Aug. 15, 1944. J. K. HODNETTE ET AL 2,356,055

SWITCH OPERATOR

Filed July 15, 1941 2 Sheets-Sheet 1

Fig. 1.

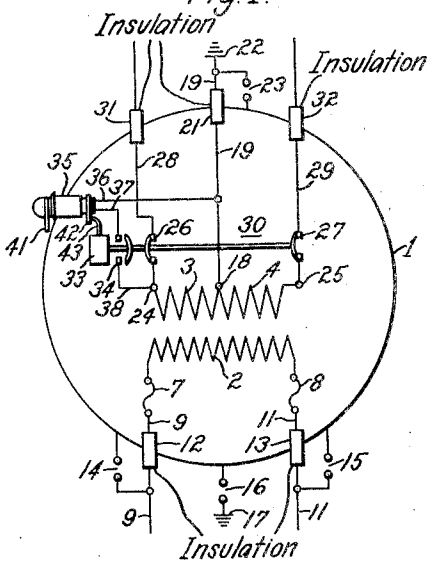


Fig. 2.

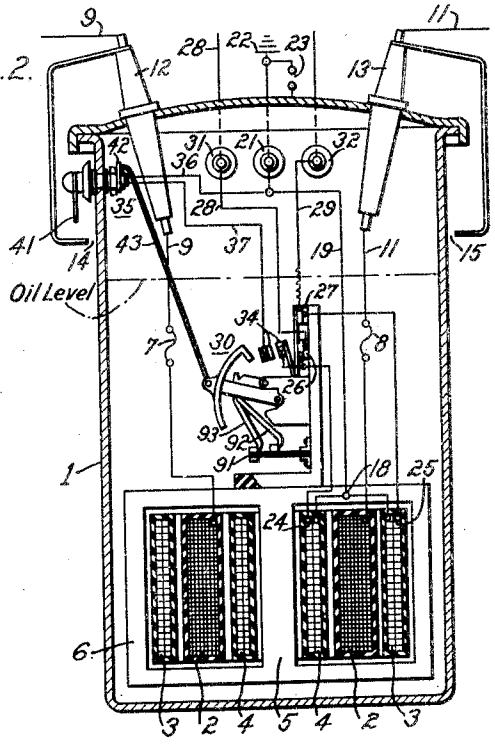


Fig. 3.

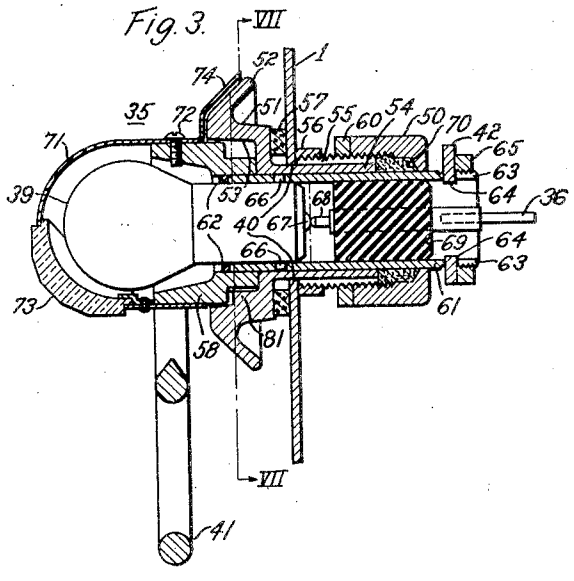
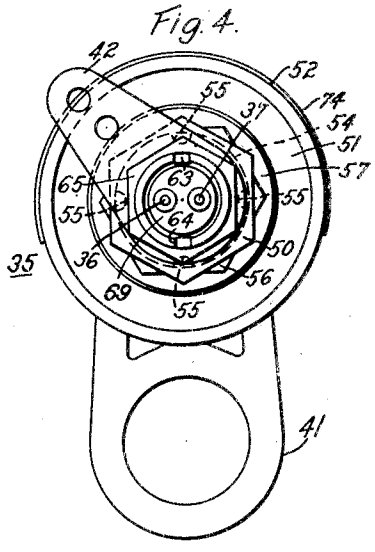


Fig. 4.



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Fig. 5.

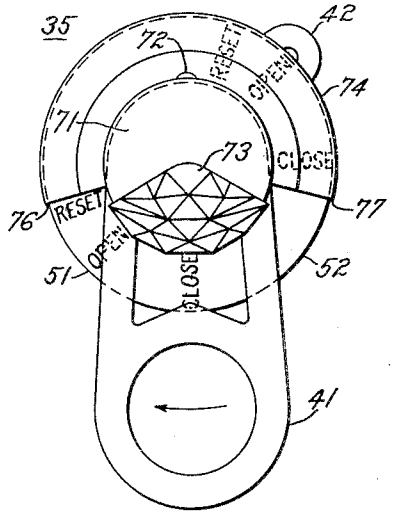


Fig. 6.

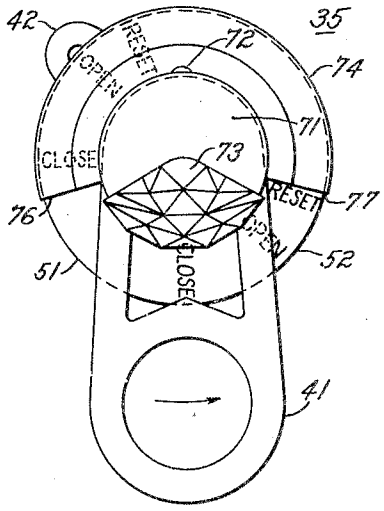


Fig. 7.

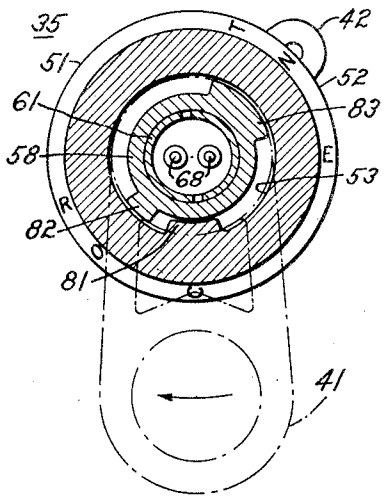
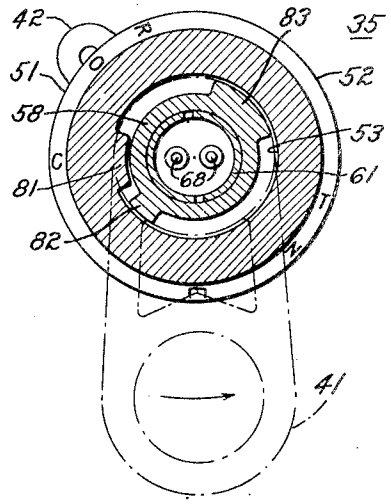


Fig. 8.



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Patented Aug. 15, 1944 2,356,055

UNITED STATES PATENT OFFICE

2,356,055

SWITCH OPERATOR

John K. Hodnette, Merrill G. Leonard, and Percy Sellers, Sharon, Pa., assignors to Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., a corporation of Pennsylvania

Application July 15, 1941, Serial No. 402,494

6 Claims. (Cl. 200—116)

The invention relates to a signal device and switch operating mechanism for electrical apparatus, such as transformers.

In certain types of distribution transformers for supplying electrical power to a distribution or load circuit, it is customary to use both a signal device for indicating a predetermined load on the apparatus and a circuit breaker for unloading the apparatus when the load increases to a greater predetermined value. The signal device is adjusted to indicate that the apparatus is operating at some predetermined overload approaching the danger point of overloading the apparatus, and the circuit breaker is adjusted to unload the apparatus at a somewhat greater overload thereon if no steps are taken to decrease the load on the apparatus.

It has been usual practice to provide a signal device and circuit breaker operating mechanism as separate devices individually mounted on different parts of the wall of the apparatus casing. It has also been the practice to provide a circuit breaker operating mechanism having a control handle that is actuated through a single sequence of control positions from the initial position, such as from closed position as the initial position, through open position to reset position, in the order named.

It is an object of this invention to provide a combined signal means and circuit breaker operating mechanism in a single device.

It is a further object of the invention to provide a circuit breaker operating mechanism for a circuit breaker that is provided with a manually operable control portion that may be arranged to operate in a selected one of two directions from its initial position.

Other objects and advantages of the invention will be apparent from the following description of a preferred embodiment thereof, reference being had to the accompanying drawings, in which:

Figure 1 is a diagrammatic view of circuits and apparatus comprising a transformer in which the signal and switch operating mechanism of the invention are employed;

Fig. 2 is a vertical sectional view of the apparatus shown in Fig. 1 with parts shown diagrammatically;

Fig. 3 is a vertical sectional view of the signal and circuit breaker operating device of the invention;

Fig. 4 is a rear or inner end view of the device shown in Fig. 3;

Figs. 5 and 6 are front or outer end views of the device shown in Fig. 3, arranged for operation of the handle from the closed position in the directions indicated by the arrows; and

Figs. 7 and 8 are sectional views of the device shown in Fig. 3, taken along the line VII—VII in Fig. 3, with the parts arranged for operations corresponding to Figs. 5 and 6, respectively.

Referring to Figs. 1 and 2 of the drawings, a casing 1 is provided for housing an electrical apparatus, such as a transformer comprising a core and winding assembly including a primary or high voltage winding 2 and a secondary or low-voltage winding having two parts 3 and 4 which may be positioned without and within the winding 2, respectively, the several windings being positioned about the winding leg 5 of a magnetic core structure 6 in a well known manner. The high-voltage winding 2 is shown connected through fuses 7 and 8 to circuit conductors 9 and 11 which extend through bushings 12 and 13 in the wall of the casing 1. The circuit conductors 9 and 11 may be connected through spark gaps 14 and 15 to the wall of the metal casing 1 in a well known manner and spark gaps 16 may be provided between the casing 1 and ground at 17, also in a well known manner, to protect the apparatus by limiting the voltage that is permitted to build up between the several parts of the apparatus.

The low-voltage winding parts 3 and 4 may have two of their terminals connected together at 18 so that the two windings provide a continuous series connected winding with the midpoint 18 connected by a conductor 19 extending through a bushing 21 in the casing wall to ground at 22. A spark gap 23 may be provided between conductor 19 and the casing 1. The outer terminals 24 and 25 of the series connected windings 3 and 4 are connected through contact members 26 and 27 of a circuit breaker 30 to conductors 28 and 29 which extend through bushings 31 and 32, respectively, in the casing wall and which comprise the secondary or distribution load circuit conductors.

The circuit breaker contact members 26 and 27 are connected to be actuated to a circuit interrupting position by a load responsive element 33 which may be a thermal device operated by the temperature of the apparatus. The circuit breaker 30 is also provided with an auxiliary contact member 34 which is actuated by the thermal responsive element 33 to close a circuit upon a predetermined load less than the load necessary to operate the switch contact members 26 and 27. The contact member 34 is shown

as closing a circuit to the unitary device 35 through conductors 36, 37 and 38 to a signal means 39 which may be an electric light. The unitary signal and circuit breaker device 35 is provided with a handle 41 outside of the apparatus casing which actuates a lever 42 within the casing, and by means of a connecting rod 43 manually operates the circuit breaker 30 to either its closed position, its open position, or its reset position.

The switch or circuit breaker 30 may be of any suitable type of circuit breaker having the characteristic function of automatically closing an auxiliary circuit upon a predetermined apparatus load, and of interrupting the load circuit upon a greater predetermined load and being capable of being operated manually to a circuit closing position, a circuit opening position, and to a reset position after opening to enable the manual closing of the circuit breaker. Such a circuit breaker switch is disclosed in United States Patent No. 2,169,586, issued August 15, 1939, to M. G. Leonard, for Circuit breaker, and assigned to the same assignee as this application.

Referring more particularly to Figs. 3 to 8 of the drawings, the device 35 comprises a foundation or base portion 51 having an outwardly flaring skirt 52, an inner recess 53, and a rearwardly extending sleeve portion 54. The stem or sleeve portion 54 is arranged to extend inwardly through an opening in the wall of the casing 1. The sleeve is provided with four slots 55, shown in Figs. 3 and 4, into which fingers 40 in the wall of the casing 1 extend to position the sleeve or base portion of the structure so as to prevent it from rotating about its axis. The structure is held tightly against the casing wall by a nut 56 on the inner side thereof which pulls the base portion inwardly to apply pressure to a gasket 57 positioned between the casing 1 and a shoulder of the base portion 51. The device 35 also includes a handle portion comprising the handle 41 and a body 58 integrally formed therewith and extending within the cavity 53 of the quadrant portion 51. A sleeve 61 is attached, as by welding or soldering at 62, to the body 58 and extends inwardly beyond the sleeve 54 of the base portion 51. Slots 63 are provided on the inner end of the sleeve 61 into which fingers 64 of the lever 42 extend so as to move the lever 42 about the axis of the sleeve upon operation of the handle 41. A nut 65 is screw-threaded to the outer end of the sleeve 61 to retain the lever 42 in position. The lamp 39 may be mounted in a socket formed by the sleeve 61 by means of projections 66 extending into bayonet slots in the sleeve in a well known manner and bringing the lamp contact members 67 into engagement with contact members 68 held within a block 69 of insulating material and connected to circuit conductors 36—37.

Referring to Figs. 3, 5 and 6, a covering 71 having a substantially spherical outer portion is attached by a screw 72 to the body 58 of the handle portion of the device. An opening is provided in the forward lower part of the cover 71 for retaining a glass crystal 73 that is preferably colored red to provide a danger signal upon the overheating of the apparatus, as indicated by the lamp 39. The rear portion of the cover 71 is provided with a flaring guard 74 covering a portion of the skirt 52 of the quadrant portion of the device, and, as shown in Figs. 5 and 6, may extend through the arc from 76 to 77 about the upper part of the flaring portion 52. It will be noted that there are two sets of markings on the quadrant member labeled "close," "open," and "reset," one set of markings of which is shown in Figs. 5 and 6 in dotted lines indicating that they are covered by the guard 74 so as not to be visible. As will be apparent from comparing Figs. 5 and 6, the closed position of the handle 41 is the same for either arrangement of the apparatus using either set of markings, and that with the arrangement shown in Fig. 6, movement from the closed position of the circuit breaker to the open and reset positions is effected by moving the handle 41 counterclockwise, as viewed in Fig. 6, and that the same sequence of operation of the circuit breaker is effected by the arrangement of the apparatus represented in Fig. 5 by moving the handle 41 clockwise. These two operating characteristics may be desired either because the switch operating device may be mounted on either of two opposite sides of an apparatus casing requiring opposite movements of the handle for corresponding operation of the circuit breaker, or because the type of breaker used requires a reverse sequence of movement of the element on the breaker controlling its several operative positions. The provision for movement of the handle in either of two directions from its initial position also has the advantage that the handle may be moved away from any obstruction resulting from the design of the tank. The arrangement of the parts of the device corresponding to the two different operating characteristics will be apparent from an examination of Figs. 7, 8, 3 and 4.

Referring to Figs. 7 and 3, it will be noted that a stop 81 is provided extending inwardly from the inner surface of the cavity 53 in the base portion 51, which is adapted to engage either of two stops 82 or 83 extending outwardly from the body 58 of the handle portion of the device that is within the cavity 53. In Figs. 3, 5 and 7, the base portion 51 is so mounted on the wall of the casing 1 that the stop 81 is at the bottom of the quadrant so that the body 58 may be moved approximately 90° from the position shown in Fig. 7 before the stop 83 will engage the stop 81.

Referring to Figs. 6 and 8, the quadrant portion 51 of the device is so mounted on the tank wall that the stop 81 thereon is at the left of the body 58 as shown in Fig. 8 instead of at the bottom, as in Fig. 7, indicating that the quadrant is mounted with a 90° difference in axial position so that the stops 82 and 83 on the body member prevent rotation in a clockwise direction from the closed position, but permit rotation in a counterclockwise direction. In the position of the quadrant shown in Figs. 6 and 8, the markings shown thereon in the lower right of the signal light and which are visible to the operator, are the markings shown in Fig. 5 at the upper left, and which in that figure are concealed from view by the guard 74, while the markings shown at the lower left of the light in Fig. 5, and are visible in the position of the quadrant shown in that figure, are, in Fig. 6, shown in dotted lines at the upper left of the light and are concealed from view by the guard 74.

To shift the quadrant from the position shown in Figs. 5 and 7 to the position shown in Figs. 6 and 8, it is necessary to remove the nut 65 and the lever 42 from the sleeve 61, and to remove the gland nut 50, the set nut 60 and the nut 56 from the sleeve 54, so as to permit movement of the device outwardly from the tank sufficiently that the fingers 40 on the tank wall will be disengaged from the slots 55 and permit rotation of the quad-

rant portion 90°, to be reinserted in the tank wall, in which position the several removed parts of the device will be reassembled. It is also necessary while the several above described parts are detached from the device, that the handle portion be moved forwardly sufficiently to disengage the stops 82 and 83 from the stop 81 and move the relative positions of the stops 81 and 82 as shown in the drawings, after which the handle portion of the device is replaced with the stops thereon within the chamber of cavity 53, as above explained.

It will be noted by reference to Fig. 2 that the circuit breaker 30 is provided with a bimetal element 91 for controlling the automatic tripping of the breaker, which element is immersed well below the level of the oil so as to be responsive to the temperature thereof as a measure of the load on the apparatus. It will also be noted that two latches 92 and 93 are arranged to be separately tripped upon continued movement of the bimetal element 91. The latch 93 is the first one to trip and effects the operation of the contact member 34 for closing the signal circuit for the lamp 39, the second latch 92 effecting operation of the breaker contacts 26 and 27 to the circuit interrupting positions.

It will be appreciated that although the invention has been disclosed as applied to a transformer, it may be applied to any electrical apparatus in which the characteristic operation of a signal light and circuit breaker are required for indicating and tripping predetermined overload values for protection of the apparatus.

Many modifications in the details of the apparatus and circuits described within the scope of our invention will be apparent to those skilled in the art and we do not wish to be limited otherwise than by the scope of the accompanying claims.

We claim as our invention:

1. In electrical apparatus subject to varying load and provided with a circuit breaker for unloading the apparatus, in combination, an apparatus casing, a manually operable means for operating said circuit breaker to three separate positions, said manually operable means including a base portion for mounting in a selected one of two positions on the apparatus casing, and a handle portion, said base and handle portions being provided with cooperating stops so arranged as to permit movement of the handle portion in one direction only from the first position to the second and third positions in sequence when the base portion is mounted in one position on the apparatus casing and to permit movement of the handle portion in the opposite direction only from the first position to the second and third positions in sequence to perform the same sequence of operation of the circuit breaker throughout the three positions of the handle portion regardless of in which of the two positions the base portion is mounted on the apparatus casing, said base portion having two sets of markings of the handle positions thereon corresponding to the two operating directions of motion of the handle portion for indicating the circuit breaker positions, and a guard carried by the handle portion positioned thereon to conceal the set of markings not to be used in a given position of the base portion.

2. In electrical apparatus provided with protective means therefor, in combination, a manually operable means for operating said protective means to three separate positions and including a handle portion arranged concentrically with said body portion, said base and handle portions being provided with cooperating stops so arranged as to permit movement of the handle portion in one direction only from the first position to the second and third positions in sequence when the base portion is mounted in one position on the apparatus casing and to permit movement of the handle portion in the opposite direction only from the first position to the second and third positions in sequence to perform the same sequence of operation of the protective means throughout the three positions of the handle regardless of in which of the two positions the body portion is mounted in the apparatus casing, said base portion having two sets of markings of the handle portions thereon corresponding to the two operating directions of motion of the handle for indicating the circuit breaker positions, and a guard carried by the handle portion positioned thereon to conceal the set of markings not to be used in a given position of the base portion.

3. In electrical apparatus subject to varying load and provided with a circuit breaker for unloading the apparatus, in combination, manually operable means for operating said circuit breaker to an open position, a closed position, and a reset position, said manually operable means including a base portion arranged for mounting in one of two fixed positions and having movement limiting stops and a handle portion also having movement limiting stops cooperative with the first-named stops, said manually operable means when installed in a selected one of the two positions being operable to effect a corresponding sequence of circuit breaker positions upon movement of the manually operable circuit breaker operating means in different directions from an initial position.

4. In electrical apparatus subject to varying load and provided with a circuit breaker for unloading the apparatus, manually operable means for operating said circuit breaker to an open position, a closed position, and a reset position, in combination, said manually operable means including a base portion arranged for mounting in one of a plurality of fixed positions and having movement limiting stops and a handle portion also having movement limiting stops cooperating with the first-named stops, said stops being so arranged as to permit one direction of motion of the handle portion from its initial position when the base portion is mounted in one of its two positions and to permit an opposite direction of motion of the handle portion from its initial position to effect the same sequence of circuit breaker positions when the base portion is mounted in another of its fixed positions.

5. In electrical apparatus positioned within a casing and being subject to varying load and provided with a circuit breaker for unloading the apparatus, manually operable means for operating said circuit breaker to an open position, a closed position, and a reset position, in combination, said manually operable means being a unitary device including a base portion for mounting in one of a plurality of fixed positions on the apparatus casing, a handle portion concentrically arranged on the base portion, said base and handle portions being provided with cooperating stops so arranged as to permit one direction of motion of the handle portion from closed position to open and reset positions in sequence when the base portion is mounted in

one fixed position on the apparatus casing and to permit an opposite direction of motion of the handle portion from closed position to open and reset positions in sequence when the base portion is mounted in another fixed position on the apparatus casing.

6. In electrical apparatus subject to varying load and provided with a circuit breaker for unloading the apparatus, in combination, manually operable means for operating said circuit breaker to an open position, a closed position, and a reset position, said manually operable means including a base portion for mounting in one of a plurality of positions on the apparatus casing, and a handle portion, said base and handle portions being provided with cooperating stops so arranged as to permit one direction of motion of the handle portion from closed position to open and reset positions in sequence when the base portion is mounted on the apparatus casing in one position and to permit an opposite direction of motion of the handle portion from closed position to open and reset positions in sequence when the base portion is mounted on the apparatus casing in another position, said base portion having two sets of markings of the handle positions thereon corresponding to the two operating directions of motion of the handle for indicating the circuit breaker positions, and a guard carried by the handle portion positioned thereon to conceal the set of markings not to be used in a given position of the base portion.

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