

March 6, 1951

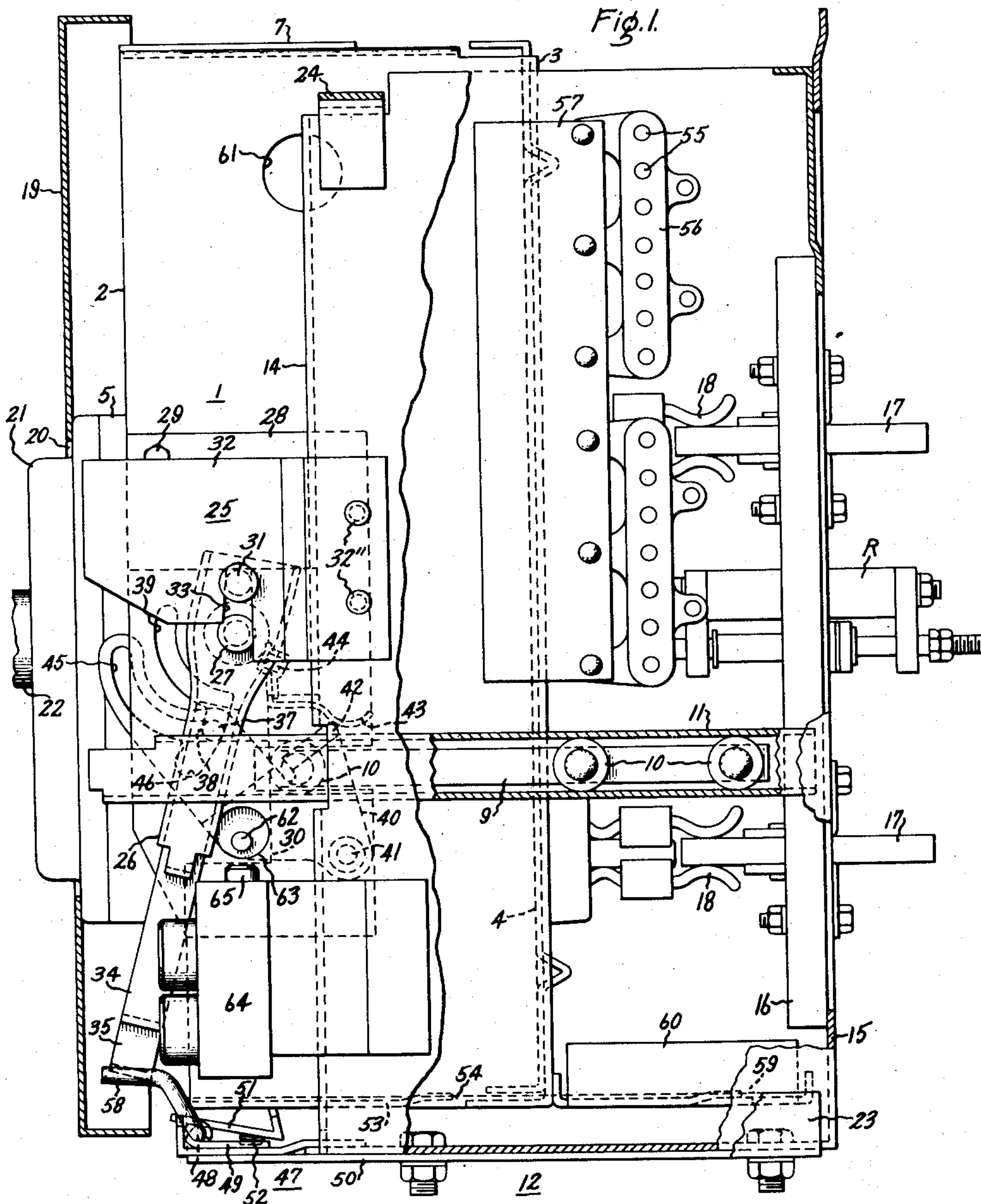
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SWITCHGEAR DRAWOUT MECHANISM

Filed Oct. 28, 1948

3 Sheets-Sheet 1



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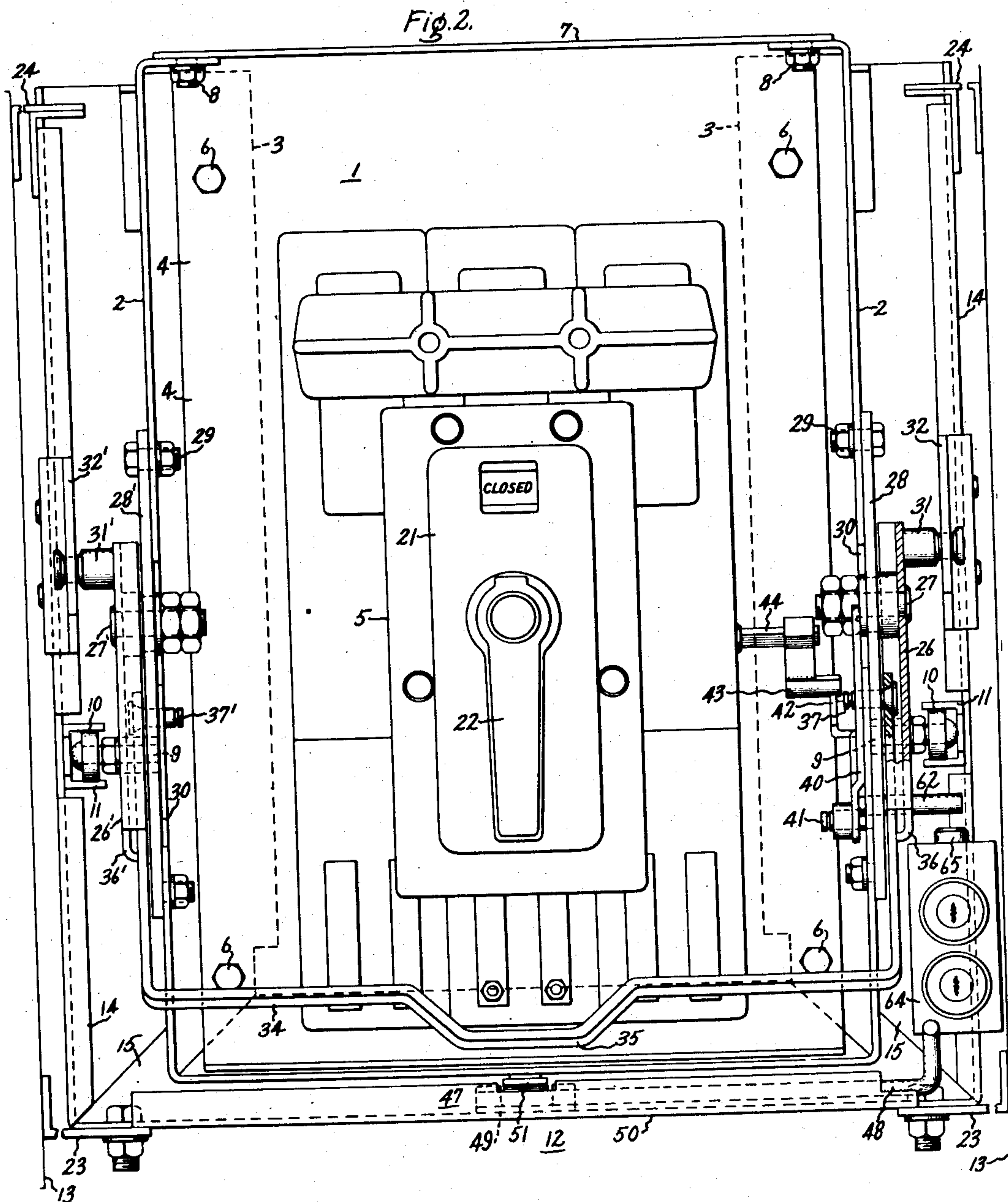
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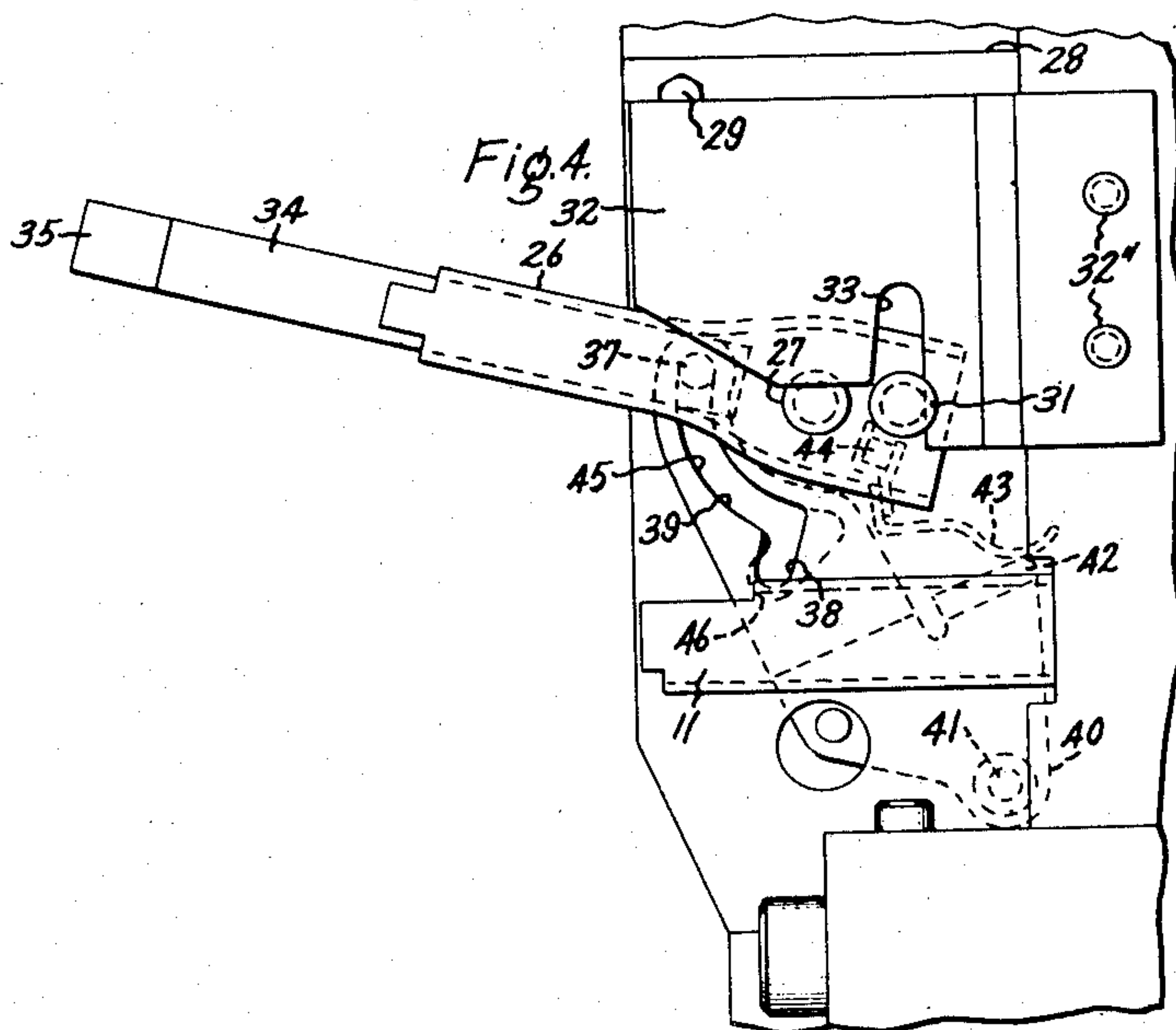
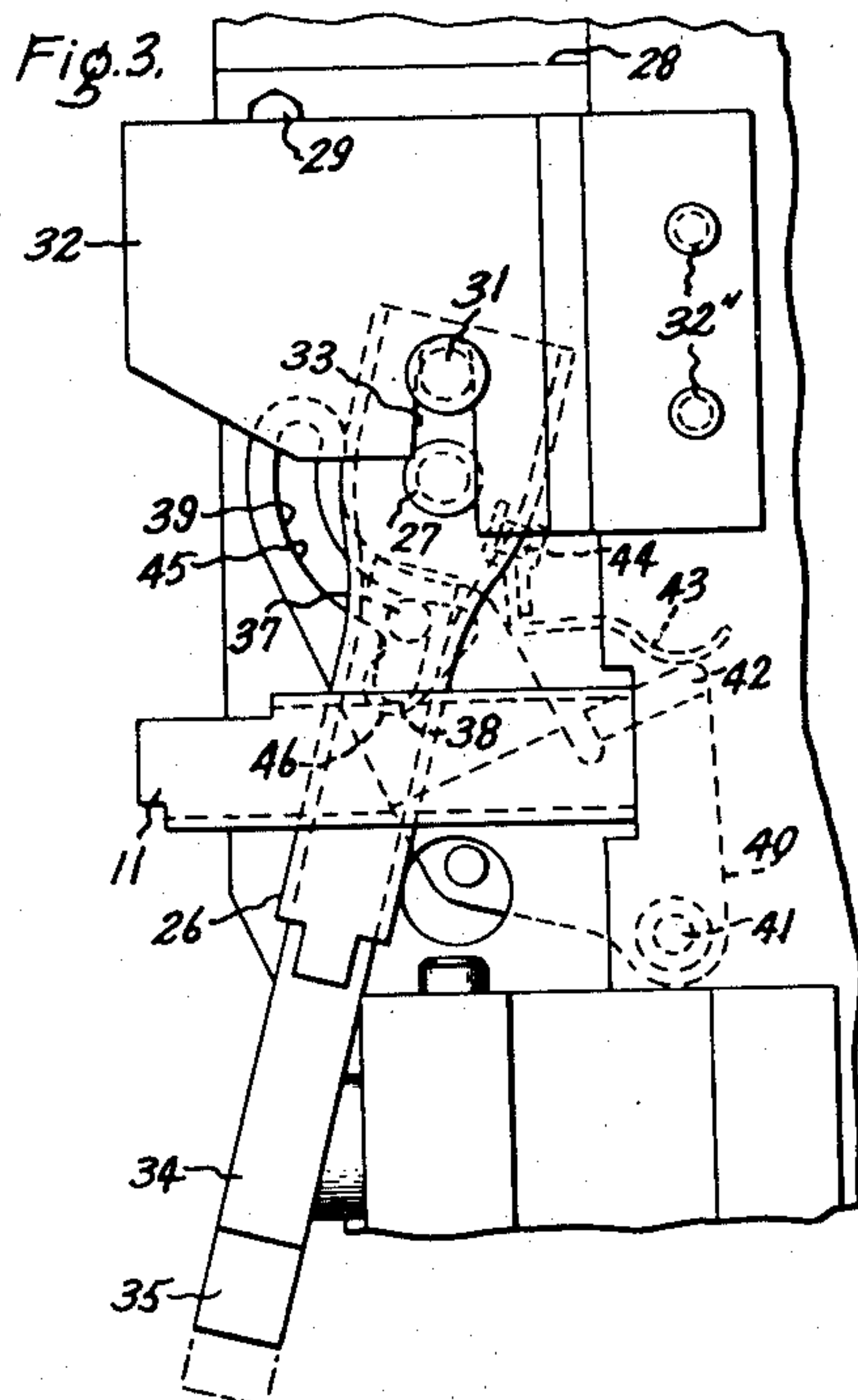
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SWITCHGEAR DRAWOUT MECHANISM

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UNITED STATES PATENT OFFICE

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SWITCHGEAR DRAWOUT MECHANISM

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13 Claims. (Cl. 200—50)

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The invention relates to drawout mechanism for metal enclosed removable switchgear, and more particularly to a removable and also separable carriage insert and drawout mechanism suitable for an automatic power circuit breaker provided with disconnect contacts whereby the circuit breaker is connected to and disconnected from the circuit upon insertion into and withdrawal of the carriage for separation from a metal enclosing cubicle.

The primary objects are to provide the powerful mechanical advantage required to engage or disengage the disconnect contacts upon the insertion and withdrawal of the carriage for an automatic power circuit breaker of substantial size, to insure the mechanical tripping of the breaker before either operation can occur, and to mechanically lock the carriage with the circuit breaker in its inserted normal operating connected position, all by means of a single handle lever mechanism.

Thus, the improved single handle lever mechanism inherently effects all the necessary operations in the proper sequence required for safety in the insertion and withdrawal of the circuit breaker as well as locking in its normal operating position.

Another object is to provide a removable circuit breaker carriage with alternative insert and drawout mechanism and alternative locking and tripping mechanism all having a single operating handle mounted on the carriage for opposite relative movements to alternatively operate the carriage insert and withdrawal mechanism and independent opposite relative movements to alternatively operate the locking and tripping mechanism.

Another object is to provide an improved form of carriage insert, drawout and locking separable mechanism having an operating lever pivoted on the carriage and provided with a fixed releasable hook fulcrum for levering the carriage between the inserted position and the drawout position wherein the hook fulcrum is automatically released to provide for complete separation of the carriage from its enclosure together with a relatively movable operating handle mounted on the lever for carriage locking and, where required, circuit breaker tripping relative movements as well as the power amplified carriage insertion and withdrawal lever operating movements.

However, the improved carriage insert, drawout and locking single handle separable mechanism of the present invention is not necessarily limited

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to circuit breaker service and in case the tripping of a circuit breaker is not required, this may be eliminated and the improved carriage drawout and locking mechanism utilized for other forms of enclosed drawout switchgear or in other similar service where separation of the mechanism is required.

Another object is to provide cooperating separately operable stop mechanism for stopping the withdrawal of the carriage in an intermediate test position for the circuit breaker or other switchgear after the primary disconnect contacts are opened and also in the final separation position of the carriage so as further to insure safe separation of the breaker or other switchgear carried thereby.

Other objects and advantages of the invention will appear in the following description of the accompanying drawings in which Fig. 1 is a side view partly in section of a metal-enclosed power circuit breaker provided with the improved carriage drawout lever mechanism of the present invention and showing the breaker locked in its normal operating position connected to the circuit. Fig. 2 is a front view of the circuit breaker and drawout mechanism shown in Fig. 1 with the cover removed from the metal enclosure. Fig. 3 is a partial side view of the drawout mechanism with the breaker tripped and ready for levering withdrawal from its inserted or connected position to its intermediate test position, and Fig. 4 is a similar partial side view of the single handle drawout mechanism with the breaker in its final levering withdrawal position wherein the hook fulcrum is released from the operating lever, with the carriage prepared for horizontal movement to its intermediate test position.

As shown in Fig. 1, the drawout carriage, indicated generally by the reference character 1, comprises a metal frame 2 which, as more clearly shown in Fig. 2 is of U-shape and provided with inwardly turned flanges 3 at the rear edges thereof for mounting the panel 4 carrying the automatic power circuit breaker 5 thereon. As schematically shown, in Fig. 2 the power circuit breaker 5 is of the improved rotary handle operated type more fully described in the co-pending Favre application, Serial Number 775,573, and assigned to the same assignee as the present invention although it should be understood that the improved carriage drawout mechanism of the present invention may be used with other forms of circuit breakers or other switchgear if desired. The circuit breaker panel 4 is removably

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mounted on the flanges 3 by means of the mounting bolts 6 and the upright legs of the U-shaped frame 2 are interconnected by the removable top plate 7 that is held in position by the studs 8.

A roller mounting bar 9 is secured outside each leg of the U-shaped frame 2 for carrying the anti-friction rollers 10 inside the channel track 11 in order to enable the circuit breaker carriage 1 to be readily inserted and withdrawn as well as separated from the metal enclosure therefor that is indicated generally by the reference character 12. The enclosure 12 is shown in the form of a metal casing or cubicle and as indicated in Fig. 2 is provided with outer enclosing side walls 13 spaced slightly away from the stronger inner supporting walls 14 on the inside of which the channel tracks 11 are supported. The enclosure 12 also is of U-shaped construction with inwardly turned back flanges 15 for mounting thereon the insulating panel 16 that carries the stationary circuit terminal contacts 17 for engaging with the movable primary disconnect contacts 18 and thereby enable the circuit breaker 5 to be connected to and disconnected from the circuit upon insertion into and withdrawal of the carriage 1 from the metal enclosing cubicle 12. The panel 16 may also carry suitable field resistors R if desired. The enclosing cubicle 12 preferably is provided with a removable door 19 having a suitable aperture 20 formed therein for enabling the position indicating panel 21 and the rotatable operating handle 22 of the circuit breaker to project therethrough when the door is closed as shown in Fig. 1. The metal-enclosing casing 12 also may be provided with the supporting angle irons 23 at the bottom corners thereof as well as the lateral supporting angles 24 connected to the upper edge of the inner supporting wall 14 in order to reinforce the casing.

In accordance with the present invention the improved single handle lever insert, drawout, and locking mechanism indicated generally by the reference character 25 is provided for controlling the insertion and withdrawal of the carriage 1 from the enclosing casing 12. This mechanism comprises a pendulous operating lever 26 pivoted adjacent its upper end on a bearing pin 27 carried by the mounting plate 28 that is secured to one of the upright legs of the U-shaped carriage frame 2 by means of the mounting bolts 29 so as to span a notch or opening 30 formed in the frame. The operating lever 26 carries a fulcrum pin 31 at its upper end so as to releasably engage the hook fulcrum member 32 that is secured to the inner side wall 14 of the enclosure 12 by means of the rivets 32''. The fixed hook fulcrum member 32 is provided with a transverse slot 33 for receiving the fulcrum pin 31 therein so as to lever the carriage 1 between the inserted position and the drawout position upon corresponding reversed pivotal movements of the lever 26 with the fulcrum pin 31 sliding in the slot 33 during such insertion and withdrawal movements.

In order to equalize the strains and thereby facilitate the insertion and withdrawal of the carriage 1 a duplicate lever arm 26', fulcrum pin 31', and hook fulcrum member 32' are provided in reversed alignment on the opposite side of the carriage 1. The two opposite levers 26 and 26' are both connected to be simultaneously operated by a single operating handle 34 that as shown in Fig. 2 is in the form of a U-shaped bar with a dropdown central handle portion 35 that can be conveniently grasped to apply the force

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required to insert and withdraw the carriage 1. Since each fulcrum pin 31—31' is located near the bearing pin 27—27' of the corresponding lever 26—26' a large amplification of the force applied to the handle 34 is obtained so as to effectively provide the powerful forces required to engage and disengage the primary disconnect contacts 18 with the circuit terminal contacts 17 during the insertion and withdrawal of the circuit breaker carriage 1.

In further accordance with the present invention the single operating handle 34 is slidably mounted on the lever arms 26 and 26' and biased for relative movement radially thereon. For this purpose each lever arm 26 and 26' is channel-shaped so as to slidably mount a corresponding end of the U-shaped single operating handle 34 therein and provided with the inturned extensions 36 and 36' at the end of the channel-shaped lever arms 26 and 26' so as to minimize the sideways travel of the ends of the U-shaped single operating handle 34 that carry the locking pins 37 and 37'. The locking pin 37 is biased by the weight of handle 34 to engage with the radial extension 38 of the arcuate slot 39 formed in the mounting plate 28 so as to enable the mounting plate 28 to act as a stop mounted on the carriage for engaging the handle to prevent movement of the lever to release the fulcrum pin 31 from the hook fulcrum member 32 until the handle 34 is raised from the predetermined relative position on the lever 26 wherein the locking pin 37 engages with the radial slot extension 38. The locking pin 37' similarly engages with a corresponding radial extension of an arcuate slot formed in the mounting plate 28' on the opposite side of the carriage 1. In this way the carriage 1 is mechanically locked with the circuit breaker in its inserted normal operating position in which it is shown in Fig. 1 and the locking elements are structurally strong enough to resist the powerful magnetic forces that tend to force the circuit breaker carriage 1 out of its inserted position whenever the circuit breaker is subjected to excessively high overload currents.

In further accordance with the present invention tripping means are provided for tripping the circuit breaker upon relative movement of the single operating handle 34 out of the locking position in which it is shown in Fig. 1 into a tripping position shown in Fig. 3. This is accomplished by means of a tripping member 40 that is pivotally mounted on the carriage 1 by means of the pivot pin 41 carried by the mounting plate 28 and having a cam shoulder 42 operable into engagement with the arm 43 extending from the circuit breaker trip shaft 44. The tripping member 40 is provided with an arcuate slot 45 for registering with the arcuate slot 39 formed in the plate 28 and also a radial extension slot 46 corresponding to the radial extension slot 38 so as to receive the handle locking pin 37 therein. Thus when the handle locking pin 37 rests at the bottom of the locking radial extension slot 38, the tripping member 40 is biased by gravity so that the arcuate slot 45 therein rests on top of the locking pin 37 so as to maintain the tripping member 40 in the non-tripping position in which it is shown in Fig. 1 with the circuit breaker 5 in its inserted normal operating position. Under these conditions all of the automatic tripping devices with which the circuit breaker 5 is provided are effective to control the tripping of the breaker. However, when the single operating handle 34 is raised so as to release the locking

pin 37 from the locking radial slot extension 38 preparatory to withdrawal of the breaker, then the tripping member 40 also is moved by the locking pin 37 so as to bring the arcuate slot 45 into register with the arcuate slot 39 and engage shoulder 42 with the arm 43 and thereby rotate the circuit breaker trip shaft 44 to its tripping position as shown in Fig. 3 with the inward radial relative movement of the operating handle 34 against its bias indicated by the dash-dot lines. In this way tripping of the breaker is insured before the mechanical lock holding the breaker in the inserted position is released preparatory to withdrawal of the breaker.

With the circuit breaker 5 tripped and the mechanical lock holding the breaker carriage 1 in the inserted position released, the single operating handle 34 then can be rotated in the clockwise direction about the bearing pin 27 to effect the levering withdrawal of the circuit breaker carriage 1. As previously pointed out, a powerful lever amplification of the force applied to the handle 34 is obtained so as to readily release the movable primary disconnect contacts 18 from the circuit terminal contacts 17. During this movement the fulcrum pin 31 slides downwardly in the fulcrum slot 33 until a position is reached wherein the hooked fulcrum member 32 is released as shown in Fig. 4 since the fulcrum pin 31 is out of the slot 33. During such power amplifying levering movement, the locking pin 37 rides in the registering arcuate slots 39 and 45 until the end of the slot is reached thus stopping the pivotal movement of the lever 26 and the handle and its relatively movable handle extension 34 in the position in which these parts are shown in Fig. 4. Thereupon, circuit breaker carriage 1 can be readily rolled toward the final separation position on the anti-friction rollers 10 inside the channel tracks 11.

In order to arrest the withdrawal movement of the carriage 1 with the circuit breaker 5 in an intermediate test position inside of the enclosing casing 12, a separately operable one-way stop mechanism 47 is provided which in the preferred form shown comprises a shaft 48 rotatably mounted in a bearing bracket 49 secured to the bottom wall 50 of the enclosing casing 12 carrying an L-shaped latching member 51 which is biased into the latching position by the compression spring 52. The bottom side 53 of the carriage frame 2 is provided with a cooperating indented one-way latching notch 54 for engaging with the upturned end of the bias latch member 51 when the carriage 1 reaches the intermediate test position. Thereupon the handle 34 may be returned to its locked position wherein the locking pin 37 engages with the radial extension 38 so as to return the tripping member 40 to the non-tripping position and thereby permit the testing operation of the automatic tripping device for the circuit breaker 5 in the intermediate test position thereof. In this position the secondary disconnect spring bias contacts 55 that are carried in the secondary contact mounting heads 56 secured to the plate 57 extending from the back of the circuit breaker carriage 1 remain in circuit closing engagement with the cooperating secondary or control contacts that are carried on the inside of the enclosing cubicle 12 and thus remain interconnected with the automatic operating circuits and devices of the breaker.

In case it is desired to entirely separate the circuit breaker carriage 1 from the enclosure 12,

the latch release finger 58 is raised so as to lower the catch member 51 out of engagement with the depressed notch 54 and thereby permit further rectilinear movement of the circuit breaker carriage 1 towards the final separation position. In order to prevent the carriage supporting rollers 11 from inadvertently being run out the open front end of the channel track 11, a second depressed one-way latching notch 59 is formed in the bottom extension plate 60 which is fixedly secured to the circuit breaker carriage 1 so that the notch 59 will engage the latch 51 when the circuit breaker carriage 1 is fully drawn out to the final separation position. In this position suitable lifting crane hooks can be inserted into the lifting holes 61 provided in the upper sides of the carriage 1 so as to swing the entire circuit breaker carriage 1 out of the enclosure 12 when latch tripping finger 51 is again raised to release the latch 51 from the notch 59.

When the breaker carriage 1 is replaced for insertion into the enclosure 12, the single operating handle 34 must be raised into the position in which it is shown in Fig. 4 before the fulcrum pin 31 can be returned into the position for engaging with the slot 33 in the hook fulcrum member 32 so as to lever the carriage 1 into its normal inserted operating position. Otherwise in case the handle should be in its normal latching position with the breaker untripped, then the fulcrum pin 31 will jam against the front edge of the hook fulcrum member 32 and thereby prevent insertion of the circuit breaker carriage 1 to the position in which the movable primary disconnect contacts 18 engage with the stationary contact terminals 17. This insures that the handle 34 must always be raised into the position in which the tripping member 40 is operated to trip the breaker 5 before the primary disconnect contacts 18 can become engaged. Upon the insertion movement of the carriage 1, the positioning latch 51 is ineffective since it is a one-way latch only.

If desired, provision may be made for lifting and locking the trip member 40 in the tripping position independently of the operating handle 34. Thus the tripping member 40 may be provided with an auxiliary pin 62 extending through a suitable opening 63 formed in the mounting plate 28 and a single or double-key locking device 64 provided with a bolt 65 which when raised into engagement with pin 62 will separately move the tripping member 40 to the tripping position and lock the tripping member therein.

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

1. A removable carriage insert and drawout mechanism having in combination an operating lever pivoted on the carriage, means including a fixed member forming a releasable hook fulcrum for the lever to move the carriage between the inserted and the drawout position wherein the hook fulcrum is automatically released, and carriage locking means including a relatively radially movable operating handle extension on the lever and a stop on the carriage for engaging the handle extension in the insert position of the lever to prevent movement of the lever from the insert position until the handle extension is retracted from engagement with the stop.

2. In combination a rectilinear removable carriage drawout mechanism having an operating lever pivoted on the carriage and provided with a fixed hook fulcrum releasable from the lever only in a predetermined angular position

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thereof, a relatively radially movable operating handle for the lever biased to a predetermined radial position thereon, and locking means for the carriage including a stop on the carriage for engaging the handle in another angular position of the lever to prevent movement of the lever to release the hook fulcrum when the handle is in its biased position on the lever.

3. In combination a removable circuit breaker carriage drawout mechanism having an operating lever pivoted on the carriage and provided with a fixed releasable hook fulcrum for levering the carriage from the inserted position to the drawout position wherein the hook fulcrum is automatically released, a relatively movable operating handle for the lever having circuit breaker tripping means operated upon relative movement thereof to a tripping position, means biasing the handle to a non-tripping position, and locking means for the carriage including a stop on the carriage for engaging the handle to prevent movement of the lever to release the hook fulcrum when the handle is in the non-tripping position.

4. In combination a removable carriage drawout mechanism having a pair of operating levers pivoted on the opposite sides of the carriage and each provided with a releasable hook fulcrum for levering the carriage from the inserted position to the drawout position wherein the hook fulcrum is automatically released, and operating means for the levers and locking means for the carriage including a substantially U-shaped operating handle having each leg operatively connected with the corresponding lever and for relative radial movement thereon, and a stop on the carriage for releasably engaging the handle to prevent movement of the carriage from the inserted position until the handle is released radially from the stop.

5. In combination a removable carriage insert and drawout mechanism having a pendulous operating lever pivoted adjacent its upper end on the carriage and provided with a radially projecting pin at its upper end and a fixed releasable hook fulcrum engaging the pin for levering the carriage between the inserted position and a position wherein the levering pin is automatically released from the hook fulcrum, locking means for the carriage including a relatively radially movable operating handle extension from the lower end of the lever and having a radially projecting latching pin and a stop on the carriage for releasably engaging the latching pin upon radial extension of the handle with the lever in the insert position to prevent movement of the carriage from the inserted position until the handle is raised to release the latching pin from the stop.

6. In combination a separable carriage drawout mechanism having an operating lever pivoted on the carriage and provided with a releasable hook fulcrum for levering the carriage between the inserted position and a predetermined position wherein the hook fulcrum is automatically released for movement of the carriage therefrom to a separation position, locking means for the carriage including a relatively movable operating handle on the lever and a stop on the carriage for releasably engaging the handle to prevent movement of the carriage from the inserted position until the handle is released from the stop, and separately releasable one way latching means for arresting only the outward

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movement of the carriage in both the predetermined position and the separation position.

7. A removable circuit breaker carriage insert, drawout, locking and tripping mechanism having a single operating handle mounted on the carriage for both pivotal insert and drawout movement and radial movement to a carriage locking position, and a circuit breaker tripping member mounted on the carriage for operation upon radial movement of the operating handle from its locking position.

8. A removable circuit breaker carriage having reversely operable insert and drawout mechanism including a lever mounted on the carriage and successive locking and tripping mechanism mounted on the carriage, a single operating handle having relatively movable means for mounting the handle on the lever for effecting opposite movements thereof to reversely operate the carriage insert and drawout mechanism and independent opposite relative movements with respect to the lever to successively operate the locking and tripping mechanism.

9. In combination a removable circuit breaker carriage insert, drawout, locking and tripping mechanism having a single operating handle mounted on the carriage for both pivotal insert and drawout movement and radial movement to a carriage locking position, means biasing the handle to the locking position, a circuit breaker tripping member mounted on the carriage for operation when the operating handle is moved radially against its bias, and means including an arcuate element mounted on the carriage for holding the handle against its bias during the pivotal insert and drawout movement thereof.

10. In combination a removable circuit breaker carriage drawout, locking and tripping mechanism having a single operating handle mounted on the carriage for pivotal movement to draw out the carriage from the inserted position and radial movement to lock the carriage in the inserted position, means biasing the handle to the locking position, means including a pin carried by the handle and a tripping member pivoted on the carriage and having an arcuate slot for receiving the pin therein to trip the breaker when the operating handle is moved radially against its bias, and means including a member fixedly mounted on the carriage and having an arcuate slot for registering with the arcuate slot of the tripping member to receive the pin therein for holding the handle against its bias during the pivotal movement thereof and thereby maintain the tripping member in the tripping position.

11. In a carriage insert, drawout and locking mechanism, the combination of a rectilinear removable carriage provided with a lever pivotally mounted on the side of the carriage and having an operating handle slidably mounted on the lever for radial movement on one side of the pivot axis, a fulcrum pin extending laterally from the lever on the opposite side of the pivot axis, a member fixed in the path of the fulcrum pin and having a transverse slot formed for releasably receiving the fulcrum pin therein to reversely move the carriage upon corresponding reverse pivotal movements of the lever by the handle, a locking pin carried by the handle, and a slotted member mounted in the path of the locking pin on the carriage and having a radial slot for receiving the handle locking pin therein upon a predetermined radial movement of the handle to hold the lever in a predetermined angular position on the carriage with the fulcrum

pin thereof engaging the slot in the fixed member to lock the carriage in a corresponding position.

12. In a circuit breaker drawout mechanism, the combination of a removable circuit breaker carriage provided with a lever pivotally mounted on the carriage and having an operating handle slidably mounted for radial movement on the lever, a fulcrum pin carried by the lever, a fixed member having a slot for receiving the fulcrum pin therein to reversely move the carriage upon corresponding pivotal movement of the lever by the handle, circuit breaker tripping means including a pin carried by the handle into a predetermined tripping position upon radial movement of the handle, and a member mounted on the carriage and having a slot for receiving the tripping pin upon opposite radial movement of the handle from the tripping position to lock the lever in a predetermined position with the fulcrum pin thereof engaging the slot in the fixed member to correspondingly lock the carriage.

13. In a circuit breaker drawout mechanism, the combination of a removable circuit breaker carriage provided with a lever pivotally mounted on the carriage and having an operating handle slidably mounted for radial movement on the lever, a fulcrum pin carried by the lever, a fixed member having a slot for receiving the fulcrum pin to reversely move the carriage upon corresponding pivotal movement of the lever by the handle, a locking pin carried by the handle, a slotted member fixedly mounted on the carriage

and having a circular slot with a radial extension for receiving the locking pin therein upon a predetermined radial movement of the handle to lock the lever in a predetermined position with the fulcrum pin thereof engaging the fixed slotted member to correspondingly lock the carriage, and circuit breaker tripping means including a slotted member movably mounted on the carriage and having a circular slot with a radial extension for receiving the locking pin therein to be moved upon radial movement of the locking pin out of the locking slot radial extension to a tripping position in registering relation with said first circular slot and maintained therein upon subsequent pivotal movement of the lever by the handle.

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