

April 18, 1950

J. D. WOOD

2,504,775

GROUND TESTING DEVICE

Filed Feb. 26, 1947

4 Sheets-Sheet 1

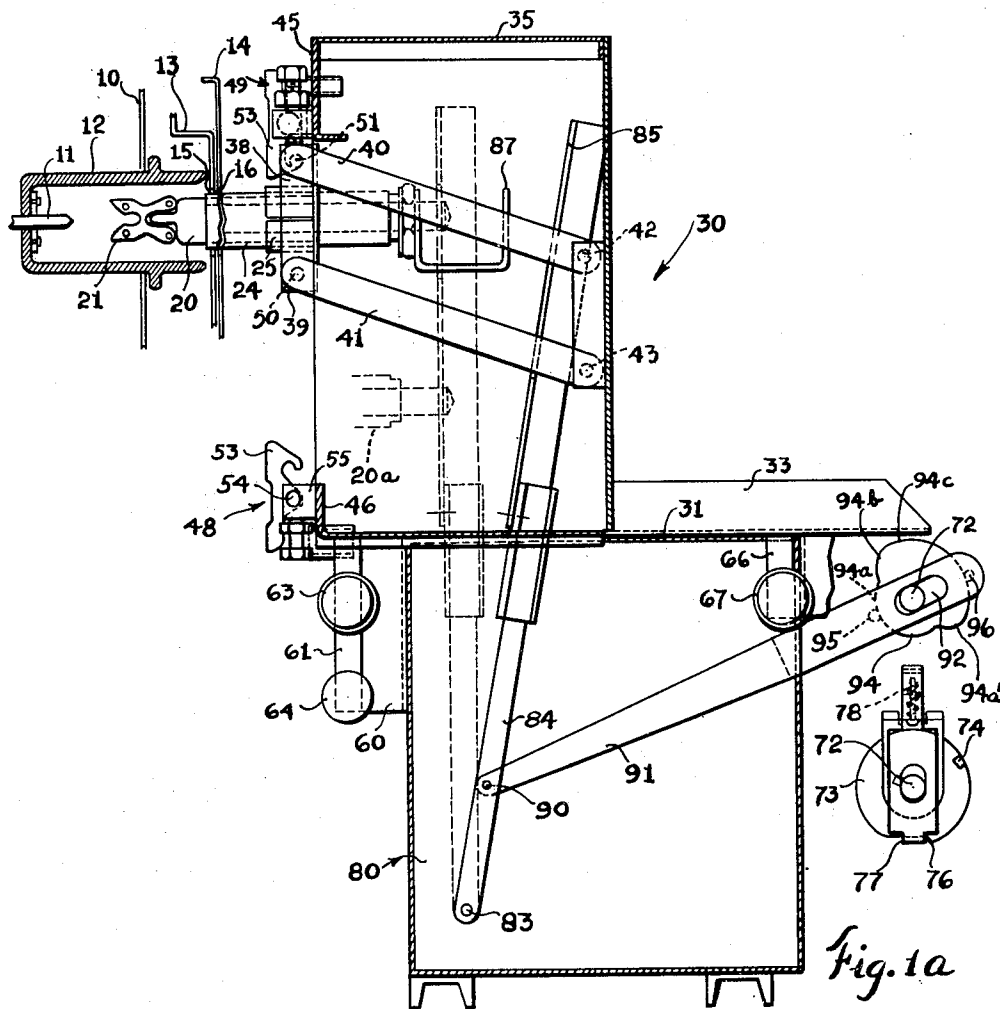


Fig. 1

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4 Sheets-Sheet 2

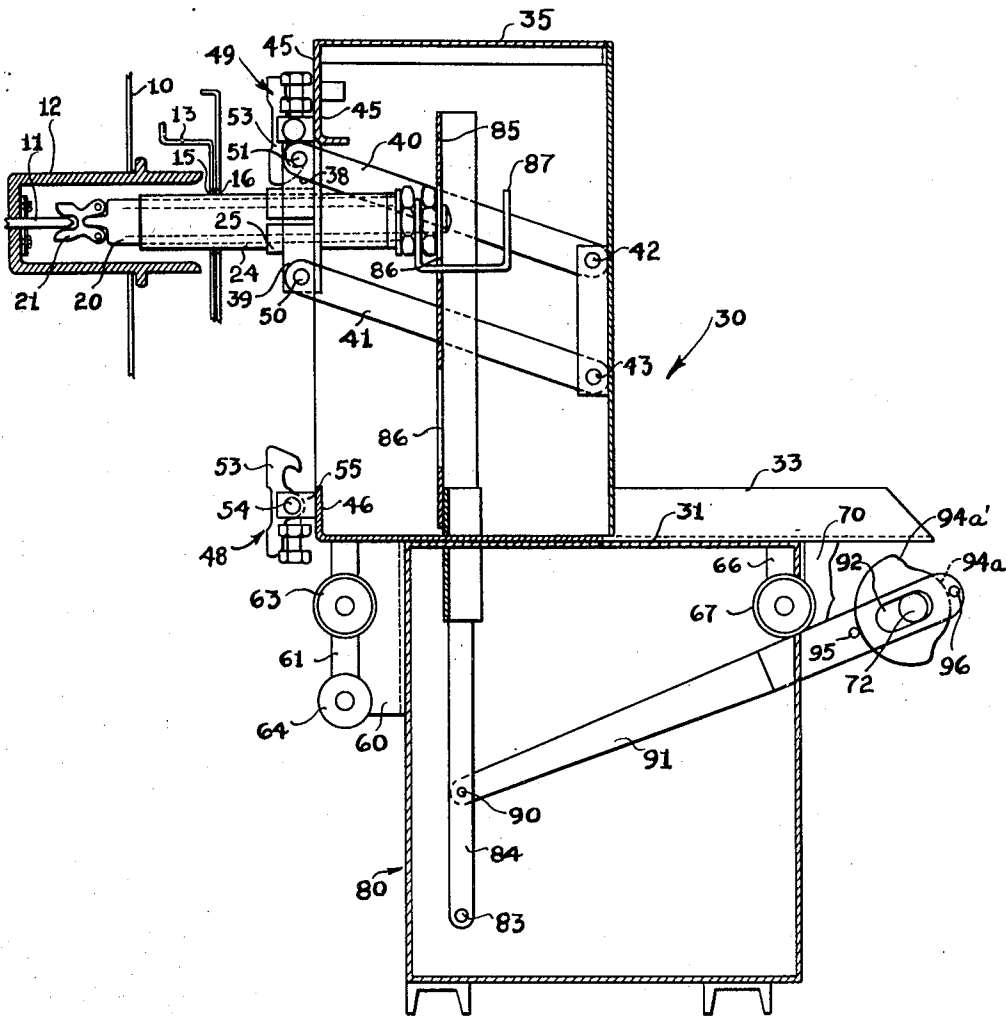


Fig. 2

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GROUND TESTING DEVICE

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4 Sheets-Sheet 3

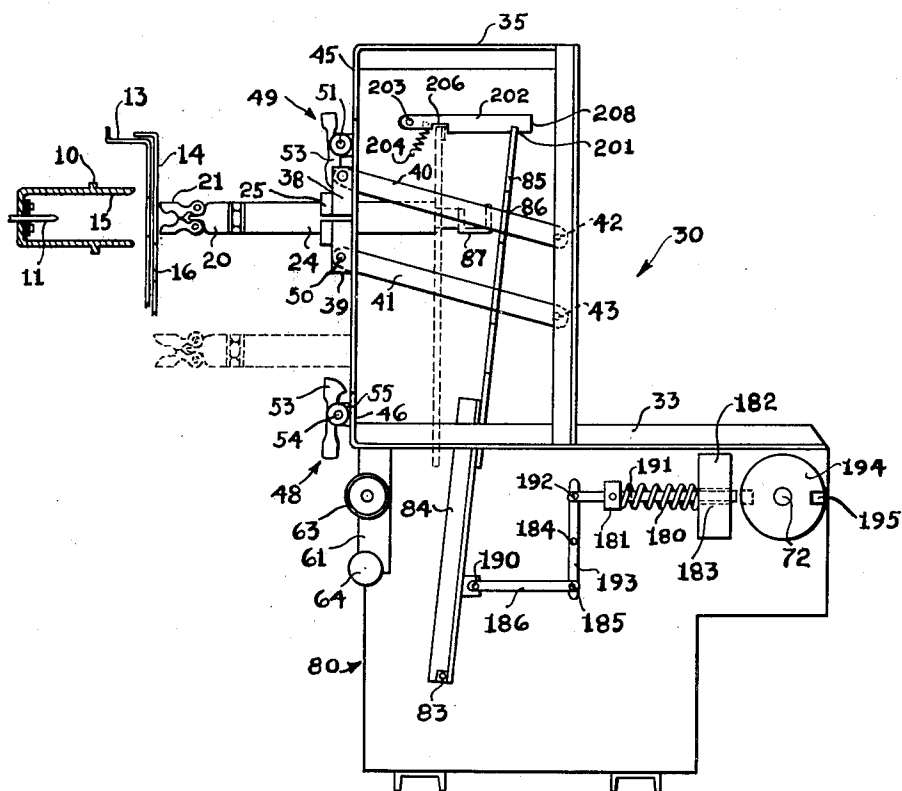


fig. 3

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4 Sheets-Sheet 4

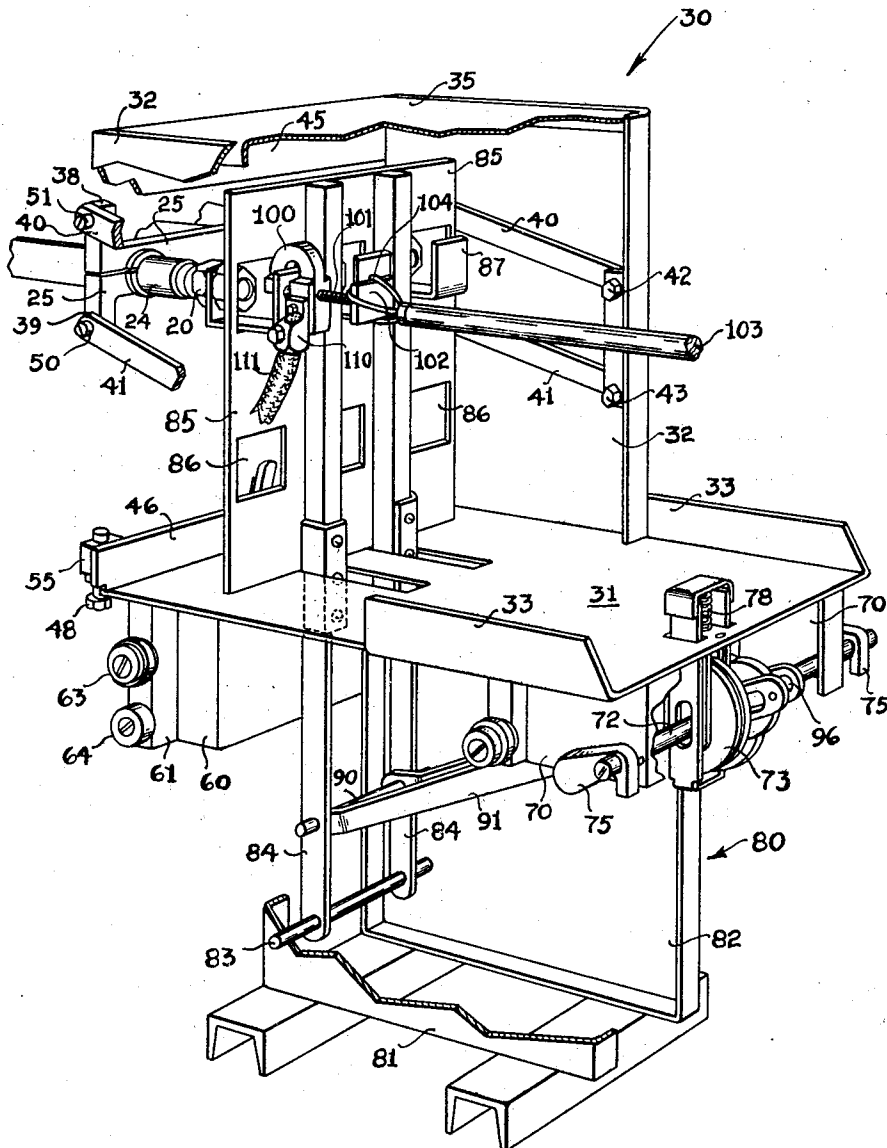


Fig. 4

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2,504,775

GROUND TESTING DEVICE

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Application February 26, 1947, Serial No. 731,165

4 Claims. (Cl. 175—298)

1

This invention relates to a grounding or earthing device which may be connected to power generating or power consuming apparatus in order to protect the same when the electrical circuits are intended to be deenergized and in order, especially, to protect men who are working on these apparatus.

In most modern switchboards, a stationary structure is provided into which electrical connections from power generating apparatus and to power consuming apparatus are led. The structure contains the bus and cable terminals which are attached to stationary elements of separable contact members through which current is led into switching apparatus which is usually readily removable.

In many types of switchboards, circuit breakers or switches are mounted in trucks or on other means which permit easy insertion or withdrawal of the switch so that its complementary contacts may be engaged with or disengaged from the stationary circuit connections.

In such installations it is often necessary for men to work on certain of the incoming or outgoing lines. For the protection of these men, it is essential that these lines be deenergized and preferably be connected to the earth in order to prevent personal injury.

The principal object of the present invention is the provision of a grounding device which may be inserted in the switchboard after the removal of a circuit breaker from its compartment.

Another object of the present invention is to engage switch elements of the grounding device with a selected set of stationary contacts within the switchboard and to provide means for thereafter connecting these elements to the earth without any danger to the attendant.

One type of switchboard construction in connection with which the grounding device of the present invention may best be used is one in which all of the stationary contacts comprising the legs of one circuit (i. e. the line) are arranged in a straight line and all of the stationary contacts comprising the legs of the circuit (the load) to which the circuit breaker will connect the first circuit are also arranged in a straight line parallel to the first group of contacts.

The grounding device of the present invention is provided with a group of contacts which may be moved selectively so that, when the device is entered into the switchboard, they may engage either the first group of contacts or the second group of contacts.

Another object of this invention, therefore, is the provision of means in a single grounding de-

2

vice which may be engaged and disengaged with a selected set of circuit connecting elements in a stationary switchboard.

A further object of the present invention is the provision in a grounding device of selectively moveable connecting elements the position of which in the grounding device may be altered to engage a selected set of stationary circuit connecting elements.

A further object of my invention is the provision in my novel grounding device of a barrier so arranged that the contact elements to which connections are to be made cannot be reached until the grounding device has been racked into the compartment.

A further object of my invention is the arrangement of the grounding device so that the completion of the racking-in and grounding operation will result in movement of the aforesaid barrier to a position wherein the contacts to be engaged and grounded are exposed.

Another and modified object of my invention is the arrangement of the grounding device so that the barrier can be moved into position to expose the contacts only after the racking-in operation is completed.

Another object of my invention is the arrangement of my novel grounding device in such a manner that the barrier is moved to a position rendering the contacts inaccessible before the racking-out of the grounding device can begin.

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 of my novel grounding device showing the elements thereof in the test position before the grounding device has been racked in.

Figure 2 is a corresponding side view showing my novel grounding device fully racked in with the contacts exposed so that they may be grounded.

Figure 3 is a side view corresponding to that of Figure 1 showing a slightly modified form of my novel grounding device.

Figure 4 is a view in perspective of the grounding device of Figures 1 and 2 showing a ground clamp with ground clamp cable and a ground clamp stick connected to one of the contact members.

Referring now to the Figures 1, 2 and 3, the compartment into which my novel grounding device is to be racked and in which it is to operate is indicated generally by the back wall 10 thereof. The circuit breaker originally in the compartment and in engagement with the disconnect

3

contacts 11 recessed in insulating housings 12 in the back wall has been removed and the grounding device has been racked in in its stead.

The fronts of the individual housings 12 are closed by the isolation shutters 13, 14 which, when the compartment is empty, are so arranged that their respective openings 15 and 16 are not in registry with each other, the shutter portion 14 being then lowered.

In order to admit the connecting elements of either the circuit breaker or the grounding device, the shutter element 14 must be raised to bring the openings 15 and 16 into registry with each other.

The grounding device is shown in Figure 1 with its connection stud 20 having the contact element 21 entered through the registered openings 15 and 16 into the recessed housing 12 but not yet engaged with the stationary disconnect contact 11 leading to a box behind the compartment.

In Figure 2, my novel grounding device is shown racked in all the way so that the contact element 21 on the end of the conductive stud 20 is in engagement with the stationary disconnect contact 11. The conductive stud 20 is provided with a sheath 24 of insulating material preferably phenolic insulation molded around the stud in order to isolate the group of studs 20 and their contacts 21 from each other.

As shown more particularly in Figure 4, the individual studs 20 are connected together by the insulating cross bars 25, 25 which are clamped on opposite sides of the aligned studs to yoke them together to operate as a single unit mechanically, although of course they are isolated from each other electrically.

My novel grounding device 30 comprises a main supporting platform or tray 31 with side vertical supports 32, 32 secured to the upstanding flanges 33, 33 of the tray 31. A suitable cover plate 35 is provided across the tops of the side vertical plates 32. The cross bars or yoke members 25 are provided with flanges 38, 39 on each side, which are respectively connected to the links 40 and 41 on each side.

The opposite ends of each of the links 40, 41 on each side are pivotally mounted on pivots 42, 43 respectively, the said pivots being secured in any suitable manner to the front ends of the vertical side panels 32, 32. The arrangement is such that the cross bar or yoke 25 carrying the three or more contact studs 20 and their associated contacts 21 may be moved from the upper position shown in the figures wherein they engage the line terminals in the compartment to the lower position indicated at 20a of Figure 1 wherein they are in a position to engage the load terminals in the compartment.

The upper covering panel 35 is a tray-like member provided with a downwardly dependent flange 45 in the rear. Similarly the main platform or tray 31 is provided with an upwardly ascending flange 46 in the rear.

Latch members 48 and 49 respectively are secured to the lower member 46 and the upper member 45 at the rear where these latches may respectively engage the pins 50 and 51 which connect the links 40 and 41 to the transverse bar or yoke 25.

Only one latch need be used for either the up or down position although a pair of latches may be used on each side for the up and down position if desired. Each latch member is a simple latching bar 53 pivotally mounted on pin 54 carried by lug 55 secured either to the flange 46 or the

4

flange 45. The latch member 53 of the lower latch 48 is spring biased in any suitable manner as by a coil spring around the pin 54 into clockwise rotation; while the corresponding latch member 53 of the latch element 49 at the upper end is similarly biased into counterclockwise rotation with respect to Figure 2.

The latch 48 will engage pin 50 when the contacts 21 are in the lowered position and hold them in that position; the latch 49 will engage the pin 51 when the contacts are in the upper position and will hold them in that position.

In order to prepare my novel grounding device for use in connection with either the line or the load contacts, it is necessary merely to release the particular latch 48 or 49 which holds the contacts by manually pressing the end of lever 53 opposite its hooked portion and then by grasping either the cross bar 25 or one of the studs 20 to move the aligned studs 20 and the cross bar 25 to the proper position where they will then be latched for an engagement with the desired set of contacts.

This of course must be done before the grounding device is moved into the compartment.

The platform 31 has secured thereto at the lower end, the downwardly extending lateral cross piece 60 having the side flanges 61 on each side, which side flanges carry the rollers 63 and 64 to ride on the track of the compartment. Adjacent the front end of the platform is a downwardly extending cross bar 66 carrying rollers 67 on each side to ride on the rail of the compartment.

The cross bar 66 and the front end of the platform 31 combine in supporting the front lower side panels 70, 70 on each side by which the rotatable racking shaft 72 is rotatably supported.

Racking shaft 72 has keyed thereto a racking disk 73 provided with radial notches 74 into which a racking bar may be inserted to rotate the shaft 72.

The outer ends of the racking shaft 72 beyond the side panel 70 are provided with levers 75, 75 on each side which engage suitable projections or camming surfaces on the side wall of the compartment of the type shown in application Ser. No. 434,544 filed March 13, 1942, now abandoned, to cooperate with them to force the grounding device 30 into the compartment on rotation of shaft 72 in a counterclockwise direction with respect to the figures and to move the grounding device out of the compartment on rotation of the shaft 72 in a clockwise direction.

The particular form of racking means used does not comprise a specific part of the present invention as long as a shaft similar to the shaft 72 is provided, which must be rotated during racking-in and racking-out of the grounding device 30.

In any event, in the specific racking device shown, the racking disk is provided with a latch surface 76 engaged by the latch 77 spring biased upwardly by spring 78 and locking the racking disk 73 against accidental rotation in a clockwise direction and therefore against accidental operation to remove the grounding device from the compartment.

The main horizontal platform 31 of the grounding device 30 is also provided with the lower housing 80 including the side panels 81 and 82. Panels 81 and 82 carry between them at the lower end thereof, the shaft 83 on which are pivotally secured the lower ends of the bars 84, 84. Bars 84, 84 carry between them the barrier 85. Barrier 85 is provided with openings

86, 86 through which the contact members 87 at the front end of the connecting studs 20 may pass.

In the test position of the grounding device, the barrier 85 is in the position shown in Figure 1 where the front contact elements 87 of the studs 20 are inaccessible. In the fully racked-in position of the grounding device 30 shown in Figures 2 and 4, the barrier has been moved to a position where the front contacting elements 87 of the connecting studs 20 have passed through the openings 86 and are accessible for grounding purposes.

The bars 84 carry above their pivot point cross-shaft 90 to which is connected the rear end of the operating link 91. The front end of the operating link 91 is slotted at 92 so that it may engage the shaft 72 without interfering with the operation of shaft 72. The slot 92 is sufficiently long so that the operating link 91 may be pushed back and forth without interference from the shaft 72.

Cam 94 is mounted on the shaft 72 and is arranged to cooperate with and bear against the cross pins of 95 and 96 carried between the parallel arms of the operating link 91.

With the grounding device in the test position before it has been racked in, all of the elements are in the position shown in Figure 1 with the operating link 91 in the retracted position and the barrier 85 in a position where the contact elements 87 are not accessible.

On rotating the shaft 72 in a counterclockwise position to rack the grounding device in, the cam 94 is also rotated in a clockwise direction. Owing to the fact that the surface 94a of cam 94 is however part of a true circle concentric with the center of shaft 72, the operating link 91 is not pushed to the left during this initial portion of the racking operation. As the racking operation nears completion, however, the surface 94b of cam 94 engages the pin 95 and pushes pin 95 to the left, thus pushing the operating link 91 to the left and rotating the vertical bars 84 in a counterclockwise direction to move the barrier 85 from the position of Figure 1 to that of Figures 2 and 4.

As the racking operation is fully completed, the section 94c of the cam 94 moves against the pin 95 resulting in no further movement of operating link 91 or barrier 85.

During the racking-out operation, it will be noted that cam surface 94a is now against the pin 96 and again during the initial stages of the racking-out operation while the contact 21 is being pulled away from contact 11, the pin 96 is not moved by the cam at all. When, however, the racking operation nears completion, then the surface 94a' of the cam moves against the pin 96 to move the pin 96 outwardly towards the front of the grounding device thereby pulling out the link 91 and rotating the barrier 85 from the position of Figure 2 to the position of Figure 1.

By this means, therefore, the barrier 85 is so integrated with the racking mechanism that it cannot be moved into the position where the contact elements 87 are accessible for grounding until the grounding device 30 is racked in; and the barrier 85 is moved back to a position where the contacts 87 are inaccessible for grounding as soon as the racking out of the grounding device commences.

When the grounding device 30 has been racked in and the barrier 85 has moved to a position

where the contact elements 87 are accessible, a grounding clamp 100 may be mounted over each of the contact elements 87, the said contact elements 87 being channel-shaped or having a flange to facilitate the placement of the U-shaped clamp 100 thereon.

The ground clamping element 100 has an extension 101 which preferably is a bolt threaded thereinto, the outer end of the extension or bolt carrying the square plate 102. An insulating ground clamp stick 103 having prongs 104 may readily engage the plate 102 so that an operator may thereby lift up the clamp 100 and place the same over the contact elements 87 without danger to himself. The stick 103 and prongs 104 may then be removed by a straight pull since the prongs 104 are of spring metal. Or the stick 103 may be rotated so that the prongs 104 rotate the plate 102 and the bolt 101 to remove the bolt 101 and plate 102 from the clamp 100.

Clamp 100 has secured thereto in any suitable manner as by the connecting element 110 the grounding cable 111 which is connected to a suitable ground so that any current which may reach the terminals 11 will be safely grounded without danger of injury to the workmen.

In Figure 3 I have shown a slight modification of my invention in which the barrier 85 is not automatically moved to the position where the contact elements 87 are accessible on the racking end of the circuit breaker, but wherein the barrier 85 may thereafter be manually moved by a stick or otherwise to the position where contacts 87 are accessible.

The shaft 72 in this case is provided with a disk 194 having the peripheral notch 195 into which the end of link 191 may enter. In the racked out position of the circuit breaker, the notch 195 is in the outer position 180° away from the end of link 191. When the circuit breaker is fully racked in, the notch 195 is rotated 180° to the position where it is in the dotted-line position opposite the end of link 191. Link 191 is biased towards the left by the compression spring 180 which bears between the roller 181 keyed to the link 191 and the stationary plate 182 having an opening 183 through which the end of link 191 passes.

Link 191 is connected by pin 192 to lever 193 pivoted on the stationary pin 184. The opposite end of lever 193 is connected by pin 185 to link 186. Link 186 is pivotally connected to pin 190 on the vertical bars 84.

The upper end of the barrier 85 is provided with a central notch 201 which bears against the latch bar 202; the said latch bar 202 is pivotally mounted on stationary pin 203 and is spring biased downwardly by the tension spring 204.

When the grounding device is fully racked in and the notch 195 has moved to the dotted line position where the front end of link 191 may enter into the said notch, then the elements are arranged so that the barrier 85 may now be pushed by a prod or otherwise to the left into the dotted line position where the contact elements 87 are accessible. When the barrier 85 is pushed towards the left, the link 186 is pulled to the left rotating the lever 193 in a clockwise direction around the pin 184 and pushing the link 191 against the compression of spring 180 so that the front end of the link 191 enters into the notch 195.

At the same time the upper end or notch 201 in the barrier 85 moves into the latch detent 206

of the latching member 202 so that the barrier 85 is held in the position where the contact elements 87 are accessible against the pressure of the compression spring 180.

When it is desired to rack the grounding device out, it is necessary first to remove the front end of link 191 from the notch 195; otherwise the shaft 72 cannot be rotated to rack the grounding device out. In order to accomplish this, the front end 203 of the latch lever 202 is raised by a prod or stick to release the upper end 201 of the barrier from the detent 205 of the latch member 202. This permits the compression spring 180 to drive the link 191 to the left, thereby rotating the lever 193 counterclockwise and pulling the link 186 to the right. This results in pulling the vertical bars 84 to the right around their pivot 83 and pulls the barrier 85 out.

This then permits the grounding device to be racked out after the contact elements have been rendered inaccessible by movement of the barrier 85 to the solid line position of Figure 3. The barrier 85 is thus so arranged in the construction of Figure 3 that it is always spring biased to the outward position. It cannot be moved and latched into the position of accessibility of the contacts 87 until the racking in operation has been completed so that contact 21 has engaged the disconnect contact or terminal 11.

It may then be moved in by a prod or stick as above pointed out. Likewise the racking out operation cannot even be commenced until the barrier is unlatched and returned to the position where contact elements 87 are inaccessible.

Thus in both forms of my novel device, the provision is made of a barrier so arranged that the contact elements of the grounding device are unavailable for grounding of the circuit until the grounding device is fully racked in. The barrier is moved into a position where the contacts are available for grounding either on completion of the racking in operation and connection of the grounding device to the terminals or immediately following the completion of the racking in and the aforesaid connection. The barrier is then moved to a position where the contacts which are to be grounded are inaccessible for connection either during the initial portion of the racking out operation before the elements 21 and 11 separate or the device may be so arranged that the barrier must be moved to the position where the contact elements are inaccessible before the racking out operation is even commenced.

I claim:

1. In a device for engaging a contact, a connection stud, a support for said stud, a racking mechanism connected to said support for racking said stud into engagement with the said contact, a pivotally mounted barrier connected to said racking mechanism, said barrier being in front of said stud when said racking mechanism is in one position for rendering said stud inaccessible and being operated simultaneously with said support by said rack when said rack is operated to operate said stud into engagement with said contact for rendering said stud accessible for connection thereto.

2. In a device for engaging a contact, a connection stud, a support for said stud, a racking

mechanism connected to said support for racking said stud into engagement with the said contact, a movable barrier connected to said racking mechanism and having an opening, said barrier being in front of said stud when said racking mechanism is in one position for rendering said stud inaccessible and being operable by said racking mechanism, when said rack is operated to operate said stud into engagement with the selected contact, to a position where one end of said stud protrudes through said opening for connection thereto.

3. In a device for selectively making contact with a first and a second contact, a connection stud, a support for said stud, a pivoted link connected at one end to said stud and pivotally mounted at its opposite end to said support, said link being operable on its pivot to move said stud selectively to a position to engage one of said contacts, a racking mechanism connected to said support for racking said stud into engagement with the selected contact, a barrier carried by said racking mechanism, said barrier being in front of said stud when said racking mechanism is in one position for rendering said stud inaccessible and being operable, when said rack is operated to operate said stud into engagement with the selected contact, to a position for rendering said stud accessible for connection thereto.

4. In a device for selectively making contact with a first and a second contact, a connection stud, a support for said stud comprising a main platform, a side vertical support and a cover plate, a pivoted link connected at one end to said stud and pivotally mounted at its opposite end to said support, said link being operable on its pivot to move said stud selectively to a position to engage one of said contacts, latch members for latching said stud in operated position, a racking mechanism connected to said support for racking said stud into engagement with the selected contact, a barrier carried by said racking mechanism, said barrier having an opening, said barrier being in front of said stud when said racking mechanism is in one position for rendering said stud inaccessible and being operable, when said rack is operated to operate said stud into engagement with the selected contact, to a position where one end of said stud protrudes through said opening making said stud accessible for connection thereto.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,584,623	McCoy	May 11, 1926
1,699,753	Rawlings	Jan. 22, 1929
1,904,565	Swanson	Apr. 18, 1933
1,955,287	Graves	Apr. 17, 1934
2,353,518	Specht	July 11, 1944

FOREIGN PATENTS

Number	Country	Date
296,113	Great Britain	Aug. 24, 1928
387,384	Great Britain	Feb. 6, 1933