June 21, 1955 G. MANG 2,711,455

CIRCUIT BREAKERS

Filed Dec. 4, 1951 4 Sheets-Sheet 1

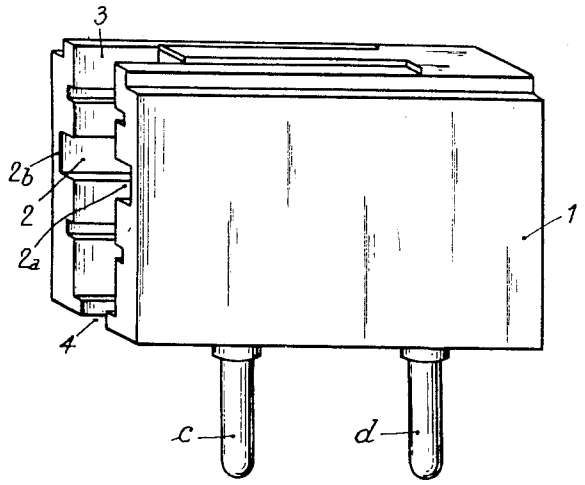


Fig. 1

Fig. 2

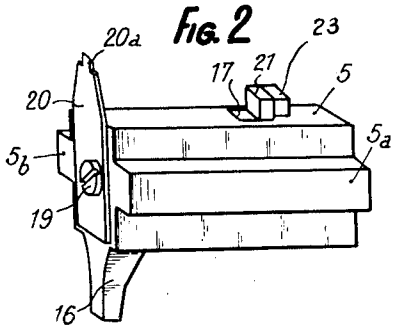
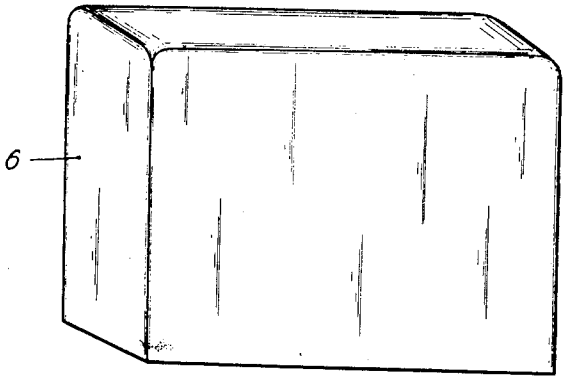


Fig. 3



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FIG. 5

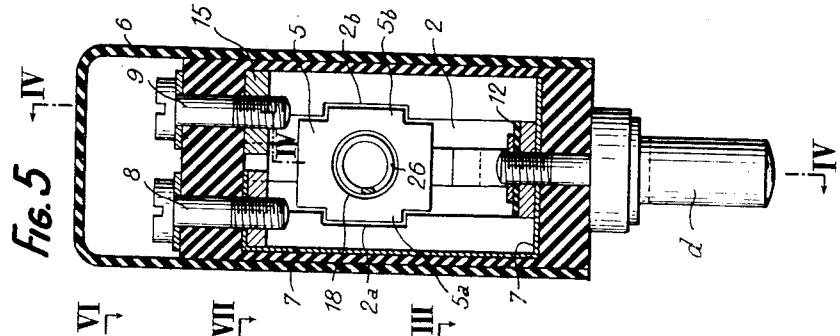
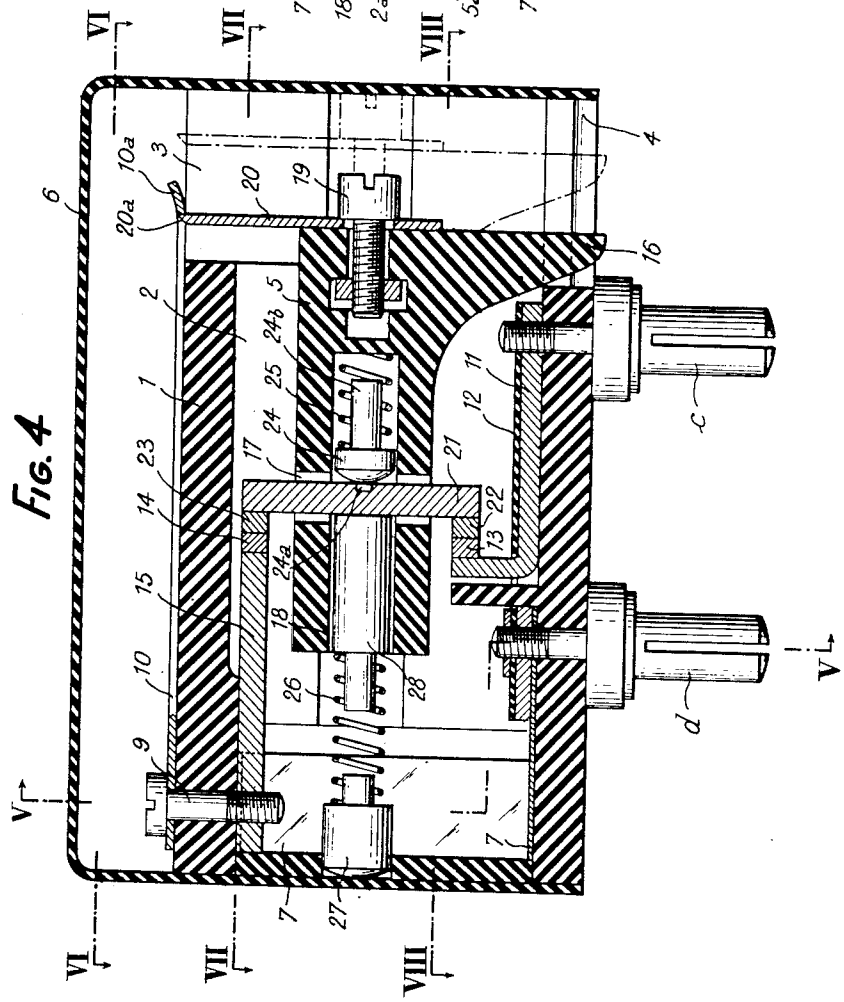


FIG. 4



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FIG. 6

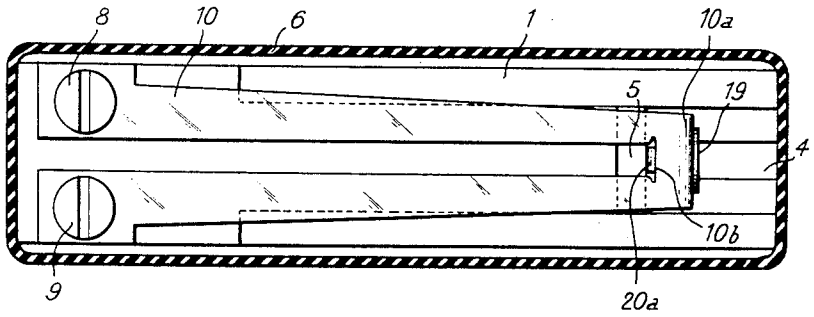


FIG. 7

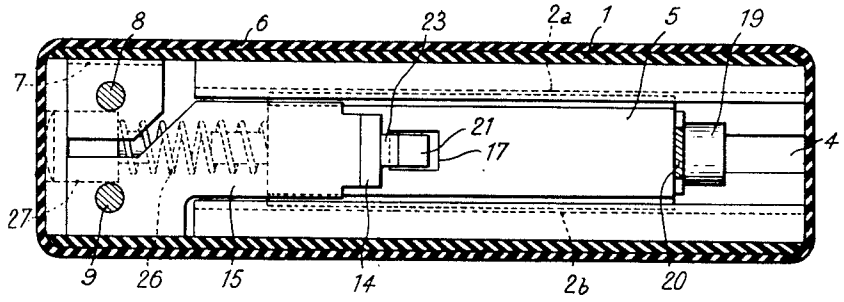
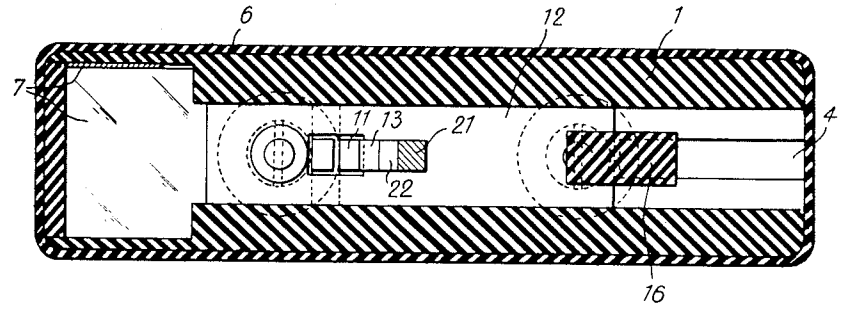


FIG. 8



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FIG. 9

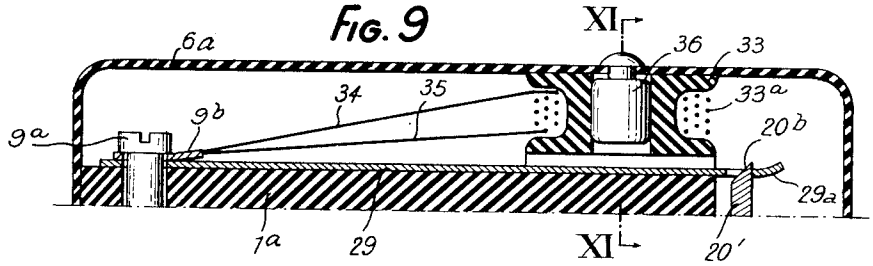


FIG. 10

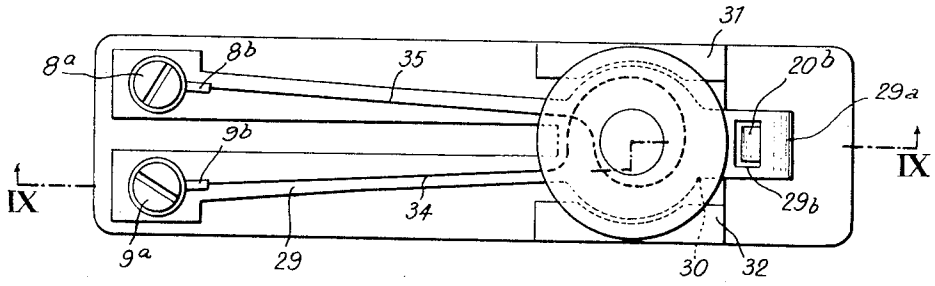


FIG. 11

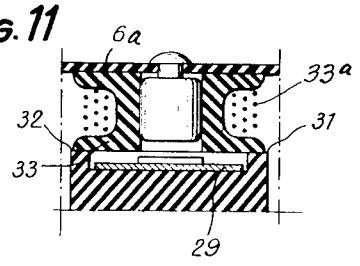
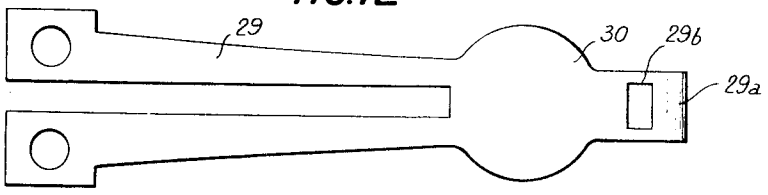


FIG. 12



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2,711,455

CIRCUIT BREAKERS

Gerard Mang, Paris, France

Application December 4, 1951, Serial No. 259,815
In France April 5, 1945

Section 1, Public Law 690, August 8, 1946
Patent expires April 5, 1965

9 Claims. (Cl. 200—116)

The present invention relates to a circuit breaker, and more particularly to a circuit breaker intended to take the part of a fuse in an electric circuit.

The present application is a continuation-in-part of my copending applications Serial No. 794,603, filed December 30, 1947, for "Automatic Circuit Breakers" and Serial No. 794,604, filed December 30, 1947, for "Automatic Circuit Breaker," now abandoned.

It is an object of the present invention to provide a circuit breaker which operates mechanically and can advantageously replace the fuses of the electric circuit into which the circuit breaker is inserted.

It is another object of the present invention to design the circuit breaker in such a manner that it interrupts the current in case of a momentary overload and allows a simple returning to normal conditions without having to replace any part thereof or to use a tool.

It is a further object of the present invention to reduce considerably the number of parts of the circuit breaker so that its cost of manufacture is relatively low and not much higher than the cost price of a fuse.

It is still another object of the present invention to increase the sensitivity of the circuit breaker so that it can be used for an electric circuit in which only weak currents flow.

It is a still further object of the present invention to render the circuit breaker capable of a very rapid interruption of the electric circuit at large overloads.

It is still another object of the present invention to provide compensating means for the wear of the contacts which as a rule takes place when the circuit breaker has to interrupt heavy excess currents.

A circuit interrupter according to the present invention comprises in its broadest aspect a body consisting of insulating material and having a boring extending through the entire length thereof, a part consisting of insulating material and being slidably arranged in the boring so as to have a first position and a second position relatively to the body, means for urging the part into the second position thereof, an electric circuit, means connected, respectively to the body and the part for closing and interrupting the electric circuit in the first and second positions of the part, a bimetallic strip inserted in the electric circuit and being arranged on an outer face of the body so as to be supported thereby, the bimetallic strip being substantially V-shaped and having two leg portions arranged in contact with the outer face of the body, and an intermediate portion connecting the leg portions and being arranged so as to project beyond the outer face of the body, the intermediate portion having a very short length compared with the lengths of the leg portions, and a member rigidly connected to the slidable part and engaging in the first position thereof an edge of the intermediate portion of the bimetallic strip, whereby the part is held in the first position thereof as long as the bimetallic strip remains substantially undeflected, whereas at an electrical overload the intermediate portion of the bimetallic strip disengages the member, and the part is suddenly transferred to the second position thereof by the urging means, thereby interrupting the electric circuit.

Preferably a handle is rigidly connected to the slidable part and adapted for manual operation in order to return the slidable part from the second position to the first position thereof.

In a preferred embodiment of the present invention stationary contacts are arranged in the body and form part of the electric circuit and a metal bar traversing the opening in the slidable part has movable contacts cooperating, respectively, with the stationary contacts, resilient means being provided for holding the metal bar with play in the opening of the slidable part, the slidable part holding in the first position thereof the metal bar and the movable contacts in circuit-closing position, whereas in the second position of the slidable part the metal bar and the movable contacts are moved away from the stationary contacts so as to interrupt the electrical circuit.

Preferably the member rigidly connected to the slidable part has a chamfered extension engaging in the first position of the slidable part an edge of the intermediate portion of the bimetallic strip.

Preferably the cross-section of the boring of the body is designed as a cross having two lateral recesses and the slidable part has a cross-section fitting into the cross-section of the boring of the body and has two lateral projections slidably arranged in the lateral recesses, respectively, of the cross-section of the boring of the body.

In a preferred embodiment of the present invention a cap encloses the body and the slidable part.

In one embodiment of the present invention an electromagnetic coil is rigidly connected to the cap so as to cooperate with the intermediate portion of the bimetallic strip, the intermediate portion forming the armature of the coil, means being provided for connecting the coil in parallel with the bimetallic strip.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings, in which:

Fig. 1 is a perspective view of the main part or body of the circuit breaker;

Fig. 2 is a perspective view of a part sliding in the body shown in Fig. 1;

Fig. 3 is a perspective view of a cap enclosing the main part or body shown in Fig. 1 and the sliding part shown in Fig. 3 when the parts are assembled;

Fig. 4 is a sectional side elevation on an enlarged scale of the first embodiment of the present invention shown in Figs. 1 to 3;

Fig. 5 is a vertical section taken along the line V—V of Fig. 4;

Fig. 6 is a horizontal section taken along the line VI—VI of Fig. 4;

Figs. 7 and 8 are horizontal sections taken, respectively, along the line VII—VII and VIII—VIII of Fig. 4;

Fig. 9 is part of a sectional elevation of a second embodiment of the present invention taken along the line IX—IX of Fig. 10;

Fig. 10 is a plan view of the second embodiment of the elevation, the casing being omitted;

Fig. 11 is a section taken along line XI—XI of Fig. 9; and

Fig. 12 is a plan view of the bimetallic strip forming part of the second embodiment of the invention.

Referring first to the drawings and first to Figs. 1 to 8, showing the first embodiment of the present invention,

the device comprises essentially on the one hand a main part or body 1 shown in Fig. 1 and consisting of insulating material such as porcelain or the like, in form or a rectangular parallel-epipedon the base of which carries two pins *c* and *d* which serve as current terminals and are screwed into the base. Furthermore, a part or member 5 (Fig. 2) is arranged for sliding in the body 1 and consists also of insulating material. Finally, a box-like cap shown in Fig. 3 is designed to enclose the body 1 and the part 5 after assembly. The cap 6 can consist either entirely of insulating material as shown in the drawings or partly of metal in order to facilitate the dissipation of heat to the outside in which case the internal wall of the cap 6 is made insulating near the bottom part thereof.

The body 1 has an internal longitudinal boring 2 which determines with the two lateral grooves or recesses 2*a* and 2*b* thereof a hollow space having the cross-sectional shape of a cross and extending over the whole length of the body 1. On one of its extremities are provided two apertures 3 and 4 which communicate, respectively, with the upper face and the lower face of the body 1. The aperture 3 prolongs substantially the vertical branch of the cross forming the boring whereas the aperture 4 has a smaller width.

The pin *d* is connected directly by a connection 7 as shown in Fig. 5 with one terminal 8 of a substantially V-shaped bimetallic strip 10 which is secured as clearly shown in Figs. 4 and 6 to the upper face of the body 1, the intermediate portion 10*a* of the strip opposite to the terminals 8, 9 thereof being turned upwards so as to form a gradient. The V-shaped bimetallic strip has two legs having a length considerably larger than the length of the intermediate portion 10*a*. The legs of the V-shaped strip 10 are supported by the outer face of the body 1 whereas the intermediate portion 10*a* projects beyond the outer face of the body 1. The metallic strip 10 can only bend so that the intermediate portion 10*a* thereof is lifted, any bending in the opposite direction being prevented by the supporting outer face of the body 1.

The second pin *c* is connected as shown in Fig. 4 by a connection 11 placed underneath an insulating plate 12 to an inner stationary contact 13 to which in the upper part of the device a stationary contact 14 corresponds which is located above the stationary contact 13 and connected by a connection 15 with the second terminal 9 of the bimetallic strip.

Inside the boring 2 of the body 1 which has a cross-shaped cross-section the part 5 is slidably arranged by means of two lateral projections 5*a* and 5*b* sliding, respectively, in the lateral grooves or recesses 2*a* and 2*b* of the body 1. The sliding part 5 has a projection 16 forming a handle and extending through the lower aperture 4. Furthermore, the slidable part 5 is provided with a longitudinal cylindrical boring 18 as shown in Fig. 4 and a transversal opening 17, whereas the back extremity thereof is provided with a plate 20 held in position by a screw 19 and having an upper end forming a chamfered edge 20*a*. The transversal aperture 17 of the sliding part 5 is traversed by a connecting metal bar 21 carrying two contacts 22 and 23 which in the position shown in Fig. 4 serve for making contact, respectively, with the stationary contacts 13 and 14, and thus, for connecting the pin *c* with the terminal 9 of the bimetallic strip 10.

The connecting bar 21 is kept in position by a button 24 having an extension 24*b* and acted upon by a helical spring 25 surrounding the extension 24*b*. The button 24 comprises at its end a part 24*a* engaging a corresponding recess in the bar 21 near its middle part.

It should be noted that the assembly consisting of the connecting bar 21, the button 24, and the spring 25 allows the bar 21 to operate as a balance beam and to abut against the stationary contacts 13 and 14 independently of their alignment relative to the vertical, and whatever the wear of the contacts is under the destructive action caused by the operation of the apparatus.

A spring 26 is disposed coaxially to the axis of sliding part 5 and abuts against the wall of the cap 6 through an intermediate member 27. The spring 26 urges the sliding part 5 back in the longitudinal direction thereof by making a pushing member 28 to abut against the bar 21.

The operation of this device is as follows:

In the closing position of the circuit represented in full lines in Fig. 4, the sliding part 5 being urged by the spring 26 is kept in position in consequence of the abutment of the extremity of the plate 20 against the edge portion 10*b* of the intermediate portion 10*a* of the bimetallic strip 10 (see Fig. 6).

If under the effect of an overload the bimetallic strip 10 is heated and bent upwards from the position shown in Fig. 4, it disengages the plate 20 of the sliding part 5. Thus the latter is no longer kept in the position shown in Fig. 4, and is suddenly urged towards the right into the position indicated by dotted lines, thereby interrupting the circuit between the stationary contacts 13 and 14 and the movable contacts 22, 23, respectively. As soon as the temperature of the bimetallic strip 10 has decreased sufficiently for assuming the initial shape thereof, the plate 20 can again be brought to engagement with the intermediate portion 10*a* of the bimetallic strip 10 by acting with a finger on the handle 16 of the sliding part 5 so that the circuit is once more closed. This step is facilitated by the gradient of the part 10*a* and the chamfered edge 20*a* of the plate 20, which lifts the same, the closing of the device being possible only when the body 1 has been lifted from the base thereof.

Referring now to Figs. 9 to 12, showing the second embodiment of the present invention, a bimetallic strip shown generally as element 29 having one layer consisting of magnetizable material such as iron is secured to the body 1*a* so that the layer consisting of magnetizable material is spaced from the body 1*a* by the other layer of bimetallic strip 29, which may be made of copper. The legs of the bimetallic strip are secured to the body 1*a* by means of terminals 8*a* and 9*a* through terminal lugs 8*b* and 9*b*, respectively. The intermediate portion of the bimetallic strip 29 includes a substantially circular portion 30 above which an electromagnetic coil 33*a* is wound around an insulating member 33. The distance of the coil 33*a* from the body 1*a* is limited by two abutments 31 and 32 connected to the body 1*a*. The lead wires 34 and 35 of the electromagnetic coil 33*a* are electrically connected, respectively, to the lug terminals 9*b* and 8*b*, through which, terminals 8*a* and 8*b* connect to the bimetallic strip 29 so that the latter is connected in parallel with the coil 33*a*. The circular portion 30 of the bimetallic strip forms the armature of coil 33*a*.

The cap 6*a* is provided with a part 36 consisting of magnetic metal and forming the central core of the electromagnetic coil 33*a*. The central core 36 centers the insulating member 33 and decreases the reluctance to passage of magnetic flux established by a magnetomotive force resulting from current flow through coil winding 33*a*.

The operation of the second embodiment is substantially the same as that of the first embodiment, the bimetallic strip 29 having a sloping end 29*a* coming into contact with the chamfered edge 20*b* of the plate 20'. In case of sudden heavy overloadings, such as those caused by a short-circuit the magnetic effect of the coil 33*a* aids the thermal effect of the bimetallic strip 29 in order to increase the rapidity with which the apparatus interrupts the electric circuit.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of circuit interrupters differing from the types described above.

While the invention has been illustrated and described as embodied in a circuit interrupter intended to take the part of a fuse in an electric circuit, it is not intended to be limited to the details shown, since various modi-

fications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be secured by Letters Patent is:

1. A circuit breaker comprising, in combination, an elongated body of insulating material having a boring extending lengthwise thereof, two terminals on said body for connection to a load circuit to be controlled, a bimetallic strip being substantially V-shaped and having two leg portions arranged in contact with the outer face of said body and an intermediate portion connecting said leg portions and being arranged so as to project beyond the outer face of said body, said intermediate portion having a very short length compared with the lengths of said leg portions, a slidable part adapted to reciprocate in said boring of said body, connecting and contact means adapted to connect said terminals and said bimetallic strip in series relation, said contact means including stationary contacts carried in said body and movable contacts carried by said slidable part and adapted to cooperate with said stationary contacts, resilient means inserted between said body and said slidable part for urging said movable contacts away from said stationary contacts, retaining means constituted by a retaining member rigidly connected to said slidable part and adapted to be engaged by said intermediate portion of said bimetallic strip in a retaining position of said strip to retain said contact means in closed position under normal condition current flowing through said bimetallic strip, said retaining means being also adapted to be released by said intermediate portion of said bimetallic strip upon said strip coming into a releasing position to release said contact means under overload current flowing in said bimetallic strip whereby said contact means are returned to their open position under the bias of said resilient means, and resetting means for manually resetting said contact means in closed position against the bias of said resilient means.

2. The circuit breaker of claim 1, wherein said resetting means are constituted by a handle rigidly connected to said slidable part and adapted for manual operation in order to return said slidable part into the position thereof which corresponds to said retaining member being in said retaining position and said contact means reset in closed position.

3. The circuit breaker of claim 1, wherein said movable contacts are fixedly secured to opposite end portions of a metal bar traversing with play a transverse opening in said slidable part, bias means being provided in said slidable part for urging said metal bar in a direction to apply said movable contacts respectively in bearing engagement against said stationary contacts in closed position of the circuit breaker.

4. The circuit breaker of claim 1, wherein said retaining member adapted to be engaged by said intermediate portion of said bimetallic strip is formed with a bevelled edge adapted to engage said intermediate portion of said bimetallic strip, the inclination of said bevelled edge being turned in the direction which aids in hooking said member against said strip.

5. The circuit breaker of claim 1, wherein said boring of said body has a cross-section designed as a cross having two lateral recesses and said slidable part has a cross-section into the cross-section of said boring of said body and has two lateral projections slidably arranged in said lateral recesses respectively of said cross-section of said boring of said body.

6. The circuit breaker of claim 1, with a cap enclosing said body and said slidable part and adapted to prevent said slidable part from sliding out of said boring of said body.

7. The circuit breaker of claim 1, with a magnetizable portion on said intermediate portion of said bimetallic strip, an electromagnetic coil rigidly positioned over said magnetizable portion of said strip, and means for connecting said coil in parallel with said bimetallic strip whereby said coil attracts said magnetizable portion of said strip and trips said breaker in case of instantaneous overload current.

8. The circuit breaker of claim 1 with a cap enclosing said body and said slidable part and adapted to prevent said slidable part from sliding out of said boring of said body, a magnetizable portion on said intermediate portion of said bimetallic strip, an electromagnetic coil carried by said cap and positioned over said magnetizable portion of said strip, and means for connecting said coil in parallel with said bimetallic strip, whereby said coil attracts said magnetizable portion of said strip and trips said circuit breaker in case of instantaneous overload current.

9. The circuit breaker of claim 1, wherein said retaining member is adjustably connected to said slidable part in a direction oriented toward said intermediate portion of said bimetallic strip for allowing the rating of the circuit breaker to be adjusted as desired.

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