July 3, 1934. J. G. HOMAN 1,964,732

DILATOR

Filed March 21, 1930

Fig. 1.

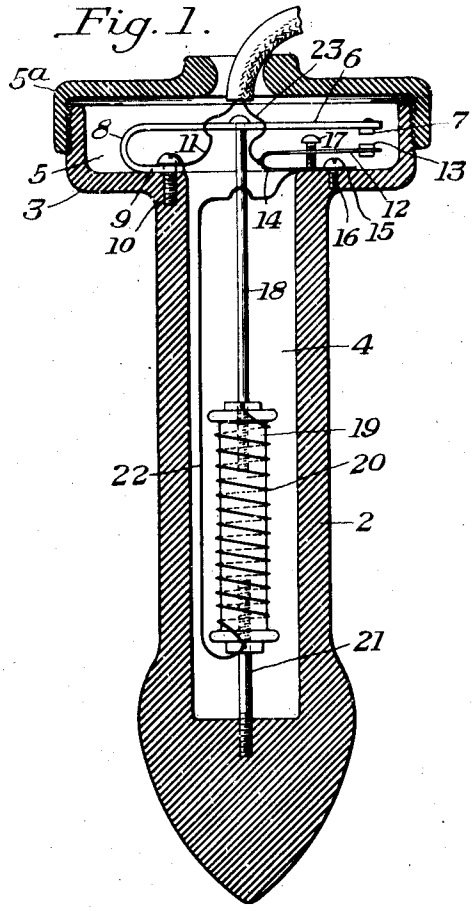


Fig. 4.

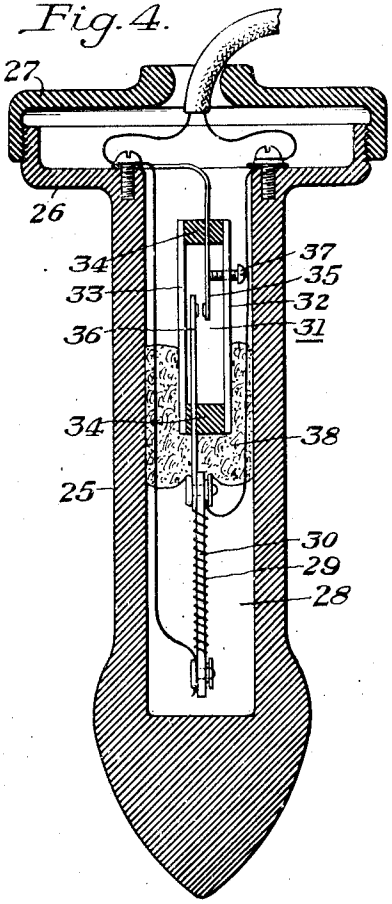


Fig. 2.

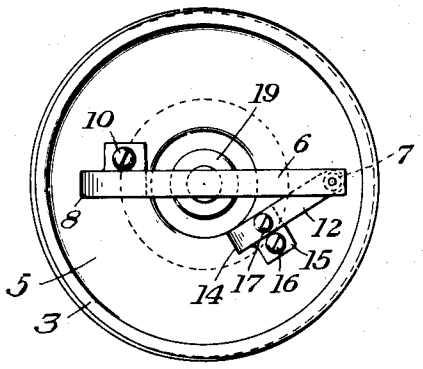
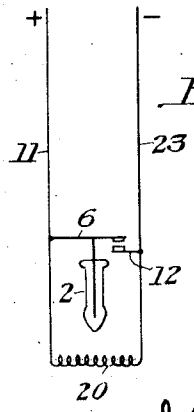


Fig. 3.



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DILATOR

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22 Claims. (Cl. 128—255)

This invention relates to an applicator for applying heat to body tissues, and is especially applicable to electrically heated devices used in effecting orificial dilation.

Devices of this kind are commonly provided in the form of a body of bakelite or hard rubber suitably shaped for orificial insertion and provided with an internal electric heater. As heretofore provided, no satisfactory means has been provided for controlling the temperature of such a device or for guarding against overheating from any cause. According to the present invention, there is provided in a device of this nature a thermostatically operated switch so arranged as to shut off the supply of heating current when the body of the dilator has reached the desired temperature, but so disposed or constructed as to prevent the shutting off of the current before the outside of the body of the dilator has reached the desired operating temperature.

It is also a matter of common knowledge that switch contact points are very likely to stick to prevent or interfere with the proper opening of the switch. According to a preferred embodiment of my invention, the switch is shunted across the heater and arranged to be closed by the thermostat when the body of the dilator has reached the predetermined operating temperature. Under these conditions the heating element is short circuited when the desired temperature is reached, and even if the switch should fail to open, overheating the dilator would not be possible.

The invention may be readily understood by reference to the accompanying drawing, in which

Fig. 1 represents a longitudinal section through a dilator embodying a present preferred form of my invention;

Fig. 2 is a top plan view of the dilator with the cover removed;

Fig. 3 is a schematic circuit diagram for the switch and heating element;

Fig. 4 is a view similar to Fig. 1 of a slightly modified arrangement.

In the construction as shown in Fig. 1, 2 designates the body of the dilator having a shape necessary to effect the purpose for which it is intended and provided with a base 3. The body of the dilator is preferably made of hard rubber or some other electric insulating material, as for instance, a phenolic condensation product such as bakelite. Hard rubber is preferred, however, due to its relatively greater coefficient of thermal expansion. Within the body of the dilator is a chamber 4, and the base of the dilator is also preferably hollow providing a chamber 5. At 5^a there is shown a cap which screws onto the base and which normally closes the chamber 5.

Within the chamber 5 is a flexible switch member 6 having a contact 7 at one end and having a looped portion 8 at the other end, this looped portion having a foot 9 which sets on the interior of the base and is held in place by a screw 10, this screw also providing a connector for a wire 11 constituting one side of a current supply circuit. A second switch element is provided at 12, this switch element having a contact at 13 and having a looped portion 14 providing a foot 15 that rests on the inside of the base. A screw 16 holds this element in place. A screw 17 passing through the upper part of the switch element 12 has its inner end bearing on the foot portion 14 of the element. By turning the screw 17, the contact 13 may be moved in or out with respect to the contact 7, thus providing an adjustment for the switch and for the thermostat hereinafter described.

Secured to the contact bar 6 is a rod 18 of a material having a lag or relatively negligible coefficient of thermal expansion, such as mangan metal or a similar alloy. This rod carries a refractory insulating element 19 at its innermost end, and about this refractory insulating element is wound a heating resistant 20 which may be formed, for instance, of nichrome wire. The lower end of the refractory body 19 is secured to a short rod or post 21 which is anchored into the distal end of the dilator body. I prefer that the rod 18 and the rod or post 21 have a threaded engagement with the body of refractory 19. One end of the nichrome wire 20 is attached to or connected with the metal rod 18 while the other end of this heating wire is connected through a wire 22 with the switch element 12. The other side of the supply current is connected through the wire 23 with the switch element 12.

The circuit for the heating element and switch is more clearly shown in Fig. 3 from which it will be seen that the wire 20 is always connected across the input wires 11 and 23, while the switch comprising the element 6 and 12 is shunted across the heater 20. When the switch 6—12 is open, current flows through the resistor 20 to heat the dilator, but when the switch is closed, the resistance is short circuited and thus deprived of a heating current.

In the operation of the device, the switch 6—12 is normally open when the current is initially supplied to the dilator and the dilator is cold. As the temperature of the dilator increases, the

body of the dilator begins to expand. Since the rod 21 and the rod 18 and the support 19 for the heating element have a practical negligible coefficient of thermal expansion, a pull is exerted on the switch bar 6 drawing it down toward the switch member 12. At the time the desired temperature is reached, the contact points 7 and 13 of the respective switch members will be in contact, short circuiting the heating element. By reason of the threaded connection between the refractory support 19 and the rod 18, and by reason of the adjustment for the contact element 12 provided through the screw 17, the temperature at which the switch closes can be very accurately adjusted.

As shown in Fig. 2, the switch member 12 is set at an angle to the switch member 6 so that the screw 17 is exposed for ready adjustment upon removal of the cap.

This structure provides several unique features. In the first place, the body of the element whose temperature is to be regulated constitutes the expansible element of the thermostat. In a dilator or similar applicator this is of a peculiar advantage. This is because the heating element is inside the dilator, and if the thermostat were directly responsive to the internal temperature, it might actuate the switch before the outside of the dilator had reached a sufficient temperature. However, by using the body of the dilator as the expansible element of the thermostat, the switch is not operated until the body of the dilator has been uniformly heated and the desired temperature reached at the outside thereof. A second unique feature is the provision of the thermostatically controlled switch in parallel with the heating element rather than in series therewith. The advantage of this resides in the fact that switch contacts are likely to stick, frequently due to the heat generated by the high resistance to the passage of current which the contacts provide when they are in loose or imperfect contact and due to arcing across the contacts. With this arrangement, if the contacts stick, the dilator would merely cool off, whereas if the switch were disposed in series with the heater and the contacts stuck, overheating of the dilator would be easily possible.

This arrangement, moreover, is relatively simple and can be built into the dilator with relatively little cost.

In the arrangement shown in Fig. 4, I have indicated a more conventional type of thermostat located within the interior of the dilator, but somewhat insulated from direct exposure to the heater whereby premature operation of the thermostat in shutting off supply of heating current is prevented.

In this figure, 25 designates the body of the dilator having a base 26 with a removable cap 27. In the interior chamber 28 of the dilator is a heating element 29, such as nichrome wire carried on a lava or other refractory support 30. Located in the chamber above the heater is a thermostat 31. This may comprise, for instance, two bars, 32 and 33, held in spaced relation by insulators 34 and having different coefficients of thermal expansion by reason of which one side of the structure will elongate more rapidly than the other under an increase in applied heating. This structure supports the switch contacts 35 and 36. The set screw 37 provides for the adjustment of one of these contacts with respect to the other. As the thermostat expands, these switch contacts are brought into engagement with each other closing a circuit similar to that shown in Fig. 3 to short circuit the resistance element of the heater.

In order to prevent the thermostat from responding too quickly to a high temperature within the chamber 28 and before the body of the dilator has become properly heated, a mass of thermal insulation 38 is interposed between the thermostat and the heater. If some means were not provided for insulating the thermostat from the direct heat within the chamber, the switch would be closed prematurely because an elevated temperature is attained inside the dilator some time before the outside has become properly heated. If the thermostat were set to close the switch at a relatively high temperature, it is obvious that the applicator would be too long in attaining a uniform temperature and the device might overheat at the outside.

The advantages of my invention reside in the provision of an electrically heated dilator or similar applicator having a thermostat so disposed and provided as to shut off the supply of heating current to the electric heater at a time when the outside of the applicator has reached the desired operating temperature and before it overheats. The invention, moreover, provides a structure which is relatively small, and in the provision of a switch which short circuits the heating element rather than opening the circuit thereto, an element of safety is provided which protects the user of the device from injury in the event the switch fails to open. The closing of the switch is, of course, positive. A further advantage is provided in that the thermostat is introduced into the dilator without increasing its size.

Moreover, the provision of a thermostat in a device of this nature is of peculiar importance, and because of the fact that the user does not know the temperature at which the device is intended to operate and must rely on the assurance of the manufacturer that the device cannot reach a temperature where harm can be done to the patient. These devices are frequently used under the direction of a physician who is inclined to be unsympathetic as to the complaint of his patient as to discomfort attending its use and burning of the patient even taking treatment under the direction of a physician would be easily possible. The provision of the thermostat materially reduces any hazard from this cause.

While I have described the invention as being applied particularly to a dilator for orificial insertion, it is to be understood that the invention, or certain features thereof are equally applicable to other types of applicators.

While I have shown and described in detail a certain preferred embodiment of my invention, it will be understood that the invention is not restricted to the particular construction and arrangement of parts herein described, and that various modifications and changes may be made within the contemplation of my invention and under the scope of the following claims.

I claim:

1. The combination with a dilator for orificial insertion having an internal electric heating element, of a thermostatically controlled switch within the dilator for controlling the current supply to the heating element, the body of the dilator forming the expansible element of the thermostat and operatively connected with the switch.

2. The combination with a dilator for orificial insertion having an electric heating element

therein, of a thermostatically controlled switch built into the body of the dilator, and arranged to effectively shut off the heating current to the heating element when the body of the dilator has reached a predetermined maximum temperature, the body of the dilator forming the expansible element of the thermostat and operatively connected with the switch.

3. In a dilator for orificial insertion, a dilator body, an electric heating element within the body, and a thermostatically controlled switch built into the body and in circuit with the heating element, the body of the dilator forming the expansible element of the thermostat and operatively connected with the switch.

4. In an applicator of the class described, a body having a chamber therein, an electric heating element within the chamber, and a thermostatically controlled switch carried by the body for effectively controlling the current flow to the electric heating element, the body of the dilator forming the expansible element of the thermostat and operatively connected with the switch.

5. In an applicator of the class described, a body to be heated, a heating element within the body, and a thermostatically controlled switch connected in parallel with the heating element.

6. In an applicator of the class described, a body, an electric heating element within the body, a switch shunted across the heating element, and thermal responsive means for closing the switch when the body of the applicator reaches a predetermined temperature.

7. In an applicator of the class described having a body portion, an electric heating element within the body portion, a switch for controlling the flow of current to the heating element, and a thermostat of which the body constitutes one element operatively connected with the switch.

8. In a dilator, a dilator body, an electric heating element within the body, a switch for controlling the flow of current to the heating element, and means utilizing the coefficient of thermal expansion of the dilator body for operating the switch.

9. In an applicator of the class described, a body, an electric heating element within the body, a switch for controlling the flow of current to the heating element, said switch comprising a movable element secured to the body, and an element having a coefficient of thermal expansion different from that of the body, having one end thereof connected with the movable element of the switch, and having the other end thereof anchored to a point in the body remote from the switch.

10. In an applicator of the class described, a body, an electric heating element within the body, a switch for controlling the flow of current to the heating element, said switch comprising a movable element secured to the body, and an element having a coefficient of thermal expansion different from that of the body, having one end thereof connected with the movable element of the switch, and having the other end thereof anchored to a point in the body remote from the switch, said switch being shunted across the electric heating element.

11. In an applicator of the class described, a body, an electric heating element within the body, a switch for controlling the flow of current to the heating element, said switch comprising a movable element secured to the body, and an element having a coefficient of thermal expansion different from that of the body, having one end thereof connected with the movable element of the switch, and having the other end thereof anchored to a point in the body remote from the switch and means for adjusting the switch.

12. In a dilator, a dilator comprising an elongated body having a base portion at one end thereof, a switch member in the base portion, a contact for cooperation of the switch member, an electric heating element within the body of the dilator, and a rod for moving said switch member connected with the switch member and with the distal end of the dilator, said rod having a relatively negligible coefficient of thermal expansion with respect to that of the body of the dilator.

13. In a dilator, a dilator body having a longitudinally extending chamber therein, a transversely movable switch element at one end of the body, a contact with which the switch element cooperates, a rod connected with the switch element extending longitudinally of the dilator, a refractory body on the rod, means for anchoring the rod and refractory body to the distal end of the dilator, and an electric heating resistance supported by the refractory body, the coefficient of thermal expansion of the rod and the refractory body being relatively less than the coefficient of thermal expansion of the dilator.

14. The combination with a dilator, of an electric heating means and thermally responsive switch having an adjustable contact shunted across the electric heating means and adapted to be closed when the temperature of the dilator reaches a predetermined maximum.

15. In a device of the class described, an elongated hollow body having an electric heating element therein, a rod extending longitudinally of the body within the hollow interior thereof, said rod having one end anchored to one end of the body, the rod and the body having different coefficients of thermal expansion, and a switch in circuit with the heating element with which the rod is connected and operated through the differential movement of the rod and body under increasing and decreasing temperatures.

16. The combination with a dilator for orificial insertion having an internal electric heating element, of a thermostatically controlled switch within the dilator for controlling the current supplied to the heating element, said switch being connected in parallel with said electric heating means.

17. The combination with a dilator for orificial insertion having an electric heating element therein, of a thermostatically controlled switch built into the body of the dilator and arranged to effectively shut off the heating current to the heating element when the body of the dilator has reached a predetermined maximum temperature, said switch being connected in parallel with the said electric heating means.

18. In an applicator of the class described, a body having a chamber therein, an electric heating element within the chamber, a thermostatically controlled switch carried by the body for effectively controlling the electric flow to the electric heating element, said switch being connected in parallel with the said electric heating means.

19. In an applicator of the class described having a body portion, an electric heating element within the body portion, a switch for controlling the flow of current to the heating element, said switch being connected in parallel with said electric heating element, and a thermostat of which

the body constitutes one element operatively connected with the switch.

20. In an applicator of the class described, a body, an electric heating element within the body, a switch for controlling the flow of current to the heating element, said switch comprising a movable element secured to the body and connected in parallel with the said electric heating element, and an element having a coefficient of thermal expansion different from that of the body having one end thereof connected with the movable element of the switch and having the other end thereof anchored to a point in the body remote from the switch, and means for adjusting the switch.

21. In a device of the class described, an elongated hollow body having an electric heating element therein, a rod extending longitudinally of the body within the hollow interior thereof, said rod having one end anchored to one end of the body, the rod and the body having different coefficients of thermal expansion, and a switch connected in parallel with the heating element with which the rod is connected and operated through the differential movement of the rod and body under increasing and decreasing temperatures.

22. In an applicator of the class described, a body to be heated, a heating element within the body, and a thermostatically controlled switch connected in parallel with the heating element, the body of the dilator forming the expansible element of the thermostat operatively connected with the switch.

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