

May 1, 1951

F. J. M. THEUNISSEN

2,551,303

AUTOMATIC CIRCUIT BREAKER

Filed Dec. 3, 1945

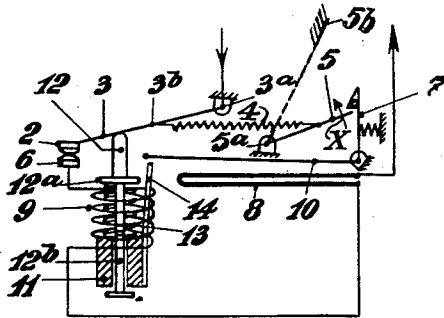


Fig. 1.

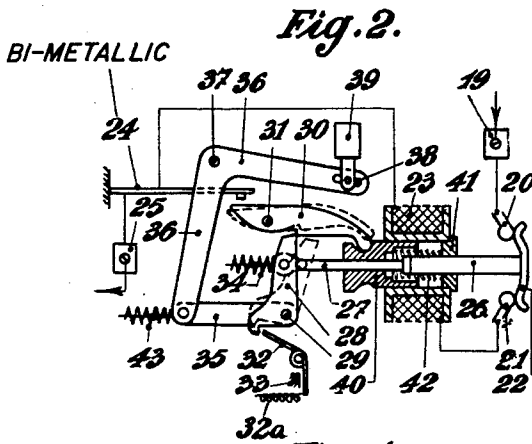


Fig. 2.

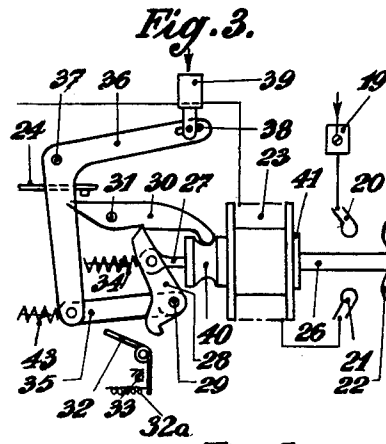


Fig. 3.

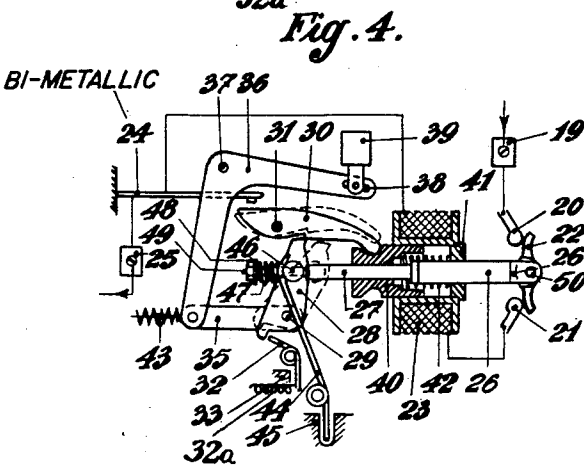


Fig. 4.

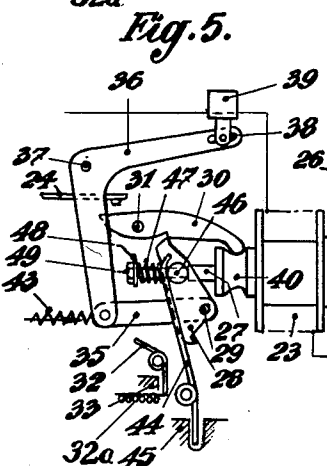


Fig. 5.

Inventor

FRANCOIS JEAN MARIE THEUNISSEN

By

Haselline, Lake & Co.
Attorneys

UNITED STATES PATENT OFFICE

2,551,303

AUTOMATIC CIRCUIT BREAKER

François Jean Marie Theunissen,
Brussels, BelgiumApplication December 3, 1945, Serial No. 632,442
In Belgium October 17, 1944Section 1, Public Law 690, August 8, 1946
Patent expires October 17, 1964

6 Claims. (Cl. 200-103)

1

My invention relates to circuit-breakers.

My copending patent application No. 632,441 filed December 3, 1945, concerns an automatic circuit breaker provided with an electro-magnet through which the current passes, and the movable armature of which actuates means for liberating (by pawl, toggle, etc.) the movable contact, when an overload current sufficient to attract the said armature passes through the apparatus, said circuit breaker being essentially characterised by the fact that the said movable armature acts directly on the movable contact, independently of the liberating means actuated by said armature. By the direct action on the movable contact, must be understood both action on the contact and on its support, so long as the impulse of the armature is transmitted to the movable contact, without involving the liberating means.

The present improvements relate to modifications and improvements in the said circuit breaker, in particular for the purpose of further accelerating the opening of the circuit in case of a very heavy overload or of a short-circuit.

One of said improvements consists in that the electro-magnet is provided with an auxiliary armature which acts positively on the movable contact, independently of the main armature and as soon as the movable contact has been released by the liberating means by the action of the electro-magnet.

The auxiliary armature is advantageously formed by a part of the member serving to transmit the impulse of the main armature to the movable contact, which member can act on the support of the movable contact or can itself form the support of the movable contact. The main armature can, in particular, be slidably mounted about the said member which is provided with a stop on which the main armature is adapted to act after having released the liberating means.

The provision of this auxiliary armature has enabled the speed of opening of the circuit to be further increased, since said auxiliary armature is directly affected by the magnetic flux which should cause the release, and since it is therefore ready to act immediately on the movable contact, as soon as the latter is released, so that the auxiliary armature imparts without any delay a considerable acceleration to the movable contact. If said movable contact had any tendency to adhere to the fixed contact, it would be sharply pulled away from same by the subsequent direct action of the main armature on the movable contact or its support.

2

Other particularities and advantages of the invention will become apparent from the description of a few examples of constructions, which is given hereinafter with reference to the accompanying diagrammatical drawing, in which:

Figures 1, 2 and 4 show three variants of construction of a circuit breaker according to the invention, in the position in which the current flows, and

Figures 3 and 5 show partial views of the circuit breakers according to Figures 2 and 4, immediately after tripping.

In the case of Figure 1, the movable contact 2 is carried by a beam 3 pivoting about a fixed point 3a and subjected, at 3b to the action of a spring 4 which is attached to a second beam 5 pivoting about the fixed point 5a. The arrangement is such that, in the engaged position illustrated in the drawing, the line of action of the spring 4 passes between the points 3a and 5a and presses the contact 2 against the fixed contact 6. The beam 5 is held in this position by a pawl 7, which can be actuated through the intermediary of an arm 10, against the action of a spring 7a. The current flows through the beam 3, the contacts 2, 6, the tripping coil 9 and a time relay formed by a bimetallic strip 8. When a moderate overload occurs, said strip acts on the arm 10 which releases the pawl 7 and enables the beam 5 to move in the direction of the arrow X by the action of the spring 4 until it contacts a suitable stop 5b and the line of action of said spring passes over to the other side of the point 3a. From this moment, the spring 4 acts to move the beam 3 and the contact 2 quickly, so as to open the circuit.

The coil 9 has a main movable armature formed by a core 11 adapted to slide about a push rod which bears on the beam 3 and the part 12 of which is in contact with said beam and is made of non-magnetic material, whereas its part 12b is constructed of magnetic material, for example of mild steel, and forms an auxiliary armature of the magnetic relay. When a heavy overload occurs, for example a short-circuit, the armature 11 moves against the action of its weak retracting spring 13 until a rod 14, which is secured to said armature 11, abuts against the arm 10 and releases the pawl 7, releasing the contact 2 through the liberating means hereinbefore described. The auxiliary armature 12b being directly affected by the magnetic flux which should cause the tripping, transmits its impulse through the rod 12 to the beam 3 and imparts a considerable acceleration to the movable contact 2, as

soon as the latter is released by the liberating means, thereby producing an extremely quick opening of the circuit. The main armature 11 continues its travel and acts on the rod 12 through the intermediary of the shoulder 12a, so as to add its impulse to that of the auxiliary armature 12b, thereby ensuring in particular the opening of the circuit if the movable contact 2 had a tendency to adhere to the movable contact 6.

In Figure 1, upward movement of the armature reacts through spring 13 on rod 12 and tends to displace it. At first, however, stem 12 is held by lever 3 urged by spring 4, which is sufficient to enable the armature to travel the short distance required for actuating lever 10 and releasing contact 2.

In the case of Figures 2 and 3, the current arrives by the terminal 19, passes through the fixed contacts 20, 21 which are short-circuited by the movable contact bridge 22, passes through the coil 23 and the bimetallic strip 24, and passes out through the terminal 25. The bridge 22 is supported by a movable rod, the part 26 of which is made of insulating material and is of larger diameter than the part 27 which forms the auxiliary armature of the magnetic relay. The free end of the part 27 is pivoted on a two-armed pawl 28 which pivots at 29. Said pawl engages the nose of one of its arms in a pawl 30 pivoted on the fixed pivot 31, whereas the nose of the other end is held by a flap 32 which is held by a light spring 32a against the stop 33. A spring 34 tends to push back the rod 27 and the contact 22 in the open circuit direction. The pawl 28 is pivoted at 29 to a connecting link 35 which is pivoted at its other end on a bell-crank lever 36 which can swing about the fixed point 37 and the other end of which is provided with an elongated slot 38 in which is engaged a setting knob 39.

This knob is depressed in order to bring the circuit breaker back to the positions shown in Figures 2 and 4 after disappearance of the current defects which had brought it to the positions shown in Figures 3 and 5.

In order to produce the release of the movable contact, it is necessary to lift the pawl 30 so as to disengage the upper nose of the pawl 28, either by the action of the bimetallic strip 24, or by the effect of the movement of the main armature 40 which is attracted towards the core 41 of the coil 23 compressing the retracting spring 42, and lifting the pawl 30 by means of a boss which is provided on said armature to act on the end of the pawl resting against the armature 40. The movable contact is thus released, since the rod 27—26 can be moved towards the right, assisted by the spring 34, disengaging the pawl 28 from the flap 32. The auxiliary armature 27 being also attracted towards the core 41, it transmits its impulse to the movable contact as soon as same has been released by the main armature 40. Towards the end of its travel, said armature 40 encounters the shoulder of the rod 26 and then acts effectively in the case in which the movable contact might have a tendency to adhere to the fixed contacts. The connecting link 35 and the lever 36 have been displaced by the spring 43, so that the mechanism is in the position shown in Figure 3.

Figures 4 and 5 show a modification of this construction. The spring 34 is replaced by a spring 44 which bears on an abutment 45, and also on the pin 46 forming the articulation between the pawl 28 and the rod 27. The rod 27

slides in an opening of the pin 46. Suitable means is provided for insuring a pressure between the contacts. In one arrangement this is done by a spring 47 bearing on the pin 46, and also on a washer 48 which is held by a nut 49 on the rod 27.

According to the invention, the movable contact is advantageously constructed in the form of a bridge 22 which is pivoted with limited play on the head 26a of the rod 26, and with a stiff fit on its pivot 50. Owing to this articulation, the pressure is balanced on the two fixed contacts, when the circuit is closed, and owing to the stiff fit on the pivot 50, the movable contact retains, when the circuit is opened, the position in which the separation of the contacts takes place simultaneously at the contacts 20 and 21, which has the effect of producing even wear of the contacts and of contributing to the speed of the break, in view of the fact that, from the start of the movement, the length of the arc is double the displacement of the contact 22.

It is obvious that various modifications can be made in the construction of the apparatus without departing from the spirit of the invention. Thus, for example, the spring 42 (Figures 2 to 5), instead of bearing on the core 41, could bear on a shoulder of the rod 26, so that all the energy of the main armature 40 would be accumulated, from the beginning of its movement, for the purpose of its subsequent action on the movable contact.

What I claim is:

1. An automatic circuit breaker comprising a fixed contact, a movable contact, means normally resiliently urging the movable contact against the fixed contact, releasable spring-actuated means tending to open the movable contact, locking means for restraining the spring actuated means, an electromagnet through which the circuit current flows, an unlocking member operatively connected to said locking means, actuating means responsive to said electro-magnet for actuating said unlocking member and freeing the spring actuated means in response to a heavy overload current flowing through said electromagnet, a principal movable armature for cooperating with said electro-magnet under the action of said overload current, a member directly operatively connected to the movable contact and provided with means arranged in the path of movement described by the principal armature whereby the member is operated by said armature after the unlocking of the movable contact, and an auxiliary movable armature cooperating with the electro-magnet and operatively connected to the said member for separately and directly acting upon the movable contact as soon as the spring actuated means has been released.

2. An automatic circuit breaker comprising a fixed contact, a movable contact, means for normally holding closed the movable contact on the fixed contact, releasable means for displacing the movable contact in response to an overload in the circuit, an electromagnet through which a circuit current flows, said displacing means including an operating member connected to the movable contact, a main movable armature actuable by the electromagnet in response to a heavy overload and provided with means for acting upon said member during the movement of the member, and an auxiliary armature, actuable by the electromagnet in response to a heavy overload, separately and directly acting upon said

member as soon as the displacing means has been released.

3. An automatic circuit breaker according to claim 2, including connections whereby the releasable means for displacing the movable contact is operated by said main movable armature.

4. An automatic circuit breaker as claimed in claim 2 wherein said auxiliary movable armature is constituted by a part of said operating member.

5. An automatic circuit breaker as claimed in claim 2 including a second fixed contact, said movable contact being arranged to bridge said fixed contacts, one of said fixed contacts being electrically connected to said electromagnet and the other to the circuit line, said movable contact including a bridging member lightly, frictionally held against rotation on said operating member.

6. An automatic circuit breaker comprising a fixed contact, a movable contact, means for normally holding closed the movable contact on the fixed contact, releasable means for displacing the movable contact in response to an overload in the circuit, an electromagnet through which the current flows, said displacing means including an operating member itself comprising a rod connected to and adapted to actuate said movable contact, an abutment on said rod, a main movable armature actuatable by the electromagnet in re-

sponse to a heavy overload being slidably mounted on said rod and arranged to act on said abutment when attracted by said electromagnet after the release operation of said displacing means, and an auxiliary armature constituting a part of said rod and actuatable by the electromagnet in response to a heavy overload, separately and directly acting upon said member as soon as the displacing means has been released.

FRANÇOIS JEAN MARIE THEUNISSEN.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
585,030	Harrington	June 22, 1897
1,330,094	Simon	Feb. 10, 1920
1,433,952	Kendall	Oct. 31, 1922
2,072,163	Frank et al.	Mar. 2, 1937
2,336,871	Lake	Dec. 14, 1943

FOREIGN PATENTS

Number	Country	Date
297,184	Germany	Mar. 27, 1917
342,143	Germany	Oct. 13, 1921
866,592	France	May 26, 1941