

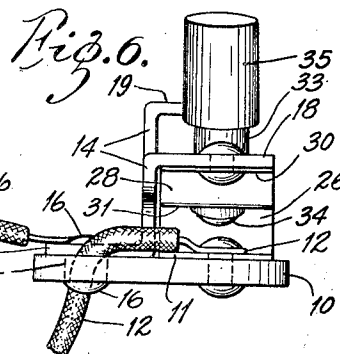
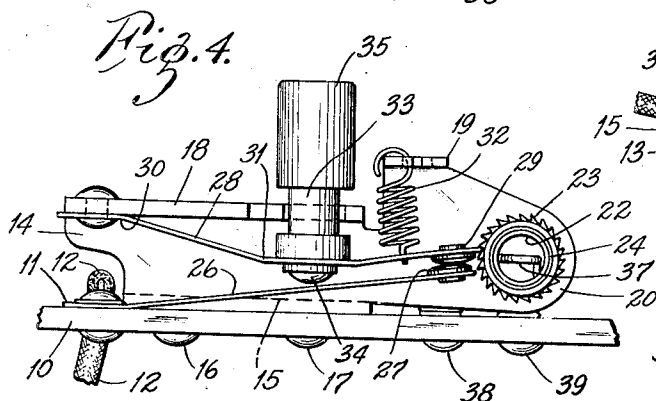
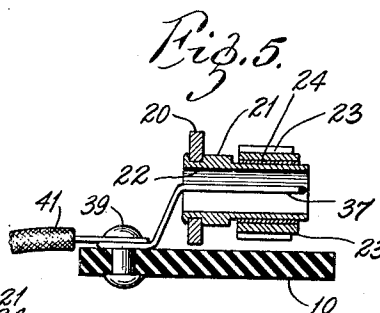
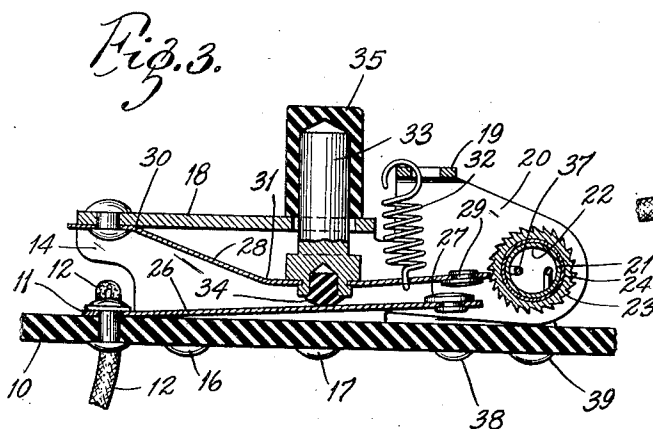
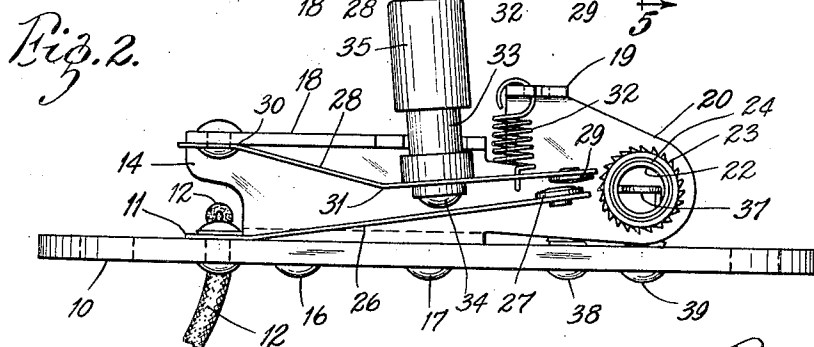
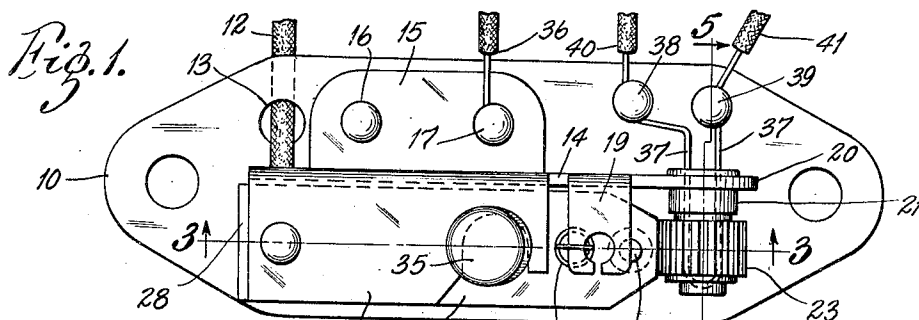
March 14, 1939.

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2,150,635

MOTOR PROTECTOR SWITCH

Filed July 22, 1936



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UNITED STATES PATENT OFFICE

2,150,635

MOTOR PROTECTOR SWITCH

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Application July 22, 1936, Serial No. 91,887

17 Claims. (Cl. 200—116)

The present invention relates to a switch adapted to be connected in circuit with a motor and actuated to open position when certain temperature conditions exceed a given maximum.

5 The switch includes a normally fixed member movable when its temperature reaches a certain value, and which member is adapted to maintain the switch closed. Means are provided directly to apply heat to this member, and it also may be located so as to be subject to ambient temperatures.

10 It is an object of the invention to provide, in a switch of this kind, two switch blades that are adapted to be held in contact by the thermally-responsive member and which move, and are retained, out of contact upon release of the thermal member.

15 It is a further object of the invention to provide means for resetting the switch blades to closed positions in suchwise that they can be brought into contact only if the movable member is held immovable.

20 It is a further object to provide such resetting means fixedly upon one of the switch blades, whereby to increase the strength and simplicity of the device.

25 It is a further object to provide means rigidly on one switch blade to prevent contact between the blades when they are not held by the thermal element, but which will permit contact when they are so held.

30 More specifically, it is an object of the invention to provide a spring-like relatively resilient switch blade and a second spring-like relatively stiff switch blade so positioned that, when the relatively resilient blade is held by the movable member, it will be deflected until contact is effected; but which, when it is not held by the movable member, will not be deflected to effect contact.

35 It is a further object to provide a switch of this kind that is trip-free.

In the drawing—

Fig. 1 is a plan view of the switch.

40 Fig. 2 is an elevation taken from the lower part of Fig. 1.

Fig. 3 is a section on the line 3—3 of Fig. 1.

Fig. 4 is a partial elevation similar to Fig. 2, but with the contacts closed.

Fig. 5 is a section on the line 5—5 of Fig. 1.

50 Fig. 6 is an end view.

The switch may be mounted on a base 10, preferably of insulating material. Two conducting terminal members are mounted on the base 10. The first of these is designated as 11 and to it is brought a lead 12 that may pass through a hole

13 in the base. The second terminal member comprises an upright portion 14 have a flange 15 extending from the bottom thereof, the flange 15 being secured to the base 10 as by rivets 16 and 17. Extending horizontally from the upstanding portion 14 at the top thereof are a flange 18 and a smaller flange 19. The upstanding portion 14 is provided with an extension 20.

As shown in Fig. 5, the extension 20 has a cylindrical hub 21 fixed thereto, the hub being hollow to provide an internal passage 22. Rotatably mounted upon the hub 21 is a ratchet wheel 23. Between this ratchet wheel and the hub is provided a supply of fusible metal 24 that, when cooled, holds the ratchet wheel fixedly and non-rotatably upon the hub.

Forming part of the terminal member 11 is a relatively stiff switch blade 26 having at the end thereof a contact element 27. The normal tendency of this switch blade 26 is to move upwardly, as shown in Fig. 2. A relatively thin, resilient switch blade 28 is secured as by means of a rivet to the horizontal flange 18 of the other terminal member. At its outer end, the switch blade 28 has a contact 29. This blade is provided with bends at 30 and 31 and is of such length as to be pressed under one of the teeth of the ratchet wheel 23. Its normal springing tendency is upwardly away from the stiff blade 26. A spring 32 may be provided between the flange 19 and the switch blade 28 tending to draw the outer end of the blade upwardly. This spring, though not essential, insures that the outer end of the blade 28 will be drawn away from the blade 26 when the switch is open.

Secured to the switch blade 28 is a stud 33. The stud extends a distance below the switch blade and has in the end thereof a plug or button 34 adapted to engage with the other switch blade 28. This plug is of non-conducting material. A handle element 35 is provided on the upper end of the stud 33. The lower end of the handle forms an abutment engageable with the flange 18 to limit the downward movement of the blade 28, as shown in Fig. 3.

The rivets 17 may be employed to receive another lead 36 for the circuit. A heater loop 37 is located within the passage 22 of the hub 21. The heater loop extends to terminals 38 and 39 from whence may extend leads 40 and 41, respectively.

The operation of the device is as follows:

The switch is susceptible of many uses. A particular one of these is its application in an electric motor casing, in which event, the leads

12 and 36 may be in series with the main leads to the motor, and the leads 40 and 41, controlling the heater coil 37, may be incidentally connected in series with some part of the motor windings. An illustration of such connection is shown in the

5 copending application of Victor Weber, Serial No. 93,794 filed August 1, 1936.

In such an installation, the switch is mounted relative to the windings of the motor (such as within the motor casing) so as to receive the heat generated thereby and transmitted to the air or to the parts of the motor structure. Such heat will be brought to the fusible metal 24 either by the air or by conduction through the parts of the motor and switch. Hence, the fusible metal 24 will be subject to melting upon rise of the temperature of the motor coils beyond a predetermined critical value.

Likewise, if the windings of the motor are caused to carry an overload such as might occur when the motor is blocked, the current through the heater coil 37 will increase so that said heater becomes hot, in which event this heat will likewise melt the fusible metal 24.

The switch is shown in closed position in Fig. 4. In this case, the fusible metal 24 is hard and the ratchet 23 is held fixed against rotation. The blade 28 is hooked under one of the teeth of the ratchet wheel 23. Owing to the relative resilience of the blade 28 and the strong spring action of the blade 26, the latter forces itself upwardly against the blade 28 and deflects the same upwardly so as to bring the contacts 27 and 29 together to close the circuit. Also, the spring 32, where provided, likewise tends to pull the blade 28 upwardly.

When the heat, either ambient or produced by the heater coil 37, is sufficiently high to melt the fusible metal 24, the pressure of the stiff blade 26, together with that of the blade 28 rotates the wheel 23 until the blade 28 is free of the ratchet tooth, following which it assumes the position of Fig. 2. In this position, the contacts are separate. They are prevented from contact by the plug 34, since upward action of the blade 26 will cause it to move into contact with this plug. The bend 31 is made to cause the blades to be generally parallel in open position, which is accentuated by their being pivoted at spaced points. It will be noted in Fig. 4 that the portion of the blade 28 adjacent the contact 29 is bowed upwardly under the influence of the blade 26 and the spring 32 acting against the retention of the one by the ratchet wheel 23. As soon as the ratchet wheel is released, this bow is removed, which tends to part the contacts. The normal upward limit of movement of the relatively stiff blade 26 may be made to occur at the position shown in Fig. 2 so that any further movement of the blade 28 would remove the contact 29 from the contact 27. However, if this limit is not made at such a point, any further upward movement of the blade 26 will bring the same against the plug 34 before the contacts 27 and 29 can come together, so that, when the switch is open, the plug 34 positively prevents closing of the contacts.

When the temperatures have cooled sufficiently so that the fusible metal 24 again may harden, the switch may be reset. In this case, it is necessary only to depress the handle 35 which forces down the blade 28. This blade is forced down until it engages under one of the teeth of the ratchet wheel 23. In this action, the plug 34 acts against the blade 26 and maintains it away from

the blade 28 so that contacts 27 and 29 are held apart. It will be seen that the pressure on the blade 26 is a positively applied pressure, since the stud 33 is fixed through the handle 35 and the plug 34 is in direct contact with this blade 26. When the blade 28 is duly hooked under the ratchet wheel tooth, a condition that exists when the handle has been depressed into contact with the flange 18, the handle 35 is released. Then the stiff spring blade 26 forces the plug 34 upwardly, deforming the relatively light switch blade 28 until the contacts 27 and 29 come together to close the circuit. This action may be augmented by the spring 32 where the same is provided.

It will be seen that, in resetting, the contacts are held apart. Thus, it is impossible to plug this switch when the fusible metal is soft. Only when it is hard and the ratchet wheel retains the relatively light blade 28 can the contacts close. To use the term of the trade, the switch, therefore, is trip-free. Furthermore, even when the fusible metal is hard, so that the blade 28 is held, the switch may be opened by depressing the handle 35. This furnishes an emergency means of holding the circuit open.

It will be seen that a mechanism has been provided to accomplish the objects set forth. It is likewise inexpensive to make and very simple in its construction and operation, involving a minimum number of parts, and a minimum amount of relative movement between them. In the claims to follow, it is to be understood that certain terms are to be taken in their broader sense, since the principles of this disclosure are not limited to a thermally released switch. In particular, the term contact is not intended to refer solely to separate contact points.

What is claimed is:

1. In a device of the kind described, a terminal member, a contact thereon, a movable switch element, a contact on said element adapted to close with said terminal contact upon movement of said element, thermal means adapted to hold said element and to release same upon occurrence of a predetermined temperature condition, and setting mechanism for moving said element into holding relation with said thermal means, said setting mechanism including means immovable with respect to said movable switch element and adapted to maintain said contacts away from each other during the action of setting the element.
2. In a device of the kind described, a terminal member, a movable switch element adapted to contact with said terminal member, but normally urged away therefrom, thermal means adapted to hold said element whereby said terminal member may contact therewith, and to release said element to permit said element to move away from said member upon occurrence of a predetermined temperature condition, reset means immovably mounted with respect to said movable element to move said element into position wherein, being held by said thermal means, it may contact with said terminal member, and means preventing contact between said element and said terminal member unless said element is held by said thermal means.
3. In a device of the kind described, a base, a movable terminal member thereon, a movable switch element secured at one end to the base, and being adapted to contact adjacent the free end with the terminal member, the free end being normally urged away from the terminal member, thermal means adapted to retain the said

free end of said element in position to be contacted by said terminal member and to release the same upon occurrence of a predetermined temperature condition, and means on said switch element intermediate its ends for depressing it into retaining position with said thermal means, said means including an element contacting said terminal member upon depressing of said means and maintaining said member and said switch element apart.

4. In a device of the kind described, a terminal member, a contact element movable into and out of engagement with the terminal member, an operating member immovable with respect to the contact element, thermally-responsive means for releasably retaining the contact element in engagement with the terminal member, means for moving the contact element out of engagement with the terminal member when the thermally-responsive means releases the contact element, and means on said element for preventing contact between said element and said member save when the element is held by said thermally-responsive means.

5. In a device of the kind described, a base, a first contact movably mounted on the base, a second contact, means mounting said second contact for movement toward and from said first contact, operating means fixedly secured relative to said second contact mounting means for depressing said second contact toward the first, thermal means releasably holding said second contact in position to close with the first contact, an element on said operating means to maintain said first and second contacts apart when the thermal means has released the second contact, and means for rendering said element inoperative when said thermal means retains the second contact whereby said first contact may close therewith.

6. In a device of the kind described, a base, a first contact, a second contact, means mounting said second contact on said base for movement toward and from said first contact, thermal means releasably engageable with a portion of said last named mounting means to retain said contact in a predetermined position, operating means by which said mounting means may be depressed into engagement with said thermal means, means mounting said first contact for movement on said base and normally urging said contact toward said second contact, and an element fixedly mounted on said mounting means engageable with said first contact mounting means to maintain said first contact away from the second upon depression of said second contact mounting means, the upward force of said first contact mounting means acting to displace said element when said portion of said second contact mounting means is retained by said thermal means and said operating means is released, whereby said first contact may close with the second.

7. In a device of the kind described, a first contact, a second contact, means mounting the second for movement toward and from the first, thermal means releasably retaining the second contact in position to close with the first, and trip-free means to move said second contact into retaining position with respect to said thermal means, said trip-free means including a member fixedly attached to said second contact, and operable upon application of force thereon to move the first contact away from the second, and

means to displace said member upon release of said force to close said contacts when said second contact is retained by said thermal means.

8. In a device of the kind described, a first contact, a second contact, integral but deformable means upon which said second contact is mounted for movement toward and from the first contact, means releasably retaining said second contact in position to close with said first contact, operating means adapted by application of pressure thereon to move said second contact into position to be retained by said retaining means, said operating means acting to prevent closing of said contacts during such application of pressure, and means displacing said operating means by deformation of said second contact supporting means upon release of said pressure when said retaining means holds said second contact.

9. In a device of the kind described, a first contact, a base, a second contact, a deformable blade attached adjacent one end to the base and supporting the second contact adjacent the other end for movement toward and from the first contact, displaceable means supporting said first contact, means releasably to retain said blade in position wherein said contacts may close together, means to move said blade to bring it into retaining relation with said retaining means, said moving means being adapted to be actuated by application of force thereto, and including an element adapted to maintain said contacts apart during such application of pressure, and means deforming said blade when it is held by said retaining means and when said pressure is removed, to displace said element and permit said contacts to close together.

10. In a device of the kind described, a base, a terminal member comprising a relatively stiff, resilient blade, a contact member comprising a relatively light, resilient blade, said stiff blade being adapted to abut said light blade to effect electrical contact therewith, said light blade being normally urged out of contact with said stiff blade, releasable means adapted to hold said light blade in position for contact, and operating means to set said light blade under said releasable means, said means acting upon application of pressure thereto to displace said light blade and to abut said stiff blade to maintain said blades apart, said stiff blade displacing said operating means upon removal of the pressure, and when said light blade is held by said releasable means, whereby to effect contact.

11. In a device of the kind described, a base, a relatively stiff, resilient blade mounted thereon, a relatively light, resilient blade mounted thereon for contact with said stiff blade and movable out of such contact, means releasably holding said blades in contact, operating means fixed to said light blade and adapted upon application of pressure thereto to move said light blade into holding relation with said releasable means, said operating means including an element abutting said stiff blade upon application of such pressure to maintain the stiff blade away from the light one, said stiff blade, upon release of the pressure and when the light blade is held by said releasable means, displacing said element by deformation of said light blade whereby contact between the blades is effected.

12. In a device of the kind described, a base, a terminal member mounted on the base for movement toward and from the same, a flexible blade, means mounting the flexible blade for movement toward or from the base for contact with the ter-

5 minal member, an element on the blade interposed between it and the terminal member and normally keeping said blade and member out of contact, means releasably holding said blade in a predetermined position toward said member, and means deforming the blade when so held whereby to displace said element and permit contact between the blade and the member.

10 13. In a device of the kind described, a base, a flanged member overhanging the base, a relatively stiff, resilient blade attached at one end to said base and movable at its other end toward or from the flanged member, a relatively light, resilient blade attached at one end to the flanged member to overlie said stiff blade, and movable at its other end toward or from the stiff blade, an element fixed to the light blade and interposed between said blades, said element normally maintaining said blades apart, fusible means releasably to retain said light blade adjacent its free end in position wherein it may contact with said stiff blade, and means to deform said light blade when so held by said fusible means to displace said interposed element and effect contact between the blades.

25 14. In a device of the kind described, a base, a terminal member mounted on said base for movement toward and from the same, a flexible blade, means attaching said blade at one end to said base, to overlie said terminal member and for movement of its free end toward and from the same, fusible means adapted releasably to hold the free end of the blade in position for contact with the terminal member, an element fixed to said blade between it and said terminal member, and normally maintaining said blade out of contact with said member, said element being located intermediate the ends of the blade, and spring means acting intermediate the ends of the blade to bow the same away from the terminal member when the releasable means retains the

free end of the blade, whereby the fixed element is removed from said terminal member and contact between the blades can be effected.

15 A mechanism as set forth in claim 14, together with a reset means comprising an element fixed to said blade and extending oppositely from said fixed element, and which is adapted, upon application of pressure thereto, to reset the blade in holding position relative to said fusible means, said pressure acting oppositely to said spring means.

16. In a device of the kind described, a base, a movable terminal element, a switch blade movable into position to contact with said terminal element, means releasably to retain said blade in such position, and means fixed to said blade and adapted to act on said terminal member to move the same out of contact with said blade.

17. In a switch mechanism, a base, a first and movable contact on the base, a second contact, a deformable member upon which said second contact is mounted and normally urged away from the first contact, means normally urging said first contact toward the second, thermal means releasably to retain the deformable member in position where said contacts may close, operating means fixed to said deformable member to move it into engagement with the thermal means, said operating means having a portion to render the means normally urging the first contact toward the second inoperative upon depression of the operating means whereby said first contact may be removed from the second, said means normally urging the first contact becoming operative upon release of the operating means to displace the portion thereof aforesaid and by deformation of the deformable member, to close said first contact against the second only when said deformable member is retained by the thermal means.

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