

July 30, 1940.

J. SACHS

2,209,351

AUTOMATIC CIRCUIT BREAKER

Original Filed July 6, 1937

3 Sheets-Sheet 1

Fig. 1

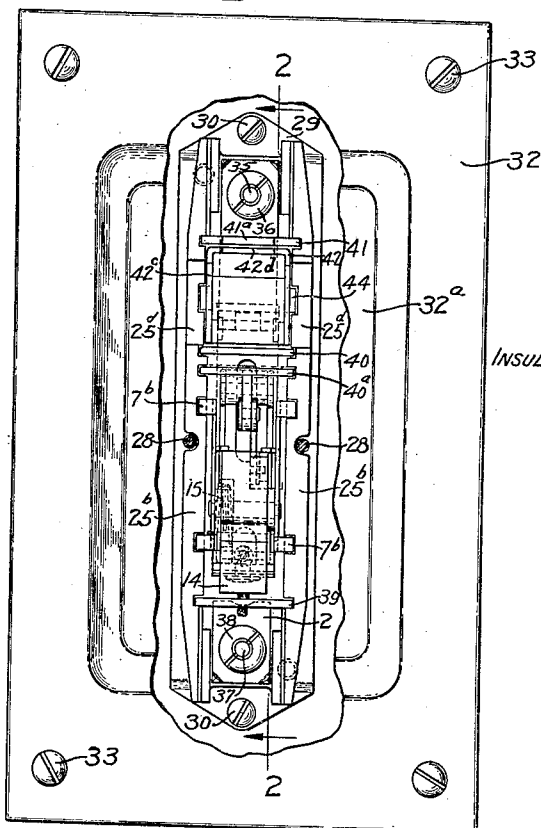


Fig. 2

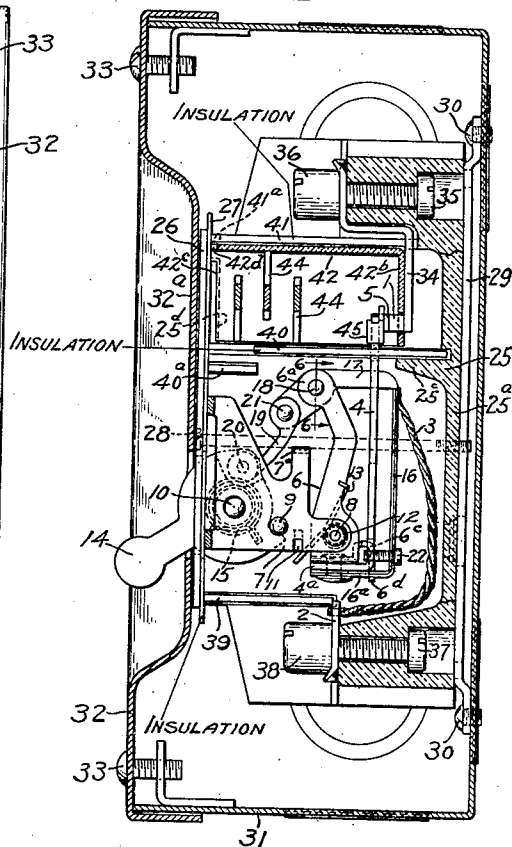


Fig. 3

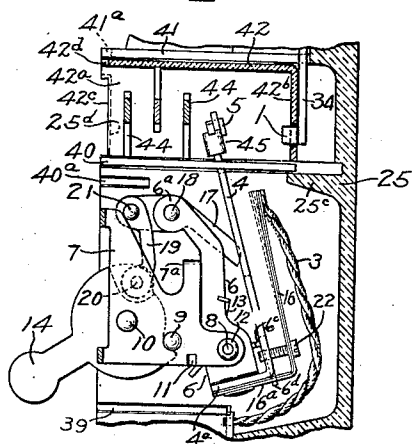
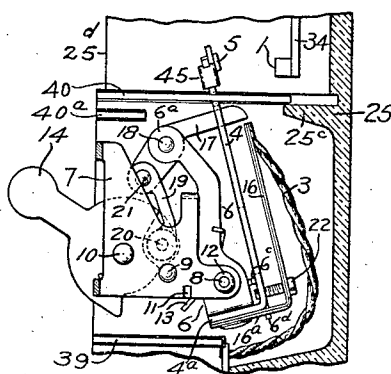


Fig. 4



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Fig. 5

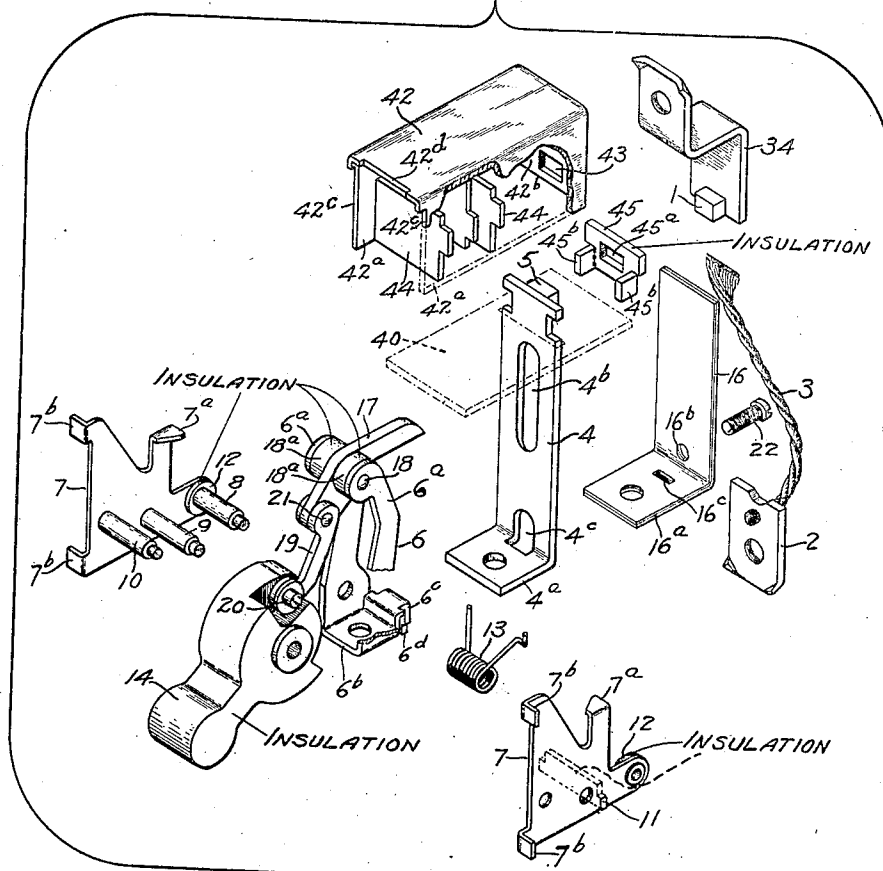


Fig. 7

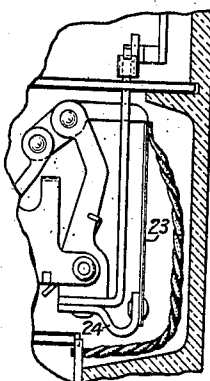
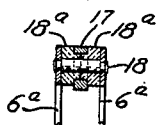


Fig. 6



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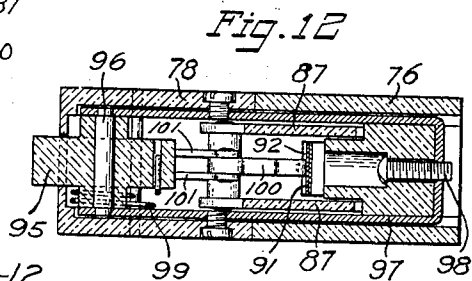
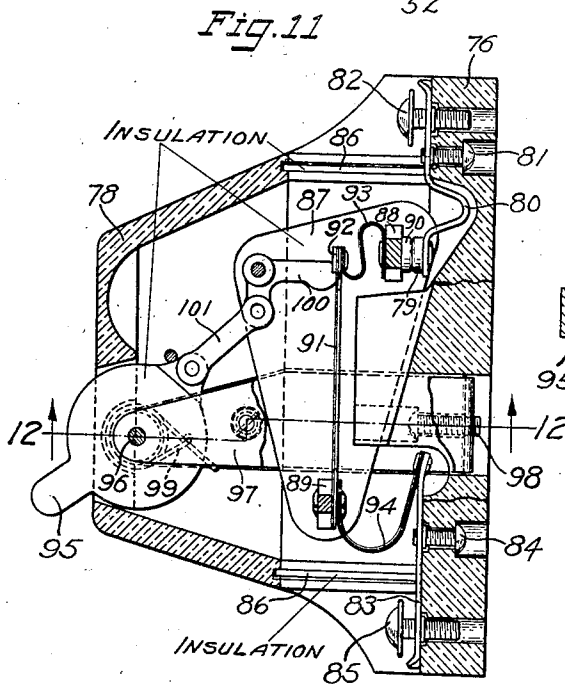
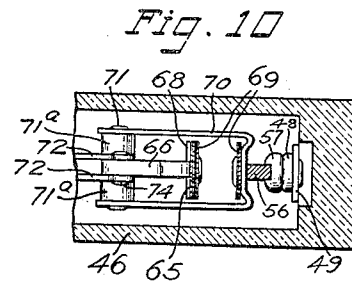
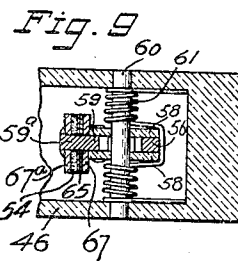
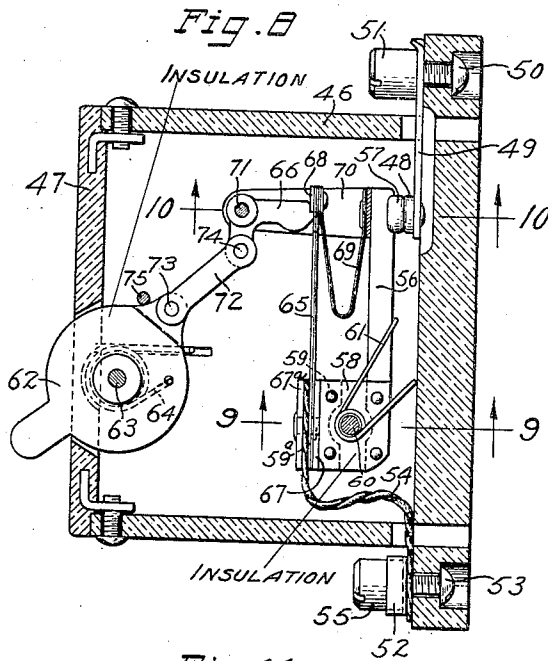
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2,209,351

AUTOMATIC CIRCUIT BREAKER

Original Filed July 6, 1937

3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

2,209,351

AUTOMATIC CIRCUIT BREAKER

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Colt's Patent Fire Arms Manufacturing Com-
pany, Hartford, Conn., a corporation of Con-
necticut

Application July 6, 1937, Serial No. 152,020
Renewed October 26, 1939

41 Claims. (Cl. 200—116)

The general object of the invention is to provide a circuit breaker of the general type disclosed in certain prior patents issued to me, but of somewhat simpler construction so that it can be produced at a lower cost.

A more specific object of the invention is to provide a single-break circuit breaker having a bodily movable bi-metallic strip for effecting automatic opening and having the said movable strip electrically connected through a flexible conductor directly with a stationary conductor on the base or housing.

Another specific object of the invention is to provide a circuit breaker having a bodily movable bi-metallic strip for effecting automatic opening and having another conductor in approximately parallel relationship therewith so that there is obtained not only an electro-thermal effect but also an electro-magnetic repulsive effect.

Still another specific object of the invention is to provide improved means for isolating the arcing zone from the mechanical parts of the circuit breaker and improved means for muffling the arc.

Other more specific objects of the invention are to provide certain improved details of structure, the advantages of which will be apparent from the drawings and the detailed description.

In the accompanying drawings I have shown four embodiments of the invention in order that its character may be fully explained, 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, with certain parts broken away to show other parts more clearly.

Fig. 2 is a vertical sectional view taken along the line 2—2 of Fig. 1.

Fig. 3 is a fragmentary vertical sectional view similar to Fig. 2, but showing the parts in the positions which they assume upon automatic opening while the handle is held in closed circuit position.

Fig. 4 is a view similar to Fig. 3, but showing all of the parts including the handle in open circuit positions.

Fig. 5 is a perspective view showing various parts of the circuit breaker separated from each other.

Fig. 6 is a fragmentary sectional view taken along the line 6—6 of Fig. 2.

Fig. 7 is a fragmentary vertical sectional view

similar to Fig. 2 but showing an alternative embodiment of the invention.

Fig. 8 is a vertical sectional view of an alternative circuit breaker embodying certain phases of the invention.

Fig. 9 is a fragmentary horizontal sectional view taken along the line 9—9 of Fig. 8.

Fig. 10 is a fragmentary horizontal sectional view taken along the line 10—10 of Fig. 8.

Fig. 11 is a vertical sectional view showing another alternative circuit breaker embodying the invention.

Fig. 12 is a horizontal sectional view taken along the line 12—12 of Fig. 11.

In describing the circuit breaker as shown in Figs. 1 to 6, I will first describe the principal parts of the circuit breaking mechanism, referring only briefly to the associated base or housing. Thereafter the base or housing will be described in greater detail. The circuit breaking mechanism is of the same general type as that disclosed in my prior patent for Automatic circuit breaker, No. 2,020,333 dated November 12, 1935.

A stationary main contact 1 is provided and also a stationary conductor 2 which is separate from the contact. The contact 1 and the conductor 2 are both mounted upon a suitable base or housing. Directly connected electrically with the stationary conductor 2 is a flexible conductor 3. For making and breaking the circuit between the contact 1 and the conductors 2 and 3 there is provided a movable contact member. As shown, the contact member is movable about a fixed axis, and the said contact member comprises a conducting element or bar 4 which carries a movable contact 5 adapted to engage and disengage the stationary contact 1. Preferably for a purpose to be set forth, the contact member also comprises an arm 6 which is in generally parallel relationship with the bar 4 and may be constructed as shown in detail in Fig. 5. The arm 6 is formed of sheet metal bent to a U-shape to provide two similar legs 6^a, 6^b; and the conducting bar 4 has an angularly bent portion 4^a which directly engages the transverse portion 6^b of the operating arm, the last said portions being held together by a rivet.

For supporting the contact member and associated parts there is provided a frame 7 which, as shown in Fig. 5, preferably includes two opposite similar plates spaced apart and connected with each other by transverse members 8, 9, 10, and 11. The transverse member 8 is a pivot or bearing member which extends through holes in the arm 6 thus providing a pivotal support for the

entire contact member. The bearing member 8 is supported in insulating bushings 12, 12 which insulate the contact member from the supporting frame. Surrounding the member 8 is a coil spring 13 which engages the arm 6 and also engages the insulating transverse member 11, this spring thus serving to bias the contact member in the contact disengaging direction. Projections 7^a, 7^a on the frame plates serve to engage the portions 6^a, 6^a of the arm 6 and thus limit forward movement of the contact member.

A handle or operating member 14 is pivotally supported on the supporting frame 7, the transverse member 10 being utilized as the pivotal support. The operating member 14 is biased in the clockwise direction by a spring 15.

In order that the operating member 14 may operate the contact member, there is provided a connecting mechanism which is controlled by means of a bi-metallic element 16 bodily movable with the contact member. Preferably and as shown the bi-metallic element 16 serves in and of itself as a latch, cooperating directly with an actuator 17 which is mechanically connected with the operating member.

Preferably and as shown, the actuator 17 is carried directly upon the contact member so as to move bodily therewith, and the before-mentioned arm 6 is utilized for this purpose. The actuator 17 is pivotally mounted at 18 between the two legs 6^a, 6^a of the operating arm. The actuator is insulated from the arm 6 by means of insulating bushings 18^a, 18^a which surround the pivot pin 18 as shown in Fig. 6. These bushings have shoulders thereon which serve to hold the actuator in central position. As shown the actuator 17 extends rearward and projects through a slot 4^b in the conducting arm 4.

A link 19 is pivotally connected with the operating member 14 at 20 and with the actuator 17 at 21. With the parts in the normal closed-circuit position as shown in Fig. 2, the pivotal axis at 20 is above a straight line connecting the pivotal axes at 10 and 21, the operating member itself thus co-operating with the link 19 to form a normally locked toggle. The before-mentioned transverse member 9 engages a suitable shoulder on the handle member to limit movement thereof in the counter-clockwise direction.

The before-mentioned latch 16 normally engages the actuator 17 and holds it in its normal relationship with the other parts as shown in Fig. 2. The bi-metallic latch 16 may be mounted and held in different ways, but as shown it is provided with an angularly bent portion 16^a which is parallel to and in contact with the angularly bent portion 4^a of the conducting bar 4. It may be held by the same rivet which connects the conducting bar 4 with the operating arm 6. The before-mentioned flexible conductor 3 is electrically connected with the bi-metallic latch 16 and preferably it is directly engaged therewith near the upper latching end thereof. This connection may be effected by brazing.

With the circuit breaker in closed-circuit position as shown in Fig. 2 it will be apparent that electrical connection is established from the stationary contact 1 to the movable contact 5, thence through the conducting bar 4 and the bi-metallic latch 16, and thence through the flexible conductor 3 to the stationary conductor 2.

As already stated, the contact member is biased in the circuit-opening direction by means of the spring 13, and the operating member is biased in the clockwise or circuit-opening direc-

tion by means of the spring 15. However, actual movement in the circuit-opening direction is normally prevented by reason of the described toggle relationship between the operating member itself and the link 19, it being understood that the latch 16 normally holds the actuator 17 from relative movement in the clockwise direction.

Normally the operating member 14 may be moved to move the contact member and thus open or close the circuit. During such normal movements the latch 16 remains engaged with the actuator 17.

If the handle or operating member 14 be held in its closed-circuit position as shown in Figs. 2 and 3 and if an abnormal current condition such as an overload is attained, the bi-metallic latch 16 is automatically deflected rearward as indicated in Fig. 3 so as to disengage and release the actuator 17. This deflection ordinarily occurs chiefly by reason of the heating of the bi-metallic element.

When the actuator is no longer held by the latch 16, the entire contact member is moved by the spring 13 to its open-circuit position as shown in Fig. 3, the actuator 17 and the link 19 assuming the relative positions shown in that figure. If the operating member be released after the parts have moved to the relative positions shown in Fig. 3, the spring 15 moves the operating member to the position shown in Fig. 4, this in turn moving the link 19 and the actuator 17 to the positions shown in that figure. The actuator is thus restored to engaged or engageable relationship with the bi-metallic latch 16.

The operation has been described as it occurs when the handle is first held and then released. Ordinarily, however, the operating member is not held and it starts to move to its open-circuit position as soon as the actuator has moved far enough in the clockwise direction to break the locking relationship between the operating member and the link 19. All of the parts thus move practically instantaneously to the position shown in Fig. 4, the actuator being immediately restored to engaging relationship with the latch. As soon as the latch has cooled sufficiently the operating member can be moved to again close the circuit.

As already stated, the deflection of the bi-metallic latch or strip 16 ordinarily occurs chiefly by reason of the heating thereof by the current. Preferably in order to augment or accelerate the deflection upon the attainment of a short circuit or other extreme excess current conditions, there is provided a conductor connected in the circuit and located closely adjacent the strip and substantially parallel therewith. As shown, this conductor is the bar 4 which has already been described. In the particular construction shown the bar 4 and the latch 16 are connected in series and the deflection of the strip is augmented or accelerated by the magnetic repulsive effect resulting from the flow of current in the closely adjacent and substantially parallel conductors 4 and 16.

In order to adjust the bi-metallic latch 16 for purposes of calibration it may be desirable to provide an adjusting screw 22 extending through a hole 16^b in the said latch. As shown the operating arm 6 has an extension 6^c which is positioned to project into a slot 4^c formed in the contact bar 4. The said extension 6^c has a tail portion 6^d which enters and fits a slot 16^c in the latch member thus assisting in holding the latch

member in place. The extension 6^c has a threaded hole therein adapted to receive a screw 22. It will be apparent that by adjusting the screw 22 the latch 16 may be moved within certain narrow limits so as to be adapted to release the actuator upon the attainment of predetermined overload condition.

Under some circumstances it may be undesirable or at least unnecessary to provide an adjustment for the bi-metallic latch. In Fig. 7 a construction is shown which is in most respects similar to that shown in Figs. 1 to 5 but which differs as to the details of the latch mounting. As shown in this figure the latch 23 is riveted to a latch carrying member 24 which is held by the same rivet that connects the contact bar with the operating arm. The remainder of the construction is or may be exactly as described and repetition is unnecessary.

The circuit breaker mechanism which has thus far been described may be mounted in various ways and may be used for various purposes. In Figs. 1 to 5 there is disclosed one suitable construction for supporting and enclosing the mechanism and there is also disclosed a novel arc muffling device. The supporting and enclosing construction and also the arc muffling device will now be described in detail, but it will be understood that as to these features I do not necessarily limit myself to the exact mechanism which has been described.

A main base or housing 25 is provided which supports the circuit breaker mechanism and all of the conducting parts. As shown this is an integral structure comprising a rear wall 25^a and two forward projecting side walls 25^b, 25^b which are spaced apart and which are identical in construction. The housing has a front cover 26 which may be of metal, and insulating sheet 27 being interposed between the cover and the housing. The cover 26 and sheet 27 will be referred collectively as constituting the front cover plate. The front cover plate is held in place by screws 28, 28, and it has an opening through which the operating member 14 projects.

The housing 25 is secured to a metallic supporting plate 29 by means of the said screws 28, 28, which thus serve as connection devices for holding the front cover plate and the supporting plate in fixed relation to each other and to the housing. The supporting plate 29 is secured by suitable means, such as screws 30, 30, to the rear wall of an outer metallic casing 31. The casing 31 has an openable front cover 32 secured by screws 33, 33, the said cover preferably having a central depressed portion 32^a closely adjacent the housing cover 26. The cover 32 also has an opening for the operating member 14.

The before-mentioned stationary contact 1 is carried by a resilient stationary conductor 34 located near the upper end of the base or housing 25 and held in place by a screw 35. A nut 36 on the screw 35 cooperates with the conductor 34 to form a wire terminal. The before-mentioned stationary conductor 2 is secured to the base or housing 25 near the lower end thereof by means of a screw 37. A nut 38 on the screw 37 cooperates with the conductor 2 to constitute a wire terminal.

The mechanism supporting frame 7 is positioned between the main side walls 25^b, 25^b of the housing. The frame 7 is so engaged by the housing that rearward movement thereof is prevented, and for this purpose the plates of the frame are shown as having lateral projections

7^b, 7^b which are seated in notches in the side walls of the housing and which prevent rearward movement of the frame. Forward movement of the frame is prevented by the front cover plate 26 when the said plate is in place. Upon removal of the front cover plate the frame and all parts carried thereby can be freely moved in the forward direction. Such movement is limited by the flexible conductor 3, but complete removal of the frame and of the parts carried thereby is possible when the conductor 2 is disconnected from the housing.

Extending transversely between the side walls 25^b, 25^b of the housing are insulating plates and there are preferably three such plates 39, 40, and 41. These plates cooperate with the rear and side walls of the housing to form chambers which are substantially closed except at the front, the front being substantially closed as before stated by the housing cover 26 together with the insulating sheet 27.

The transverse plates 39, 40, and 41 are preferably entered in opposite grooves formed in the side walls of the housing. The transverse plates engage the rear ends of the grooves so that rearward movement is limited, and the plates are normally held against forward removal by means of the housing cover 26.

The circuit breaking mechanism is positioned chiefly in the lower chamber between the transverse plates 39 and 40. The conducting bar 4 projects upward through the transverse plate 40, and as before stated the operating member 14 projects forward through the covers 26 and 32. The stationary contact 1 and the movable contact 5 on the conducting bar 4 are positioned in the upper chamber between the transverse plates 40 and 41. Thus the plate 40 serves to separate the arcing zone at the contacts from the mechanism of the circuit breaker.

Preferably in order that the plate 40 may more effectively separate the arcing zone from the circuit breaker mechanism, it is made movable and is provided with a relatively small aperture through which the contact bar passes and which it relatively closely fits. The plate is therefore movable in its own plane and it is so moved whenever the contact bar 4 moves to open or close the circuit.

In order that the two chambers may be substantially completely separated from each other, under all conditions, stationary walls are provided in association with the movable plate 40. A transverse plate 40^a is provided at the front, this being positioned in grooves in the side walls of the housing and being held in place by the front cover. This plate 40^a cooperates with the movable plate 40 to separate the two chambers when the movable plate is in its rearward position as shown in Fig. 2. A wall 25^c is formed integrally on the rear wall of the housing, and this cooperates with the movable plate to separate the two chambers when the movable plate is in its forward position as shown in Figs. 3 and 4.

Preferably an arc muffling device is positioned in the upper chamber between the two plates 40 and 41, this device being in the main at the front of the two contacts. Preferably the arc muffling device is a separate structure normally held in place by the front cover 26, but being removable as a unit after the cover has been removed.

The details of the arc muffling device may be widely varied but as shown it comprises an insulating sheet 42 bent to provide two opposite

parallel walls 42^a, 42^a. There is preferably also provided a rear wall 42^b which may be formed as an integral part of the main sheet. The wall 42^b has an opening 43 therein through which the contact 1 projects when the arc muffling device is in place. Carried by the opposite walls 42^a, 42^a are metallic plates 44, 44, oppositely positioned so as to provide a circuitous or serpentine passageway as clearly shown in Fig. 2. Preferably the said walls 42^a, 42^a have slots or apertures therein in which are seated the end portions of the plates 44, 44. The entire arc muffling device is of such size that it substantially fills the upper chamber between the plates 40 and 41. The side walls of the housing preferably have opposite grooves for the ends of the plates 44, 44, as shown in Fig. 1. The opposite side walls of the arc muffling device have notches 42^c, 42^c therein and the upper wall has a notch 42^d therein. The side main walls of the housing have notches 25^d, 25^d registering with the notches 42^c, 42^c and the upper plate 41 has a notch 41^a therein registering with the notch 42^d.

In order to prevent burning of that part of the contact bar 4 immediately adjacent the contact 5 there is preferably provided an insulating element 45. This element has a hole 45^a therein through which the contact 5 projects and it has ears 45^b, 45^b thereon which are bent around the bar 4 to hold the insulating element in place.

When the movable contact 5 is moved away from the stationary contact 1, either manually or automatically, any arc-formed gases are forced to move in a generally forward direction through the serpentine passageway between the plates 44, 44. With the movable plate 40 in its forward position as shown in Figs. 3 and 4, the gasses can escape only through the notches 42^c, 42^c and 42^d. Thus the gasses are not only prevented from entering the lower chamber which contains the circuit breaker mechanism, but they are guided in a serpentine or circuitous path so as to be cooled prior to being discharged from the circuit breaker housing.

In Figs. 8, 9, and 10 I have shown a somewhat different mechanism which may be regarded as alternative to the mechanism shown in Figs. 1 to 6 and already described in detail. This mechanism is shown in a somewhat simpler housing but it will be understood that this is merely for convenience of illustration and that no limitation is intended in this respect.

A main housing 46 is provided which is substantially closed except at the front where there is a removable cover 47. A stationary contact 48 is provided which is mounted on a resilient conductor 49. The conductor 49 is held in place by a screw 50, and a nut 51 on the screw provides a wire terminal. A stationary conductor 52 is secured to the base or housing by means of a screw 53. The conductor 52 is in clamping engagement with a flexible conductor 54 which extends into the interior of the housing. A nut 55 on the screw 53 serves as a wire terminal.

Within the housing 46 is a contact member which includes a conducting element or bar 56 carrying a movable contact 57 adapted to engage the stationary contact 48. The conducting element or bar 56 is pivotally mounted at or near the end thereof opposite the contact. As shown, the said element or bar is positioned between two insulating plates 58, 58 and is secured thereto by means of rivets. Also positioned between the plates 58, 58 and similarly secured thereto is a conducting plate 59. A pivot pin 60

is mounted in suitable apertures in the side walls of the housing 46 and extends through suitable apertures in the insulating plates 58, 58. In this way the contact member is pivotally mounted for movement about the axis of the pin 60. It is biased for movement in the contact disengaging or circuit-opening direction by means of a spring 61.

A handle or operating member 62 is pivotally supported on a pin 63 extending transversely between the side walls of the housing. A spring 64 serves to bias the operating member for movement in the clockwise or circuit-opening position. In order that the operating member may operate the contact member there is provided a connecting mechanism which is similar in many respects to that shown in Figs. 1 to 6. This mechanism includes a bi-metallic latch 65 and an actuator 66.

The latch 65 is mechanically connected to and is movable with the conducting element 56. It is connected near the pivotal axis of the conducting element and it extends in general parallelism therewith toward the contact carrying end thereof. The latch is also electrically connected with a portion of the conducting element 56 and is also electrically connected with the flexible conductor 54.

As illustrated in the drawings the latch 65 has an opening therein through which projects an integral extension 59^a on the conducting plate 59, there being an interposed metallic washer 67. The inner end of the flexible conductor 54 has electrical connection with the bi-metallic latch 65 and preferably it directly engages the latch at the front face thereof and is clamped in place by means of a metallic washer 67^a. The forward end of the extension 59^a is riveted over as shown to engage the metallic washer 67^a. At the other end of the bi-metallic latch is a transverse latch bar 68 and the said end of the latch is electrically connected with the conducting bar 56 by means of a thin flexible conductor 69. This conductor 69 permits the latch 65 to flex freely under the influence of heat caused by current flowing therein.

For supporting the actuator 66 there is provided a U-shaped bracket or arm 70 which is secured at its rear end to the conducting bar 56 immediately adjacent the movable contact 57. The said actuator 66 is pivotally mounted at 71 between the two legs of the arm 70. The actuator is held in central position by means of bushings 71^a, 71^a which surround the pivot pin 71.

Links 72, 72 are pivotally connected with the operating member 62 at 73 and with the actuator 66 at 74. With the parts in the normal closed-circuit position as shown in Fig. 8 the pivotal axis at 73 is above a straight line connecting the pivotal axes at 63 and 74, the operating member itself thus cooperating with the links 72 to form a normally locked toggle. A transverse pin 75 is provided which serves to limit movement of the handle member in the counter-clockwise direction.

With the circuit breaker in closed-circuit position as shown in Fig. 8, it will be apparent that electrical connection is established from the stationary contact 48 to the movable contact 57, thence through the contact bar 56 and the flexible conductor 69 to the bi-metallic latch 65, and thence through the flexible conductor 54 to the stationary conductor 52.

The manner of operation is substantially the same as already described in conjunction with

Figs. 1 to 6 and detailed explanation is unnecessary. The operating member 62 can be used under normal circumstances to move the contact member to open or close the circuit. In the event of an overload the bi-metallic latch is deflected rearward thus releasing the actuator 66 and permitting both the contact member and the operating member to move to their open-circuit positions.

Another alternative construction is shown in Figs. 11 and 12 and here again a simplified base or housing is shown. A main housing 76 is provided which is closed at the sides and which has a removable cover 78 at the front. A stationary contact 79 is provided which is mounted on a resilient conductor 80. The conductor 80 is held in place by a screw 81, and a screw 82 provides a convenient wire terminal. A stationary conductor 83 is secured to the base or housing by means of a screw 84. A screw 85 serves as a wire terminal. The ends of the housing are closed by insulating plates 86, 86 fitting slots in the side walls, and held in place by the cover 78.

Within the housing 76 is a movable contact member which comprises two insulating plates 87, 87 spaced apart transversely and connected by two transversely extending conducting elements 88 and 89. These conducting elements extend into suitable slots in the said plates. A movable contact 90 is carried by the transverse element 88 and is adapted to engage the stationary contact 79. Rigidly secured to the transverse element 89 is a bi-metallic latch 91 similar to the latch 65 shown in Fig. 8 and similarly provided with a transverse latch bar 92. The latch is electrically connected with the movable contact 90 by a flexible conductor 93.

There is provided a resilient supporting and conducting element 94 having one end rigidly connected mechanically with the conductor 83 and having the other end rigidly connected mechanically with the transverse conducting element 89. As shown it is riveted at both ends. The said element 94 serves to electrically connect the conductor 83 and the latch 91, and in addition it serves as the sole mechanical support for the corresponding end of the contact member. By reason of its resiliency the element 93 permits an approximately pivotal movement of the contact member and it biases the said member for movement in the disengaging or circuit-opening direction.

A handle or operating member 95 is pivotally supported on a transverse pivot pin 96 extending between the arms of a U-shaped bracket 97. The bracket is held in place by a screw 98 and the arms thereof extend forward through slots in the rear wall of the housing. A spring 99 serves to bias the operating member for movement in the clockwise or circuit-opening position.

In order that the operating member may operate the contact member there is provided an actuator 100 and two links 101, 101. These parts are similar in construction and operation to the corresponding parts shown in Fig. 8 and already described in detail. Repetition is unnecessary.

What I claim is:

1. The combination in an automatic circuit breaker, of a stationary contact, a stationary conductor separate from the said contact, a flexible conductor electrically connected at one end with the stationary conductor, a movable contact member having a contact adapted to engage and disengage the stationary contact, the said contact member being biased for movement toward

its open-circuit position and being normally mechanically held against such movement, and a thermostatic bi-metallic strip supported upon and bodily movable with the contact member and electrically connected between the movable contact and the other end of the flexible conductor, the said strip being adapted to be heated upon the attainment of an abnormal current condition therein and thus deflected so as to mechanically release the contact member and permit it to automatically move to open-circuit position.

2. The combination in an automatic circuit breaker, of a stationary contact, a stationary conductor separate from the said contact, a flexible conductor electrically connected at one end with the stationary conductor, a movable contact member including a contact adapted to engage and disengage the stationary contact, the said member being biased in the contact disengaging direction, a bodily movable bi-metallic latch on the contact member electrically connected between the movable contact and the other end of the flexible conductor, the said latch being automatically deflected from its normal relationship with the contact member upon the attainment of abnormal current conditions in the circuit, a movable actuator normally engaged by the latch to prevent relative movement of the contact member and being released upon automatic deflection of the latch to permit automatic circuit opening movement of the contact member, and means for operating the actuator to enable it in cooperation with the latch to normally effect the movement of the contact member to and from its contact engaging position.

3. The combination in an automatic circuit breaker, of a stationary contact, a stationary conductor separate from the said contact, a flexible conductor electrically connected at one end with the stationary conductor, a movable contact member including a contact adapted to engage and disengage the stationary contact, the said member being movable about a substantially fixed axis and biased in the contact disengaging direction, a bodily movable bi-metallic latch on the contact member electrically connected between the movable contact and the other end of the flexible conductor, the said latch being automatically deflected from its normal relationship with the contact member upon the attainment of abnormal current conditions in the circuit, an actuator supported upon and bodily movable with the contact member and also pivotally movable relatively thereto, the actuator being normally engaged by the latch to prevent relative pivotal movement and being released upon automatic deflection of the latch to permit automatic circuit-opening movement of the contact member, and means for operating the actuator to enable it in cooperation with the latch to normally effect the movement of the contact member to and from its contact engaging position.

4. In an automatic circuit breaker, the combination of a stationary contact, a stationary conductor separate from the said contact, a flexible conductor electrically connected at one end with the stationary conductor, a movable contact member having a contact adapted to engage and disengage the stationary contact, the said contact member being biased for movement toward its open-circuit position and being normally mechanically held against such movement, and a thermostatic bi-metallic strip rigidly supported at one end upon the contact member and bodily movable therewith, the said strip being electrically

cally connected at its rigidly supported end with the movable contact and at its opposite end with the other end of the flexible conductor and the said strip being adapted to be heated upon the attainment of an abnormal current condition therein and thus deflected so as to mechanically release the contact member and permit it to automatically move to open-circuit position.

5. In an automatic circuit breaker, the combination of a stationary contact, a movable contact member including a conducting bar with a contact thereon adapted to engage and disengage the stationary contact, the said member being biased in the contact disengaging direction, a bodily movable bi-metallic latch on the contact member closely adjacent and substantially parallel with the said bar and electrically connected in the circuit in series therewith, the said latch upon the attainment of abnormal current conditions in the circuit being automatically deflected from its normal relationship with the contact member as the result of thermal action within the strip and the said latch upon the attainment of extreme excess current conditions being deflected at an accelerated rate by reason of magnetic repulsive action between the latch and the conducting bar, a pivoted actuator normally engaged by the latch to prevent relative pivotal movement and released upon automatic deflection of the latch to permit automatic circuit opening movement of the contact member, and means for operating the actuator to enable it in cooperation with the latch to normally effect the movement of the contact member to and from its contact engaging position.

6. In an automatic circuit breaker, the combination of a stationary contact, a stationary conductor separate from the said contact, a flexible conductor electrically connected at one end with the stationary conductor, a movable contact member including a conducting element with a contact thereon adapted to engage and disengage the stationary contact, the said member being pivoted near one end of the conducting element and being biased in the contact disengaging direction, a bodily movable bi-metallic strip mechanically and electrically connected at one end with the conducting element near the pivoted end thereof and extending in general parallelism with the said conducting element toward the contact carrying end thereof, the said bi-metallic strip being mechanically and electrically connected at the other end with the said flexible conductor so as to be thus included in the circuit and the said strip upon the attainment of abnormal current conditions in the circuit being automatically deflected from its normal relationship with the contact member as the result of thermal action within the strip and the said latch upon the attainment of extreme excess current conditions being deflected at an accelerated rate by reason of magnetic repulsive action between the latch and the conducting bar, and operating and controlling means adapted for moving the contact member to open or close the circuit and adapted for releasably holding it in closed-circuit position, the last said means being associated with the bi-metallic element so that upon automatic deflection of the element the said means is released to permit automatic circuit-opening movement of the contact member.

7. In an automatic circuit breaker, the combination of a stationary contact, a stationary conductor separate from the said contact, a flexible conductor electrically connected at one end

with the stationary conductor, a movable contact member including a conducting bar with a contact thereon adapted to engage and disengage the stationary contact, the said member being biased in the contact disengaging direction, a bodily movable bi-metallic latch on the contact member closely adjacent and substantially parallel with the said bar and electrically connected in series between the said bar and the other end of the flexible conductor, the said latch upon the attainment of abnormal current conditions in the circuit being automatically deflected from its normal relationship with the contact member as the result of thermal action within the strip and the said latch upon the attainment of extreme excess current conditions being deflected at an accelerated rate by reason of magnetic repulsive action between the latch and the conducting bar, a pivoted actuator normally engaged by the latch to prevent relative pivotal movement and released upon automatic deflection of the latch to permit automatic circuit-opening movement of the contact member, and means for operating the actuator to enable it in cooperation with the latch to normally effect the movement of the contact member to and from its contact engaging position.

8. An automatic circuit breaker comprising in combination, a stationary contact, a pivoted contact member including an operating arm and a conducting bar substantially parallel with the arm and having a contact thereon adapted to engage and disengage the stationary contact, the said member being biased in the contact disengaging direction, a bodily movable bi-metallic latch on the contact member substantially parallel with the said arm and with the said bar and electrically connected in the circuit in series with the bar, the said latch being automatically deflected from its normal relationship with the contact member upon the attainment of abnormal current conditions in the circuit, an actuator supported upon and bodily movable with the operating arm of the contact member and also pivotally movable relatively thereto, the actuator being normally engaged by the latch to prevent relative pivotal movement and being released upon automatic deflection of the latch, and means for operating the actuator to enable it in cooperation with the latch to normally effect the movement of the contact member to and from its contact engaging position.

9. An automatic circuit breaker comprising in combination, a stationary contact, a pivoted contact member including a conducting element having a contact thereon adapted to engage and disengage the stationary contact, the said member being biased in the contact disengaging direction, a bodily movable bi-metallic latch on the contact member at one side of the conducting element and electrically connected in the circuit in series therewith, the said latch being automatically deflected from its normal relationship with the contact member upon the attainment of abnormal current conditions in the circuit, an actuator connected with the contact member for pivotal movement about a movable axis near the movable contact and at the side of the conducting element opposite to that at which the latch is positioned, the said actuator having a portion which extends to the first said side of the conducting element and which is normally engaged by the latch to prevent relative pivotal movement and is released upon automatic deflection of the latch, and means for operating

the actuator to enable it in cooperation with the latch to normally effect the movement of the contact member to and from its contact engaging position.

5 10. An automatic circuit breaker comprising in combination, a stationary contact, a pivoted contact member including an apertured conducting element having a contact thereon adapted to engage and disengage the stationary contact, the said member being biased in the contact disengaging direction, a bodily movable bi-metallic latch on the contact member at one side of the conducting element and electrically connected in the circuit in series therewith, the said latch being automatically deflected from its normal relationship with the contact member upon the attainment of abnormal current conditions in the circuit; an actuator connected with the contact member for pivotal movement about a movable axis near the movable contact and at the side of the conducting element opposite to that at which the latch is positioned, the said actuator extending through the aperture in the element and being normally engaged by the latch to prevent relative pivotal movement and being released upon automatic deflection of the latch, and means for operating the actuator to enable it in cooperation with the latch to normally effect the movement of the contact member to and from its contact engaging position.

11. An automatic circuit breaker comprising in combination, a stationary contact, a pivoted contact member including an apertured conducting bar having a contact thereon adapted to engage and disengage the stationary contact and also including an operating arm at one side of the conducting bar, the said member being biased in the contact disengaging direction, a bodily movable bi-metallic latch on the contact member at the other side of the conducting bar and electrically connected in the circuit in series therewith, the said latch being automatically deflected from its normal relationship with the contact member upon the attainment of abnormal current conditions in the circuit, an actuator supported upon and bodily movable with the operating arm of the contact member and also pivotally movable relatively thereto, the actuator extending through the aperture in the bar and being normally engaged by the latch to prevent relative pivotal movement and being released upon automatic deflection of the latch, and means for operating the actuator to enable it in cooperation with the latch to normally effect the movement of the contact member to and from its contact engaging position.

12. The combination in an automatic circuit breaker, of a stationary contact, a contact member including a conducting element pivoted for movement about a fixed axis and also including a contact carried directly by the conducting element near the other end and adapted to engage and disengage the stationary contact to close and open the circuit, means for biasing the said contact member toward its open-circuit position, an actuator carried by the conducting element for pivotal movement about a transverse axis which is at a substantial distance from the said fixed axis and in fixed relation to the movable contact, a bodily movable bi-metallic latch mechanically connected to and movable with the conducting element and also electrically connected with a portion of the said element, the said latch being normally engaged with the actuator but being automatically deflected from its

normal relationship upon the attainment of abnormal current conditions in the circuit so as to disengage the actuator and thus permit automatic movement of the contact member to its open-circuit position free from restraint by the actuator, and means for operating the actuator to enable it in cooperation with the latch to normally effect the movement of the contact member to and from its closed-circuit position.

13. The combination in an automatic circuit breaker, of a stationary contact, a contact member including a conducting element pivoted near one end for movement about a fixed axis and also including a contact carried directly by the conducting element near the other end and adapted to engage and disengage the stationary contact to close and open the circuit, means for biasing the said contact member toward its open-circuit position, transversely spaced forward extending legs carried by the conducting element near the contact carrying end thereof, an actuator connected between the said legs for pivotal movement about a transverse axis which is in fixed relation to the movable contact, a bodily movable bi-metallic latch mechanically connected to and movable with the conducting element and also electrically connected with a portion of the said element, the said latch being normally engaged with the actuator but being automatically deflected from its normal relationship upon the attainment of abnormal current conditions in the circuit so as to disengage the actuator and thus permit automatic movement of the contact member to its open-circuit position free from restraint by the actuator, and means for operating the actuator to enable it in cooperation with the latch to normally effect the movement of the contact member to and from its closed-circuit position.

14. The combination in an automatic circuit breaker, of a stationary contact, a contact member including a conducting element pivoted near one end for movement about a fixed axis and also including a contact carried directly by the conducting element near the other end and adapted to engage and disengage the stationary contact to close and open the circuit, means for biasing the said contact member toward its open-circuit position, an actuator carried by the conducting element for pivotal movement about a transverse axis which is at a substantial distance from the said fixed axis and in fixed relation to the movable contact, a bodily movable bi-metallic latch mechanically connected to the conducting element near the pivotal axis thereof and extending in general parallelism therewith toward the contact carrying end thereof, the said latch being also electrically connected with a portion of the said element and the said latch being normally engaged with the actuator but being automatically deflected from its normal relationship upon the attainment of abnormal current conditions in the circuit so as to disengage the actuator and thus permit automatic movement of the contact member to its open-circuit position free from restraint by the actuator, and means for operating the actuator to enable it in cooperation with the latch to normally effect the movement of the contact member to and from its closed-circuit position.

15. The combination in an automatic circuit breaker, of a stationary contact, a stationary conductor separate from the said contact, a flexible conductor electrically connected at one end with the stationary conductor, a contact member

including a conducting element pivoted near one end for movement about a fixed axis and also including a contact carried directly by the conducting element near the other end and adapted to engage and disengage the stationary contact to close and open the circuit, means for biasing the said contact member toward its open-circuit position, an actuator carried by the conducting element for pivotal movement about a transverse axis which is at a substantial distance from the said fixed axis and in fixed relation to the movable contact, a bodily movable bi-metallic latch mechanically connected to the conducting element near the pivotal axis thereof and extending in general parallelism therewith toward the contact carrying end thereof, the said latch being also electrically connected with a portion of the said element and with the said flexible conductor and the said latch being normally engaged with the actuator but being automatically deflected from its normal relationship upon the attainment of abnormal current conditions in the circuit so as to disengage the actuator and thus permit automatic movement of the contact member to its open-circuit position free from restraint by the actuator, and means for operating the actuator to enable it in cooperation with the latch to normally effect the movement of the contact member to and from its closed-circuit position.

16. In an automatic circuit breaker, the combination of a stationary contact, a pivoted contact member including a conducting bar with a contact thereon adapted to engage and disengage the stationary contact, the said member being biased in the contact disengaging direction, an actuator supported upon and bodily movable with the conducting bar and also pivotally movable relatively thereto about an axis spaced from the bar, a bodily movable bi-metallic latch on the contact member electrically connected with the bar and positioned with its plane between the bar and the axis of the actuator, the said latch being normally engaged with the actuator but being automatically deflected from its normal relationship so as to disengage the actuator upon the attainment of abnormal current conditions in the circuit, and means for operating the actuator to enable it in cooperation with the latch to normally effect the movement of the contact member to and from its contact engaging position.

17. In an automatic circuit breaker, the combination of a stationary contact, a pivoted contact member including a conducting bar with a contact thereon adapted to engage and disengage the stationary contact, the said member being biased in the contact disengaging direction, a flexible conductor electrically connected with the conducting bar, an actuator supported upon and bodily movable with the conducting bar and also pivotally movable relatively thereto about an axis spaced from the bar, a bodily movable bi-metallic latch on the contact member electrically connected near its latching end with the said flexible conductor and positioned with its plane between the bar and the axis of the actuator, the said latch being normally engaged with the actuator but being automatically deflected from its normal relationship so as to disengage the actuator upon the attainment of abnormal current conditions in the circuit, and means for operating the actuator to enable it in cooperation with the latch to normally effect the movement

of the contact member to and from its contact engaging position.

18. In an automatic circuit breaker, the combination of a base, a stationary contact on the base, a stationary conductor on the base separate from the said contact, a movable contact member having a contact adapted to engage and disengage the stationary contact, the said contact member being biased for movement toward its open-circuit position and being normally mechanically held against such movement, a resilient supporting and conducting element having one end rigidly connected mechanically with the base and having the other end rigidly connected mechanically with the contact member so as to serve as a support for the contact member while permitting the said member to move substantially pivotally, the said element at its first said end being electrically connected with the said stationary conductor on the base, and a bodily movable bi-metallic strip on the contact member electrically connected in the circuit in series with the said resilient conducting element, the said strip being adapted to be heated upon the attainment of an abnormal current condition therein and thus deflected so as to mechanically release the contact member and permit it to automatically move to open-circuit position.

19. In an automatic circuit breaker, the combination of a base, a stationary contact on the base, a stationary conductor on the base separate from the said contact, a movable contact member having a contact adapted to engage and disengage the stationary contact, the said contact member being biased for movement toward its open-circuit position and being normally mechanically held against such movement, a resilient supporting and conducting element having one end rigidly connected mechanically with the base and having the other end rigidly connected mechanically with one end of the contact member so as to serve as the sole support for the contact member at the said end thereof while permitting the said member to move substantially pivotally, the said element at its first said end being electrically connected with the said stationary conductor on the base, and a bodily movable bi-metallic strip on the contact member electrically connected in series between the said resilient conducting element and the said movable contact, the said strip being adapted to be heated upon the attainment of an abnormal current condition therein and thus deflected so as to mechanically release the contact member and permit it to automatically move to open-circuit position.

20. The combination in an automatic circuit breaker, of a base, a stationary contact on the base, a stationary conductor on the base separate from the said contact, a movable contact member including a contact adapted to engage and disengage the stationary contact, a resilient supporting and conducting element having one end rigidly connected mechanically with the base and having the other end rigidly connected mechanically with one end of the contact member so as to serve as the sole support for the contact member at the said end thereof while permitting the said member to move substantially pivotally, the said element at its first said end being electrically connected with the said stationary conductor on the base, a bodily movable bi-metallic latch on the contact member electrically connected in series between the said resilient con-

ducting element and the said movable contact, the said latch being automatically deflected from its normal relationship with the contact member upon the attainment of abnormal current conditions in the circuit, and an actuator normally engaged by the latch to effect the movement of the contact member to and from its contact engaging position, the said actuator being disengaged by the latch upon automatic deflection of the latter to permit automatic circuit-opening movement of the contact member.

21. In an automatic circuit breaker, the combination of a housing formed with a mechanism containing chamber open at the front, a plate substantially closing the housing chamber at the front but having a handle opening therein, a mechanism supporting frame positioned entirely within the housing chamber and engaged by the housing to prevent rearward movement, the said frame being behind and in engagement with the front plate and the said frame being held by the plate and being otherwise freely movable in the forward direction, and an automatic circuit breaking mechanism carried by the frame and freely movable in the forward direction when the frame is so moved, the said mechanism being positioned chiefly within the housing chamber and having a movable handle at the front extending through the opening in the front plate.

22. In an automatic circuit breaker, the combination of a housing formed with a rear wall and with parallel side walls spaced apart, a plate substantially closing the housing at the front but having a handle opening therein, the entire rear face of the said plate being flat and the said rear face being in engagement with the front edges of the housing side walls, a mechanism supporting frame positioned entirely between the housing side walls and engaged by the housing to prevent rearward movement, the said frame being behind and in engagement with the said flat rear face of the front plate and the said frame being held by the plate and being otherwise freely movable in the forward direction, two conducting means adjacent the respective end portions of the housing and supported independently of the frame, and an automatic circuit breaking mechanism carried by the frame and freely movable in the forward direction when the frame is so moved, the said mechanism being positioned entirely between the housing side walls and behind the said flat rear face of the front plate and serving when in closed-circuit position to electrically connect the said two conducting means and the said mechanism having a movable handle at the front extending through the opening in the front plate.

23. In an automatic circuit breaker, the combination of an integral insulating housing formed with a rear wall and with parallel side walls spaced apart, the said side walls having two pairs of opposed grooves in their inner faces, two insulating plates extending transversely between the side walls and positioned in the said opposed grooves, a mechanism supporting frame positioned between the side walls and engaged by the housing to prevent rearward movement, a cover plate substantially closing the housing at the front but having a handle opening therein, the said cover being in front of the said transverse plates and in front of the frame and preventing removal thereof, two conducting means carried by the respective end portions of the housing at the outer sides of the said transverse plates, and an automatic circuit breaking

mechanism carried by the frame and positioned at least chiefly between the transverse plates and serving when in closed-circuit position to electrically connect the said two conducting means on the end portions of the housing, the said mechanism having a movable handle at the front extending through the opening in the front cover.

24. In an automatic circuit breaker, the combination of a housing formed with a mechanism containing chamber open at the front, a cover plate substantially closing the housing chamber at the front but having a handle opening therein, a mechanism supporting frame positioned entirely within the housing chamber and engaged by the housing to prevent rearward movement, the said frame being behind and in engagement with the front cover plate and the said frame held by the plate and being otherwise freely movable in the forward direction, an automatic circuit breaking mechanism carried by the frame and freely movable in the forward direction when the frame is so moved, the said mechanism being positioned chiefly within the housing chamber and having a movable handle at the front extending through the opening in the front cover plate, a supporting plate in engagement with the housing at the rear thereof, connection devices extending from the front cover plate to the rear supporting plate and serving to hold the said plates in fixed relation to each other and to the housing, and means on the rear supporting plate whereby it may be independently secured to a stationary rear wall.

25. In an automatic circuit breaker, the combination of an insulating housing provided with parallel side walls spaced apart, an apertured insulating partition plate extending transversely between the side walls and movable in its own plane, a stationary contact at one side of the movable plate, and an automatic circuit breaking mechanism positioned between the side walls of the housing and chiefly at the other side of the movable plate, the said mechanism including a movable contact bar extending through and approximately fitting the aperture in the movable plate and having a contact thereon adapted to engage and disengage the stationary contact.

26. In an automatic circuit breaker, the combination of an insulating housing provided with walls substantially enclosing all but one side of a contact containing chamber, an apertured plate substantially closing the remaining side of the said chamber and rectilinearly movable in its own plane, a stationary contact within the said chamber and at one side of the movable plate, and an automatic circuit breaking mechanism positioned chiefly at the other side of the movable plate and outside of the said chamber, the said mechanism including a movable contact bar extending through and approximately fitting the aperture in the movable plate and having a contact thereon within the chamber adapted to engage and disengage the stationary contact.

27. In an automatic circuit breaker, the combination of an insulating housing provided with parallel side walls spaced apart and having a pair of opposed grooves in their inner faces, an apertured insulating partition plate extending transversely between the side walls and movable in the said opposed grooves, a stationary contact at one side of the movable plate, and an automatic circuit breaking mechanism positioned between the side walls of the housing and chiefly at the other side of the movable plate, the said

mechanism including a movable contact bar extending through and approximately fitting the aperture in the movable plate and having a contact thereon adapted to engage and disengage the stationary contact.

28. In an automatic circuit breaker, the combination of an insulating housing provided with parallel side walls spaced apart and having two pairs of closely spaced opposed grooves in their inner faces, an apertured insulating plate extending transversely between the side walls and movable in the grooves of one pair, a stationary plate in the grooves of the other pair and cooperating with the movable plate to form a partition which is substantially closed with the movable plate in any position, a stationary contact at one side of the movable plate; and an automatic circuit breaking mechanism positioned between the side walls of the housing and chiefly at the other side of the movable plate, the said mechanism including a movable contact bar extending through and approximately fitting the aperture in the movable plate and having a contact thereon adapted to engage and disengage the stationary contact,

29. In an automatic circuit breaker, the combination of an insulating housing provided with parallel side walls spaced apart and having a pair of opposed grooves in their inner faces, two insulating plates extending transversely between the side walls and with one of them apertured and movable in the said opposed grooves, a stationary contact at the outer side of the movable plate, and an automatic circuit breaking mechanism positioned between the side walls of the housing and chiefly between the two transverse plates, the said mechanism including a movable contact bar extending through and approximately fitting the aperture in the movable plate and having a contact thereon adapted to engage and disengage the stationary contact.

30. In an automatic circuit breaker, the combination of an insulating housing provided with parallel side walls spaced apart and having two pairs of opposed grooves in their inner faces, two insulating plates extending transversely between the side walls and positioned in the said opposed grooves, one of the said plates being apertured and movable in its grooves, a cover substantially closing the casing at the front but having a handle opening therein, the said cover being in front of the said transverse plates and preventing removal thereof, a stationary contact at the outer side of the movable plate, and an automatic circuit breaking mechanism positioned between the side walls of the housing and chiefly between the two transverse plates, the said mechanism including a movable contact bar extending through and approximately fitting the aperture in the movable plate and having a contact thereon adapted to engage and disengage the stationary contact, the said mechanism having a movable handle at the front extending through the opening in the front cover.

31. The combination in an automatic circuit breaker, of an insulating housing provided with parallel side walls spaced apart and having three pairs of opposed grooves in their inner faces, a cover substantially closing the housing at the front but having a handle opening therein, three insulating plates extending transversely between the side walls and positioned in the said opposed grooves and providing two substantially enclosed chambers, two conducting means carried by the respective end portions of the housing outside of

the said chambers, a stationary contact in one of the said enclosed chambers and electrically connected with one of the said conducting means, and an automatic circuit breaking mechanism positioned chiefly in the other enclosed chamber and electrically connected with the other of the said conducting means, the said mechanism including a movable contact bar extending into the chamber containing the stationary contact and having a contact thereon adapted to engage and disengage the said stationary contact and the said mechanism having a movable handle at the front extending through the opening in the front cover.

32. The combination in an automatic circuit breaker, of an insulating housing provided with parallel side walls spaced apart and having three pairs of opposed grooves in their inner faces, a cover substantially closing the housing at the front but having a handle opening therein, three insulating plates extending transversely between the side walls and positioned in the said opposed grooves and providing two substantially enclosed chambers, the inner one of the said three plates being apertured and movable in its grooves, two conducting means carried by the respective end portions of the housing outside of the said chambers, a stationary contact in one of the said enclosed chambers and electrically connected with one of the said conducting means, and an automatic circuit breaking mechanism positioned chiefly in the other enclosed chamber and electrically connected with the other of the said conducting means, the said mechanism including a movable contact bar extending through and approximately fitting the aperture in the movable plate and having a contact thereon in the contact containing chamber adapted to engage and disengage the stationary contact and the said mechanism having a movable handle at the front extending through the opening in the front cover.

33. An automatic circuit breaker comprising in combination, an insulating housing provided with two closely adjacent chambers separated by a relatively thin partition, the said chambers being substantially closed except at the front, removable front cover means normally substantially closing both of the chambers at the front, a stationary contact in one of the said chambers, an automatic circuit breaking mechanism positioned chiefly in the other chamber and including a movable contact bar extending into the chamber containing the stationary contact and having a contact thereon adapted to engage and disengage the stationary contact, and an arc muffling device in the chamber containing the contacts and in front of the said contacts.

34. An automatic circuit breaker comprising in combination, an insulating housing provided with two closely adjacent chambers separated by a relatively thin partition, the said chambers being substantially closed except at the front, removable front cover means normally substantially closing both of the chambers at the front, a stationary contact in one of the said chambers, an automatic circuit breaking mechanism positioned chiefly in the other chamber and including a movable contact bar extending into the chamber containing the stationary contact and having a contact thereon adapted to engage and disengage the stationary contact, the said mechanism being readily movable from its chamber as a unit in the forward direction upon removal of the front cover means, and an arc muffling

device in the chamber containing the contacts and in front of the said contacts.

35. An automatic circuit breaker comprising in combination, an insulating housing provided with two closely adjacent chambers separated by a relatively thin partition, the said chambers being substantially closed except at the front, removable front cover means normally substantially closing both of the chambers at the front, a stationary contact in one of the said chambers, an automatic circuit breaking mechanism positioned chiefly in the other chamber and including a movable contact bar extending into the chamber containing the stationary contact and having a contact thereon adapted to engage and disengage the stationary contact, the said mechanism being readily movable from its chamber as a unit in the forward direction upon removal of the front cover means, and an arc muffling device in the chamber containing the contacts and in front of the said contacts, the said arc muffling device being readily movable from its chamber as a unit upon removal of the front cover means.

36. An automatic circuit breaker comprising in combination, an insulating housing formed with a rear wall and with parallel side walls spaced apart, the said side walls having two pairs of opposed grooves in their inner faces, two insulating plates extending transversely between the side walls and positioned in the said opposed grooves to provide a chamber which is substantially closed except at the front, a cover substantially closing the chamber at the front and positioned in front of the said transverse plates to prevent removal thereof, a stationary contact in the said chamber, an automatic circuit breaking mechanism positioned chiefly outside of the said chamber adjacent one of the transverse plates, the said mechanism including a movable contact bar extending into the chamber and having a contact thereon adapted to engage and disengage the stationary contact, and an arc muffling device in the chamber in front of the said contacts, the said muffling device being normally held in place by the front cover but being readily removable as a unit in the forward direction upon removal of the cover.

37. An automatic circuit breaker comprising in combination, an insulating housing formed with a rear wall and with parallel side walls spaced apart, the said side walls having three pairs of opposed grooves in their inner faces, three insulating plates extending transversely between the side walls and positioned in the said opposed grooves to provide two chambers which are substantially closed except at the front, a cover substantially closing the chambers at the front and positioned in front of the said transverse plates to prevent removal thereof, a stationary contact in one chamber, a mechanism supporting frame positioned in the other chamber and having lateral projections engaging the side walls to prevent rearward movement, the said frame being held in place by the cover but otherwise readily movable in the forward direction, an automatic circuit breaking mechanism

carried by the frame and positioned at least chiefly in the same chamber, the said mechanism including a movable contact bar extending into the chamber containing the stationary contact and having a contact thereon adapted to engage and disengage the said stationary contact, and an arc muffling device in the chamber containing the contacts and in front of the said contacts, the said muffling device being normally held in place by the front cover but being readily movable as a unit in the forward direction upon removal of the cover.

38. For an automatic circuit breaker, an arc muffling device comprising in combination two opposite parallel side walls, an end wall, and a plurality of transverse substantially parallel plates extending between the said walls and spaced apart longitudinally, alternate plates being respectively closely adjacent and spaced from the end wall so as to provide a circuitous passageway through the muffler.

39. For an automatic circuit breaker, an arc muffling device comprising in combination an insulating sheet bent to provide two opposite parallel walls, the said walls having pairs of opposite apertures therein spaced apart longitudinally, and transverse plates having end projections seated in the said apertures, the said plates being in staggered relationship so as to provide a serpentine passageway through the muffler.

40. In an automatic circuit breaker, the combination of an insulating housing provided with a chamber open at the front but otherwise substantially closed, a removable front cover normally substantially closing the chamber at the front, a stationary contact in the chamber, an automatic circuit breaking mechanism positioned chiefly outside of the chamber and including a movable contact bar extending into the chamber and having a contact thereon adapted to engage and disengage the stationary contact, and an arc muffling device in the chamber in front of the said contacts, the said muffling device comprising transverse plates providing a circuitous passageway for arc formed gases.

41. In an automatic circuit breaker, the combination of an insulating housing provided with a chamber open at the front but otherwise substantially closed, a removable front cover normally substantially closing the chamber at the front, a stationary contact in the chamber, an automatic circuit breaking mechanism positioned chiefly outside of the chamber and including a movable contact bar extending into the chamber and having a contact thereon adapted to engage and disengage the stationary contact, an insulating sheet positioned in the chamber in front of the said contacts and bent to provide two opposite parallel walls, the said walls having pairs of opposite apertures therein spaced apart longitudinally, and transverse plates having end projections seated in the said apertures, the said plates being in staggered relationship so as to provide a serpentine passageway for arc formed gases.

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