Jan. 4, 1949. R. J. BASKERVILLE 2,458,240

OPERATING MECHANISM FOR ELECTRIC CIRCUIT BREAKERS

Filed Dec. 9, 1944

Fig. 1.

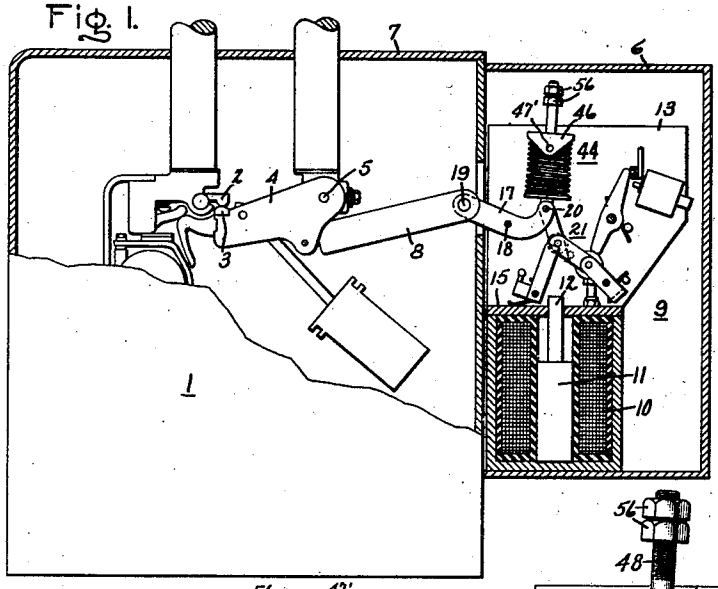


Fig. 2.

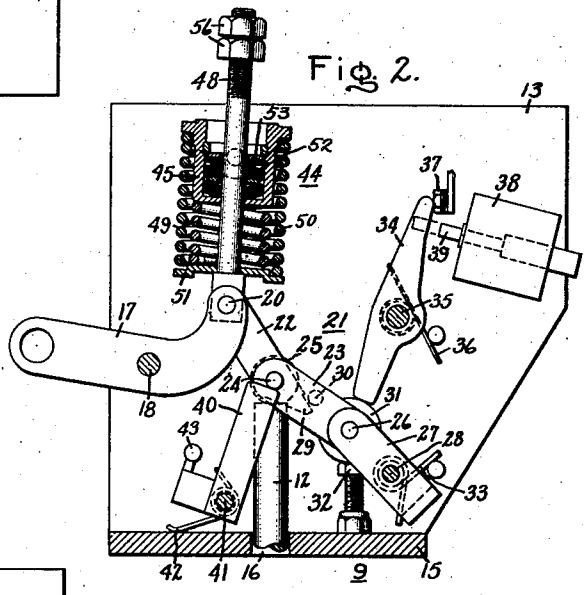


Fig. 4.

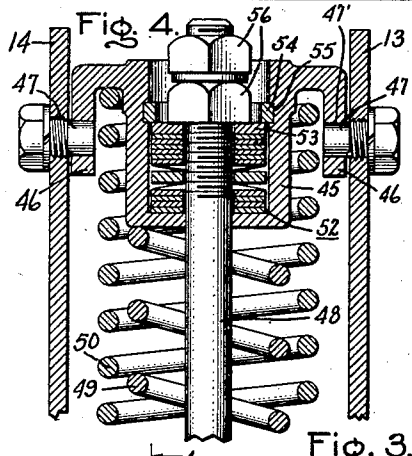
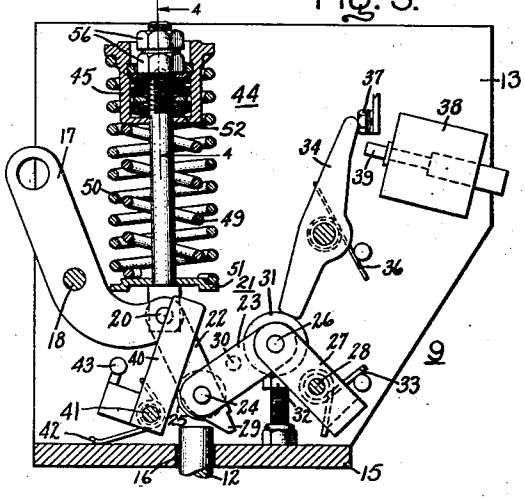


Fig. 3.



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OPERATING MECHANISM FOR ELECTRIC CIRCUIT BREAKERS

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3 Claims. (Cl. 200—166)

1

My invention relates to operating mechanisms for electric circuit breakers, and more particularly to operating mechanisms of the trip-free type wherein the means to be actuated may be instantly released either during or after the period of actuation independently of the actuating or motive means.

The operation of apparatus such as electric circuit breakers or switches by trip-free mechanisms is an old and well known practice. Such operating mechanisms were usually modified in accordance with the particular type of circuit breaker to which they were applied and means for relating the operating mechanisms to various devices such as opening springs or buffing and damping devices had to be provided. Needless to say such arrangements were complicated, expensive, and did not lend themselves well to general application without elaborate changes and the like.

It is therefore the principal object of my invention to provide a new and improved unitary operating mechanism for an electric switch or circuit breaker comprising a trip-free type of mechanism including opening spring means and buffer devices.

It is another object of my invention to provide a new and improved operating mechanism of the trip-free type for electric switches or circuit breakers which is simple and compact, of sturdy construction, and simple to manufacture.

Further objects and advantages of my invention will become apparent as the following description proceeds and the features of novelty which characterize my invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

For a better understanding of my invention reference may be had to the accompanying drawing in which Fig. 1 is an elevational view partly in section of an electric circuit breaker employing the operating mechanism of my invention; Fig. 2 is an enlarged view of a portion of Fig. 1 illustrating the operating mechanism at a predetermined point during the closing operation of the electric circuit breaker; Fig. 3 is a view similar to Fig. 2 showing the operating mechanism in the position which it assumes with the associated circuit breaker in the fully open position; and Fig. 4 is an enlarged sectional view taken on the line 4—4 of Fig. 3, assuming that no parts of Fig. 3 are cut away.

Although the operating mechanism of my invention is applicable to various forms of electric circuit breakers and switches, I have chosen to

2

illustrate it specifically as applied to circuit breakers of the type disclosed in Linde Patents 2,293,513 and 2,335,068, granted August 18, 1942 and November 23, 1943, respectively, and assigned to the same assignee as the present application. This circuit breaker is generally indicated in Fig. 1 by the numeral 1 and comprises a pair of relatively movable contacts 2 and 3. The contact 3 is a movable contact and is supported on an arm 4 rotatable about a pivot 5. The operating mechanism of my invention is mounted in a housing 6 closely associated with the housing 7 of the circuit breaker 1. A suitable link 8 interconnects pivotally mounted arm 4 with the operating mechanism of my invention, generally indicated at 9.

The motive means for operating mechanisms for electric circuit breakers, as will be understood by those skilled in the art, might be a fluid motor, electric motor, solenoid or any suitable means. For the purpose of illustrating my invention the motive means of the operating mechanism 9 of my invention is illustrated as a solenoid 10 comprising a vertically movable armature 11 attached to an operating plunger 12. Solenoid 10, as illustrated in the drawings, is mounted beneath the trip-free linkage of the operating mechanism which is supported between a pair of parallel side plates 13 and 14, best shown in Fig. 4. Side plates 13 and 14 in effect form a housing for the trip-free linkage and associated parts of my invention and preferably the solenoid 10 is supported from these parallel plates or a base plate 15 associated therewith. Base plate 15 is provided with an opening 16 through which plunger 12 may extend.

The thrust-transmitting linkage providing the trip-free mechanism comprises the operating crank 17, pivotally mounted at 18 between plates 13 and 14. One end of operating crank 17 is pivotally connected as at 19 to link 8. The other end of operating crank 17 is curved and is connected by pivotal means as indicated at 20 to a collapsible or floating linkage, generally indicated at 21. This linkage 21 is very similar to that disclosed and claimed in Thumim Patent 1,827,626, granted October 13, 1931, and assigned to the same assignee as the present application.

Floating or collapsible linkage 21 comprises the link 22 and the link 23 pivotally related by a shaft having an extension 24. A suitable roller 25 is also mounted on the shaft having the extension 24. The free end of link 22 is connected with the curved end of operating crank 17 as is indicated at 20. The free end of link 23 is

pivotally connected as is indicated at 26 with a crank 27 rotatable about a fixed pivot 28 supported between plates 13 and 14. It will be observed from the drawings that links 22 and 23 form a toggle with the shaft having the extension 24 as the knee joint thereof. The plunger 12 is adapted in its upward movement to engage the roller 25 positioned at the knee of the toggle and upward movement thereof to the position indicated in Fig. 2 straightens the toggle comprising links 22 and 23 and causes rotation of operating crank 17 in a counter-clockwise direction about pivot 18. The limiting movement of the toggle comprising links 22 and 23 is determined by an extension 29 on link 22 which cooperates with a pin 30 on link 23 in a manner which is clearly obvious from Fig. 2.

Rotatable about the axis of pivot 26 between the pair of links 23 and a U-shaped crank or lever 27 is trip-latch roller 31 which is adapted to rest on a stop bolt 32 supported from the plate 15, the proper height of which may be adjusted in a manner which is obvious from the drawing. A suitable resetting spring 33 tends to rotate lever 27 in a counter-clockwise direction so that trip-latch roller 31 tends to be in engagement with stop bolt 32. It will be obvious from a study of Figs. 2 and 3 that if trip-latch roller 31 is maintained in a fixed position against stop bolt 32, a force applied to toggle roller 25 will cause rotation of operating crank 17 about pivot 18. If, however, trip-latch roller 31 is free to move away from stop bolt 32, then the thrust-transmitting linkage collapses toward the right and rotation of operating crank 17 will not occur for the toggle links 22 and 23 straighten out to cause crank 27 to rotate clockwise against the bias of its resetting spring 33. In order to hold trip-latch roller 31 against stop bolt 32, thereby to control the collapsible linkage, there is provided a trip-latch 34 pivotally mounted at 35 to side plates 13 and 14. A trip-latch spring 36 biases trip-latch 34 to the position indicated in Figs. 2 and 3 against stop 37. In this position trip-latch 34 holds trip-latch roller 31 in a fixed position against stop bolt 32. A suitable trip-coil 38 positioned in the manner disclosed and claimed in Thumim Patent 1,988,287, granted January 15, 1935, and assigned to the same assignee as the present application, is provided. When the plunger 39 associated with trip-coil 38 is moved to the dotted position indicated in Fig. 2, trip-latch 34 is rotated so that trip-latch roller 31 is free to move with lever 27 about pivot 28 causing collapse of the collapsible linkage 21.

In order to restrain the collapsible linkage 21 in the thrust-transmitting breaker-closed position indicated in Fig. 2, a pivotally mounted prop 40 is provided rotatable about a shaft 41 supported between side plates 13 and 14. A suitable spring 42 biases prop 40 in a clockwise direction against a stop 43. When the collapsible linkage 21 is moved to the position indicated in Fig. 2 by plunger 12 prop 40 moves under the extension 24 of the shaft forming the knee of the toggle comprising links 22 and 23 to hold the linkage in the thrust-transmitting position even though plunger 12 returns to the position indicated in Fig. 1.

In order to cause high speed opening of the circuit breaker 1, circuit breaker opening springs are usually provided which in addition require buffer or dashpot means to cushion the opening movement near the end of the opening stroke to prevent damage to the mechanism. In accordance with my invention I provide a combined opening spring and buffing device generally indicated at 44 which is an integral part of the operating mechanism or in other words, an operating mechanism is provided including in a unitary structure a collapsible trip-free linkage, opening springs and a buffing device. The combined opening spring and buffing device of my invention comprises a cylindrical housing 45 having integral extensions 46 forming a yoke. This yoke is pivotally mounted between side plates 13 and 14. Each of the side plates is provided with a swivel pin 47 engaging an opening 47' in the associated integral extension 46 of cylindrical housing 45. Swivel pins 47 are really extensions of bolts threadedly mounted in plates 13 and 14 as is clearly shown in Fig. 4. A suitable guide rod 48 extends through an opening in cylindrical housing 45 and the lower end thereof is pivotally connected to operating crank 17 and link 22 as indicated at 20. The cylindrical housing 45 with the integral extensions 46 forms a base from which the inner kick-off spring 49 and the outer follow-up spring 50 bias the crank 17 and consequently the circuit breaker 1 to the open position by exerting a downward opening force against the guide rod crosshead 51. In this manner the opening springs 49 and 50 exert a force directly against operating crank 17 and during the operation of the opening springs the pivoted yoke comprising elements 45 and 46 is free to swing on its pivot bearings in accordance with the angular movement of guide rod 48 so that the spring force will always be applied in its most efficient manner.

Within cylindrical housing 45 are stacked suitable buffing elements such as spring washers, leather disks, and washers of other suitable shock-absorbing materials. These buffing elements are generally indicated at 52 and are provided with central openings through which guide rod 48 can extend. On top of the buffing element 52 is a striker plate 53 also provided with a central opening through which guide rod 48 can extend. A retainer ring 54 positioned in a recess 55 within cylindrical housing 45 maintains the striker plate 53 and buffing elements 52 in the position indicated in the drawing. The end of guide rod 48 is threaded and provided with a pair of stop nuts 56 which engage striker plate 53 near the end of the opening stroke whereupon the buffing elements cushion the final opening movement of the operating mechanism. It will be observed that the combined buffing and opening spring device makes a convenient bench assembled unit for easy installation and removal by means of the swivel pins 47 which screw into side plates 13 and 14.

In view of the detailed description included above, the operation of the circuit breaker operating mechanism of my invention will be obvious to those skilled in the art. With the circuit breaker in the closed position, as indicated in Fig. 1, energization of trip coil 38 will permit trip-latch roller 31 to move away from stop bolt 32 whereupon the extension 24 of the toggle pivot shaft moves off from prop 49 with the consequent collapse toward the right of the linkage 21 that finally resets to the position indicated in Fig. 3. The opening springs 49 and 50 acting against cross head 51, while causing the rapid collapse of the linkage 21, at the same time will rotate operating crank 17 to cause high speed opening of the circuit breaker 1. Near the end of the opening stroke stop nuts 56 on guide rod 48 engage striking plate 53 of the buffing device whereupon the buffing elements 52 become effective to cushion the final opening movement. Closing of the

circuit breaker is obtained by energization of solenoid 10 which causes plunger 12 to move up from the position indicated in Fig. 3 to the position indicated in Fig. 2 with the consequent thrust-transmitting movement of the linkage 21 to its latch-restrained position of Fig. 2. This operation causes rotation of operating crank 17 and recharging of opening springs 49 and 50. During both the opening and closing operation the combined opening spring and buffing device 44 is free to pivot about swivel pins 47.

My new and improved operating mechanism may readily be applied to various circuit breakers and the desired high speed opening operations and cushioning operation of the circuit breaker which are inherent in my device, will be automatically supplied to the circuit breaker.

It should be understood that my 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 my invention.

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

1. An arrangement for imparting opening force to a pivotally mounted main operating member of an electric circuit breaker to open said circuit breaker and for arresting the opening operation of said circuit breaker comprising a pivotally mounted yoke member, a rod pivotally connected to said main operating member and slidable through an opening in said yoke member, spring means interposed between said yoke member and said main operating member for biasing said circuit breaker to the open position, said yoke member being movable about its pivotal support in such a way that the bias of said spring means is effective throughout the opening operation of said circuit breaker, cushioning material mounted on said yoke member, and a projection on said rod for engaging said cushioning material near the end of the opening operation of said circuit breaker.

2. An arrangement for imparting opening force to a pivotally mounted main operating member of an electric circuit breaker to open said circuit breaker and for arresting the opening operation

of said circuit breaker comprising a pivotally mounted yoke member, a plurality of shock absorbing apertured discs mounted in said yoke member, a rod pivotally connected at one end thereof to the main operating member and slidable through an opening in said yoke member and through the apertures in said discs, a projection on the opposite end of said rod for engaging said shock absorbing discs near the end of the opening operation of said circuit breaker, and spring means interposed between said yoke member and said main operating member for biasing said circuit breaker to the open position.

3. An arrangement for imparting opening force to a pivotally mounted main operating member of an electric circuit breaker to open said circuit breaker and for arresting the opening operation of said circuit breaker comprising a pivotally mounted yoke member, a plurality of yieldable apertured discs mounted in said yoke member, a rod pivotally connected at one end thereof to the main operating member and slidable through an opening in said yoke member and through the apertures in said discs, a projection on the opposite end of said rod for engaging said yieldable discs near the end of the opening operation of said circuit breaker, and a plurality of compression springs interposed between said yoke member and said main operating member and surrounding said rod for biasing said circuit breaker to the open position.

RALPH J. BASKERVILLE.

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