

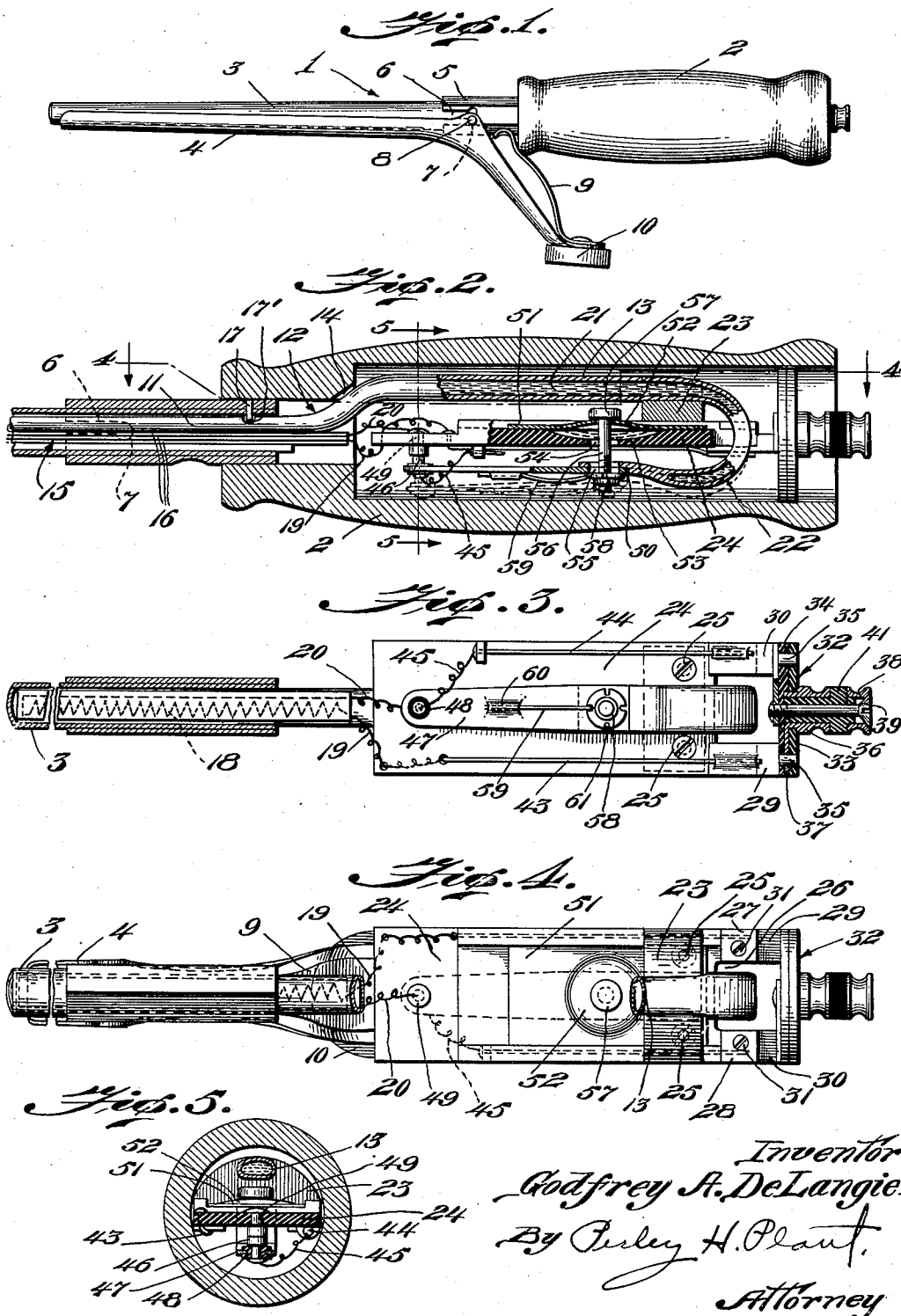
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CONTROL MECHANISM

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CONTROL MECHANISM

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This invention relates to a temperature control mechanism for an electrically heated device and more particularly to a device of this character which is fully automatic in its action and which is capable of acting at relatively low temperature and responding to relatively slight temperature changes.

One object of the invention is to provide a device of this character comprising a heat responsive member having a portion thereof free to move in response to variations in temperature and means acting upon the movable portion of the heat responsive member to vary its rate of movement at certain points adjacent to the critical temperature whereby quick movement of the movable portion of said heat responsive member may result in order to produce quick movement of the switch in making and breaking the electric current.

Another object of the invention is to provide a heat responsive member having a portion free to move in response to variations in temperature and a switch member carried by the movable portion of said heat responsive member for making or breaking an electric current.

A further object of the invention is the provision of a control member connected with the movable portion of a heat responsive member for varying the movement of the free portion of said heat responsive member when subject to variations in temperature.

Another object of the invention is to provide a device of this character having means for effecting movement of an electric switch to make or break an electric circuit at predetermined temperatures together with means for effecting the movements of the switch member in such a manner as to substantially prevent arcing of the current when the circuit is made or broken.

Another object of the invention is to provide a quick acting switch for making or breaking an electric circuit together with means for restraining movement of the switch at temperatures adjacent to the operating temperature and for effecting a sudden release of the switch member to cause a

quick movement of the same in making or breaking the electric circuit.

Other objects and advantages of the invention relate to various improved details of construction and novel methods of operation as will be more fully set forth in the detailed description to follow:—

Referring to the drawings:—

Fig. 1 is a side elevational view of a curling iron illustrating one form of my invention as applied thereto,

Fig. 2 is a vertical sectional view of the structure as shown in Fig. 1, certain of the parts being shown in elevation,

Fig. 3 is a longitudinal view of the structure shown in Fig. 2 partially in section and taken at substantially right angles to the section shown in Fig. 2.

Fig. 4 is a longitudinal view partially in section of the structure shown in Fig. 2, taken substantially along the line 4—4 of Fig. 2, and looking in the opposite direction from the view shown in Fig. 3, and,

Fig. 5 is a transverse sectional view of the structure, taken substantially along the line 5—5 of Fig. 3.

In the embodiment of the invention illustrated herewith my improved mechanism is illustrated as applied to an electric curling iron, although it is to be understood that it is applicable for use in connection with a variety of other electrically heated devices and appliances, such as, hot water bottles, flatirons, electric curlers, etc., and more particularly in connection with such devices or appliances as require a control means capable of operating within narrow temperature ranges.

In the form of the invention shown herein, 1 designates generally an electric curling iron provided with a handle 2, a fixed blade 3, and a movable blade 4. In the structure shown the fixed blade 3 has a collar 5 secured thereto which is provided upon opposite sides with parallel grooves 6 having depressions 7 located adjacent the inner ends thereof, the said grooves being adapted to receive oppositely positioned projections 8 carried by a portion of the movable blade 4.

A leaf spring 9 is secured to the base por-

tion 10 of the movable blade 4 in such a manner that its free end is adapted to engage a portion of the fixed blade 3 to resiliently seat the projections 8 in the depressions 7 of the grooves 6 when the parts are in assembled position as shown in Fig. 1, while permitting separation of the parts by forcing the movable blade 4 towards the fixed blade 3 when it is necessary to disassemble the parts.

The fixed blade 3 has a portion 11 of the thermostatic member 12 secured therein and a portion 13 of said thermostatic member extending rearwardly from the fixed blade 3, and adapted to be positioned within the handle 2 to serve as a support for certain of the elements of the control mechanism.

In assembling the parts the handle 2 is first passed over the fixed blade 3 and forced rearwardly thereon until an abutment 14 thereon engages the portion 13 of the thermostatic member. The movable blade 4 is then pressed into engagement with the fixed blade in such position as to bring the oppositely positioned projections 8 into registry with the open ends of the grooves 6. The projections 8 are then forced rearwardly into the grooves 6 to a position opposite the depressions 7 into which they are drawn by the pressure exerted by the spring 9 carried by the movable blade.

The fixed blade 3 of the iron comprises a tapered tubular metallic member having the smaller end thereof closed and adapted to receive an electrical heating element 15 and one end 11 of the fixed portion 12 of the heat responsive member. The electrical heating element 15 may be formed in any suitable or desired manner and in the present instance comprises several thin plates 16 of mica or other suitable insulating material having positioned therebetween a suitable resistance coil 18 having terminals 19 and 20 adapted for connection to the terminals of an electric circuit for heating the fixed blade 3 of the iron. The heat responsive member 12 is of tubular construction substantially throughout its length and preferably contains a quantity of fluid material 21 capable of expanding under the influence of an increase in temperature and correspondingly contracting upon a decrease in temperature. The heat responsive member 12 comprises the fixed portion 11 located within the tubular portion of the fixed blade 3 in close contact with the heating element 15 and the fixed portion 13 extending outwardly therefrom and terminating in a curved free end portion 22 which is free to move in response to variations in temperature and which is caused to move outwardly from the longitudinal axis of the fixed blade by any substantial increase in temperature of the fluid contained therein. The curved end portion 22 of the heat responsive member is spaced from the heating element 15 a suffi-

cient distance to be located out of the sphere of direct influence of the heating element and is actuated wholly by the expansion or contraction of the fluid contained in the heat responsive member, which expansion or contraction is induced through the heating or cooling of the liquid by temperature changes in the heating element.

The portion 13 of the heat responsive member 12 which extends outwardly from the fixed blade 3 is secured in any suitable manner to a supporting member 23 which carries a plate 24 of insulating material firmly secured thereto as by screws or other suitable fastening means 25. The plate 24 may be formed of bakelite, ebonite or other suitable insulating material and one end thereof is recessed as at 26 to provide a space for the reception of a part of the movable portion 22 of the heat responsive member, thus forming outwardly projecting sides 27 and 28, to which are secured metal plates 29 and 30 respectively by means of suitable fastening devices 31, for supporting a contact plug 32.

The contact plug 32 comprises a pair of circular disks 33 and 34 formed of insulating material which are secured to the plates 29 and 30 by suitable fastening means 35.

A tubular contact plate 36 is carried by the disks 33 and 34 and provided with a flange 37 located between the disks 33 and 34 by which electrical connection is made with the metal plate 29 for one branch of an electric circuit. A tubular contact plate 38 which makes connection with the other branch of the circuit is supported in spaced relation to the contact plate 36, by means of a metal screw 39 which connects the contact plate 38 with a flange 40 carried by the other metallic plate 30. The tubular contact plates 36 and 38 and their connecting parts are insulated from each other by the disks 33 and 34 and bushing 41, each of which is formed of suitable insulating material.

The metal plates 29 and 30 are secured to the plate 24 of insulating material and are thereby insulated from each other and the metal elements of the structure. The metal plate 29 which is in electrical connection with the contact plate 36 is directly connected with one terminal 19 of the resistance element by the conducting wire 43. A conductor 44 and flexible wire connection 45 connect the plate 30 with a movable contact member 46 carried by a switch member 47, and insulated therefrom by means of an insulating bushing 48. A stationary contact member 49 is carried by the plate 24 of insulating material and has secured thereto the other terminal 20 of the resistance element.

The movable end portion 22 of the heat responsive member 12 which extends beyond the anchoring plate 23 is hollow throughout the major portion of its extent and the hol-

low interior portion thereof is continuous with the hollow interior portions of the parts 11 and 13 thereof. The switch member 47 is secured to the free end of the movable portion 22 of the heat responsive member as at 50 by soldering or in any other suitable manner. One side of the insulating plate 24 is recessed to receive a thin metal plate 51 which is provided with a dent or concavo-convex portion 52 which normally occupies the position as shown in full lines in Fig. 2 of the drawings. The concavo-convex portion 52 is of materially less superficial area than the metal plate 51, and has its edges spaced from the edges of the metal plate 51 upon all sides thereof. A circular recess 53 is formed in the plate 24 opposite the concavo-convex portion 52 of the plate 51 and an opening 54 extends through the plate 24 and communicates with the recess 53 adjacent to the central part thereof. An opening 55 is formed in the switch member 47 or in the extreme end portion of the free end 22 of the heat responsive member or in both, and a connecting member 56 is passed through an opening formed in the central part of the concavo-convex portion of the metal plate 51 and through the openings 54 and 55. The connecting member 56 may be provided with an enlarged head 57 adapted to engage the convex face of the concavo-convex portion 52 of the plate 51 when the concavo-convex portion of the plate 51 occupies its normal position and an adjusting nut 58 may be threaded upon the opposite end of the connecting member 56 to overlie and engage the outer surface of the switch or movable end portion of the heat responsive member. The concavo-convex portion of the thin metal plate is resilient, in that it tends to return automatically to its normal position as shown in Fig. 2 of the drawings after deformation caused by movement of the free end portion 22 of the heat expansive member into position to move the switch member 47 so as to carry the contact 46 out of engagement with the contact 49.

The nut 58 may be adjusted as desired upon the connecting member 56 and held in the desired adjusted position by means of a flexible spring locking member 59 having one end secured to the switch member as at 60 and the opposite end adapted to engage any one of a plurality of radial notches 61 formed in the nut 58.

In the operation of the structure the contact plug 32 is inserted in a suitable socket to bring the contact plates 36 and 38 into effective contact with the terminals of an electric circuit whereby current may be provided for heating the device.

The current may pass from the contact plate 36 through the flange 37 and plate 29 to the conductor 43 and from thence to the resistance element 18 through connection

with the terminal 19. The other terminal 20 of the resistance element 18 is secured to the fixed contact 49 carried by the plate 24, and the circuit from the movable contact 46 is completed to the contact plate 38 by the flexible wire connection 45, conductor 44, metal plate 30 with its flange 40, and connecting screw 39.

In the normal position of the parts as shown in full lines in Fig. 2, the contacts 46 and 49 are in engagement and the circuit is closed through the resistance element 18. As the temperature of the resistance element is raised the fluid 21 contained in the heat responsive member 12 expands and causes the free end portion 22 thereof to move outwardly from the longitudinal axis of the structure. The outward movement of the free end portion 22 of the heat responsive member is restrained however, by the resistance offered by the head 57 of the connecting member 56 coming into engagement with the convex face of the concavo-convex portion 52 of the metal plate 51. When the force tending to move the free end portion 22 of the heat responsive member outwardly from the longitudinal axis of the structure is sufficient to overcome the resistance to change exerted by the concavo-convex portion 52 of the metal plate 51, the concavo-convex portion 52 of the plate 51 suddenly moves from its full line position as shown in Fig. 2 to its dotted line position as shown in that figure, thus permitting quick movement of the free end portion 22 of the heat responsive member and the switch member 47 outwardly from the longitudinal axis of the structure and into the position of these parts as shown by dotted lines in Fig. 2, whereby the contact member 46 is suddenly separated from the contact member 49 in such a manner as to prevent arcing as the current through the resistance element 18 is broken.

The breaking of the circuit through the resistance element 18 permits the cooling of the liquid in the heat responsive member 12 to such an extent that the free end portion 22 no longer tends to move outwardly from the longitudinal axis of the structure as strongly as it did in drawing the concavo-convex portion 52 of the plate 51 into its dotted line position, and as a consequence the force exerted by the free end portion 22 of the heat responsive member is eventually overcome by the tendency of the concavo-convex portion 52 of the plate 51 to resume its initial full line position. When this point is reached the concavo-convex portion 52 of the member 51 suddenly returns to its initial full line position, thus drawing the free end portion 22 of the heat responsive member and the switch member 47 inwardly into the full line positions shown in Fig. 2, and returning the contact 46 into engagement with the

contact 49 to close the circuit through the resistance element 18.

By securing the adjusting nut 58 in the proper position upon the connecting member 56 the control mechanism may be set to break the circuit through the resistance element 18 at any desired temperature. When the parts of the heat responsive member are properly proportioned the structure provides a very delicate means for controlling the temperature of the heated member, and may be made effective for controlling the temperature of the iron within a temperature range of one or two degrees and at very low temperatures, such as from one to two hundred degrees F.

While I have shown the switch member 47 as carried by the free end of the movable end portion of the heat responsive member, it is to be understood that the switch plate may be otherwise mounted and controlled by the movable portion of the heat responsive member.

Various changes may also be made in the form and arrangement of the other parts of the mechanism, as well as the changes in the shape and proportions of the elements employed, and the substitution of equivalents without departing from the spirit and scope of the appended claims, which are to be broadly construed in the light of the foregoing description.

What I claim is:—

1. In a control mechanism for an electrically heated device, the combination with a heat transmitting member, a heat responsive member comprising a closed tube having a fixed portion located in position to absorb heat from the heat transmitting member and a portion remote from said heat absorbing portion and free to move in response to variations in temperature, a contact actuated by movement of the free portion of said heat responsive member, and means for restraining the movement of the free portion of said heat responsive member, said means being operative to effect a sudden release of the movable portion of said heat responsive member when the temperature of the same reaches a predetermined point, whereby said contact is given a quick movement to open an electric circuit.

2. In a control mechanism for an electrically heated device, the combination with a heat responsive member having a fixed portion and a portion free to move in response to variations in temperature, of a switch member carried by the movable portion of said heat responsive member and movable with the movable portion of said heat responsive member into or out of engagement with a cooperating stationary switch member to open or close an electric circuit, and means for restraining the movement of the free portion of said heat responsive member in one direction, said means being operative

to effect a quick release of the movable portion of said heat responsive member when the temperature of the same reaches a predetermined point.

3. In an apparatus of the character described the combination of a temperature operated controlling member having a movable portion, an electrical contact carried by the movable portion of said member, a stationary electrical contact with which the electrical contact carried by the movable portion of said member is adapted to cooperate to open or close an electric circuit, and resilient means for restraining movement of the movable portion of said controlling member under certain conditions of temperature and for permitting quick movement of the same when the temperature reaches a predetermined point.

4. In a control mechanism for an electrically heated device, a thermostatic member comprising a closed tube containing an expansible material and having a fixed portion and an end portion free to move in response to variations in temperature, a switch member carried by the free end portion of said tube and movable to cooperate with a stationary switch member to open or close an electric circuit upon movement of the free end portion of said tube, and resilient means for restraining the movement of the free end portion of said tube under certain conditions of temperature and permitting a quick movement of the free end portion of said tube when the temperature reaches a predetermined point whereby quick movement of said switch member is effected.

5. In a control mechanism for an electrically heated device, a thermostatic member comprising a closed tube having a fixed portion and a curved end portion remote from said fixed portion and free to move in response to variations in temperature, a switch member carried by the free end portion of said tube and movable therewith to open or close an electric circuit upon movement of the free end portion of said tube, and means comprising a thin metallic plate provided with a resilient deformable portion for restraining the movement of the free end portion of said tube until the temperature reaches a predetermined point and operative to release the free end portion of said tube when the temperature reaches a predetermined point whereby the free end portion of said tube causes a quick movement of said switch to open the electric circuit.

6. In a control mechanism for an electrically heated device, a thermostatic member comprising a closed end tube having a curved end portion free to move in response to variations in temperature, a switch member carried by the free end portion of said tube, and means comprising a thin metallic plate provided with a resilient deformable portion for re-

tarding the movement of the free end portion of said tube until the temperature reaches a predetermined point and operative to effect a quick release of the free end portion of said tube when the temperature reaches a predetermined point and thereby cause a quick movement of said switch to open the circuit.

7. In a control mechanism, a thermostatic member comprising an elongated closed end tube having a fixed portion located in proximity to a heat transmitting member and a free end portion remote from and located outside the sphere of direct influence of said heat transmitting member and movable in response to variations in temperature, a switch member movable to open or close an electric circuit and actuatable upon movement of the free end portion of said tube, means for restraining the movement of the free end portion of said tube at temperatures above or below a predetermined point but operable to permit a sudden movement of the free end portion of said tube at said predetermined temperature and to return the free end portion of said tube to its initial position upon decrease in temperature whereby quick movement of said switch is effected to open or close the electric circuit.

8. In a control mechanism, a thermostatic member, a switch for opening or closing an electric circuit, a metal plate having a resilient dented portion formed therein of less area than the area of said plate and movable independently of a portion of said plate, and means connecting the dented portion of said metal plate with said thermostatic member for effecting quick movement of said switch at or near the critical temperature point.

9. In a control mechanism, an elongated thermostatic member, a switch for opening or closing an electric circuit, a thin metal plate having a resilient deformable portion and a relatively stable portion located outwardly of said deformable portion, means connecting the deformable portion of said metal plate with said thermostatic member for effecting quick movement of said switch at or near the critical temperature point.

10. In a control mechanism for an electrically heated device, the combination with a heat responsive member comprising a closed tube containing an expansible material and having a portion thereof free to move in response to variations in temperature, a switch carried by the free portion of said heat responsive member, and means for restraining the movement of the free portion of said heat responsive member throughout a portion of its path.

11. In a control mechanism, a thermostatic member, a switch actuated by said thermostatic member for opening or closing an electric circuit, a metal plate provided with a portion and a distorted portion the

distorted portion being movable under pressure out of its normal position and automatically returnable to its normal position upon the removal of pressure thereon independently of the remaining portion of said plate, and means directly connecting said thermostatic member with the distorted portion of said plate for controlling the movement of said switch.

12. In a control mechanism, a thermostatic member, a switch for opening or closing an electric circuit, a metal plate having a relatively stable portion and a resilient deformable portion, and means for connecting said switch with the deformable portion of said metal plate for resisting the movement of said switch to open the circuit under certain conditions of temperature and returning said switch into position to close the circuit under other conditions of temperature, without material movement of the relatively stable portion of said plate.

13. In a control mechanism, a thermostatic member, a switch carried by said thermostatic member for opening or closing an electric circuit, a metal plate having a concavo-convex portion, means for operatively connecting the concavo-convex portion of said metal plate with said switch member, and means for varying the effective length of said connecting means.

14. In a device of the character described a thin metal plate provided with a deformable portion, a temperature controlled movable member, means for operatively connecting the deformable portion of said plate with said movable member, and adjustable means for varying the effective length of said connecting means.

15. In a device of the character described, a switch member movable to open or close an electric circuit, a thin metal plate provided with a concavo-convex portion located within and spaced from the periphery of said thin metal plate on all sides thereof, and means for positively connecting said switch with the concavo-convex portion of said metal plate for controlling the movement of said switch.

16. In a device of the character described, a thermostatic member having a portion free to move in response to variations in temperature, a switch carried by the movable portion of said thermostatic member, and means for restraining the movement of the free portion of said member under certain conditions of temperature while permitting a quick movement of the free portion of said member when the temperature reaches a predetermined point whereby quick movement of said switch is effected.

17. In an apparatus of the character described, the combination of a temperature operated controlling member having a portion movable upon increase in temperature and provided with an electric contact member

for closing a circuit, and resilient means for restraining the movement of the movable portion of said controlling member but permitting quick movement thereof to open the circuit when the temperature reaches a predetermined point, said resilient means being effective upon decrease in temperature to return the movable portion of said controlling member to its initial position and close the circuit.

18. In a control mechanism for an electrical device, the combination with a heat responsive member having one end portion thereof free to move in response to variations in temperature, a switch member carried by the movable portion of said heat responsive member, and resilient means for restraining movement of the free end portion of said heat responsive member in one direction under increase in temperature while permitting quick movement of the same when the temperature reaches a predetermined point, said resilient means being operative to effect a quick movement of the free end portion of said controlling member in the opposite direction when the temperature falls below a predetermined point.

In testimony whereof I have affixed my signature.

GODFREY ALFRED DE LANGIE.

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