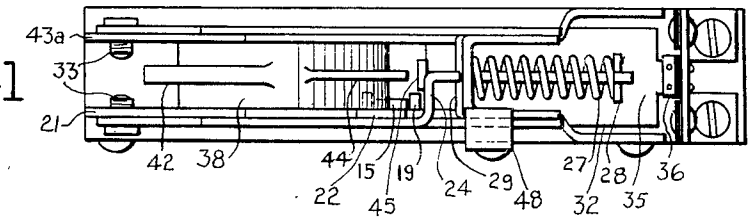
Dec. 14, 1937. A. J. THOMSON 2,102,295

CIRCUIT BREAKER

Original Filed March 6, 1933 2 Sheets-Sheet 1

Fig-1



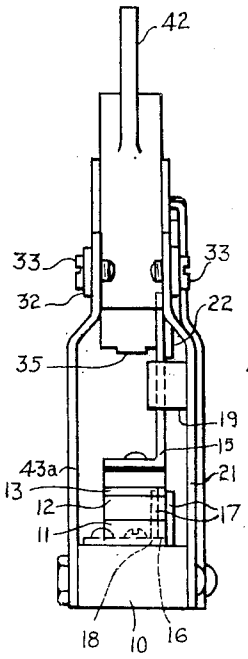


Fig-3

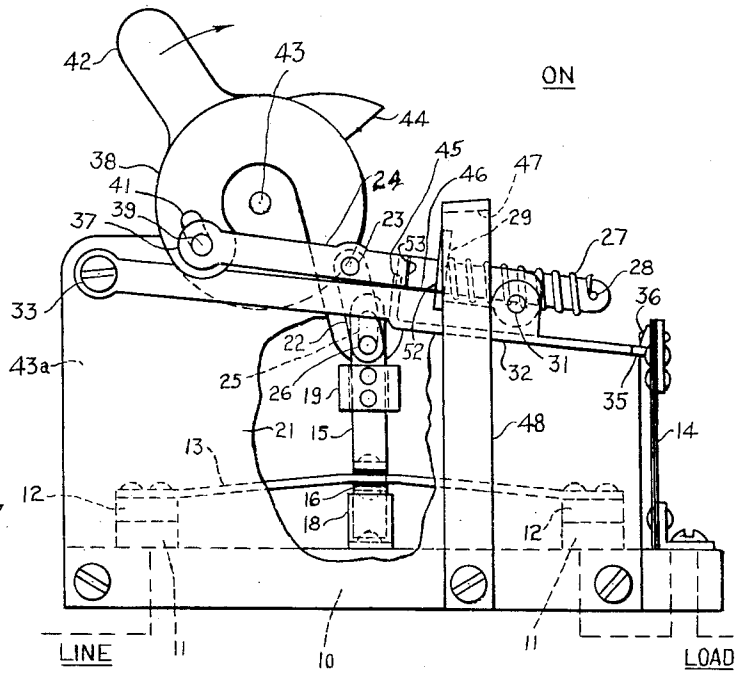


Fig-2

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CIRCUIT BREAKER

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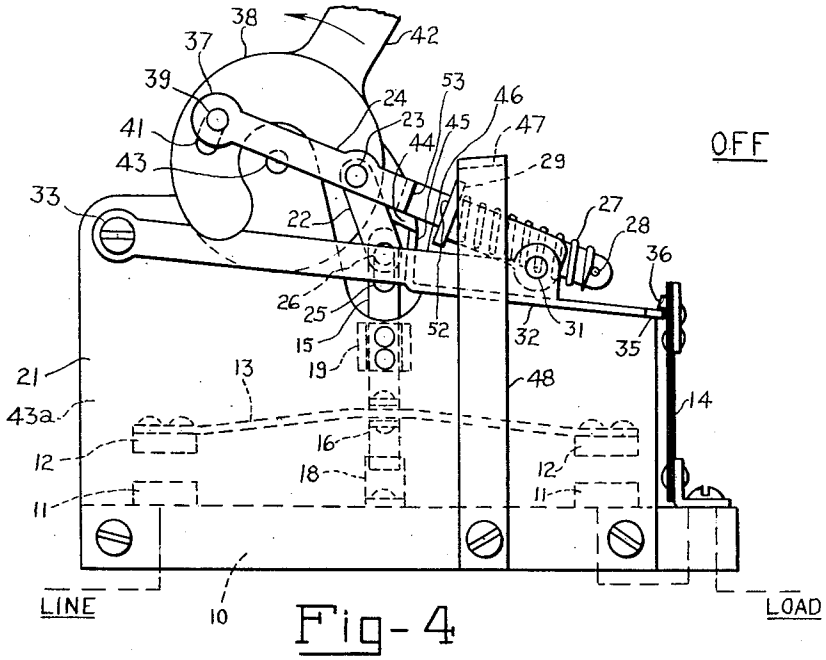


Fig-4

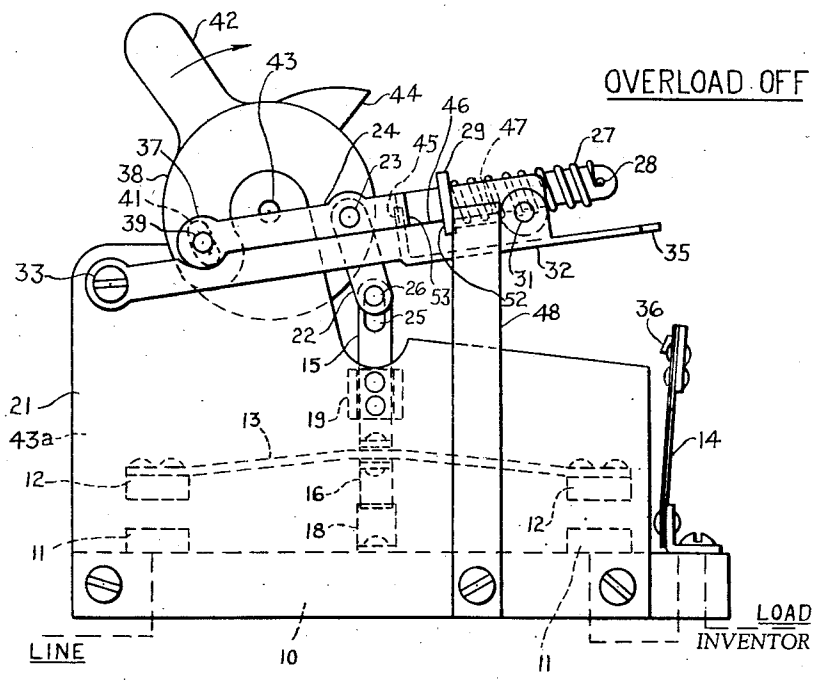


Fig-5

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Patented Dec. 14, 1937 2,102,295

UNITED STATES PATENT OFFICE

2,102,295

CIRCUIT BREAKER

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REISSUED APR 1 - 1941

Application March 6, 1933, Serial No. 659,714
Renewed January 11, 1937

22 Claims. (Cl. 200—116)

This invention relates to circuit breakers, and principally aims to provide a novel form of circuit breaker, such as will be particularly described with reference to the appended drawings.

The breaker herein disclosed is provided with a novel operating mechanism which forms the principal novel feature thereof and the provision of which is a principal object of the invention.

Among the characteristics of the breaker disclosed in the drawings, are the following:

(1) The breaker is trip free; that is to say, upon release of the breaker parts by the overload release element, the breaker parts will trip and move to their overload released position, even though the handle, which normally operates the breaker, is held against movement intentionally or accidentally; the breaker parts trip for overload release, free of the handle.

(2) The breaker is so constructed as to have quick make and break action on normal operation, and quick-break action on overload release, and these actions are accomplished even though a relatively small number of parts are used in the breakers.

(3) The connection between the operating handle and the breaker parts, though permitting quick make and break, is positive, so that even though the springs which provide the quick make and break action should become injured, or prove insufficient to cause make and break, or so that even though the contacts stick, make and break can be accomplished positively by movement of the handle.

(4) The operating springs are in the nature of compression springs, which is of advantage, due to the fact that compression springs are more satisfactory of operation than other forms of springs.

(5) Further, the compression springs are mounted on links so that in the event a spring breaks, the broken parts will not fall into and among the live parts of the breaker, with consequent damage.

(6) Further, the operating compression springs are so positioned and connected that they need be flexed only a relatively small distance, as contrasted with other breakers, wherein considerable flexing of the springs is required, it being observed that lessening of the required spring-flexing has the effect of prolonging the life of the springs.

(7) Further, the springs are not connected to the operating handles, and therefore, the handles can be moved, for positive make and break, independently of the springs.

(8) Further, reset action, after overload "off" tripping, can be accomplished without the contact arm moving out of "off" position, this insuring that the circuit will not be closed, even momentarily, on reset. Further, the parts are so constructed that the reset action includes a snap action, to insure quick and positive reset.

Still further objects will readily occur to those skilled in the art upon reference to the following description and the accompanying drawings in which—

Figs. 1–3 are plan, elevation, and end views, respectively of a circuit breaker, shown in "on" position;

Figs. 4 and 5 show the device in "off" position and overload "off" position, respectively.

The device of Figures 1–5

In Figures 1 to 5 there is shown a circuit breaker having three positions, "on" (Fig. 2), switch "off" (Fig. 4) and overload "off" (Fig. 5).

The device includes a base 10 having a pair of contacts 11 which are to be engaged by the contacts 12 on the ends of a resilient bridging contact arm 13. One of the contacts 11 is connected to the line, and the other is connected to one leg of the thermostatic or bi-metallic warping element 14, the other leg of the latter being connected to the load. When the contact arm 13 is in "on" position, current flows through contacts 11 and 12, contact arm 13 and warping element 14.

To the vertically moving contact arm 13 is rigidly secured an upwardly projecting sliding link 15 and a downwardly projecting guide plate 16, these being insulated from arm 13, as shown.

The lower end of the guide plate 16 slides between two spring jaws 17 of a lower guide block 18 firmly fastened to base 10. The sides of the sliding link 15 snugly fit into an upper guide block 19 rigidly secured to a vertical front plate 21.

A link 22 is pivotally connected at 23 to a horizontal link 24 and is slidably connected to the upper end of link 15, through an elongated slot 25 in link 15, receiving a pin 26 of link 22. A coiled compression resisting spring 27 is mounted on the right hand end of link 24, between a pin 28 thereon and the bight of a U-shaped, horizontally positioned spring compression link 29, which is pivotally connected at 31 to a pawl 32, the latter being pivotally connected by shouldered screws 33 on its left hand end to front plate 21 and vertical back plate 43a. As indicated, the link 24 passes through a slot in the bight of link 29, and these links move as a unit, around pivot 31. In the "on" position, the right hand or free end 35 of

pawl 32 is held down by a tongue 36 of warping element 14.

The left hand end 37 of link 24 is pivotally connected to an operating bell crank 38 by a pin 39, the latter sliding in an arcuate slot 41 of the crank. The bell crank has an extension 42 forming an operating handle for the device, and is pivotally supported on the cross shaft 43, the latter connecting front plate 21 and the vertical back plate 43a.

The parts just described may be operated as a simple, quick make and break switch as follows: Assume the parts to be in "on" position (Figure 2). When the handle 42 is moved to the right, the bell crank 38 rotates clockwise, carrying end 37 of link 24 along with it, thus moving links 24 and 29, together, about the pivot 31, clockwise. This action pulls link 24 to the left a slight degree and builds up an increased compression in coil springs 27. All this while, the link 22 and its pin 26 travels the length of the slot 25 in sliding link 15, and link 15 and arm 13 do not move, link 15 being held by spring jaws 17 frictionally engaging guide part 16.

As soon as link 24 has passed over center (shaft 43) the coil spring operates, to move links 24 and 29 further past shaft 43, with a snap action, thus pulling contact arm 13 to its "off" position, for a quick break of the circuit, slot 41 permitting snap action movement of links 24 and 29, independently of the handle 42, so that quick break may be effected independently of the operator.

Handle 42 is so connected that it may move the sliding link 15, without the assistance of the spring 27, after having taken up the lost motion provided in slots 25 and 41. This permits the handle 42 to move the bridging arm 13 positively to the "off" position, and permits the operator to free the contacts 12 in case they should stick, and to move the switch positively to the "off" position, independently of the spring, in the event the spring should become broken or weakened too much to function of its own accord.

The bell crank 38 may be moved to the extreme "off" position as limited by the engagement of the reset lug 44 and stop 45 on pawl 32.

Reverse movement of handle 42, to the left, from the "off" position (Fig. 4) imparts a counter-clockwise movement to link 24 about pin 31. This action pulls link 24 to the left and compresses spring 27 between pin 28 and the bight of the spring compression link 29, until link 24 is past center (shaft 43).

All this while, the link 22 and its pin 26 travels the length of the slot 25 in sliding link 15, and link 15 and arm 13 do not move, being held by spring clips 17 frictionally engaging guide part 16. Then the compressive force of the spring reacts, giving a rapid counter-clockwise movement to link 24, forcing down link 22, sliding link 15, and arm 13, until the circuit is completed through contacts 11 and 12.

Slot 41 permits a snap action movement of links 24 and 29, independent of the movement of handle 42, in order to effect a quick make, independent of the operator. The bell crank may be moved to the extreme "on" position, as determined by the length of slot 41, and the "on" position of link 24, as shown in Fig. 2.

The action just described is a quick make action, and takes place when spring 27 functions properly. At other times, the positive connection between handle 42 and link 15, as previously described, insures contact making.

During switch operation, travel of pawl 32, about its pivot screws 33 is prevented, by its end 35 being held by the tongue 36 of warping element 14.

It will be observed that slot 41 provides a lost motion connection between handle 42 and link 24, which permit movement of the latter, when overcenter and as influenced by spring 27, independently of the handle for accelerating the quick make and break action of the linkage 24, 22, 15, etc., the extent of this action being determined by the dimensions of slot 41 and the associated parts. A positive make and break action of the linkage is, however, assured by the positive (even though lost motion) connection between handle 42 and link 24.

The foregoing parts, in conjunction with other parts to be described below, serve to move contact arm from "on" position to a second or overload "off" position, when element 14 warps to the right due to an overload in the line, and also serve to enable the operator to reset the switch after it had been tripped on overload, by moving the various parts, linkages, and the pawl 32 from their overload "off" position to their normal "off" position without causing contact arm 15 to close the circuit and these operations are carried on as follows:

Assume the switch to be in "on" position. When the element 14 warps (to the right) its tongue 36 releases pawl end 35, permitting the compression in spring 27 to tend to move link 29, and consequently pin 31, to the left. Since pin 29 is fixed to pawl 32 at 31, the movement of pin 31 to the left is on an arc whose center is pivot 33, and is necessarily accompanied by an upward movement of pin 31. The parts move up and their inertia carries them to the point where pawl 32 is engaged by the hooked ledge 47 on stop 46. By this time, the line of action of spring 27, thru a line connecting pivot 39 and pin 28, is above center 43, and the spring therefore causes drum 38 to rotate clockwise, to pull the left end of link 24 clockwise, and to pull pin 23 upwardly. This movement, operating through links 22 and 15, raises contact arm 13 to the position shown in Figure 5, known as "overload off", for breaking the circuit. Quick break is of course assured by the action of spring 27.

In view of the fact that this action can take place without interference from handle 42, due to the fact that the pivot 39 does not move on this action, the breaker cannot be prevented from tripping, merely by holding handle 42 so that pivot 39 can not move. In other words, the breaker will trip even though the handle be held. This characteristic places the breaker in the trip-free class.

When the parts are to be reset, that is to say, when contact arm 13 is to be moved from "overload off" (Fig. 5) to switch "off" (Fig. 4), handle 42 is moved to the right, rotating bell crank 38 clockwise until the lower edge of elongated slot 41 comes in contact with pin 39 carrying it past center (shaft 43). The spring 27 then continues the clockwise movement of pin 39 pivoting link 24 about pin 31 until shoulder 52 on spring compression link 29 engages shoulder 53 on link 24.

A continued movement of the handle to the right causes the stop lug 44 on bell crank 38 to engage stop 45 on pawl 32, rotating the latter clockwise about screws 33 until its end 35 snaps under tongue 36 of warping element 14, resetting the parts to the switch "off" position of Figure 4.

By properly proportioning and connecting the

parts, the action may be such that during movement of the handle 42, lug 44 can be resetting link 32 to its normal latched position, during the time that link 24 is moving overcenter to the "off" position.

It will be seen that the position of the contact arm 13 does not change while the other parts move from overload "off" position to switch "off" position (reset position). Accordingly, there is no danger of the circuit being closed, even momentarily, until the breaker is under the control of the warping element 14.

It will be observed at this time that the breaker described in the foregoing possesses certain novel and desirable characteristics. It is trip-free; it operates with a quick make and break action, both on normal switch operations, and on overload; it insures positive make and break, in addition to and without interfering with the quick make and break; and it can be reset after tripping, with a snap action.

In addition, in the event the spring 27 breaks, it will not fall into the live parts of the breaker, with consequent damage, but will remain upon the link 24 upon which it is mounted, being held between pin 28 and link 29.

Further, since the spring 27 does not have to be flexed to any great extent, due to the tangential relation of the link 27 and the drum 38, the life of the spring is relatively prolonged.

Further, it is to be noted that this circuit breaker employs only one spring for all its operations, this spring serving to perform the functions of quick make and quick break under normal switching, and quick break under overload tripping.

Further, since the spring 27 connects the operating link 24 and the pawl, it is free of the handle, and therefore does not interfere with positive make and break action of the handle, as contradistinguished from constructions wherein the spring connects the operating link or part to the handle.

Now having described one form of breaker, reference will be had to the following claims which determine the scope of the invention, it being expressly understood that the breaker heretofore described and disclosed has been chosen merely as an example, and not as illustrating all of the possible embodiments of the invention.

I claim:

1. In a circuit breaker of the character described, an operating mechanism including an elongated pawl fixedly pivoted at one end to a fixed part, and normally held down at the other end by an overload release part, an operating crank fixedly pivoted to a fixed part and having a reset part for engaging said pawl and resetting it by moving it downwardly after it has been released by said release part and moved upwardly, an operating link connected at one end to said crank by a positive, lost-motion pivotal connection and positioned alongside said pawl, with its aforesaid pivotal connection adjacent the pivotal connection of the pawl, a compression spring on the end of said operating link adjacent the release part, and a spring compression link pivotally connected to the operating link and to the pawl.

2. In a circuit breaker of the character described, an operating mechanism including an elongated pawl fixedly pivoted at one end to a fixed part, and normally held down at the other end by an overload release part, an operating crank fixedly pivoted to a fixed part and having a reset part for engaging said pawl and resetting it by moving it downwardly after it has been released by said release part and moved upwardly, an operating link connected at one end to said crank by a positive, lost motion pivotal connection and positioned alongside said pawl, with its aforesaid pivotal connection adjacent the pivotal connection of the pawl, a compression spring on the end of said operating link adjacent the release part, and a spring compression link pivotally connected to the operating link and to the pawl, the spring providing a quick make and break movement for the breaker parts controlled by the operating link.

3. In a circuit breaker of the character described, an operating mechanism including an elongated pawl fixedly pivoted at one end to a fixed part, and normally held down at the other end by an overload release part, an operating crank fixedly pivoted to a fixed part and having a reset part for engaging said pawl and resetting it by moving it downwardly after it has been released by said release part and moved upwardly, an operating link connected at one end to said crank by a positive, lost motion pivotal connection and positioned alongside said pawl, with its aforesaid pivotal connection adjacent the pivotal connection of the pawl, a compression spring on the end of said operating link adjacent the release part, and a spring compression link pivotally connected to the operating link and to the pawl, the aforesaid links moving about the connection between the spring compression link and the pawl, as a pivot, with the pawl at rest, during normal make and break operation.

4. In a circuit breaker of the character described, an operating mechanism including an elongated pawl fixedly pivoted at one end to a fixed part, and normally held down at the other end by an overload release part, an operating crank fixedly pivoted to a fixed part and having a reset part for engaging said pawl and resetting it by moving it downwardly after it has been released by said release part and moved upwardly, an operating link connected at one end to said crank by a positive, lost motion pivotal connection and positioned alongside said pawl, with its aforesaid pivotal connection adjacent the pivotal connections of the pawl, a compression spring on the end of said operating link adjacent the release part, and a spring compression link pivotally connected to the operating link and to the pawl, the links moving about the connection between the spring compression link and the pawl, as a pivot, with the pawl at rest, during normal make and break operation, the spring providing a quick make and break movement for the breaker parts controlled by the operating link.

5. In a circuit breaker of the character described, an operating mechanism including an elongated pawl fixedly pivoted at one end to a fixed part, and normally held down at the other end by an overload release part, an operating crank fixedly pivoted to a fixed part and having a reset part for engaging said pawl and resetting it by moving it downwardly after it has been released by said release part and moved upwardly, an operating link connected at one end to said crank by a positive, lost motion pivotal connection and positioned alongside said pawl, with its aforesaid pivotal connection adjacent the pivotal connection of the pawl, a compression spring on the end of said operating link adjacent the release part, and a spring compression link pivotally connected to the operating link and to the pawl, the operating link and the pawl together

moving about their adjacent pivotal connections as pivots, on overload release movement.

6. In a circuit breaker of the character described, an operating mechanism including an elongated pawl fixedly pivoted at one end to a fixed part, and normally held down at the other end by an overload release part, an operating crank fixedly pivoted to a fixed part and having a reset part for engaging said pawl and resetting it by moving it downwardly after it has been released by said release part and moved upwardly, an operating link connected at one end to said crank by a positive, lost motion pivotal connection and positioned alongside said pawl, with its aforesaid pivotal connection adjacent the pivotal connection of the pawl, a compression spring on the end of said operating link adjacent the release part, and a spring compression link pivotally connected to the operating link and to the pawl, the operating link and the pawl together moving about their adjacent pivotal connections as pivots on overload release movement, the spring providing a quick make and break movement for the breaker parts controlled by the operating link.

7. In a circuit breaker of the character described, an operating mechanism including an elongated pawl fixedly pivoted at one end to a fixed part, and normally held down at the other end by an overload release part, an operating crank fixedly pivoted to a fixed part and having a reset part for engaging said pawl and resetting it by moving it downwardly after it has been released by said release part and moved upwardly, an operating link connected at one end to said crank by a positive, lost motion pivotal connection and positioned alongside said pawl, with its aforesaid pivotal connection adjacent the pivotal connection of the pawl, a compression spring on the end of said operating link adjacent the release part, and a spring compression link pivotally connected to the operating link and to the pawl, the links moving about the connection between the spring compression link and the pawl, as a pivot, with the pawl at rest, during normal make and break operation, the operating link and the pawl together moving about their adjacent pivotal connections as pivots, on overload release movement.

8. In a circuit breaker, a linkage comprising parallel elongated links, a movable connection which is pivotally secured to one link and is movable along and engages the other and which connects the links, said other and engaged link being provided with resilient means disposed between an end thereof and the connection, holding means at opposite ends of said linkage for holding said linkage in normal position, and a contact operatively connected to the linkage, the linkage normally being so held by the holding means that the resilient means thereof is in a condition wherein it has potential energy stored therein, and constantly tends to vary the distance between the connection and one of the holding means and to shift the linkage, movement of one of said holding means releasing the linkage and permitting the resilient means to expend its potential energy and shift the linkage about the other holding means and at the same time to vary the distance between the connection and the first holding means, so as to provide a snap action movement of the linkage and a snap release of the contact.

9. In a circuit breaker, a linkage comprising parallel elongated links, a movable connection which is pivotally secured to one link and is movable along and engages the other and which connects the links, said other and engaged link being provided with resilient means disposed between an end thereof and the connection, holding means at opposite ends of said linkage for holding said linkage in normal position, and a contact operatively connected to the linkage, the linkage normally being so held by the holding means that the resilient means thereof is in a condition wherein it has potential energy stored therein, and constantly tends to vary the distance between the connection and one of the holding means and to shift the linkage, one of said holding means being manually movable, movement of that holding means releasing the linkage and permitting the resilient means to expend its potential energy and shift the linkage about the other holding means and at the same time to vary the distance between the connection and the first holding means, so as to provide a snap action movement of the linkage and a snap release of the contact.

10. A construction of the character described in claim 8, wherein both anchorages are movable, with one manually controlled and the other controlled by the circuit current so as to move on overload.

11. In a circuit breaker, a linkage comprising parallel elongated links, a movable connection which is pivotally secured to one link and is movable along and engages the other and which connects the links, said other and engaged link being provided with resilient means disposed between an end thereof and the connection, holding means at one end of said linkage for holding said linkage in normal position, a movably mounted handle operatively connected to the linkage near the end thereof remote from the holding means, a contact operatively connected to the linkage, the linkage normally being so held that the resilient means is in a condition wherein it has potential energy stored therein and constantly tends to shift the linkage and vary the distance between the connection and the holding means, movement of the handle shifting the linkage to a position wherein subsequent release thereof from manual control will permit the resilient means to expend its potential energy and shift the linkage about the holding means and vary the distance between the connection and the holding means with a snap action to provide a snap action release of the contact.

12. A construction of the character described in claim 11 wherein the handle is rotatably mounted and wherein movement of the handle shifts the linkage across and over the center of rotation of the handle, whereupon the resilient means expends its energy to continue shifting of the linkage but with a snap action.

13. A construction of the character described in claim 11 wherein the handle is rotatably mounted and wherein movement of the handle up to its over center position shifts the linkage and also energizes the resilient means and wherein movement of the handle across its over center position places the linkage in position to be moved further, but with a snap action, by the resilient means when the handle is released.

14. A construction of the character described in claim 11 wherein the holding means is responsive to circuit conditions so as to release on overload and permit the resilient means to shift the linkage about the handle and vary the length

of the variable length part thereof with a snap action to provide a snap action release of the contact.

15. A construction of the character described in claim 11 wherein the holding means is responsive to circuit conditions so as to release on overload and permit the resilient means to shift the linkage about the handle and vary the length of the variable length part thereof with a snap action to provide a snap action release of the contact, the handle being movable thereafter to reset the thus released linkage into a position wherein it is held by the holding means.

16. In a circuit breaker, a frame, a link, means pivotally mounting the link thereon, a handle pivotally mounted on the frame, means pivotally connecting the handle to the link and so constructed and arranged as to enable the link to slide circularly about the pivotal mounting of the handle, the handle being operable to slide the link circularly about the pivotal mounting of the handle, a contact controller, means connecting it to the link, a spring operatively connected to the link in such a manner that it will oppose movement of the link out of one position, the spring being positioned to be stressed by and on movement of the link out of that position and to move the link with a snap action into another position when so stressed and when the link has been moved partially out of the first position and towards such other portion by the handle.

17. In a circuit breaker, a frame, a link, means pivotally mounting the link thereon, a handle pivotally mounted on the frame, means pivotally connecting the handle to the link and so constructed and arranged as to enable the link to slide circularly about the pivotal mounting of the handle, the handle being operable to slide the link circularly about the pivotal mounting of the handle, a contact controller, means connecting it to the link, a spring operatively connected to the link in such a manner that it will oppose movement of the link out of one position, the spring being positioned to be stressed by and on movement of the link out of that position and to move the link with a snap action into another position when so stressed and when the link has been moved partially out of the first position and towards such other portion by the handle, and means for automatically releasing the pivotal mounting for the link on a circuit abnormality to release the link and permit the spring to move it about its pivotal connection to the handle for circuit interruption.

18. A circuit breaker including a movable mechanism, a contact, means operatively connecting the contact to the movable mechanism whereby movement of the mechanism causes movement of the contact, a handle, means pivotally mounting the handle, means operatively connecting the handle to the mechanism whereby movement of the handle causes movement of the mechanism, a movable circuit current responsive latch so constructed and located that it engages and holds the mechanism under normal circuit conditions and moves from normal position to release the mechanism under abnormal circuit conditions, a spring operatively connected to the mechanism for biasing it for movement when it is released by the latch or moved by the handle, the handle and the latch providing separate holding means for the mechanism, the spring, the latch, the mechanism, and the handle being so constructed and arranged and relatively located that on release of the latch the spring biases the mechanism to open circuit position by moving it around the handle as a pivot without moving the handle, and on movement of the handle the spring biases the mechanism to open circuit position by moving it around the latch as a pivot without moving the latch, the points of connection between the handle and the mechanism and between the latch and the mechanism being spaced from each other.

19. In a circuit breaker controlling mechanism, a resilient mechanism, a movable current responsive latch so constructed and arranged that it normally engages the mechanism for holding it, the parts being so arranged relatively that the mechanism, when held by the latch, is under longitudinal stress, the latch being movable on a circuit abnormality for releasing the mechanism, a rotatably mounted handle, means operatively connecting it to the mechanism, the handle being so constructed and arranged that on rotary movement thereof out of its normal position it will stress the mechanism longitudinally and move it bodily out of its normal position and towards the center of rotation of the handle so that when the handle is released after such movement the mechanism will tend to relieve itself of the longitudinal stress created therein by such movement of the handle with a snap action, the parts being so arranged relatively that on such stress relieving movement of the mechanism following such handle movement and subsequent release, the mechanism will move bodily beyond the center of rotation of the handle and about the connection between the mechanism and latch as a pivot, and also being so arranged relatively that on release of the latch, when the handle and mechanism are in normal position, the mechanism will tend to relieve itself of the stress that it possesses when it is held by the latch with a snap action and in so doing will move bodily about its connection to the handle as a pivot.

20. A construction of the character described in claim 18 wherein the handle is so arranged relatively to the contact that it may be manipulated to reset the contact, following movement thereof responsive to release of the latch, by movement of the handle in a manner generally similar to the movement thereof that causes movement of the link about the latch as a pivot.

21. A construction of the character described in claim 19, wherein the handle is so arranged relatively to the mechanism that it may be manipulated to reset the mechanism into normal position and held by the latch under stress, following movement thereof responsive to release of the latch, by movement of the handle in a manner generally similar to the movement thereof that causes movement of the mechanism out of normal latch held position.

22. A construction of the character described in claim 19 wherein the points of connection between the handle and mechanism and between the latch and mechanism are spaced from each other.

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