June 4, 1940. W. H. FRANK 2,203,462

CIRCUIT BREAKER

Filed Feb. 28, 1938 2 Sheets-Sheet 1

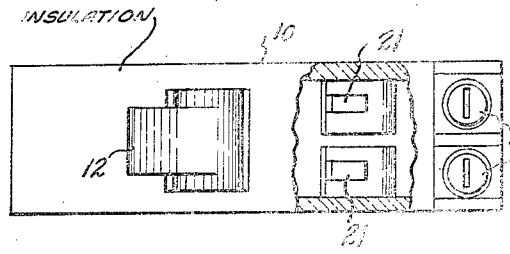


Fig. 4

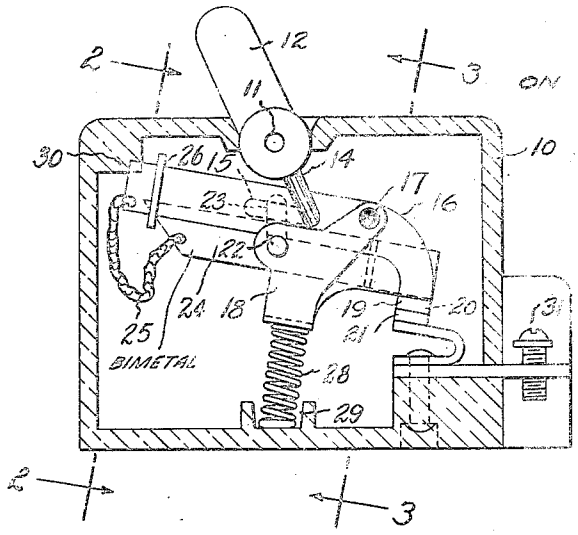


Fig. 1

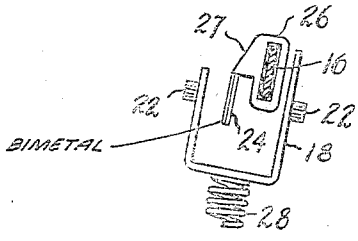


Fig. 2

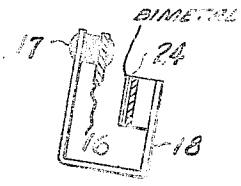


Fig. 3

INVENTOR.
William H. Frank

BY Daniel G. Cullen
ATTORNEY.

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CIRCUIT BREAKER

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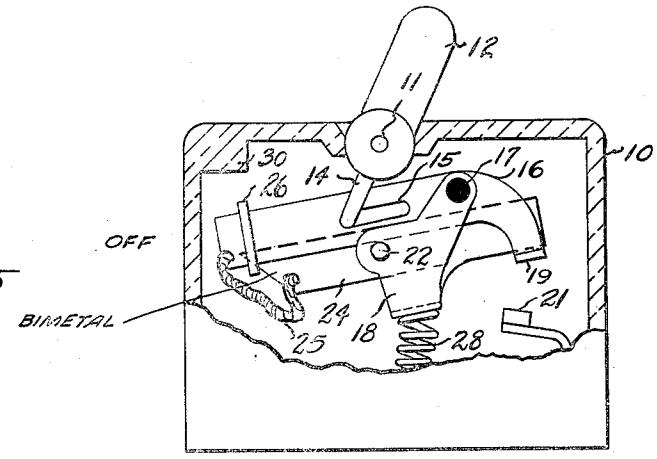


Fig. 5

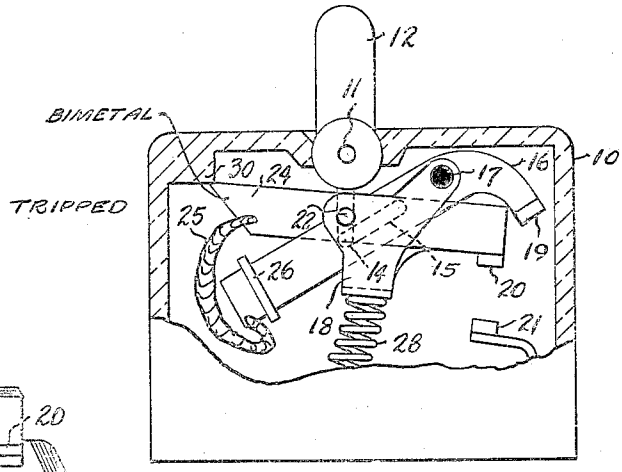


Fig. 6

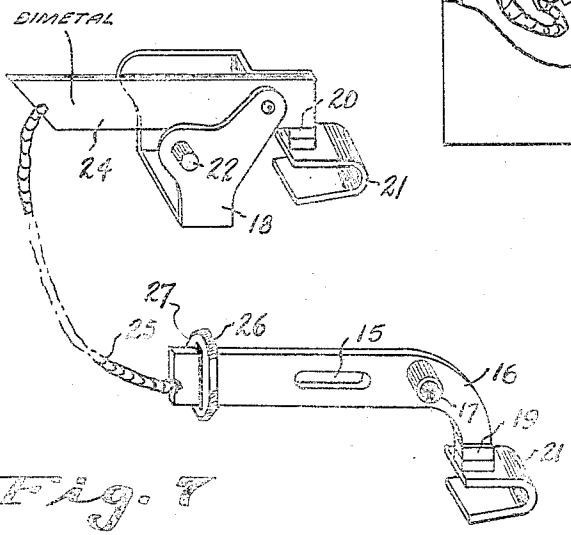


Fig. 7

INVENTOR.
William H. Frank

BY

Daniel G. Sullivan
ATTORNEY.

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UNITED STATES PATENT OFFICE

2,203,462

CIRCUIT BREAKER

William H. Frank, Detroit, Mich.

Application February 28, 1938, Serial No. 192,997

13 Claims. (Cl. 200—88)

This application relates to circuit breakers and the invention hereof aims particularly to provide circuit breakers having novel features. One feature is the provision of double break contact sets for suitably rupturing high capacities and at high voltages. Another feature is an arrangement whereby magnetic forces in the breaker tend to expedite release on overload. A third feature is an arrangement employing two relatively adjustable movable contacts for engaging two fixed contacts.

For an understanding of the breakers herein disclosed, reference should be had to the appended drawings. In these drawings:

Fig. 1 shows a breaker in "on" position;

Figs. 2 and 3 are sections on lines 2—2 and 3—3 of Fig. 1;

Fig. 4 is a cut away plan view;

Figs. 5 and 6 show the breaker in "off" and "tripped" positions respectively;

Fig. 7 is an exploded view of breaker parts.

The breaker of Figs. 1–7 includes a casing 10 in whose upper wall is journalled, on a pin 11, a breaker handle 12 whose lower end is in the form of a finger 14 disposed within a slot 15 of actuator bar and contact arm 16 pivotally connected by an insulated pin 17 to a cradle 18.

Cradle 18, equipped with parts about to be described (contact 20 and latch 24), forms a contact arm. The actuator bar and contact arm 16 and the contact arm formed by cradle 18 have movable contacts 19 and 20 adapted to make with the relatively insulated and separate U-shaped stationary contacts 21. Suitable barriers may be provided to isolate parts of one polarity from those of another; for example, one contact 21 from another.

The cradle has axle pins 22 whose ends are received within slots 23 in the side walls of the breaker casing and securely mounts a bimetal latch 24, with one end of the latch being fixed to the cradle and the other end being free but being connected by a flexible connection 25 to a free end of the actuator bar and contact arm 16 on which free end is insulatedly mounted an abutment ring 26 having a sloping edge 27.

Bearing against the cradle is a coiled compression spring 28 seated in a seat 29 of the breaker casing.

The upper wall of the casing is provided with a stop 30 for purposes to be described.

Binding posts 31 for the circuit conductors are connected to the stationary contacts 21 and the circuit is established between these contacts and their mating movable contacts 19 and 20 through the actuator bar and contact arm 16, the connection 25 and the bimetal latch 24.

The operation of the breaker is as follows:

When the breaker is in closed circuit position (on) the parts remain stationary due to the cooperation described in the following: Spring 28 tends to rotate the unit 16—18—24 clockwise on the lower end of finger 14 as a pivot, but such tendency is stopped by the engagement of contacts 19—20—21; at the same time the spring tends to rotate the handle 12 counterclockwise on its pivot 11 but such tendency is stopped by the engagement of the handle with the left edge of the slot of the casing, Fig. 1, where the handle projects through such slot.

When the circuit is to be opened manually, the parts are caused to be moved as follows: Handle 12 is moved clockwise to the "off" position and the lower end of its finger 14 crosses the line of action of spring 28, whereupon the spring rotates the unit 16—18—24 counterclockwise around the pivot 22 to open the circuit, movement terminating because of the engagement of the handle at the right end of the casing slot and the engagement of the finger 14 in the left end of the slot 15 of the contact arm 16.

In the event of an overload, sufficient to cause warping of latch 24 away from ring edge 27 of contact arm 16, the parts move as follows:

The latch 24 warps to the left, Fig. 2, to destroy the latched connection between contact arm 16 and cradle 18. Spring 28 exerts an upward force on cradle 18 and moves it upwardly to the position of Fig. 6, movement of the cradle being guided by the riding of pin 22 in the casing slot 23. Cradle 18 moves until its left end engages stop 30 at the upper part of the casing, as shown in Fig. 6. Simultaneously, spring 28, acting through the pivot 17, which connects cradle 18 and contact arm 16, causes the right end, Fig. 1, of contact arm 16 to swing upwardly and open the circuit, the arm 16 rotating counterclockwise about the end of handle 14 as a pivot. This movement continues until the left end of contact arm 16 engages the bight of cradle 18 and both the cradle 18 and the contact arm 16 come to rest in the position of Fig. 6.

This movement will all take place, to open the circuit, at both contacts 19 and 20, even if the handle 12 were forcibly held in the "on" position of Fig. 1 and thus the breaker may be described as being trip free, that is to say, it will cause the circuit to open on overload even if the handle were held. However, if the handle were not held at this time, or if it were held and subse-

quently released, the handle would be caused to move from the position of Fig. 1 to that of Fig. 6 in the following manner:

Movement of the cradle 18 and the contact arm 16 on overload to the position of Fig. 6 will cause the slot 15 to rotate from the position of Fig. 1 to that of Fig. 6. The upward force of the spring 28 at that time, acting on the cradle 18 and the arm 16 which are at that time locked in the positions shown in Fig. 6, will exert a component force, due to the angle of the slot 15 as shown in Fig. 6 on the extension or finger 14 of handle 12, in a direction and in an amount sufficient to cause rotation of the handle to the position of Fig. 6, clockwise about its pivot 11, with its movement arrested in the position of Fig. 6 because of the engagement of the end of extension 14 of the handle with the left end of slot 15. In this way, the handle position will indicate that the circuit breaker has been tripped due to an overload.

For resetting the parts after they have been released by the occurrence of an overload the following action takes place: Movement of the handle to the "off" position from Fig. 6 causes its finger 14 to move contact arm 16 clockwise about pivot 22 and due to the connection at 17 to simultaneously lower the cradle 18 with its latch 24; the parts 18 and 16 move at different speeds until ring edge 27 slides up and over latch 24 to lock parts 16 and 24 together, whereupon they move simultaneously. The handle movement is stopped by the engagement of the handle with the right end of the casing slot, in the "off" position of Fig. 5.

Adjustment of the contacts for simultaneous break is effected by bending the stationary contacts 21, as desired, for adjustment.

Further it will be seen that in the breaker hereof current flows in the arm 16 in a direction opposite to that which flows in latch 24; thus, parts 16, 25, and 24 cooperate to form a U shaped loop having a magnetic effect such that when current flow is excessive, as on overload, there arises a strong tendency for the parts 16 and 24 to repel each other; this tendency aids the warping effect of the latch 24 and expedites release for overload.

Summary

Parts 18 and 24 can be considered as a contact arm which is pivotally supported in the breaker casing on pivots 22 and in turn pivotally supports, on pivot 17, the other contact arm 16. The two contact arms are relatively latched to move in unison; when their latch connection is released, they move separately, although their contact ends move simultaneously for a moment after latch release, enough to break the circuit, due to the fact that their pivotal connection at 17 is out of line with the pivotal support at 22.

Now having described the breaker hereof, reference will be had to the claims which follow for a determination of the protection sought herein.

I claim:

1. A circuit breaker comprising two adjacent pivotally connected contact arms, one of which is formed as a circuit condition responsive trip control latching element having an inherent characteristic to move in response to circuit conditions, the parts being so constructed and positioned that the latching element is interlocked to the other contact arm when the latching element is under normal circuit influence and releases itself from such other contact arm when the latching element is under abnormal circuit influence, so as not to be interlocked to such other arm, a spring arranged to act on the unit formed of said arms when these are interlocked relatively, and a handle arranged for acting on the unit formed of said arms, when these are interlocked relatively, the arms being arranged to be interlocked and thus move as a unit during normal circuit conditions and to be free of one another and thus move separately and relatively during abnormal circuit conditions, the arms having contacts at one set of adjacent ends.

2. A circuit breaker comprising two adjacent pivotally connected contact arms, one of which is formed as a circuit condition responsive trip control latching element having an inherent characteristic to move in response to circuit conditions, the parts being so constructed and positioned that the latching element is interlocked to the other contact arm when the latching element is under normal circuit influence and releases itself from such other contact arm when the latching element is under abnormal circuit influence, so as not to be interlocked to such other arm, a spring arranged to act on the unit formed of said arms when these are interlocked relatively, and a handle arranged for acting on the unit formed of said arms, when these are interlocked relatively, the arms being arranged to be interlocked and thus move as a unit during normal circuit conditions and to be free of one another and thus move separately and relatively during abnormal circuit conditions, the arms having contacts at one set of adjacent ends and being electrically connected at the other set of adjacent ends, and being elongated and disposed alongside each other, current flowing through the arms from contact to contact and through their electrical interconnection in opposite directions.

3. In a circuit breaker, adjacent contact arms, contacts at one set of adjacent ends and means interconnecting the arms at the other set of adjacent ends, one of the arms being formed as a latch for the two arms relatively, current flowing from contact to contact, through the arms and their interconnection means, with the flow of current in the two arms being in opposite directions whereby the arms and their interconnection form a magnetic loop which on current flow has a tendency to separate the arms and release their latched connection.

4. In a circuit breaker, adjacent contact arms, contacts at one set of adjacent ends and means interconnecting the arms at the other set of adjacent ends, one of the arms being formed as a latch for the two arms relatively, current flowing from contact to contact, through the arms and their interconnection means, with the flow of current in the two arms being in opposite directions whereby the arms and their interconnection form a magnetic loop which on current flow has a tendency to separate the arms and release their latched connection, one of the arms being pivotally supported by the other, which latter is in turn pivotally supported in the breaker casing.

5. In a circuit breaker, adjacent contact arms, contacts at one set of adjacent ends and means interconnecting the arms at the other set of adjacent ends, one of the arms being formed as a latch for the two arms relatively, current flowing from contact to contact, through the arms and their interconnection means, with the flow of

current in the two arms being in opposite directions whereby the arms and their interconnection form a magnetic loop which on current flow has a tendency to separate the arms and release their latched connection, one of the arms being pivotally supported by the other, which latter is in turn pivotally supported in the breaker casing, and a spring and handle for moving the arms in unison when they are latched relatively and out of unison when they are not latched relatively.

6. In a circuit breaker, two stationary contacts, two pivotally connected contact bars, a circuit responsive latch latching the bars, said latch when unreleased preventing relative movement of the bars and when released permitting them to move relatively, the latch being supported on and by one of the bars, and a spring engaging a bar, and, when the parts are in one position, and the bars latched, biasing the bars against the stationary contacts, and being operative to bias the bars to move relatively and away from the stationary contacts in the event of latch release.

7. In a circuit breaker, two stationary contacts, two pivotally connected contact bars, a circuit responsive latch latching the bars, said latch when unreleased preventing relative movement of the bars and when released permitting them to move relatively, the latch being supported on and by one of the bars, and a spring engaging a bar, and, when the parts are in one position, and the bars latched, biasing the bars against the stationary contacts, and being operative to bias the bars to move relatively and away from the stationary contacts in the event of latch release, whereafter the latch relatches the bars relatively.

8. A circuit breaker comprising a contact arm, a circuit condition responsive trip control element or latch having an inherent characteristic to move in response to circuit conditions, a movably mounted actuating bar pivotally connected to said contact arm and positioned to be interlocked to the arm by the element when the latter is under normal circuit influence, or to be released thereby when the latter is under abnormal circuit influence, so as not to be interlocked to the arm, a spring acting directly on said arm and thus acting on the unit formed of said arm and actuating bar when these are interlocked relatively, the actuating bar being adapted to be moved manually for acting on the unit formed of said arm and actuating bar when these are interlocked relatively, the arm and actuating bar being arranged to be interlocked and thus move as a unit during normal circuit conditions and to be free of one another and thus move separately and relatively during abnormal circuit conditions, the actuating bar and the contact arm having contacts on their adjacent ends.

9. A circuit breaker comprising a contact arm, a circuit condition responsive trip control element or latch having an inherent characteristic to move in response to circuit conditions, a movably mounted actuating bar pivotally connected to said contact arm and positioned to be interlocked to the arm by the element when the latter is under normal circuit influence, or to be released thereby when the latter is under abnormal circuit influence, so as not to be interlocked to the arm, a spring acting directly on said arm and thus acting on the unit formed of said arm and actuating bar when these are interlocked relatively, the actuating bar being adapted to be moved manually for acting on the unit formed of said arm and actuating bar when these are interlocked relatively, the arm and actuating bar being arranged to be interlocked and thus move as a unit during normal circuit conditions and to be free of one another and thus move separately and relatively during abnormal circuit conditions, the actuating bar and the contact arm having contacts on their adjacent ends and being electrically interconnected at their other adjacent ends.

10. In a circuit breaker, an actuator bar, a stationary contact, a contact bar pivotally connected to the actuator bar near one end of the contact bar, a circuit responsive latch latching the contact bar and the actuator bar at the other end of the contact bar, said latch when unreleased causing the contact bar and actuator bar to move together without relative movement and when released permitting the contact bar and actuator bar to move relatively, the latch being supported on and by the contact bar, and a spring engaging the contact bar between the points where the contact bar is connected to the actuator bar, and, when the parts are in one position, biasing the contact bar against the stationary contact and towards latch held position with respect to the actuator bar, and being operative to bias the contact bar to move relative to the stationary contact and the actuator bar in the event of latch release, the actuator bar having a contact on the end thereof pivotally connected to the adjacent end of the contact bar, and having its other end, which is latched to the other end of the contact bar, electrically connected to such other end of the contact bar.

11. In a circuit breaker, an actuator bar, a stationary contact, a contact bar pivotally connected to the actuator bar near one end of the contact bar, a circuit responsive latch latching the contact bar and the actuator bar at the other end of the contact bar, said latch when unreleased causing the contact bar and actuator bar to move together without relative movement and when released permitting the contact bar and actuator bar to move relatively, the latch being supported on and by the contact bar, and a spring engaging the contact bar between the points where the contact bar is connected to the actuator bar, and, when the parts are in one position, biasing the contact bar against the stationary contact and towards latch held position with respect to the actuator bar, and being operative to bias the contact bar to move relative to the stationary contact and the actuator bar in the event of latch release, movement of the actuator bar manually when it is latched to the contact bar causing movement of the spring to produce a snap action movement of the contact bar into its final resting places in circuit open and circuit closed positions, the actuator bar having a contact on the end thereof pivotally connected to the adjacent end of the contact bar, and having its other end, which is latched to the other end of the contact bar, electrically connected to such other end of the contact bar.

12. In a circuit breaker, an actuator bar, a stationary contact, a contact bar pivotally connected to the actuator bar near one end of the contact bar, a circuit responsive latch latching the contact bar and the actuator bar at the other end of the contact bar, said latch when unreleased causing the contact bar and actuator bar to move together without relative movement and when released permitting the contact bar and actuator bar to move relatively, the latch being supported on and by the contact bar, and a spring

engaging the contact bar between the points where the contact bar is connected to the actuator bar, and, when the parts are in one position, biasing the contact bar against the stationary contact and towards latch held position with respect to the actuator bar, and being operative to bias the contact bar to move relative to the stationary contact and the actuator bar in the event of latch release, the spring, on latch release, first causing movement of the contact bar away from the stationary contact and relative to the actuator bar, and thereafter causing movement of the actuating bar out of its then position unless the actuating bar be held, in which event, the spring will cause such movement of the actuating bar as soon as the actuating bar is released, the actuator bar having a contact on the end thereof pivotally connected to the adjacent end of the contact bar, and having its other end, which is latched to the other end of the contact arm, electrically connected to such other end of the contact bar.

13. In a circuit breaker, an actuator bar, a stationary contact, a contact bar pivotally connected to the actuator bar near one end of the contact bar, a circuit responsive latch latching the contact bar and the actuator bar at the other end of the contact bar, said latch when unreleased causing the contact bar and actuator bar to move together without relative movement and when released permitting the contact bar and actuator bar to move relatively, the latch being supported on and by the contact bar, and a spring engaging the contact bar between the points where the contact bar is connected to the actuator bar, and, when the parts are in one position, biasing the contact bar against the stationary contact and towards latch held position with respect to the actuator bar, and being operative to bias the contact bar to move relative to the stationary contact and the actuator bar in the event of latch release, manual movement of the actuator bar thereafter causing the latch to relatch the contact bar and actuator bar relatively, the actuator bar having a contact on the end thereof pivotally connected to the adjacent end of the contact bar, and having its other end, which is latched to the other end of the contact bar, electrically conected to such other end of the contact bar.

WILLIAM H. FRANK.