Feb. 6, 1951 C. D. EICHELBERGER 2,540,814

REMCVABLE SWITCHGEAR INTERLOCKING CONTROL

Filed June 18, 1948

Fig. 1.

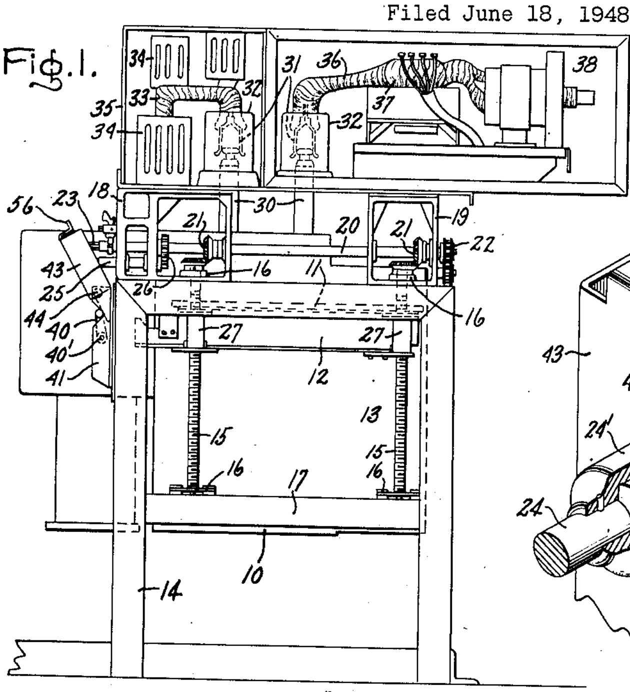


Fig. 4.

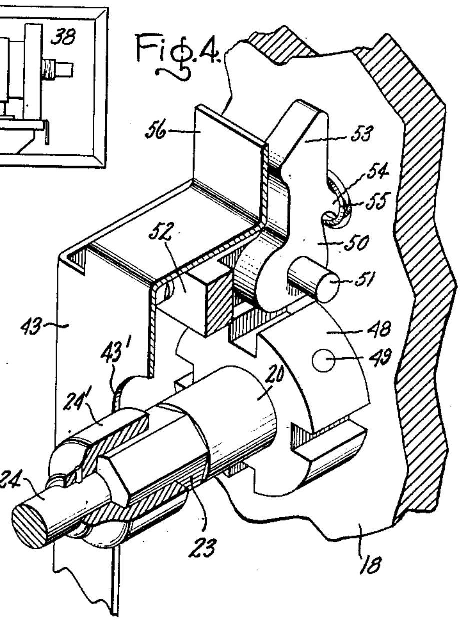


Fig. 2.

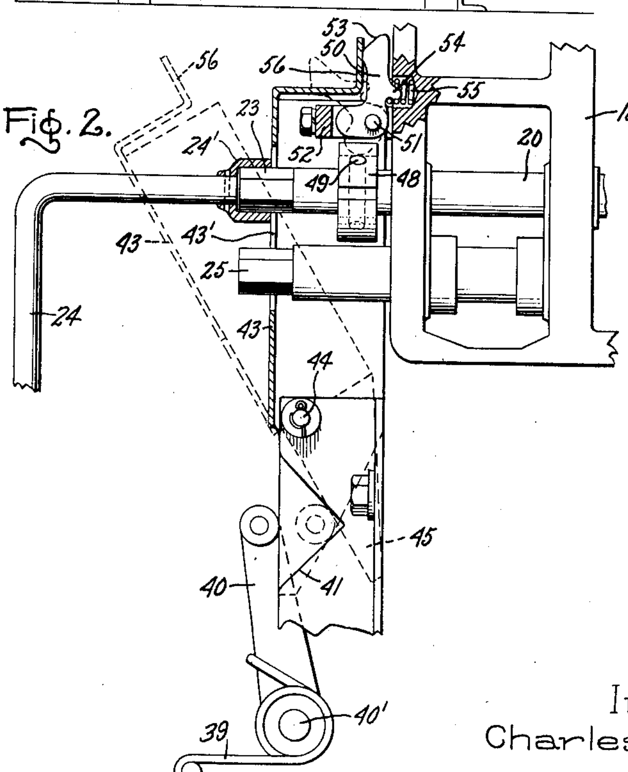
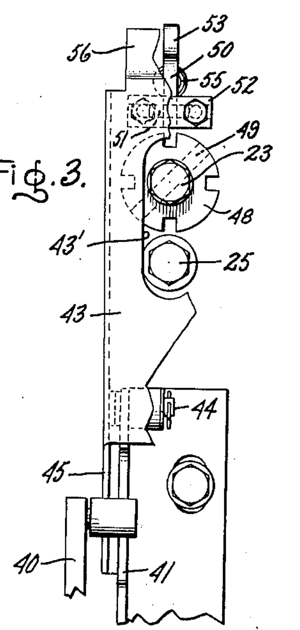


Fig. 3.



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REMOVABLE SWITCHGEAR INTERLOCKING CONTROL

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1 Claim. (Cl. 200—50)

The invention relates to removable switchgear interlocking control and particularly to interlocking control for metal-enclosed removable self-disconnecting circuit breakers having position-changing mechanism for moving the circuit breaker between the connected and the disconnected positions provided with a removable operating member.

Many metal-enclosed removable self-disconnecting circuit breakers, particularly of the drop-down power circuit interrupting type, are used in electric power stations and substations to enable the circuit breakers to be readily withdrawn for inspection and maintenance service and quickly replaced on the line. To insure safety, such circuit breakers ordinarily are equipped with tripping interlocks that prevent disconnecting or re-connecting the breaker while it is closed. Most of the circuit breakers of the drop-down type, particularly in the larger sizes, are provided with jack screw elevating mechanism that can be either motor operated or manually operated to raise the breaker and hold it in its connected operating position on the line.

The principal object of the present invention is to provide an improved sequential multiple interlock mechanism operable under control of the operating member so that it will positively lock the removable self-disconnecting circuit breaker in its operating connected position upon disengagement of the removable operating member as well as prevent operation of the circuit breaker position-changing mechanism unless the breaker is first tripped open by the re-engagement of the removable operating member.

Thus the improved sequential multiple interlock mechanism upon removal of the operating member and for freeing the circuit breaker for reclosure automatically insures against any creepage of the circuit breaker position-changing mechanism due to jars or vibrations produced upon repeated closing and opening operations of the breaker in service or otherwise such as might cause the circuit breaker to become accidentally disconnected in service and also insures that the circuit breaker is always tripped open before the anti-creep lock is released upon the re-engagement of the removable operating member with the position-changing mechanism. Thus the removable operating member serves as the key element in the improved sequential multiple interlocking mechanism of the present invention and in this way, additional security and safety in the interlocking control of the breaker is obtained.

Further objects and advantages of the invention will appear in the following description of

the accompanying drawing in which Fig. 1 is a side elevation of a typical metal-clad removable self-disconnecting circuit breaker provided with the improved multiple interlocking control of the present invention; Fig. 2 is a partial side view of the improved multiple interlocking control on an enlarged scale with certain parts broken away to show more clearly the details of construction; Fig. 3 is a front view of the interlocking mechanism shown in Fig. 2 and Fig. 4 is a further enlarged perspective view indicating more clearly the cooperating relationships of the removable operating member with the several parts of the improved sequential multiple interlocking control mechanism.

As shown in Fig. 1, the circuit breaker 10 is indicated as of the air blast type although the present invention is not in any way limited to this type of circuit breaker but may be used with advantage with any type of removable self disconnecting oil or air circuit breaker. The removable circuit breaker 10 as shown is provided with a supporting track or bar 11 on each side thereof for engagement by the opposite lifting channels 12 of the circuit breaker position-changing or elevating mechanism indicated generally by the reference character 13. Each lifting channel 12 is moved by a pair of jack screws 15 having suitable thrust and guide bearings 16 mounted on the cross members of the circuit breaker supporting channel frame 17.

All of the jack screws 15 are simultaneously operated by means of the rotatable driving member or shaft 20 that is rotatably supported in the box frames 18 and 19 and interconnected by means of the beveled gearing 21 with the two jack screws 15 shown and by means of the chain and sprocket gearing 22 with a similar beveled gear shaft for operating the jack screws on the opposite side of the breaker. Each jack screw 15 operates a traveling nut 27 that is suitably secured to one of the lifting channels 12. The shaft 20 is provided with an hexagonal end 23 for engagement by the socket head 24' of a removable manual operating crank 24 as shown in Figs. 2 and 4 although the crank 24 may be applied to the hexagonal end of the stub shaft 25 that is connected to drive the operating shaft 20 through the power amplifying gearing 26 if desired. While a removable manual operating crank 24 is shown in the drawing, it will be understood that, if desired, removable means in the form of a portable electric drill or the like may be provided with a socket for engaging with the shaft 20 to raise and lower the breaker.

In Fig. 1 the removable circuit breaker 10 is shown in its elevated self-connected operating position wherein the terminal studs **30** of the circuit breaker engage with the connecting socket contacts **31** mounted inside of the insulating bushings **32**. One of the socket contacts **31** is shown connected by the insulated conductor **33** with one of the busbars **34** located within the isolated busbar compartment **35** while the other socket contact **32** is shown connected by the insulated conductor **36** with a suitable current transformer **37** mounted inside the isolated load terminal compartment **38**. Thus when the circuit breaker is lowered, the terminal studs **30** are automatically disconnected from the socket contacts **31** so that the entire breaker mechanism **10** may be lowered onto a dolly and bodily removed from the supporting frame **17** for inspection, test, and maintenance.

It will be understood that the circuit breaker **10** is provided with suitable electric condition responsive automatic tripping mechanism, not shown. To insure safety in the removing and replacing operations, the circuit breaker **10** also is provided with an interlock tripping member **40** carried on an extension of the breaker trip shaft **40'** and biased by a spring **39** to a normally inactive position to be engaged by the cam plate **41** carried by the frame **14** and thereby moved to the tripping position so as to insure that the breaker is always tripped when it is raised into its connected operating position as shown in Fig. 1 by operation of the elevating mechanism **13**. Thus the breaker is always open when the terminal studs **30** are engaged with the sockets **31** and consequently the power circuit controlled by the breaker can be closed only by closure of the breaker itself.

To insure that the circuit breaker is always tripped before the elevating mechanism **13** can be manually operated to lower the breaker and disengage the terminal studs **30** from the sockets **31**, a movable interlocking member **43** in the form of a box-like cover is pivotally mounted on the frame **14** on the pivot pin **44** so as to be movable into a tilted position as shown in Fig. 1 that effectively bars engagement of the removable crank **24** with the hexagonal end of either the operating shaft **20** or the stub shaft **25**. Consequently, before an operator can apply the crank **24**, the interlock member **43** must be moved from its tilted blocking position as shown by the dotted lines in Fig. 2 to which it is biased when the breaker is in the connected position both by gravity and by the spring **39** of the circuit breaker trip member **40** to its full-line position shown in Fig. 2. This can be done either by manually tilting the member **43** or more simply by using the removable crank **24** to tilt the member **43** until the ends of both the operating shaft **23** and the stub shaft **25** project through the restricted opening **43'** formed in interlock member **43** for engagement of the crank with the end of the shaft. Such engagement of the crank with the shaft forces the extension **45** of the interlock member **43** operates the circuit breaker tripping member **40** against the bias of spring **39** when the interlock member **43** is moved from its blocking position shown in dotted lines in Fig. 2 to its full-line position. Thus the interlocking member **43** effectively insures that the elevating mechanism **13** can never be manually operated by the crank **24** to lower the breaker unless the breaker is first opening by operation of the breaker tripping member **40**.

It will be observed, however, that the circuit breaker **10** is supported in its connected operating position in which it is shown in Fig. 1 entirely by the jack screws **15**. Consequently, under conditions of repeated jarring or continued vibration the jack screws **15** may creep enough so as to gradually lower the circuit breaker **10** from its connected operating position in which it is shown in Fig. 1. In case such gradual creepage continues until the breaker tripping member **40** engages with the cam plate **41** and trips the breaker, then serious inconvenience may result from such undesirable breaker operation.

In accordance with the present invention such accidental creepage of the elevating mechanism is effectively eliminated by means of a notched collar **48** fixed to the operating shaft **20** by the anchoring pin **49** and a latch **50** biased into engagement with the notches in the collar **48** to effectively lock the shaft **20** against any accidental rotation due to jars or vibrations. The latch **50** is pivotally mounted on the pin **51** carried by the bracket **52** that is bolted to the elevating mechanism cross frame **18** and is provided with a cam-shaped arm **53** having a finger **54** for engaging the end of the biasing spring **55** that biases the latch **50** into locking engagement with a slot in collar **48** as indicated by the dotted lines in Fig. 2.

To retract the latch **50**, the box-like movable interlock member **43** is provided with an upturned finger **56** that is carried into operating engagement with the cam-shaped arm **53** of the latch **50** when the interlocking member **43** is moved to its full-line position shown in Fig. 2 in which the hexagonal end **23** of the operating shaft **20** becomes accessible through opening **43'** for application of the socket **24'** of the crank **24** thereto. When the crank **24** is thus applied to operate shaft **20**, the socket **24'** overlaps the edges of the restricted opening **43'** formed in the interlock member **43** and hence serves to force the interlock member **43** to the position in which it is shown in full line in Fig. 2 so as both to maintain the latch **50** out of locking engagement with the slotted collar **48** and the circuit breaker tripping member **40** in the tripping position. This permits the shaft to be turned to rotate the operating shaft **20** so as to turn the jack screws **15** to lower the tripped circuit breaker from its connected operating position in which it is shown in Fig. 1 to the disconnected position or vice versa. Thus to effect a lowering or raising operation the removable operating member **24** must force the interlocking member **43** to perform the multiple interlocking functions of providing access to the operating shaft **20**, maintaining the circuit breaker tripping member **40** in the tripping position, and maintaining the latch **50** out of locking engagement with the slotted collar **48**. Upon disengagement of the removable operating member **24** after the circuit breaker is raised to its connected position, the latch **50** is first returned into locking engagement with the slotted collar **48** and the interlocking member **43** is then returned to its bias position whereby the circuit breaker tripping member **40** is returned to the non-tripping position.

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

In combination, a circuit breaker position-changing mechanism having a rotatable drive shaft provided with an interlocking member comprising a slotted collar fixed thereto and rotatable therewith, a removable operating member engageable with one end of the shaft for moving the breaker between the connected and disconnected positions, a second interlock member biased to a first position for yieldingly barring engagement of said removable operating member with the one end of the shaft and movable to a second position upon engagement therebetween, tripping means operated by said second interlock member in said second position for opening the breaker, and a movable latch having biasing means for biasing the latch into locking engagement with the first interlocking member to prevent creepage of the position-changing mechanism while the operating member is disengaged from the shaft and having means operated by the second interlock member in said second position thereof for releasing the latch.

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