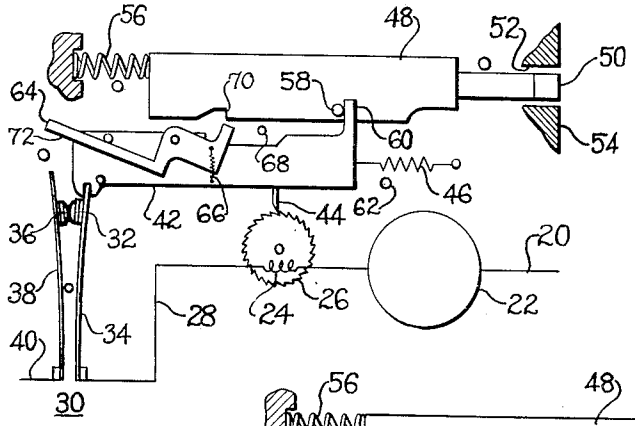
Aug. 15, 1950 D. F. ALEXANDER 2,518,741

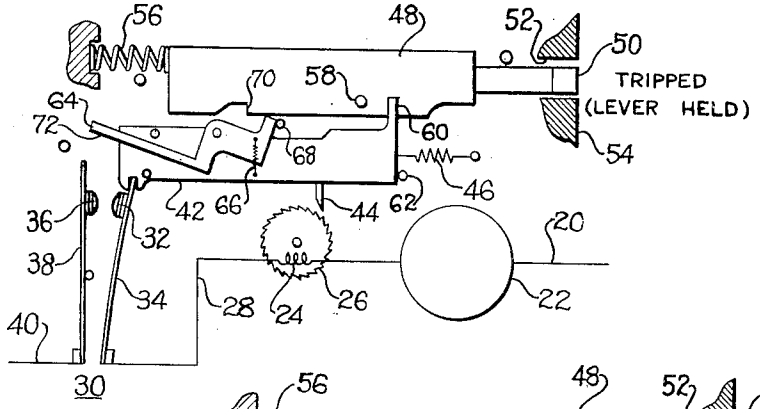
PROTECTOR CONTROL

Filed March 7, 1946



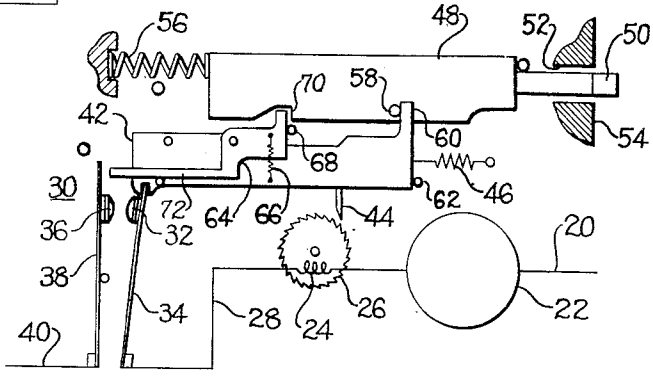
NORMAL

FIG. 1



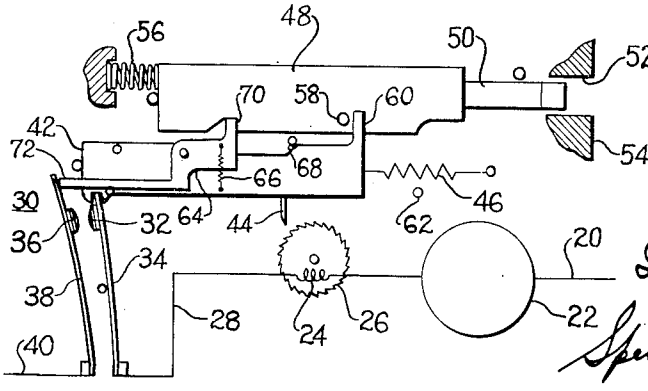
TRIPPED
(LEVER HELD)

FIG. 2



TRIPPED

FIG. 3



RESET

FIG. 4

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PROTECTOR CONTROL

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21 Claims. (Cl. 200—116)

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This invention relates to electrical apparatus and more particularly to circuit overload protectors.

Circuit overload protectors of many varieties have been made for many years. In the case of some protectors, it is possible to force operation of the electrical apparatus under conditions which are dangerous. Operation under such conditions is very liable to produce serious damage which the installation of the protector is intended to eliminate. For example, some protective devices may be held manually in the closed positions, endangering the appliance under overload conditions. Often protector contacts are damaged by manipulation of the resetting device after the protector has been reset properly.

It is an object of my invention to provide a simple inexpensive circuit overload protector which cannot be prevented from opening and holding open the circuit under overload conditions and which cannot be damaged or abused by improper manipulation.

It is another object of my invention to provide a simple inexpensive circuit overload protector which cannot forcibly be kept closed under overload conditions.

It is another object of my invention to provide a simple circuit overload protector in which the contacts cannot be opened manually after resetting.

It is another object of my invention to provide a protector in which free movement of the manual reset operator is permitted at all times without permitting any abuse of the protector.

It is another object of my invention to provide a simple inexpensive circuit overload protector in which the contacts are held open during the resetting of the protector.

To attain these objects I have provided a manually reset switch mechanism tripped by a current responsive or thermal responsive device. The reset operator is normally uncoupled from the current responsive device and the switch mechanism so that the protector cannot be abused or damaged after it has been properly reset. The reset operator is only coupled to the current responsive device and the switch mechanism when the protector has freely tripped without manual interference.

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

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In the drawings:

Fig. 1 is a diagrammatic view of one embodiment of a circuit protector in the normal position illustrating one form of my invention;

Fig. 2 is a similar view of the protector, shown however, with the protector freely tripped but the reset operator held;

Fig. 3 is a similar view of the protector, shown however, with the protector freely tripped without interference with the reset operator; and

Fig. 4 is a similar view, shown however with the protector in the process of being reset.

Referring now to the drawings, there is shown an electric circuit including a conductor **20** and an electrical device such as a motor **22**, a heating coil **24** for heating the solder pot ratchet wheel **26**, a conductor **28** and the switch mechanism **30**, all connected in series. The switch mechanism **30** includes a contact **32** connected by the flexible connection **34** with the conductor **28** and the contact **36** at the upper end of the spring blade **38**, which is anchored and connected to the conductor **40** at its lower end. Since the switch mechanism **30** is connected in series with the circuit, its opening will prevent energization of the electric circuit.

The leaf spring blade **38** when free assumes a true vertical position as shown in Figs. 2 and 3. The position of the contact **32** is controlled by the first member **42** by which it is supported. The member **42** is provided with a pawl **44** which is normally in engagement with the uppermost tooth of the ratchet wheel **26** as shown in Fig. 1. The ratchet wheel **26** is normally held in a fixed position by being soldered upon a pin as in the conventional solder pot construction. This solder has such a low melting point that upon an overload passing through the electric circuit, the pin will be sufficiently heated by the coil **24** surrounding the pin to melt the solder and permit rotation of the ratchet wheel **26**. Below the point of excessive current flow, the solder, however, will remain solid and prevent the rotation of the ratchet wheel **26**. For clearness this is all shown diagrammatically. However, any form of current or thermal responsive device may be used in place of the coil **24** and the ratchet wheel **26**. The first member **42** is normally pulled to the right by the tension spring **46** so that if the solder holding the ratchet wheel **26** melts, the pawl **44** and the member **42** will move to the right to separate the contacts **32** and **36** thereby opening the switch mechanism **30** to deenergize the electric circuit as shown in Fig. 3.

Above the first member **42** is the manual reset

operator 48 having a projecting pin 50 extending through an aperture 52 in the front wall 54 of the protector casing of which only a fragment is shown. The manual reset operator 48 is biased to the right to project the pin 50 by the compression spring 56 at its left end. Under normal conditions the projecting pin 50 is prevented from protruding beyond the wall 54 by the pin 58 which projects from the manual reset operator 48 and which is pressed into engagement with the upturned projection 60 of the first member 42. This arrangement of the pin 58 and the projection 60 constitutes a one-way lost motion connection in which the connection is made when either the pin 58 or the projection 60 is moved toward each other; but these are disconnected when they move away from each other.

As a result of this one-way lost motion connection, if there is an overload passing through the electric circuit sufficient to melt the solder holding the ratchet wheel 26, the first member will move to the right to open the switch mechanism 30 no matter if the manual reset operator 48 is held and fails to move as is shown in Fig. 2. When the pawl 44 is released, the first member 42 moves freely to the right thus separating the pin 58 and the projection 60. If the movement of the manual reset operator 48 is not interfered with, the spring 56 will keep the pin 58 in contact with the projection 60 thereby permitting the operator 48 to move to the right to the limit of its movement, as shown in Fig. 3. This permits the end of the pin 50 to project from the wall 54 of the casing, as shown in Fig. 3, thereby indicating the protector is in the open position. The tip of the projecting pin 50 may be provided with a contrasting color for this purpose.

It should be noted that in both Figs. 1 and 2, the holding of the manual reset operator 48 or the projecting pin 50 will not prevent the proper tripping and opening of the switch mechanism of the protector under overload circuit conditions. Furthermore, the wall 54, the aperture 52 and the pin 50 are so arranged that the pin 50 can only be pushed inwardly, that is, to the left in this position. The pushing of the pin 50 and the operator 48 to the left has no effect upon the first member 42 or the switch mechanism 30. The switch contacts cannot be opened thereby in Fig. 1 and they cannot be kept closed under overload conditions, as shown in Fig. 2, since the manual reset operator 48 is not coupled to the first member 42.

It is only after the manual reset operator 48 is completely released and moves to the right to the extreme limit of its movement in that direction that it is in a position to be reset and to affect the condition of the switch mechanism. It, however, cannot move to the right to the limit of its movement until the first member 42 has also moved to the right to the limit of its movement, which is determined by the stop pin 62. This is due to the one-way lost motion connection between the pin 58 and the projection 60.

To reset and reclose the protector, the first member 42 is provided with a rockably or pivotally mounted latch 64 normally held by the tiny spring 66 in the retracted position where it is inaccessible to resetting manipulation, as shown in Figs. 1 and 2. The first member 42 constitutes a guide means for guiding the lateral movement of the pivot of the latch 64. When the first member 42 is released and moves to the right to the position against the stop pin 62, the latch 64 engages a pin 68 above its pivot point to lift the projection at the upper end thereof into the notch 70 provided in the bottom of the manual reset operator 48. In this lifted position, the latch 64 is exposed or rendered accessible to resetting manipulation. When all the elements are in this position the protector may be safely reset by pushing the manual reset operator 48 and the pin 50 to the left, as shown in Fig. 4. This causes the notch 70 to engage the latch 64 to carry the first member to the left thereby carrying the pawl 44 to the left so that upon release of the manual reset operator 48 the pawl 44 will again engage the ratchet wheel 26. If the solder holding the ratchet wheel has solidified the pawl 44 will again engage one of the upper teeth of the ratchet wheel 26 to hold the first member in the position shown in Fig. 1.

The latch 64 is provided with a long arm 72 which, when its upward projection extends into the notch 70, will engage the upper end of the leaf spring 38 to open the contacts 32 and 36, as shown in Fig. 4. By this arrangement no current can flow through the circuit during the resetting of the protector thereby insuring that the protector will prevent the circuit from being overloaded even during the time of resetting the protector. However, when the manual reset operator 48 is released, as shown in Fig. 1, the latch 64 will be pivoted in a clockwise direction by the tiny spring 66 to lift the arm 72 out of the way of the leaf spring 38 to permit the switch mechanism 30 to be closed. The closing of the switch mechanism 30, however, cannot be accomplished until the manual reset operator 48 is released, as shown in Fig. 1. Immediately upon such release and the engagement of the pawl 44 with the ratchet wheel 26 the latch 64 will be released by the notch 70 to turn in a clockwise direction to the position shown in Fig. 2, thereby permitting the switch mechanism 30 to close. The closing, however, does not take place until after the latch 64 is released, so that the release of the latch 64 is required before the switch mechanism 30 is closed.

Thus as soon as the latch 64 is released the protector is free to trip regardless of any manipulation of the manual reset operator 48. Thus the protector is completely trip free and any movement of the manual reset operator 48 cannot open the switch mechanism 30, nor can it affect the engagement of the pawl 44 with the ratchet wheel 26, nor can affect the position of the latch 64. Thus by this arrangement the protector is protected from abuse and free to perform its proper function at all times. While the invention is shown applied to a circuit overload protector, it is applicable to any current or temperature responsive device for controlling an electric circuit.

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

What is claimed is as follows:

1. An electric circuit protector including a manipulating means, a switch mechanism connected to control the circuit to be protected, a first means for opening and holding open said switch mechanism, a current responsive means for preventing the operation of said first means under normal current conditions and for releasing said first means upon excessive current conditions to open the switch mechanism, an interconnecting means between said first means and said manipu-

lating means for coupling the first means to the manipulating means in one direction of movement thereof, releasing means for preventing the coupling of said interconnecting means when said current responsive means is effective to prevent the operation of said first means, said interconnecting means being provided with opening means effective when it is in coupling condition and ineffective when it is in the uncoupled condition for holding open said switch mechanism during the resetting of said first means.

2. An electric circuit protector including a switch mechanism connected to control the circuit to be protected, a first means for opening and holding open the switch mechanism, a current responsive means for preventing the operation of said first means under normal current conditions and for releasing said first means under excessive current conditions to open the switch mechanism, a manipulating means for resetting said first means and the switch mechanism, a releasable interconnecting means between the first means and the manipulating means including spring means for preventing the interconnecting means from coupling the first means and the manipulating means when the first means is held by the current responsive means, stop means located in the path of movement of the interconnecting means for operating the interconnecting means to couple the manipulating means and the first means when the current responsive means releases the first means to open the switch mechanism upon excessive current conditions.

3. An electric circuit protector including a switch mechanism connected to control the circuit to be protected, a first means for opening and holding open the switch mechanism, a current responsive means for preventing the operation of said first means under normal current conditions and for releasing said first means under excessive current conditions to open the switch mechanism, a manipulating means for resetting said first means and the switch mechanism, a releasable interconnecting means between the first means and the manipulating means including spring means for preventing the interconnecting means from coupling the first means and the manipulating means when the first means is held by the current responsive means, stop means located in the path of movement of the interconnecting means for operating the interconnecting means to couple the manipulating means and the first means when the current responsive means releases the first means to open the switch mechanism upon excessive current conditions, said interconnecting means being provided with opening means for holding open said switch mechanism during actual resetting operations.

4. An electric circuit protector including a switch mechanism connected to control the circuit to be protected, a first means for opening and holding open the switch mechanism, a current responsive means for preventing the operation of said first means under normal current conditions and for releasing said first means under excessive current conditions to open the switch mechanism, a manipulating means for resetting said first means and the switch mechanism, a releasable interconnecting means between the first means and the manipulating means including spring means for preventing the interconnecting means from coupling the first means and the manipulating means when the first means is held by the current responsive

means, stop means located in the path of movement of the interconnecting means for operating the interconnecting means to couple the manipulating means and the first means when the current responsive means releases the first means to open the switch mechanism upon excessive current conditions, said interconnecting means being provided with opening means for holding open said switch mechanism during actual resetting operations, said spring means being effective to operate the interconnecting means to uncoupling position to uncouple the manipulating means from the first means for preventing the manual opening of the switch mechanism after the first means is reset.

5. An electric circuit protector including a switch mechanism connected to control the circuit to be protected, a first means for opening and holding open said switch mechanism, a current responsive means for preventing the operation of said first means under normal current conditions and for releasing said first means under excessive current conditions, a manipulating means for resetting said first means, coupling means for coupling the first means to the manipulating means after the first means is released, releasing means for preventing the coupling of the first means and the manipulating means when the first means is being held by the current responsive means.

6. An electric circuit protector including a switch mechanism connected to control the circuit to be protected, a first means for opening and holding open said switch mechanism, a current responsive means for preventing the operation of said first means under normal current conditions and for releasing said first means under excessive current conditions, a manipulating means for resetting said first means, coupling means for coupling the first means to the manipulating means after the first means is released, releasing means for preventing the coupling of the first means and the manipulating means when the first means is being held by the current responsive means, said coupling means being provided with opening means for holding open the switch mechanism during the resetting of said first means.

7. An electric circuit protector including a switch mechanism connected to control the circuit to be protected, a first means for opening and holding open said switch mechanism, a current responsive means for preventing the operation of said first means under normal current conditions and for releasing said first means under excessive current conditions to open the switch mechanism, a manipulating means for resetting said first means, a latching device having a spring means for normally keeping it in unlatching position, means for moving the latching device to latch the manipulating means to the first means in one direction of movement only when both the first means and the manipulating means are fully released.

8. An electric circuit protector including a switch mechanism connected to control the circuit to be protected, a first means for opening and holding open said switch mechanism, a current responsive means for preventing the operation of said first means under normal current conditions and for releasing said first means under excessive current conditions to open the switch mechanism, a manipulating means for resetting said first means, a latching device having a spring means for normally keeping it in

unlatching position, stop means for moving the latching device to latch the manipulating means to the first means in one direction of movement only when both the first means and the manipulating means are fully released, said latching device being provided with means for holding open the switch mechanism during the resetting of the first means.

9. An electric circuit protector including a switch mechanism connected to control the circuit to be protected, a first movable member operably connected to the switch mechanism, biasing means for biasing the first member and the switch mechanism into the circuit opening position, current responsive means for holding the first member and the switch mechanism in the closed position under normal current conditions and for releasing the first member under excessive current conditions to open the switch mechanism, a manipulating member having a one-way lost motion connection with said first member, spring means for biasing said maniulating member into said lost motion connection with the first member, a normally retracted latch means for coupling the manipulating member to the first member, and stop means for moving said latch means into latching engagement when the first member and the manipulating member are fully released.

10. An electric circuit protector including a switch mechanism connected to control the circuit to be protected, a first movable member operably connected to the switch mechanism, biasing means for biasing the first member and the switch mechanism into the circuit opening position, current responsive means for holding the first member and the switch mechanism in the closed position under normal current conditions and for releasing the first member under excessive current conditions to open the switch mechanism, a manipulating member having a one-way lost motion connection with said first member, spring means for biasing said manipulating member into said lost motion connection with the first member, a normally retracted latch means for coupling the manipulating member to the first member, stop means for moving said latch means into latching engagement when the first member and the manipulating member are fully released said latch means being provided with opening means effective during latching engagement for holding open said switch mechanism.

11. An electric circuit controller including a switch mechanism, a first means for opening and holding open the switch mechanism, a temperature responsive means for preventing operation of the first means under normal temperature conditions and for releasing said first means under abnormal temperature conditions, a manual reset operator for resetting said first means, coupling means for coupling the first means to the manual reset operator after the first means is released, releasing means for preventing the coupling of the first means and the manual reset operator when the first means is being held by the temperature responsive means.

12. An electric circuit controller including a switch mechanism, a first means for opening and holding open the switch mechanism, a temperature responsive means for preventing operation of the first means under normal temperature conditions and for releasing said first means under abnormal temperature conditions, a manual reset operator for resetting said first means, coupling means for coupling the first means to the manual reset operator after the first means is released, releasing means for preventing the coupling of the first means and the manual reset operator when the first means is being held by the temperature responsive means, said coupling means including opening means for holding open the switch mechanism during the resetting of said first means.

13. An electric circuit protector including a first movable means, a movable manipulating means having a projecting portion, a pivoted coupling means pivoted to said first means for engaging said projecting portion upon said manipulating means to couple the two means together for movement in one direction, current responsive latching means cooperating with said first means for normally preventing movement of said first means in an opposite direction under normal current conditions and for releasing said first means under excessive current conditions, a switch mechanism operated to the open position in response to the release of said first means, said switch mechanism being connected to control the circuit to be protected, and a stop means located in the path of movement of the coupling means when said first means is released for pivoting the coupling means into the engaging position to couple the first means and the manipulating means together.

14. An electric circuit protector including a control means comprising a first movable means and a pivoted means rockably mounted upon said first movable means, spring means for urging said first means in one direction and for urging said pivoted means to rock in one direction relative to said first movable means, said pivoted means having one position exposed to resetting manipulation and a second position where it is inaccessible to resetting manipulation, current responsive holding means for holding said first means from movement in said one direction under safe current conditions and for releasing under unsafe current conditions said first movable means for movement in said one direction under a force supplied by said spring means, and a stop means located in the path of movement of and engaged by a portion of said pivoted means when the first movable means is released for rocking a portion of said pivoted means in a second direction to said one position exposed to resetting manipulation to make possible the resetting of the first means.

15. An electric circuit protector including a control means comprising a first movable means and a pivoted means rockably mounted upon said first movable means, spring means for urging said first means in one direction and for urging said pivoted means to rock in one direction relative to said first movable means, said pivoted means having one position exposed to resetting manipulation and a second position where it is inaccessible to resetting manipulation, current responsive holding means for holding said first means from movement in said one direction under safe current conditions and for releasing under unsafe current conditions said first movable means for movement in said one direction under a force supplied by said spring means, and a stop means located in the path of movement of and engaged by a portion of said pivoted means when the first movable means is released for rocking a portion of said pivoted means in a second direction to said one position exposed to resetting manipulation to make possible the resetting of

the first means, said pivoted means when released from said stop and when free from resetting manipulation being movable under a force supplied by said spring means in said one direction relative to the first means to said second position inaccessible to resetting manipulation.

16. A control including a control means comprising a first movable means and a pivoted means rockably mounted upon said first movable means, spring means for urging said first means in one direction and for urging said pivoted means to rock in one direction relative to said first movable means, said pivoted means having one position exposed to resetting manipulation and a second position where it is inaccessible to resetting manipulation, temperature responsive holding means for holding said first means from movement in said one direction under safe temperature conditions and for releasing under unsafe temperature conditions said first movable means for movement in said one direction under a force supplied by said spring means, and a stop means located in the path of movement of and engaged by a portion of said pivoted means when the first movable means is released for rocking a portion of said pivoted means in a second direction to said one position exposed to resetting manipulation to make possible the resetting of said first means.

17. A control including a control means comprising a first movable means and a pivoted means rockably mounted upon said first movable means, spring means for urging said first means in one direction and for urging said pivoted means to rock in one direction relative to said first movable means, said pivoted means having one position exposed to resetting manipulation and a second position where it is inaccessible to resetting manipulation, temperature responsive holding means for holding said first means from movement in said one direction under safe temperature conditions and for releasing under unsafe temperature conditions said first movable means for movement in said one direction under a force supplied by said spring means, and a stop means located in the path of movement of and engaged by a portion of said pivoted means when the first movable means is released for rocking a portion of said pivoted means in a second direction to said one position exposed to resetting manipulation to make possible the resetting of said first means, said pivoted means when released from said stop and when free from resetting manipulation being movable under a force supplied by said spring means in said one direction relative to said first means to said second position inaccessible to resetting manipulation.

18. A control including a guide means, a control means having a support upon which it is rockably mounted, said support being guided in a predetermined path by said guide means, spring means for moving said control means with its support guided in said predetermined path by said guide means, temperature responsive holding means for restraining said support from movement under a force supplied by said spring means in said predetermined path under safe temperature conditions and for releasing under unsafe conditions said support for movement under a force supplied by said spring means under the guidance of said guide means, stop means located in the path of movement of a portion of the control means eccentric to said support and offset from said predetermined path for causing a pivotal movement of the control means upon the engagement therebetween, said control means being provided with reset means having one position in which it is exposed to resetting manipulation to which it is movable by said pivotal movement for returning said control means to the holding control of said temperature responsive means and having a second position in which it is inaccessible to resetting manipulation, said reset means being movable under a force supplied by said spring means to said second position upon said return of the control means to the holding control.

19. A control including a guide means, a control means having a support upon which it is rockably mounted, said support being guided in a predetermined path by said guide means, spring means for moving said control means with its support guided in said predetermined path by said guide means, electrical current responsive holding means for restraining said support from movement under a force supplied by said spring means in said predetermined path under safe current conditions and for releasing under unsafe conditions said support for movement under a force supplied by said spring means under the guidance of said guide means, stop means located in the path of movement of a portion of the control means eccentric to said support and offset from said predetermined path for causing a pivotal movement of the control means upon the engagement therebetween, said control means being provided with reset means having one position in which it is exposed to resetting manipulation to which it is movable by said pivotal movement for returning said control means to the holding control of said current responsive means and having a second position in which it is inaccessible to resetting manipulation, said reset means being movable under a force supplied by said spring means to said second position upon said return of the control means to the holding control.

20. An electric circuit protector including a control means comprising a first movable means and a pivoted means rockably mounted upon said first movable means, a reset operator having a reset portion movable in a predetermined path, spring means for urging said first movable means in one direction and for urging said pivoted means to rock in one direction relative to the first movable means to a position out of the predetermined path of movement of said reset portion of the reset operator, current responsive holding means for holding said first means for movement in said one direction under safe current conditions and for releasing under unsafe current conditions said first movable means for movement in said one direction under a force supplied by said spring means, and a stop means located in the path of movement of and engaged by a portion of said pivoted means when the first movable means is released for rocking a portion of said pivoted means in a second direction to a position in the predetermined path of the reset portion of the reset operator to make possible the resetting of the first movable means.

21. A control including a control means comprising a first movable means and a pivoted means rockably mounted upon said first movable means, a reset operator having a reset portion movable in a predetermined path, spring means for urging said first movable means in one direction and for urging said pivoted means to rock relative to the first movable means to a position out of the predetermined path of movement of said reset portion of the reset operator, temperature respon-

sive holding means for holding the first means from movement in said one direction under safe temperature conditions and for releasing under unsafe temperature conditions said first movable means for movement in said one direction under a force supplied by said spring means, and a stop means located in the path of movement of and engaged by a portion of said pivoted means when the first movable means is released for rocking a portion of said pivoted means in a second direction to a position in the predetermined path of the reset portion of the reset operator to make possible the resetting of the first movable means.

DONALD F. ALEXANDER.

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