means. However, the invention is not so limited in that it may be used in other types of applications and for other purposes.

An object of this invention is to provide a thermal responsive device which is automatically actuated at a certain predetermined abnormally high temperature and which device may be easily reset when the temperature to which it is subjected has been reduced in value below the operating point thereof.

Another object of this invention is to provide a thermal responsive device in which the operating members thereof are easily and readily removable or interchangeable.

Another object of this invention is to provide a thermal responsive device which has a very sensitive temperature indicating means.

Another object of this invention is to provide a thermal responsive device in which the operating elements thereof are covered and, hence, are protected from damage by engagement therewith.

Another object of this invention is to provide a thermal responsive device which, when in actuated position, gives visible indication thereof.

Other objects and advantages reside in the construction of parts, the combination thereof and the mode of operation, as will become more apparent from the following description.

In the drawing,

Figure 1 is a side sectional view showing the thermal responsive device of this invention in its de-actuated position.

Figure 2 is a side elevational view similar to that of Figure 1 showing the device of this invention in an actuated position.

Figure 3 is a sectional view taken substantially on line 3—3 of Figure 1.

Figure 4 is a fragmentary sectional view showing the manner in which the operating members of the device may be easily removed from the body of the device.

Figure 5 is a sectional view taken substantially on line 5—5 of Figure 1.

Referring to the drawing in detail, a thermal responsive device of this invention comprises a body member 10 provided with an internal cavity 12. The body 10 is also provided with a cylindrical bore 14 which extends from the cavity 12 to the end of the body 10. The bore 14 thus provides an opening at one end of the body 10 leading to the cavity 12.

Within the bore 14 is threadedly mounted a guide bearing 16 provided with an elongate hole therethrough within which an actuator rod 18 is slidably mounted.

The rod 18 extends from the cavity 12 through the guide bearing 16 and from the body 10.

At the end of the body member 10 is a cradle member 20 which is freely and rotatably attached thereto by means of a ring member 22. Between the ring member 22 and the upper portion of the body 10 is provided a groove 24 within which an inwardly extending annular base 26 of the cradle 20 is freely movable.

The cradle member 20 also comprises a flange member 28 which terminates in an arcuately downwardly extending hook member or abutment member 30. Opposite the flange 28, the cradle 20 is provided with a vertical wall member 32 which has an elongate vertical groove 34 therein.

Rigidly attached at the upper end of the rod 18, which extends from the body 10, is a plate member 38 which is normal to the axis of the rod 18. The plate member 38 has an end portion 40 which extends into the groove 34 of the vertical wall 32. Slidable engagement of the plate 38 within the groove 34 prevents rotation of the cradle 20 with respect to the rod member 18. The other end of the plate 38 is provided with a short upwardly extending hook member 44.

Attached to the plate 38 is a bearing bracket 48 which supports a bearing housing 50. Rotatably carried by the bearing housing 50 and the bearing bracket 48 is a shaft member 54. Firmly attached to the shaft 54 is a wheel 56 provided with teeth 60. Each of the teeth 60 has a radial surface 62.

Within the bearing housing 50 is a body of fusible material 64, such as solder or any other suitable substance. The fusible material 64 nearly surrounds the shaft member 54 as it engages the shaft member 54 at the end thereof and along most of the length thereof, as clearly shown in Figure 5. The fusible material 64 in a solid state thus firmly secures the shaft 54 to the bearing housing 50 so that the shaft 54 is unable to rotate within the bearing housing 50. The hook member 30 is adapted to engage a radial surface 62 of one of the teeth 60 of the wheel 56, as shown in Figure 1. When the solid condition of the fusible material 64 retains the shaft 54 from rotation, the wheel 56 is, of course, unable to rotate. Hence, the wheel 56 with its bearing housing 50 and fusible material 64 acts as a thermal responsive latch mechanism cooperable with the hook member 30. Thus, when the hook 30 engages a radial surface 62 of one of the teeth 60 of the wheel 56, as shown in Figure 1, movement of the rod 18 from the body 10 is prevented.

Within the cavity 12 of the body 10 is a compression spring 68 which engages an abutment plate 70. The rod member 18 is provided with a comparatively small diameter portion 72 so that a shoulder 74 is formed between the larger diameter of the rod 18 and the smaller diameter 72 thereof. The smaller diameter portion 72 is encircled by the compression spring 68. The abutment plate 70 is forced against the shoulder 74 of the rod 18 by the compression spring 68. Thus, the compression spring 68 urges the rod 18 in a direction from the cavity 12 of the body 10. However, as stated above, the hook member 30 which engages the wheel 56 prevents movement of the rod 18 from the body 10, as shown in Figure 1, when the fusible material 64 is solidified.

At the upper portion of the bearing housing 50 is a block member 76 to which is attached a connector plate 77 of a cup-shaped hood member 78. The bearing housing 50 also is attached to the hood 78 by means of an extension 80 of the bearing housing 50. The cup-shaped hood member 78 in its inverted position acts as a protective covering over the moving elements of the thermal responsive device. However, the hood 78,

which is made of any suitable thermal conductive material, also acts as a thermal conductor for the fusible material **64** within the bearing housing **50**.

Thus, if the temperature of a room in which the thermal responsive device is located should reach a value above the fusing point of the fusible material, the hood **78**, acting as a conductor, readily transfers heat into the bearing housing **50**, melting the fusible material therein and releasing the shaft **54** so that it is free to rotate. Due to the fact that the wheel **56** is firmly attached to the shaft **54**, the wheel **56** may rotate when the fusible material **64** is in its fused state.

The rod member **18**, urged by the spring **68**, thus causes rotation of the wheel **56** as the bearing housing **50** is forced upwardly, rotatively disengaging the wheel **56** from the hook **30**. Thus, the rod member **18** forced by the spring **68** is permitted to move in a direction from the body **10**.

The movement of the rod **18** by means of the spring **68** is limited by engagement of the abutment plate **70** with an end wall **82** of the cavity **12**, as shown in Figure 2.

The rod **18** may be attached to any suitable indicating means or control means so that upon axial movement of the rod **18** from the position as shown in Figure 1 to the position as shown in Figure 2, the indicating or control means is actuated. Of course, such actuation indicates that a certain predetermined temperature has been reached at the location of the thermal responsive device.

When the temperature at the location of the thermal responsive device decreases sufficiently that the fusible material **64** re-solidifies, the shaft **54** is again firmly attached to the bearing housing **50** so that the shaft **54** is once more unable to rotate. Hence, the wheel member **56** is unable to rotate. By manually pressing upon the hood **78**, moving the bearing housing **50** and the wheel **56** toward the body **10**, the wheel **56** is again placed in latched engagement with the hook **30**, as one of the teeth **60** of the wheel **56** is engaged by the hook **30**. Due to the fact that the groove **34** within the vertical wall **32** prevents rotation of the plate **38** with respect to the cradle **20**, the hook member **30** always is in proper alignment to engage the wheel **56**. Furthermore, due to the fact that the cradle **20** is rotatably mounted upon the body **10**, the cradle, with the other elements including the hood **78**, may rotate as a unit. Due to the fact that the hood **78** may be obviously accessible to an observer of the device, such observer may intentionally or unintentionally manually grasp the hood **78** and attempt to rotate the hood. If such rotation is attempted, the entire unit rotates with respect to the body **10** and no damage results.

In order to prevent the rod member **18** from being withdrawn entirely from within the body **10**, the upwardly extending hook member **44** of the plate **38** is adapted to contact the hook **30** of the flange **28**, as best shown in Figure 4, so that the rod member **18** and the elements attached thereto may not be withdrawn from the body **10**. However, if it is desired to make such a removal, all that is necessary is to cause the flange member **28** to be bent outwardly as shown by the dotted lines in Figure 4, so that upon outward movement of the rod **18** from the body **10**, the hook **30** is not engaged by the hook **44**. If the flange **28** is so bent outwardly, the bearing housing **50** with the hood **78** including the rod **18** may be removed from the body **10**. Hence, removal and repair or replacement of these members is readily and easily possible.

Thus, it may be understood that the thermal responsive device of this invention provides means by which a high temperature may be indicated and/or controlled. After the device has been actuated, as shown in Figure 2, to respond to indication of an abnormal temperature, the device may be easily reset to the position shown in Figure 1 after the temperature has decreased below the operating value of the thermal responsive device. Naturally, it is to be understood that the operating value or the operating temperature of the device is the fusing point of the fusible material **64** within the bearing housing **50**. Hence, a fusible material for a particular application is chosen in accordance with the fusing point of the material and the desired operating temperature of the device.

Within the body **10** may be located any suitable control or indicating apparatus for actuation by the rod **18** upon axial movement thereof.

Although the preferred embodiment of the device has been described, it will be understood that within the purview of this invention various changes may be made in the form, details, proportion and arrangement of parts, the combination thereof and mode of operation, which generally stated consist in a device capable of carrying out the objects set forth, as disclosed and defined in the appended claims.

Having thus described my invention, I claim:

1. In a thermal responsive device comprising a tubular enclosing body, a rod longitudinally movable within said body and extending therefrom, a spring urging movement of said rod from said body, a cradle rotatably attached to the end of said body and encircling the rod, the cradle including a guide wall and a hook member, the guide wall being provided with an elongate slot, a plate attached at the end of said rod normal to the axis thereof, the plate having an end extending into the elongate slot of the guide wall, the other end of the plate having an arcuate portion, a bearing block attached to the plate, a rotatable shaft journalled in said bearing block normal to said rod, a fusible material attaching the shaft to said block preventing rotation of said shaft, a toothed wheel attached to the shaft, the hook member of said cradle engaging said wheel, the hook thus retaining the rod from axial movement urged by the spring, and a cup-shape hood made of thermal conductor material attached to said bearing block and extending over said bearing block and covering the end of the rod, the hood member acting as a thermal sensing element so that upon subjection to a predetermined high temperature the fusible material melts permitting rotation of said shaft, thus permitting rotational release of said wheel from the hook member releasing the rod for axial movement in a direction from said body, movement of the rod from said body being limited by engagement of the arcuate portion of said plate with the hook member of the cradle.

2. A thermal device including a support body, an actuator rod movably supported within said body and having an end portion extending therefrom, a resilient spring urging said actuator rod from said support body, an abutment flange rotatably attached to said support body at the exterior thereof, a latch member attached to said rod and engageable with said abutment flange to retain the actuator rod from movement from the support body, and thermal responsive means attached to said latch member releasing said latch member for operation upon subjection to a predetermined temperature, release of said latch member permitting movement of said actuator rod by said spring in a direction from said support body.

3. A thermal device comprising a support body, the support body having a cavity therein provided with an opening at one end thereof, an elongate actuator member within the cavity of the support body and having an end portion extending therefrom through the opening thereof, means urging the actuator member in a direction from the support body, a shaft rotatably attached to the end portion of the actuator member, a notched wheel attached to the shaft, fusible material attached to the shaft and to the end portion of the actuator member for retaining the shaft from rotation until the fusible material is subjected to a given predetermined temperature, an arcuate hook member rotatably attached to the exterior of the support

body adjacent the open end of the cavity and engageable with the notched wheel for retaining the actuator member from movement in a direction from the support body, means attached to the actuator member and to support body maintaining alignment of the hook member with the notched wheel, the fusible material releasing the shaft for rotation upon subjection of the fusible material to the given predetermined temperature thus permitting rotation of the shaft and movement of the notched wheel, thus resulting in movement of the actuator member.

4. A thermal responsive device for indicating a predetermined abnormal temperature within a room comprising a support body, the support body having a cavity therein provided with an opening at one end thereof, an elongate actuator member within the cavity of the support body and having an end portion extending therefrom through the opening thereof, resilient means urging the actuator member in a direction from the support body, a guide member rotatably attached to the exterior of the support body and encompassing the open end of the cavity, the guide member extending from the support body in a direction parallel to the actuator member, a bearing block attached to the end portion of the actuator member exterior of the housing, a shaft rotatably supported by the bearing block, a notched wheel attached to the shaft, fusible material attached to the shaft and to the

bearing block for retaining the shaft from rotation until the fusible material is subjected to a given predetermined temperature, an arcuate hook attached to the guide member and engageable with the notched wheel for retaining the actuator member from movement in a direction from the support body, a projection extending from the bearing block and slidably engageable with the guide member, a hood member attached to the bearing block and adapted to be disposed within a room, the hood member encompassing the bearing block, the hood member transferring room heat to the fusible material releasing the shaft for rotation upon subjection of the fusible material to the given predetermined temperature, thus permitting movement of the notched wheel, thus permitting movement of the actuator member in a direction from the support body, and an abutment member extending from the bearing block and engageable by the arcuate hook member upon sufficient movement of the actuator member in a direction from the support body.

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