

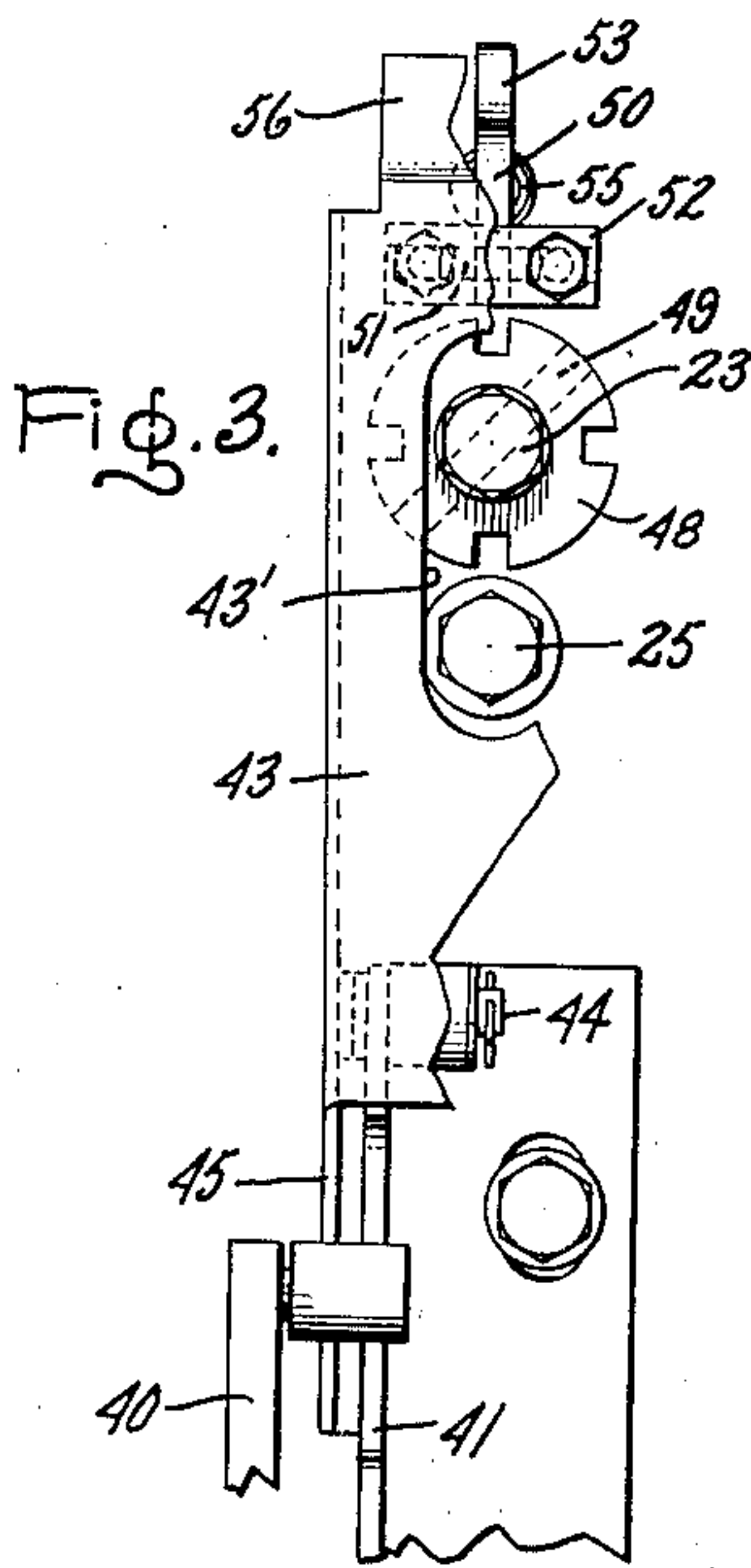
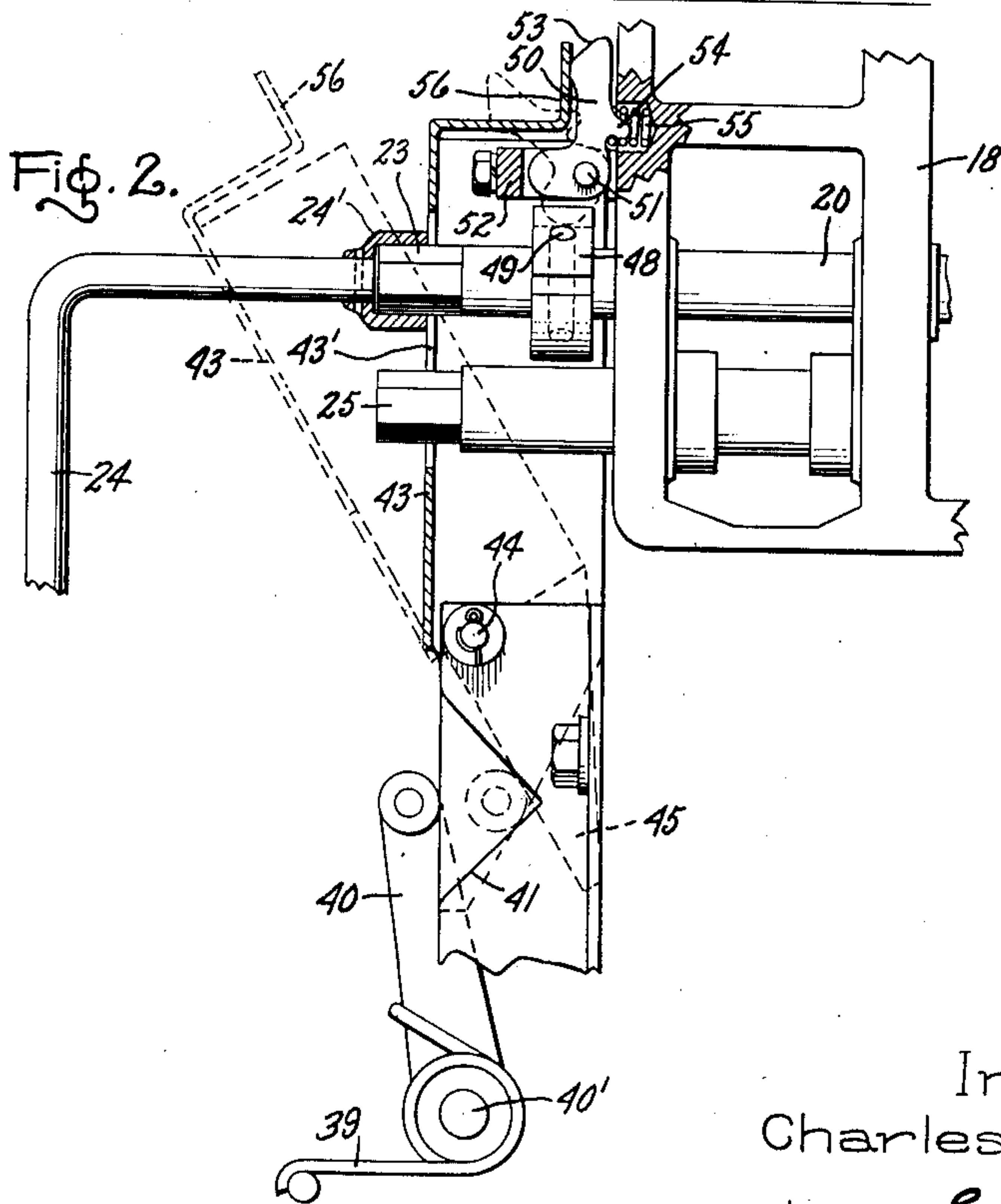
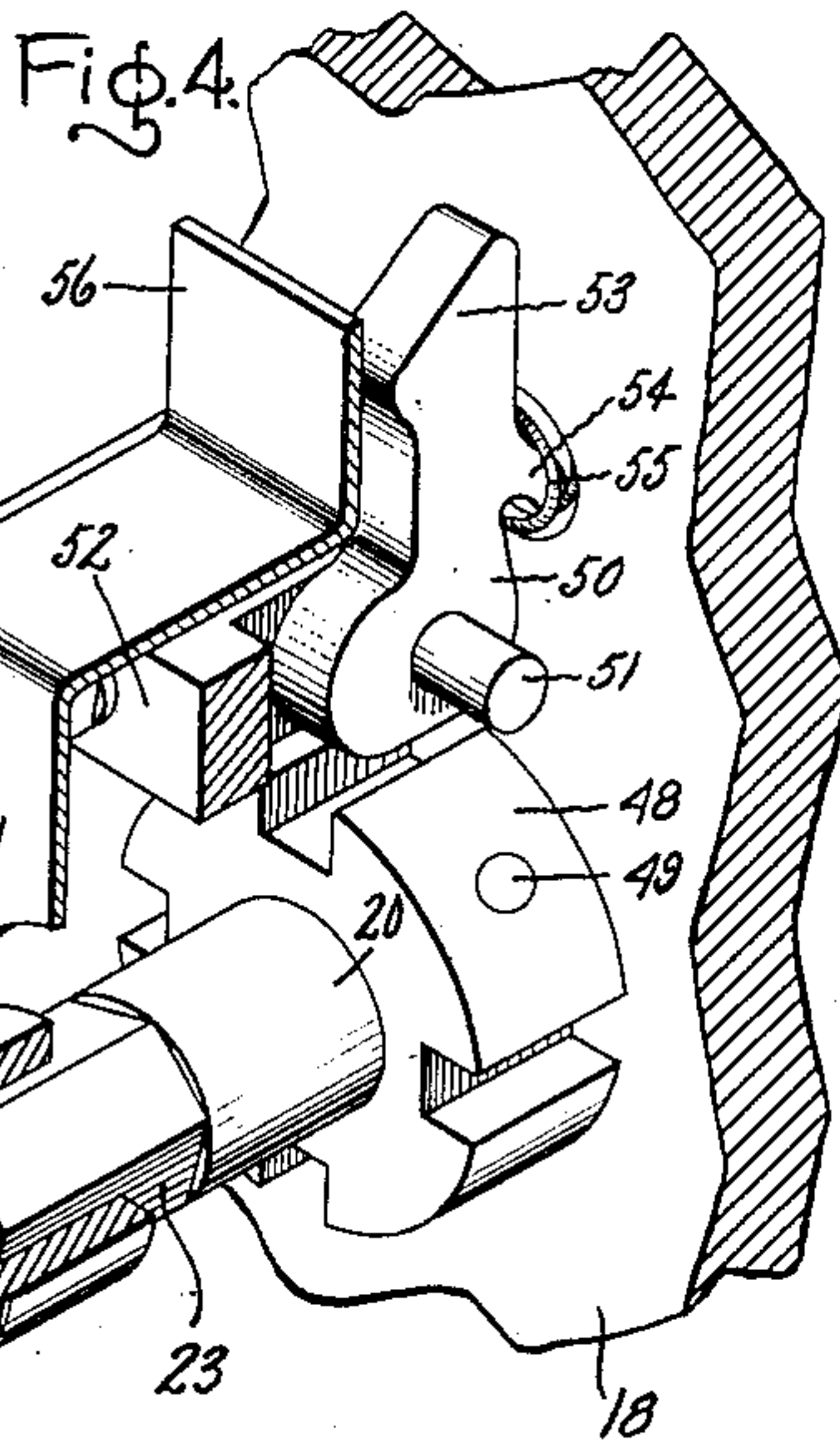
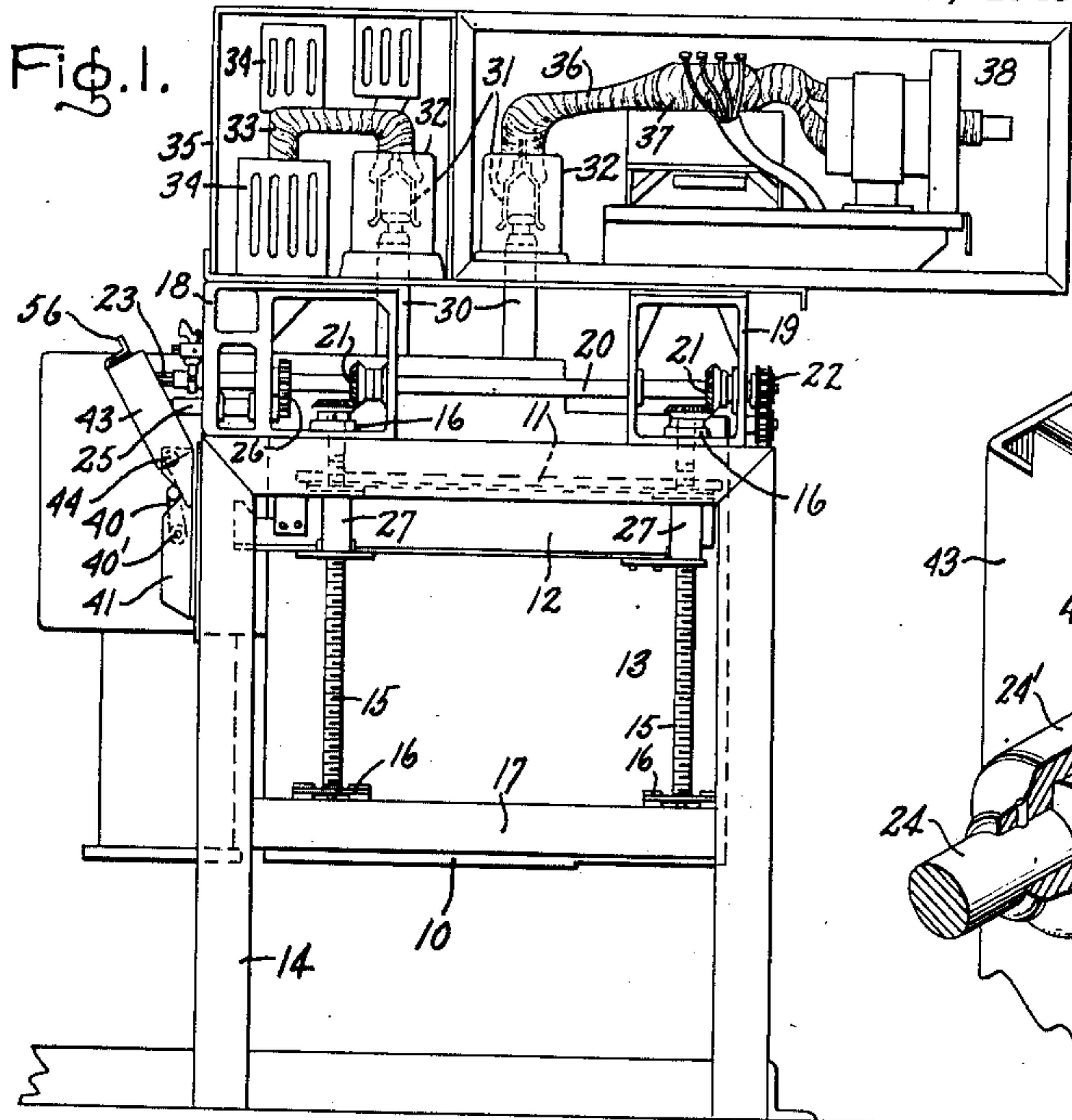
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**2,540,814**

## REMOVABLE SWITCHGEAR INTERLOCKING CONTROL

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## UNITED STATES PATENT OFFICE

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## REMOVABLE SWITCHGEAR INTERLOCKING CONTROL

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1 Claim. (Cl. 200—50)

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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interrupting type, are used in electric power stations and substations to enable the circuit breakers to be readily withdrawn for inspection and maintenance service and quickly replaced on the line.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

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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



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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

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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 up-turned 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



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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

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means operated by the second interlock member in said second position thereof for releasing the latch.

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