

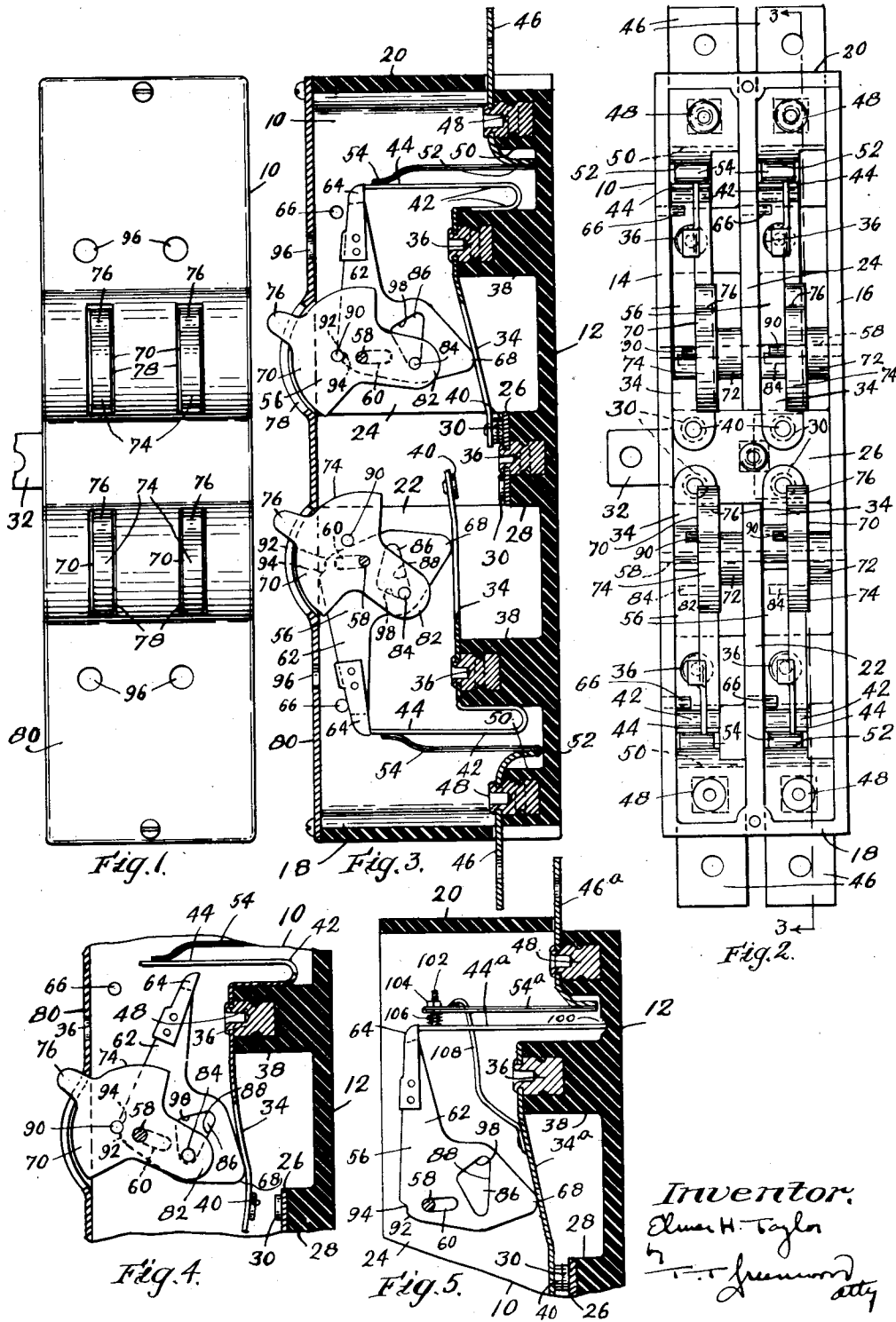
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CIRCUIT BREAKER

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CIRCUIT BREAKER

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This invention relates to electric switches and circuit breakers especially intended for the control and overload protection of house lighting circuits, although by no means restricted to such use.

One of the objects of the invention is the provision of an electric switch or circuit breaker that is small and compact, inexpensive in construction, and has provision for manual operation and also for automatic overload opening.

Another object of the invention is the provision of a switch or circuit breaker that is transversely narrow so that a number of similar switches may be combined side by side and yet occupy a relatively small length.

A further object of the invention is an improved form of switch or circuit breaker assembly comprising a plurality of movable switch or circuit breaker units cooperating with a common terminal structure.

Another object of the invention is the provision of a switch or circuit breaker having a movable contact carrying member and an improved form of actuating mechanism therefor including a cam member movable about a pivot for opening and closing the switch, and overload responsive means for disengaging said cam member and the pivot for permitting pivotal movement of the cam member about a second pivot for effecting overload opening of the switch.

Another object of the invention is the provision of a switch or circuit breaker having a cam member for effecting the closing of the switch and electrical means for tripping the cam member for effecting overload opening of the switch and a swinging handle for effecting the resetting of the cam member and the manual opening and closing of the switch.

Another object of the invention is the provision of an electric switch having an actuating member for effecting the opening and closing of the switch, the actuating member being held releasably by a strut member in position to permit manual opening and closing of the switch, and overload responsive means to displace the strut member to permit movement of the actuating member in a direction to secure automatic opening of the switch.

A further object is generally to improve the construction and operation of circuit breakers.

Fig. 1 is a front elevation of a switch or circuit breaker assembly embodying the present invention.

Fig. 2 is a plan view of the switch casing of Fig. 1 with the cover removed.

Fig. 3 is a section taken along line 3—3 of Fig. 2.

Fig. 4 is a detail of the switch mechanism in the electrically tripped condition thereof.

Fig. 5 illustrates a modified construction of the overload responsive mechanism.

The switch or circuit breaker assembly herein illustrated comprises four switches or circuit breakers which are identical and are contained in an insulating enclosing casing 10 having the bottom wall 12, the upstanding side walls 14 and 16, the end walls 18 and 20, and the intermediate walls 22 and 24. Said side and intermediate walls define four chambers or compartments each housing a separate switch unit. The intermediate walls 22 and 24 are terminated in confronting spaced relation and a terminal plate 26 is located therebetween and is secured to the top of a boss 28 rising from the bottom wall. Said terminal plate carries four stationary contact members 30, each confronting a switch compartment and adapted to cooperate with the movable switch members therein. The terminal plate 26 is provided with an ear 32 that extends outwardly through a side wall 14 for connection with a circuit conductor.

The switches are identical in construction and but one need be described.

The movable switch member comprises a resilient conducting strip 34 fixed by an inset attaching member 36 to the upper face of a ledge 38 that is integral with and upstands above the bottom wall 12 of the casing. Said strip 34 in the normal, open-circuit position thereof extends forwardly and generally parallel with the bottom wall from said ledge 38 and is terminated in its free end in a contact member 40 which is adapted to cooperate with the associated stationary contact member 30 disposed therebeneath.

The end of the strip on the opposite side of the supporting ledge 38 is reflexed laterally over the ledge into the U-shape 42 and has an upstanding or forwardly-extended projecting leg 44 which forms a movable strut for a part of the actuating mechanism presently to be described.

A switch terminal 46 is secured by an inserted attaching member 48 to the front face of a boss 50 rising from the bottom wall 12 of the enclosing casing and has one end projected through the end wall 18 for attachment to a circuit conductor. The inner end 52 of said terminal member is reflexed toward the bottom wall 12 at right angles with the body of said terminal member and the lower or inner end of a horizontal bi-

metallic thermally-expansible strip 54 is spot-welded or otherwise electrically and mechanically connected thereto. The upper or outer end of said bimetallic strip is spot welded or otherwise mechanically secured to the outer end of the strut 44 below the top thereof. The bimetallic strip is thus included directly in the circuit of the separable contact members and is adapted to become heated by a sufficient excess current to flex and move the upper end of the strut 44 downwardly, Fig. 3, for the purpose of securing overload tripping of the switch.

The switch operating mechanism includes an actuating cam member 56 formed from sheet insulating material or molded of insulating material and preferably having a thickness about equal to one-half the width of the movable contact strip 34. Said actuating member is disposed loosely upon a pivot pin or rod 58 which extends through or has a bearing in the side walls 14 and 16 and the intermediate wall 22 and spans the space and traverses two switch compartments and constitutes also a support for the similar switch operating mechanism in the adjoining compartment.

Said cam member 56 is provided with a slot 60 that is elongated in a direction generally normal to the switch arm 34 and in which slot the pivot pin 58 is located, the purpose of the slot being to permit reciprocation of the actuating member and pivotal movement thereof on the end of the strut 44, as will presently appear, for effecting manual opening and closing of the switch and for permitting engagement between the bottom or inner end of the slot and the pin 58 to allow the actuating member to pivot on the pin to secure the automatic opening of the switch.

The cam member 56 is provided with a laterally elongated arm 62 that is directed toward the strut 44. A metal finger 64 is secured to the end of the arm and projects therebeyond and is adapted to rest pivotally upon the top of the strut during the manual opening and closing operations of the switch. A pin 66 carried by the wall 14 and overlying the top of the arms prevents unnecessary upward movement of the arm in a resetting direction.

The actuating member 56 is provided with a cam-shaped lower end, the point 68 of which bears against the resilient contact strip 34 to flex said member inwardly into switch closed position when the actuating member is moved inwardly.

The actuating member 56 is operated by a handle member 70 which preferably is composed of insulating sheet material or is molded into shape. Said member preferably is approximately equal in thickness to about one-half the width of the resilient strip 34 and is pivotally mounted on the pin 58 beside the actuating member 56 and is spaced from the intermediate wall 22 by a suitable spacer 72. The actuating member is provided with an arcuate top edge 74 and with an intermediate upstanding thumb piece 76 which projects through a slot 78 of the removable cover 80. Movement of the thumb piece and the handle member in one direction or downwardly, Fig. 3, effects the closing of the switch. Movement of the handle member in the opposite direction effects the opening of the switch. The handle member is provided with a projecting part 82 that extends from the pivot pin 58 toward the contact strip 34 and has fixed therein a laterally extended pin 84 that is located in a generally triangularly spaced cam opening 86 of the actuating member.

In the switch open position of the actuating member the pin 84 is adapted to be engaged with the bottom or inner wall 88 of the opening 86 and said wall is so inclined with respect to the arcuate line of swinging movement of said pin as the handle piece is moved downwardly in a switch closing direction, as to effect a camming action between the pin and said bottom wall which causes said actuating member to pivot about the strut 44 and to flex the resilient strip 34 downwardly into engagement with the stationary contact member, thereby to close the switch. In the switch closed position, the pin 84 is at the upper side of the line between the pivot pin 58 and the point of contact of the cam nose 68 and the contact strip 34 so that the resiliency of the strip holds the parts in switch closed position. When the handle member is given an initial upward movement the pressure of the resilient strip 34 upon the cam nose or point 68 of the actuating member causes the part to move into open circuit position.

While the engagement between the pin 84 and the wall 88 can be utilized to hold the switch manually closed it is preferred to effect the final closing movement by a laterally projecting pin 90 of the handle member, which pin overlies the upper side edge of the actuating member and in the final closing movement has a camming effect on the face 92 of the actuating member and moves into a notch 94 thereof where the actuating and handle members are held releasably in switch closed position by the pressure exerted therebetween by the resilient strip 34. Positive movement of the handle member in a switch open position moves the pin 90 out of the notch 94 and over the center so that the resilient strip 34 is thus effective in moving the parts rapidly into an open circuit position.

In the closed circuit position of the parts the cam wall 88 of the opening 86 of the actuating member preferably is free from engagement with the pin 84.

The normal switch open position of the parts is illustrated in the bottom switch of Fig. 3. The normal switch closed position of the parts is illustrated in the upper switch of Fig. 3.

When an overload traverses the circuit the bimetallic strip 54 is heated and caused to be moved in a direction to cause the strut member 44 to move out from under the finger 64 of the arm 62. The strut member 44 may be initially biased by its inherent resiliency for such movement and may be restrained normally from such movement by the thermostatic strip, or the strut member may be initially without bias and be pulled out from under the arm by the flexing of the strip since the bimetallic strip and the strut member are preferably joined together.

Since the pressure of the resilient contact strip 34 acts on the actuating member 56 below the pivot pin 58 and on the side of said pin opposite said strut, this pressure is such as to effect movement of the actuating member in a switch opening direction into a position as illustrated in Fig. 4, in which position the contact members are separated and the switch circuit is open. With the specific construction herein illustrated the actuating member and the handle member move to electrically-tripped switch-open position conjointly, providing the handle member is free for such movement, as by having the slot 78 in the cover plate sufficiently long. If, however, the handle is held from such movement, the actuating member will move into circuit-open position

Independently of the handle. In the electrically tripped condition of the switch the finger 76 of the handle member is disposed in a higher position, with respect to the upper switch Fig. 3, than it assumes in the manually opened condition of the switch. This displaced position may be utilized as an indication of the electrically tripped condition of the switch, if desired. The electrically tripped condition of the switch may also be differently denoted, however. For instance, the cover plate 80 may be provided with a window 96 therein above a part of the arm 62 of the actuating member. This arm is close under the window in the set position thereof and hence the appearance of the arm through the window is an indication of the set condition thereof. When the switch is tripped electrically the arm moves away from the window and hence the disappearance of the arm is an indication of the tripped condition of the switch.

When the actuating member is released for movement in a switch opening direction, due to operation of the bimetallic strip, this movement cannot be prevented by holding the handle member stationary since the notch 94 and cam part 92 of the actuating member will merely move out from engaging position with the pin 90 of the handle member and the actuating member will thus move to open position independently of the handle member. Thus the switch mechanism is desirably trip-free from the handle member.

The actuating member 56 is returned to a reset condition where it is again engaged with the strut member 44 by moving the handle member downwardly into a full open position. This movement causes the pin 84 of the handle member to engage the inclined wall 98 of the opening 86 to swing the actuating member in the opposite or counter-clockwise direction to restore the arm 62 to its initial position on top of the strut member 44.

While it is preferred to utilize the pin 90 of the handle member and the cooperating notch 94 and cam face 92 of the actuating member 56 to secure final switch closed position of the parts and to move the cam face 88 of the actuating member away from engagement with the pin 84 of the handle member for the purpose of reducing friction and rendering the operation of the switch somewhat easier, the pin 90 and the notch 94 and cam face 92 can be eliminated if desired without modifying the operation of the switch as above described, except that in this instance the pin 84 and the cam face 88 will remain in engagement during the final closing movement of the switch and during the first part of the electrically tripped movement of the actuating member.

In the electrically tripped movement of the actuating member, the actuating member pivots upon the pin 58, being held from undue sliding on said pin, otherwise permitted by reason of the slot 60, by the pin 90, or if this pin is eliminated, by the pin 84. If the handle should happen to be held stationary during the tripping movement of the actuating member then the pin 84 accomplishes the above result.

It is preferred to have the strut member 44 project forwardly above the top of the bimetallic strip 54 and directly engage the arm of the actuating member as it is considered preferable to have the bimetallic strip under no mechanical stresses except those imposed by the flexing thereof.

While it is preferred to have the strut and con-

tact carrying strip 34 formed integrally, the construction may be otherwise. Fig. 5 illustrates an arrangement wherein the strut member 44a is a separate strip fulcrumed at one end in a notch or recess 100 of the casing and engaged with and supporting the actuating member at its other end. The bimetallic strip 54a in this modification is secured to the terminal conductor 46a as before. At its free end, however, it has a bolt 102 passed therethrough, the bolt being fixed to the free end of the strut member and having a nut 104 thereon engaged by the bimetallic strip. With this arrangement the flexing of the strip upwardly pulls on the bolt 102 and hence pulls the free end of the strut out from under the actuating member, thereby causing it to trip as above described. A compression spring 106 is interposed between the strut member and the bimetallic strip to hold said strip against the nut 104. With this arrangement a flexible braid 108 serves electrically to connect the movable contact carrying strip 34a with the upper end of the bimetallic strip so that the switch current can traverse and heat said bimetallic strip.

I claim:

1. An electric switch comprising a movable contact member biased for movement in a circuit-opening direction when the switch is closed, an actuating member for moving said contact member in a closing and an opening direction, two pivotal supports for said actuating member, said actuating member having means exerting pressure on said contact member at the same side of both pivotal supports, operating means for moving said actuating member in said directions, and means for removing one pivotal support from said actuating member.

2. An electric switch comprising a movable contact member biased for movement in a circuit-opening direction, an actuating member having a cam bearing on said contact member for moving it in a circuit-closing direction, a first pivotal support for said actuating member, an operating member for effecting pivotal movement of said actuating member on said first pivotal support in a circuit-closing direction, electro-responsive means for effecting operative disengagement between said actuating member and said first pivotal support, and a second pivotal support for said actuating member between said first pivotal support and said cam operative upon disengagement of said first pivotal support to permit movement of said actuating member in a circuit-opening direction.

3. An electric switch comprising a switch member biased for movement from a circuit-closed toward a circuit-open position, an actuating member engageable with said switch member for moving said switch member from circuit-open to circuit-closed position, two pivotal supports for said actuating member located on the same side of the region of engagement between said actuating and switch member, an operating member for moving said actuating member about one pivotal support and free of the other support for effecting circuit-closing movement of said switch member, and electro-responsive means for rendering said one pivotal support ineffective and for causing said actuating member to pivot about said other pivotal support in a circuit-opening direction.

4. An electric switch comprising a movable switch member biased for movement from a circuit-closed toward a circuit-open position, an actuating member having two pivotal supports

therefor and in the circuit-closed position thereof and of said switch member exerting pressure on said switch member at the same side of both pivotal supports but nearer one than the other pivotal support, operating means for moving said actuating member about said remote pivotal support in a circuit-closing direction, said remote pivotal support being responsive to an abnormal electrical condition to become ineffective in supporting said actuating member and to shift the support of said actuating member to the near support and effect pivotal movement of said actuating member in a circuit-opening direction on said rear pivotal support.

5. An electric switch comprising an actuating member, two pivotal supports therefor, a movable switch member biased for movement from a circuit-closed toward a circuit-open position and when in closed position exerting pressure on said actuating member for pivotal movement thereof in the same direction on both said pivotal supports, and means for withdrawing one pivotal support from supporting relation with said actuating member and effecting opening movement of said actuating member and switch member by movement of said actuating member on said other support.

6. An electric switch including a movable switch member biased for movement in an opening direction, an actuating member having a pivotal support and capable of movement about said pivotal support to effect movement of said switch member in a closing direction, a second pivotal support for said actuating member on which said actuating member is movable to effect movement of said contact member in an opening direction, means for shifting the support of said actuating member from one to the other of said pivotal supports, and an operating member moving said actuating member in the opposite direction about said second pivotal support to re-engage it with said first pivotal support.

7. An electric switch including a movable switch member biased for movement in an opening direction, an actuating member having a pivotal support and capable of movement about said pivotal support to effect movement of said switch member in a closing direction, a second pivotal support for said actuating member on which said actuating member is movable to effect movement of said contact member in an opening direction, electro-responsive means for shifting the support of said actuating member from one to the other of said pivotal supports, and an operating member moving said actuating member in the opposite direction about said second pivotal support to re-engage it with said first pivotal support.

8. An electric switch including a movable contact carrier, an actuating member engageable with said carrier for moving it into a switch closed position, an electro-responsive displaceable fulcrum for said actuating member, a pivoted operating member having means engageable with said actuating member for moving it between switch open and closed positions on said electro-responsive displaceable fulcrum, spring means urging said actuating member for movement toward switch open position from a switch closed position and for holding said operating member releasably in the switch closed position thereof, means for effecting displacement of said fulcrum from said actuating member, and a second fulcrum about which said actuating member is arranged to pivot when free from said first fulcrum.

9. An electric switch including a movable contact carrier, a pivotally supported actuating member engageable with said carrier for moving it into switch closed position, a pivotal operating member, said operating and actuating members having cooperating cam sections for effecting the reciprocation of said actuating member on corresponding reciprocatory movements of said operating member and for releasably holding said actuating member in switch closed position, and means for shifting the pivotal support of said actuating member from the under to the upper side of said actuating member to effect switch-opening movement of said carrier.

10. An electric switch including a movable contact carrier, a pivotally supported actuating member engageable therewith for moving said contact carrier into switch-closed position, said actuating member having a cam-faced opening at one side of the pivotal support therefor and having a slot that is elongated in the direction of switch-closing movement of said actuating member, and a reciprocable operating member for said actuating member having a pivot pin that is extended through said slot and having a cam pin located in said opening and engageable with a cam wall thereof for effecting reciprocatory movement of said actuating member in response to reciprocatory movement of said operating member.

11. An electric switch including a resilient contact carrying strip, an actuating member engageable with said strip for flexing it against its inherent resiliency in a circuit closing direction, said actuating member having a cam-walled opening and a slot that is elongated in the direction of switch-closing movement of said actuating member, and an operating member for said actuating member having a pivot pin passed through said slot and having a cam pin in said opening and engageable with a cam wall thereof for effecting reciprocatory movement of said actuating member, and a releasably electro-responsive pivotal support for said actuating member.

12. An electric switch including a movable spring biased contact carrier, an actuating member engageable with said carrier for moving it in a switch closing direction, a pivotal support for said carrier located at one side of the line of engagement between said actuating member and carrier, an operating member for said actuating member having a pivotal support therefor that is eccentric with respect to the pivotal support of said actuating member and a cam bearing on said actuating member and movable in engagement therewith across a line through the pivotal support for said operating member and the point of engagement between said actuating member and contact carrier for effecting closing of the switch and the releasable retention of said actuating member and operating member in switch-closed position.

13. In an electric switch including a spring urged contact carrier biased for movement in a switch-opening direction, an actuating member engageable with said carrier for moving it into switch closed position, a pivotal support for said actuating member disposed at one side of the line of engagement between said actuating member and contact carrier, an operating member for said actuating member having a pivotal support therefor that is eccentric with respect to the pivotal support for said actuating member, said actuating and operating members having means providing cooperating cam faces, one of which is

movable over the other with pivotal movement of said operating member in a switch closed direction to effect corresponding movement of said actuating member, and means providing other cooperating cam faces of said actuating and operating members engageable during the latter part of the movement of said operating member into switch closed position to effect separation of said first named contact faces and the final movement of said actuating member into switch-closed position.

14. In an electric switch including a spring urged contact carrier biased for movement in a switch-opening direction, an actuating member engageable with said carrier for moving it into switch closed position, a pivotal support for said actuating member disposed at one side of the line of engagement between said actuating member and contact carrier, an operating member for said actuating member having a pivotal support therefor that is eccentric with respect to the pivotal support for said actuating member, said actuating and operating members having means providing cooperating cam faces, one of which is movable over the other with pivotal movement of said operating member in a switch closing direction to effect corresponding movement of said actuating member, and means providing other cooperating cam faces of said actuating and operating members engageable during the latter part of the movement of said operating member into switch-closed position to effect separation of said first named contact faces and the final movement of said actuating member into switch-closed position, said last named cam faces in the switch closed position thereof having a point of engagement that is on the side of the pivot of said operating member opposite the line of engagement between said actuating member and carrier whereby to hold said actuating member releasably in switch-closed position.

15. An electric switch including a movable switch member biased for movement from switch closed towards switch open position, an actuating member associated with said switch member for moving it into switch closed position and being also movable therewith in a switch opening direction, a support on which said actuating member can rock during movement thereof in a switch closing and opening direction, guiding means associated with said actuating member for guiding it during such movement, an operating member associated with said actuating member for moving it into switch open and closed position and having an over-center operative connection with said actuating member for holding it releasably in switch closed position, an electro-responsive means for operably disconnecting said actuating member from said support, said switch member exerting pressure on said actuating member in a direction to move the disconnected actuating member on said guiding means into a switch open position.

16. An electric switch including a movable switch member biased for movement from a switch closed toward a switch open position, an operating member therefor having a pivotal support, an actuating member slidable on said pivotal support and having a support on which it can rock for movement to and from switch closed position under urge of said operating member, said operating member having an over-center operative connection with said actuating member for moving said actuating member into and holding it releasably in switch closed position, and

electro-responsive means for operably disconnecting said actuating member from its support for effecting switch opening movement of said movable switch member under its bias.

17. An electric switch including a movable switch member biased for movement from a circuit closed toward a circuit open position, a movable support, an actuating member rockable on said support and having means for exerting pressure on said switch member in a switch closing direction, a pivoted operating member having cam means engageable with said actuating member arranged to move it in a switch closing direction and having an over-center operative connection with said actuating member to hold it releasably in switch closed position, electro-responsive means for moving said support from its engagement with said actuating member, and other supporting means opposed to and displaced from said movable support engageable with said actuating member for guiding it for movement in a circuit opening position under the bias of said movable switch member upon removal from said support.

18. An electric switch including a switch member biased for movement from a switch closed toward a switch opening position, an actuating member engaged with said switch member and movable in switch closing and opening directions to effect the closing and opening of the switch, a strut member on which said actuating member is pivoted during such movement thereof, and means for removing said strut member from operative association with said actuating member and a pivotal support opposed to and displaced laterally from said strut member on which said actuating member turns in a switch opening direction free from said strut member.

19. In an electric switch, the combination of a supporting base, a switch member comprising an inherently resilient contact carrying strip secured to said base and having a reflexed free portion constituting a strut, switch operating mechanism operative upon said strip for moving it between switch open and closed positions and having a part normally supported by said strut, and electro-responsive means for moving said strut from the aforesaid relation to effect the switch opening movement of said strip.

20. In an electric switch, the combination of a supporting base, a switch member comprising an inherently resilient contact carrying strip secured to said base and having a reflexed free portion constituting a strut, switch operating mechanism operative upon said strip for moving it between switch open and closed positions and having a part normally supported by said strut, a terminal, and a thermo-responsive bimetallic member connected with said terminal and having an electrical and mechanical connection with said strut for conducting current between said terminal and strip and for moving said strut from the aforesaid relation.

21. In an electric switch, a movable contact member, two opposed displaced fulcrums, an actuator for said contact member disposed between said fulcrums and normally bearing and fulcruming on one fulcrum, and means for withdrawing said one fulcrum to effect the fulcruming of the actuator on the other fulcrum.

22. In an electric switch, two opposed displaced fulcrums, an actuator between said fulcrums, spring means exerting pressure on said actuator on the same side of both fulcrums arranged to press said actuator in one direction against one

fulcrum and in the opposite direction against the other fulcrum, a contact member operated by said actuator, and means for withdrawing one fulcrum from operative relation with the actuator to effect the turning of the actuator about the other fulcrum.

23. In an electric switch, two opposed displaced fulcrums, an actuator disposed between said fulcrums and arranged to bear in one direction on one fulcrum and in the opposite direction on the other fulcrum, spring means exerting pressure on said actuator on the same side of both fulcrums, an operating member having a pivotal connection with one fulcrum and an over-center connection with said actuator by which it is held releasably in switch closed and open positions, a movable contact member operated by said actuator, and means for withdrawing said other fulcrum from operative relation with said actuator

to effect the turning of said actuator about the remaining fulcrum.

24. In an electric switch, a pivoted operating handle movable between switch open and closed positions, an actuator having a pivotal support on said operating handle and also having a second and removable pivotal support on which it normally pivots, spring means urging said actuator against both pivots when in switch closed position and through said actuator exerting pressure on said operating handle at one side of its pivot to maintain said operating handle releasably in switch closed position, means for removing said removable pivotal support from said actuator to effect its movement into switch open position by said spring means, and a movable contact controlled by said actuator.

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