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F. J. HARDMAN

1,952,129

CIRCUIT BREAKER

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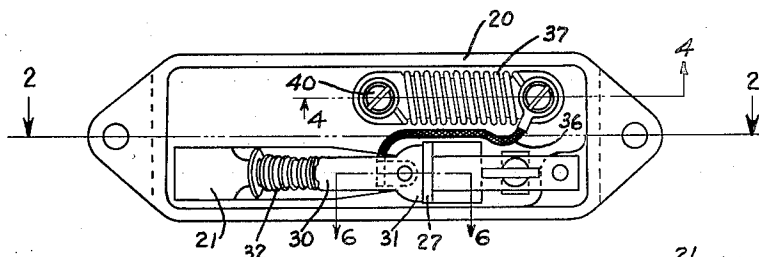


Fig. 1.

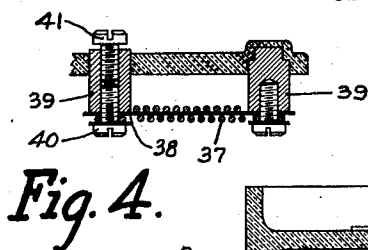


Fig. 4.

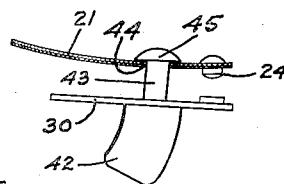


Fig. 7.

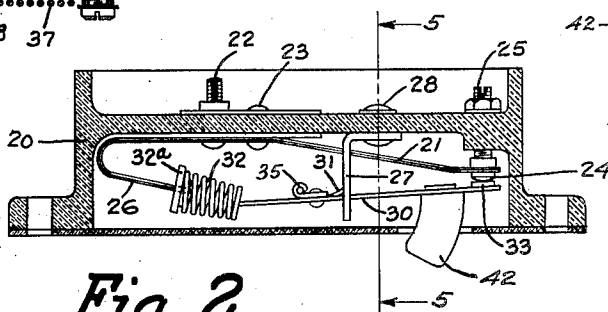


Fig. 2.

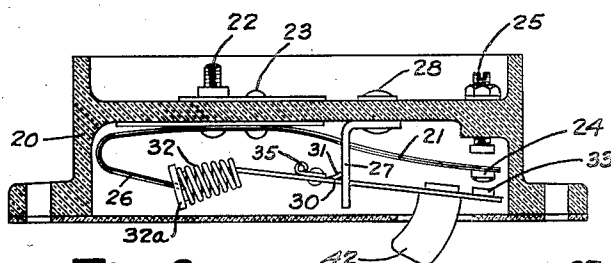


Fig. 3.

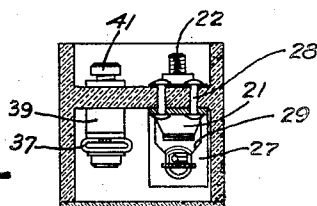


Fig. 6.

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Fig. 5.



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UNITED STATES PATENT OFFICE

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CIRCUIT BREAKER

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12 Claims. (Cl. 200—138)

This invention relates to improvements in thermostatically controlled switches.

It is one of the objects of the present invention to provide a temperature responsive switch having a quick make and break action and which has greater sensitivity than found heretofore in switches of this type. This object is accomplished by providing a toggle device comprising pivotally connected elements resiliently urged away from each other whereby the toggle will tend to "break", with respect to a line connecting the remote ends of the elements, in either direction depending upon the location of their pivotal connection with respect to said line, said toggle device cooperating with thermostatic members operable cumulatively to move said elements in opposite directions respectively with respect to their pivotal connection and a switch member which is actuated in response to the "breaking" of the toggle.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawing wherein a preferred embodiment of one form of the present invention is clearly shown.

In the drawing:

Fig. 1 is an inverted plan view of the thermostatic switch with the cover plate removed.

Fig. 2 is a sectional view taken along the line 2—2 of Fig. 1, and shows the contacts in engagement.

Fig. 3 is a view similar to Fig. 2 showing the contacts disengaged.

Fig. 4 is a view taken on the line 4—4 of Fig. 1 and illustrates the structure of the heating unit.

Fig. 5 is a sectional view taken along the line 5—5 of Fig. 2.

Fig. 6 is an enlarged detail view of the bracket structure as related to the thermostatic element and pivoted member, this view is taken along line 6—6 of Fig. 1.

Fig. 7 is an enlarged view of the insulating connection between the contacts provided for automatic resisting of the switch.

Referring to the drawing, the device is shown comprising a housing 20, preferably made up of any suitable insulating material. This housing may be made up of metal which would require the insulation of substantially all of the interior elements. However, by constructing the housing of a molded condensation product such as bakelite or the like, complex insulation of the various movable parts within the switch is practically eliminated.

The housing contains a thermostatic element 21 secured to the housing by a terminal screw 22 and a rivet 23. The one end of the thermo-

static element 21 carries a contact 24. This end of the thermostatic element normally rests against a stop screw 25 carried by the housing 20, this screw being adjustable so that this movable end of the thermostatic element 21 may be maintained in a proper position by the adjustment of the screw 25. The other end of the thermostatic element 21 has a hook-shaped end as at 26.

A bracket 27 is secured in the housing 20 by rivets 28, this bracket 27 having an aperture 29 for receiving the plate 30. A tongue 31 is pressed or punched from the plate 30, said tongue engaging the bracket 27 and acting as a fulcrum for pivotally supporting the plate 30 upon said bracket 27. To maintain the tongue 31 in engagement with bracket 27, a resilient element or spring 32 is interposed between the end of the hooked portion 26 of the thermostat 21 and the one end of the plate 30. The spring is insulatingly supported upon the end of the thermostatic portion 26 by an insulating collar 32a, the opposite end of the spring being secured to the end of plate 30 in any suitable manner. A contact 33 is carried at one end of the plate 30, said contact being adapted to engage the contact 24 supported at the end of the thermostatic element 21. As shown in Fig. 2, spring 32 is so positioned relative to one end of the plate 30 and the thermostatic portion 26 that it exerts a force upon the end of the plate 30, urging the said plate 30 in a counter-clockwise direction about its fulcrum tongue 31 so that contact 33 is urged into engagement with the contact 24 on the thermostatic element 21. As shown in Fig. 3 the plate 30 is moved into a position in which spring 32 is exerting pressure upon the end of plate 30 to move the contact 33 out of engagement with the associated contact 24.

Plate 30 carries a terminal 35 to which one end of a wire 36 is connected. The other end of this wire is electrically connected to one end of the heater coil 37, the opposite end of said heater coil being connected to the screw 40 which is electrically connected with screw 41 forming a terminal for one end of the main wire leading to the switch. The heater wire 37 is wound about heat resisting and insulating material 38 such as mica or the like, said material being supported upon standards 39 provided in the housing 20. As has been mentioned heretofore, the other terminal screw is designated by the numeral 22, the other main wire being connectible to this screw. 42 designates the resetting button.

The device functions as follows:

Normally the switch is open. To close the circuit through the switch, the resetting button 42, preferably of insulating material and carried by the plate 30, is pressed so that the contact 33 engages with contact 24 supported by thermo-

static element 21 which normally lies in the position as shown in Fig. 2. As soon as the plate 30 is moved into the position as shown in Fig. 2, the spring 32 will be moved into the position in which it will exert pressure to move the plate 30 in a counter-clockwise direction about its fulcrum tongue 31, thereby urging contact 33 into engagement with contact 24. Current now flows from the main wire into the terminals 41 and 40 and thence through the heater coil 37, wire 36 to the terminal 35, plate 30 and thence across contacts 33 and 24, through the thermostatic element 21, terminal screw 22 to the other side of the line. Excessive current flowing through the heater coil 37 will eventually create sufficient heat within the housing 20 to cause the thermostatic element 21 to flex toward the position as shown in Fig. 3. In flexing, the contact carrying end of the thermostatic element 21 moves so that its contact 24 is urged against the contact 33 and thus said contact is moved in the same direction against the effect of the spring 32 upon the plate 30. Movement of the contact 33 by the contact 24 away from the stop screw 25 moves the plate 30 in a clockwise direction and thus the end thereof, engaged by the spring 32 will be moved toward alignment with the end 26 of the thermostatic element 21 which also engages the spring. The heat within the housing 20 also causes the hook-shaped end of the thermostatic element 21 to flex, resulting in movement of the end portion 26 which engages the spring supporting insulating washer 32a, in a direction opposite the movement of the end of the spring engaged by the plate 30, so that as the contact carrying plate 30 is moved clockwise by the contact 24, the ends of the spring 32 are moved counter-clockwise, resulting in an alignment of the end 26 of the thermostatic element, the end of the plate 30 engaging with the spring, and the fulcrum tongue 31 of said plate. As soon as the plate 30 is moved slightly beyond this alignment, spring 31 will suddenly flip the plate 30 clockwise so that contact 33 is suddenly moved out of engagement with the contact 24, the contacts 24 and 33 and their supporting members 21 and 30 respectively assuming the position as shown in Fig. 3. The circuit having been broken, the heat within the housing 20 will be dissipated, thereby permitting the thermostatic element 21 gradually to return to the position as shown in the Fig. 2, after which plate 30 may again be operated by the member 42 to close the circuit through contacts 24 and 33.

In order to make the device self-setting, the operating member 42 may have an insulating stem 43 extending therefrom, through an opening 44 in the thermostatic element 21, this portion 43 of the operating portion having an enlarged head 45 engaging the side of the thermostatic element 21 opposite the plate 30. With this type of operating member 42 the plate 30 will be drawn toward the position as shown in Fig. 2 by the return movement of the thermostatic element 21 in response to lowering temperatures so that, before said thermostatic element 21 reaches the position as shown in Fig. 2, it will have moved the plate 30 into a position in which spring 32 may suddenly flip said plate 30 counter-clockwise to cause its contact 33 to again engage the contact 24, said spring thus holding the plate 30 in position as shown in Fig. 2 until sufficient heat has been provided within the housing 20 to again flex the thermostatic element 21 to move against the contact 33.

In the present invention applicant has provided a thermostatic switch including two movable contacts, one of which is movable by the thermostatic element, the other being mounted upon a pivoted arm and being movable through a certain range by the cooperating contact which, as has been mentioned, is carried on a thermostatic element.

One advantage of the present device is that while the thermostat is operating to approach the instant in which circuit interruption is obtained, one contact, carried by the thermostatic element, is moving against the other contact whose movement is resisted by a spring so that good contact pressure is maintained until the instant the spring suddenly flips the contact carried on the arm out of engagement with the contact carried on the thermostatic element. At no time is the contact pressure between said contacts reduced sufficiently to cause arcing, for both contacts are being urged in opposite directions, one against the other, the force exerted by the thermostatic element overcoming that of the spring which urges its contact against the thermostatically operated contact. The contact supporting elements are so arranged that during their operation, a slight rubbing movement between the contacts obtains, thereby tending to eliminate any pitting between the contacts caused by any arcing which might occur upon the sudden disengagement of said contacts.

Another feature of the device is that the spring is interposed between two movable elements which at all times move in opposite directions, thereby tending to more sudden disengagement of the contacts and thereby substantially reducing the possibility of arcing.

While the form of embodiment of the present invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. A thermo switch comprising, in combination, a thermostatic strip arranged to flex in response to temperature changes so as to occupy a given position at ordinary temperatures and to move away from said position upon an increase in temperature; a contact carried at one end of said strip; a pivoted member; a contact carried at one end of said pivoted member and adapted to engage the contact on the strip; and elastic means supported between the ends of said thermostatic strip and pivoted member opposite their contacts for urging the pivoted member into either its contact making or breaking position.

2. A thermo switch comprising, in combination, a thermostatic strip arranged to flex in response to temperature changes; a contact carried by said strip; a movable plate; a contact carried by said plate and adapted to engage the aforementioned contact; and a spring interposed between the thermostatic strip and plate, yieldably urging the contact on the plate into engagement with the contact on the strip while the former is being moved by the latter and until a proper position is attained at which said spring is adapted quickly to move the plate to disengage its contact from the contact on the strip.

3. A thermo switch comprising, in combination, a housing, a thermostatic strip insulatingly supported in said housing; a contact carried at one end of said strip; a bracket insulatingly supported in the housing; an arm pivotally supported on the bracket; a contact carried at one end of

the arm and adapted to engage the contact on the thermostatic strip; and a spring interposed between the other ends of the thermostatic strip and pivoted arm, said spring normally urging the arm to hold its contact in engagement with the cooperating contact, said spring, however, being shiftable by the operation of the arm by the thermostatic strip quickly to move said arm into contact engaging position when the said arm has been moved in a proper position by said strip.

4. A thermo switch comprising, in combination, a housing made of insulating material, a thermostatic strip supported within said housing; a contact carried at one end of the thermostatic strip; an arm pivotally supported within said housing; a contact secured at one end of said arm and adapted to engage the aforementioned contact and a coil spring insulatingly supported between the other ends of the thermostatic strip and arm, said spring normally exerting pressure upon the arm to maintain its contact in engagement with the contact on the thermostatic switch, said spring, however, being shifted by the movement of the one end of the thermostatic device and the movement of the arm by the opposite end of the thermostatic device whereby said spring is adapted quickly to throw the arm into contact disengaging position when a proper position is attained.

5. A thermo switch comprising, in combination, a toggle device comprising pivotally connected elements, said device comprising a normally compressed helical spring and a lever pivoted intermediate its ends, a switch contact carried by the lever arm remote from the spring, a second contact engageable with the first contact, and a bimetallic thermostat fixed intermediate its ends so as to provide two thermostat members one of said members extending directly from the fixed point toward the first contact and carrying the second contact and the other member having a portion extending also toward the switch contacts and connected with one end of said spring, said thermostat members bending in the same direction in response to temperature changes whereby they are operable cumulatively to move the toggle elements in opposite directions, respectively, with respect to their pivotal connection.

6. A thermo switch, comprising in combination, a toggle device including cooperating members, one of said members being pivotally mounted, means resiliently forcing said members away from each other on one side of the pivotal mounting, a contact secured to the pivotally mounted member on the other side of the pivotal mounting, a cooperating contact adapted to engage the other contact, and thermostatic means for changing the direction of the force of the resilient forcing means so that after a predetermined change of direction of the force said contacts disengage with a snap action.

7. A thermo switch, comprising in combination, a toggle device including pivotally connected elements, means resiliently urging said elements away from each other, said means effecting a tendency of said toggle to "break" with respect to a line connecting the remote ends of said elements, one of said elements being pivotally mounted on a pivotal support and having an arm extending from the pivotal support therefor, switching means having cooperating contacts

adapted to be engaged and one of which contacts is carried by one end of the extending arm, and thermostatic means for moving said arm and resilient means in opposite directions, respectively, to effect "breaking" of said toggle and hence control of said cooperating contacts.

8. A thermo switch, comprising in combination, a thermostatic strip adapted to flex in response to temperature changes so that it occupies a given position at normal temperature and flexes from said position upon a change of temperature; a contact secured to said strip; a pivotally mounted member; a contact carried by said pivotally mounted member and in alignment for engagement with the first mentioned contact; and resilient means pivotally supported between the ends of said thermostatic strip and pivotally mounted member for urging the pivoted member into either its contact making or breaking position.

9. In a thermo switch, the combination comprising, a support, a thermostatic member secured near its mid-portion to said support, a contact secured to said thermostatic member near one end thereof, a pivotally mounted member having a cooperating contact mounted thereon, and means pivotally coupling the other end of said thermostatic member to an end of said pivotally mounted member.

10. In a thermo switch, the combination comprising, a support, a thermostatic member secured near its mid-portion to said support, a contact secured to said thermostatic member near one end thereof, a pivotally mounted member having a cooperating contact mounted thereon, a manual operating member secured to said pivotally mounted member, and means pivotally and resiliently coupling the other end of said thermostatic member to an end of said pivotally mounted member.

11. In a thermo switch, the combination comprising, a support, a thermostatic member secured near its mid-portion to said support, a contact secured to said thermostatic member near one end thereof, a pivotally mounted member having a cooperating contact mounted thereon, means pivotally coupling the other end of said thermostatic member to an end of said pivotally mounted member, and additional means coupling said pivotally mounted member to said thermostatic member so that motion of said thermostatic member in one direction causes corresponding movement of said pivotally mounted member and movement of said thermostatic member in the opposite direction causes said pivotally mounted member to follow after a predetermined movement of the thermostatic member.

12. A thermo switch comprising, in combination, a toggle device including a thermostatic member and a cooperating member, said cooperating member being pivotally mounted; means resiliently forcing said members away from each other on one side of the pivotal mounting; a contact mounted on said cooperating member on the other side of the pivotal mounting; a cooperating contact adapted to engage the other contact; and said thermostatic member changing the direction of the force of the resilient forcing means so that after a predetermined change of direction of the force said contacts disengage with a snap action.

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