Jan. 2, 1940. J. SACHS 2,185,524

AUTOMATIC CIRCUIT BREAKER

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Fig. 1

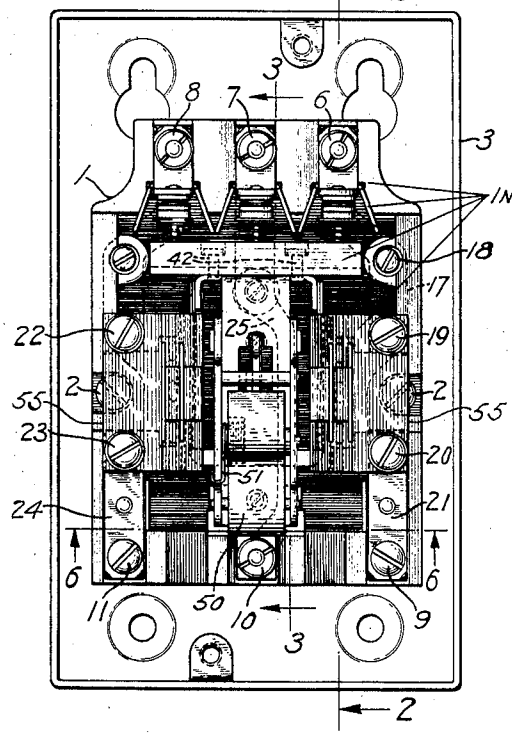


Fig. 2

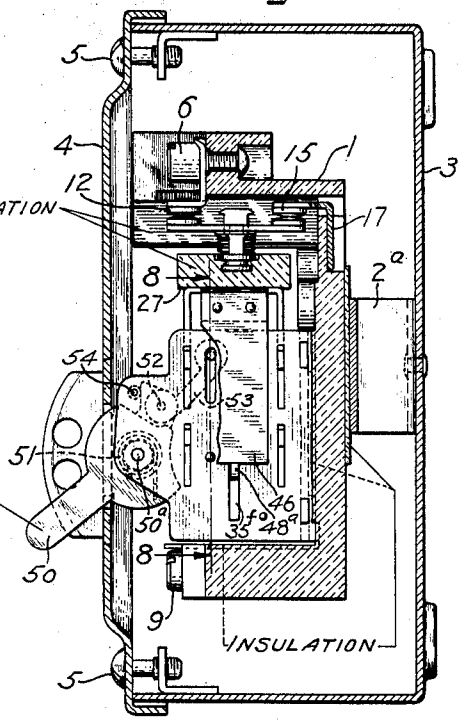


Fig. 3

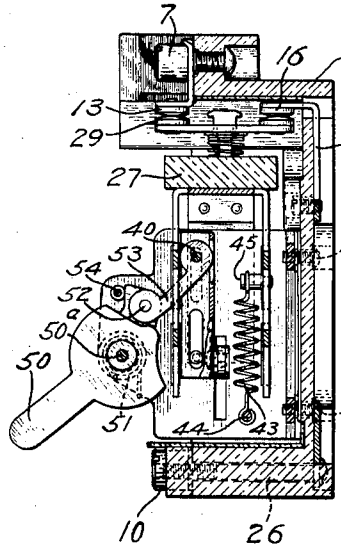


Fig. 4

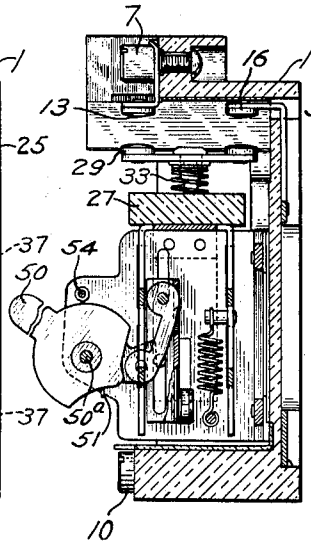
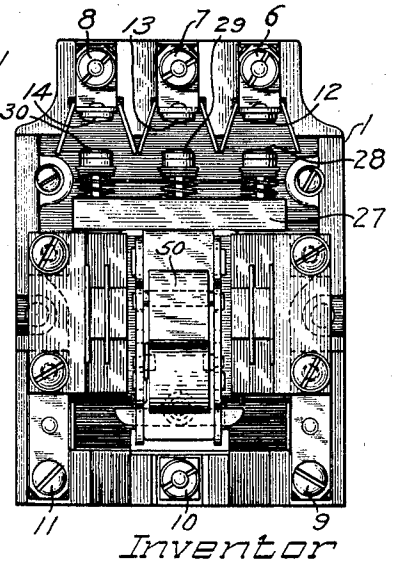


Fig. 5



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Fig. 6

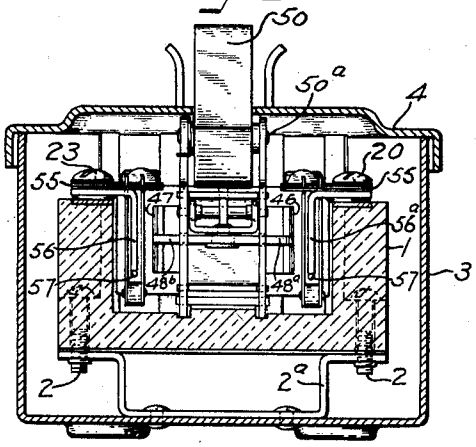
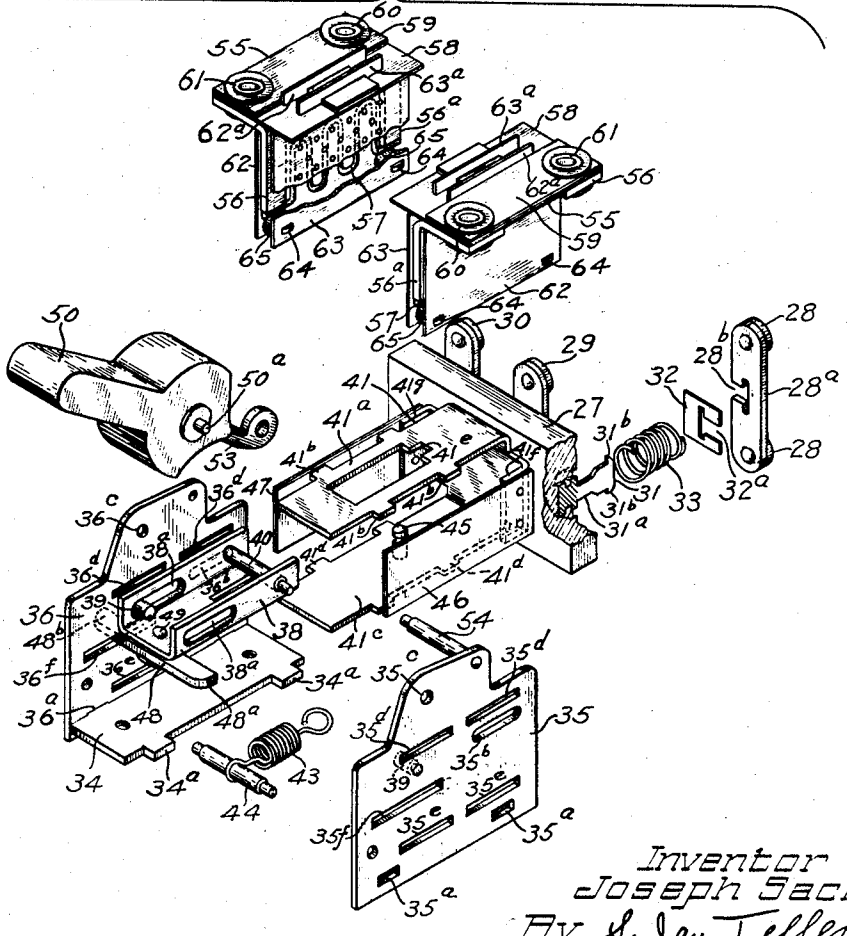


Fig. 7



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Fig. 8

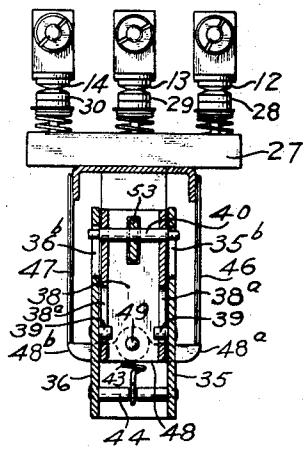


Fig. 9

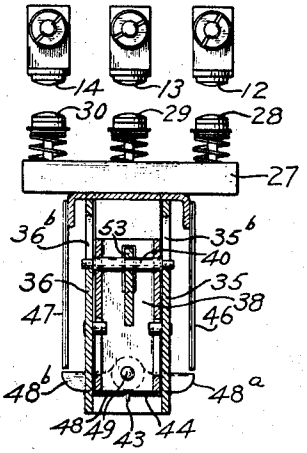


Fig. 10

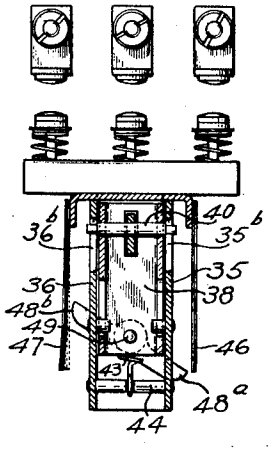
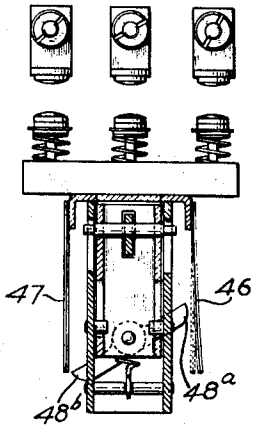


Fig. 11



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Patented Jan. 2, 1940 2,185,524

UNITED STATES PATENT OFFICE

2,185,524

AUTOMATIC CIRCUIT BREAKER

Joseph Sachs, West Hartford, Conn., assignor to Colt's Patent Fire Arms Manufacturing Company, Hartford, Conn., a corporation of Connecticut

Application October 4, 1938, Serial No. 233,265

28 Claims. (Cl. 200—116)

The present invention relates to an automatic circuit breaker and is particularly adapted for incorporation in an automatic circuit breaker of the general type disclosed in my prior patent for Automatic circuit breaker No. 2,094,964 dated October 5, 1937. The circuit breaker disclosed in the said patent is responsive to only one controlling condition, this is, an excess current condition in one leg of an electric circuit. The circuit breaker embodying the present invention is essentially different in that it is responsive to either one of two different controlling conditions, as for instance an excess current condition in either one of two legs of the circuit.

While I do not necessarily so limit myself, a circuit breaker embodying the present invention is particularly adapted for use as a "motor starter". It is capable of carrying a moderate overload for a predetermined short interval of time, but the design is such that automatic opening of both legs of the circuit will occur if the overload continues in either one of the two legs of the circuit for a longer interval of time.

A motor starter embodying the present invention is manually operable to close and open the circuit for the ordinary starting and stopping of the motor. Two electro-responsive devices are provided connectible in two legs of the circuit and each serving upon the attainment of excess current conditions in the corresponding circuit leg to release the movable contacts from the control of the operating member or handle and thus permit the circuit to automatically open independently of the handle.

One of the objects of the invention is to provide a circuit breaker or motor starter of the type specified having a simple, inexpensive and reliable mechanism for effecting the automatic release of the movable contact or contacts to permit automatic circuit opening movement thereof. When there is a handle the said contact or contacts are released from the control of the said handle, or handle operated actuating member, in the manner heretofore specified. In accordance with the invention two movable electro-responsive means are included in the mechanical connection between the actuating member and the member carrying the movable contact or contacts, these two electro-responsive means normally serving to maintain the mechanical connection and either of them upon electro-responsive action serving to break the mechanical connection. Preferably and as shown, these electro-responsive means are bi-metallic strips bodily movable with the movable contact or contacts.

Another object of the invention is to provide an improved general arrangement of parts which facilitates assembly and disassembly and which enables certain of the parts to be readily removed for inspection, repair or replacement without disturbing other parts.

In accordance with the invention I provide various advantageous details of construction and operation all of which will be fully apparent from the following specification.

In the accompanying drawings I have shown one suitable 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, the front cover of the enclosing box being omitted.

Fig. 2 is a vertical sectional view taken along the line 2—2 of Fig. 1 and showing the cover of the enclosing box.

Fig. 3 is a vertical sectional view taken along the line 3—3 of Fig. 1, the enclosing box being omitted.

Fig. 4 is a view similar to Fig. 3 but showing the various parts in open-circuit positions instead of closed-circuit positions.

Fig. 5 is a view similar to Fig. 1 but omitting the enclosing box and showing the parts in open-circuit positions.

Fig. 6 is a transverse sectional view taken along the line 6—6 of Fig. 1 and showing the cover of the enclosing box.

Fig. 7 is a perspective view showing various parts of the circuit breaker mechanism separated from each other in order that the details of construction may be more readily apparent.

Fig. 8 is a fragmentary sectional view taken along the line 8—8 of Fig. 2 and showing certain of the parts in their closed-circuit positions.

Fig. 9 is a view similar to Fig. 8 but showing the parts in the positions which they assume when the operating member or handle is moved to open-circuit position.

Fig. 10 is a view similar to Fig. 8 but showing the parts in the positions which they assume when the operating member or handle is held in closed-circuit position and when automatic opening is effected by reason of excess current in the left hand leg of the circuit.

Fig. 11 is a view similar to Fig. 8 but showing the parts in the positions which they assume when the operating member or handle is held in closed-circuit position and when automatic opening is effected by reason of excess current in the right hand leg of the circuit.

Referring to the drawings, 1 represents an insulating block or base which serves as a support for all of the electrical parts of the circuit breaker and for all of the mechanically operative parts. The base 1 is secured by means of screws 2, 2 to a bracket 2a which is connected with the rear wall of an enclosing box 3. The box 3 has a removable front cover 4 normally held in place by screws 5, 5. The cover 4 has a front opening adapted to receive the operating member or handle of the circuit breaker as will presently appear.

A three pole circuit breaker is shown, there being three wire terminals 6, 7 and 8 secured to the base 1 near the top edge thereof and three other wire terminals 9, 10 and 11 secured to the base 1 near the bottom edge thereof. Electrically and mechanically connected with the respective wire terminals 6, 7 and 8 are stationary contacts 12, 13 and 14 having downward exposed contact faces. Each of the stationary contacts 12, 13 and 14 constitutes one of a pair of such contacts, the other contact of each pair being similarly constructed and positioned but located toward the rear. These latter contacts will be referred to as the rear stationary contacts, the rear contact 15 for the right leg of the circuit being shown in Fig. 2 and the rear contact 16 for the center leg of the circuit being shown in Figs. 3 and 4.

The rear stationary contact 15 at the right is carried by a conductor 17 at or near the rear of the base, this conductor being engaged by screws 18 and 19 which extend through the base to the front thereof. A screw 20 similar to the screw 19, is mounted at the front of the base, this screw being associated with a conductor 21 which carries the before-mentioned wire terminal 9. A heating unit to be presently described in detail is connected between the screws 19 and 20 and there is thus established a continuous electric circuit from the rear stationary contact 15 to the wire terminal 9. In similar manner the rear stationary contact at the left is electrically connected with the wire terminal 11, there being heater engaging screws 22 and 23 similar to the screws 19 and 20, and there being a conductor 24 at the front similar to the conductor 21.

The rear stationary contact 16 at the center is carried by a conductor 25 at the rear of the base which extends downward to a position near the lower end of the base where it is engaged by a screw 26 extending forward to the front of the base and providing electrical connection with the wire terminal 10.

A contact carrying block 27 is movable vertically in a manner to be presently described. This block 27 carries three pairs of bridging contacts 28, 29 and 30 adapted when in their upper positions to engage and electrically connect the stationary contacts of the several pairs.

The several pairs of bridging contacts carried by the block 27 are similar and a detailed description of one of them will suffice for all. Referring particularly to Fig. 7, it will be observed that the contacts 28, 28 constituting one pair are mounted on a bridging conductor 28a which is carried by the contact member 27. Preferably the bridging contacts and their connecting conductor are readily detachable from block 27 so that they can be replaced if worn or burned. Projecting upward from the block 27 is a flat stud 31 having a narrowed portion 31a and having laterally projecting teeth 31b, 31b. The conductor 28a has a T-slot 28b therein, the entrance portion of which is of such width as to receive the narrowed portion 31a of the stud 31. There is also provided a washer 32 having a T-slot 32a therein similar to the T-slot 28b but reversed as to position. A coil spring 33 is provided which is adapted to surround the stud 31. In assembling the parts the spring 33 is placed on the stud 31 and compressed. Then the washer 32 and the bridging connector 28a are placed on the stud, the entrance portions of their T-slots receiving the narrowed portion 31a of the stud 31. After being thus assembled the bridging conductor 28a and the washer 32 are permitted to move forward under the influence of the spring 33 until further movement is prevented by the laterally projecting teeth 31b, 31b. Thus the bridging connector is detachably and yieldably connected to the contact carrying block; and it can be readily removed by reversing the procedure last described. When the block is moved upward the movable contacts on the bridging connector can engage the corresponding stationary contacts, the spring 33 yielding as required and providing the necessary contact pressure.

Carried by the base 1 is a frame which serves to carry all of the movable parts of the circuit breaker. This frame is approximately U-shaped in horizontal section, the legs of the U consisting of two parallel vertical side plates which project forward. As shown, the frame consists of three separate plates, there being a rear plate 34 and two separate side plates 35 and 36. The rear plate 34 is secured directly to the base as for instance by means of screws 37, 37 and the side plates 35 and 36 have slots such as 35a, 36a therein which receive tongues 34a, 34a on the plate 34. The end portions of these tongues are riveted over to hold these side plates in place.

Mounted between the side plates 35 and 36 for rectilinear movement is an actuating member 38. As shown, this member 38 is a U-shaped metallic plate having slots 38a, 38a in the side legs thereof which receive studs 39, 39 projecting inward from the side plates 35 and 36. Extending transversely between the side legs of the U-shaped plate 38 is a pin 40 having end extensions which project through slots 35b and 36b in the plates 35 and 36. It will be seen that the studs 39, 39 and the end extensions on the pin 40 serve as means for guiding the actuating member 38 for rectilinear movement between the two side plates 35 and 36.

The contact carrying block 27 is carried by a metallic member 41 which is U-shaped in vertical section, the legs of the U extending downward. The block 27 is connected with the member 41 by means of screws or rivets 42. The front leg 41a of the plate 41 has tongues 41b, 41b projecting transversely therefrom, these tongues entering slots 35d in the side plate 35 and slots 36d in the side plate 36. The rear leg 41c of the plate 41 has tongues 41d, 41d projecting transversely therefrom, these tongues entering slots 35e in the side plate 35 and slots 36e in the side plate 36. The said lugs 41b, 41b and 41d, 41d thus serve to guide the member 41 for rectilinear movement between the side plates 35 and 36. It will be observed that the member 41 is supported and guided entirely independently of the actuating member 38. For convenience the member 41 together with the insulating block 27 and the contacts carried

thereby will be referred to collectively as constituting the "contact member" of the circuit breaker. All of the parts of the contact member are movable in substantial unison with each other so as to make and break the circuit simultaneously at all of the contacts.

The contact member is biased for movement in the circuit-opening direction. As shown, this biasing is effected by means of a spring 43. One end of the spring is connected with a pin 44 extending transversely between the side plates 35 and 36 of the frame and the other end of the spring is connected with a stud 45 projecting from the rear leg 41c of the plate 41.

In accordance with the invention, I provide two separate condition-responsive devices which are bodily movable with the movable contact or contacts and each of which is adapted to act separately from the other to mechanically release the said contact or contacts and thus permit automatic circuit-opening movement thereof. In the embodiment of the invention herein disclosed, the said condition-responsive devices are electro-responsive, each of them having at least a portion thereof inherently responsive to an electrical effect and normally bodily movable with the contact member and with the actuating member. The said electro-responsive means normally serve to provide at least a portion of a mechanical connection so that the actuating member can cause the movement of the contact member to open and close the circuit. Upon electro-responsive action of either one of the electro-responsive means separately from the other, the before-mentioned mechanical connection is broken and the contact member is permitted to automatically move to its open-circuit position entirely independently of the actuating member. The details of the mechanical construction arrangement of the two electro-responsive means may be widely varied within the scope of my invention. One particular construction which has been found satisfactory is shown and will be described in detail.

The before-mentioned electro-responsive means associated with the actuating and contact members preferably comprises two thermostatic bi-metallic strips fixedly connected with one of the said members. As shown, there are two such strips 46 and 47 positioned at the sides of the contact member and connected respectively with integral extensions 41f and 41g on the plate 41. The mechanical connecting means also comprises two interconnected pivoted arms having operative connection with one of the said members. As illustrated, the two interconnected arms are integral with each other and constitute the end portions 48a and 48b of a transverse lever 48 which is pivoted at 49 to the actuating member 38. The arms 48a and 48b extend transversely to positions at the outer sides of the respective side plates 35 and 36 and preferably they extend through slots 35f and 36f in the said side plates. The before described bi-metallic strips 46 and 47 normally engage respectively with the lever arms 48a and 48b and the strips thus serve as latches to normally hold the contact member in fixed relationship with the actuating member.

Positioned between the side plates 35 and 36 is an operating member or handle 50 this being pivotally supported on the side plates by means of transversely projecting pivot pins 50a projecting into holes 35c and 36c in the side plates. A spring 51 serves to bias the operating member 50 for movement in the clockwise direction. Pivotally connected at 52 to the operating member 50, as more clearly shown in Fig. 3, is a link 53, the other end of the link being engaged by the before-mentioned pin 40 on the actuating member 38. A hole 41e in the front leg 41a of the member 41 provides clearance for the link 53. The link 53 serves to enable the operating member 50 to move the actuating member 38 in either direction. Movement of the operating member 50 in the counter-clockwise direction is limited by a pin 54 extending transversely between the side plates 35 and 36.

As shown in Figs. 2 and 3, the inner portion of the operating member 50 cooperates with the link 53 to form an overset toggle, which holds all of the parts in closed-circuit positions. Pressure for maintaining the toggle in its overset or locked position as shown is provided by the spring 43. The pin 54 prevents movement of the operating member in the counter-clockwise direction beyond the position illustrated. When the operating member 50 is moved in the clockwise direction so as to break the toggle, the parts are then moved by the springs 43 and 51 to their open-circuit positions as shown in Fig. 4.

The bi-metallic strips 46 and 47 are deflectible by heat and as concerns the broader aspects of the invention I do not limit myself as to the manner of heating the said strips. Preferably, however, there are two separate means associated respectively with two legs of the circuit and with the said two bi-metallic strips, the said means serving upon the attainment of excess current conditions in either leg of the circuit to cause the independent heating and deflection of the corresponding strip. As shown, there are two similar separate heaters 55, 55 having normally fixed positions, these heaters being mounted on the insulating base 1 entirely independently of the frame which carries the contact member and the associated parts. The heater 55 at the right, serves as an electrical connection between the screws 19 and 20 and the heater 55 at the left, serves as an electrical connection between the screws 22 and 23. The heaters are thus readily detachable and it will be clear that by removing the corresponding screws either of the heaters can be removed for inspection, repair or replacement.

The mechanical construction of the heaters can be widely varied but one suitable construction is shown in the upper portion of Fig. 7. Essentially each heater comprises two L-shaped strips 56 and 56a which are apertured to receive the attachment screws before-mentioned. Connected with the ends of the strips 56 and 56a is a section of high resistance heating wire 57 bent to a serpentine shape as shown. Preferably the L-shaped members 56 and 56a are covered by insulating plates 58 and 59 connected with the said members by means of hollow rivets 60 and 61 which receive the corresponding attachment screws. Other insulating plates 62 and 63 are provided at opposite sides of the resistance wire 57, these plates having extensions 62a and 63a which extend through slots in the insulating plate 58. The plates 62 and 63 are connected with each other by rivets 64, 64 which extend through suitable spacing washers 65, 65. If desired the inner plate 63 may be perforated as shown to permit heat from the wire 57 to be more readily transmitted. By referring particularly to Fig. 6 it will be observed that the resistance wires of the two heaters are normally positioned in relatively close proximity to the bi-

metallic strips 46 and 47. The heaters are connected respectively in the right hand and left hand legs of the circuit and the resistance wires of the heaters are designed to carry normal current without excessive heating. However, upon attainment of excess current conditions in either of the said legs of the circuit the corresponding resistance wire is heated to a much higher temperature, and its heat is transmitted to the adjacent bi-metallic strip 46 or 47.

The operation of the circuit breaker under normal and abnormal current conditions will be more readily understood by reference to the fragmentary diagrammatic views which constitute Figs. 8, 9, 10 and 11. Fig. 8 shows the parts in closed-circuit positions, this view corresponding in this respect to Fig. 1. The actuating member 38 is held in its upper position by means of the operating member 50 and the link 53, and the contact member is correspondingly held in its upper position by reason of the engagement of the bi-metallic strips or latches 46 and 47 with the pivoted arms 48^a and 48^b which taken together constitute the lever 48. The contact member is biased for movement in the downward direction by the spring 43 as already explained, but it cannot so move by reason of the said engagement of the bi-metallic latches with the lever arms.

When the operating member is moved to break the toggle as shown in Fig. 4, the actuating member and the contact member move downward in unison to the positions shown in Fig. 9. This separates the movable contacts from the stationary contacts and breaks all three legs of the circuit simultaneously. It will be clear that by moving the operating member 50 upward or downward, the actuating member and the contact member can normally be moved upward to close the circuit or downward to open the circuit.

As has already been explained, the heaters 55, 55 are connected in the two outer legs of the circuit and are so designed that under normal current conditions they remain at relatively low temperatures. However, upon the attainment of excess current conditions, the resistance wires of the heaters are heated to much higher temperatures and this heat is transmitted to the adjacent bi-metallic strips to cause outward deflection thereof. Obviously, a momentary excess current condition in either leg of the circuit will have no appreciable effect as time is required to heat the resistance wire and to transmit the heat from the wire to the adjacent bi-metallic strip or latch. However, if the excess current condition is continued in one leg of the circuit, as for instance in the left hand leg, the corresponding bi-metallic latch 47 is eventually heated so as to be deflected outward sufficiently to become disengaged from the corresponding pivoted arm 48^b as shown in Fig. 10. This disengagement of the latch 47 from the arm 48^b permits the contact member to be moved downward by the spring 43 thus opening the circuit, this downward movement of the contact member being entirely independent of the actuating member. It will be observed that this automatic opening of the circuit occurs as the result of the deflection of only one of the bi-metallic latches, as for instance 47, without any heating or deflection of the other bi-metallic latch, as for instance 46.

Fig. 10 shows the actuating member 38 in its closed-circuit position, it being assumed that it is so held by the operating member 50; and this figure therefore illustrates the fact that the automatic opening of the circuit occurs even though the operating member be held in closed-circuit position. However, if the handle is not held, or if it is first held and later released, the absence of the stress normally exerted by the spring 43 permits the toggle to be broken and permits the operating member to be thrown to its open-circuit position by means of the before-mentioned spring 51, thus causing the actuating member 38 to also move to its open-circuit position as shown in Fig. 9. It will be understood that when the operating member is not held it starts to move to open-circuit position as soon as the toggle is broken. The operating member and also the actuating member therefore move while the contact member is moving, with the result that the actuating member is not at any time far behind the contact member.

It should be observed that movement of the actuating member to its lower open-circuit position brings the lever arms 48^a and 48^b to the lower ends of the slots 35^f and 36^f, the said arms being thus forced into their normal transverse positions as shown. In this way the disengaged arm 48^b is returned to position for reengagement with the latch 47 as soon as the latch has sufficiently cooled. The fact that the actuating and contact members move almost simultaneously to their open-circuit positions greatly facilitates relatching as the disengaged arm is restored to relatching position while the bi-metallic latch is still heated and deflected.

Fig. 11 is similar to Fig. 10, but shows the action which takes place when the excess current condition is in the right hand circuit instead of in the left hand circuit. Inasmuch as the manner of operation is similar, a repetition of the description is unnecessary.

While I have shown and described a circuit breaker responsive to excess current conditions in either one of two legs of a circuit, it is to be understood that as to some of the features of mechanical construction I do not necessarily so limit myself. The mechanical construction of the actuating and contact members and their associated parts has certain advantages which are not necessarily limited for use with two separate electro-responsive means.

What I claim is:

1. An automatic circuit breaker comprising in combination, a stationary contact, a contact movable out of or into engagement with the stationary contact to open or close the circuit, the said movable contact being biased for circuit-opening movement but normally being mechanically held against such movement, two devices bodily movable with the movable contact and each adapted to act separately from the other to mechanically release the said contact and thus permit automatic circuit-opening movement thereof, and two separate means associated with the said devices and respectively causing each of them to act in response to a predetermined condition.

2. An automatic circuit breaker comprising in combination, a stationary contact, a contact movable out of or into engagement with the stationary contact to open or close the circuit, the said movable contact being biased for circuit-opening movement but being mechanically held against such movement, and two devices bodily movable with the movable contact and each adapted to respond to a predetermined thermal condition and thereupon act separately from the

other said device to mechanically release the movable contact and thus permit automatic circuit-opening movement thereof.

3. An automatic circuit breaker comprising in combination, two stationary contacts connectible respectively in two legs of a circuit, a movable contact member having two contacts connectible respectively in the said legs of the circuit and adapted to simultaneously engage and disengage the respective stationary contacts, the said contact member being biased for circuit-opening movement and normally being mechanically held against such movement, two electro-responsive means each having at least a portion thereof inherently responsive to an electrical effect and normally movable bodily with the contact member, each of the said means upon electro-responsive action thereof serving separately from the other to mechanically release the contact member and thus permit automatic circuit-opening movement thereof, and means for connecting the said electro-responsive means in the respective legs of the circuit so as to cause electro-responsive action of either of the said means upon the attainment of excess current conditions in the corresponding leg of the circuit.

4. The combination in an automatic circuit breaker, of a stationary contact, a contact movable out of or into engagement with the stationary contact to open or close the circuit, the said movable contact being biased for circuit-opening movement, and two bi-metallic strips bodily movable with the movable contact and normally cooperating with each other to form portions of a mechanical connection which holds the movable contact against circuit-opening movement, each of the said strips being adapted to respond to a predetermined thermal condition and thereupon act separately from the other to release the movable contact and thus permit automatic circuit-opening movement thereof.

5. In an automatic circuit breaker, the combination of a stationary contact, a movable contact, a movable actuating member normally adapted to move the movable contact to open or close the circuit, means biasing the movable contact toward its open-circuit position independently of the actuating member, two devices bodily movable with the movable contact and the actuating member and each adapted to act separately from the other to mechanically disconnect the movable contact from the actuating member and thus permit automatic circuit-opening movement of the said contact independently of the actuating member, and two separate means associated with the devices and respectively causing each of them to act in response to a predetermined condition.

6. In an automatic circuit breaker, the combination of a stationary contact, a movable contact, a movable actuating member normally adapted to move the movable contact to open or close the circuit, means biasing the movable contact toward its open-circuit position independently of the actuating member, two devices bodily movable with the movable contact and the actuating member and each adapted to respond to a predetermined thermal condition and thereupon act separately from the other said device to mechanically disconnect the movable contact from the actuating member and thus permit automatic circuit-opening movement of the said contact independently of the actuating member, and a means associated with one of the said devices and causing it to be heated in response to a predetermined electrical condition in the circuit.

7. In an automatic circuit breaker, the combination of a stationary contact, a movable contact, a movable actuating member normally adapted to move the movable contact to open or close the circuit, means biasing the movable contact toward its open-circuit position independently of the actuating member, two devices bodily movable with the movable contact and the actuating member and forming portions of the mechanical connection between them, each of the said devices being adapted to act separately from the other to mechanically disconnect the movable contact from the actuating member and thus permit automatic circuit-opening movement of the said contact independently of the actuating member, two separate means associated with the devices and respectively causing each of them to act in response to a predetermined condition, a pivoted operating member biased toward its open-circuit position, and toggle links operatively connecting the operating member with the actuating member, the said links when in overset position holding the operating member in closed circuit position and being normally held in their said overset position as the result of pressure transmitted from the contact to the actuating member by means of the said mechanical connection.

8. In an automatic circuit breaker, the combination of two stationary contacts connectible respectively in two legs of a circuit, a movable contact member having two contacts movable in unison therewith and with each other and connectible respectively in the said legs of the circuit, the said movable contacts being adapted to simultaneously engage and disengage the respective stationary contacts, a movable actuating member normally adapted to move the contact member to open or close the said legs of the circuit, means biasing the contact member toward its open-circuit position independently of the actuating member, two electro-responsive means each having at least a portion thereof inherently responsive to an electrical effect and normally movable bodily with the contact and actuating members, each of the said means upon electro-responsive action thereof serving separately from the other to mechanically disconnect the contact member from the actuating member and thus permit the said contact member to automatically move independently to its open-circuit position, and means for connecting the said electro-responsive means in the respective legs of the circuit so as to cause electro-responsive action of either of the said means upon the attainment of excess current conditions in the corresponding leg of the circuit.

9. In an automatic circuit breaker, the combination of two stationary contacts connectible respectively in two legs of a circuit, a movable contact member having two contacts movable in unison therewith and with each other and connectible respectively in the said legs of the circuit, the said movable contacts being adapted to simultaneously engage and disengage the respective stationary contacts, a movable actuating member normally adapted to move the contact member to open or close the said legs of the circuit, means biasing the contact member toward its open-circuit position independently of the actuating member, two bi-metallic strips deflectible by heat and normally movable bodily with the contact and actuating members, each of the

said strips upon deflection serving separately from the other to mechanically disconnect the contact member from the actuating member and thus permit the said contact member to automatically move independently to its open-circuit position, and two separate means associated respectively with the said legs of the circuit and with the said bi-metallic strips and serving upon the attainment of excess current conditions in either leg of the circuit to cause the independent heating and deflection of the corresponding strip.

10. In an automatic circuit breaker, the combination of two stationary contacts connectible respectively in two legs of a circuit, a movable contact member having two contacts movable in unison therewith and with each other and connectible respectively in the said legs of the circuit, the said movable contacts being adapted to simultaneously engage and disengage the respective stationary contacts, a movable actuating member normally adapted to move the contact member to open or close the said legs of the circuit, means biasing the contact member toward its open-circuit position independently of the actuating member, two bi-metallic strips deflectible by heat and normally movable bodily with the contact and actuating members, each of the said strips upon deflection acting separately from the other to mechanically disconnect the contact member from the actuating member and thus permit the said contact member to automatically move independently to its open-circuit position, and two separate stationary heaters connected respectively in the said legs of the circuit and positioned adjacent the said bi-metallic strips and serving upon the attainment of excess current conditions in either leg of the circuit to cause the independent heating and deflection of the corresponding strip.

11. The combination in an automatic circuit breaker, of a stationary contact, a movable actuating member, a movable contact member having a contact adapted to engage and disengage the stationary contact, the said actuating member being normally mechanically connected with the actuating member so as to move in unison therewith to open or close the circuit; means biasing the contact member toward its open-circuit position independently of the actuating member, and two bi-metallic strips deflectible by heat and normally movable bodily with the said contact and actuating members and constituting portions of the mechanical connection between them, each of the said strips upon deflection acting separately from the other to release the contact member from the actuating member and thus permit the entire contact member to automatically move as a unit to its open-circuit position independently of the actuating member.

12. The combination in an automatic circuit breaker, of a stationary contact, a movable actuating member, a movable contact member having a contact adapted to engage and disengage the stationary contact, the said actuating member being normally mechanically connected with the actuating member so as to move in unison therewith to open or close the circuit, means biasing the contact member toward its open-circuit position independently of the actuating member, and two bi-metallic strips deflectible by heat and normally movable bodily with the said contact and actuating members and cooperating with each other to jointly provide a mechanical connection between them, each of the said strips upon deflection acting independently of any deflection of the other strip to release the contact member from the actuating member and thus permit the entire contact member to automatically move as a unit to its open-circuit position independently of the actuating member.

13. The combination in an automatic circuit breaker, of a stationary contact, a movable actuating member, a movable contact member having a contact adapted to engage and disengage the stationary contact, the said actuating member being normally mechanically connected with the actuating member so as to move in unison therewith to open or close the circuit, means biasing the contact member toward its open-circuit position independently of the actuating member, two thermostatic bi-metallic strips deflectible by heat and normally movable bodily with the said contact and actuating member and constituting portions of the mechanical connection between them, each of the said strips upon deflection acting separately from the other to release the contact member from the actuating member and thus permit the contact member to automatically move to its open-circuit position independently of the actuating member, a pivoted operating member biased toward its open-circuit position, and toggle links operatively connecting the operating member with the actuating member, the said links when in overset position holding the operating member in closed circuit position and being normally held in their said overset position as the result of pressure transmitted through the bi-metallic strips to the actuating member.

14. The combination in an automatic circuit breaker, of two stationary contacts connectible respectively in two legs of a circuit, a movable actuating member, a movable contact member having two contacts movable in unison therewith and with each other and connectible respectively in the said legs of the circuit, the said movable contacts being adapted to simultaneously engage and disengage the respective stationary contacts and the said contact member being normally mechanically connected with the actuating member so as to move in unison therewith to open or close the said legs of the circuit, means biasing the contact member toward its open-circuit position independently of the actuating member, two bi-metallic strips deflectible by heat and normally movable bodily with the said contact and actuating members and constituting portions of the mechanical connection between them, each of the said strips upon deflection acting separately from the other to release the contact member from the actuating member and thus permit the said contact member to automatically move independently to its open-circuit position, and two separate means associated respectively with the said legs of the circuit and with the said bi-metallic strips and serving upon the attainment of excess current conditions in either leg of the circuit to cause the independent heating and deflection of the corresponding strip.

15. The combination in an automatic circuit breaker, of two stationary contacts connectible respectively in two legs of a circuit, a movable actuating member, a movable contact member having two contacts movable in unison therewith and with each other and connectible respectively in the said legs of the circuit, the said movable contacts being adapted to simultaneously engage and disengage the respective stationary contacts and the said contact member being normally mechanically connected with the actuating mem-

ber so as to move in unison therewith to open or close the said legs of the circuit, means biasing the contact member toward its open-circuit position independently of the actuating member, two bi-metallic strips deflectible by heat and normally movable bodily with the said contact and actuating members and constituting portions of the mechanical connection between them, each of the said strips upon deflection acting separately from the other to release the contact member from the actuating member and thus permit the said contact member to automatically move independently to its open-circuit position, and two separate heaters connected respectively in the said legs of the circuit and positioned adjacent the said bi-metallic strips and serving upon the attainment of excess current conditions in either leg of the circuit to cause the independent heating and deflection of the corresponding strip.

16. An automatic circuit breaker comprising in combination, a stationary contact, a movable contact member having a contact adapted to engage and disengage the stationary contact, means biasing the contact member toward its contact-disengaging open-circuit position, and a mechanical connection adapted to normally hold the contact member in its closed-circuit position, the said mechanical connection comprising two interconnected movable arms and also comprising two latches bodily movable with the contact member and electro-responsively movable out of their normal relationship thereto, the said latches normally engaging the respective arms so as to jointly maintain the mechanical connection which normally holds the contact member and each of the said latches upon electro-responsive movement serving independently of any movement of the other latch to disengage its corresponding arm so as to thus break the said mechanical connection and permit automatic circuit-opening movement of the contact member.

17. An automatic circuit breaker comprising in combination, a stationary contact, a movable actuating member, a movable contact member having a contact adapted to engage and disengage the stationary contact, means biasing the contact member toward its contact-disengaging open-circuit position independently of the actuating member, and a mechanical connection between the actuating and contact members normally enabling the former to effect movement of the latter to open and close the circuit, the said mechanical connection comprising two interconnected movable arms having operative connection with one of the last said members and also comprising two bodily movable latches carried by the other of the last said members and electro-responsively movable out of their normal relationship thereto, the said latches normally engaging the respective arms so as to jointly maintain the mechanical connection between the two members and each of the said latches upon electro-responsive movement serving independently of any movement of the other latch to disengage its corresponding arm so as to thus break the said mechanical connection and permit circuit-opening movement of the contact member independently of the actuating member.

18. An automatic circuit breaker comprising in combination, a stationary contact, a movable actuating member, a movable contact member having a contact adapted to engage and disengage the stationary contact, means biasing the contact member toward its contact-disengaging open-circuit position independently of the actuating member, and a mechanical connection between the actuating and contact members normally enabling the former to effect movement of the latter to open and close the circuit, the said mechanical connection comprising two interconnected movable arms having operative connection with one of the last said members and also comprising two bi-metallic latches carried by the other of the last said members and deflectible out of their normal relationship thereto when heated, the said latches normally engaging the respective arms so as to jointly maintain the mechanical connection between the two members and each of the said latches upon being heated and deflected serving independently of any heating and deflection of the other latch to disengage its corresponding arm so as to thus break the said mechanical connection and permit circuit-opening movement of the contact member independently of the actuating member.

19. An automatic circuit breaker comprising in combination, a stationary contact, a movable actuating member, a movable contact member having a contact adapted to engage and disengage the stationary contact, means biasing the contact member toward its contact-disengaging open-circuit position independently of the actuating member, a mechanical connection between the actuating and contact members normally enabling the former to effect movement of the latter to open and close the circuit, the said mechanical connection comprising two interconnected movable arms having operative connection with one of the last said members and also comprising two bi-metallic latches carried by the other of the last said members and deflectible out of their normal relationship thereto when heated, the said latches normally engaging the respective arms so as to jointly maintain the mechanical connection between the two members and each of the said latches upon being heated and deflected serving independently of any heating and deflection of the other latch to disengage its corresponding arm so as to permit the arm to move and thus enable the contact member to move to its open-circuit position independently of the contact member, and means serving upon movement of the members to open-circuit positions to restore the arms to their normal relationship with respect to the said latches.

20. An automatic circuit breaker comprising in combination, a stationary contact, a movable actuating member, a movable contact member having a contact adapted to engage and disengage the stationary contact, means biasing the contact member toward its contact-disengaging open-circuit position independently of the actuating member, a mechanical connection between the actuating and contact members normally enabling the former to effect movement of the latter to open and close the circuit, the said mechanical connection comprising two interconnected pivoted arms having operative connection with one of the last said members and also comprising two bi-metallic latches carried by the other of the last said members and deflectible out of their normal relationship thereto when heated, the said latches normally engaging the respective arms so as to jointly maintain the mechanical connection between the two members and each of the said latches upon being heated and deflected serving independently of any heating and deflection of the other latch to disengage its corresponding arm so as

to thus break the said mechanical connection and permit circuit-opening movement of the contact member independently of the actuating member, and means connected in the circuit and associated with one of the bi-metallic latches and serving upon the attainment of excess current conditions in the circuit to cause the heating and deflection of the last said latch.

21. An automatic circuit breaker comprising in combination, two stationary contacts connectible respectively in two legs of a circuit, a movable actuating member, a movable contact member having two contacts movable in unison therewith and with each other and connectible respectively in the said legs of the circuit, the said movable contacts being adapted to simultaneously engage and disengage the respective stationary contacts, means biasing the contact member toward its contact-disengaging open-circuit position independently of the actuating member, a mechanical connection between the actuating and contact members normally enabling the former to effect movement of the latter to open and close the circuit, the said mechanical connection comprising two interconnected pivoted arms having operative connection with one of the last said members and also comprising two bi-metallic latches carried by the other of the last said members and deflectible out of their normal relationship thereto when heated, the said latches normally engaging the respective arms so as to jointly maintain the mechanical connection between the two members and each of the said latches upon being heated and deflected serving independently of any heating and deflection of the other latch to disengage its corresponding arm so as to thus break the said mechanical connection and permit circuit-opening movement of the contact member independently of the actuating member, and two separate means associated respectively with the said legs of the circuit and with the said bi-metallic strips and serving upon the attainment of excess current conditions in either leg of the circuit to cause the independent heating and deflection of the corresponding strip.

22. An automatic circuit breaker comprising in combination, two stationary contacts connectible respectively in two legs of a circuit, a movable actuating member, a movable contact member having two contacts movable in unison therewith and with each other and connectible respectively in the said legs of the circuit, the said movable contacts being adapted to simultaneously engage and disengage the respective stationary contacts, means biasing the contact member toward its contact-disengaging open-circuit position independently of the actuating member, a mechanical connection between the actuating and contact members normally enabling the former to effect movement of the latter to open and close the circuit, the said mechanical connection comprising two interconnected pivoted arms having operative connection with one of the last said members and also comprising two bi-metallic latches carried by the other of the last said members and deflectible out of their normal relationship thereto when heated, the said latches normally engaging the respective arms so as to jointly maintain the mechanical connection between the two members and each of the said latches upon being heated and deflected serving independently of any heating and deflection of the other latch to disengage its corresponding arm so as to thus break the said mechanical connection and permit circuit-opening movement of the contact member independently of the actuating member, and two separate stationary heaters connected respectively in the said legs of the circuit and positioned adjacent the said bi-metallic strips and serving upon the attainment of excess current conditions in either leg of the circuit to cause the independent heating and deflection of the corresponding strip.

23. An automatic circuit breaker comprising in combination, a stationary contact, a movable actuating member, a movable contact member having a contact adapted to engage and disengage the stationary contact, means biasing the contact member toward its contact-disengaging open-circuit position independently of the actuating member, and a mechanical connection between the actuating and contact members normally enabling the former to effect movement of the latter to open and close the circuit, the said mechanical connection comprising two interconnected arms having direct pivotal connection with one of the last said members and also comprising two bi-metallic latches carried by the other of the last said members and deflectible out of their normal relationship thereto when heated, the said latches normally engaging the respective arms so as to jointly maintain the mechanical connection between the two members and each of the said latches upon being heated and deflected serving independently of any heating and deflection of the other latch to disengage its corresponding arm so as to thus break the said mechanical connection and permit circuit-opening movement of the contact member independently of the actuating member.

24. An automatic circuit breaker comprising in combination, a stationary contact, a movable actuating member, a movable contact member having a contact adapted to engage and disengage the stationary contact, means biasing the contact member toward its contact-disengaging open-circuit position independently of the actuating member, and a mechanical connection between the actuating and contact members normally enabling the former to effect movement of the latter to open and close the circuit, the said mechanical connection comprising a single lever directly pivotally connected with one of the last said members and including two oppositely extending rigidly connected arms and the said connection also comprising two bi-metallic latches carried by the other of the said members and deflectible out of their normal relationship thereto when heated, the said latches normally engaging the respective arms so as to jointly maintain the mechanical connection between the two members and each of the said latches upon being heated and deflected serving independently of any heating and deflection of the other latch to disengage its corresponding arm so as to thus break the said mechanical connection and permit circuit-opening movement of the contact member independently of the actuating member.

25. In an automatic circuit breaker, the combination of a main frame having two side plates spaced apart, an operating member movably connected with the side plates of the frame, an actuating member rectilinearly movable between the frame side plates and guided thereby, means operatively connecting the operating member with the actuating member, a contact member rectilinearly movable between the frame side

plates and guided thereby independently of the actuating member, the said contact member carrying a movable contact, a stationary contact positioned to be engaged and disengaged by the movable contact, means biasing the contact member toward its contact-disengaging open-circuit position independently of the actuating member, and a mechanical connection between the actuating and contact members normally enabling the former to effect movement of the latter to open and close the circuit, the said mechanical connection comprising two interconnected pivoted arms having operative connection with one of the last said members and also comprising two bi-metallic latches carried by the other of the last said members and deflectible out of their normal relationship thereto when heated, the said latches normally engaging the respective arms so as to jointly maintain the mechanical connection between the two members and each of the said latches upon being heated and deflected serving independently of any heating and deflection of the other latch to disengage its corresponding arm so as to thus break the said mechanical connection and permit circuit-opening movement of the contact member independently of the actuating member.

26. In an automatic circuit breaker, the combination of a main frame having two side plates spaced apart, an operating member movably connected with the side plates of the frame, an actuating member rectilinearly movable between the frame side plates and guided thereby, means operatively connecting the operating member with the actuating member, a contact member rectilinearly movable between the frame side plates and guided thereby independently of the actuating member, the said contact member carrying a movable contact, a stationary contact positioned to be engaged and disengaged by the movable contact, means biasing the contact member toward its contact-disengaging open-circuit position independently of the actuating member, and a mechanical connection between the actuating and contact members normally enabling the former to effect movement of the latter to open and close the circuit, the said mechanical connection comprising two interconnected pivoted arms having pivotal connection with one of the last said members and extending in opposite directions to positions at the outer sides of the respective side plates and the said mechanical connection also comprising two bi-metallic latches carried by the other of the last said members and deflectible out of their normal relationship thereto when heated, the said latches being positioned at the outer sides of the said side plates and normally engaging the respective arms so as to jointly maintain the mechanical connection between the two members and each of the said latches upon being heated and deflected serving independently of any heating and deflection of the other latch to disengage its corresponding arm so as to thus break the said mechanical connection and permit circuit-opening movement of the contact member independently of the actuating member.

27. In an automatic circuit breaker, the combination of a main frame having two side plates spaced apart, an operating member movably connected with the side plates of the frame, an actuating member rectilinearly movable between the frame side plates and guided thereby, means operatively connecting the operating member with the actuating member, a contact member rectilinearly movable between the frame side plates and guided thereby independently of the actuating member, the said contact member carrying a movable contact, a stationary contact positioned to be engaged and disengaged by the movable contact, means biasing the contact member toward its contact-disengaging open-circuit position independently of the actuating member, a mechanical connection between the actuating and contact members normally enabling the former to effect movement of the latter to open and close the circuit, the said mechanical connection comprising two interconnected pivoted arms having pivotal connection with one of the last said members and extending in opposite directions to positions at the outer sides of the respective side plates and the said mechanical connection also comprising two bi-metallic latches carried by the other of the last said members and deflectible out of their normal relationship thereto when heated, the said latches being positioned at the outer sides of the said side plates and normally engaging the respective arms so as to jointly maintain the mechanical connection between the two members and each of the said latches upon being heated and deflected serving independently of any heating and deflection of the other latch to disengage its corresponding arm so as to thus break the said mechanical connection and permit circuit-opening movement of the contact member independently of the actuating member, and two separate stationary heaters connected respectively in the said legs of the circuit and positioned adjacent the said bi-metallic strips and serving upon the attainment of excess current conditions in either leg of the circuit to cause the independent heating and deflection of the corresponding strip.

28. The combination in an automatic circuit breaker, of an insulating base, a main frame on the base, an operating member movably mounted on the main frame, an actuating member carried by the frame and guided thereby for movement in a fixed path, means operatively connecting the operating member with the actuating member, a contact member carried by the frame and guided thereby independently of the actuating member for movement in a fixed path, the said contact member carrying movable contacts and being normally movable with the actuating member, stationary contacts mounted on the base independently of the frame and positioned to be engaged and disengaged by the respective movable contacts, means on the frame biasing the contact member toward its contact-disengaging open-circuit position independently of the actuating member, two bi-metallic strips deflectible by heat and normally movable bodily with the said contact and actuating members, each of the said strips upon deflection serving separately from the other to mechanically disconnect the contact member from the actuating member and thus permit the said contact member to automatically move independently to its open-circuit position, and two separate stationary heaters mounted on the base independently of the frame and connected respectively in the said legs of the circuit, the said heaters being positioned adjacent the respective bi-metallic strips and serving upon the attainment of excess current conditions in either leg of the circuit to cause the independent heating and deflection of the corresponding strip.

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