

March 2, 1965

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3,171,921

CIRCUIT BREAKER OPERATING MECHANISM

Filed Oct. 3, 1960

3 Sheets-Sheet 1

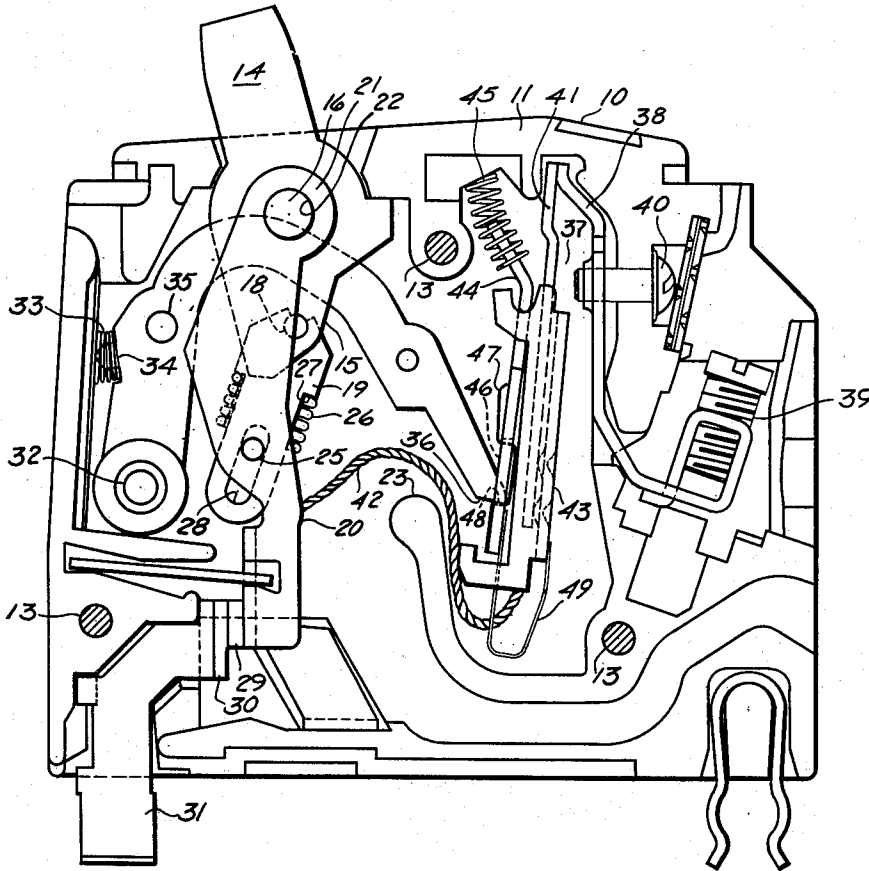


FIG. 1

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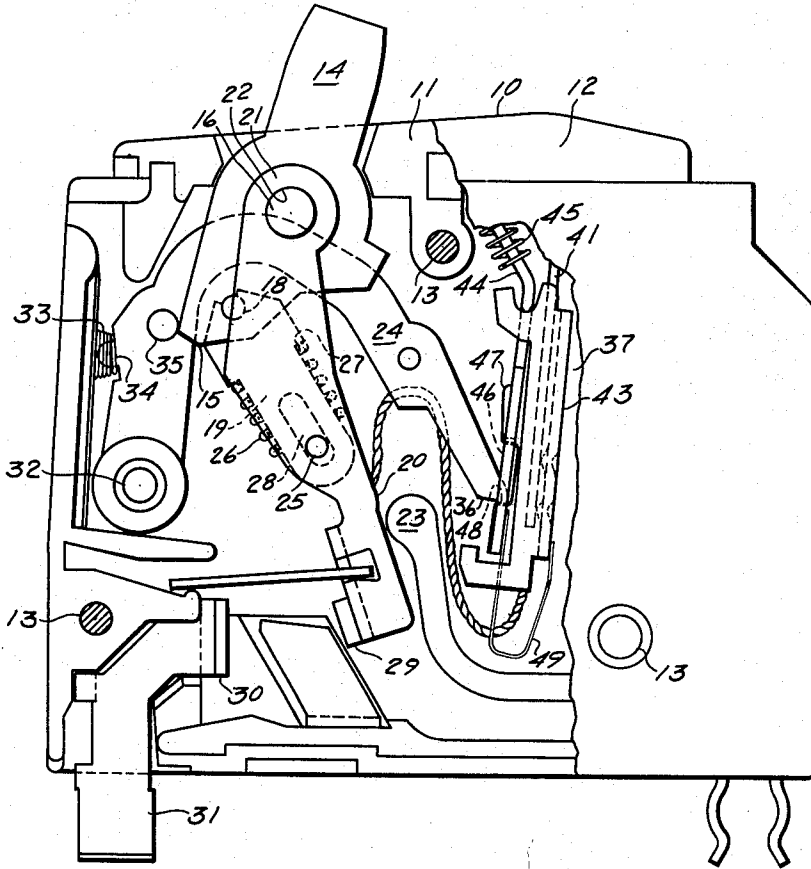


FIG. 2

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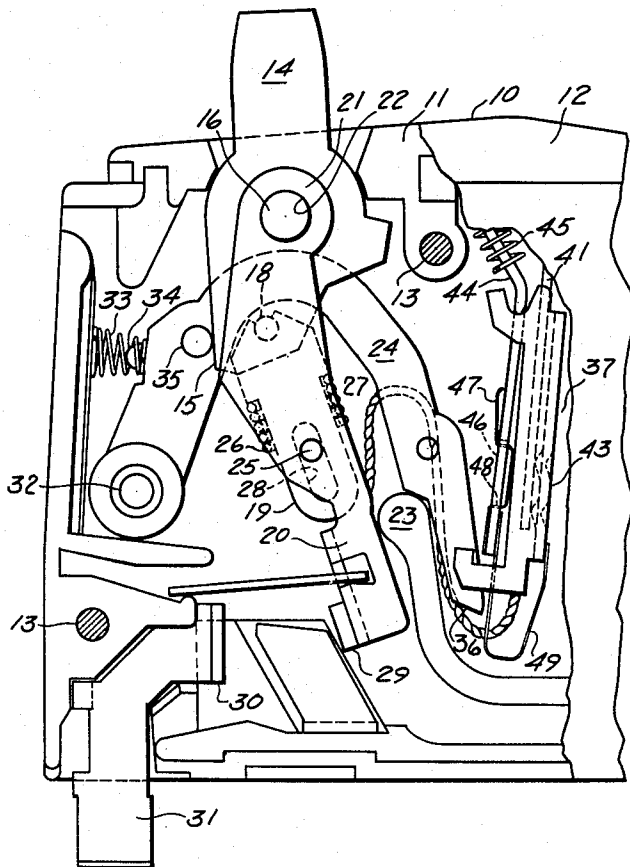


FIG. 3

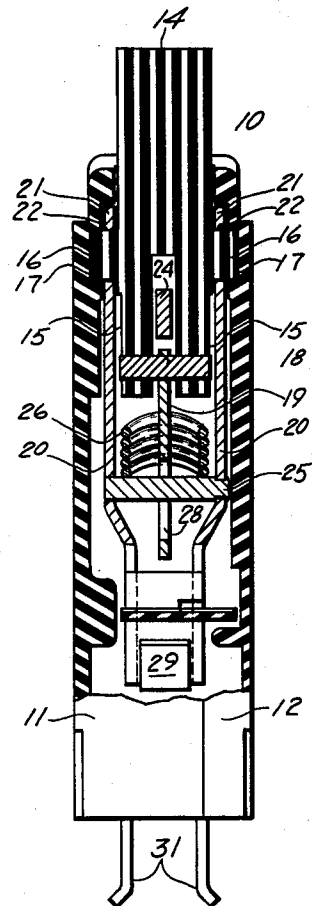


FIG. 4

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CIRCUIT BREAKER OPERATING MECHANISM
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 3 Claims. (Cl. 200—116)

This invention relates generally to electrical circuit breakers and, particularly, to operating mechanisms therefor.

Patent No. 2,902,560 for Circuit Breaker, issued September 1, 1959 to Stanback et al. and assigned to the same assignee as the present invention, discloses a molded case circuit breaker employing a toggle operated overcenter spring mechanism. This type of mechanism, which is in widespread use and performs satisfactorily, comprises a movable contact carrier having one end pivoted against a movable manual operator and a tension spring having one end attached near the other end of the contact carrier. The other end of the tension spring is attached to a movable cradle member which is maintained in latched position by a suitable electroresponsive tripping mechanism. During tripping it is first necessary for the cradle member to move to carry the tension spring over center before the movable contact carrier can move to contact-open position. Thus, there is a time delay and a period of decreasing contact pressure, both undesirable, before the contacts open. Furthermore, use of the same strong tension spring to hold the contacts closed and to force cradle member against the tripping mechanism results in undue force being exerted on the latter, such force tending to interfere with proper calibration of the tripping mechanism. It is desirable, therefore, to provide an improved type of toggle operated overcenter spring mechanism for circuit breakers which overcomes the aforesaid disadvantages and has additional advantages.

Accordingly, it is an object of this invention to provide an improved circuit breaker mechanism wherein manual opening and closure of its contacts is carried out by moving an overcenter spring over center and wherein automatic opening of its contacts during tripping is initiated by movement of its movable contact toward contact-open position before the overcenter spring passes over center.

Another object is to provide a circuit breaker mechanism of the aforesaid character wherein contact opening during tripping is initiated by a direct blow on its movable contact carrier.

Another object is to provide a circuit breaker mechanism of the aforesaid character wherein the overcenter spring is distinct from biasing means which initiate contact opening during tripping.

Another object is to provide improved means for mounting the movable contact carrier of the circuit breaker mechanism.

Another object is to provide improved means for mounting the overcenter spring.

A more specific object is to provide an improved circuit breaker mechanism wherein the movable contact carrier is pivotally mounted on a pivotable operating member and a compression type overcenter spring is disposed between the contact carrier and the operating member and wherein a movable cradle member having its own biasing spring in adapted to be latched in untripped position by an electroresponsive trip mechanism and is adapted to be unlatched for movement toward tripped position during which it acts directly upon the contact carrier to effect contact separation before the overcenter spring passes over center.

Other objects and advantages of the invention will hereinafter appear.

The accompanying drawings illustrate a preferred embodiment of the invention, it being understood that the embodiment illustrated is susceptible of modification with respect to details thereof without departing from the scope of the appended claims.

In the drawings:

FIG. 1 is a side view of a circuit breaker incorporating the invention with its side cover removed and showing the circuit breaker mechanism disposed in "on" or "closed" position.

FIG. 2 is similar to FIG. 1 but shows the circuit breaker mechanism disposed in "off" or "open" position.

FIG. 3 is similar to FIGS. 1 and 2 but shows the circuit breaker mechanism disposed in "tripped" position.

FIG. 4 is a cross sectional view of the circuit breaker taken along the line 4—4 of FIG. 3.

With reference to the drawings, the circuit breaker in which the present invention is embodied comprises a case 10 which is formed by an open-sided base member 11 and a cover member 12 therefor which is secured thereto by a plurality of rivets 13. The base 11 and cover 12 are preferably molded from suitable electrical insulating material and are provided with complementary recesses and projections which afford support for the circuit breaker mechanism, hereinafter described. The case 10 is provided with suitable openings through which extend the manual operating member and the electrical connecting members for the circuit breaker mechanism.

A manual operating member 14 having a handle portion extending outwardly of the case 10 through the top wall thereof and having a body portion provided with a pair of legs 15 extending inwardly into the case is provided with trunnions 16 which are journaled in suitable bearing recesses 17 (see FIG. 4) in the case to pivotally support the manual operating member.

A pin 18 extends between and is supported by the legs 15 of the manual operating member 14 and a spring guide link 19, hereinafter described, is pivotally supported on the pin and depends therefrom.

A movable contact carrier member 20 having a pair of upwardly extending legs 21, each of which is provided with a circular aperture 22 near its uppermost end, is pivotally supported on the trunnions 16 of the manual operating member 14. Conceivably, the movable contact carrier 20 could be pivoted directly on the case 10 instead of on the trunnions 16 of the manual operating member 14 if suitable provisions were made therefor. The movable contact carrier 20 is movable clockwise to contact-closed position and is movable in the opposite direction to contact-open position; travel in the latter direction being limited by a stop projection 23 molded in the case 10, as FIGS. 2 and 3 show. The stop projection 23 also serves to limit clockwise travel of a movable cradle member 24, hereinafter described, as FIG. 3 shows.

The legs 21 of the movable contact carrier 20 rigidly support a guide pin 25 therebetween which serves as a bearing surface for the lower end of an overcenter spring 26 which is of the compression type. The upper end of the overcenter spring 26 is intended to exert a force on the manual operator 14 but it is not practical in the embodiment shown to have the upper end of the overcenter spring 26 bear directly thereagainst. Accordingly, the spring guide link 19 is provided and the overcenter spring 26 surrounding it bears against the shoulders 27 provided near the upper end of the spring guide link. The spring guide link 19 insures that the overcenter spring 26 is properly disposed with respect to the manual operator member 14 and the movable contact carrier 20 no matter what relative position they assume. The spring guide link 19 is provided with an aperture or slot 28

which slidably accommodates the guide pin 25 on the movable contact carrier 20.

The lower end of the movable contact carrier 20 is provided with a movable contact 29 which is electrically and mechanically connected thereto and is adapted to cooperate with a stationary contact 30 which is electrically and mechanically connected to an electrically conductive spring jaw clip 31. The spring jaw clip 31 is supported on the case 10 by entrapment and adapts the circuit breaker for electrical connection to an electrical terminal (not shown) on a circuit breaker panelboard (not shown).

The U-shaped cradle or tripping member 24 is pivotally supported at one end on a hub 32 formed on the base 11 of the case 10. The cradle 24 extends between the legs 15 of the manual operator 14 above the pin 18 carried by the latter. The cradle 24 is biased for rotation in the clockwise direction (with respect to FIGS. 1, 2 and 3) about the hub 32 by a biasing spring 33 which is disposed between the left end wall of the case 10 and the cradle. It is preferred that the biasing spring 33 be of the compression type and that it be of conical configuration so that nesting or telescoping of the convolutions thereof occurs during compression in order to conserve space. The biasing spring 33 must be sufficiently strong to overcome the force of the overcenter spring 26 when the latter is acting to maintain the movable contact carrier 20 in closed position, as will hereinafter appear. The cradle 24 is provided with a projection 34 which cooperates with one end of the biasing spring 33 to maintain the latter in proper position. The cradle 24 is further provided with a transversely disposed reset pin 35 which is adapted to cooperate with the legs 21 of the movable contact carrier 20 when tripping occurs and with the legs 15 of the manual operator 14 when the circuit breaker mechanism is being reset, as will hereinafter appear. The cradle 24 is provided at its other end with a latching portion 36 which is adapted to cooperate with a current responsive tripping mechanism 37.

The electroresponsive tripping mechanism 37, which is adapted to latch the cradle 24 in one position and to release it for movement to another position during tripping, is supported by an electrically conductive terminal strap 38 which is supported by the case 10 and is provided with a terminal screw 39 at its exterior end portion. The strap 38 is provided with a calibration screw 40 which is rotatable to move the strap 38 thereby changing the position of the tripping mechanism 37. As will be understood, the particular construction of the current responsive tripping mechanism 37, hereinafter briefly described, forms no part of the present invention and equivalent tripping mechanisms may be employed. However, reference may be had to Patent No. 2,902,560, hereinbefore referred to, for a more complete description of the construction and operation of a current responsive tripping mechanism substantially identical to that disclosed herein. The current responsive tripping mechanism 37 comprises an electrically conductive bimetallic member 41 which is welded at its upper end portion to the terminal strap 38. One end of a flexible electrical conductor 42 is electrically connected to the bimetallic member 41 and the other end is electrically connected to the movable contact carrier 20. A magnetic yoke member 43 is welded to the lower or free end portion of the bimetallic member 41. A movable magnetic armature member 44 is pivotally supported on the yoke 43 and is biased thereagainst by a helical compression spring 45 which is disposed between the top wall of the case 10 and the armature. The armature member 44 is provided with an aperture 46 in which a hardened steel member 47 is secured and the member 47 affords a latch surface 48 for the latching portion 36 of the cradle 24. A U-shaped ambient temperature compensation bimetallic member 49 has one end rigidly attached to the lower end portion of the yoke 43 and the other end of the member 49 bears against the free end of the armature 44 to maintain the latter in predetermined position.

The circuit breaker operates in the following manner.

With reference to FIG. 2, the circuit breaker mechanism is shown in "manually opened" condition wherein the overcenter spring 26 is disposed over center in the left-hand direction thereby causing the manual operator 14 to be biased to its extreme position in the clockwise direction and causing the movable contact carrier 20 to be biased to its extreme position in the counterclockwise direction against the stop projection 23. The cradle 24 is latched in untripped position by the tripping mechanism 37 and the biasing spring 33 therefor is compressed.

The circuit breaker mechanism is moved from the "manually opened" condition shown in FIG. 2 to the "closed" condition shown in FIG. 1 by manually moving the manual operator 14 to its extreme position in the counterclockwise direction thereby causing the overcenter spring 26 to be carried over center in the right-hand direction. The overcenter spring 26 acts upon the guide pin 25 to bias the movable contact carrier member 20 in the clockwise direction whereupon contact is established between the movable contact 29 and the stationary contact 30. Thus, an electrical circuit is completed from the spring jaw clip 31, through the stationary contact 30, the movable contact 29, the movable contact carrier 20, the flexible conductor 42, the bimetallic member 41 of the tripping mechanism, 37, to the electrically conductive strip 38. The cradle 24 remains latched in untripped position by the tripping mechanism 37 and the biasing spring 33 therefor remains compressed.

The circuit breaker mechanism is moved from the "closed" condition shown in FIG. 1 to the "tripped open" condition shown in FIG. 3 in response to an abnormal circuit condition which causes movement of the latch surface 48 on the tripping mechanism 37 away from the cradle 24. When this occurs, the latch surface 48 of the tripping mechanism 37 becomes disengaged from the latching portion 36 of the cradle 24 and the cradle, under the action of the biasing spring 33 which tends to decompress, rotates in the clockwise direction to its extreme position against the stop projection 23. As the cradle 24 rotates, the reset pin 35 carried thereby strikes directly against the legs 21 of the movable contact carrier 20 causing the latter to move in the counterclockwise direction thereby effecting separation of the movable contact 29 and the stationary contact 30. As the contact carrier member 20 moves, it carries the overcenter spring 26 over center in the left-hand direction and the overcenter spring then biases the movable contact carrier 20 against the stop projection 23 and biases the manual operator 14 from its extreme leftward position to a central or upright position. Movement of the manual operator 14 to its extreme rightward position is prevented because the legs 15 of the manual operator member come to rest against the reset pin 35 on the cradle 24, as FIG. 3 shows.

The circuit breaker mechanism is "reset," that is to say, moved from the "tripped open" condition to the "open" condition shown in FIG. 2, by manually moving the manual operator 14 in the clockwise direction so that the legs 15 thereof bear against the reset pin 35 on the cradle 24 to cause the latter to rotate in a counterclockwise direction against the biasing spring 33 until the latching portion 36 of the cradle 24 re-engages the latch surface 48 of the tripping mechanism 37. The circuit breaker mechanism then assumes the "open" condition shown in FIG. 2 and is in readiness to be moved to the "closed" condition shown in FIG. 1.

What is claimed is:

1. An electric circuit breaker comprising an insulating case, manually operable means pivotable on said case about a point, contact carrying means pivotable to circuit open and circuit closed positions, spring guide means pivotally supported on said manually operable means and slidably associated with said contact carrying means, compression type overcenter spring means supported by said spring guide means and adapted to bias said contact carry-

ing means and said manually operable means in opposite rotative directions, the line of action of said overcenter spring means being shiftable by said manually operable means to cause actuation of said contact carrying means, tripping means pivotable on said case and movable to latched and unlatched positions, biasing means disposed between said tripping means and said case to bias said tripping means toward unlatched position, and electro-responsive means supported by said case normally maintaining said tripping means in latched position and being operable to permit movement of said tripping means to unlatched position, said tripping means being adapted to move said contact carrying means toward circuit open position and effect shifting of the line of action of said overcenter spring means across said point by said contact carrying means.

2. An electric circuit breaker comprising an insulating case having a pair of confronting walls, a bearing recess in each of said confronting walls, a manually operable member having trunnions which are journaled in said bearing recesses for pivoting about a point, said manually operable member also having a handle exterior of said case and a bifurcated portion within said case, first support means mounted between the two legs of said bifurcated portion of said manually operable member, a spring guide pivotally supported on said first support means and having a slot therein, a movable contact carrying member having a pair of legs, each of said legs being provided with an aperture which adapts the movable contact carrying member to be pivotally supported on the trunnions of said manually operable member for movement to circuit open and circuit closed positions, second support means mounted between the two legs of said movable contact carrying member, said second support means being adapted for sliding engagement with said slot in said spring guide, a helical compression spring surrounding said spring guide for actuating said contact carrying member and for biasing the latter and said manually operable member in opposite rotative directions, one end of said spring bearing against said second support means and the other end of said spring bearing against a shoulder provided on said spring guide, tripping means pivotable on said case and movable to latched and unlatched positions, said tripping means extending between the two legs of said bifurcated portion of said manually operable member inwardly of said first support means, biasing means disposed between said tripping means and said case to bias said tripping means toward unlatched position, and electroresponsive means supported by said case normally maintaining said tripping means in latched position and being operable to permit movement of said tripping means to unlatched position, said tripping means being adapted to move said contact carrying means toward circuit open position and effect shifting of the line of action of said overcenter spring means across said point by said contact carrying means.

3. An electric circuit breaker comprising an insulating support, a manually operable member pivotable on said support about a point, said manually operable member having a handle portion and a leg portion, a movable contact carrying member pivotable on said manually operable member about said point to circuit open and circuit closed positions, said movable contact carrying member also carrying a pin, a guide link having one end pivotally mounted on said leg portion of said manually operable member and having its other end slidably associated with said pin on said movable contact carrying member, a helical compression spring surrounding said guide link and having one end bearing against said pin and having its other end bearing against a portion of said guide link, said compression spring being adapted to be moved over center by said manually operable member to cause actuation of said contact carrying member, said compression spring being further adapted to bias said manually operable member and said movable contact carrying member in opposite rotative directions, a tripping member pivotable on said support and movable to latched and unlatched positions, electroresponsive means normally maintaining said tripping member in latched position and being operable to permit movement of said tripping member toward unlatched position, and biasing means disposed between said support and said tripping member to move the latter toward its unlatched position, said tripping member having a portion adapted to strike said movable contact carrying member to initiate movement of the latter toward circuit open position, and said tripping member portion being further adapted to be engaged by said leg portion of said manually operable member as the latter is moved to reset said tripping member after the latter has moved to unlatched position.

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