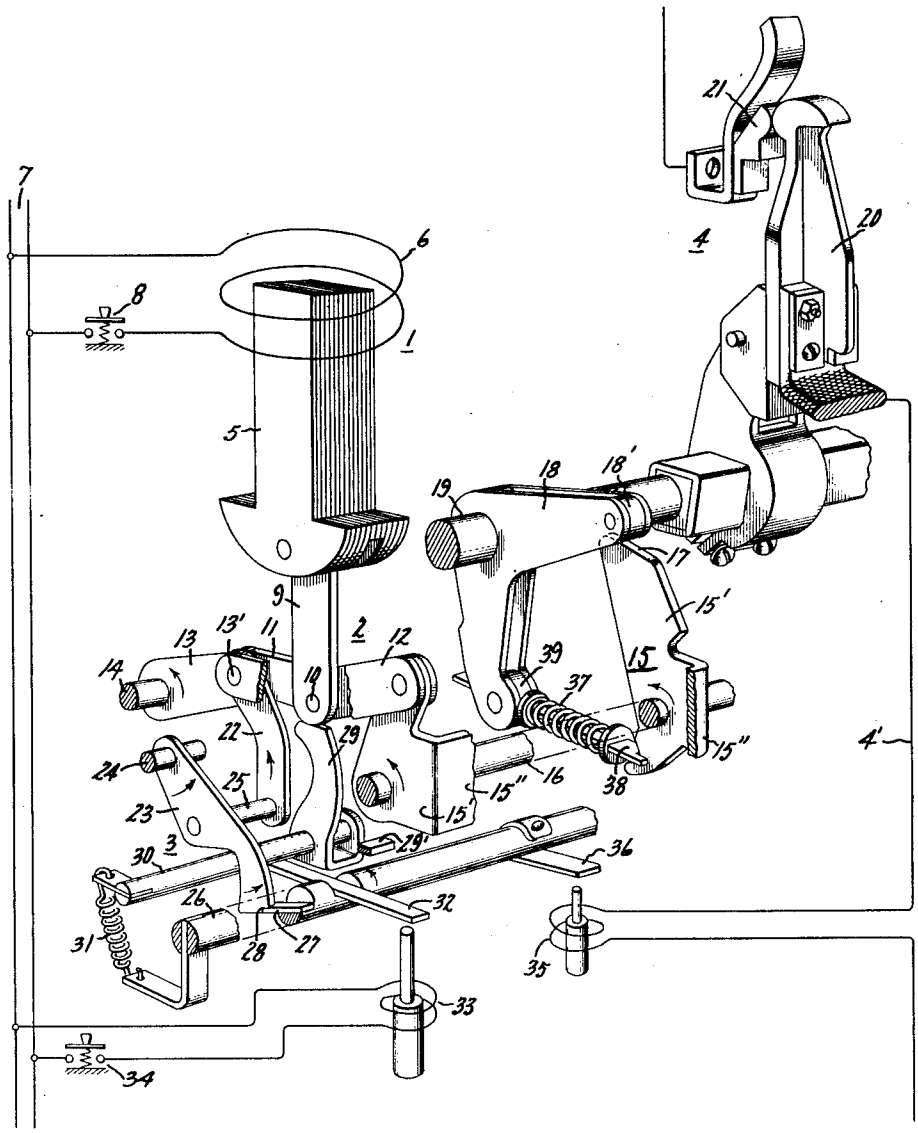
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OPERATING MECHANISM

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Inventors:
Winfield A. Atwood,
George Rudolph,
by Harry E. Dunham
Their Attorney.

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OPERATING MECHANISM

Winfield A. Atwood, Yeadon, and George Rudolph, Manoa, Pa., assignors to General Electric Company, a corporation of New York

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Our invention relates to operating mechanisms, more particularly to operating mechanisms of the trip-free type having application to electric circuit breakers and the like, and has for its principal object the provision of an improved operating mechanism that is simple, compact and rugged in construction, positive, efficient and rapid in operation, and suitable for the operation of either single or multipole circuit breakers and the like.

Our invention will be more fully set forth in the following description referring to the accompanying drawing, and the features of novelty which characterize our invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

Referring to the drawing, the single figure thereof is a perspective view, partly in section and partly diagrammatic, of an electric circuit breaker mechanism of the solenoid operating type embodying the present invention.

The complete operating mechanism illustrated by way of example may comprise a solenoid or suitable actuating means generally indicated at 1, a main operating linkage or toggle 2, a tripping device for the toggle mechanism generally indicated at 3 and the means to be actuated comprising in the present instance an electric circuit breaker 4.

The operating solenoid 1, which obviously can be replaced by any suitable type of manual or motive device, comprises a reciprocally guided plunger 5 operable within the energizing coil diagrammatically indicated at 6. The solenoid is shown as being operated from a control source 7 through a push-button control switch 8, but any suitable method of control may be used.

The main operating toggle 2, which comprises a pair of interconnected links 11 and 12, is operatively connected to the solenoid plunger 5 or actuating means by a link 9 at the toggle joint or knee 10. The link 11 is connected to a guide link 13 having a fixed pivot at 14 and the link 12 to a crank 15 that is rotatable on a fixed shaft 16.

The crank 15, which is operated by the toggle 2, in a manner presently to be described, comprises a generally U-shaped member having substantially parallel sides 15' through which the shaft 16 extends, interconnected by an integral transverse strip 15'' extending parallel to the shaft. The crank at one side is provided with a cam surface 17 adapted to coact with a circuit breaker crank 18 which is rigidly connected through a rotatable countershaft 19 to the movable arm 20 of the circuit breaker 4. When the crank 15 is rotated clockwise as viewed by straightening of the main toggle 11—12 in response to elevation of the solenoid plunger, the cam face 17 bearing on the roller 18' of the breaker crank rotates the breaker shaft 19 in counterclockwise direction whereby the movable contact structure 20 of the circuit breaker 4 is moved into contact engagement with the stationary contact structure 21. This movement, or working stroke of the breaker structure 20 is generally in opposition to spring pressure tending to bias the breaker to open circuit position.

For the purpose of holding the toggle 11—12 at the pivot 13' in thrust-transmitting position with respect to the crank 15 the toggle guide link 13 is related to suitable latching and tripping means comprising a link 22 connected to the toggle pivot 13' and to a latch 23 having a fixed pivot at 24. The members 22 and 23 are suitably interconnected as at 25 for insuring a force-reducing connection. Coacting with the latch 23 is a rotatable tripping shaft 26 to which is secured a detent member 27 adapted to engage the latch 23 at the notched portion 28.

In the position shown collapse of the toggle 11—12, that is, counterclockwise rotation of the toggle pivot 13' and dropping of the knee joint, is restrained by the latch 23 and detent 27. Tripping movement, that is, counterclockwise rotation of the tripping shaft 26, effects release of the latch 23 so that it is free to rotate counterclockwise for releasing the pivot 13' and permitting collapse of the toggle.

In the closed circuit or restraining position shown the tripping means 3 is latched and the toggle is held in an under-set extended position by a prop 29 adapted to support the knee 10 of the toggle. The prop is shown as being secured to a rotatable shaft 30 that is resiliently connected by a spring 31 as illustrated to the tripping shaft 26 so as to facilitate resetting of both the prop and the latching means after a circuit opening or releasing operation of the mechanism.

Referring more particularly to the tripping means, the tripping shaft 26 is provided with an offset portion or arm 32 for coacting with a tripping means 33 that is shown as a solenoid energized from the control source 7 by a switch 34. The member 32 obviously may also be engaged by manual tripping means. The conventional overload tripping coil 35 shown as energized from the main circuit at 4' also coacts with the tripping shaft at 36, operation of any tripping means causing counterclockwise rotation of the tripping

shaft and release of the main toggle. The movement of the parts during the opening or releasing operation is indicated by the direction arrows.

The breaker crank 18 is also connected to the crank 15 by means of a compression spring 37 guided on a member 38 engaging one end of the crank 15 and having a guided sliding connection at 39 with an arm of the crank 18. In the closed circuit position shown the spring 37 is under compression so that immediately upon release of the tripping latch collapse of the toggle 11—12 is accelerated by the stored spring energy, resulting in rapid movement of the cam surface 17 away from the roller 18'. The circuit breaker crank 18 is also acted upon throughout the breaker opening stroke by the spring 37 tending to accelerate separation of the contacts 20 and 21. During the closing operation when the crank 15 is rotated clockwise the spring 37 is placed under compression by reason of the comparatively long lever arm of the crank 18 acting in the opposite direction on the spring.

When the toggle 11—12 is released in response to a tripping operation, the toggle pivot 13' is free to rotate counterclockwise about pivot 14 thereby causing shifting of the toggle knee 10 from the end of the prop 29 and permitting free collapse of the toggle. When this occurs the pivot 13' reverses its movement and drops so that the latch 23 can return to its initial position during which return movement it rides over the latch detent 27 and resets in the position illustrated. The prop 29 is suitably shaped as illustrated for permitting free movement of the toggle knee 10 alongside the prop.

The resilient connection 31 between the trip shaft 26 and the prop shaft 30 biases the tripping detent into latching engagement after the latch 23 in dropping pushes down on and passes by the latch detent 27, the latter snapping into reset position due to the bias of spring 31. At the same time the spring 31 exerts a counterclockwise bias on the prop 29 urging it against the side of link 9 so that when the links 11 and 12 are raised to toggle position in a subsequent closing operation, the prop 29 is snapped beneath the toggle knee 10 to hold the mechanism in closed position independently of the actuating means or solenoid 1. A stop member 29' is provided for preventing movement of the prop beyond the toggle knee.

It will therefore be noted that the mechanism is trip-free in operation since at any time during the closing stroke release of the toggle pivot 13' in response to a tripping operation causes freeing and subsequent collapse of the toggle and opening of the circuit breaker. The opening speed is very rapid due to the fact that the main toggle can simply shift laterally off the prop 29 to open the breaker. Actual breaking of the toggle is therefore unnecessary to initiate the opening movement. In the case of trip-free operation wherein the solenoid 6 is energized, the toggle remains in the extended position shown during the opening stroke. The resetting operation then depends on deenergization of the solenoid in order that the latch 23 may drop to its latching position. The circuit breaker can if desired have separate means such as springs for normally biasing the same toward open circuit position.

It should be understood that our invention is not limited to specific details of construction and arrangement thereof herein illustrated, and that changes and modifications may occur to one skilled in the art without departing from the spirit of our invention.

What we claim as new and desire to secure by Letters Patent of the United States is:

1. Operating mechanism comprising actuating means, a linkage operatively connected to said means, tripping means for holding said linkage in thrust-transmitting position, a crank operatively connected to said linkage and a cam actuated by and movable with said crank, said cam being offset along the axis of rotation of said crank.

2. Operating mechanism comprising actuating means, a linkage operatively connected to said means, a tripping device for holding said linkage in thrust-transmitting position, a crank comprising a U-shaped structure operatively connected to said linkage at one side thereof, the opposite side of said structure being formed as a cam for coacting with means to be actuated.

3. Operating mechanism comprising actuating means, a crank including a cam portion operatively connected to said means, a second crank connected to a circuit breaker operable between open and closed circuit positions and coacting with said cam portion, and a resilient connection between said cranks, said connection being stressed during the movement of said first crank toward circuit-closing position for accelerating the circuit-opening movement of said second crank.

4. Operating mechanism comprising a collapsible linkage, a tripping device for holding said linkage in thrust-transmitting position, means to be actuated, and a spring operatively interconnecting said means and said linkage arranged so as to be stressed when said linkage effects a working stroke of said means, said spring being effective to accelerate the collapse of said linkage in response to actuation of said tripping device.

5. Operating mechanism comprising a collapsible linkage, a tripping device for holding said linkage in thrust-transmitting position, a cam connected to said linkage, a crank coacting with said cam connected to means to be actuated, said cam and crank being rotatable in opposite directions during a working stroke of said cam, and a spring arranged in compression between said cam and crank so as to be effective to cause acceleration of the collapse of said linkage and opening movement of said crank in response to actuation of said tripping device.

6. Operating mechanism comprising actuating means, a toggle operatively connected thereto, a guide link connected to one end of said toggle and a crank connected to the other end, said crank including a cam portion, a tripping device connected to said toggle and guide link for restraining that end of said toggle in thrust-transmitting position, a prop for likewise supporting the knee of said toggle, a second crank connected to means to be actuated and coacting with said cam portion, and a resilient connection between said cranks for accelerating movement of said second crank when said tripping device is actuated causing collapse of said toggle and reverse movement of said first crank.

7. Operating mechanism comprising actuating means, a linkage operatively connected thereto, a tripping device for holding said linkage in thrust-transmitting position, a prop for likewise restraining said linkage at a joint thereof, and a resilient connection between said prop and tripping device for normally biasing both said prop

and said tripping device to the reset positions thereof.

8. Operating mechanism comprising a main toggle adapted to be straightened for effecting a working stroke, a tripping device including a rotatably mounted tripping shaft for holding a portion of said toggle in thrust-transmitting position, a rotatably mounted prop adapted to engage the knee of said toggle for likewise holding the same in its straightened position, and a spring interconnecting said prop and said tripping shaft, said spring being placed under tension upon operation of said tripping shaft to release said toggle whereby said prop and said shaft are both biased toward reset positions.

9. Operating mechanism comprising an actuating solenoid, a toggle connected at the knee joint thereof to said solenoid, a tripping device including a latch for restraining one end of said toggle in thrust-transmitting position, a crank to be connected to the other end of said toggle, a prop for holding said toggle knee joint in extended position, said crank including a cam portion, a second crank operatively connected to a circuit breaker member coacting with said cam portion, and a spring interconnecting said cranks adapted to be stressed when said first crank is operated to effect closing movement of said circuit breaker member, said spring being effective to accelerate the collapse of said toggle and the opening movement of said member upon release of said tripping latch.

10. A circuit breaker operating mechanism comprising an actuating linkage, a crank operatively connected to said linkage, a cam mounted with respect to said crank for movement therewith, a rotatable circuit breaker element operatively related to said cam, and a resilient connection between said cam and breaker element for accelerating the circuit opening operation.

11. A circuit breaker operating mechanism comprising an actuating toggle, pivoted tripping means for holding said toggle in thrust-transmitting position, a cam shaft operated by said toggle, a circuit breaker element operatively related to said cam shaft, and a pivoted prop for holding said toggle in an underset extended position, the axes of said tripping means and prop being compactly grouped with respect to said cam shaft.

12. A circuit breaker operating mechanism comprising actuating means, a toggle operatively connected at its knee to said means, a circuit breaker element adapted to be moved to closed circuit position in response to straightening of said toggle, a latch for holding one end of said toggle in a thrust-transmitting position, a prop for likewise holding said toggle knee in an underset position when extended, and a spring common to and interconnecting said latch and prop for biasing the same towards reset positions.

WINFIELD A. ATWOOD.
GEORGE RUDOLPH.