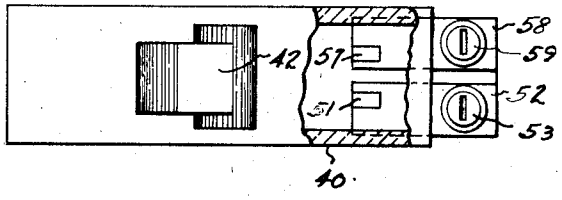
Aug. 26, 1941. W. H. FRANK 2,254,067

CIRCUIT BREAKER

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Fig. 3



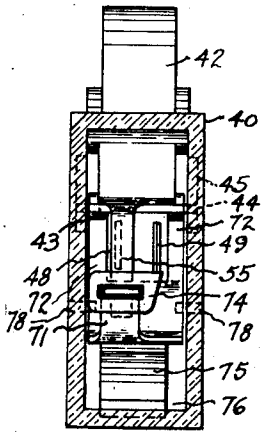


Fig. 2

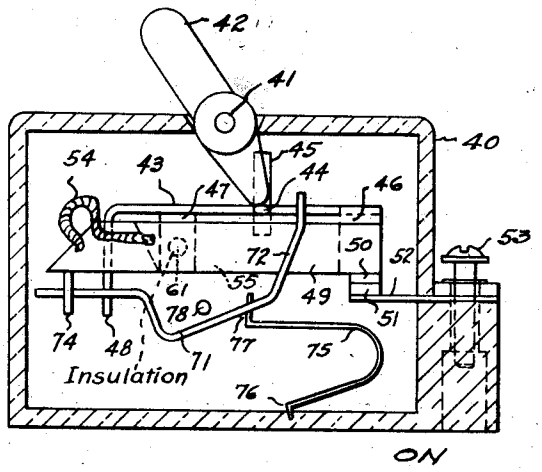


Fig. 1

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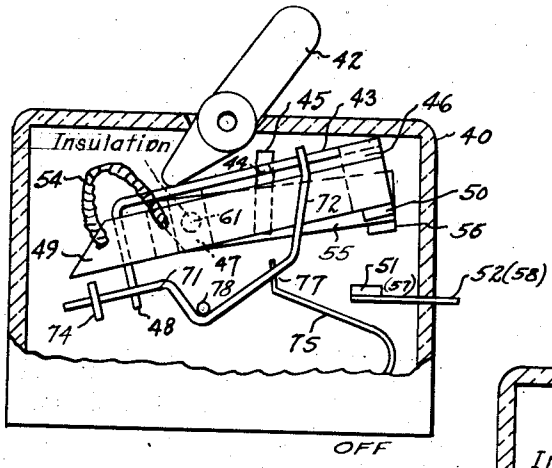


Fig. 4

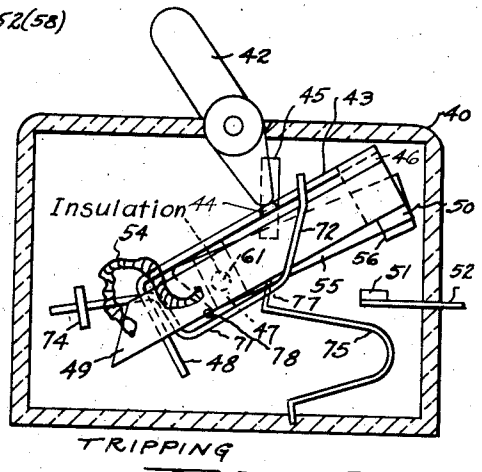


Fig. 5

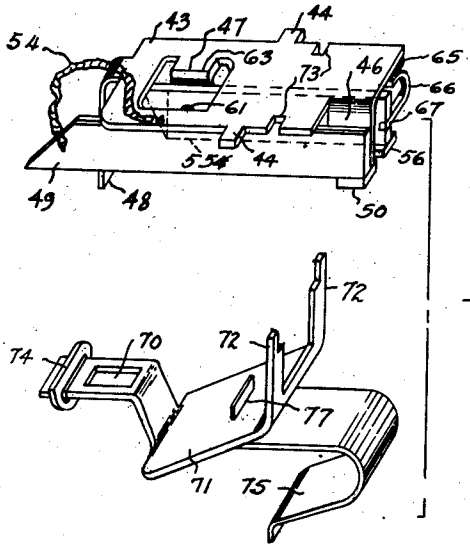


Fig. 6

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CIRCUIT BREAKER

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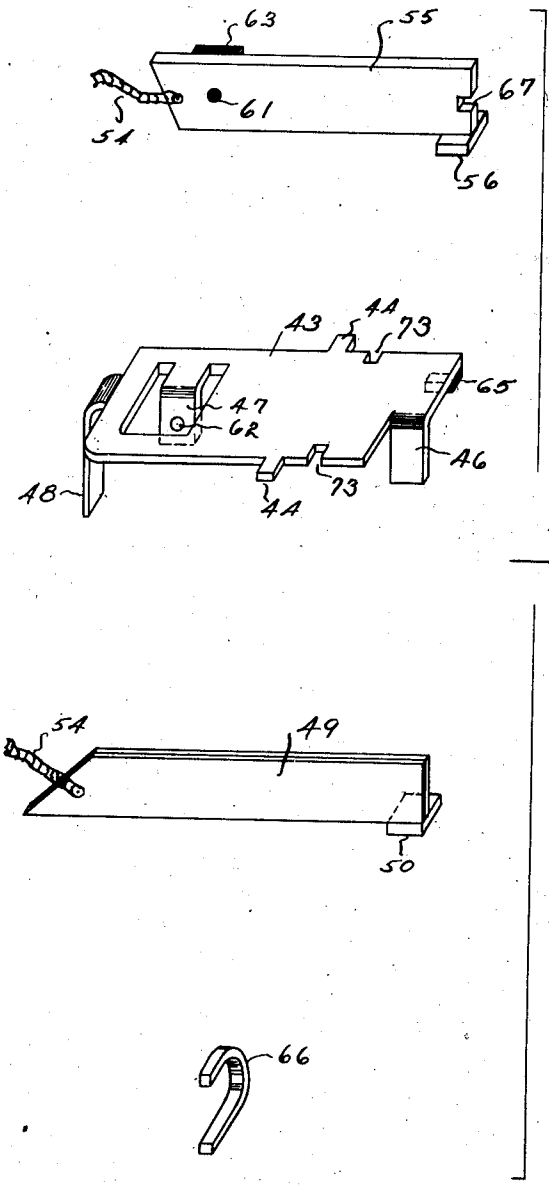


Fig. 7

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Patented Aug. 26, 1941 2,254,067

UNITED STATES PATENT OFFICE

2,254,067

CIRCUIT BREAKER

William H. Frank, Detroit, Mich., assignor to Bulldog Electric Products Company, Detroit, Mich., a corporation of West Virginia

Original application February 28, 1938, Serial No. 192,997. Divided and this application April 6, 1940, Serial No. 328,387

19 Claims. (Cl. 200—116)

This application relates to circuit breakers.

In a prior application, Serial No. 183,953, of January 8, 1938, now Patent No. 2,229,842 of January 28, 1941, there is disclosed a circuit breaker having two parallel adjacent bars 14—22. The former (14) carries a contact and also a thermal latch which releasably connects it to the other (22); it (14) is directly engaged by the handle, whereas the latter (22) is directly engaged by the operating spring. In that circuit breaker, the thermal latch and the arm or bar 14 which supports it are formed as a contact arm or bar by virtue of the provision thereon of a movable contact for engagement with a stationary contact, and the thermal latch itself is connected at an end by a flexible wire to a binding post or the like. That circuit breaker is therefore a single break circuit breaker.

In this application there is disclosed a circuit breaker representing an improvement over the circuit breaker of the prior application above mentioned, which improvement resides in the provision of a second contact arm or bar insulatedly mounted on the first named contact arm or bar and having a second movable contact thereon. The two contact arms have their movable contacts at adjacent ends thereof and the other ends of these contact arms are connected by a flexible wire running from the second named contact arm to the end of the thermal latch supported on the first named contact arm. The two contact arms therefore, with their flexible wire, form a U-shaped magnetic loop extending from one movable contact through the contact arm, the flexible wire, the other contact arm, and back to the second movable contact.

In the respect that the circuit breaker hereof includes two contacts for double break, the circuit breaker hereof resembles the circuit breaker of an application, Serial No. 192,997 filed February 28, 1938, now Patent No. 2,203,462 of June 4, 1940, of which the instant application is a division.

For an understanding of the circuit breaker hereof, reference should be had to the appended drawings. In these drawings:

Fig. 1 shows the circuit breaker hereof in "on" position;

Figs. 2 and 3 are end and plan views;

Figs. 4 and 5 show the breaker in "off" and "trip" positions, respectively;

Figs. 6 and 7 are exploded views of parts.

The breaker of this application includes a casing 40 in whose upper wall is journalled, on a pin 41, a breaker handle 42 beneath whose lower end is a metal plate 43. This is to be known as a contact arm, or contact bar, or contact operating arm, or main bar or arm, and corresponds to part 14 of application Serial No. 183,953. It is formed with edge lugs 44 formed to ride within slots 45 of the casing sides. Formed from the plate 43 are three downwardly projecting lugs or tongues 46, 47 and 48, respectively.

Although the casing is shown as of one integral piece, this is merely for convenience in illustration, for in actual practice the casing will be of two or more sections to permit assembly of the device.

Fixed to and in electrical contact with the lug 46 is a bimetal latch 49 on whose lower edge is fixed a movable contact 50 adapted to make with a stationary contact 51 connected by a strap 52 to a binding post 53. Connected to the free end of the bimetal element 49 is a flexible lead 54 which connects to the end of a second contact arm or bar 55 provided with a contact 56 adapted to make with a stationary contact 57 connected by a strap 58 to a binding post 59.

Contact arm or bar 55 is provided with a pin at 61 which is insulatedly mounted in a hole at 62 formed in the tongue 47 bent down from the contact arm or bar 43. An insulation washer 63 insulates the contact arm 55 from the lug 47.

Fixed to an end of the plate 43 is an insulation washer 65 against which bears one end of a U spring 66 which has its other end fixedly disposed within a notch 67 in the contact arm 55. Spring 66 thus can be seen to tend to separate the contact end of the contact arm 55 from the adjacent end of plate 43.

Tongue 48 is disposed within a hole 70 formed in a cradle or supplementary bar 71 having upwardly projecting fingers 72 disposed within edge slots 73 of the plate 43 which engagement at 72—73 forms a knife edge pivotal bearing for the cradle with respect to the plate.

Insulatedly supported on the end of the cradle opposite the pivotal fingers 72 is mounted a ring 74 whose upper edge forms an abutment for the lower edge of the bimetal element 49, when the bimetal element is in latching position.

A flat-leaf spring 75 has its lower end seated in a notch at 76 in the casing bottom and has its upper end passed through a slot 77 in the cradle 71 to form a pivotal knife-edge bearing between the cradle and spring at this point.

When the breaker is closed the loop circuit is completed between the binding posts 53—59 through the straps 52—58, the contacts 51—57

and 50—56, the bimetal element 49 and the contact arm 55 to the flexible lead 54. Movement of the parts from "on" position opens the circuit simultaneously at contacts 50—51 and 56—57.

The operation of the breaker is as follows:

"On": parts 71, 55, 49 and 43 are latched together by the engagement of latch 49 with ring 74 to form a unit and spring 75 tends to rotate this unit clockwise about the lower end of the handle; the engagement of the contacts and the engagement of the handle with the left edge of the slot in the cover through which it projects stops such tendency.

"Off": handle 42 is moved to the "off" position, Fig. 4, whereupon the spring 75 expands and rotates the unit counterclockwise about the lower end of the handle with snap action; movement will be arrested by the engagement of the handle with the right end of the slot in the casing through which the handle projects and by the engagement of the right end of the plate 43 with the upper wall of the casing.

"Tripped": when the bimetal element 49 warps and releases itself from the cradle ring 74, the parts of the unit are free to move relatively. The spring 75 will first urge the cradle upwardly until it reaches the fixed pivot 78, whereupon the spring will cause the cradle to swing to the position of Fig. 5; plate 43, contact arm 55, and the bimetal element 49 will follow the cradle to separate the contacts and movement will be arrested by the engagement of the right end of the plate with the top of the casing; thereafter, the handle will be moved from the position of Fig. 5 to that of Fig. 4, after which the left end of the plate, contact arm, and bimetal element will move further upwardly until they reach the position of Fig. 4, which is the final "tripped" or "off" position.

It will be observed that the instant breaker has a double contact break, 50—56, at arm 55 and at the bimetal element 49, and that make and break at the independent contact sets 50—51 and 56—57 is simultaneous.

It will also be seen that in the breaker hereof, current flows in the contact arm 55 in a direction opposite to that of the current which flows in the bimetal latch 49; when current flow is excessive, as on overload, there arises a strong tendency for the parts 55 and 49 to repel each other. This tendency aids the warping effect of the latch 49 and expedites release for overload.

Parts 49, 54, and 55 can be seen to form a U-shaped loop which tends to open on flow of current and which tendency, when current flow is excessive, as on overload, causes separation of parts 49 and 55 to expedite release of these parts on overload.

It will be observed that the three parts 43, 55, and 71 may each be referred to as a bar. Part 71 is referred to as a cradle or supplementary bar. Part 55 is referred to as a contact arm or contact bar or contact operating arm.

Now having described the circuit breaker herein disclosed, reference should be had to the claims which follow,

I claim:

1. A circuit breaker mechanism comprising a contact bar, a supplementary bar, and a thermal latch, an overcenter spring bearing against the supplementary bar, and an over center handle operatively connected to the contact bar, the bars being generally parallel and longitudinally extending, the spring and handle being generally transverse of and separated by the unit comprising the two bars, these being connected to each other by the latch, and a second contact bar, insulatedly mounted on the first named contact bar, and connected to the latch by a flexible wire.

2. A circuit breaker mechanism comprising a contact bar, a supplementary bar, and a thermal latch, an overcenter spring bearing against the supplementary bar, and an overcenter handle operatively connected to the contact bar, the bars being generally parallel and longitudinally extending, the spring and handle being generally transverse of and separated by the unit comprising the two bars, these being connected to each other by a pivotal connection and by said latch, and a second contact bar, insulatedly mounted on the first named contact bar, and connected to the latch by a flexible wire.

3. In a circuit breaker, a contact bar and a supplementary bar, a stationary contact, the contact bar being pivotally connected to the supplementary bar near one end of the contact bar, a circuit responsive latch latching the contact bar and the supplementary bar at the other end of the contact bar, said latch when unreleased causing the contact bar and supplementary bar to move together without relative movement and when released permitting the contact bar and supplementary bar to move relatively, the latch being supported on and by the contact bar, and a spring engaging the supplementary bar between the points where the contact bar is connected to the supplementary bar, and, when the parts are in one position, causing the contact bar to move against the stationary contact and towards latch held position with respect to the supplementary bar, and being operative to cause relative movement of the contact bar, the stationary contact, and the supplementary bar in the event of latch release, and a second contact bar, insulatedly mounted on the first named contact bar, and connected to the latch by a flexible wire.

4. In a circuit breaker, a contact bar and a supplementary bar, a stationary contact, the contact bar being pivotally connected to the supplementary bar near one end of the contact bar, a circuit responsive latch latching the contact bar and the supplementary bar at the other end of the contact bar, said latch when unreleased holding the contact bar and supplementary bar against relative movement and when released permitting the contact bar and supplementary bar to move relatively, the latch being supported on and by the contact bar, and a spring engaging the supplementary bar between the points where the contact bar is connected to the supplementary bar, the parts being so arranged that when they are in one position, the spring causes the contact bar to move against the stationary contact and towards the latch held position with respect to the supplementary bar, with the spring being operative to cause relative movement of the contact bar, the stationary contact, and the supplementary bar in the event of latch release, the parts also being so arranged that movement of the contact bar manually, when it is latched to the supplementary bar, causes movement of the spring to produce a snap action movement of the contact bar, and a second contact bar, insulatedly mounted on the first named contact bar, and connected to the latch by a flexible wire.

5. In a circuit breaker, a contact bar and a

supplementary bar, a stationary contact, the contact bar being pivotally connected to the supplementary bar near one end of the contact bar, a circuit responsive latch latching the contact bar and the supplementary bar at the other end of the contact bar, said latch when unreleased causing the contact bar and supplementary bar to move together without relative movement and when released permitting the contact bar and supplementary bar to move relatively, the latch being supported on and by the contact bar, and a spring engaging the supplementary bar between the points where the contact bar is connected to the supplementary bar, and, when the parts are in one position, causing the contact bar to move against the stationary contact and towards latch held position with respect to the supplementary bar, and being operative to cause relative movement of the contact bar, the stationary contact, and the supplementary bar in the event of latch release, whereafter the latch relatches the contact bar and supplementary bar relatively, and a second contact bar, insulatedly mounted on the first named contact bar, and connected to the latch by a flexible wire.

6. In a circuit breaker, a contact bar and a supplementary bar, a stationary contact, the contact bar being pivotally connected to the supplementary bar near one end of the contact bar, a circuit responsive latch latching the contact bar and the supplementary bar at the other end of the contact bar, said latch when unreleased causing the contact bar and supplementary bar to move together without relative movement and when released permitting the contact bar and supplementary bar to move relatively, the latch being supported on and by the contact bar, and a spring engaging the supplementary bar between the points where the contact bar is connected to the supplementary bar, and, when the parts are in one position, causing the contact bar to move against the stationary contact and towards latch held position with respect to the supplementary bar, and being operative to cause relative movement of the contact bar, the stationary contact, and the supplementary bar in the event of latch release, the contact bar and the supplementary bar lying alongside one another, in an elongated unit, the breaker having a handle for engaging the contact bar and pivotally mounted between its ends on a pivotal axis transverse of the supplementary bar and contact bar, and a second contact bar, insulatedly mounted on the first named contact bar, and connected to the latch by a flexible wire.

7. A circuit breaker comprising a contact bar, a circuit condition responsive trip control element or latch having an inherent characteristic to move in response to circuit conditions, a movably mounted supplementary bar pivotally connected to said contact bar and positioned to be interlocked to the contact bar by the element when the latter is under normal circuit influence, or to be released thereby when the latter is under abnormal circuit influence, a spring acting directly on said supplementary bar, the contact bar being arranged to be moved manually, the contact bar, the element, and the supplementary bar comprising elongated members arranged so as to be generally alongside one another and to move generally along with one another, together or relatively as the case may be, the spring and the manually engageable surface of the contact bar being on opposite sides of the group comprising the contact bar, the element, and the supplementary bar, and a second contact bar, insulatedly mounted on the first named contact bar, and connected to the latch by a flexible wire.

8. A circuit breaker comprising a contact bar, a circuit condition responsive trip control element or latch having an inherent characteristic to move in response to circuit conditions, a movably mounted supplementary bar pivotally connected to said contact bar and positioned to be interlocked to the contact bar by the element when the latter is under normal circuit influence, or to be released thereby when the latter is under abnormal circuit influence, a spring acting directly on said supplementary bar, the contact bar being arranged to be moved manually, the contact bar, the element, and the supplementary bar comprising elongated members arranged so as to be generally alongside one another, and to move generally along with one another, together or relatively as the case may be, the spring and the manually engageable surface of the contact bar being on opposite sides of the group comprising the contact bar, the element, and the supplementary bar, the parts being so arranged that on the arising of a circuit abnormality, the element moves to release the supplementary bar from the contact bar, whereupon the spring moves the contact bar and supplementary bar relatively, after which the spring moves the parts so as to create once more an interlocking relation between the contact bar and the supplementary bar, and a second contact bar, insulatedly mounted on the first named contact bar, and connected to the latch by a flexible wire.

9. A circuit breaker including a movable contact, a stationary contact, a movable contact operating arm, a handle, and a thermally responsive latch for said arm, the handle and movable contact being so connected that movement of the handle in one direction causes the movable contact to withdraw from the stationary contact, and movement of the handle in the opposite direction causes the movable contact to approach the stationary contact, and a single spring for pressing the movable contact against the stationary contact when the parts are in circuit closed position, and for biasing the movable contact away from the stationary contact when the arm is released by the latch, the spring being connected to the contact operating arm free and independently of the handle, through a supplementary bar alongside the contact operating arm and latched thereto by the latch, with the handle directly and constantly engaging the contact operating arm which carries the latch, and a contact arm, insulatedly mounted on the contact operating arm, and connected to the latch by a flexible wire.

10. A circuit breaker including a movable contact, a stationary contact, a movable contact operating arm, a handle, and a thermally responsive latch for said arm, the handle and movable contact being so connected that movement of the handle in one direction causes the movable contact to withdraw from the stationary contact, and movement of the handle in the opposite direction causes the movable contact to approach the stationary contact, and a single spring for pressing the movable contact against the stationary contact when the parts are in circuit closed position, and for biasing the movable contact away from the stationary contact when the arm is released by the latch, and for producing snap movement of the movable contact following movement of the handle, the

spring being connected to the contact operating arm free and independently of the handle, through a supplementary bar alongside the contact operating arm and latched thereto by the latch, with the handle directly and constantly engaging the contact operating arm which carries the latch, and a contact arm, insulatedly mounted on the contact operating arm, and connected to the latch by a flexible wire.

11. A circuit breaker including a movable contact, a stationary contact, a movable contact operating arm, a handle, and a thermally responsive latch for said arm, the handle and movable contact being so connected that movement of the handle in one direction causes the movable contact to withdraw from the stationary contact, and movement of the handle in the opposite direction causes the movable contact to approach the stationary contact, and a single spring for pressing the movable contact against the stationary contact when the parts are in circuit closed position, and for biasing the movable contact away from the stationary contact when the arm is released by the latch, the spring being connected to the contact operating arm free and independently of the handle, through a supplementary bar alongside the contact operating arm and latched thereto by the latch, with the handle directly and constantly engaging the contact operating arm which carries the latch, the latch being formed as an extended part of the arm, the arm and latch together comprising a unit having no fixed pivotal mounting but mounted on and by the handle, and a contact arm, insulatedly mounted on the contact operating arm, and connected to the latch by a flexible wire.

12. In a circuit breaker, a circuit responsive releasable latch, a stationary contact, a contact bar and a supplemental bar, the bars being pivotally interconnected near one end, and releasably interlatched relatively at their other end by said latch the latch being supported on and by the contact bar, and a spring engaging the supplemental bar between the points where the bars are relatively interconnected, the parts being so arranged that when they are in one position, the spring biases the contact bar against the stationary contact and towards latch held position with respect to the supplemental bar, with the spring being operative to bias the contact bar to move relative to the stationary contact and the supplemental bar in the event of latch release, and a second contact bar, insulatedly mounted on the first named contact bar, and connected to the latch by a flexible wire.

13. In a circuit breaker, a circuit responsive releasable latch, a stationary contact, a manually actuable contact bar and a supplemental bar, the bars being pivotally interconnected near one end, and releasably interlatched relatively at their other end by said latch the latch being supported on and by the contact bar, and a spring engaging the supplemental bar between the points where the bars are relatively interconnected, the parts being so arranged that when they are in one position, the spring biases the contact bar against the stationary contact and towards latch held position with respect to the supplemental bar, with the spring being operative to bias the contact bar to move relative to the stationary contact and supplemental bar in the event of latch release, the parts also being so arranged that movement of the contact bar manually, when it is latched to the supplementary bar, causes 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, and a contact arm, insulatedly mounted on the contact operating arm, and connected to the latch by a flexible wire.

14. A circuit breaker mechanism comprising a main bar and a bimetal or thermal latch, these being elongated and alongside each other, one end of the bar being fixed to one end of the latch, a cradle in latching engagement with a free end of the latch, the cradle and bar being longitudinally extending and generally parallel, an overcenter spring bearing against the cradle and a handle operatively connected to the bar, the spring and handle being generally transverse of and separated by the unit comprising the bar-latch and cradle, in combination with a second bar lying alongside and parallel to the first or main bar, and having one end fixed to the free end of the main bar, the fixed end of the second bar being connected to the free end of the latch by a flexible wire, the free end of the second bar and the adjacent or latch supporting end of the main bar having contacts, the second bar, the wire, and the latch thus forming a U shaped magnetic loop, the thermal latch being so constituted and being so arranged relative to the two bars and cradle that flow of current in the loop tends to bias the free end of the latch free of the cradle, by moving it in the direction in which that end moves as it warps on a rise of temperature therein.

15. A circuit breaker mechanism comprising a main bar and a bimetal or thermal latch, these being elongated and alongside each other, one end of the bar being fixed to one end of the latch, a cradle in latching engagement with a free end of the latch, the cradle and bar being longitudinally extending and generally parallel, an overcenter spring bearing against the cradle and a handle operatively connected to the bar, the spring and handle being generally transverse of and separated by the unit comprising the bar-latch and cradle, in combination with a second bar lying alongside and parallel to the first or main bar, and having one end fixed to the free end of the main bar, the fixed end of the second bar being connected to the free end of the latch by a flexible wire, the free end of the second bar and the adjacent or latch supporting end of the main bar having contacts, the second bar, the wire, and the latch thus forming a U shaped magnetic loop, the thermal latch being so constituted and being so arranged relative to the two bars and cradle that flow of current in the loop tends to bias the free end of the latch free of the cradle, by moving it in the direction in which that end moves as it warps on a rise of temperature therein, and means pivotally interconnecting the main bar and the cradle.

16. A circuit breaker mechanism comprising a main bar and a bimetal or thermal latch, these being elongated and alongside each other, one end of the bar being fixed to one end of the latch, a cradle in latching engagement with a free end of the latch, the cradle and bar being longitudinally extending and generally parallel, an overcenter spring bearing against the cradle and a handle operatively connected to the bar, the spring and handle being generally transverse of and separated by the unit comprising the

bar-latch and cradle, in combination with a second bar lying alongside and parallel to the first or main bar, and having one end fixed to the free end of the main bar, the fixed end of the second bar being connected to the free end of the latch by a flexible wire, the free end of the second bar and the adjacent or latch supporting end of the main bar having contacts, the second bar, the wire, and the latch thus forming a U shaped magnetic loop, the thermal latch being so constituted and being so arranged relative to the two bars and cradle that flow of current in the loop tends to bias the free end of the latch free of the cradle, by moving it in the direction in which that end moves as it warps on a rise of temperature therein, and means pivotally interconnecting the main bar and the cradle, at a point near the contact end of the main bar, but between the ends of the main bar.

17. A circuit breaker including a movable contact, a stationary contact, a movable contact operating arm, a handle, and a thermally responsive latch for said arm, the handle and movable contact being so connected that movement of the handle in one direction causes the movable contact to withdraw from the stationary contact, and movement of the handle in the opposite direction causes the movable contact to approach the stationary contact, and a single spring for pressing the movable contact against the stationary contact when the parts are in circuit closed position, and for biasing the movable contact away from the stationary contact when the arm is released by the latch, and for producing snap movement of the movable contact following movement of the handle, the spring being connected to the contact operating arm free and independently of the handle, through a supplementary bar alongside the contact operating arm and latched thereto by the latch, with the handle directly and constantly engaging the contact operating arm which carries the latch, the handle being of the push-manipulation type and so constructed and the parts being so connected that snap movement of the contact operating arm, caused by the spring and initiated by movement of the handle, will not be restrained on normal manipulation of the handle, and a second contact bar, insulatedly mounted on the contact arm and connected to the latch by a flexible wire.

18. A circuit breaker mechanism comprising a contact bar, a supplementary bar, and a thermal latch, an overcenter spring bearing against the supplemental bar, and an overcenter handle operatively connected to the contact bar, the bars being generally parallel and longitudinally extending, the spring and handle being generally transverse of and separated by the unit comprising the two bars, these being connected to each other by the latch, the latch being carried by one of the bars, and means for restraining undesired relative movement of the two bars comprising a lug on one of them at all times disposed in a hole in the other, and a second contact bar, insulatedly mounted on the first named contact bar and connected to the latch by a flexible wire.

19. A circuit breaker mechanism comprising a contact bar, a supplementary bar, and a thermal latch, an overcenter spring bearing against the supplemental bar, and an overcenter handle operatively connected to the contact bar, the bars being generally parallel and longitudinally extending, the spring and handle being generally transverse of and separated by the unit comprising the two bars, these being connected to each other by a pivotal connection and by said latch, the latch being carried by one of the bars, and means for restraining undesired relative movement of the two bars comprising a lug on one of them at all times disposed in a hole in the other, and a second contact bar, insulatedly mounted on the first named contact bar and connected to the latch by a flexible wire.

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