

May 29, 1951

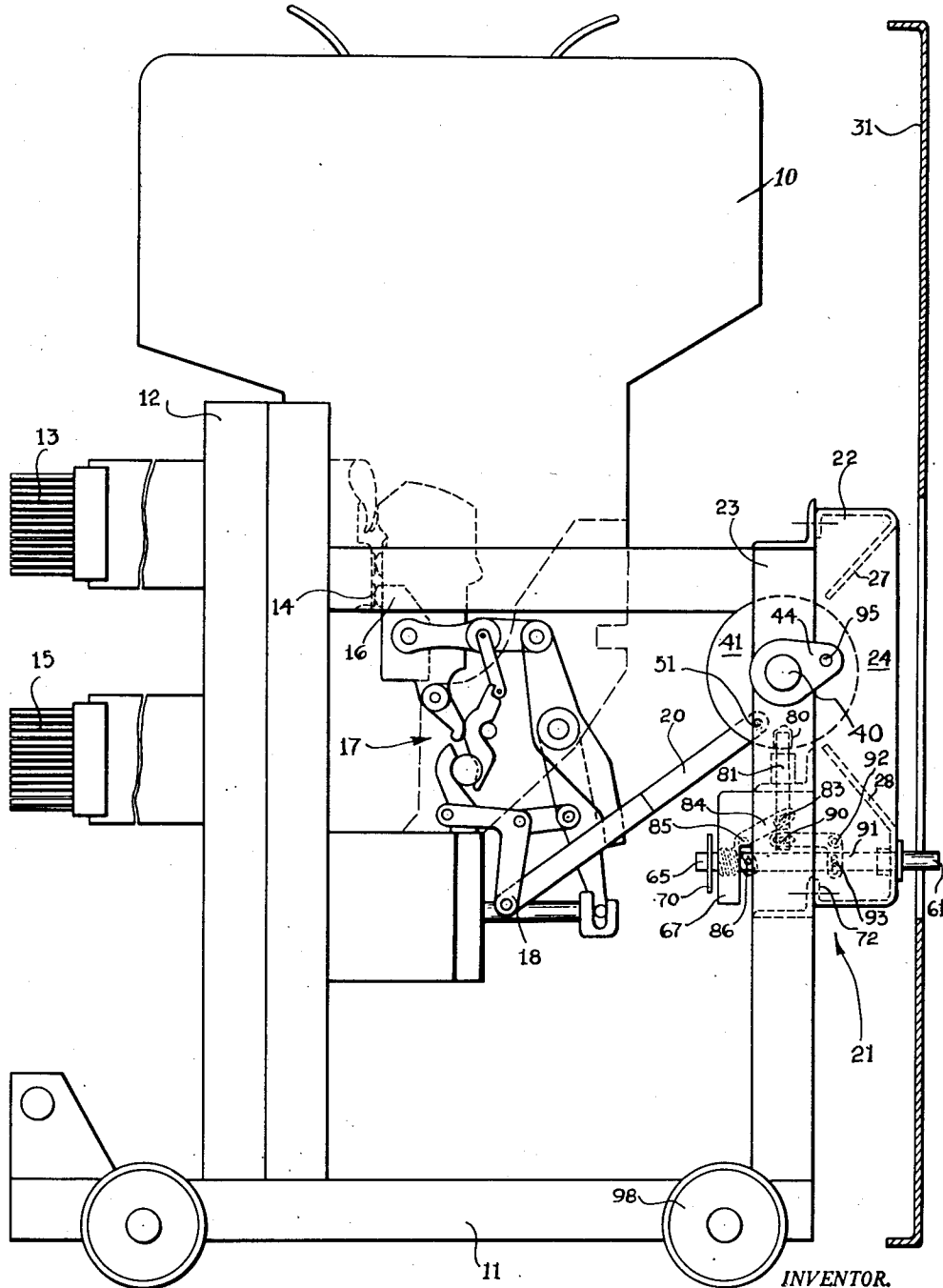
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2,554,510

DRAWOUT MECHANISM FOR COMPARTMENTED CIRCUIT BREAKERS

Filed Sept. 12, 1946

5 Sheets-Sheet 1



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DRAWOUT MECHANISM FOR COMPARTMENTED CIRCUIT BREAKERS

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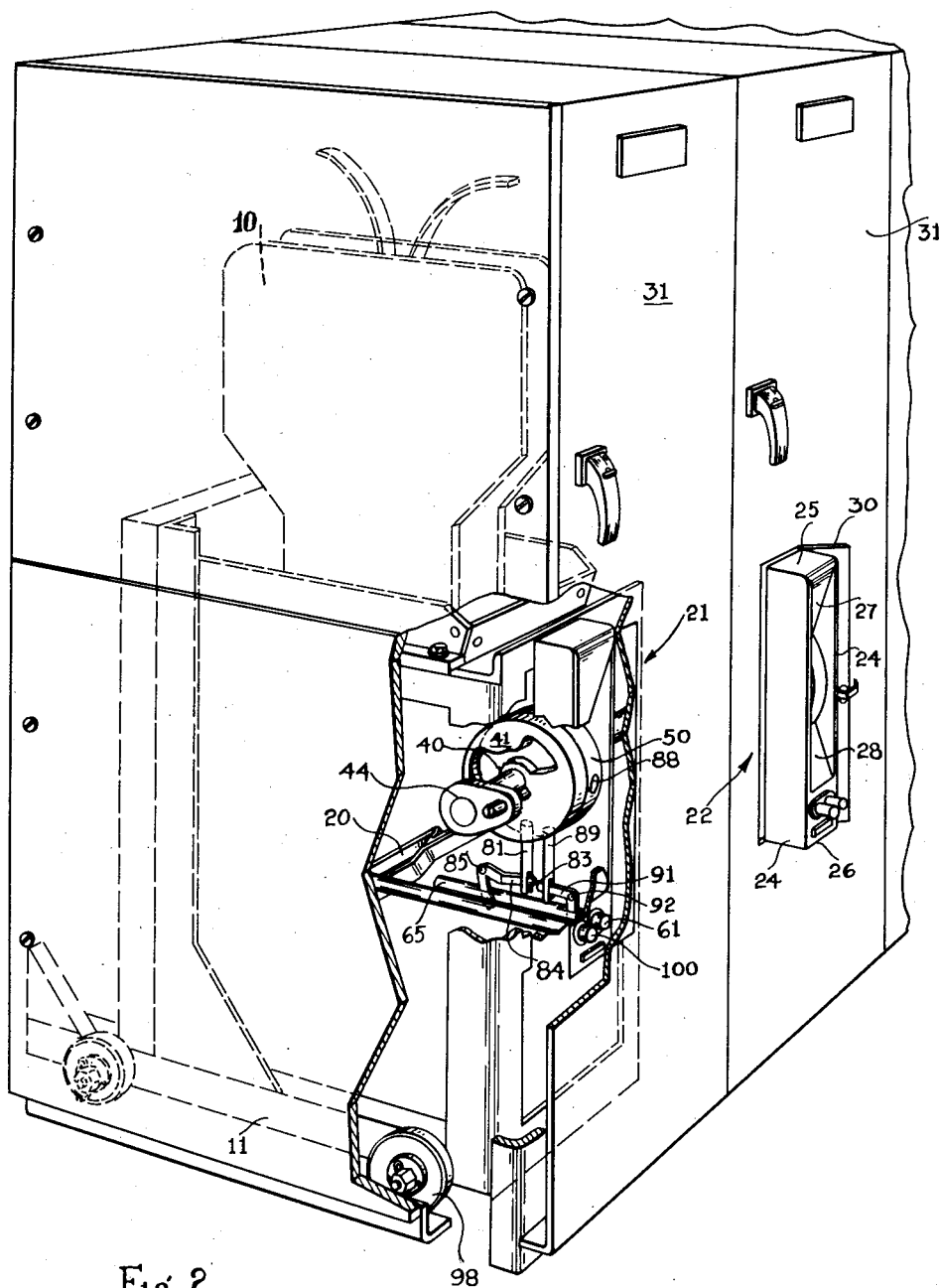


Fig. 2

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5 Sheets-Sheet 3

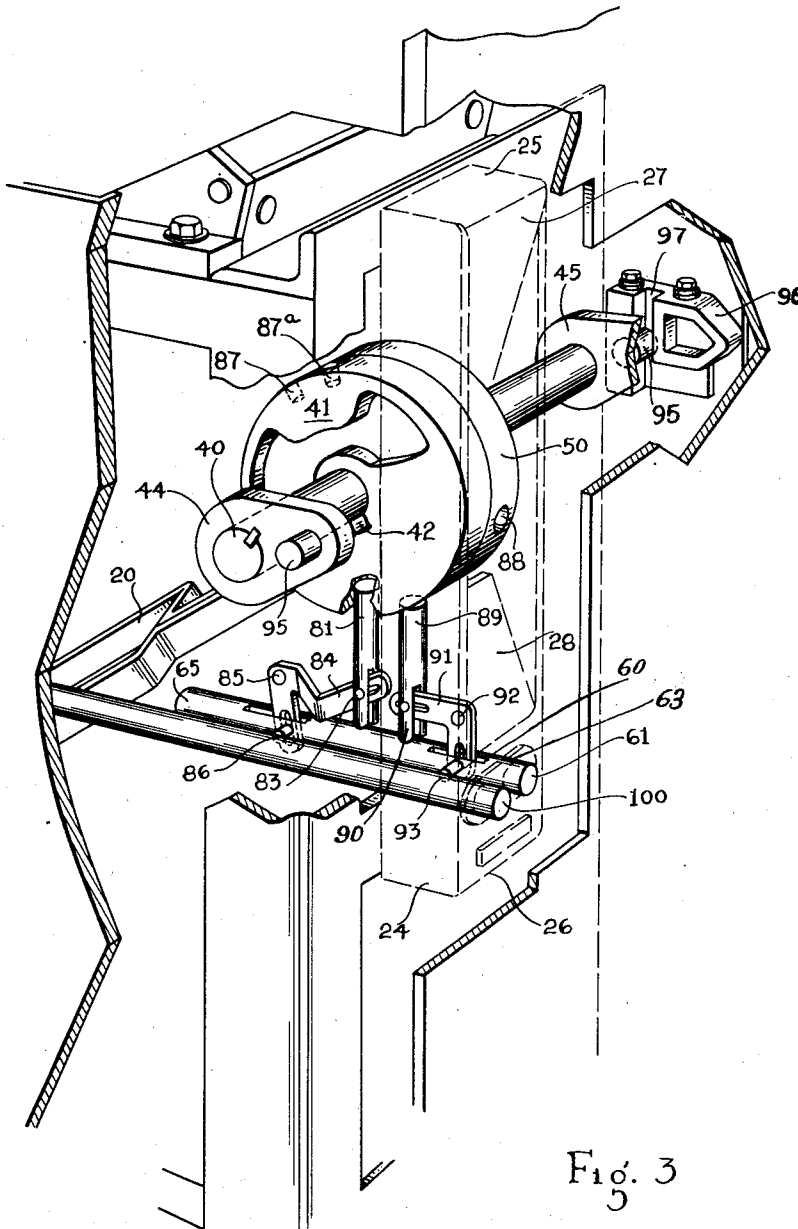


Fig. 3

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DRAWOUT MECHANISM FOR COMPARTMENTED CIRCUIT BREAKERS

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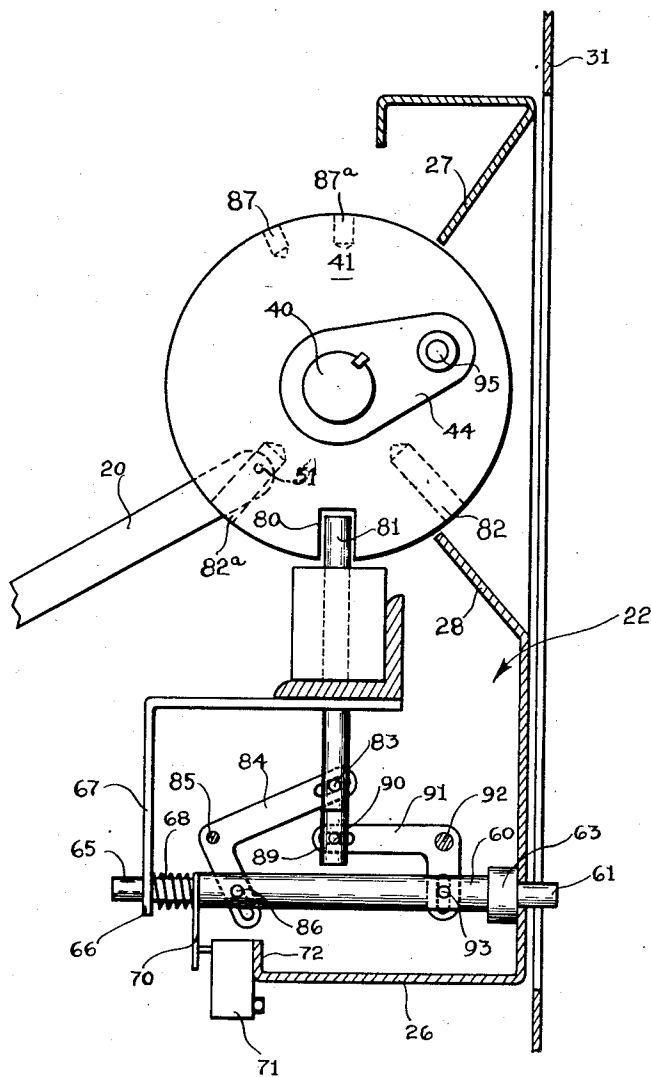


Fig. 4

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5 Sheets-Sheet 5

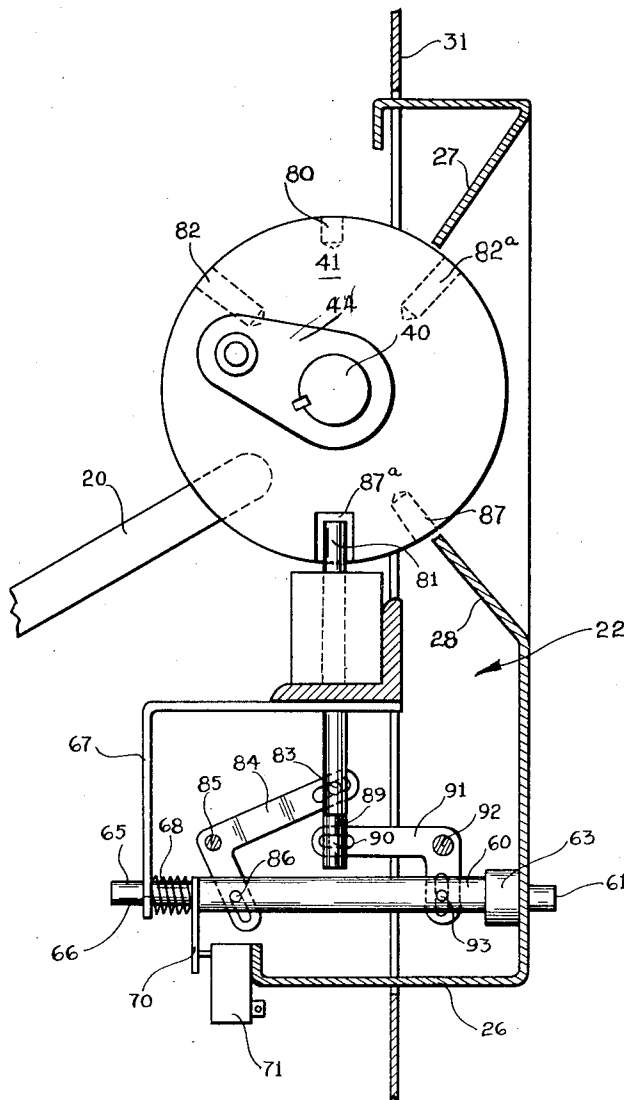


Fig. 5

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Outlook of Father

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2,554,510

DRAWOUT MECHANISM FOR COMPARTMENTED CIRCUIT BREAKERS

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Application September 12, 1946, Serial No. 696,559

7 Claims. (Cl. 200—50)

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My present invention relates to circuit breaker enclosures, and more specifically to racking mechanism arranged to facilitate the drawing out of circuit breakers from a circuit breaker housing in a switchboard.

Circuit breaker structures mounted on trucks in switchboard housings frequently must be moved to a test position wherein they are disconnected from the back connection studs within the housings without interfering with the operation of the remainder of the switchboard.

In practice, it has been found that a circuit breaker which must maintain substantially continuous service has been erroneously racked out and thus interrupted a line which is supposedly in service. This usually is the result of a misunderstanding between the operator in control of the service and a workman sent to rack out a circuit breaker for test. The circuit breaker is remote controlled.

Accordingly, I have provided an arrangement for so interlocking the circuit breaker with its racking mechanism that the racking mechanism cannot be operated unless the operator has first tripped the breaker. Thus, if the workman erroneously starts to rack out a circuit breaker, he will be unable to do so.

This also has the advantage that in racking a circuit breaker out of the operative position to the test position, it is done only when the circuit breaker is tripped so that current interruption will occur between movable contacts having an appropriate arc quencher and will not take place at the back connection studs which are not thus protected.

It is also desirable to provide means for moving the circuit breaker on its truck to the test position without opening the door of the compartment or housing, while nevertheless providing a clear indication when the circuit breaker has been moved to the test position.

Accordingly a primary object of my invention is the provision of novel racking mechanism for a truck mounted circuit breaker adapted to move the circuit breaker out of and into a compartment of a switchboard.

Another and important object of my invention is the provision of novel racking mechanism which can be operated from the front panel of the compartment without the necessity for opening the front panel and which is adapted to move the truck mounted circuit breaker from the operative position to the test position.

Still another object of my invention is the provision of novel means for indicating the position

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of the truck mounted circuit breaker in the compartment.

A further object of my invention is the provision of novel means for interlocking the racking mechanism with the circuit breaker itself so that the racking mechanism is operative only when the circuit breaker is in the tripped condition.

The foregoing and many other objects of my invention will become apparent in the following description and drawings in which

Figure 1 is a side view showing the arrangement of my novel racking mechanism on a truck mounted circuit breaker.

Figure 2 is a view in perspective partly broken away showing specifically the operating elements of my novel racking mechanism.

Figure 3 is a view corresponding to a portion of Figure 2 showing the operating details of my novel racking mechanism, and modified to eliminate non-essential details.

Figure 4 is a side view corresponding to a portion of Figure 1 showing the details of my novel racking mechanism when the circuit breaker truck is sufficiently within the compartment so that the circuit breaker is in operative position.

Figure 5 is a view corresponding to that of Figure 4 showing the position of the racking elements with the truck moved forward in the compartment so that the circuit breaker is in the test position.

Referring now to Figure 1, I have here shown a truck mounted circuit breaker 10 of the type generally shown in Patent No. 2,355,075, issued August 8, 1944, in which the truck 11 carries an insulated back panel 12 on which the circuit breaker elements are mounted. Upper back connection stud 13 is connected to stationary circuit breaker contact 14. Lower back connection stud 15 is connected to the movable circuit breaker contact 16. The circuit breaker is operated by any suitable mechanism such as that shown in the aforementioned Patent No. 2,355,075, issued August 8, 1944, and is so arranged that in the closed position of the circuit breaker, the bell crank 18 is connected by the linkage 17 to the movable contact carrying member 16 and is in the position shown in Figure 1. In the open position of the circuit breaker, the bell crank 18 of the movable contact member 16 has moved toward the left with respect to Figure 1 pulling link 20 along with it toward the left.

The circuit breaker racking mechanism indicated generally at 21 comprises a housing 22 secured to a front frame member 23 of the truck mechanism and rigidly braced with respect there-

to. As shown in Figures 1 and 2, the housing 22 comprises a pair of side panels 24, 24 top and bottom panels 25 and 26 respectively, and inclined front panels 27 and 28. The housing 22 of the racking mechanism is so mounted on the front frame 23 of the truck that it registers with the door 30 (Fig. 2) of the front frame member 31 of the switchboard compartment.

When the racking mechanism in housing 22 is to be operated open, the door 30 is opened to provide access thereto. With the circuit breaker in the operative position, the racking mechanism in the housing 22 is recessed entirely with the front panel 31, as shown in the left hand compartment of Figure 2. When the truck 11 and the racking mechanism 21 in housing 22 are withdrawn to the test position, the entire housing 22 of the racking mechanism 21 projects out through the door 30 in frame member 31 as shown in the right hand compartment of Figure 2.

The racking mechanism comprises a shaft 40 rotatably mounted in appropriate bearings in the front frame member 23 of the truck 11. Said shaft 40 carries the racking disc 41 keyed thereto in any suitable manner as by the key 42. Shaft 40 also has keyed thereto in any suitable manner at each of its ends the crank elements 44 and 45 so that these elements are rotatable with the shaft 40. Shaft 40 also has mounted thereon the interlock disc 50. The interlock disc 50 is not keyed to the shaft 40 but is rotatable thereon so that the shaft 40 may rotate even though the interlock disc 50 is held. Interlock disc 50 is connected by pin 51 to the link 20, which in turn is connected to the end 15 of movable contact arm 16 of the circuit breaker 10.

An interlock rod 60 (Fig. 4) is provided in the lower part of racking housing 22 terminating in an interlock release button 61 accessible from the outside of the housing 22. Button 61 of interlock rod 60 is slidable longitudinally in bearing 63 secured to the lower portion of the front panel of housing 22. Button 61 is of smaller diameter than rod 60 so that the enlarged diameter of rod 60 bearing against the left hand side of the bearing 63, limits the movement of the interlock rod 60 toward the front of the housing.

The rear end of the interlock rod 60 is turned down at 65 and passes through an appropriate bearing 66 in flanged plate 67 carried by the front frame 23 of the truck (Figs. 1, 4 and 5). A compression spring 68 is carried between plate 67 and the rear end of the enlarged diameter of rod 60 biases the rod 60 toward the right with respect to Figure 4 or toward the front of the housing. Rod 60 carries adjacent its rear end a bar 70 which engages the electrical switch 71 secured to flange 72 of lower panel 26 of housing 22.

Racking disc 41 is provided with a locking recess 80 as shown in Figure 4 into which the bolt 81 fits when the circuit breaker and its truck are entirely within the housing with the circuit breaker back connection studs connected to the appropriate back connection elements of the compartment. Consequently with bolt 81 locked in the racking disc 41, racking disc 41 cannot be rotated.

Racking disc 41 is provided with a plurality of peripheral holes 82—82a into which a bar may be inserted in order to rotate the disc 41 and thus operate the racking mechanism. However, prior to any attempt at rotating the disc 41, it is necessary to remove the bolt 81 from the recess 80 in the racking disc 41. Bolt 81 as shown in Figures 2, 3 and 4 is connected by pin 83 to the bell crank

lever 84, which bell crank lever 84 is pivoted at 85 on a portion of the front frame 23 of the truck 11.

The lower leg of bell crank 84 is connected by pin 86 to the rod 60. The connection at pins 83 and 86 are appropriately slotted as shown to permit bell crank 84 to rotate readily about its pivot 85 without binding. When it is now desired to rack out the circuit breaker truck 11 to the test position, the door 30 is opened and a racking bar is inserted in the opening 82.

Button 61 is pushed in toward the left with respect to Figure 4. This operates the electrical switch 71 in order to operate any control, indicating, or locking circuits which should be thrown into operation when the truck of the particular circuit breaker is being racked to test position. At the same time pushing in of button 61 causes a clockwise rotation of bell crank 84 to pull down bolt 81 and thus pull same out of the recess 80 of racking disc 41, thus freeing racking disc 41 for operation.

However, operation of the racking disc 41 to rack out the circuit breaker should not occur unless the circuit breaker itself is in the tripped position so that the back connection studs will not be required to interrupt heavy current. For this purpose, therefore, the interlock disc 50 which is connected to the link 20 is provided on the shaft 40. Interlock disc 50 is so arranged that when the circuit breaker is in the open position, link 20 has pulled interlock disc 50 around to a position where the opening 88 thereof registers with the bolt 89. Bolt 89 is connected by pin 93 to bell crank lever 91 which is pivoted at 92 on the front frame 23 of the truck 11.

A lower leg of bell crank 91 is connected by pin 93 to the interlock rod 60. Here appropriate slots are provided at pins 93 and 93 to prevent binding of the bell crank lever 91. When the button 61 is pushed in, then in addition to rotating bell crank 84 clockwise to pull down bolt 81, the bell crank lever 91 is rotated clockwise to push up the bolt 89. Bolt 89 is pushed up against the periphery of the interlock disc 50.

If the circuit breaker is in the open position, then interlock disc 50 is in the position where opening 88 thereof registers with bolt 89 and bolt 89 may freely enter opening 88 at the same time that the bolt 81 is withdrawn from opening 80 of racking disc. If, however, the circuit breaker is in the closed position then the opening 88 and interlock disc 50 is out of registry with the bolt 89 and bolt 89 cannot move up.

Since bolt 89 cannot move up, this prevents the rod 60 and the button 61 from being pushed in and thus prevents withdrawal of bolt 81 from the racking disc 41. Consequently, the racking disc 41 cannot be freed to operate unless the circuit breaker is in the open position.

Assuming now that the circuit breaker is properly in the open position so that bolt 89 may enter opening 88 in interlock disc 50, then insertion of a racking bar in opening 82 of racking disc 41 and pushing in of button 61 will remove the bolt 81 from the opening 80 of the racking disc 41 and at the same time push the bolt 89 into opening 88 of the interlock disc 50, thus locking the circuit breaker in open position.

The racking bar (not shown) is pulled up to rotate the racking disc 41 in a counter-clockwise direction, (as seen in Figures 1, 2, 3, 4, and 5). Rotation of the racking disc 41 causes the shaft 40 to rotate and the roller 95 to rise in the slot 97 of the block 96. Since the block 96 is fastened

securely to the frame of the cubicle, rotation of the crank element 45 causes the truck 11 and circuit breaker 10, mounted thereon, to move forward. Similarly, element 44 causes roller 95 to rise in a similar slot of a block (not shown) at the left (Figure 3). When the racking bar has reached the upper limit of the housing 22 and is prevented from further rotation by the upper inclined front panel 27 it must be re-inserted in a similar hole 82a and a second rotation of the racking disc 41 is made. Before the racking bar has reached the inclined front panel for the second time the bolt 81 biased upwardly by compression spring 68 through ball crank 84 will enter the hole 87 which will lock the circuit breaker 10 in the test position. To completely remove the breaker from the cubicle the release button 61 must be pushed again to remove the bolt 81 from the hole 87 and the racking bar moved up to complete the second rotation of the racking disc 41 at which time the locking bolt 81 enters the hole 87a in the racking disc 41 and locks the breaker 10 in the position in which its studs 13 and 15 are disconnected from the bus bar. The entire housing 22 of the racking device 21 then emerges through the door 30 in frame member 31 and the full emergence of the housing 22 to the position shown at the right hand compartment of Figure 2 indicates that the circuit breaker has been racked to the open position.

In returning the circuit breaker to operating position, the racking mechanism first rendered operative by operation of button 61, is racked in the reverse direction, i. e., by inserting the racking bar in opening 82 and pulling downwardly.

The positions of the racking elements of the circuit breaker structure when the circuit breaker has been racked out are shown in Figure 5. Here the additional opening 87a in the racking disc 41 is moved opposite the bolt 81 so that release of the button 61 will permit spring 68 to drive rod 60 back to the right and thus force the bolt 81 back into locking relation with the racking disc 41 while at the same time withdrawing bolt 89 from locking relation with the interlock disc 50.

Since interlock disc 50 is now released, the circuit breaker may now be operated in the test position. In order to operate the circuit breaker between its open and closed condition when in its test position, a rod 100 is provided connected to the tripping mechanism of the circuit breaker and operable as shown from the front of the compartment panel. Any attempt to rack the circuit breaker back into operative position without first pushing in the button 61 would result in failure since the racking disc 41 is locked by the bolt 81 having entered the hole 87a, and the circuit breaker 10 cannot be racked to the operative position except by the rotations of the racking disc 41. This will prevent accidental racking of the circuit breaker while the contacts are closed. In order to reestablish the circuit breaker in the operative position once more, button 61 must be pushed in and as before described, the bolt 81 cannot be removed from opening 87a of racking disc 41 unless the bolt 89 is free to enter opening 88 of interlock disc 50; and this can occur only when the circuit breaker is in the open circuit position.

Consequently the circuit breaker can be pushed back into operative position only when the contacts thereof are open. When it is pushed back into the operative position, roller 95 bearing against the block 96 causes the crank 44 to rotate back from the position of Figure 5 to the position of Figure 4 so that the racking elements are re-

turned to operative position for moving the circuit breaker out once more.

As will now be clear from the above, the essence of this invention is its fool proof safety feature. In power station operation it is undesirable to have some circuits interrupted for any reason, except in extreme cases.

Therefore, it is conceivable that in certain cases some circuits would never be shut down and that careless or inadvertent manipulation of the breakers protecting such circuits could cause injury or serious damage. With the present invention, however, such a contingency is virtually impossible.

If an authorized power station employee gave instruction for servicing a particular circuit breaker and the operator should select the wrong breaker he would be unable to withdraw the wrong breaker since its racking disc 41 would be locked by the bolt 81 being entered in the recess 80.

This he would not be able to free by pushing the release button 61 since that member cannot be actuated unless the interlock disc 50 is properly rotated to present the opening 88 to the interlock bolt 89, and the interlock disc 50 cannot be rotated except by tripping open the breaker contacts.

It is obvious therefore that if operators follow the invariable rule of never tripping a circuit breaker, they can never inadvertently remove the wrong circuit breaker from a line that is alive or in service.

In the event that it is desired to remove the circuit breaker entirely after it has been racked out to test position, this can be accomplished because in the final test position the pin 95 (Figure 3) has been moved down to a position in the slot 97 below the surface of member 96 and is then free to be entirely withdrawn, together with the circuit breaker, from the housing.

In the foregoing I have described my invention solely in connection with a specific illustrative embodiment thereof. Since many variations and modifications of my invention should now be obvious to those skilled in the art, I prefer to be bound not by the disclosures herein contained but only by the appended claims.

I claim:

1. In a switch gear mechanism, a truck mounted circuit breaker having an operative and a test position and having an open and a closed condition, a compartment for said circuit breaker having a front panel, a racking mechanism comprising a racking disk having a lock, means for operating said racking mechanism from said front panel for racking said breaker between its operating and test positions, and means controlled by said circuit breaker for rendering said racking mechanism ineffective to rack said breaker from operating to test position while said circuit breaker is in closed condition, comprising a disk, a member connected to said circuit breaker movable contact at one end and to said disk at the other end and a connection from said disk to said lock for operating said lock to lock said racking disk when said circuit breaker is in closed position.

2. In a switch gear mechanism, a truck mounted circuit breaker having an operative and a test position and having an open and a closed condition, a compartment for said circuit breaker having a front panel, a racking mechanism comprising a racking disk having a lock, means for operating said racking mechanism from said front panel for racking said breaker between

its operating and test positions, means for rendering said racking mechanism ineffective to rack said breaker from operating to test position while said circuit breaker is in closed condition comprising means cooperating with said lock on said racking disk when said circuit breaker is in closed position, said racking mechanism having a lock for preventing operation thereof while said circuit breaker is closed, and manually operable means for removing said lock operable only when said circuit breaker is in its open position, said manually operable means including a disk on said racking mechanism and a second disk, each of said disks having recesses, individual bolts for said recess, said bolts being controlled by said manual means, the bolt for the recess of said second disk preventing the removal of the bolt from said racking mechanism disk except when said circuit breaker is in open condition.

3. In a switch gear mechanism, a truck mounted circuit breaker having an operative and a test position and having an open and a closed condition, a compartment for said circuit breaker having a front panel, a racking mechanism comprising a racking disk having a lock, means for operating said racking mechanism from said front panel for racking said breaker between its operating and test positions, means for rendering said racking mechanism ineffective to rack said breaker from operating to test position while said circuit breaker is in closed condition comprising means cooperating with said lock on said racking disk when said circuit breaker is in closed position, said racking mechanism having a lock for preventing operation thereof while said circuit breaker is closed, and manually operable means for removing said lock operable only when said circuit breaker is in its open position, said manually operable means including a disk on said racking mechanism and a second disk, each of said disks having recesses, individual bolts for said recess, said bolts being controlled by said manual means, and a positive connection from said circuit breaker to said second disk for rotating said disk to a position in which the recess thereof is opposite its bolt when said circuit breaker is in open position.

4. In a switch gear mechanism, a truck mounted circuit breaker having an operative and a test position and having an open and a closed condition, a compartment for said circuit breaker having a front panel, a racking mechanism comprising a racking disk having a lock, means for operating said racking mechanism from said front panel for racking said breaker between its operating and test positions, means for rendering said racking mechanism ineffective to rack said breaker from operating to test position while said circuit breaker is in closed condition comprising means cooperating with said lock on said racking disk when said circuit breaker is in closed position, said racking mechanism having a lock for preventing operation thereof while said circuit breaker is closed, and manually operable means for removing said lock operable only when said circuit breaker is in its open position, said manually operable means including a disk on said racking mechanism and a second disk, each of said disks having recesses, individual bolts for said recess, said bolts being controlled by said manual means, and a positive connection from said circuit breaker to said second disk for rotating said disk to a position in which the recess thereof is opposite its bolt when said circuit

breaker is in open position, said first bolt being prevented from leaving its recess except when said second bolt enters the recess of said second disk.

5. In a circuit breaker having a pair of operable contacts having an engaged and a disengaged position, and having an operative and test position, back connection studs connected to said cooperable contacts; a cubicle for said circuit breaker having side and back walls and a front door panel through which said circuit breaker is rackable into and out of its cubicle; a racking mechanism having a lock; means for operating said racking mechanism to operate said circuit breaker between an operating position, in which said back connection studs are in position for electrical connection in the power circuit being protected by said circuit breaker and a test position in which said back connection studs are in the position of disengagement from the power circuit; a connection from one of said cooperable contacts to said lock on said racking mechanism for locking said racking mechanism against operation of said circuit breaker with respect to its cubicle when said pair of operable contacts are in engagement, and a member accessible from outside said front door panel for operating said lock to release said racking mechanism solely when said pair of operable contacts are disengaged from each other, said front panel of said cubicle having an opening through which said racking mechanism is accessible by said first means to permit racking of said circuit breaker to its test position, part of said racking mechanism protruding through said opening in said front door panel when said circuit breaker is in its test position.

6. In a circuit breaker having a pair of operable contacts having an engaged and a disengaged position, and having an operative and test position, back connection studs connected to said cooperable contacts; a cubicle for said circuit breaker having side and back walls and a front door panel through which said circuit breaker is rackable into and out of its cubicle; a racking mechanism having a lock; means for operating said racking mechanism to operate said circuit breaker between an operating position, in which said back connection studs are in position for electrical connection in the power circuit being protected by said circuit breaker, and a test position in which said back connection studs are in the position of disengagement from the power circuit; a connection from one of said cooperable contacts to said lock on said racking mechanism for locking said racking mechanism against operation of said circuit breaker with respect to its cubicle when said pair of cooperable contacts are in engagement, and a member accessible from outside said front door panel for operating said lock to release said racking mechanism solely when said pair of cooperable contacts are disengaged from each other, said front panel of said cubicle having an opening through which said racking mechanism is accessible by said first means to permit racking of said circuit breaker to its test position, part of said racking mechanism protruding through said opening in said front door panel when said circuit breaker is in its test position, and a second member extending through said front door panel connected to said cooperable contacts for operating said cooperable contacts to disengaged position.

7. In a circuit breaker having a pair of co-

operable contacts having an engaged and a disengaged position, and having an operative and test position; back connection studs connected to said cooperable contacts; a cubicle for said circuit breaker having side and back walls and a front door panel through which said circuit breaker is rackable into and out of its cubicle; a racking mechanism having a lock means for operating said racking mechanism between an operating position, in which said back connection studs are in position for electrical connection in the power circuit being protected by said circuit breaker, and a test position in which said back connection studs are in the position of disengagement from the power circuit, a physical connection from one of said cooperable contacts to said racking mechanism for preventing operation of said racking mechanism when said pair of cooperable contacts are in engagement and for permitting release of said lock to permit

operation of said racking mechanism by said first means when said pair of cooperable contacts are disengaged from each other, and an opening in the front panel of said cubicle through which said racking mechanism is accessible by said first means to permit racking of said circuit breaker to its test position when said racking mechanism has been released for operation.

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