Feb. 6, 1951 J. M. ANDERSEN ET AL 2,540,082

TEMPERATURE CONTROLLED LATCH

Filed April 8, 1948

Fig. 1.

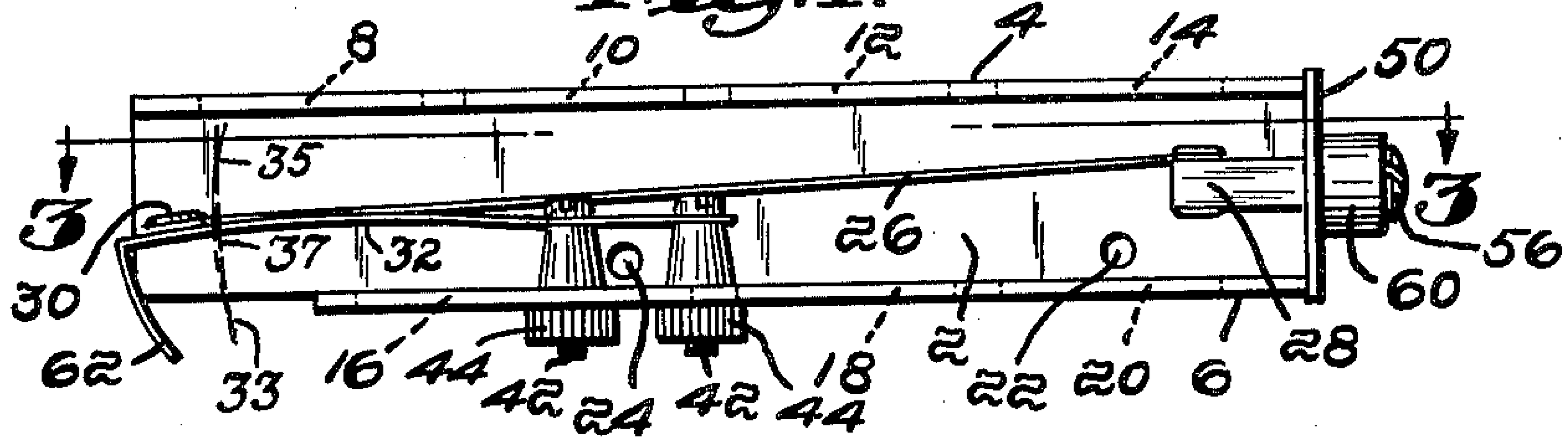


Fig. 2.

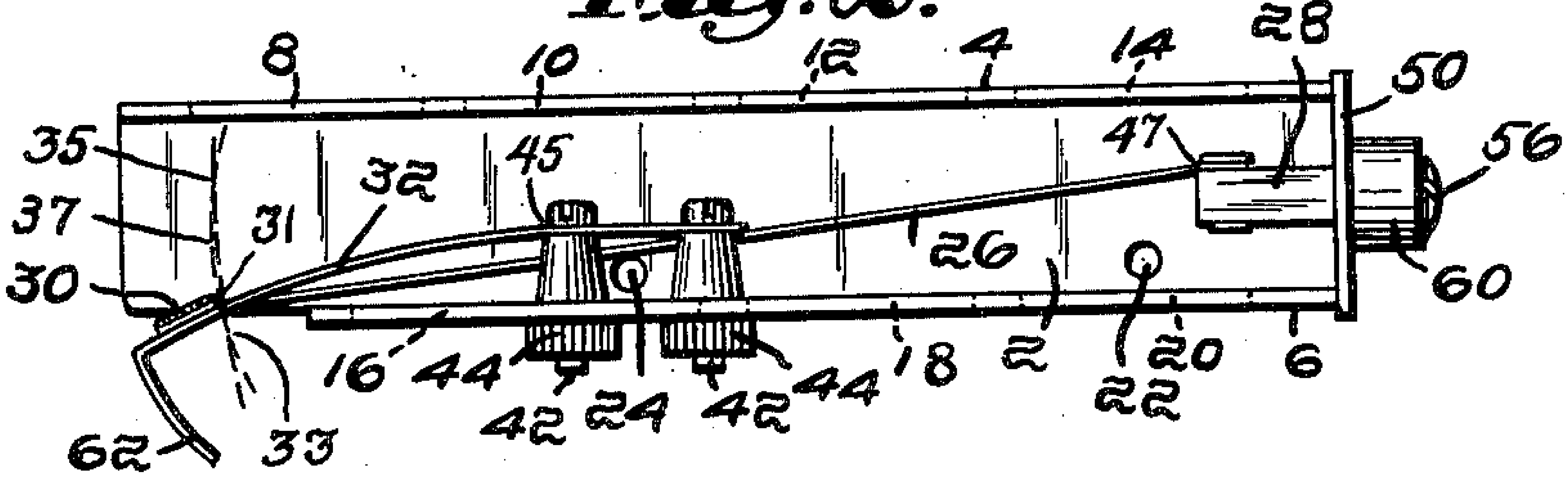


Fig. 3.

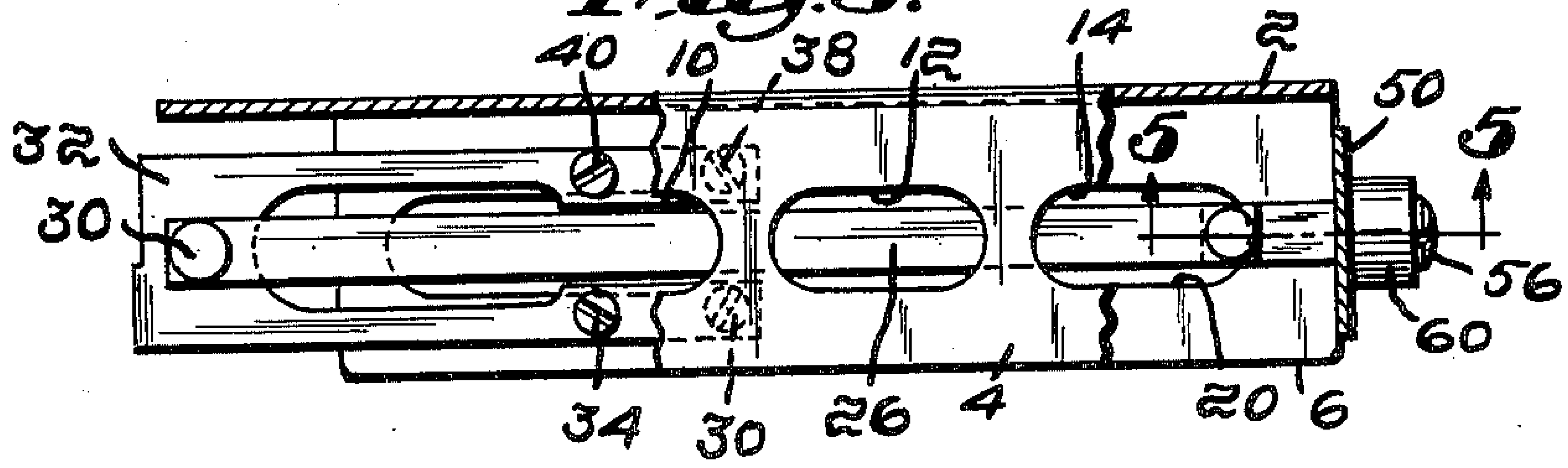


Fig. 4.

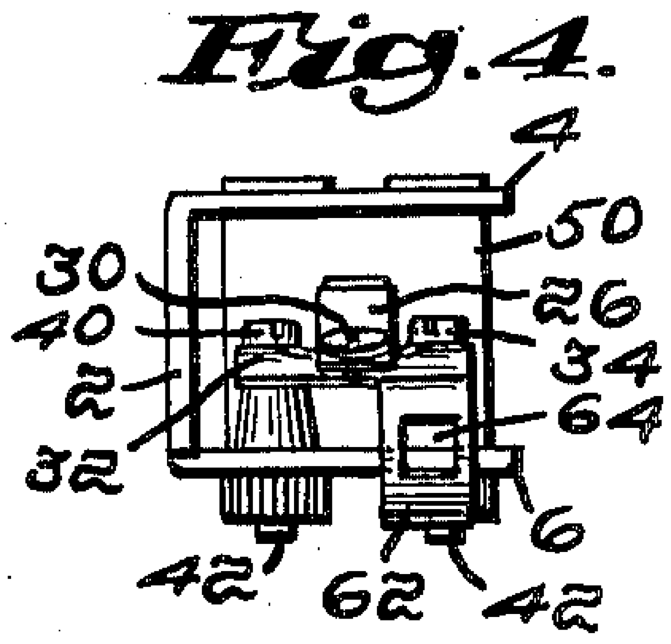


Fig. 5.

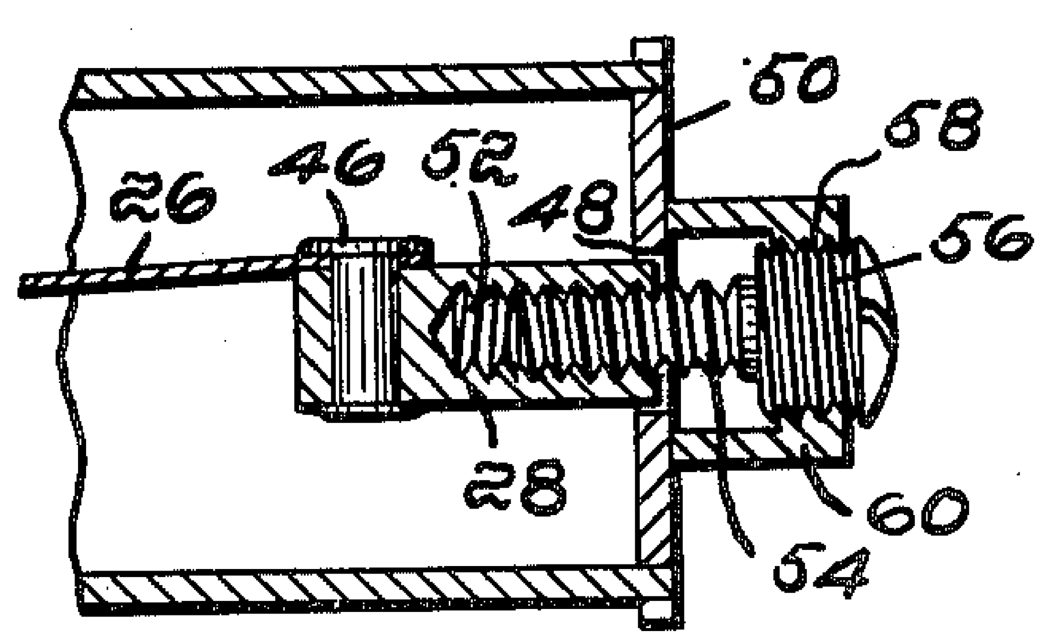
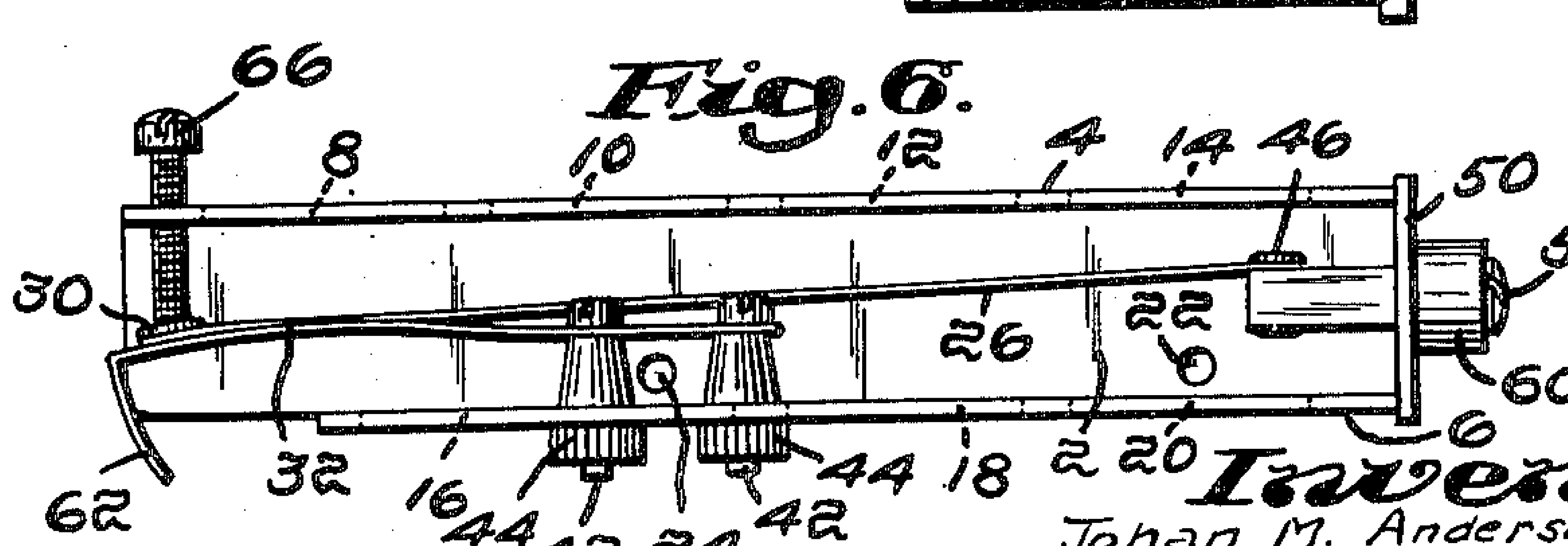


Fig. 6.



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TEMPERATURE CONTROLLED LATCH

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11 Claims. (Cl. 74—97)

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This invention relates to a temperature controlled latch.

The invention contemplates a mechanism which will automatically go off or release itself when the temperature has risen to a predetermined degree or at a lower temperature if the temperature at the unit has risen rapidly.

The invention contemplates a release mechanism which is self-actuated and has sufficient inherent power to perform a useful function, such as closing a switch or tripping a lever, thereby putting in operation some desired mechanism.

The construction of the present invention has been found to be particularly useful in initiating the action of fire alarms of either the portable or permanently mounted type. When potential fire conditions are developing, the situation usually presented will be either one of a slow rise in temperature or, if the fire has already broken out, the rate of rise of the temperature may be more than gradual or even very rapid, although the overall temperature at the release unit has not as yet become excessive.

The construction of the present invention is such that it will go off under any of the aforesaid conditions, and in so doing can be arranged to put the alarm in actuation either by closing a switch, throwing a lever, or by initiating some train of operations which will cause the alarm to sound.

The invention also includes a novel means for adjusting the unit after assembly so that it will operate at any selected maximum temperature. The adjustment mechanism permits mass manufacture of the several parts with somewhat less precision than would be required if no variation could be achieved after assembly.

While the unit has been found particularly useful with fire alarms, it is to be understood that it can be used in any situation where a control is needed to actuate at a given rising temperature or at a given rate of rise in the temperature or under a combination of the two. The unit will operate in gas or in liquid with equal facility.

These and other advantages of the invention will be more clearly understood as the description proceeds with the aid of the accompanying drawing, in which

Fig. 1 is a side elevation of the unit in latched position.

Fig. 2 is a side elevation similar to Fig. 1 showing the unit in unlatched position after having gone off due to a temperature rise.

Fig. 3 is a plan view on the line 3—3 of Fig. 1,

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with a portion of the frame top remaining in position.

Fig. 4 is an end view looking from the left of Fig. 1.

Fig. 5 is an enlarged sectional elevation on the line 5—5 of Fig. 3.

Fig. 6 is a modified form in which a stop is used to limit movement in one direction when the latch is in one position.

The unit comprises a horizontal U-shaped supporting frame having a vertical back 2, a horizontal top 4, and a horizontal bottom 6. This supporting frame is of relatively heavy gauge sheet metal and sufficiently strong to withstand easily any loads imposed thereon by the other elements without appreciable distortion. The top 4 has a series of perforations throughout its length 8, 10, 12 and 14, while the bottom 2 has a generally similar group of perforations 16, 18 and 20. The object of these perforations or openings is to permit free flow of air through the frame to reach the temperature sensitive unit easily. In the back 2 are two holes 22 and 24 to facilitate the mounting of the unit.

The thermostatic element is a filament of metal in which the cross sectional area is small in relation to the surface area so that it will be very sensitive to temperature changes. In the preferred form of the invention the thermostatic element is a thin ribbon of metal 26, having a coefficient of expansion greater than that of the supporting frame. One end of the ribbon is fastened to an adjustable support 28 and the other end is secured at 30 to the center of the U-shaped member 32, hereinafter sometimes referred to as the actuator. The ends of the legs of the U-shaped member are rigidly secured by cap screws to four mounting posts 34, 36, 38 and 40 that are fixed to the bottom 6 of the frame. These mounting posts are shown as having threaded members 42 which extend through the bottom 6 and are secured in place by the nuts 44.

The U-shaped member or actuator is made of spring steel and has been given a permanent set or curvature of approximately the form shown in Fig. 2, the unlatched position. Thus, when otherwise unrestrained, the actuator will assume the position shown in Fig. 2.

If we consider a point 31 at the right edge of rivet 30 as the effective point of connection between actuator 32 and ribbon 26, then if the actuator and the ribbon were disconnected from each other, the point 31 considered with respect to the actuator only will travel in an arc having an effective radius equal to the distance from the point 31 to the point 45 of support 44. Point 31 considered with respect to the ribbon 26 will travel in a flatter arc having an effective radius from the point 31 to the point 47 on support 28. These two arcs cross each other at two points 33 and 35. However, since the actuator 32 and ribbon 26 are connected at point 31, it is obvious that as the actuator is moved from point 33 to point 35 the ribbon 26 will be under changing tension. If the actuator is moved below point 33 or above point 35, ribbon 26 will go slack. As actuator 32 is moved from point 33 to point 35, it passes a dead center point 37 where ribbon 26 is at maximum tension and the legs of the actuator under maximum compression. Of course, in moving over the entire sector from 33 to 35, either ribbon 26 must be stretched or the legs of the actuator 32 must be slightly buckled, or there may be a combination of both conditions. Since the supporting frame 20 is much heavier than the other parts, there will be but negligible compression of the frame. Such stretching of ribbon 26 and buckling of the legs of the actuator as occur will be well within the elastic limits of both. The most noticeable distortion that takes place is the buckling of the legs of actuator 32 as the parts on being recocked are moved from point 33 past dead center 37 to point 35. However, the strength of ribbon 26 is such that the stretching thereof is negligible. It is the buckling of the legs of actuator 32 that permits the movement from point 33 past dead center 37 to point 35.

When the actuator is above dead center position 37, the downward bias of the actuator legs is insufficient to buckle the legs sufficiently so that point 31 can pass dead center 37, and, of course, since ribbon 26 will not stretch enough under the force applied, it is apparent that the point of connection 31 will remain above dead center 37. If support 28 is moved to the right, the radius from 31 to 45 of the actuator will tend to be shortened, and hence the actuator and the point 31 will be raised further above dead center. If support 28 is moved to the left, the buckled legs of actuator 32 will straighten somewhat, and because of their downward bias will carry point 31 closer to dead center position 37.

When the actuator is in "on" position, that is, above dead center point 37, the tension of ribbon 26 holds the legs of actuator 32 sufficiently buckled so that the downward bias of the legs cannot buckle the legs further and drive the actuator past dead center. When ribbon 26 is elongated by the application of heat so that the legs of actuator 32 may straighten slightly and move downwardly toward dead center position, the point will finally be reached, as elongation of ribbon 26 proceeds, where the downward bias of the legs can just overcome the restraining force of the ribbon. The points of intersection of the arcuate paths of the actuator and ribbon get closer as the ribbon increases in length with rising temperature. The strength of the downward bias of the actuator in relation to the stiffness or compressibility of the legs is the controlling factor in determining how nearly the intersection points must approach each other before actuation occurs. At this point where the downward bias dominates, the actuator snaps vigorously downwardly under its own power and assisted by whatever tension is available in ribbon 26 after dead center 37 has been passed. The assistance of ribbon 26 continues until such time as the normal arc of point 31 of the actuator crosses the normal arc of point 31 of the ribbon in its present elongated condition. After reaching this point the ribbon will go slack and render no further assistance in the downward movement of the actuator 32 to its lowermost unstressed position.

While the actuator 32 has been U-shaped with inherent downward bias in the legs as a preferred form, it will be understood that any hinged or pivoted member having means for biasing such member downwardly could be used as a substitute construction. The present form, however, is preferred, and as the independent downward bias of the actuator is of sufficient strength and power that upon unlatching due to sufficient elongation of ribbon 26, the downward snap of the actuator will be adequate to do whatever is required to set the alarm or other mechanism in operation.

In practice it is desirable to have the ribbon made of material which has a coefficient of expansion substantially greater than that of the supporting frame. Further, it is desirable that the ribbon have a relatively large surface area in proportion to its cross section, so that a rapid rise in temperature applied thereto will cause rapid elongation as distinguished from the corresponding relatively slow elongation of the supporting frame due to the much heavier cross section of the frame and the relatively low coefficient of expansion.

By adjusting the tension of ribbon 26 it is apparent that the temperature at which the unit will unlatch itself may be accurately controlled. For example, under a given tension of ribbon 26 it will be found that upon a very gradual rise in temperature under which both the frame and ribbon elongate to the full amount permitted by the temperature, the elongation of the ribbon will be sufficiently greater than that of the frame to cause unlatching to occur at a particular temperature. On the other hand, if the latched unit is subjected to a rapid rise in temperature, the ability of the ribbon to absorb this increase in heat in a given time is greater than that of the supporting frame. As a result, the ribbon increases in length at a greater rate and to a greater extent than the frame. Thus the difference in elongation results in the downward bias of the actuator driving past dead center at a lower temperature than would be the case with a slow rise in temperature.

There are two advantages in this construction. If conditions are such that heat is being generated slowly but no fire has as yet broken out, the alarm will go off before combustion temperatures have been reached. On the other hand, if a fire should suddenly break out to cause a corresponding rapid rise in temperature, the alarm will go off at a lower temperature, so that aid can be summoned sooner.

The adjusting mechanism for controlling the tension of ribbon 26 is shown in detail in Fig. 5. The end of ribbon 26 is secured to support 28 by means of rivet 46. Support 28, square in cross section, passes freely through a correspondingly shaped hole 48 in the end member 50 of the frame. Support 28 is threaded at 52 to receive a corresponding threaded member 54, the outer end of which has a thread 56 of slightly different pitch. This outer thread 56 engages thread 58 of a short tubular member or bushing 60, whose left hand end rests against the face of end 50. The engaging parts of the face of end member 50 and bushing 60 are roughened to whatever degree is necessary to prevent rotation of the bushing when the parts are under tension and threaded member 54 is rotated. It is contemplated that it will be unnecessary to apply other holding means to bushing 60 to prevent rotation during final adjustment, the frictional engagement sufficing. In making the adjustment at the outset, both the screw and bushing are turned to the right, thus drawing the support 28 to the right. When an approximately correct tension on ribbon 26 has been reached, the pressure of bushing 60 against the end member 50 will be sufficient to hold the bushing stationary as the screw is thereafter rotated an additional amount. Due to the slightly different pitch of threads 54 and 56, the former of which might be, for example, 24 threads to the inch and the latter 28 threads to the inch, the effect will be that one revolution of the screw will move support 28 to the right $^1/_{168}$ of an inch. In this manner a fine and accurately controlled adjustment is provided. Other adjusting means could, of course, be used without departing from the scope of the present invention.

On the left hand end of actuator 32 is a down turned finger 62 having an opening 64 therethrough, which may serve as a convenient means for engaging an operating lever or other mechanism to be moved to cause actuation of the alarm. However, any other convenient way of connecting the actuator to the subsequent mechanism may be adopted as seems expedient.

In the preferred construction the tension of ribbon 26 determines the stable position of the actuator beyond dead center. If desired, however, an adjustable stop such as 66 shown in Fig. 6 may be utilized to limit the upward movement of the actuator beyond the snap over or dead center position. The operation in both constructions is the same.

Thus, it will be seen that the present invention provides a control which will go off at a predetermined maximum temperature when the temperature rise is slow and at some lower temperature when the rate of rise of the temperature is rapid.

While a preferred form of the invention has been shown and described, it is to be understood that the invention is not to be limited thereby but only by the appended claims.

We claim:

1. A thermostatically operable latch comprising a supporting frame, an actuator mounted for arcuate movement with respect to said frame, a temperature sensitive filament connected to said frame and said actuator, the free, normal arcuate path of the point of connection of the actuator with said filament, if said actuator were disconnected from said filament and at normal temperature, intersecting the free, normal arcuate path of the point of connection of said filament with said actuator, if said filament were disconnected from said actuator and at normal temperature, at two fairly close points with a dead center point therebetween, means effective when said actuator is in latched position for constantly urging said actuator toward unlatched position, said filament when in latched position at normal temperature being in sufficient tension to hold said actuator on one side of the said dead center point against the means urging said actuator in one direction and thereafter, upon sufficient elongation of said filament due to a rise in temperature and upon a corresponding moving together of the points of intersection of the two arcuate paths, the means constantly urging said actuator toward unlatched position will be greater than the restraining force provided by said filament and actuator at that temperature and will drive said actuator past said dead center point to a second stable irreversible position.

2. A thermostatically operable latch as set forth in claim 1, in which said actuator is generally U-shaped and said filament is axially aligned with the longitudinal center line of said actuator.

3. A thermostatically operable latch as set forth in claim 1, in which said actuator has flexible legs and a cross portion connecting said legs, the ends of said legs are rigidly affixed to said frame, and said filament is connected to said actuator at said connecting cross portion.

4. A thermostatically operable latch as set forth in claim 1, in which said actuator is generally U-shaped with legs the ends of which are rigidly supported on said frame, said actuator when unrestrained by said filament having a normal biased position below said dead center point.

5. The combination set forth in claim 1, in which said temperature sensitive filament is connected to said frame by an adjusting mechanism, whereby the longitudinal position of said filament may be shifted to vary the degree of temperature at which actuation occurs.

6. The combination set forth in claim 1, in which said temperature sensitive filament is connected to said frame by an adjusting mechanism, said adjusting mechanism comprising a differential screw, whereby the longitudinal position of said filament may be shifted to vary the degree of temperature at which actuation occurs.

7. The combination of two members of different lengths, each fixed at one end on a common support, the other ends, when free, movable in arcuate paths, which paths intersect at two closely adjacent points with a dead center point therebetween, said members connected at their movable ends so that during movement between said intersection points, the longer member will be in tension and the shorter member will be in compression, a force constantly urging the shorter of said members in one direction, the longer member being adjusted at normal temperatures to maintain said shorter member at one side of said dead center position in opposition to said force, said longer member capable of sufficient elongation under an adequate rise in temperature to cause the points of intersection of the arcuate paths to approach each other sufficiently to enable said force to move said members past said dead center point toward said other intersection point, said tension member assisting in said movement after said dead center point has been passed.

8. The combination set forth in claim 7, in which the coefficient of expansion of said longer member is greater than the coefficient of expansion of said common support.

9. The combination set forth in claim 7, in which adjustable means is mounted on said support and said longer member is connected to said adjustable means whereby the points of intersection of the free arcuate paths of the ends of said members may be varied and the amount of elongation of said longer member required before said shorter member may snap past dead center may be controlled.

10. The combination set forth in claim 7, in which the connection between said support and

the longer of said members is by means of an adjusting mechanism for varying the longitudinal position of the said longer member with respect to said support, said adjusting mechanism comprising a differential screw.

11. A thermostatically operable latch comprising a supporting frame, a long, narrow, spring member fixedly secured to said frame at one end and having over its normal arc of movement of its free end an inherent bias in one transverse direction, a temperature sensitive filament much longer than said spring secured to said frame at a point remote from the fixed end of said spring and with its free end extending in the direction of the free end of said spring and connected thereto, the normal arcuate paths of the free ends of said spring and filament, if unconnected to each other, intersecting at relatively close points with a dead center point therebetween, said spring longitudinally compressible so that said spring may be manually moved in opposition to said bias from one point of intersection through said dead center point to the other point of intersection, said filament capable of sufficient elongation under rising temperature to reduce the amount of compression of said spring needed to pass said dead center point to a degree capable of being accomplished by the inherent bias of said spring to move the members automatically in the direction of said bias to a second irreversible position.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,290,866	Arias	Jan. 14, 1919
2,182,856	Riche	Dec. 12, 1939
2,204,791	Davis	Jan. 18, 1940
2,338,271	Ulanet	Jan. 4, 1944

FOREIGN PATENTS

Number	Country	Date
311,974	Germany	May 7, 1919
379,726	Germany	Aug. 28, 1923