June 10, 1958 R. C. INGWERSEN 2,838,635

ELECTRIC SWITCH HAVING AUTOMATIC CURRENT OVERLOAD PROTECTION

Filed July 16, 1956 5 Sheets-Sheet 1

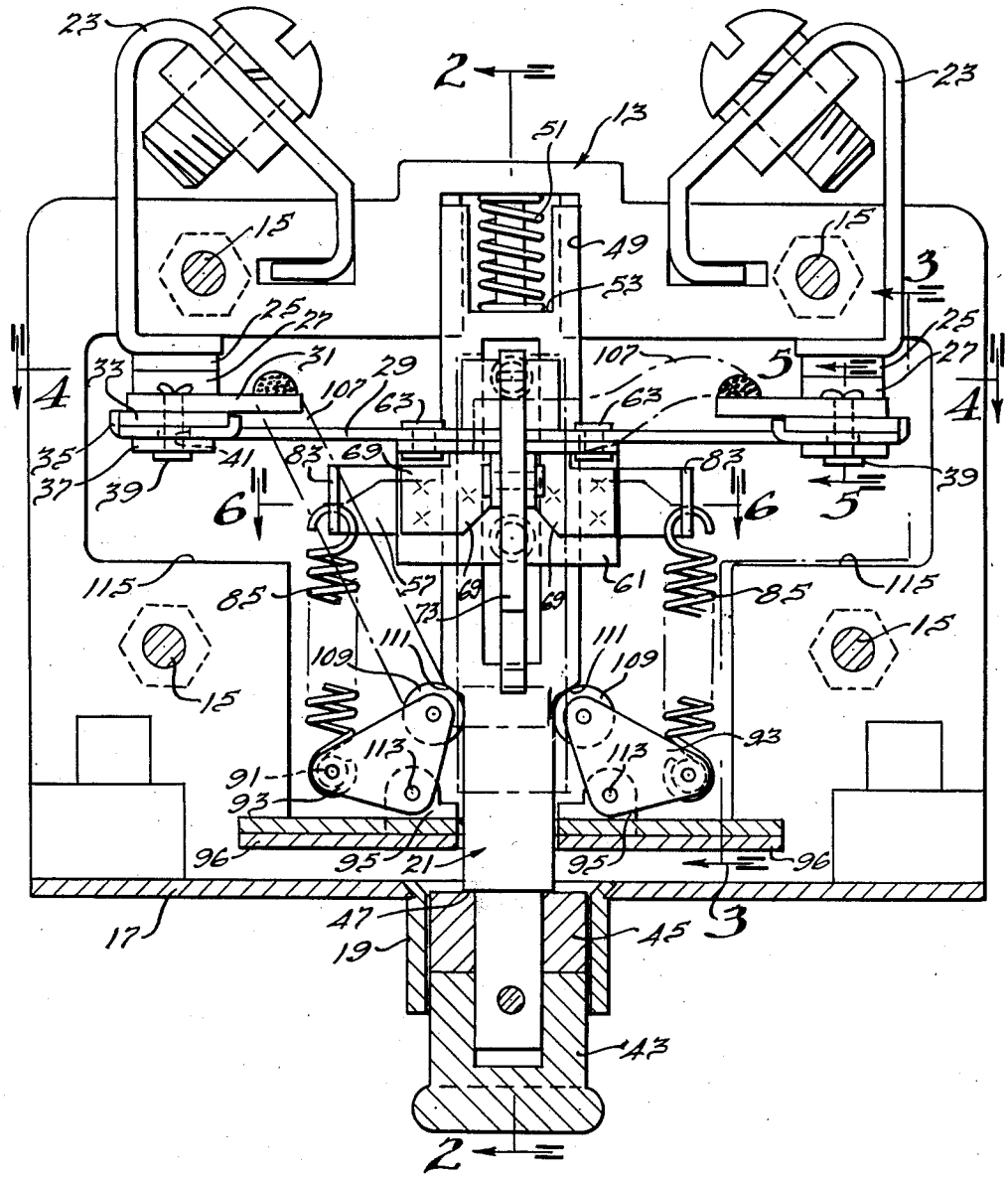


Fig. 1.

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Filed July 16, 1956 5 Sheets-Sheet 2

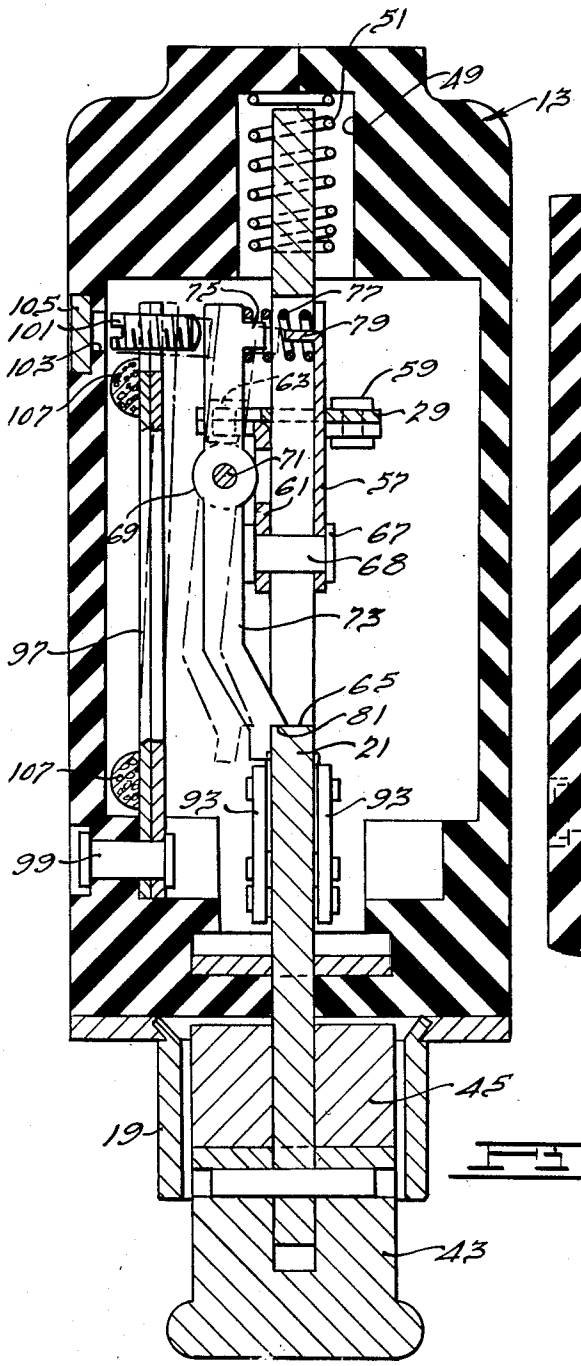


Fig. 2.

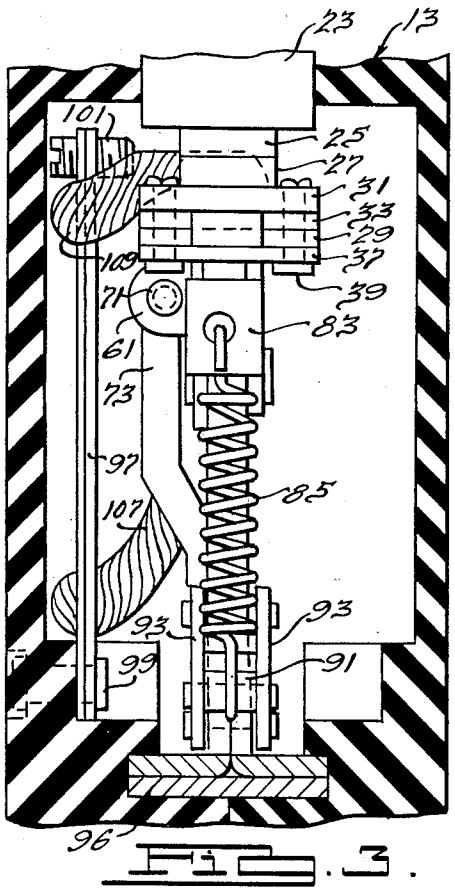


Fig. 3.

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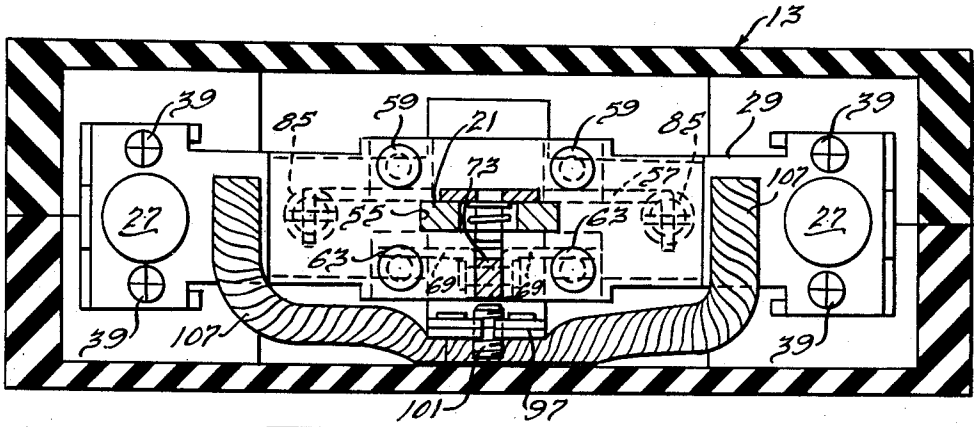


FIG. 4.

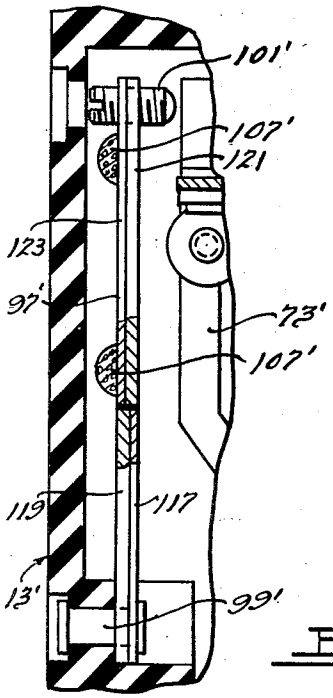


FIG. 6.

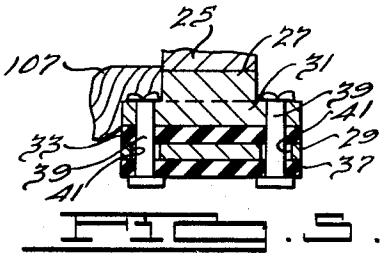


FIG. 5.

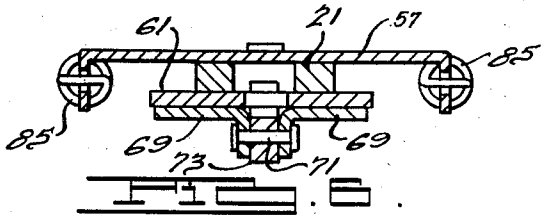


FIG. 7.

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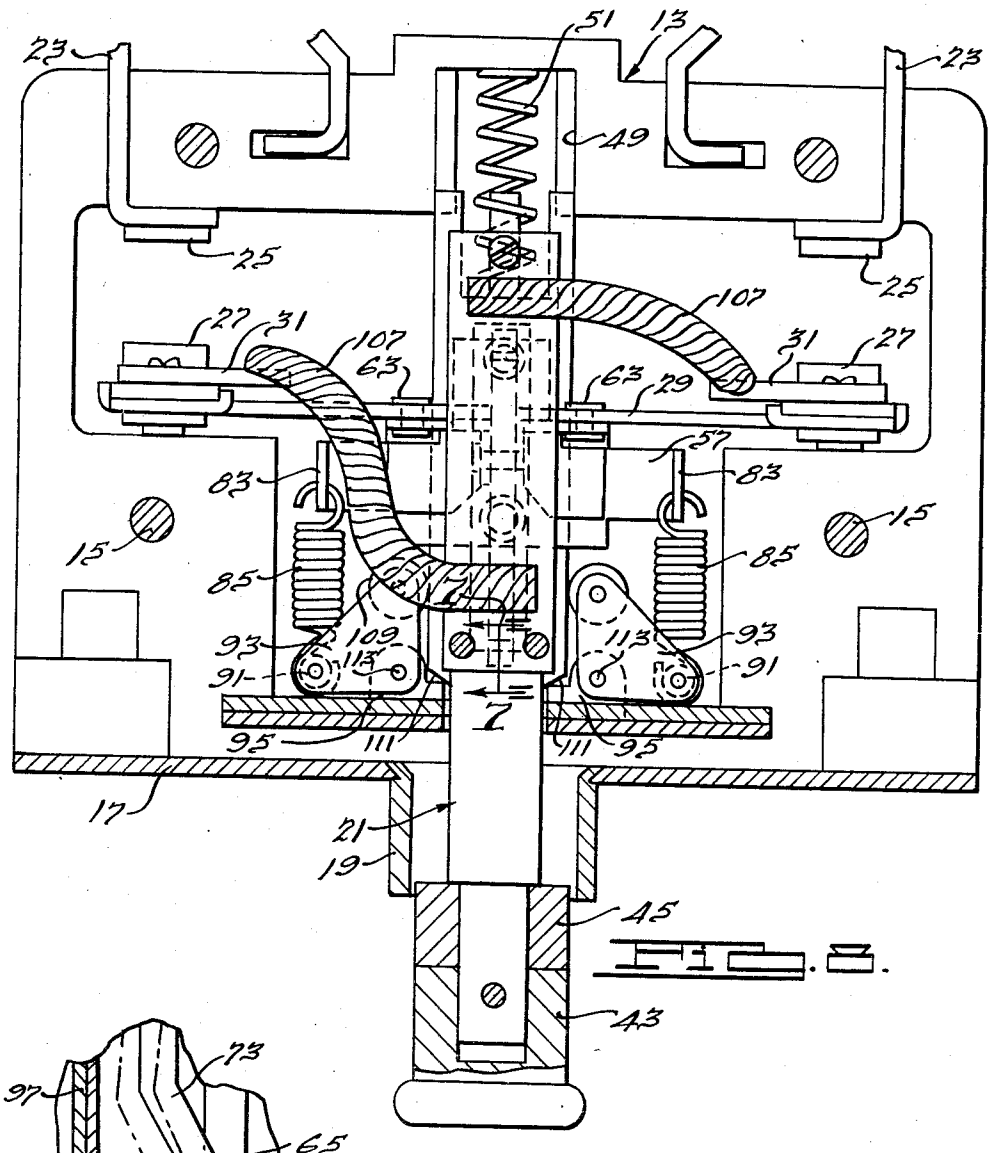


FIG. 2.

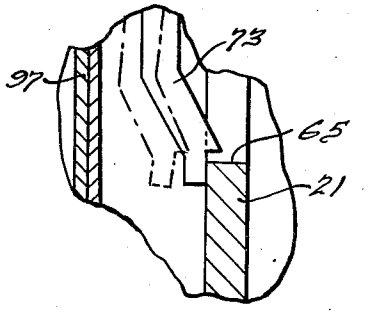


FIG. 1.

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ELECTRIC SWITCH HAVING AUTOMATIC CURRENT OVERLOAD PROTECTION

Filed July 16, 1956 5 Sheets-Sheet 5

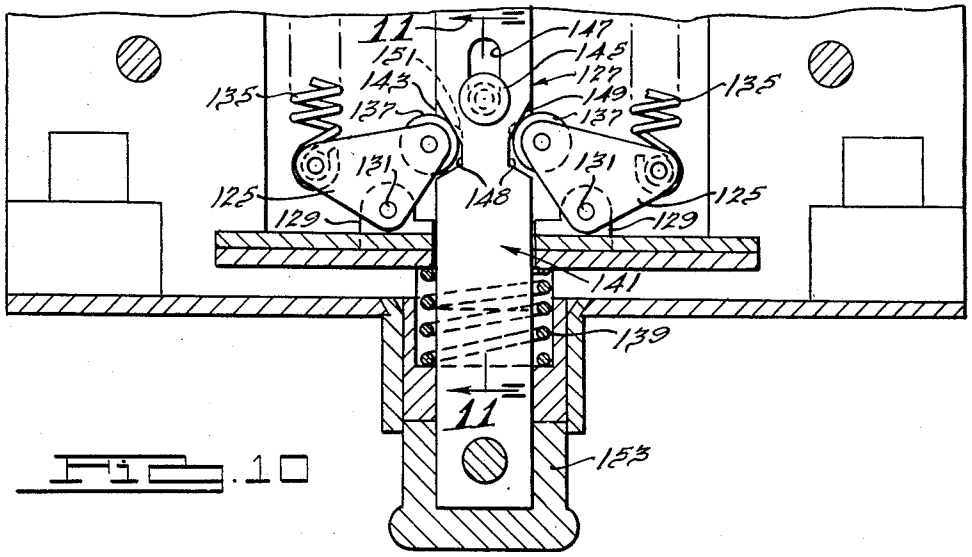
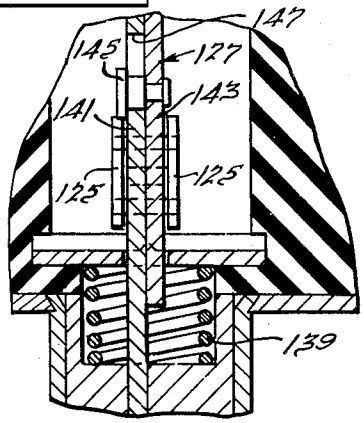


Fig. 10

Fig. 11.



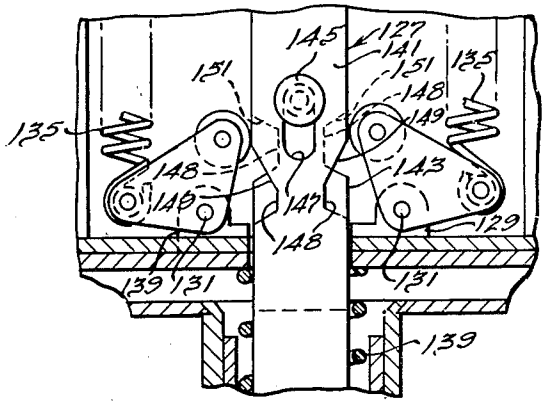


Fig. 12

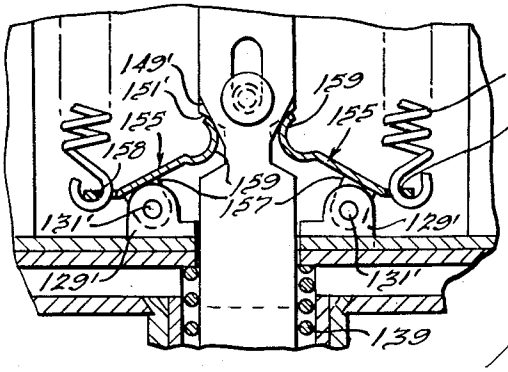


Fig. 13

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2,838,635

ELECTRIC SWITCH HAVING AUTOMATIC CURRENT OVERLOAD PROTECTION

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

Application July 16, 1956, Serial No. 598,188

5 Claims. (Cl. 200—116)

This invention relates generally to electric switches, and more particularly to an electric switch incorporating a circuit breaker automatically actuatable in response to a predetermined current overload.

It is an object of this invention to provide an electric switch of the aforementioned type which is exceptionally efficient in operation, durable in construction, and is composed of a lesser number of parts than in comparable switches heretofore devised.

It is a still further object of this invention to provide an electric switch of the aforementioned type having a lesser number of parts affected by shrinkage than has heretofore been possible, thus increasing the efficiency and life of the switch.

It is a still further object of this invention to provide an electric switch of the aforementioned type including a current responsive thermostat element which may be easily calibrated and which is less subject to fatiguing stress or strain than in comparable devices heretofore devised.

It is a still further object of this invention to provide an electric switch of the aforementioned type in which certain of the metal parts are less subject to overheating and thus weakening as compared to previous structures, and in which danger of salt shunt is eliminated because of the novel manner in which the switch contacts are supported.

It is a still further object of this invention to provide a switch of the aforementioned type which incorporates, in conjunction with the thermostat element, an ambient temperature compensating arrangement.

It is a still further object of this invention to provide in a switch of the aforementioned type an improved latch structure for releasably and positively retaining the switch actuator plunger in a set position against accidental displacement, while permitting convenient and easy manual actuation of the plunger when desired.

It is a still further object of this invention to provide an improved electric switch of the aforementioned type which is less expensive to manufacture and produce than comparable switches heretofore known.

These and other objects of this invention will become apparent from the following detailed description taken in conjunction with the accompanying drawings, in which:

Figure 1 is a longitudinal view, partially in section and partially in elevation, of a switch of this invention with the parts shown in contact closed position;

Fig. 2 is an enlarged sectional view of the structure illustrated in Fig. 1 taken along the line **2—2** thereof;

Fig. 3 is an enlarged, fragmentary, sectional view of the structure illustrated in Fig. 1 taken along the line **3—3** thereof;

Fig. 4 is an enlarged sectional view of the structure illustrated in Fig. 1 taken along the line **4—4** thereof;

Fig. 5 is an enlarged, fragmentary, sectional view of the structure illustrated in Fig. 1 taken along the line **5—5** thereof;

Fig. 6 is an enlarged, fragmentary, sectional view of the structure illustrated in Fig. 1 taken along the line **6—6** thereof;

Fig. 7 is an enlarged, fragmentary, sectional view of the structure illustrated in Fig. 8 taken along the line **7—7** thereof;

Fig. 8 is a view, partially in section and partially in elevation, similar to Fig. 1, but illustrating the position of the parts in contact open position;

Fig. 9 is a fragmentary sectional view of a modified form of a bimetal element from that illustrated in the previous embodiment;

Fig. 10 is a longitudinal, fragmentary view, partially in section and partially in elevation, illustrating a further embodiment of the invention with respect to the manual latch arrangement and showing the actuator plunger latched in its normal "in" or closed position;

Fig. 11 is a sectional view of the structure illustrated in Fig. 10 taken along the line **11—11** thereof;

Fig. 12 is a fragmentary view, partially in section and partially in elevation, similar to Fig. 10, illustrating the position of the parts when the actuator plunger is in its "out" or open position; and

Fig. 13 is a fragmentary view, similar to Fig. 10, illustrating a still further embodiment of the latching structure of this invention.

Referring now to the drawings and more particularly to Figs. 1 to 8, it will be seen that an electric switch incorporating an automatic electric circuit breaker is illustrated. The switch includes a suitable hollow casing **13** which may be molded of plastic or the like and is formed in two halves secured together by any suitable means, such as fasteners **15**. A base plate **17** closes the bottom of the casing and carries a collar **19** through which one end of an actuator plunger **21** extends. Terminal elements **23** are suitably supported in the casing **13** and are adapted to be connected in an electric circuit in a usual manner. A fixed contact **25** is mounted on the inner end of each of the terminal elements **23**, within the hollow casing **13**. Movable contacts **27** are supported in the casing for movement into and out of engagement with the fixed contacts **25**. The switch is, of course, constructed so that when the movable contacts are in engagement with the fixed contacts, a circuit is closed through the switch, which circuit is adapted to be interrupted upon the occurrence of a predetermined current overload or upon manual actuation of the plunger **21** so as to cause the contacts to move out of engagement with each other.

A movable contact **27** is supported adjacent each end of a contact carrying arm or plate **29**. In the past, the contact carrying arm, which is formed of stainless steel or the like, has carried current between the contacts, and, with the aid of other metal parts, a bimetal or thermostat element. With such prior constructions, overheating of the contact carrying arm can occur which tends to anneal the arm and thus weaken it. Still further, salt shunts are possible when the contact current carrying arm and other metal parts carry current, which will render the switch and circuit breaker inoperative or unsatisfactory.

In the instant invention, the movable contacts **27** are insulated from the contact carrying arm **29** so that no current flows through the contact carrying arm. This is accomplished by brazing each contact **27** to a metallic plate **31**, which, in turn, engages the top surface of an insulator plate **33** supported adjacent an end of the contact carrying arm **29** by means of upturned ears or

flanges 35. A second insulator plate 37 engages the underside of the contact carrying arm adjacent each end thereof and rivets 39 secure the insulators and the contact plates to the arm 29 at each end thereof. The contact carrying arm 29 has apertures 41 adjacent each end thereof which are larger in diameter than the diameter of the rivets 39, and in view of the fact that the insulator plates 33 are held against shifting movement relative to the contact carrying arm, no metallic contact can occur between contacts 27 and the arm 29.

The actuator plunger 21 is supported in the casing 13 for axial "in" and "out" movement, and, as previously explained, the plunger 21 has a reduced outer end which projects beyond the casing and into the collar 19. A button 43 is connected to the outer end of the plunger 21, and a spacer or collar 45 is disposed between the button 43 and a shoulder 47 spaced inwardly of the outer end of the plunger 21. The spacer or ring 45 is of a different color than the button 43, and when the plunger is in its "in" position, as illustrated in Fig. 1, only the button 43 is visible, while when the plunger is in its "out" position, as illustrated in Fig. 8, both the button 43 and the ring 45 are visible, thus visually indicating whether the plunger is in its "in" or "out" position. The inner end of the plunger 21 is formed in a fork-like manner and is slidably disposed in a recess 49 in the casing. A coil spring 51 is sleeved over the center prong at the inner end of the plunger and engages the bottom of the recess 49 as well as the adjacent surface 53 on the plunger, and the spring 51 is compressed when the plunger is in its "in" position and thus yieldably urges the plunger to its "out" position.

The contact carrying arm 29 is provided with an aperture 55 in the center thereof through which the plunger 21 extends so that relative axial sliding movement between the plunger and the contact carrying arm can occur. A slide member 57 is secured to the contact carrying arm 29 on one side of the actuator plunger by suitable means, such as rivets 59. A hinge plate 61, which is of a generally inverted L-shape in cross-section, as can be seen in Fig. 2, is disposed on the opposite side of the actuator plunger 21 from the slide 57, and the horizontal leg of hinge plate 61 is secured to the underside of the contact carrying arm 29 by rivets 63. The actuator plunger 21 is provided with an elongated slot 65 intermediate its ends to permit the contact carrying arm 29, the slide member 57 and the hinge plate 61 to slide axially relative thereto. The hinge plate 61 and the slide member 57 are interconnected by means of a rivet 67 which extends through a spacer sleeve 68 disposed in the slot 65. The hinge plate 61, the slide 57 and the contact carrying arm 29 are thus interconnected as a slide or contact carrier assembly or unit for sliding movement relative to the actuator plunger 21 to the extent of the slot 65.

A pair of spaced apart hinges 69, which are generally angle-shaped, are welded or otherwise suitably secured to the hinge plate 61. A hinge pin 71 is supported by the hinges 69 and pivotally supports, between the hinges 69, a lever-like latch element 73. The latch 73 is pivotally supported intermediate its ends, and extends upwardly through suitable apertures in the hinge plate 61 and contact carrying arm 29 and has a projection 75 adjacent the upper end thereof which supports one end of a coil spring 77. The opposite end of the coil spring is sleeved over a projection 79 on the upper end of the slide 57 so that the spring 77 acts between the latch and the slide to yieldably urge the upper end of the latch away from the plunger 21 thereby causing the latch to rotate in a counterclockwise direction about the hinge pin 71.

The lower end of the latch 73 is formed with a latching surface or shoulder 81 which normally engages the wall defining the bottom of the slot 65 in the actuator plunger 21 so as to releasably lock the slide or contact carrier assembly to the actuator plunger so that "in" and "out" movement of the actuator plunger will cause comparable movement of the slide assembly. In this connection, the slide member 57 is provided with flanges 83 adjacent its lateral ends to which the upper ends of coil springs 85 are connected. The lower end of each coil spring 85 is connected to a pin 91 which extends between and is supported by latch plates 93 supported for pivotal movement in the casing 13 by means of hinge plates 95 which are carried by a plate 96 anchored in the casing. When the contact carrying arm 29 is in its "in" or contact closed position, the springs 85 are under tension, thereby causing the slide assembly to move with the actuator plunger upon manual movement thereof when the latch 73 is in latching engagement with the actuator plunger.

An elongated bimetal or thermostat element 97 has its lower end anchored by means of a rivet 99 in the casing adjacent to and alongside of the latch 73. A screw 101 is threaded into the upper end of the bimetal strip 97 which is free to warp or deflect toward and away from the latch 73. A suitable opening 103 is provided in the casing adjacent the screw 101 so that the position of the screw in the bimetal element may be adjusted by a screwdriver or the like to properly and accurately calibrate the circuit breaker. The opening 103, after the adjustment has been accomplished, is closed by means of a closure plate 105. The screw 101, upon deflection of the bimetal element due to heating under the influence of an overload current, engages the upper end of the latch 73 and pivots it in a clockwise direction about the pivot pin 71, thereby swinging the latching surface or shoulder 81 out of engagement with the actuator plunger, whereupon the springs 85 will pull the slide assembly downwardly on the actuator plunger and cause the movable contacts 27 to move out of engagement with the fixed contacts 25. It should at this time be pointed out that the bimetal element 97 is electrically connected with the movable contact plates 31 by means of electrical conduits or pigtails 107 so that if a predetermined overload current flows through the switch and circuit breaker, the upper or inner end of the bimetal element, due to heating, will deflect toward the latch 73 to cause the unlatching action previously described.

The actuator plunger 21 is normally held in the "in" position shown in Fig. 1 by means of a latch assembly composed of rollers 109 supported on the latch plates 93 and engaging shoulders or latching surfaces 111 on the actuator plunger. When the springs 85 are under tension, due to the movable contacts 27 being in engagement with the fixed contacts 25, the latch plates 93 are rotated by the springs in a clockwise direction about pins 113 which support the latch plates on the hinge plates 95. Thus, the rollers 109 are yieldably urged into engagement with the plunger latching shoulders 111, and the springs 85 exert sufficient force to retain the plunger in its "in" position against the action of the coil spring 51 adjacent the inner end of the plunger. However, when the latch 73 is disengaged from plunger 21, due to current overload, and the contact carrier or slide assembly moves downwardly or outwardly on the plunger, tension in the springs 85 is released, and the compressed spring 51 will move the plunger downwardly and cam the rollers 109 and latch plates 93 in a counterclockwise direction to the position illustrated in Fig. 8. The plunger 21 is thus moved to its "out" position, as illustrated in Fig. 8, by spring 51.

The downward or outward moement of the slide assembly is limited by means of abutment surfaces 115 in the casing, and when the plunger moves outwardly, the bottom of the plunger slot 65 moves below the shoulder or latching surface 81 on the latch 73. When the bimetal element 97 cools, due to current interruption, it will swing back to its normal position, thereby permitting the spring 77 to swing the latch 73 in a counterclockwise direction so that the latching surface 81 will again be disposed in a position to be engaged by the bottom wall of the plunger slot 65 when the button 43 on the outer end of the actuator plunger is pushed inwardly.

When the plunger is pushed inwardly, the movable contacts **27** will again move into engagement with the fixed contacts **25** and the plunger will be latched and retained in its "in" position by the engagement of the rollers **109** with the plunger latching surfaces **111**, and the plunger will be held in its "in" position because the springs **85** will have again become tensioned or stretched so that sufficient force is applied against the rollers **109** to prevent the spring **51** from moving the plunger to its "out" position.

When it is desired to manually open the switch from the position illustrated in Fig. 1, the user merely grasps the button **43** on the outer end of the plunger **21** and pulls the same outwardly. The application of manual force will cause the plunger shoulders **111** to cam the rollers **109** and the latch plates **93** in a counterclockwise direction to permit the plunger to move to its "out" position. In view of the fact that the latching surface **81** on the lower end of the latch **73** is in engagement with the actuator plunger, the slide or contact carrier assembly will move outwardly with the plunger, thereby moving contacts **27** out of engagement with the fixed contacts **25** and interrupting current flow through the switch and circuit breaker. When it is desired thereafter to manually close the switch, button **43** is merely pushed inwardly until the movable contacts **27** engage the fixed contacts **25**, at which time the rollers **109** and latch plates **93** will have swung under the impetus of the springs **85** into engagement with the latching surfaces **111** on the plunger, thereby retaining the plunger in its "in" position.

It should be noted that the only plastic parts in this electric switch are the button **43**, the ring **45** and the two halves of casing **13**. The remainder of the internal parts are metal, and as metal stampings are cheaper to produce than molded plastic parts, this construction is less expensive than heretofore known comparable devices. Still further, plastic tends to shrink more than metal, and with a minimum of plastic parts, less shrinkage occurs with this construction than any previous known constructions. There are, furthermore, in this construction, fewer parts than in any comparable switch and circuit breaker which has heretofore been devised. Thus, the switch and circuit breaker of this invention is less expensive to manufacture than comparable switches heretofore known, and is more durable and efficient in operation for the reasons set forth above.

Referring now to Fig. 9 of the drawings, a modified thermostat or bimetal element **97'** is illustrated which provides ambient temperature compensation in the circuit breaker. It is well-known that bimetal elements will warp or deflect in one direction upon the application of heat thereto and in an opposite direction when subjected to colder temperatures. Electric switches of the type referred to herein may be used in installations where the air temperature is extremely high or extremely low, and in such event it may be necessary to compensate for the high and low temperature extremes in order to prevent the bimetal element from warping or deflecting, because of ambient temperatures, in such a manner as to adversely affect the calibration and operation of the device. In the embodiment illustrated in Fig. 9, the bimetal element, which is composed of laminated back-to-back high and low coefficient of expansion strips, is constructed so that the lower or outer portion of the element has a low expansion metal strip **117** adjacent to the latch **73'** and a high expansion strip **119** on the opposite side thereof, while the upper or inner portion of the bimetal element has a high expansion strip **121** adjacent to the latch **73'** and a low expansion strip **123** on the opposite side thereof. The pigtails **107'** which connect the movable contacts with the bimetal element are connected with the upper or inner portion of the bimetal element so that the lower or outer portion of the element is out of the electric circuit. The screw **101'** is connected with the upper end of the bimetal element, as previously described, and is adapted to engage the upper end of the latch **73'** to cause the same to move out of engagement with the actuator plunger, all as previously described. However, in view of the fact that the high and low expansion strips on the upper and lower portions of the bimetal element are reversed, and in view of the fact that the lower end of the bimetal element is anchored to the casing **13'** by means of rivet **99'**, the bimetal element will operate satisfactorily in response to current overload irrespective of ambient temperatures. Furthermore, in view of the fact that only the upper or inner portion of the bimetal element is electrically connected in the circuit, this portion only will warp or deflect upon the occurrence of current overload so as to actuate the latch **73'**. It will thus be appreciated that ambient temperature compensation may be provided in the switch and circuit breaker of this invention.

Referring now to Figs. 10 through 12, it will be seen that a modified manual latch arrangement for the actuator plunger is illustrated. It has been found that the manual latch, previously described, may require, in certain instances, excessive manual pulling force to cam the rollers and latch plates out of the way in order to manually move the actuator plunger to its "out" position. If the tension on the coil springs is reduced so as to make the plunger more easily manually actuatable, then a sufficient force may not be present to positively retain the plunger in its "in" position against accidental displacement due to vibrations, shocks, etc. Thus, in order to eliminate any problems with respect to properly loading or tensioning the springs, and in order to overcome the aforementioned difficulties, the latch structure illustrated in Figs. 10 through 12 has been devised. As in the previous embodiment, latch plates **125** are pivotally supported by hinge plates **129** and pivot pins **131** on opposite sides of actuator plunger **127**. The latch plates **125** are connected with coil springs **135** which tend to rotate the latch plates clockwise so as to retain rollers **137**, carried by the latch plates, in engagement with the actuator plunger, all as previously described. It will be noted that in this embodiment, a coil spring **139** is provided in the bottom portion of the casing rather than in the upper portion, as in the previous embodiment, to urge the plunger to its "out" position.

The primary difference between the structure illustrated in Figs. 10 through 12 and that previously described is in the construction of the actuator plunger, and it will be noted that the actuator plunger is formed of a lower or outer portion **141** and an upper or inner portion **143**. These portions overlap each other and are connected together for relative sliding movement by means of a rivet or the like **145** carried by the inner portion and extending through an elongated slot **147** in the outer portion **141**. When the plunger is in the "in" position, as illustrated in Fig. 10, the rivet **145** abuts the bottom of the slot **147**. The plunger portions **141** and **143** have their opposite sides notched or recessed at **148** to receive rollers **137** and cam or latch surfaces define the inner ends of each notch. The outer plunger portion **141** thus is provided with a cam surface **149** on each side thereof which normally engages the rollers **137**, and the inner plunger portion **143** is provided with a latch surface **151** on each side thereof which engages the rollers **137**. It will, however, be noted that the angle of each cam surface **149** relative to the axial centerline of the plunger is much less than the angle of each latch surface **151**, relative to the same line, so that the surfaces **151** are disposed at a wedging angle to the path of travel of rollers **137** and will positively retain the inner plunger portion against movement from its "in" position. The surfaces **149** are disposed at a camming angle to rollers **137**. Therefore, when the button **153** on the lower end

of the actuator plunger is pulled outwardly, the rollers 137 and latch plates 125 will be initially cammed away from the actuator plunger by the cam surfaces 149, because the outer actuator plunger portion 141 will initially move while the inner actuator plunger portion 143 will remain stationary until the inner end of the slot 147 engages the rivet 145, at which time both actuator plunger sections will move outwardly together. Continued movement of the two sections together is possible because the rollers have been cammed away from the wedging angle surfaces 151 to permit the actuator plunger to move to its "out" position. Thus, with this arrangement, the actuator plunger is retained in its "in" position by the engagement of the rollers 137 with the latch or wedge angle surfaces 151, while the camming action is done by the engagement of the cam surfaces 149 with the rollers 137, thus making it easier to manually pull the plunger out but insuring that the plunger is properly retained in its "in" position against accidental displacement. The spring 139, of course, urges the outer plunger portion outwardly so that the unit operates as a circuit breaker, as previously described.

In the embodiment illustrated in Fig. 13, the structure is substantially the same as that described in connection with Figs. 10 through 12, except that instead of the latch plate and roller arrangement, a pair of metal stampings 155 are provided. Each of the stampings 155 includes an ear 157 which is pivotally supported on pin 131', which, in turn, is supported on the hinge plate 129'. An aperture 158 is provided in the lateral outer end of each stamping 155, outwardly of the hinge plate 131', and one end of the spring 135' is connected therewith. The opposite end of each latch stamping 155 is formed into a generally semi-circular section 159, the outer arcuate portion or surface of which engages the latch and cam surfaces 149' and 151'. The device shown in Fig. 13 operates exactly the same way as the device of Figs. 10 through 12. The use of a simple sheet metal stamping for a latch plate and the elimination of the rollers reduces the cost of the switch and circuit breaker, thus making possible the building of the same more economically without affecting the improved results thereof.

What is claimed is:

1. An electric switch having automatic overload current protection including a hollow casing, fixed contact means in said casing, contact means movable into and out of engagement with said fixed contact means to open or close an electric circuit through said switch, plunger means supported in said casing for lineal movement between an "in" and an "out" position and projecting exteriorly of said casing, support means for said movable contact means supported on said plunger means for lineal movement relative thereto, latch means connected with said support means and normally engaging said plunger means to connect said plunger means and said support means together for movement as a unit, thermostat means in said casing electrically connected with said movable contact means and energizable upon the occurrence of a predetermined current overload to move said latch means out of latching engagement with said plunger means, spring means connected with said supporting means to move the same and said movable contact means out of engagement with said fixed contact means upon said movement of said latch means, spring means in said casing urging said plunger means to said "out" position, second latch means in said casing engageable with said plunger means to releasably retain said plunger means in said "in" position against the action of said plunger spring means, means yieldably retaining said second latch means in engagement with said plunger means, and means on said plunger means engageable with said second latch means to move the same away from said plunger means against said yieldable means when said plunger means is manually moved from its "in" position to its "out" position.

2. An electric switch incorporating automatic circuit breaker protection for current overloads including a hollow casing, terminal means supported in said casing, fixed contact means supported in said casing and connected with said terminal means, additional contact means in said casing movable into and out of engagement with said fixed contact means to close or open an electric circuit through said switch, plunger means supported in said casing for lineal movement between an "in" position and an "out" position and having a portion thereof disposed exteriorly of said casing, slide means supported on said plunger means for lineal movement relative thereto, means connecting said movable contact means with said slide means so that movement of said slide means causes corresponding movement of said movable contact means, an elongated latch element pivotally supported intermediate its ends on said slide means, said latch element having means adjacent one end thereof normally engaging said plunger means so that said slide means and said plunger means will move together as a unit and so that said movable contacts will be held in engagement with said fixed contacts when said plunger means is in its "in" position, an elongated bimetal element anchored adjacent one end thereof in said casing with the opposite end thereof being free to warp or deflect toward and away from said latch element, said bimetal element being electrically connected with said movable contact means so that upon the occurrence of a predetermined overload current said bimetal element will move against said latch element and move the same out of latching relationship with said plunger means, a spring supported in said casing urging said plunger means to said "out" position, latch means pivotally supported in said casing for movement toward and away from said plunger means for releasably retaining said plunger means in its "in" position against the action of said spring, spring means connected between said latch means and said slide means and placed under tension when said movable contact means is in engagement with said fixed contact means so as to yieldably urge said latch means into engagement with said plunger means and to urge said slide means and movable contact means carried thereby away from said fixed contact means, whereby when said latch element is moved out of latching relationship with said plunger means said spring means will move said slide means and said movable contact means away from said fixed contact means while at the same time releasing the spring tension on said latch means which retains said plunger means in said "in" position so that said spring can move said plunger means to its "out" position, and whereby even when said latch element is in latching relationship with said plunger means the exterior portion of said plunger means can be manually moved to its "out" position because of the yieldable loading of said latching means against said plunger means.

3. An electric switch including a hollow casing, fixed contact means supported in said casing, plunger means supported in said casing for axial movement and projecting exteriorly of said casing, contact means supported on said plunger means and movable into and out of engagement with said fixed contact means upon movement of said plunger means between an "in" position and an "out" position, said plunger means including first and second overlapping portions slidably movable relative to each other, means providing a lost motion connection between said plunger portions so that said first portion can move outwardly relative to said second portion a predetermined distance and thereafter said portions will move as a unit, latch means supported in said casing for movement toward and away from said plunger means, means yieldably urging said latch means into engagement with said plunger means, said second plunger portion having a surface engaging said latch means when said plunger means is in its "in" position, said surface being disposed at a wedging angle to the path of travel of said latch

means so that said plunger means will be positively retained against inadvertent outward movement relative to said casing, said first plunger means portion having a cam surface engageable with said latching means to cam said latching means away from said plunger means when said plunger means is manually pulled outwardly so that said plunger means can be easily manually actuated while being positively retained against accidental displacement.

4. An electric switch including a hollow casing, fixed contact means supported in said casing, plunger means supported in said casing for axial movement and projecting exteriorly of said casing, contact means supported on said plunger means and movable into and out of engagement with said fixed contact means upon movement of said plunger means between an "in" position and and "out" position, said plunger means including first and second overlapping portions, means providing a lost motion connection between said portions so that said first portion will move outwardly a predetermined distance relative to said second portion and thereafter said portions will move outwardly as a unit, latch means pivotally supported in said casing adjacent said plunger means, said latch means including an arcuate surface engageable with said plunger means, spring means in said casing connected with said latch means and yieldably pivoting the same so that said arcuate surface is spring-loaded against said plunger means, said plunger second portion having a surface disposed at a wedging angle to the path of travel of said arcuate surface and engaging said arcuate surface when said plunger means is in its "in" position to thereby retain the same against

inadvertent outward movement relative to said casing, said first plunger means portion having a cam surface overlapping said wedging angle surface engageable with said latching means arcuate surface to cam said latching means away from said plunger means when said plunger means is manually pulled outwardly so that said plunger means can be easily manually actuated.

5. The structure of claim 4 wherein the latching means is in the form of a sheet metal stamping having an ear intermediate the opposite ends thereof which is pivotally connected to said casing and having an aperture on one side of said ear to which said spring means is connected and having an arcuate end portion on the opposite side of said ear forming the arcuate surface engageable with said plunger means.

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