Feb. 25, 1958 R. C. INGWERSEN 2,824,931

ELECTRIC OVERLOAD CIRCUIT BREAKER

Filed March 7, 1955 3 Sheets-Sheet 1

Fig. 1

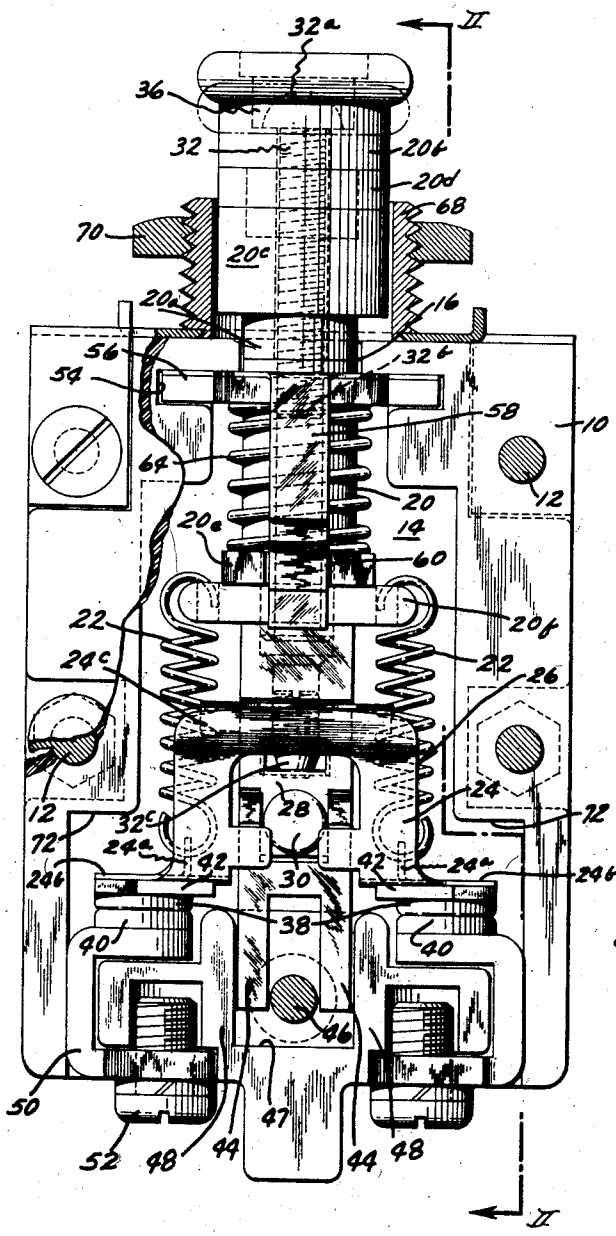
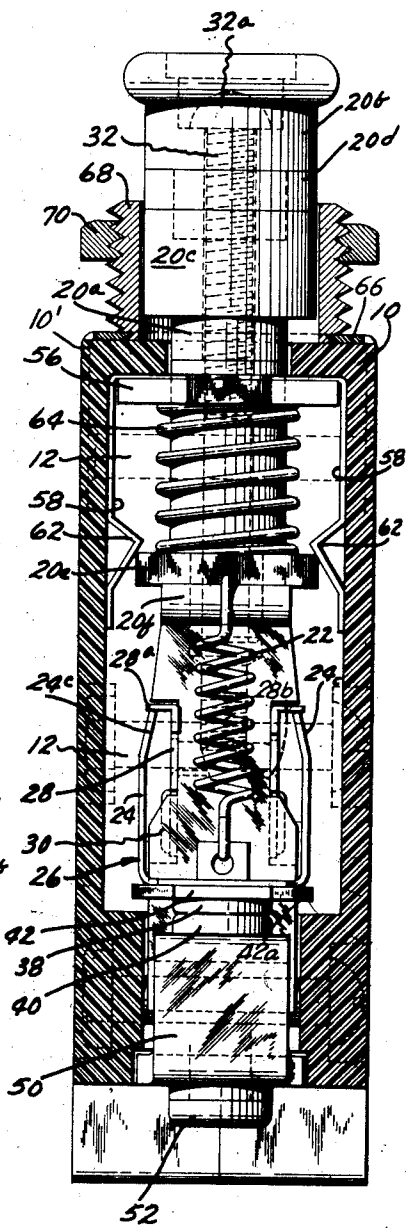


Fig. 2



INVENTOR
Richard C. Ingwersen

BY
Lawrence R. Kenna
ATTORNEY

Feb. 25, 1958 R. C. INGWERSEN 2,824,931

ELECTRIC OVERLOAD CIRCUIT BREAKER

Filed March 7, 1955

3 Sheets-Sheet 2

Fig. 4

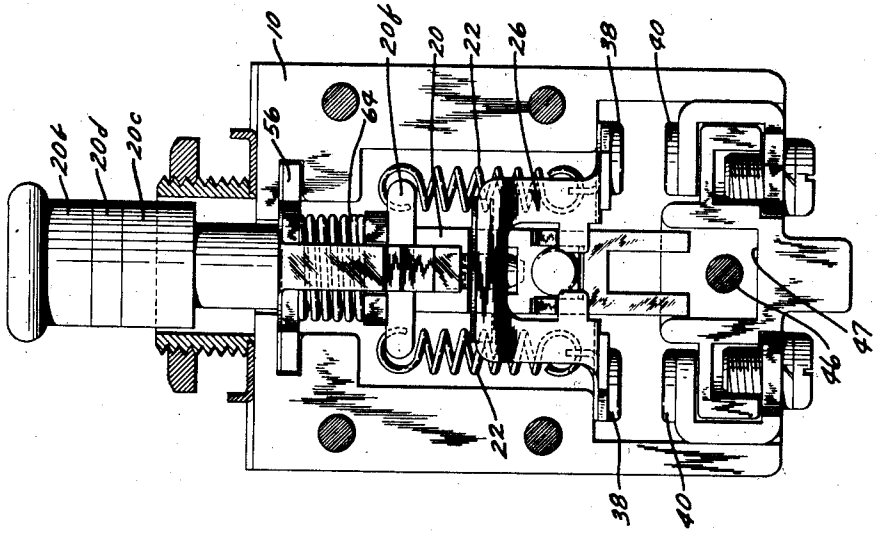
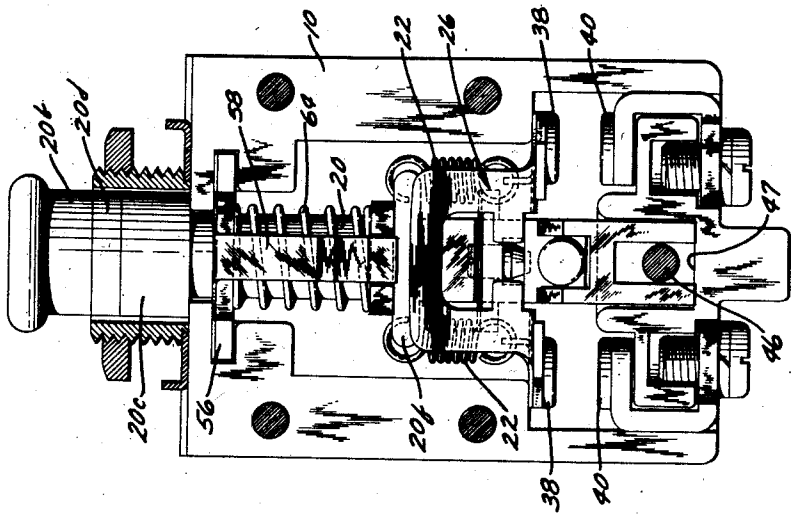


Fig. 3



INVENTOR
Richard C. Ingwersen

BY
Lawrence F. Beaman

ATTORNEY

Feb. 25, 1958 R. C. INGWERSEN 2,824,931

ELECTRIC OVERLOAD CIRCUIT BREAKER

Filed March 7, 1955 3 Sheets-Sheet 3

Fig. 6

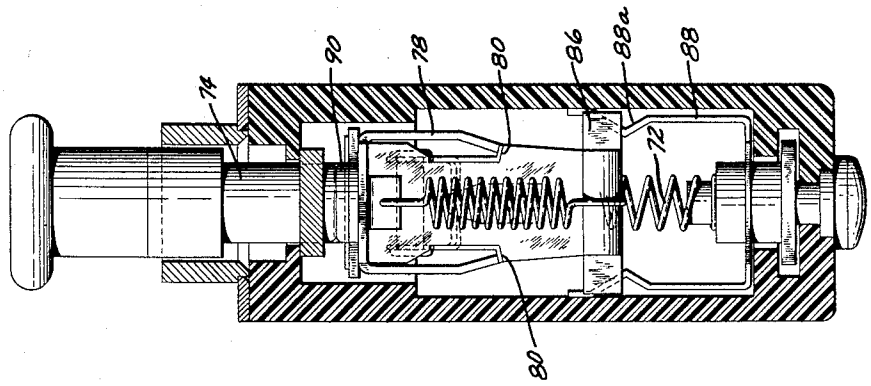
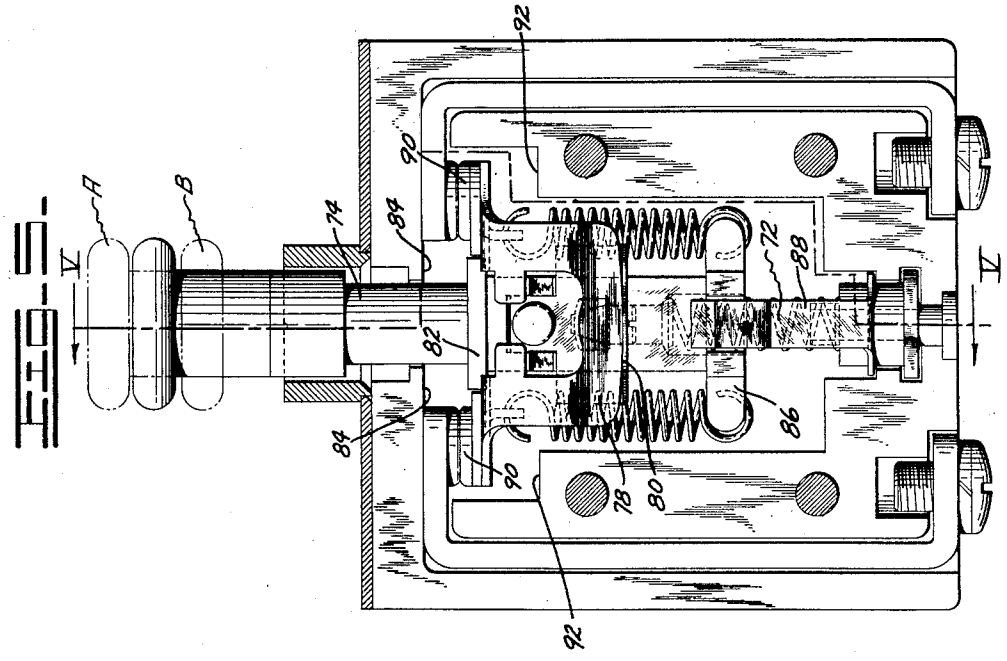


Fig. 5



INVENTOR
Richard C. Ingwersen
BY
Seymour F. Beaman
ATTORNEY

United States Patent Office 2,824,931 Patented Feb. 25, 1958

2,824,931

ELECTRIC OVERLOAD CIRCUIT BREAKER

Richard C. Ingwersen, Jackson, Mich., assignor to Mechanical Products, Inc., Jackson, Mich., a corporation of Michigan

Application March 7, 1955, Serial No. 492,508

7 Claims. (Cl. 200—116)

This invention relates to electric circuit breakers which are capable of being employed as mechanical on and off switches but which also have automatic current overload protection due to the action of latch means by which fixed and movable contact means are maintained in the closed position but which latch means is responsive to the current, conducted in the circuit closed by said contacts, to free the movable contact means to move automatically to open position upon the occurrence of a predetermined current overload.

The prior art circuit breakers employ an actuator in the form of a rectilinearly slidable plunger which is actuatable in the manner of a manual push and pull button to close and open the circuit at the contacts, respectively, and which plunger is operatively connected with the movable contact means and with a bimetallic latch in such manner that when the plunger is pushed-in the movable contact means is closed against the fixed contact means and the latch is set into position to hold the contacts closed, whereas when the plunger is pulled-out the contacts are opened. Further, the construction and arrangement of said prior art circuit breakers was such that upon the latch being automatically actuated to open the contacts the plunger moves to an outwardly projected position in which a marking thereon, such as a colored band, is brought into view to indicate that the circuit has been interrupted.

An objection to these prior art circuit breakers is that there is the possibility of the plunger being pushed farther in than its normal pushed-in and circuit closing position, due for example, to someone inadvertently "brushing" against the plunger, with the result that the circuit was unintentionally opened, while, further, there is nothing to distinguish whether the circuit has been opened due to overload, or due to manual actuation of the plunger.

An object of the invention is to provide a push-pull and automatic current overload circuit breaker of the above described kind in which, when the plunger has been moved to close the contacts, further inward pressure on the plunger merely tends to effect closer engagement of the contacts.

Another object of the invention is to provide a circuit breaker of the above kind in which the movement of the plunger is arranged to take place in such manner as to indicate whether the circuit has been interrupted due to the occurrence of current overload, or due to manual actuation of the plunger.

Yet a further object of the invention is to provide an electric circuit breaker of the above kind in which the overall size of the circuit breaker can be considerably reduced compared with the prior art circuit breakers.

Further objects and advantages of the present invention, residing in the construction, arrangement and combination of parts will be understood and appreciated from a consideration of the following description with reference to the accompanying drawings and from the appended claims.

In the drawings:

Fig. 1 is an elevational view looking upon the inside of one of the two casing sections of a circuit breaker and switch in accordance with the invention, with the circuit breaker and switch mechanism in position therein and the contacts closed,

Fig. 2 is a cross section on the line II—II of Fig. 1,

Fig. 3 is a similar view to Fig. 1 but showing the parts in the contact open position, due to overload.

Fig. 4 is a similar view to Fig. 3 showing the parts in the contact open position due to manual actuation of the actuator plunger,

Fig. 5 is a similar view to Fig. 1 but of an alternative construction in which the actuator plunger is arranged to move in reverse sense to the arrangement according to the previous figures, and

Fig. 6 is a cross section on the line V—V of Fig. 5.

Referring to Figs. 1 to 4 of the drawings, **10**, **10'** indicate a pair of similar casing sections of electrical insulating material which are held secured together, as by bolts **12**, and which casing sections combine to form an enclosed interior space **14** in which the automatic overload circuit breaker and manual switch mechanism is mounted and secured in operative assesmbly.

At one end, the casing sections define an opening **16** through which the cylindrical end portion **20***a* of an actuator plunger **20** extends to the outside of the casing and carries an actuator button **20***b* axially spaced from a collar **20***c* by an indicator ring **20***d* which ring **20***d* is of some distinctive color (being white, for example, and the collar **20***c* being red) so that, in this particular embodiment of the invention, when the said ring **20***d* is visible, as will be described later, this denotes that the switch is in the "on" position and that the bi-metallic latch is also in the engaged position.

The plunger **20** is formed with a flange portion **20***e* and another and adjacent flange part **20***f*. Flange **20***f* has one end of a pair of coil springs **22** anchored thereto, the opposite ends of which springs are anchored to ears **24***a* bent out from transverse bridges **24***b* which interconnect a pair of parallel spaced apart bi-metallic and U-shape latch parts **24**, said ears, bridge portions and latch parts being of integral construction and forming a unitary latch and movable contact assembly, indicated by the general reference **26**. This assembly is mounted for rectilinear sliding movement with respect to the plunger **20** but, in the position shown in Figs. 1 and 2, the unit is held against such relative movement due to the latching engagement of the free ends **24***c* of the latch parts **24** with abutment ledges **28***a* defined at the free ends of a pair of wear resistant plates **28** secured, with initial tension, against opposite sides of the plunger portions **20**, as by the rivet **30**.

The plunger parts **20***a*, **20***b*, **20***c* and **20***d* are shown separately formed and connected together by an axial screw **32**, the head **32***a* of which is accessible at the outer end of the button **20***b* and which screw is screwed into the upper end of the plunger portion **20**, as indicated at at **32***b*. The abutment plates **28** have inturned ears **28***b*, which may be of curved section to give them lateral stability, and between which the tapered lower end **32***c* of screw **32** engages, said screw being mounted in an axial bore **36** in the plunger portion **20** and being accessible for adjustment through said bore. By adjustment of the screw **32** it is possible to cause the abutment ledges **28***a* to move laterally outwards or inwards with respect to the edges **24***c* of the latch parts **24** and thereby adjust the extent to which said edges must travel before the latch parts disengage the abutments. Such adjustments would be effected upon initial assembly of the parts, if tests indicated that adjustment should be

made, and enables the unlatching action to be controlled within fine limits.

The latch parts 24 carry a pair of laterally spaced electrical contacts 38, which are the movable contacts, and cooperate with companion fixed electrical contacts 40 to close the electrical circuit involved.

As distinct from the prior art constructions in which the movable contacts were carried at the outer ends of relatively long flexible conductor arms secured at their inner ends to the bridge portions of the U-shape latch parts, with the present construction the said conductor arms are eliminated and the movable contacts 38 are immediately fastened upon the bridge portions 24*b* through the medium of intermediate plates 42 having end portions 42*a* which, as seen in Fig. 2, project beyond the confines of the engaged fixed and movable contacts and serve as baffles to protect the bi-metallic parts 24 from direct attack by the flame and gas evolved, due to arcing, when the circuit is suddenly interrupted, as will be described. The plates 42 may be of stainless steel.

By eliminating the said conductor arms the important advantage is gained, compared with the prior art circuit breaker that the overall width of the circuit breaker can be reduced to as much as one half size and enable two circuit breakers according to the present construction to be mounted side by side upon a panel to occupy approximately the same space as the prior art circuit breaker.

At its lower end, as seen in Figs. 1 and 2, the plunger portion is formed with fork prongs 44 between which a transverse pin 46, secured between the casing sections, is located to guide the fork prongs, and hence the plunger, for rectilinear sliding motion with respect to the casing opening 16 and the interior casing guide surfaces 48 seen at the lower end of Fig. 1.

The fixed contacts 40 are shown mounted within and upon the casing by bent conductor strips 50 carrying the terminal posts 52.

Fixedly mounted within a cavity 54 at the upper end of the casing interior there is a sheet metal plate part 56 from which a pair of diagonally opposite flexible blades 58 depend, said blades being guided through slots 60 in the plunger flange 20*e* and being formed with inwardly directed opposed angular portions 62 which have camming engagement with the inner ends of said flange slots and serve to retain the plunger in the contact open position when the plunger is actuated in the manner of a push-pull switch, as will be described later.

A coil spring 64 is mounted about the plunger and engages between the upper interior wall surface of the casing and the flange 20*e*. This spring 64 constantly urges the plunger 20 inwardly with respect to the casing and maintains the contact pressure.

A metal cap 66 secured upon the exterior of the casing at the upper end thereon, in the position as shown in the drawings, carries an exteriorly screw-threaded boss 68, through which the plunger part 20*c* passes and which boss carries a nut 70 by which the circuit breaker can be mounted in a desired location.

72 indicates ledge surfaces or abutments within the casing interior with which the bridge parts 24*b* of the bi-metallic latch parts engage to arrest movement of these parts in the circuit opening direction.

In operation, with the parts as shown in Figs. 1 and 2, the plunger is in a pushed-in position in which the plunger indicator portion 20*d* is visible, the plunger flange 20*e* is located beneath the spring blade angle portions 62, the contacts 38 and 40 are closed, the bi-metallic latch parts 24 are engaged with the abutment ledges 28*a* and, as the result, the springs 22 are tensioned. With the parts thus positioned, upon a current overload condition, to which the bi-metallic parts 24 have been calibrated, being reached, the parts 24, due to heating by the conducted current, and their bi-metallic characteristic, will automatically disengage the abutment ledges 28*a*, with the result that the tensioned springs 22 operate immediately to move the latch parts 24 and movable contacts 42 upwards (in the position as shown in Figs. 1 and 2), with sudden breaking of the circuit at the contacts 38 and 40 and movement of the plunger downwards due to the action of the spring 64. Said upward movement of the parts 24, and hence the movable contacts 38, is relative to the plunger and is arrested when the bridge portions 24*b* of the latch parts arrive against the ledges 72, whereas the resulting downward movement of the plunger causes the indicator portion 20*d* to disappear from sight by its passage into the boss 68. The plunger is brought to rest in its inward position by the arrival of the plunger fork prongs 44 against the bottom and interior casing surface 47.

Fig. 3 shows the position of the parts when the contacts have been opened due to current overload.

With the parts as seen in Fig. 3, to re-set the bi-metallic latch parts 24 against their abutment ledges 28*a* the plunger is pulled outwards against the action of the spring 64 until the abutment ledges 28*a* are brought opposite the edges 24*c* of the latch parts, whereupon these edges, due to the inherent springiness thereof, move into engagement with the abutment ledges. The latch parts are then re-united with the plunger, at which time the plunger will be held in an extended position due to the plunger flange 20*e* being on the upper side of the angular portions 62 of the blades 58. To close the contacts, therefore, the plunger must be pushed-in to move this flange 20*e* to the opposite side of the angular portions 62, at which time the spring 64 is free to take over, and carry the movable contacts 42 back into engagement with the fixed contacts 40. The parts will then be in the position shown in Fig. 1.

To open the contact assembly manually, with the parts as indicated in Figs. 1 and 2, the plunger 20 is pulled upwards (in the position as shown) against the action of the spring 64 but in this instance the latch parts 24 will remain in engagement with their abutment ledges 28*a* and will move as one with the plunger, until the contact plates 42 are brought against the ledges 72. While this movement is taking place the plunger flange 20*e* will pass upwardly beyond the angular portions 62 of the spring blades 58, with the result that at the time when the contact plates 42 are arrested against the ledges 72 the plunger flange 20*e* will be positioned above the said angular portions and will hold the plunger in its outwardly projected position in which both the plunger portions 20*d* and 20*c* are in sight and reveal that the contacts have been opened due to manual actuation of the plunger.

As above indicated plunger portion 20*d* can be colored white and portion 20*c* red. Thus, an observer looking at the circuit breaker with the parts positioned as shown in Figs. 1 and 2 will see only the white band displayed by plunger portion 20*d*, thereby indicating that the contacts are closed. With the parts as seen in Fig. 3, plunger portion 20*d* is hidden within the casing and only the plunger portion 20*b* is seen. This plunger portion will be in its natural color, such as black. With the parts as seen in Fig. 4, both the plunger portions 20*d* and 20*c* will be outside the casing i. e. the white and the red portions. Accordingly when neither the white nor the red is seen an observer knows that the circuit breaker has been actuated due to overload. When the white only shows he knows that the circuit breaker has been reset and is in contact closed condition. When both red and white are shown he knows that the circuit breaker has been manually opened. This visible indication of whether the circuit breaker has been opened due to overload or manually is an important feature.

With the contacts closed as seen in Figs. 1 and 2, pressure against the plunger head 32*a* will not separate the contacts but, due to the rigid connection involved, will

increase the pressure at the closed contacts 38 and 40. This is an additional important feature of this circuit breaker.

The circuit breaker according to Figs. 5 and 6 possesses the advantages of the already described circuit breaker but with the plunger motion taking place in the reverse sense.

According to Figs. 5 and 6, the plunger spring 72 operates to constantly urge the re-set actuator plunger 74 outwardly with respect to the casing 76 with the result that when the bi-metal latch parts 78 leave the abutment ledges 80 due to the occurrence of overload the plunger will be projected outwardly to the dotted position A where it will be held due to the engagement of a flange plate 82 on the plunger with the inside casing surfaces 84.

With the circuit breaker set in the contact closed position as seen in Figs. 5 and 6 the slotted flange 86 on the plunger is located on one side (the top, as shown) of the angular portions 88*a* of the flexible blades 88. These blades and slotted flange 86 correspond to the parts 58, 62 and 20*e* of Fig. 2 and enable the circuit breaker to be actuated manually as a push-pull switch. With the circuit breaker set in the contact closed position, in which the projecting plunger end is in the full line position, to open the contacts 90 manually the plunger must be pushed in to the second dotted position B. In so doing the latch plates 78 will remain set upon the abutment ledges 80 so that the plunger, latch plates and abutment ledges move as one. At the same time as the movable contacts and latch assembly are moved against the stop surfaces 92 within the casing the slotted plunger flange 86 will be forced past the angular portions 88*a* of the flexible blades 88. Thus, when the contacts have been moved to the open position by manually pushing the plunger 74 inwards the plunger will be held in the inwardly depressed position by the engagement of the flange 86 beneath said angular portions. It will be appreciated therefore that the principle of operation of this circuit breaker is the same as that according to Figs. 1 to 4 but that the plunger movements take place in the reverse sense. By appropriate coloring of the plunger with bands as described with reference to Figs. 1 to 4 it is possible to determine at a glance whether the breaker contacts have been opened due to overload or due to manual actuation.

Having thus disclosed my invention, what I consider as novel, and wish to secure by Letters Patent, what I claim is as follows:

1. In a manually operable switch having automatic current overload protection, the combination with an actuator plunger for moving movable contact means into closed or open position with respect to fixed contact means, said contacts being within a casing structure, of means mounting said plunger for rectilinear motion with respect to said casing structure, said plunger including an end portion projecting to the outside of said casing and said mounting means including spring means acting to urge said plunger in one direction with respect to said casing, said movable contact means being connected with latch means responsive to the conducted current and said actuator plunger including an abutment for said latch means, said latch means being automatically releasable from said abutment upon the occurrence of a predetermined overload current, and said casing including means engageable with said actuator plunger to maintain the plunger in a first position in which said contacts are closed and said plunger projects a certain distance outside said casing, said spring means being operative to move the plunger to a second position, upon release of said latch from said abutment, in which said plunger projects a different distance outside the casing than said certain distance.

2. An electric current breaker having fixed and movable contacts and a bi-metal latch structure operatively connected with said contacts to hold the same engaged, said latch structure being responsive to the conducted current to automatically open the circuit at said contacts upon the occurrence of a predetermined current overload and actuator means being provided to re-set the contacts and latch structure in circuit closing position, said actuator means being manually actuatable to open the circuit at said contacts, the provision of means including a spring element mounting said actuator means for inward motion, from an outward position corresponding to the position of said actuator means when manually actuated to open said circuit to effect said re-set, and for further inward motion upon the occurrence of said current overload.

3. In a manually operable switch having automatic current overload protection, the combination with an actuator plunger for moving the movable contact means into closed or open position with respect to the fixed contact means, of means mounting said plunger for rectilinear motion with respect to casing structure containing said contact means, said plunger including an end portion projecting to the outside of said casing and said mounting means including spring means acting to urge said plunger inwardly with respect to said casing, said movable contact means being connected with latch means responsive to the conducted current and said actuator plunger including an abutment for said latch means, said latch means being automatically releasable from said abutment upon the occurrence of a predetermined overload current, and said casing including stop means engageable with said actuator plunger to maintain the plunger in a first position in which said contacts are closed and said plunger projects a certain distance outside said casing, said spring means being operative to move the plunger to a second position, upon release of said latch from said abutment, in which said plunger projects a different distance outside the casing than said certain distance, said plunger being movable past said stop means by manual actuation of the plunger with attendant opening of the contacts, said manual actuation being against the action of said spring and said stop means arresting the plunger in an open contact position in which the plunger projects yet a different distance outside of casing than said certain distance.

4. An electric circuit breaker, comprising in combination fixed electrical contact, a movable electrical contact in opposed relation to said fixed contact, structure supporting said movable contact for movement toward and from said fixed contact, latch means for releasably holding the movable contact against the fixed contact, said latch means being in electrical connection with said contacts so as to be responsive to the conducted current for actuating said latch means to release the movable contact for movement away from the fixed contact upon the occurrence of current overload, actuator means, said actuator means being actuatable to set said latch means in position to hold the movable contact against the fixed contact, and means mounting said actuator means for inward movement with respect to the casing upon release of the latch due to current overload, means mounting said actuator means for limited inward movement with respect to the casing to set said latch in position to hold the movable contact against the fixed contact, said mounting means including spring means connected with said actuator means to cause the actuator means to move farther inwards with respect to the casing upon the occurrence of current overload, said actuator mounting and spring means permitting said actuator to be manually actuated to release said latch means from contact engaging position independently of said current overload.

5. In an electric circuit breaker, casing structure, a fixed contact in said casing, a movable contact in the casing adapted to make and break electrical contact with the fixed contact, a contact reset actuator, spring means mounting said actuator in the casing for rectilinear movement constantly into the contact opening position, a thermal responsive latch connected with said movable

contact to constitute therewith a movable contact-latch unit, said latch being responsive to overload currents and being adapted to have latching engagement with said actuator to restrain the movable contact-latch unit and actuator to have unified movement with respect to the fixed contact and in the contact opening direction, a second spring means connecting said movable contact-latch unit with said actuator and operable to break the electrical contact with a snap action when the latch is disengaged from the actuator, said second spring means being stressed when the electrical contact is made consequent upon relative movement between said contact-latch unit and said plunger, an abutment on said casing structure limiting said snap action movement of the movable contact-latch unit and an abutment limiting movement of said actuator by its said spring mounting means when the latch is disengaged.

6. An electric circuit breaker comprising a casing, a fixed electrical contact supported in said casing, a movable electrical contact supported in said casing for movement into and out of engagement with said fixed contact, actuator means movably supported in said casing, means operatively connecting said movable contact means and said actuator means so that said actuator means can be manually actuated to move said movable contact means into and out of engagement with said fixed contact means while said movable contact means can also move relative to said actuator means upon occurrence of current overload to permit said movable contact means to move out of engagement with said fixed contact means, means supporting said actuator means in said casing so that said actuator means will move in one direction in said casing upon the occurrence of a current overload and in an opposite direction upon manual actuation to move said movable contact means away from said fixed contact means whereby to indicate whether the movable contact means have been moved to open position due to the occurrence of current overload or due to manual actuation of said actuator means.

7. An electric circuit breaker including a casing, fixed electrical contact in said casing, an electrical contact movably supported in said casing for movement into and out of engagement with said fixed contact, latch means for releasably holding said movable contact in engagement with said fixed contact, said latch means being in electrical connection with said movable contact so as to be responsive to conducted current for actuation to release the said movable contact for movement away from said fixed contact upon the occurrence of current overload, actuator means movably supported in said casing for in and out movement, means operatively connecting said actuator means and said latch means so that manual movement of said actuator means inwardly in said casing will cause said latch means to hold said movable contact means in engagement with said fixed contact means and so that outward manual movement of said actuator means will cause said movable contact means to move out of engagement with said fixed contact means, said means connecting said latch means and said actuator means permitting relative movement between said latch means and said actuator means upon the occurrence of a current overload, and means mounting said actuator means in said casing for inward movement with respect to said casing upon the occurrence of current overload.

References Cited in the file of this patent

UNITED STATES PATENTS

2,076,385	Petersen	Apr. 6, 1937
2,335,081	Platz	Nov. 23, 1943
2,385,727	Platz	Sept. 25, 1945
2,487,725	Platz	Nov. 8, 1949
2,504,793	Baxter	Apr. 18, 1950
2,519,297	Stump et al.	Aug. 15, 1950
2,576,815	Sundt	Nov. 27, 1951
2,625,625	Ingwersen	Jan. 13, 1953
2,665,347	Ingwersen	Jan. 5, 1954