Dec. 23, 1958 E. COLEMAN 2,866,036

ELECTRIC CIRCUIT BREAKERS

Filed Nov. 30, 1955 4 Sheets-Sheet 1

Fig. 1.

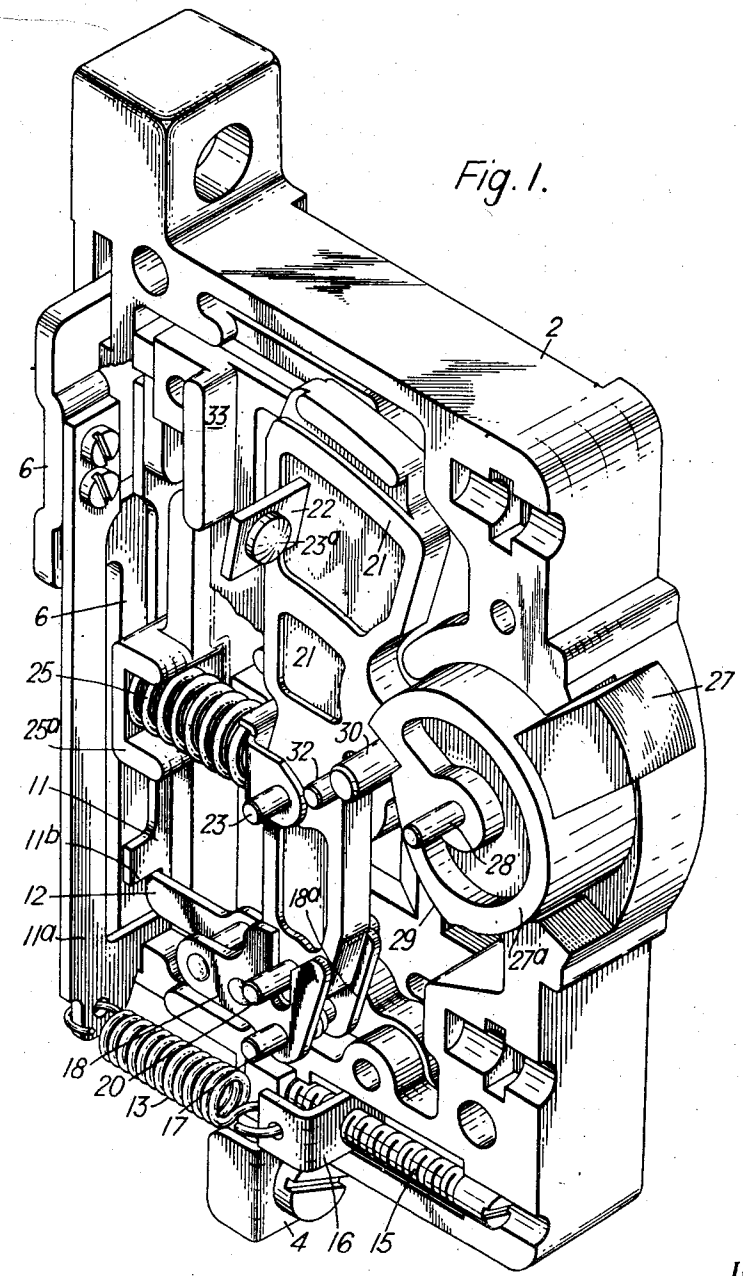

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Fig.2.

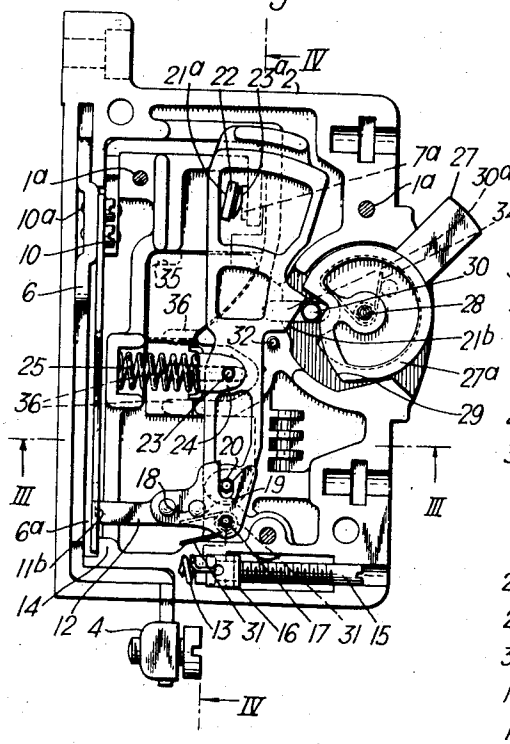
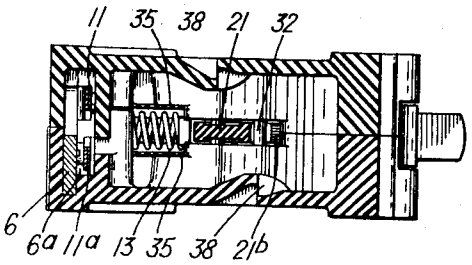


Fig.4.

Fig.3.



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ELECTRIC CIRCUIT BREAKERS

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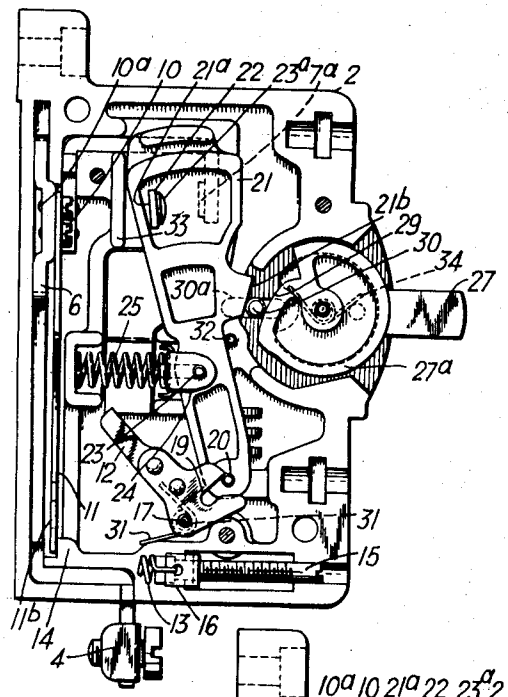

Fig. 5.

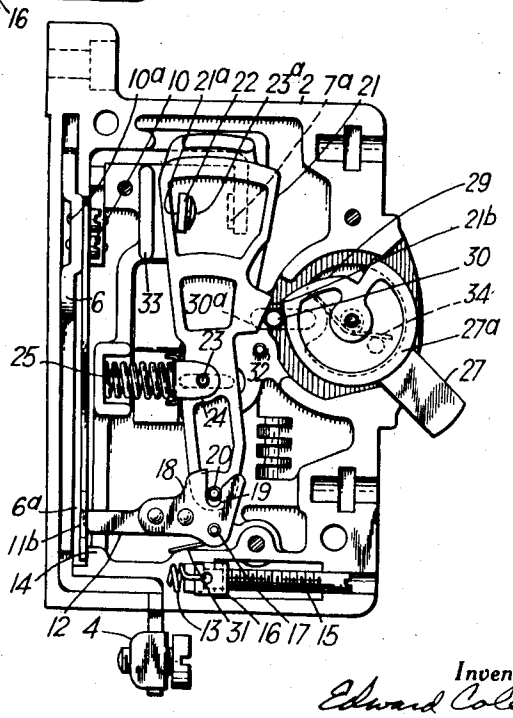

Fig. 6.

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Fig. 7.

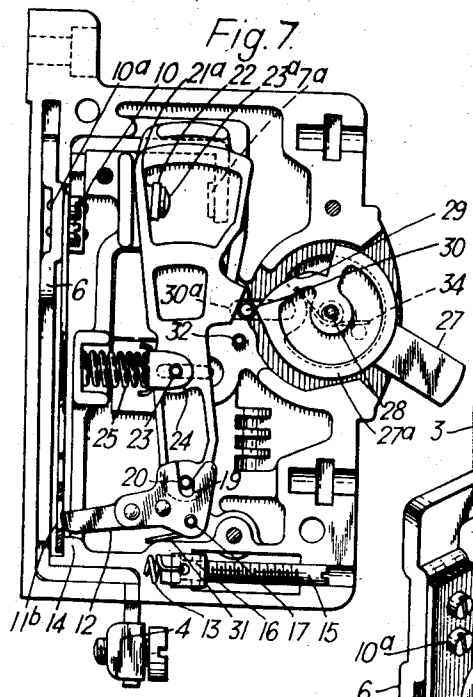
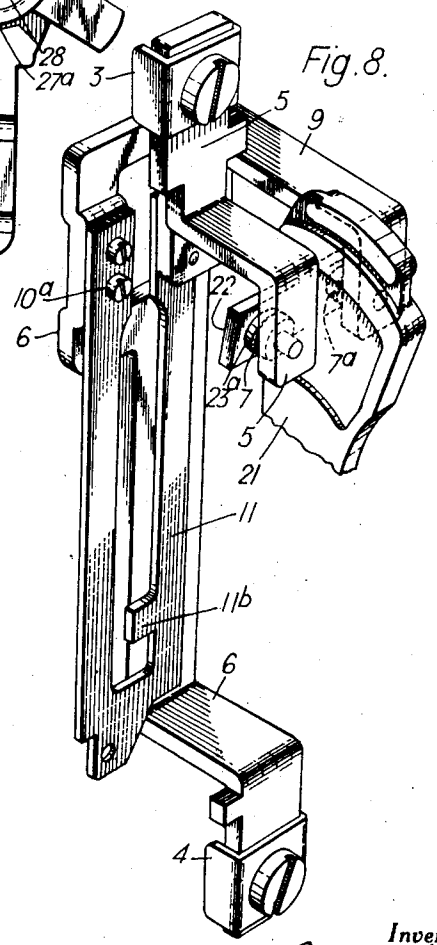


Fig. 8.



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2,866,036

ELECTRIC CIRCUIT BREAKERS

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Application November 30, 1955, Serial No. 550,132

Claims priority, application Great Britain December 15, 1954

17 Claims. (Cl. 200—116)

This invention relates to improvements in electric circuit breakers having an overload device. Such overload device may comprise a thermal bimetal plate which is flexed on overload to cause actuation of a trip mechanism and provide inverse time delay characteristics. This plate may be associated with a magnetic arrangement for actuating the mechanism instantly on short circuit conditions. Alternatively the overload device may be an armature which is flexed magnetically so as to be instantaneously attracted on overload, or short circuit, for actuating the trip mechanism. The principal object of the invention is to provide a small and compact construction in which the risk of flash-over between the contacts is eliminated or minimized, and in which a very rapid break is obtained on a predetermined overload or short circuit. A further object is to reduce friction and wear and thereby minimize the effort required for actuation of the trip mechanism by the overload device. A further object is to produce an efficient arrangement in which the latched engagement between a trip lever and such device is desirably small and constant for different current adjustments. Yet another object is to provide a simple means for indicating the condition of the circuit breaker and to enable the current required for tripping to be adjusted reliably and simply by said means which avoid the necessity for manipulation of the bimetal or of means which cause its position to be varied.

According to one feature of the invention an insulating plate carrying the moving contact has pivotal engagement with a trip lever and is adapted to isolate opposed chambers in which the fixed contacts are mounted, for the purpose of preventing flash-over between them.

A further feature of the invention is to provide a longitudinally divided or bifurcated flexing member having one leg disposed parallel to a current-carrying strip so that a magnetic field is induced for actuating the tripping mechanism. The flexing current-carrying member for actuating the trip mechanism may be connected in series with a metal strip spaced therefrom and adapted for carrying current in the same direction so that the flexing member is actuated instantaneously on overload when the member is an armature and also on short circuit when such member is a bimetal.

Another feature of the invention is to maintain the flexing member in engagement with an abutment in the casing by a spring, the tension or compression of which is adjustable so that the current required for tripping may be varied without any alteration in the degree of latched engagement of the member with a trip lever.

According to a further feature of the invention the insulating plate carrying the moving contacts is, on a predetermined overload, initially moved freely through a gap into abutment with a fulcrum before finally disengaging the moving contact from the fixed contacts. Such arrangement develops a kinetic energy or impetus which results in effectively overcoming inertia in the moving contact and in breaking down any incipient welding of the contacts.

The circuit breaker may be operated by a dolly having a cam surface operable on the insulating plate through a guidingly mounted pin or roller engageable with a slope or ramp on the plate. The casing may comprise moulded casing parts the opposed walls of which are formed with grooves and with recesses or chambers for the reception of the pivot pins, rollers, contacts and other components of the circuit breaker. Such parts may also be formed with ribs or baffles for providing tortuous paths for contributing to the dissipation of the energy of the arc in its passage from the contact chambers. The latter separated, by the said insulating plate, may have the arcs deflected laterally, by the provision of shaped insulating partitions, into expansion chambers, from which the gases are discharged through louvre outlets in the casing parts. Thus the heat energy of the arcs is effectively absorbed before discharge of the gases.

In order to enable the invention to be readily understood reference will now be made to the accompanying drawings illustrating by way of example a circuit breaker embodying a flexing member in the form of a bimetal plate, in which drawings:

Figure 1 is a perspective view to an enlarged scale, with one side of the moulded casing removed and showing the parts in the "on" position.

Figure 2 is a side elevation of Figure 1.

Figure 3 is a section on the line III—III of Figure 2.

Figure 4 is a section on the line IV—IV of Figure 2.

Figures 5, 6 and 7 are views similar to Figure 2, Figure 5 illustrating the parts in the tripped position, Figure 6 showing the parts in the "off" and reset positions, and Figure 7 showing the parts in the position between those illustrated in Figures 5 and 6.

Figure 8 is a perspective view to an enlarged scale of the bimetal and associated parts.

Referring to the drawings each member **1**, **2** of a two-part moulded casing has its opposed faces recessed or chambered, for the reception of the components of the circuit breaker. The members **1**, **2** are connected by rivets **1***a* and provided at top and bottom with terminals **3**, **4**. The upper terminal **3** is disposed on the exposed upper end of a metal strip **5** provided on its lower end with one of a pair of fixed contacts **7**, **7***a* disposed in the front of a rectangular chamber **8** of the casing. The other fixed contact **7***a* is mounted on one end of a rearwardly extending strip **9**, the other end of which is secured by screws **10** to the free end of one arm **11** of a bifurcated bimetal plate mounted in opposed grooves at the rear of the casing parts. The free end of the other arm **11***a* of the bimetal is secured by screws **10***a* to a strip **6** of extended length. The end of this strip is formed with a right-angled bend, the exposed lower arm of which has the terminal **4** mounted thereon. The length of the strip is so bent that the major portion is parallel to, and disposed just out of contact with, the rear of the first-mentioned arm **11** of the bimetal, so that a space **6***a* is provided between these parts. Such arrangement results in all of the current flowing through said arm and the strip in the same direction. The induced magnetic field causes flexing of the bimetal at its united end and rapidly actuates the tripping mechanism. The improved arrangement enables a highly efficient tripping on short circuit conditions to be achieved practically entirely due to magnetic attraction between the two series connected, current-carrying strips producing instantaneous flexing of the member **11**, without the aid of wound magnets.

The united end of the U-shaped bimetal is free to flex and one leg is formed with an inwardly projecting lug **11***b* engaged by the end of a pivotally mounted trip lever **12**. A helical tension spring **13** has one end engaged with the bimetal and serves for pressing the free end against an abutment **14** on the casing. The degree of pressure with which the bimetal is pressed against this abutment may

be varied by the adjustment of a screw **15**, the head of which is accessible for rotation from the front of the casing and the other end of which enters a tapped opening in an L-shaped bracket **16** secured to the other end of the screw. The arrangement enables the latch engagement between the trip lever **12** and the bimetal **11** to be desirably small and constant for all positions of screw adjustment. This adjustment affects the tension of the spring and consequently the pressure with which the bimetal is pressed against the abutment **14**, thereby resulting in more or less heating of the bimetal being required for producing tripping of the contacts. The requisite current for effecting tripping may be observed on a scale marking on the casing co-operating with the screw. Instead of a tension spring, a compression spring may be provided which is operative on the rear face of the bimetal.

The trip lever comprises two parallel plates **18**, **18***a*, one of which is formed with a rearwardly extending leg **12** engageable with the bimetal. The lever is pivoted between its ends, on a fixed transverse pin **17**, and the plates are formed with slots **19**, at right-angles to the length of the leg **12** for freely receiving a pin **20** carried on the lower end of a flat insulating plate **21**. This plate, disposed between the moulded casing parts **1**, **2**, has its upper end of enlarged area and formed with a small aperture **21***a* through which extends a closely fitting transverse contact strip **22** having contact buttons **23***a* at each end for engagement with the fixed contacts **7**, **7***a*. The provision of the moving contacts on each side of the insulating plate results in the isolation of the contact chambers from each other so that flash-over between the contacts therein is effectively prevented.

Midway between its ends, the flat plate **21** is pivotally connected by a pin **23** to a small U-shaped member **24** on the rear end of which bears a helical compression spring **25**, which is seated at its other end in a recess **25***a* in the casing. The ends of the pin **23** are located in guiding grooves **26**, in the opposed faces of the casing parts **1**, **2**. In the "on" position the spring acts for pressing the plate **21** forwardly about the pin **20** so that the moving contacts are engaged with the fixed contacts as seen in Figure 2.

The dolly **27**, made of insulating material, is disposed between the moulded casing parts **1**, **2** and has a handle portion projecting forwardly therefrom. A semi-circular body portion **27***a*, through the centre of which extends a pivot pin **28**, has its rear face formed as a cam **29** which is operative on a metal pin **30**, the ends of which are disposed in short horizontal guiding grooves **30***a* in the opposed inner faces of the casing parts **1**, **2**. This pin **30** is located between the cam of the dolly and an inclined ramp or slope **21***b* on the insulating plate **21**. Such arrangement provides a positive drive for the contacts so that interruption of the circuit is not dependent on the action of the spring.

In operation, manual switching from the "on" to the "off" position is effected by the dolly, the cam of which causes the roller **30** to act on the plate **21** for turning it about the pivot **20** against the action of the spring for causing disengagement of the contacts, as shown in Figure 6. Movement of the dolly to the "on" position permits the compressive effect of the spring **25** to return the parts to the "on" position shown in Figure 2, in which the roller **30** is disposed in a V-shaped formation or fulcrum on the cam. During the manual operation, the trip lever **12** is locked in engagement with the bimetal **11**. The movement of the pin **30** over the crest of the cam **29** defines the respective positions of the dolly.

In the event of overload conditions, rearward flexing of the lower end of the bimetal causes release of the trip lever. A spring **31** turns the lever about its pivot **17** to the position shown in Figure 5. As a result the pin **20** at the lower end of the plate **21** is moved forward by the spring **25**. The front edge of the plate is thereby caused to abut against a fixed pin **32** which then constitutes the fulcrum for the turning of the plate to bring it into the tripped position Figure 5, and the contacts are rapidly disengaged. An abutment **33** on the casing restricts the turning of the plate. During this movement a spring **34** turns the dolly into a mid-position, in which "On" and "Off" legends thereon are obstructed by the casing parts. In the positions shown in Figures 2 and 6 the appropriate legend is visible.

In order to reset the circuit breaker after a tripping operation, the dolly is depressed from the position shown in Figure 5 to that shown in Figure 6, Figure 7 illustrating an intermediate position. As will be seen the trip lever is thereby turned about the pin **17** to cause its re-engagement with the bimetal and restoration of the parts to the "off" position, after which the dolly can be manipulated to bring them to the "on" position.

A pair of shaped insulating shields **35** disposed on each side of the spring **25** serve for deflecting the arcs from the contacts **7** and **7***a* into separate channels, each of which is formed with projecting baffles or ribs **36** arranged for constraining the arc to follow a tortuous path. Beyond the baffles or ribs the gases are directed into expansion chambers **37**, from which they are expelled through louvre openings **38** in side walls of the casing.

The forms of the invention here described and illustrated are presented merely as examples of how the invention may be embodied and applied. Other forms, embodiments and applications of the invention, coming within the proper scope of the appended claims, will, of course, suggest themselves to those skilled in the art.

Having thus described our invention we claim:

1. An electric circuit breaker comprising a casing, a pair of fixed contacts disposed therein, a bimetal element connected to said fixed contacts, a handle mounted on such casing, a flat insulating plate disposed longitudinally of said casing and extending between said fixed contacts, a mounting disposed between the ends of said casing for pivotally supporting said plate, an aperture in one end of said plate, a closely fitting moving contact bridge member extending through said aperture and engageable at each end with said fixed contacts, a pivotally mounted trip lever adapted to be actuated by said element and pivotally engageable with the other end of said plate.

2. An electric circuit breaker comprising a casing, fixed contacts mounted in said casing, an insulating plate provided with moving contacts thereon for engagement with said fixed contacts, a terminal connected to one of said fixed contacts, a strip for mounting said other fixed contact, a bifurcated bimetal element, one arm of said element secured to said strip, a second extended strip secured to the free end of the other bimetal arm, said second strip having a bent portion disposed parallel to said first bimetal arm and provided with a second terminal disposed at its end.

3. An electric circuit breaker having a casing, an abutment on said casing, an overload device comprising a bimetal strip having a free end, an adjustable spring acting on said free end for normally maintaining said strip in engagement with said abutment, the tension of said spring adapted to vary the current controlling the flexing of said strip, a lever in latched engagement with said strip, and means for adjusting the tension of said spring to trip said lever without altering the amount of such latched engagement.

4. An electric circuit breaker comprising an overload device, a pair of terminals, a flexing bimetallic current-carrying member, a metal strip disposed in spaced relation to said member and arranged to carry current in the same direction therewith, said member and said strip connected in series carrying the entire current passing between said terminals, and a trip mechanism adapted to be actuated by said member.

5. An electric circuit breaker according to claim 1 having a fulcrum abuting said insulating plate when the latter is moved freely by a predetermined overload before

said plate finally disengages said moving contacts from said fixed contacts.

6. An electric circuit breaker according to claim 2 having a pivotally mounted trip lever adapted to be activated by the united end of said bimetal element.

7. An electric circuit breaker according to claim 2 wherein said rigid strips connect said external terminals with respective ends of said bimetal flexing element.

8. An electric circuit breaker according to claim 3 in which a helical tension spring connects said armature with a bracket, and a screw engageable with said bracket adjusts the tension of said spring.

9. An electric circuit breaker according to claim 1 wherein a bracket is connected to said insulating plate and pivotally mounted on a pin, guide grooves in said casing for mounting said pin and spring means normally urging said plate into contact position.

10. An electric circuit breaker comprising a casing, terminals at top and bottom of said casing, a bifurcated strip adapted to be flexed on overload, a rigid plate connecting said strip and one of said terminals and disposed parallel to and spaced from said strip so that current flows through said strip and plate in the same direction, a trip lever one end of which is engageable with the united flexing end of said strip, a spring pressed insulating plate pivotally engageable with the otner end of said lever, moving contacts on each side of said plate, fixed contacts mounted in said casing, a dolly pivotally mounted in said casing provided with a cam, and a roller disposed between said cam and the front edge of said insulating plate.

11. An electric circuit breaker comprising a casing, fixed contacts disposed therein, an insulating plate having a transversely extending bridge member provided with moving contacts at one end thereof, a trip lever engaging the other end of said plate, a pivot connecting said lever and said plate, a dolly for actuating said plate, said plate revolving about said pivot during manual operation of said dolly, a thermal bimetal strip connected to said fixed contacts engaging said lever and adapted to be flexed on overload to release said lever, a fulcrum disposed on said casing engageable by said plate in tripped position and a spring disposed between said casing and said plate turning said plate about said fulcrum to disengage said fixed and moving contacts.

12. An electric circuit breaker comprising a casing, an abutment on said casing, fixed contacts within said casing, a longitudinal insulating plate carrying moving contacts thereon, manual means for operating said plate, a thermal bimetal overload strip fixed to said casing at one end and one free end adapted to flex on overload, a spring operable upon said free end for engagement with said abutment, a trip lever engageable with said free end and adjustable means for varying the pressure said free end bears against said abutment.

13. An electric circuit breaker comprising a casing, fixed contacts, a flexing overload device connected to said fixed contacts, a trip lever actuated by said device, an insulating plate having pivotal engagement at one end with said lever, an arm extending transversely through the other end of said plate, contacts mounted on each end of said arm, a dolly formed with a cam, a roller interposed between said cam and the front edge of the plate, and a spring mounted in the casing and acting on the rear edge of said plate.

14. An electric circuit breaker according to claim 11 in which said lever is L-shaped, having one arm engageable with said bimetal strip and the other arm slotted for freely receiving said pivot.

15. An electric circuit breaker according to claim 11 in which said lever comprises a pair of spaced plates having aligned slots, one of said lever plates extending for latching engagement with said bimetal strip.

16. An electric circuit breaker according to claim 11 having a roller, short guiding grooves provided in said casing for mounting the ends of said roller, a ramp provided on said insulating plate engaging said roller and a cam on said dolly operative on said roller.

17. An electric circuit breaker according to claim 11 wherein said casing is provided with contact chambers, separate lateral channels, an expansion chamber, openings in the side walls of said casing and a pair of insulating shields, whereby arcs from said contact chambers are deflected by said shields into said channels to said expansion chamber and expelled through said openings.

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