

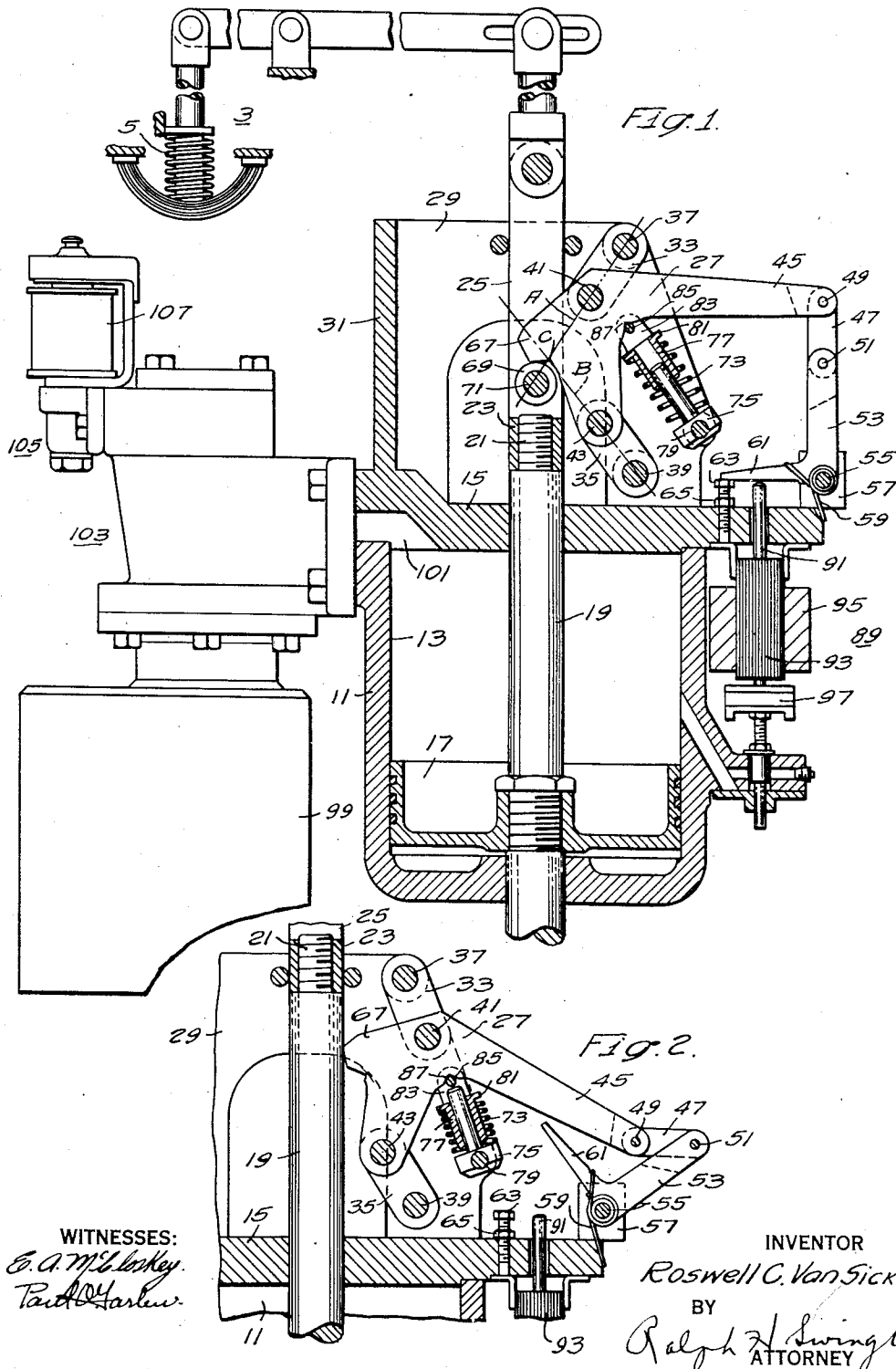
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R. C. VAN SICKLE

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LATCH MECHANISMS

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WITNESSES:

E. A. McLoskey.
Paul H. Harlow.

INVENTOR

Roswell C. Van Sickle.

BY

BY
Ralph H. Swingle
ATTORNEY

UNITED STATES PATENT OFFICE

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LATCH MECHANISM

Roswell C. Van Sickle, Wilkinsburg, Pa., assignor
to Westinghouse Electric & Manufacturing
Company, East Pittsburgh, Pa., a corporation
of Pennsylvania

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This invention relates to circuit breakers and more particularly to latch mechanism for circuit breakers.

One object of the invention is to provide an improved latching mechanism for a circuit breaker that is simple, reliable in operation and inexpensive to manufacture.

Another object of the invention is to provide an improved high-speed latching mechanism for a circuit breaker.

Another object of the invention is to provide a circuit breaker with an improved floating latch which is capable of high-speed latching and unlatching operation.

Another object of the invention is to provide a circuit breaker with an improved high-speed latching mechanism wherein the latch is mounted on movable pivots and engages directly with the breaker operating rod.

Another object of the invention is to provide a circuit breaker with an improved latching mechanism wherein the latch member travels with the breaker rod a predetermined distance in both latching and unlatching operations to permit high-speed latching and unlatching.

The novel features that are considered characteristic of the invention are set forth in the appended claims. The invention itself, however, both as to structure and operation, together with additional objects and advantages thereof will be best understood from the following detailed description thereof when read in connection with the accompanying drawing, in which:

Figure 1 is an elevational view, partly in section, of a circuit breaker operating mechanism embodying the principles of the invention; and

Fig. 2 is a fragmentary elevational view, partly in section, showing the latch mechanism in the unlatched position.

Referring to the drawing, the circuit breaker 3, which is illustrated diagrammatically, may be of any conventional construction either of the oil-break, air-break or gas-blast type and is adapted to be operated to the open position by means of an accelerating spring 5. The circuit breaker is adapted to be operated to the closed position by means of an operating mechanism which in the embodiment shown is of the compressed-air or gas-operated type. The operating mechanism in the embodiment shown includes a main casting 11 which is formed to provide an operating cylinder 13 closed at the lower end by an integral part of the casting. The upper end of the cylinder 13 is closed by means of a member 15 suitably secured thereto. Mounted in the cylinder 13 is an

operating piston 17 secured to a piston rod 19 which is slidable through an air-tight opening in the top wall 15 of the cylinder. The upper end of the piston rod 19 is threadedly connected as at 21 to the connecting portion of a bifurcated member 23, the two arms 25 of which extend upwardly in parallel relationship. The upper ends of the arms 25 are operatively connected to the circuit breaker 3 through a suitable linkage.

In order to hold the breaker closed, the member 23, piston rod 19 and the piston 17 are held in closed position by means of a high-speed latch 27 supported between a pair of spaced parallel frames 29 (only one being shown) integral with and extending upwardly from the cylinder head 15. As shown in Fig. 1, the left-hand ends of the frames 29 are rigidly connected by an integral cross member 31. The latch 27 is supported by an upper link 33 and a lower link 35, the upper link 33 being pivotally supported on a pin 37 and the lower link on a pin 39. The pins 37 and 39 are mounted in the frame member 29. The links 33 and 35 each comprise spaced parallel links (only one of each being shown) and are respectively pivotally connected to the latch 27 by pins 41 and 43. The latch member 27 is provided with an integral tail 45, the outer end of which is slotted to receive the upper end of a toggle link 47. The toggle link 47 is pivotally connected by means of a pivot pin 49 to the tail 45 of the latch member. The lower end of the toggle link 47 is pivotally connected by means of a knee pivot pin 51 to a toggle link 53, the upper end of which is slotted to receive the link 47. The toggle link 53 is pivotally mounted on a fixed pivot pin 55 supported in a pair of spaced lugs 57 (only one being shown) suitably secured to the cylinder head 15. The toggle comprising the links 47 and 53 comprises a tripping toggle and is biased to a slightly overset position by means of a spring 59 coiled about the pivot pin 55 and having one end bearing against the end of the cylinder member 15. The other end of the spring 59 is hooked over a tail 61 integral with the link 53 and projecting inwardly therefrom substantially parallel to the top of the cylinder. The overset position of the tripping toggle 47—53 is adjustably limited by the end of the tail 61 resting on an adjusting screw 63 threadedly engaging the member 15 and locked in its adjusted position by a lock nut 65.

In its overset position, the toggle 47—53 holds a latching projection 67 on the latch member 27 in latching engagement with a latch roller 69 disposed between the arms 25 of the member 23 and rotatably mounted on a pin 71 supported in

the arms 25. The latch member 27 is biased to its latching position by means of a coil spring 73 compressed between male and female spring guides 75 and 77. The spring guide 75 is headed to retain the spring 73 and is pivotally supported on a fixed pivot pin 79 mounted in the frames 29. The female spring guide 77 is generally tubular in shape to slidably receive the male spring guide 75 and is provided with an annular flange 81 against which one end of the spring 73 bears. The spring guide 77 is also provided with a pair of spaced ears 83 (only one being shown) in which is securely mounted a pin 85 pressed by means of the spring 73 into a notch 87 in the apex of the latch member 27 thus biasing the latch member to latching position.

The manner of mounting the latch member 27 on the links 33 and 35 and the location of the several pivot points 37, 39, 41 and 43 provides a movable center C about which the latch member 27 pivots during its latching and unlatching movements. This center C is located at the intersection of a line A drawn through the centers of the pins 37 and 41, and a line B drawn through the centers of the pins 39 and 43. Referring to Fig. 1, it will be seen that the movable center C of the latch member 27 is located close to the latching point of contact of the latch member with the latch roller 69 so that the force applied by the accelerating spring 5 through the roller 69 is applied to the latch member by a short lever arm which tends to rotate the latch member clockwise about the movable center C at the intersection of the center lines A and B. Due to the arrangement of parts, the force tending to move the latch member in unlatching direction applies a comparatively light load to the tripping toggle 47-53 which in its slightly overset position restrains the latch member in latching position.

In order to operate the tripping toggle 47-53 to thereby permit unlatching movement of the latch mechanism and opening of the breaker, there is provided an electromagnetic trip device indicated generally at 89 (Fig. 1) which includes a vertically disposed tripping plunger 91 having its upper end disposed directly beneath the tail 61 of the tripping toggle link 53. In addition to the trip plunger 91, the trip device comprises a magnet core 93 of magnetic material, an energizing coil 95 mounted on one leg of the core 93, and a movable armature 97. The trip plunger 91 is secured to the center portion of the armature 97 and extends upwardly through a guide opening in the center portion of the core 93 and through an opening in the cylinder top 15.

The trip device 89 may be energized in any well known manner to effect tripping of the breaker. When the trip device is energized, the armature 97 is moved upwardly against the core 93 causing upward movement of the trip plunger 91. The upward movement of the trip plunger acts on the tail 61 to rotate the link 53 moving the knee 51 of the tripping toggle 47-53 over-center to the right of the center line 49-55, whereupon the accelerating spring 5, acting through the connecting train and the latch roller 69, moves the latch mechanism to the right causing complete collapse of the tripping toggle. The latch mechanism is shown in Fig. 3 in its unlatched position with the nose of the latch projection 67 resting against the side of the piston rod 19, being biased to this position by the spring 59.

During the early part of the unlatching move-

ment, the latch member 27 pivots in a clockwise direction about its movable instant center C, swinging the links 33 and 35 in counterclockwise directions about their respective pivots 37 and 39. The latch member 27 continues to pivot about its instant center C until the pin 41 passes to the right of a line drawn through the center of pins 37 and 43. Thereafter, continued upward movement of the latch roller 69 continues the counterclockwise movement of the link 33 but the link 35 reverses its direction of movement and rotates in a clockwise direction back approximately to its original position. The movement of the latch member continues toward the right and in a clockwise direction until the roller 69 moves above the latch projection 67 and the piston rod 19 engages the nose of the latch and holds the latch mechanism in the position shown in Fig. 2. During the early part of the unlatching action, the latch surface of the latch projection 67 travels with the upwardly moving roller 69 pivoting about the point C. It will thus be seen that there is no frictional load imposed on the point of contact of the latch with the latch roller 69. Since the latch surface moves with the latch roller 69 for at least a portion of the unlatching movement, a greater length of time may be used in withdrawing the latch to unlatching position. The load on the latch is released the instant the tripping toggle is operated by the trip device thereby permitting high-speed opening of the breaker.

During the unlatching movement of the latch mechanism the line of action of the spring 73 passes to the right of a center line through the pivots 37-41 and then biases the latch mechanism away from the piston rod 19 with a very small moment arm. This biasing force of the spring 73 is overcome by the force of the spring 59 which acts through the toggle links 53 and 47 to press the nose of the latching projection 67 against the side of the rod 19.

The breaker is adapted to be closed, following an opening operation, by compressed gas admitted to the cylinder 13 above the piston 17. Compressed gas is admitted from an auxiliary reservoir or tank 99 to the upper end of the cylinder 13 through an inlet passage 101 controlled by a main inlet valve indicated generally at 103 secured to the side of the casting 11. The opening operation of the main inlet valve 103 is, in turn, controlled by an electromagnetically operated pilot valve 105. The valve mechanism is fully disclosed in copending application Serial No. 410,686, filed September 13, 1941, of J. M. Cumming and R. C. Cunningham and assigned to the assignee of the present invention. For this reason, a detailed disclosure of this mechanism is not included herein since reference may be had to the above-noted application for a complete understanding thereof.

The pilot valve 105 is operated by the electromagnet 107 which, when energized, causes opening of the pilot valve to admit compressed gas from the tank 99 to operate the main inlet valve 103. Actuation of the main inlet valve admits compressed gas to the upper end of the operating cylinder 13 which drives the piston 17 quickly downwardly to close the breaker.

When the mechanism is operated to the closed position, the piston rod 19 and the connecting member 23 move downwardly carrying the latch roller 69 past the latching projection 67 of the latch member 27. As soon as the roller passes below the projection 67, the spring 59 acts to move the line of action of the spring 73 over-

center to the left of the line 37-41. The spring 13 aided by the spring 59 is then effective to reverse the movement of the latching mechanism and reengage the latching projection 67 with the roller 69. During the relatching movement, the link 33 swings clockwise and the link 35 moves first counterclockwise and then clockwise to its normal position. During the latter part of this movement the latch surface of the latch member 27 follows the roller 69 downwardly; the latch 27 rotating in a counterclockwise direction about its instant center C until the toggle 47-53 is moved to its overset position by the spring 59. The breaker is now latched in its closed position as shown in Fig. 1.

For illustrative purposes, the invention is shown applied to a compressed gas-operated closing mechanism for a circuit breaker. It will be obvious, however, that the latch mechanism is admirably adapted for use with other types of operating mechanisms such, for instance, as a solenoid-operated mechanism.

It will be apparent from the foregoing description that there is provided an inexpensive latch mechanism which permits high-speed opening of the breaker by quickly releasing the load and by permitting the holding latch surface to travel a predetermined distance with the releasable mechanism. Since there is no frictional load on the latch, it may be made of ordinary steel instead of hardened steel heretofore used for latch mechanisms. Another advantage of the invention is that no special devices are needed to hold the latch open when the breaker is open.

Having described the invention in accordance with the patent statutes, it is to be understood that various changes and modifications may be made in the structural details thereof without departing from some of the essential features of the invention. It is, therefore, desired that the language of the appended claims be given as reasonably broad interpretation as the prior art permits.

I claim as my invention:

1. In a circuit breaker provided with a biased member releasable to permit opening of the circuit, in combination, a latch for engaging and restraining said releasable member in closed position, a plurality of movable support members for said latch, one of said support members being collapsible to permit unlatching movement of said latch, said support members being disposed to permit a portion of said latch to travel with said releasable member during at least a portion of the unlatching movement.

2. In a circuit breaker provided with a biased member releasable to effect opening of the circuit, in combination, a latch member for engaging and restraining said member in closed position, a plurality of support members for pivotally supporting said latch at different points, means biasing said latch to latching position; a toggle for restraining said latch in latching position and operable to release the latch to thereby cause release of said releasable member; said support members permitting the latch engaging portion of the latch to travel with the releasable member during a portion of the opening movement thereof.

3. In a circuit breaker provided with a releasable member biased to effect opening of the circuit, in combination, a latch member biased to latching position for engaging and restraining said releasable member in closed position, a plurality of support means for supporting said latch

for floating movement in latching and unlatching directions, a toggle for restraining said latch in latching position, said toggle when actuated permitting the latch to release said releasable member.

4. In a circuit breaker provided with a biased member releasable to effect opening of the circuit, in combination, a floating latch biased to latching position for engaging and restraining said member in closed position, a toggle biased to an overset position for holding said floating latch in latching position, and means for actuating said toggle to cause the floating latch to release said member, said latch being supported in a manner to permit the latch portion of the latch to travel with said member during a part of the unlatching movement.

5. In a circuit breaker provided with a biased member releasable to permit opening of the circuit, in combination, a latch for engaging and restraining said releasable member in closed position, means biasing said latch to latching position, a tripping toggle for restraining said latch in latching position, said toggle being operable to permit movement of said latch to unlatching position, means supporting said latch to permit the latching portion thereof to travel with said releasable member during a part of the unlatching movement, and spring means biasing said tripping toggle to restraining position, said releasable member being effective in the open position to restrain said latch in unlatching position and to restrain said tripping toggle in non-restraining position.

6. In a circuit breaker provided with a biased member releasable to effect opening of the breaker, in combination, a floating latch for engaging and restraining said releasable member in closed position, an overcenter spring normally biasing said latch to latching position and operable during the unlatching movement to bias said latch in unlatching direction, means for releasably restraining said latch in latching position, said means being operable in response to abnormal circuit conditions to release said latch, and means supporting said latch to permit the latching surface thereof to travel with the releasable member during the first part of the unlatching movement said overcenter spring during the latter part of the latching movement acting to move said latch quickly to latching position.

7. In a circuit breaker, an operating rod movable with the breaker, a latch roller on said rod, a latch for engaging said roller to releasably restrain the breaker in closed position, a plurality of movable support members for said latch, means for restraining said latch in latching position, said means being operable to permit unlatching movement of said latch, and said support members being disposed to permit the latching surface of the latch to travel with said roller during a portion of the unlatching movement.

8. In a circuit breaker having a biased member releasable to effect opening of the breaker, a latch for engaging and restraining said releasable member in closed position, an overcenter spring normally biasing said latch to latching position, restraining means for releasably restraining said latch in latching position, means for operating said restraining means to release said latch, means supporting said latch in a manner to permit the latching surface thereof to travel in the same direction as the releasable member during at least a portion of the unlatching movement of said latch, said overcenter

spring acting during the latter part of the unlatching movement of said latch to bias the latch in unlatching direction.

9. In a circuit breaker comprising an operating member biased to cause opening of the breaker, a latch for engaging a part movable with said operating member to restrain said member in closed position, means for holding said latch in latching position, said means being operable to permit movement of said latch to unlatching position, and an overcenter spring normally biasing said latch to latching position, said spring moving over center during movement of said latch to unlatching position to bias said latch in unlatching direction.

10. In a circuit breaker having a member releasable to effect opening of the breaker, a floating latch for engaging and restraining said releasable member in closed position, an overcenter spring normally biasing said latch to latching position, a toggle for positively holding said latch in latching position, means for actuating said toggle to permit said latch to move to unlatching position to thereby release said releas-

able member, said overcenter spring during movement of said latch to unlatching position moving over center to bias said latch in unlatching direction, a spring biasing said toggle to holding position and operable to start said latch in latching direction, said overcenter spring during movement of said latch in latching direction moving over center to actuate said latch to latching position.

11. In a circuit breaker provided with a biased member releasable to effect opening of the circuit, a latch member supported on a pair of pivoted links having their axes intersecting near the latch point for releasably restraining said biased member, and releasable means for controlling the movement of said latch on said pivoted links.

12. In a circuit breaker provided with a member biased to effect opening of the breaker, a floating latch having no fixed pivot, but having an instant pivot near the latch point for releasably restraining said biased member, and releasable means for controlling movement of said floating latch about said instant pivot.

ROSSELL C. VAN SICKLE.