Nov. 12, 1935. J. SACHS 2,020,334

AUTOMATIC CIRCUIT BREAKER

Filed Oct. 14, 1933 2 Sheets-Sheet 1

Fig 1

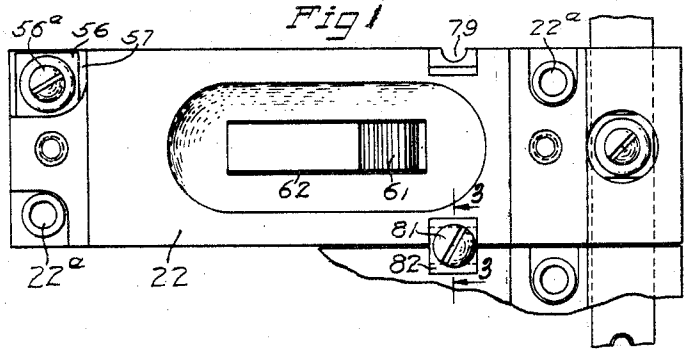


Fig. 3

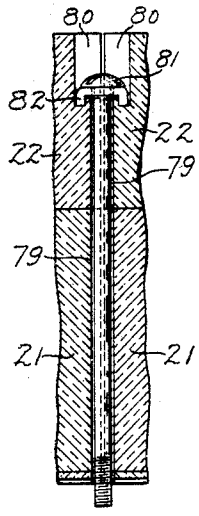


Fig. 2

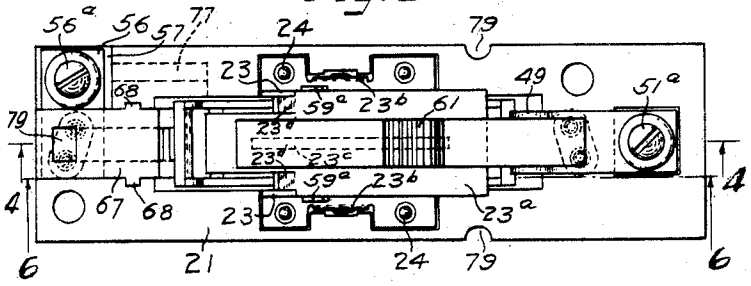


Fig. 4

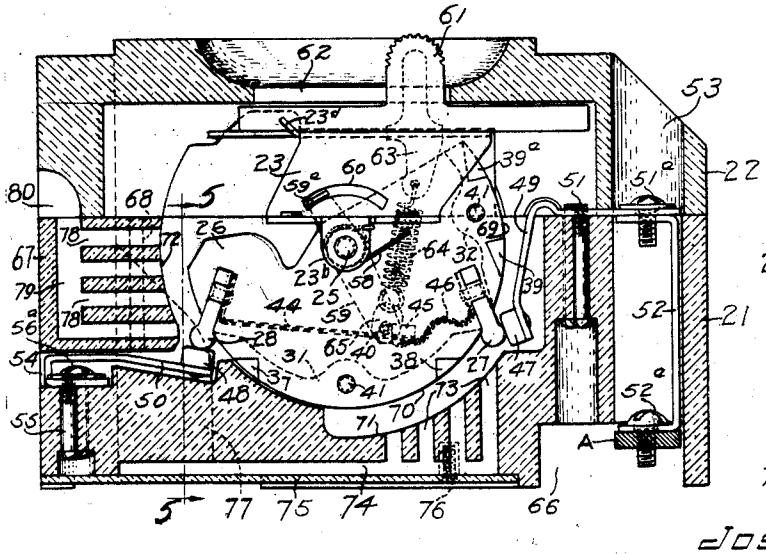
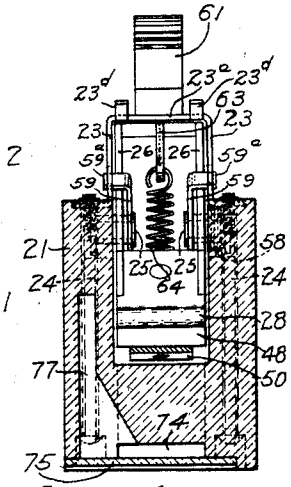


Fig 5



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Fig 6

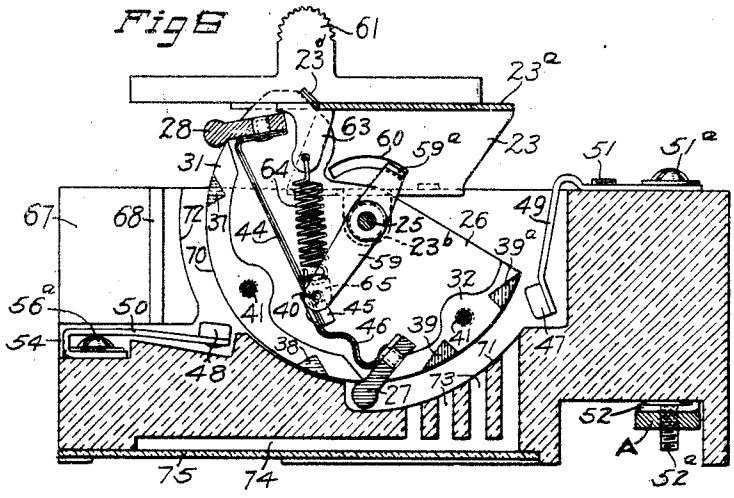


Fig 7

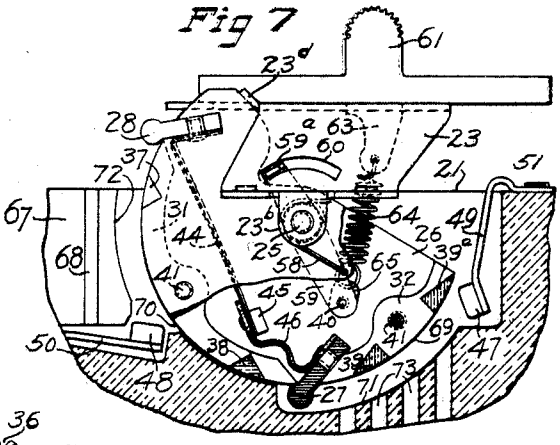


Fig 8

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UNITED STATES PATENT OFFICE

2,020,334

AUTOMATIC CIRCUIT BREAKER

Joseph Sachs, West Hartford, Conn.

Application October 14, 1933, Serial No. 693,619

5 Claims. (Cl. 200—116)

This invention relates particularly to an automatic circuit breaker of the type set forth in my patent for Automatic circuit breakers, No. 1,592,632 dated March 27, 1934 and in my application for Automatic circuit breaker, Serial No. 693,081 filed October 11, 1933.

In my said patent I have disclosed a circuit breaker which includes a movable contact member provided with a movable contact adapted to engage and disengage a stationary contact and which also includes a movable actuating member or actuator normally serving to effect the movement of the contact member to bring the movable contact into or out of engagement with the stationary contact. An electro-responsively controlled mechanical connection is provided between the actuator and the contact member, and this connection is automatically released upon the attainment of excess current conditions in the circuit, thus permitting the contact member to automatically move to open-circuit position. In accordance with the invention disclosed in the said patent, a movable operating member is provided in association with the actuator, and interposed between the said operating member and the actuator is a means such as an over-the-center spring for effecting movement of the actuator and of the contact member with a snap action independent of and uncontrolled by the movement of the operating member.

The general object of the present invention is to provide an automatic circuit breaker of the general type disclosed in my said patent but having certain advantageous details of construction and operation. A more specific object of the invention is to provide a circuit breaker having the quick-make-and-break features disclosed in the said patent and having an arrangement of contacts and other parts similar to that disclosed in my said application Serial No. 693,081.

Further and more specific objects of the invention will be apparent from the following specification and claims.

In the accompanying drawings I have shown one embodiment of the invention, but it will be understood that the drawings are intended for illustrative purposes only and are not to be construed as defining or limiting the scope of the invention, the claims forming a part of this specification being relied upon for that purpose.

Of the drawings:

Fig. 1 is a front view of a circuit breaker embodying the invention.

Fig. 2 is a view similar to Fig. 1, but showing the front insulating cover removed.

Fig. 3 is a fragmentary sectional view taken along the line 3—3 of Fig. 1.

Fig. 4 is a longitudinal sectional view taken along the line 4—4 of Fig. 2 and showing the movable parts in their closed-circuit positions.

Fig. 5 is a transverse sectional view taken along the line 5—5 of Fig. 4, but omitting the front cover.

Fig. 6 is a longitudinal sectional view taken along the line 6—6 of Fig. 2 and showing the movable parts in their open-circuit positions.

Fig. 7 is a fragmentary view similar to Fig. 6, but showing the movable parts in different relative positions.

Fig. 8 is a detail perspective view showing certain parts of the circuit breaker separated from each other.

In the drawings I have shown a circuit breaker embodying the invention, this circuit breaker being particularly adapted for panel board use. There is provided a main insulating base or support 21 which carries all of the other parts of the circuit breaker. Fitting the support 21 at the front thereof is an insulating cover 22. The rear support 21 is of box-like form, being substantially closed at all four sides and at the bottom. The front cover is also of more or less box-like form, having a recess open at the bottom into which certain parts of the mechanism project. When the two parts 21 and 22 are assembled as shown, there is provided an interior recess which contains all of the operative parts of the circuit breaker other than the handle. The two parts may be connected by suitable screws or bushings extending through holes at 22^a, 22^a.

Carried by the rear support 21 near the front thereof are two forward projecting parallel metallic plates 23, 23 which are held in place by means of screws 24, 24 extending forward from the rear of the support. The two plates 23, 23 are preferably integral with each other, being connected by a transverse flange 23^a. The plates 23, 23 are provided with integral rearward extending portions 23^b, 23^b, and on these rearward extensions are inward extending pivot studs 25, 25. A pivotally mounted contact carrying member is provided which includes two parallel plates 26, 26 spaced apart transversely and pivotally mounted on the respective studs 25, 25. Suitable spacing washers hold the plates in proper spaced relationship to the supporting plate extensions 23^b, 23^b.

The two plates 26, 26 serve to carry the main movable contacts 27 and 28 of the circuit breaker, and while I do not necessarily so limit myself,

I prefer to construct and arrange the contacts in a manner set forth in my said copending application, Serial No. 693,081. The two contacts are positioned between the outer planes and the two plates 26, 26 and they are arranged in tandem, that is, they are spaced apart in the direction of movement or circumferentially. Preferably and as will be clearly apparent from an examination of Figs. 5 and 8, each movable contact 27 and 28 extends from one to the other of the two plates 26, 26 and is in direct engagement with both of them. Preferably and as shown each of the said plates 26 is provided with a hole 29 and a notch 30 adapted to receive similarly shaped lateral projections on the corresponding contact. When the said projections on the contacts are entered in the said holes and notches of the two plates, the contacts are firmly held in proper predetermined relationship. It will be observed that, by reason of the tandem arrangement of the contacts, the two plates 26, 26 are much closer together than would otherwise be possible. The reduction in the distance between the plates makes it possible for the entire circuit breaker to be correspondingly narrower.

The two plates 26, 26 are additionally connected and held in spaced relation by means of insulating members 31 and 32. The said members 31 and 32 are preferably structurally separate from the plates, and as shown the plates are notched at 33, 34, 35 and 36 to receive projections 37, 38, 39 and 39a formed on the insulating members. The two plates and the insulating members are held in proper relationship by means of tie rods or rivets 41, 41 extending through suitable holes 42, 42 and 43, 43. Preferably the plates 26, 26 have arcuate outer edges concentric with the pivotal axis at 25, 25 and the insulating members 31 and 32 are externally shaped to conform to these arcuate edges.

The two movable contacts 27 and 28 are electrically connected with each other, this electrical connection preferably being through an electro-responsive means which is carried by and is bodily movable with the contact member. By preference and as shown, this electro-responsive means is a bi-metallic thermostatic strip 44 mechanically and electrically connected directly with one of the contacts, as for instance the contact 28. The strip 44 is provided at its projecting end with a lug 45 which enables the strip to serve as a latch as will be presently explained.

In order to complete the electrical connection between the two contacts 27 and 28 there is provided a suitable flexible connection 46 between the strip 44 and the contact 27. This flexible connection may be widely varied as to details, but as shown it consists of a stranded or braided flat strip. The strip 46 is sufficiently flexible to permit the bi-metallic strip 44 to freely deflect or bend under the influence of heat.

Carried by the insulating support 21 are two substantially stationary main contacts 47 and 48 which are connected with the said support by means of more or less resilient bent conducting straps 49 and 50. These stationary contacts 47 and 48 are so positioned and arranged that they can be firmly engaged respectively by the two movable contacts 27 and 28 as clearly shown in Fig. 4. The outer end of the supporting strap 49 is held in place by means of screws 51 and it is connected by means of a screw 51a with a rearward extending conductor 52. A recess 53 in the cover 22 provides access to the screw 51a. The outer end of the conducting strap 50 engages the bottom wall of a recess 54 formed in the main support 21 and is held in place by screws 55. The conductor 50 has a laterally extending portion 56 which is provided with a wire terminal 56a. Suitable recesses 57 are formed in the upper left hand corners of the support 21 and of the cover 22 to permit access to the said wire terminal 56a.

It will be apparent that pivotal movement of the contact member serves to bring the movable contacts 27 and 28 into or out of engagement with the respective stationary contacts 47 and 48 to make or break the circuit. When the parts are in the contact engaging position as shown in Fig. 4 electrical connection is established between the conductor 52 and the terminal 56a. A suitable spring 58 is provided for biasing the member in the contact disengaging or circuit-opening direction. This spring surrounds one of the pivot studs 25 and is between the supporting plate extension 23b and the insulating plate 26.

For actuating the contact member for normal switching purposes or to effect closing of the circuit after automatic opening thereof, I provide a member which I shall term an actuating member or actuator. The actuator is shown as being mounted co-axially with the contact member, but as to this coaxial mounting I do not necessarily limit myself. Preferably and as illustrated the actuator consists of two spaced metallic plates 59, 59 mounted on the pivot studs 25, 25 between the plates 26, 26, the said actuator plates 59, 59 being held in place by means of integral heads on the said studs. At their lower or inner ends the actuator is provided with a transverse pin or roller 40 which, at normal temperatures, is engaged by the lug 45 on the thermostatic latch 44. With the parts in the relative positions shown in Fig. 4 the actuator and the contact member are positively connected to move in unison. Preferably in order to limit the pivotal movement of the actuator the said plates 59, 59 are provided with outwardly bent ears 59a, 59a which extend through slots 60 formed in the respective plates 23, 23.

A manually accessible operating handle is provided, this being mounted for sliding or rectilinear movement. Preferably and as shown the handle member 61 is constructed and shaped to slide along a flange 23a on the supporting plates 23, 23. The handle member has a flat inner portion which engages the flange and has another portion which extends outward through a slot 62 in the cover 22 so as to be adapted to be conveniently engaged manually. The flat portion of the handle member is long enough to entirely close the slot 62 with the handle member in any position. Carried by the handle member is a metal plate 63 which extends downward through a slot 23c in the flange 23a, and this plate 63 is connected with the actuator 59 by means of a tension coil spring 64. The spring 64 directly engages the said plate 63 and it is connected with the actuator 59 indirectly through the medium of a U-shaped yoke 65 which is connected with the plates 59, 59 by means of the pin 40.

When the parts are in the relative positions shown in Fig. 4 the spring 64 holds the actuator and the contact members in their extreme right hand positions, thus holding the movable contacts 27 and 28 in firm engagement with the stationary contacts 47 and 48. When the handle member 61 is moved toward the left the

spring 64 moves between the legs of the actuator until it passes the dead center position and then the spring serves to move the parts quickly and with a snap action to the open-circuit position shown in Fig. 6. In this position the plates 26, 26 of the contact member engage stops 23d, 23d on the supporting plates 23, 23. When the handle is moved back to the closed-circuit position shown in Fig. 4 the operation is reversed and the contacts are moved quickly to the closed-circuit positions with a snap action.

As already explained the bi-metallic strip 44 is electrically connected between the movable contacts 27 and 28. It is adapted to be deflected downward or outward upon the passage of excess current therethrough, with the result that the lug 45 is disengaged from the pin or roller 40. Upon such disengagement the contact member with the contacts 27 and 28 thereon is moved by the spring 58 to the full open-circuit position as shown in Fig. 7. It will be understood that in order to close the circuit after the contact member has automatically moved to the position shown in Fig. 7, it is necessary to first move the handle member 61 to the open-circuit position so as to permit the lug 45 to reengage the pin or roller 40. After that the circuit can be closed in the usual way as already described.

I have only briefly described the supporting and enclosing members 21 and 22 as these may be widely varied. As shown they are particularly adapted for panel board use. In order to accommodate the bus bar A of a panel board, the rear supporting member 21 is provided with a transverse notch or recess 66. The before-mentioned conductor 52 may be connected directly with the bus bar by means of a screw 52a.

I have referred to a recess 54 in which are located portions of the conductor 50. In order that this recess may normally be substantially closed I preferably provide a separate insulating block 67 adapted to fit this recess. Preferably the sides of the recess 54 are provided with grooves and the block 67 is provided with tongues 68, 68 adapted to enter the said grooves and thus hold the block in place.

For controlling and confining the arc-formed gases I provide means similar to those disclosed in my said copending application, Serial No. 693,081. The path of movement of each movable contact is surrounded by four insulating walls, three of the walls being stationary and one of the walls being movable. For the contact 27 the movable wall is the outer surface 69 of the insulating member 32 and for the contact 28 the movable wall is the outer surface 70 of the insulating member 31. The main support 21 is formed with an arcuate wall 71 concentric with the said wall 69 and the auxiliary block 67 is formed with a wall 72 concentric with the wall 70. Discharge vents 73 extend downward from the surface 71 and communicate with a duct 74, which duct is closed at the rear by means of a separate insulating plate 75 held by screws 76. The duct 74 communicates with a duct 77 which terminates in a discharge opening at the left hand end of the circuit breaker and in the recess 57. Formed in the block 67 are vents 78, 78 which communicate with a duct 79 in the block, this duct in turn communicating with an open notch 80 in the cover 22. It will be apparent that, by means of the vents 73, 73 and 78, 78 and the described ducts, the arc-formed gases can be discharged, the construction being such that the gases are cooled prior to discharge.

When two or more circuit breakers are to be placed closely adjacent each other, as in a panel board, each two adjacent circuit breakers may be held by a single screw as indicated in Figs. 1 and 3. As shown the main insulating members 21 and 22 are provided at opposite sides with semi-cylindrical grooves 79, 79, a recess 80 being formed at the top of each groove. When two units are placed side by side the grooves and recesses of the adjacent parts register with each other and the two registering grooves 79 are adapted to receive a screw such as 81. The head of the screw engages a lock plate 82 having its edges bent rearward to enter notches in the recesses 80, 80. Thus each screw 81 serves to hold the two adjacent circuit breaker units.

What I claim is:

1. The combination in an automatic circuit breaker, of a main insulating support, a structurally separate insulating cover on the support, a rectilinearly movable operating member supported and guided on the main support independently of the cover but having a portion accessible through an opening in the cover, a pivoted actuator on the support, a pivoted contact member on the support biased independently of the actuator toward its open-circuit position and releasably connectible with the actuator so as to be normally controlled thereby, a mechanism operatively interposed between the operating member and the actuator and serving upon movement of the former to effect movement of the latter and of the contact member, the said mechanism including a spring for effecting such movement with an independent snap action, and an electro-responsive means serving upon the attainment of abnormal current conditions in the circuit to release the contact member from the actuator for independent automatic circuit-opening movement.

2. The combination in an automatic circuit breaker, of a main insulating support, two spaced supporting plates on the support, a rectilinearly movable operating member supported and guided on the supporting plates, a pivoted actuator on the support, a pivoted contact member on the support biased independently of the actuator toward its open-circuit position and releasably connectible with the actuator so as to be normally controlled thereby, a mechanism operatively interposed between the operating member and the actuator and serving upon movement of the former to effect movement of the latter and of the contact member, the said mechanism including a spring for effecting such movement with an independent snap action, and an electro-responsive means serving upon the attainment of abnormal current conditions in the circuit to release the contact member from the actuator for independent automatic circuit-opening movement.

3. In an automatic circuit breaker, the combination of two spaced supporting plates, a U-shaped actuator pivotally mounted between the supporting plates, a contact member including two spaced side plates at opposite sides of the actuator and also pivotally mounted between the supporting plates, the said contact member being biased for circuit-opening movement independently of the actuator, an electro-responsively controlled mechanical connection between the actuator and the contact member normally enabling the former to move the latter to open and close the circuit, the said mechanical connection being automatically releasable upon the attainment of abnormal current conditions to per-

mit automatic circuit-opening movement of the contact member, a movable operating member, and an over-the-center spring between the two legs of the actuator and serving as an operative connection between the operating member and the actuator for effecting snap opening and closing movements of the actuator and the contact member.

4. In an automatic circuit breaker, the combination of two spaced supporting plates, a contact member pivotally mounted between the supporting plates and including two spaced side plates and also including two electric contacts arranged in tandem between the outer planes of the side plates, two stationary contacts engageable by the movable contacts, means for biasing the said contact member for independent circuit-opening movement, a U-shaped actuator pivotally mounted between the side plates of the contact member, an electro-responsively controlled mechanical connection between the actuator and the contact member normally enabling the former to move the latter to open and close the circuit, the said mechanical connection being automatically releasable upon the attainment of abnormal current conditions to permit automatic circuit-opening movement of the contact member, a movable operating member, and an over-the-center spring between the two legs of the actuator and serving as an operative connection between the operating member and the actuator for effecting snap opening and closing movement of the actuator and the contact member.

5. In an automatic circuit breaker, the combination of two spaced supporting plates, a U-shaped actuator pivotally mounted between the supporting plates, a contact member including two spaced side plates at opposite sides of the actuator and also pivotally mounted between the supporting plates, the said contact member being biased for circuit-opening movement independently of the actuator, an electro-responsively controlled mechanical connection between the actuator and the contact member normally enabling the former to move the latter to open and close the circuit, the said mechanical connection being automatically releasable upon the attainment of abnormal current conditions to permit automatic circuit-opening movement of the contact member, a rectilineally movable operating member carried by the supporting plates, and an over-the-center spring between the two legs of the actuator and serving as an operative connection between the operating member and the actuator for effecting snap opening and closing movements of the actuator and the contact member.

JOSEPH SACHS.