Feb. 6, 1951 A. KÄSER 2,540,337

TEMPERATURE CONTROLLED ELECTRIC SWITCH

Filed Feb. 18, 1949 2 Sheets-Sheet 1

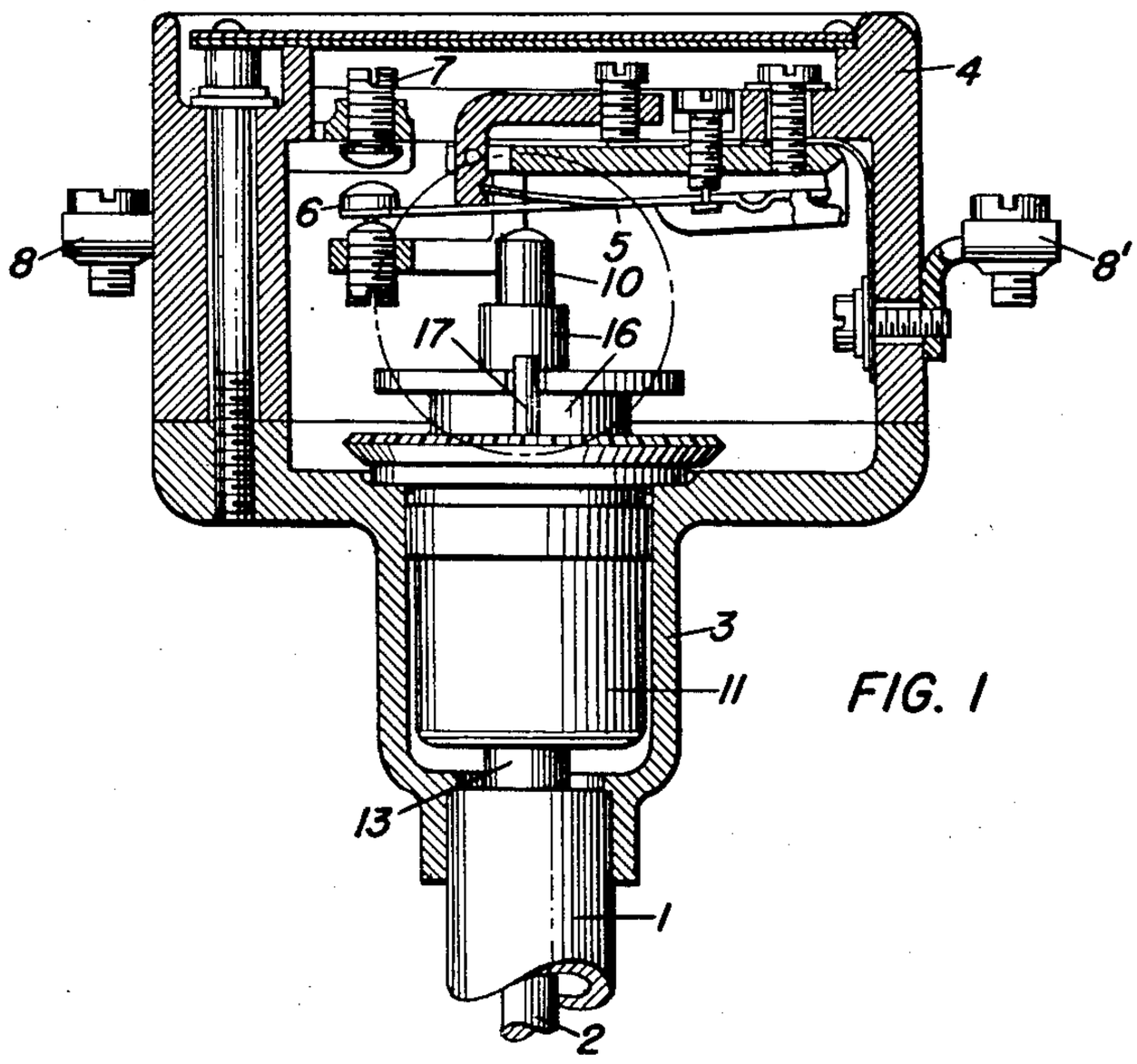

FIG. 1

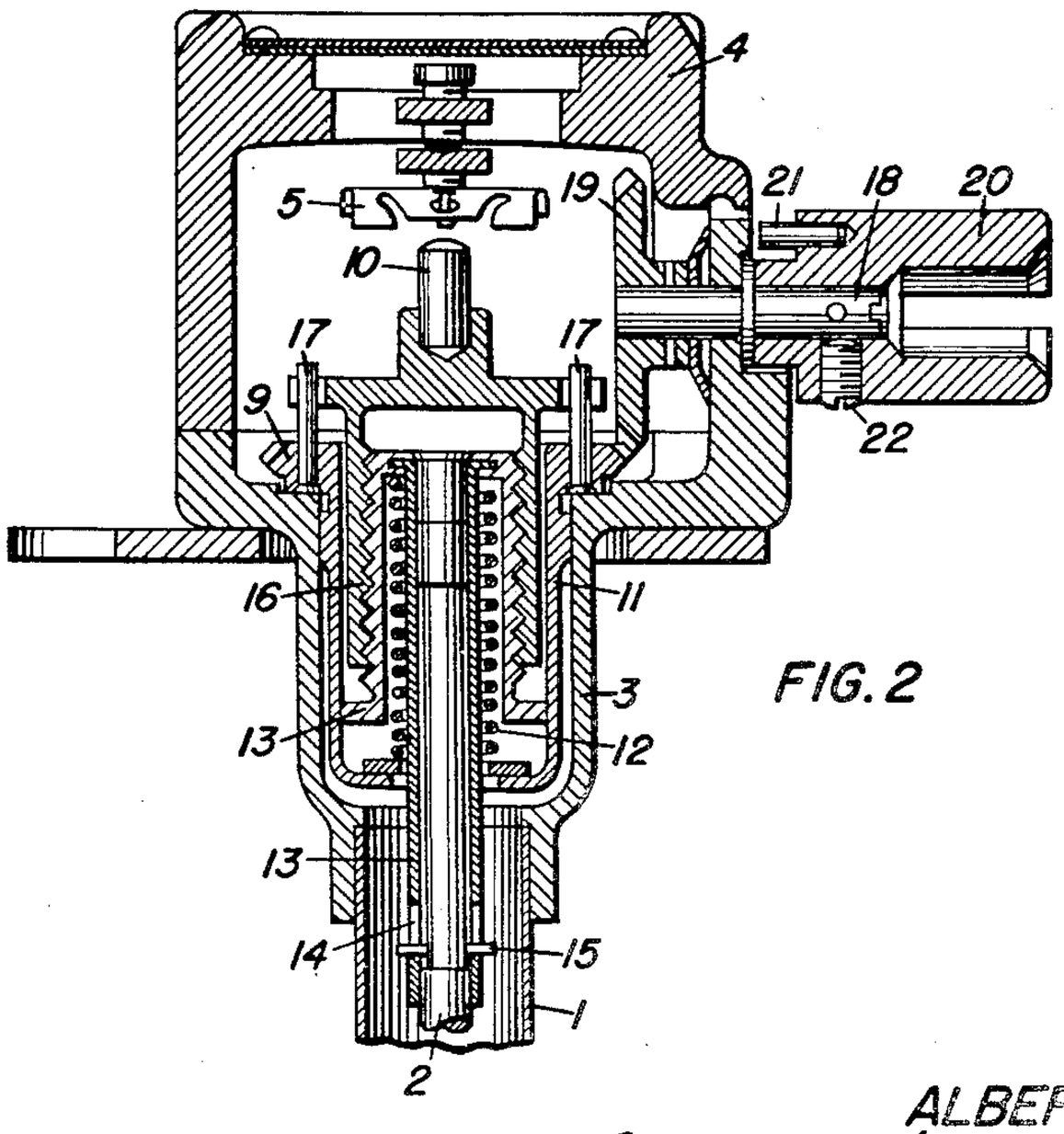

FIG. 2

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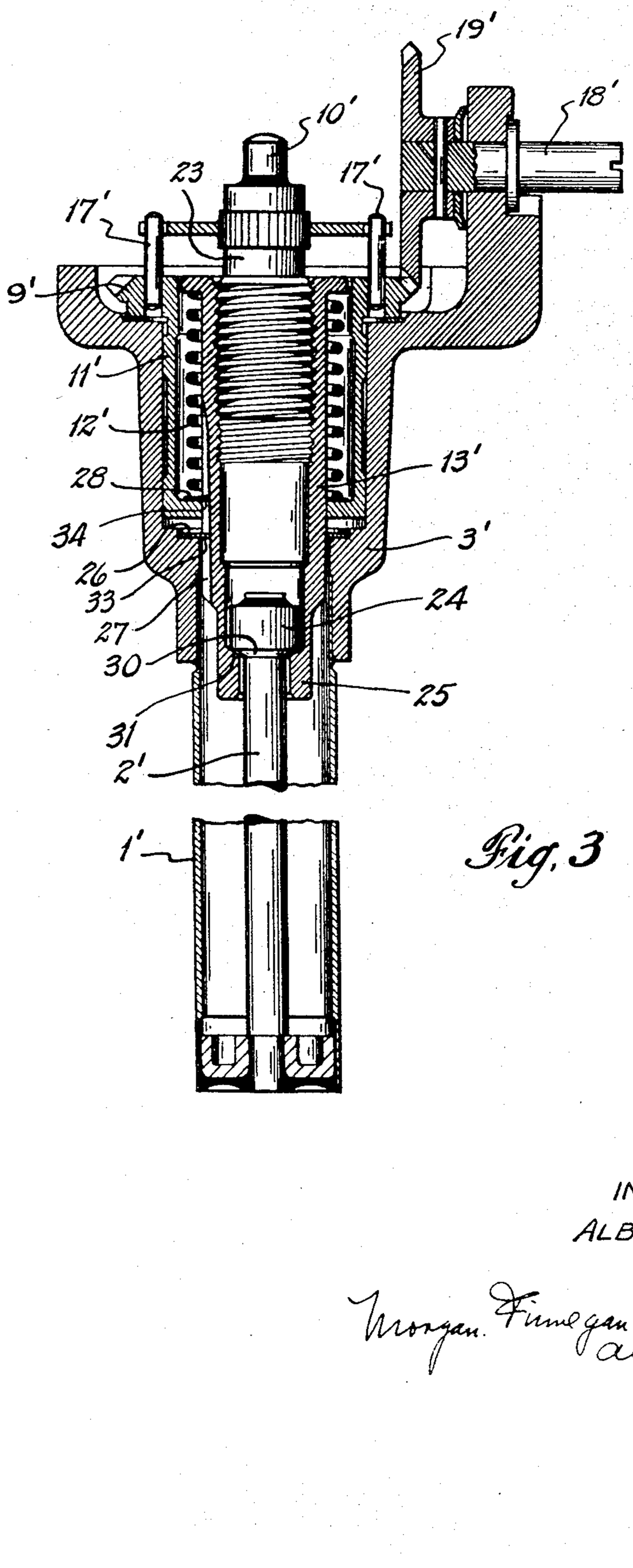

Fig. 3

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Patented Feb. 6, 1951

2,540,337

UNITED STATES PATENT OFFICE

2,540,337

TEMPERATURE CONTROLLED ELECTRIC SWITCH

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Application February 18, 1949, Serial No. 77,154
In Switzerland March 12, 1948

6 Claims. (Cl. 200—137)

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The present invention relates to a switch actuated by temperature sensitive means and more particularly to such a switch wherein flexible means are provided between the switch and actuating means to prevent undue mechanical stresses in the switch.

Objects and advantages of the invention will be set forth in part hereinafter and in part will be obvious herefrom, or may be learned by practice with the invention, the same being realized and attained by means of the instrumentalities and combinations pointed out in the appended claims.

The invention consists in the novel parts, constructions, arrangements, combinations, and improvements herein shown and described.

The accompanying drawings, referred to herein and constituting a part hereof, illustrate an embodiment of the invention, and together with the description, serve to explain the principles of the invention.

Of the drawings:

Fig. 1 is a view partly in cross section and partly in side elevation of a typical and illustrative embodiment of the invention;

Fig. 2 is a cross section at right angles to the section taken through the device in Fig. 1; and

Fig. 3 is a view partly in cross section and partly in elevation of a modified embodiment of certain of the mechanism shown in Figs. 1 and 2 of the drawings.

The object of the invention is the provision of an improved switch actuated by temperature sensitive means wherein a flexible connection is provided between said means and switch in order to prevent undue stresses from being exerted on the switch mechanism which would damage or break it. The invention further provides a switch of the type mentioned wherein said flexible connection is provided in combination with the means for varying the temperature responsive operation of the switch.

Referring now in detail to the illustrative embodiments of the invention shown by way of example in the accompanying drawings, and referring first to the embodiment of Figs. 1 and 2, the numeral 1 denotes an expansion tube and 2 an actuating rod of a temperature sensitive device for actuating a switch said device being of any known and conventional type. The tube 1 is rigidly connected at its upper end to the lower portion of a housing 3 which is an integral part of the switch housing 4, and at its lower end the tube 1 is interconnected with the rod 2 in accordance with standard practice in temperature responsive devices of this type.

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The switch mechanism in the housing 4 is of a known type comprising a leaf spring 5 mounted as shown and carrying at its free end the movable contact 6 for engagement with the fixed contact 7 when the switch is closed. The numerals 8 and 8' denote the customary terminals for the electrical connection of the switch contacts. The switch is actuated by the action of an insulated pressure pin 10 made preferably of glass or porcelain which is adapted to engage the leaf spring 5 and is positively connected with the rod 2 for movement therewith. The known operation of the switch and temperature responsive means is that as temperature increases about the tube 1, the tube expands and the rod 2 is moved downwardly, the pressure pin 10 being thus pulled downwardly and away from leaf spring 5, said spring then moving contact 6 away from contact 7 and the switch is opened. When the switch is opened the connection of the switch with the heat supply is customarily such that the heat supply is interrupted and the medium being heated is allowed to cool. As cooling progresses the tube 1 contracts, the rod 2 is moved upwardly, and the pressure pin 10 rises to close the contacts 6 and 7. In the temperature responsive switch mechanism described it will be apparent that if the device while adjusted for operation at a high temperature is cooled well below that temperature there is the risk that the switch will be damaged, since tube 1 will undergo a relatively large contraction and through the action of the rod 2 the pressure pin 10 will press with considerable force against the arm of the switch.

In accordance with the present invention this danger of damage or breakage in the described mechanism is obviated by providing a flexible connection between the insulated pressure pin 10 and the actuating rod 2, and the pressure pin is also supported for longitudinal adjustment for various temperatures of operation. The details of such mechanism are shown in Fig. 2 of the drawings in which a rotatable cylindrical element 11 carries a bevel gear 9 at its upper end and surrounds a coiled spring 12 which exerts an upward thrust upon an externally threaded, double sleeve member 13. The inner sleeve portion of double sleeve member 13 surrounds the rod 2 and has a slitted aperture 14 adjacent the lower end thereof to receive a pin 15 carried by rod 2, the sleeve 13 being normally pressed upwardly to engage said pin as shown in Fig. 2 by the action of spring 12. An internally threaded adjusting

sleeve or nut 16 is screwed on sleeve 13, and the upper portion of nut 16 carries the pressure pin 10. The nut 16 is connected to the gear 9 and element 11 for correlative rotation therewith by means of pins 17. The element 11 and adjusting nut 16 may be rotated for the axially adjusted positioning of pin 10 by means of a bevel gear 19 in mesh with gear 9, the former being carried by a shaft 18, which also carries a coupling sleeve 20 and a stop 21, the sleeve 20 being fixed to the shaft by means of set screw 22. The pin 22 can be placed in any of several different positions, and by so altering the position in which the coupling sleeve 20 is held with respect to shaft 18, the temperature range in which the operating temperature is to be set may be altered as desired.

The operation of the device just described is as follows: As the temperature rises, the adjusting nut 16 carrying the insulated pressure pin 10 is drawn downwardly as the expansion tube expands. The switch spring 5 is thus eased, as the external force exerted on it decreases. As soon as the external force has become less than the force of the leaf spring downwardly in the direction of the axis of the temperature feeler, the switch 5 moves into the "off" position. As the temperature falls, the process is reversed, since the external force exerted through the pressure pin 10 increases until it is equal to or greater than the force of the leaf spring. When this occurs the switch 5 again closes its contacts. If now the device while at room temperature is, for example, to be suddenly set to a switching off value of 300° C., the pressure pin 10 would have to be moved a relatively large distance in the direction of the leaf spring if the device is to switch off only when the necessary large expansion of the tube 1 has taken place. It will easily be seen that in this case the leaf spring, which normally responds to an expansion of a few hundredths of a millimeter, would sustain damage. In the device of the invention this difficulty is avoided because the leaf spring, after the switch has been closed by the upward movement of the pin 10, is stressed further by a definite amount which it can easily support until equality exists between the downward force of the leaf spring and the upward pressure of spring 12. Thus as the nut 16 is turned further (in setting the device to a high temperature) instead of a further upward movement of the nut 16 and pin 10, a downward movement of the sleeve 13 occurs, and the force acting through the pin 15 on the rod 2 is thus removed, as the guide slit 14 of the threaded sleeve 13 moves downward in relation to the pin 15 and the rod 2, which remain stationary. By the time the feeler device has been raised to a temperature of 300° C., the tube 1 will have expanded to such an extent that the pin 15 will pull the threaded sleeve 13, the adjusting nut 16 and the insulated pressure pin 10 away from the switch again, relieving the latter of the compressive force of the pressure spring 12, and thus allowing the switch to re-open.

The reverse process, i. e., setting for a temperature of say 0° C., while the device is at a temperature of e. g., 300° C., requires the downward adjustment of the adjusting nut 16 to an extent equal to the expansion of the tube 1 in the previous example. This opens the switch 5, the heat supply is discontinued and the temperature feeler cools down. When the temperature feeler has been finally cooled to room temperature the resulting contraction of the tube 1 forces the insulated pressure pin 10 in the direction of the

switch 5 to a position such that the switch remains just switched off.

The embodiment of the invention shown in Fig. 3 of the drawings is similar in its operation to the embodiment just described, and the similar and equivalent parts thereof have been numbered with prime numerals corresponding to the parts shown in Figs. 1 and 2. The differences in the embodiment of Fig. 3 will be noted that the single sleeve element 13' is internally threaded to receive an externally threaded adjusting screw 23 which carries the insulated pressure pin 10', the screw being rotated by means of gears 9' and 19' from shaft 18'. In this embodiment the expansion of tube 1' is transmitted to the pin 10' through rod 2' by means of the enlarged end portion 24 thereof, which is provided preferably with an inclined surface 30 to seat on a correspondingly inclined surface 31 formed on a lower boss portion 25 of the sleeve 13'.

Compared with the first example of carrying the invention into practice, the design shown in Fig. 3 has the advantage that it is simpler from the constructional point of view and that more direct transmission of the movements of the temperature feeler to the switch takes place. This is partly due to the fact that the setting device no longer has any unreliable weak points. By eliminating the first type of joint it is possible to obtain a better centering of the setting thread in relation to the axis of the sensitive feeler. This factor is important, since the proper resilience of the flexible part is dependent on the said centering. It should also be observed that in setting the operating temperature the rod 2' is not stressed by the rotation of the upper members, elastic after-effects thus being avoided, since the threaded sleeve 13' is prevented from rotating relative to the housing 3' by a ring disc 26 fixed to housing 3' and having an extension 33 engaging in a groove 27 of the threaded sleeve 13'. An extension 34 of the washer 28, on which the pressure spring 12 rests also engages in the same groove, in such a manner that the spring 12' also undergoes no rotational stress when the bevel housing 11' rotates.

Compared with known devices of a similar nature, in which for setting the operating temperature the whole switch is adjusted, the device according to the invention has the advantage that the switch is stable in any position. Moreover in the present invention, the adjustment of the device is more accurate, as it has no levers with inevitable lost motion and friction in the bearings. A further advantage is that the axis of operation of the pin 10 or 10' lies in the direction of movement of the actuating rod.

The invention in its broader aspects is not limited to the specific mechanisms shown and described but departures may be made therefrom, within the scope of the accompanying claims, without departing from the principles of the invention and without sacrificing its chief advantages.

What I claim is:

1. In combination, a switch having a movable contact, a rod member axially movable responsive to temperature changes adapted to move said contact, and means between an end of said rod member and said contact for preventing excessive mechanical stresses on said contact and for varying the effective length of said rod member, said means comprising a housing carrying a bevel gear in mesh with a second driving bevel gear, a threaded adjusting member carrying an insulated

pressure pin, a threaded sleeve engaged with said adjusting member, and a spring bearing on said housing and sleeve, said adjusting member and housing being connected for correlative rotation.

2. In combination, a switch having a movable contact, a rod member axially movable responsive to temperature changes adapted to move said contact, and means between an end of said rod member and said contact for preventing excessive mechanical stresses on said contact and for varying the effective length of said rod member, said means comprising a housing carrying a bevel gear in mesh with a second driving bevel gear, a threaded adjusting member carrying an insulated pressure pin, a threaded sleeve engaged with said adjusting member, and a spring bearing on said housing and sleeve, said adjusting member and housing being connected for correlative rotation, said rod member and sleeve being interconnected for limited relative axial movement.

3. In combination, a switch having a movable contact, a rod member axially movable responsive to temperature changes adapted to move said contact, and means between an end of said rod member and said contact for preventing excessive mechanical stresses on said contact and for varying the effective length of said rod member, said means comprising a housing carrying a bevel gear in mesh with a second driving bevel gear, an internally threaded adjusting member carrying an insulated pressure pin, an externally threaded sleeve engaged with said adjusting member, and a spring bearing on said housing and sleeve, said adjusting member and housing being connected for correlative rotation.

4. In combination, a switch having a movable contact, a rod member axially movable responsive to temperature changes adapted to move said contact, and means between an end of said rod member and said contact for preventing excessive mechanical stresses on said contact and for varying the effective length of said rod member, said means comprising a housing carrying a bevel gear in mesh with a second driving bevel gear, an externally threaded adjusting member carrying an insulated pressure pin, an internally threaded sleeve engaged with said adjusting member, and a spring bearing on said housing and sleeve, said adjusting member and housing being connected for correlative rotation.

5. In combination, a switch having a movable contact, a rod member axially movable responsive to temperature changes adapted to move said contact, and means between an end of said rod member and said contact for preventing excessive mechanical stresses on said contact and for varying the effective length of said rod member, said means comprising a housing carrying a bevel gear in mesh with a second driving bevel gear, a threaded adjusting member carrying an insulated pressure pin, a threaded sleeve engaged with said adjusting member, and a spring bearing on said housing and sleeve, said adjusting member and housing being connected for correlative rotation, said rod member and sleeve having cooperating inclined surfaces adapted to engage each other.

6. In combination, a switch having a movable contact, a rod member axially movable responsive to temperature changes adapted to move said contact, and means between an end of said rod member and said contact for preventing excessive mechanical stresses on said contact and for varying the effective length of said rod member, said means comprising a housing carrying a bevel gear in mesh with a second driving bevel gear, an externally threaded adjusting member carrying an insulated pressure pin, an internally threaded sleeve engaged with said adjusting member, and a spring bearing on said housing and sleeve, said adjusting member and housing being connected for correlative rotation and means for preventing rotation of said sleeve with said adjusting member.

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