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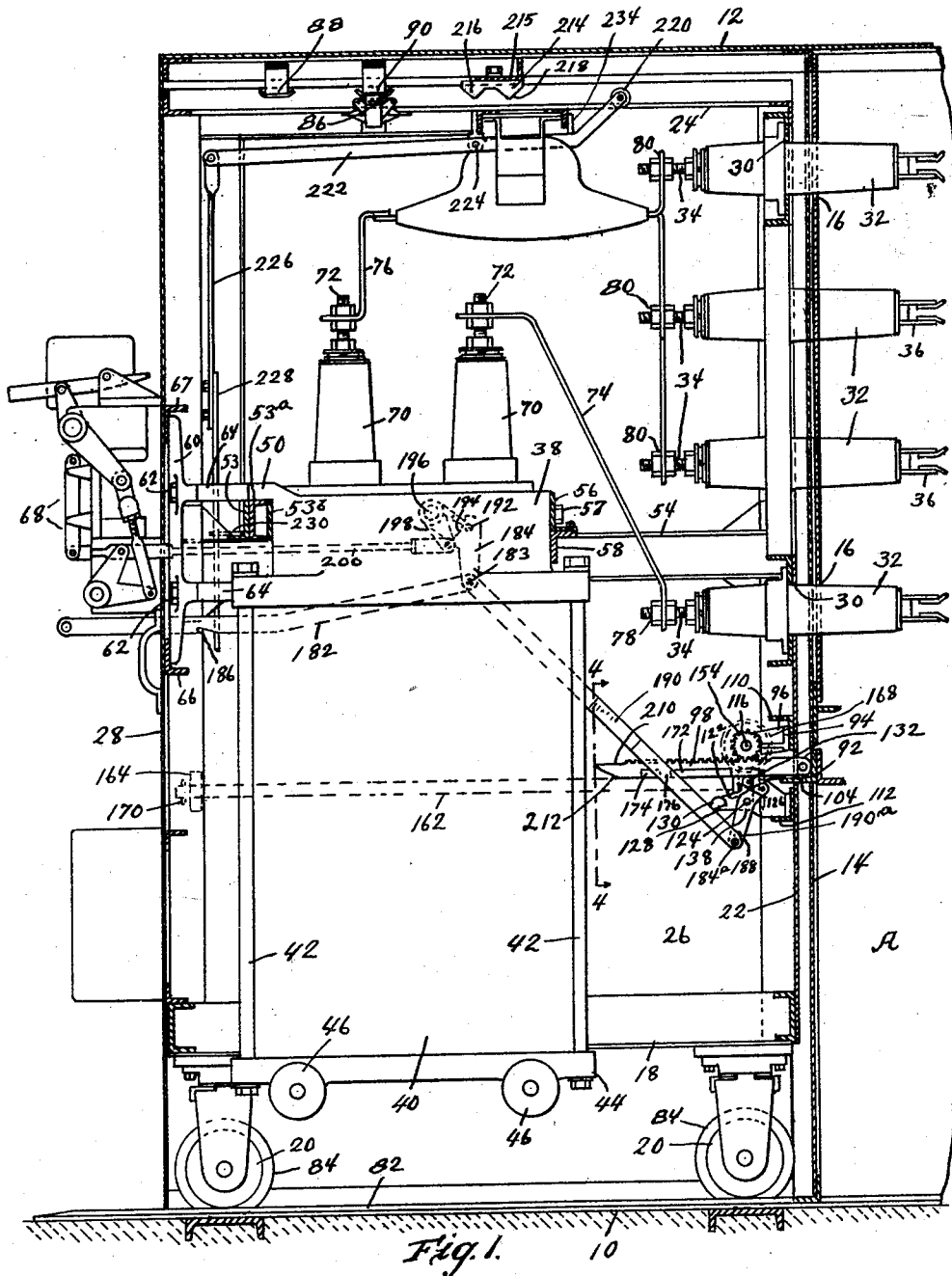
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1,869,856

ELECTRIC SWITCH AND RACKING DEVICE THEREFOR

Filed Oct. 18, 1929

4 Sheets-Sheet 1



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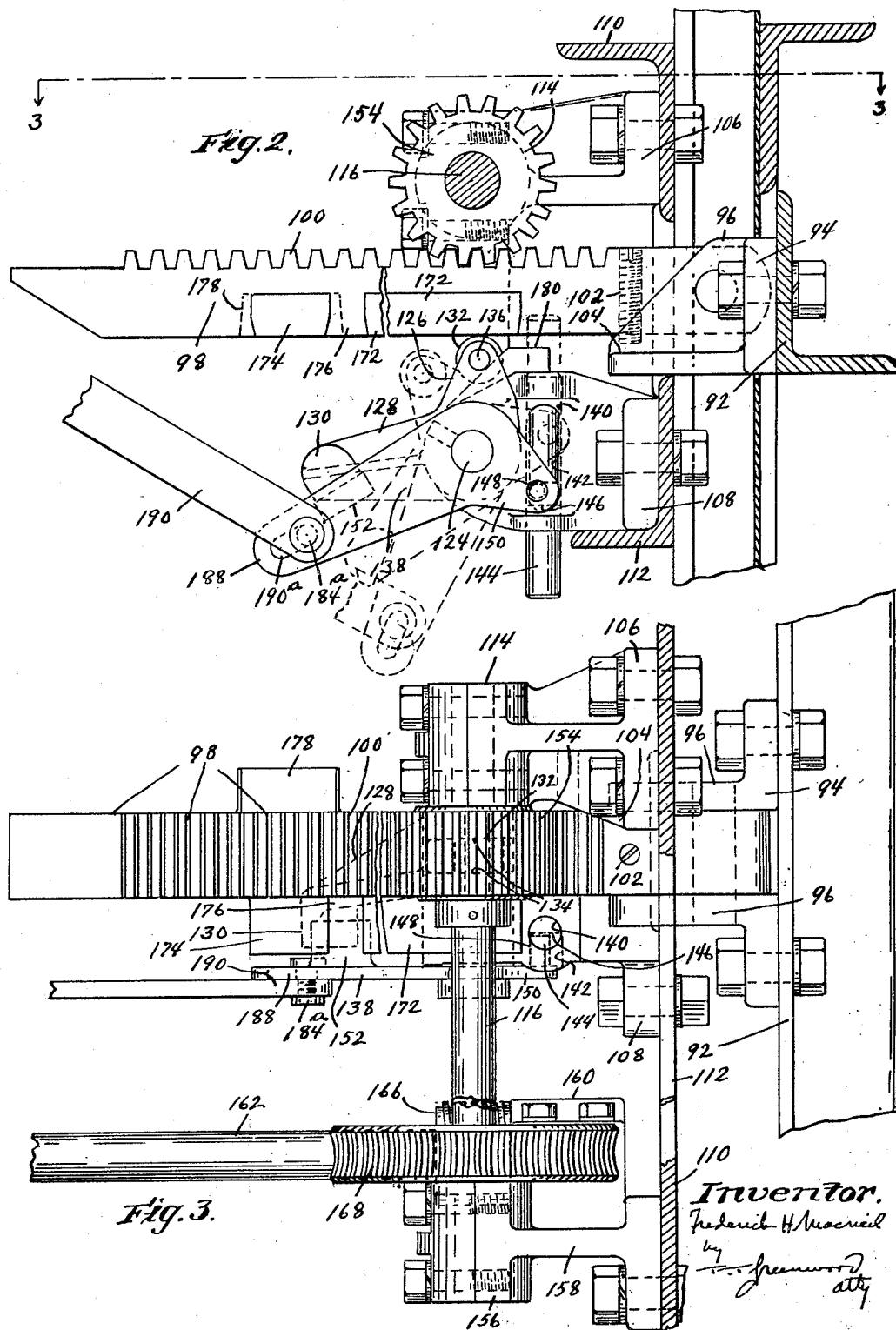
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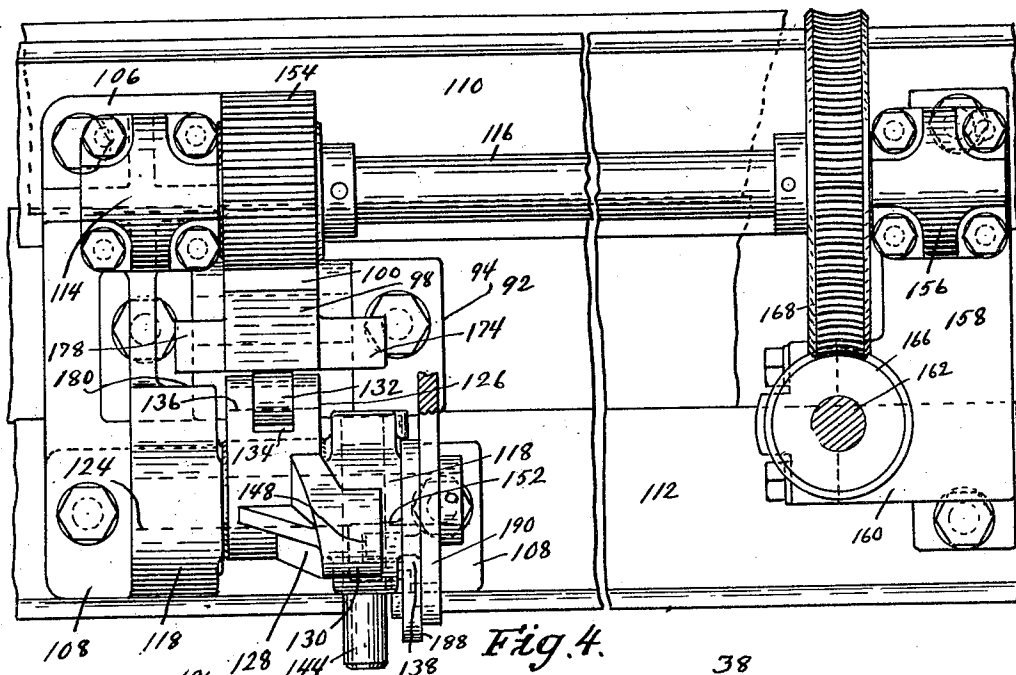


Fig. 4.

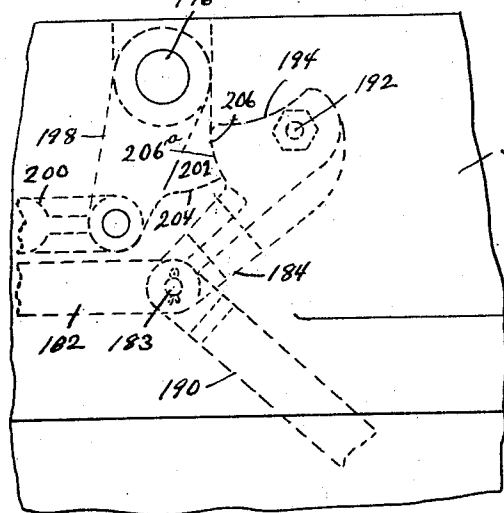


Fig. 5.

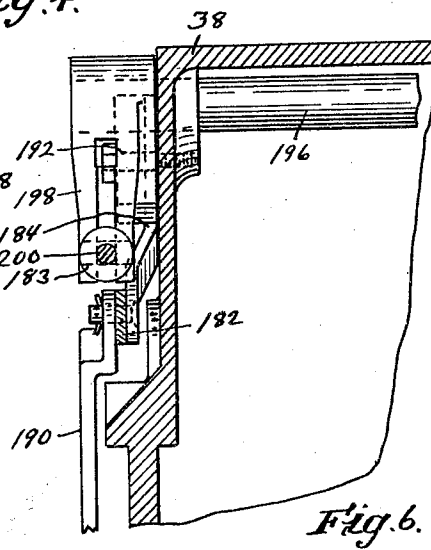


Fig. 6.

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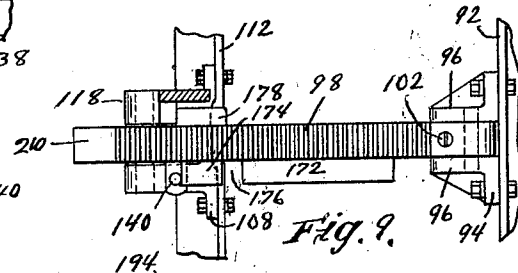
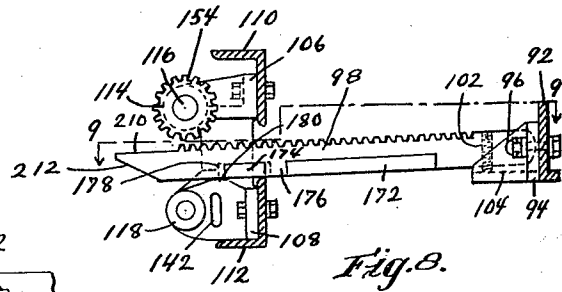
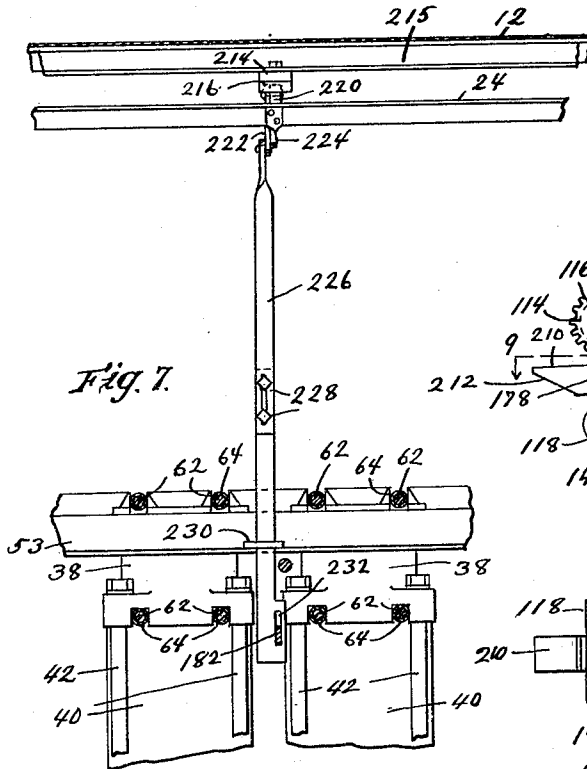
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ELECTRIC SWITCH AND RACKING DEVICE THEREFOR

Filed Oct. 18, 1929

4 Sheets-Sheet 4



UNITED STATES PATENT OFFICE

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ELECTRIC SWITCH AND RACKING DEVICE THEREFOR

Application filed October 18, 1929. Serial No. 400,536.

This invention relates to electric switch gear of the type in which the main switch, usually an oil immersed circuit breaker, is mounted on a truck and is rolled horizontally into and out of circuit controlling position in which position the switch terminals are brought into engagement with cooperating line terminals carried by the fixed portion of the switch gear, the switch and line terminals constituting movable and fixed contact members of disconnecting, or isolating, switches which are arranged to be automatically connected and disconnected by corresponding movements of the truck to and from its circuit controlling position.

The truck is adapted to be rolled on its wheels by the operator into a position wherein the disconnecting switches are about to engage, and force-multiplying means are provided to move the truck forcibly the remaining distance into circuit controlling position during which movement the disconnecting contacts are moved into frictional engagement. In moving the truck out of circuit controlling position, the force multiplying means is utilized to move the truck into a terminal-disengaged position from which the switch may be easily withdrawn by the operator.

It is an object of the present invention to provide an improved racking device for forcibly effecting the final and initial movement of the truck to and from circuit controlling position and also to provide means for interlocking the racking means with the circuit interrupter so that it is impossible for the operator to move the truck into or out of terminal engagement unless the interrupter is in contact open position, and also to prevent the operator from changing the condition of the interrupter during the racking operation.

During the horizontal movement of the truck to and from circuit controlling position, the truck is adapted to be arrested in an intermediate position in which the movable contacts of secondary disconnecting switches carried by the truck are engaged by a supplementary set of fixed contacts carried by the fixed portion of the switch gear.

In this position of the secondary contacts all of the low tension or secondary circuits are connected electrically with conveniently located test terminals; and it constitutes a further object of the invention to provide automatic means to lock the truck in this test position in its movement, both into and out of the cell.

A yet further object of the invention is the provision of a cell-enclosed truck type switch having interconnecting members carried by the truck and cell arranged to effect a predetermined movement of the truck and means to lock the truck in intermediate position while maintaining said interconnecting members in cooperating engagement.

A yet further object of the invention is the provision of automatic means to lock the truck in the aforesaid intermediate position, and manual means operable from the front of the truck to release said locking means.

A yet further object of the invention is the provision of means automatically operated by the withdrawal of the truck from the cell for moving the manually controlled locking means into locking position.

Another object of the invention is generally to improve the construction and operation of enclosed electric switch gear.

Fig. 1 is a side elevation of a cell enclosed truck type electric switch and the racking device therefor embodying the invention, the enclosing cell being shown in section.

Fig. 2 is a sectional elevation showing the interconnecting members carried by the truck and cell by which the truck is racked into and out of circuit controlling position.

Fig. 3 is a plan view taken on line 3—3 of Fig. 2.

Fig. 4 is a front sectional elevation taken along line 4—4 of Fig. 1.

Fig. 5 is a detail showing the interlocking cam mechanism.

Fig. 6 is a front sectional elevation of Fig. 5.

Fig. 7 is a partial front elevation showing the automatic locking means for the manual operating lever.

Fig. 8 is a sectional elevation of the inter-

connecting members of the truck and cell with the truck in the out-position.

Fig. 9 is a plan view taken along line 9—9 of Fig. 8.

Fig. 10 is a perspective view of the breaker operating crank.

Fig. 11 is a perspective view of the cam lever.

Fig. 12 is a perspective view of the rack and pinion housing.

The enclosing cell structure for the switch includes the bottom wall 10, the top wall 12, and the rear wall 14, which forms the front closure for a bus compartment A in which are located the fixed line terminals (not shown) which are adapted to cooperate with the movable terminals carried by the breaker. Said rear wall 14 is provided with suitable apertures 16 in alignment with said fixed terminals.

The movable, or truck, portion of the switch gear includes the bottom supporting platform 18 having truck wheels 20, the rear wall 22, top wall 24, side walls 26, and the front wall 28, which latter wall comprises the closure for the open front of the fixed portion of the switch gear. The rear wall 22 is provided with openings 30 which are in alignment with openings 16 in the rear wall 14 of the cell. Horizontal insulating bushings 32 are secured in said openings 30 and project through said apertures 16 into the bus compartment A when the truck is in circuit controlling position in the cell. Said bushings 32 are provided with conducting studs 34 which terminate in contact members 36 constituting the movable contact members of automatic disconnecting switches, the fixed contact members of which are carried by the line terminals of the cell structure.

The circuit interrupter herein shown is of the three phase type comprising three separate phase units, each of which includes a switch frame 38 and an oil receptacle 40 secured dependently therebelow by means of tie-rods 42 and an elevated wheeled platform 44. Each phase unit of said interrupter is adapted to be supported independently and removably in elevated position on the movable switch gear whereby the several units thereof may be separately lowered and rolled away on the wheels 46 of platform 44. The switch frames 38 of the interrupters are accordingly provided with forwardly extending ledges 50 which are adapted to rest upon a transverse supporting member including as an integral unit a channel member 53, an angle 53a, and a flat bar 53b. Said transverse member is supported by means of a pair of spaced horizontal channel members 54 which are secured to the opposite side walls 26 of the movable truck. The rear support for the interrupter comprises an angle 56 which is secured removably to the switch frame 38 by bolts 57 and rests on

the upper legs of the spaced channels 54 to which it is secured removably by bolts. A second and inverted angle member 58 extends between the legs of channels 54, and is secured permanently to the angle 56, as by welding.

To remove the interrupter from the truck, the bolts securing angle 56 to the channels 54 are removed and the interrupter is drawn rearwardly along the top of channels 54 until the ledge 50 of the switch frame is free from channel 52 of the transverse supporting member after which the bolts 57 are removed and the switch is lowered by suitable means (not shown). Said switch frame 38 is further provided with a forwardly extended platen 60 which is secured thereto by means of bolts 62 and is spaced from the switch frame by means of cylindrical spacer members 64 which surround the bolts 60. Said platen has secured thereto, at the top and bottom, transverse angles 66 and 67 which are secured to the front wall 28. Said platen 60 is adapted to provide the support for the switch opening and closing mechanism 68. Each interrupter unit is further provided with a pair of upstanding insulating bushings 70 having terminals 72 which are connected by means of conductors 74 and 76 with the line and bus terminals 78 and 80 respectively.

The movable truck unit is adapted to be rolled horizontally into and out of the cell on rails 82 fixed to the cell floor 10 which are adapted to be engaged by the flanges 84 on wheels 20 whereby to guide the truck unit and align the bushings 32 thereof with the apertures 16 in the rear wall 14.

In describing the operation of the breaker, it will be convenient to designate four positions in the horizontal movement thereof into and out of the cell structure, first, the "full-out" position when the truck unit is entirely removed from the cell structure; second, the "disconnect" position in which the truck is partly within the cell but with the movable contact members 36 of the automatic disconnecting switches entirely disconnected from their cooperating fixed terminal members; third, the "test" position, in which the contact members 36 are still out of engagement with their cooperating fixed terminals and the movable secondary contact members 86 are in engagement with the forward fixed secondary contact members 88; fourth, the "in" position, as shown in Fig. 1, in which the contact members 36 of the disconnecting switches are in engagement with their cooperating contact members, and the movable secondary disconnects 86 are in engagement with the service contacts 90.

There are a plurality of secondary contact members 86, 88 and 90 which are arranged in sets transversely of the cell and the truck and the moving set is arranged to have a

sliding engagement with the stationary sets and to yield vertically while making and breaking such engagement. The movable set 86 is connected to the various opening, closing and control apparatus carried by the truck, and when engaged with the set 90, connect such apparatus with suitable control circuits by which the switch is operated in service and its condition indicated. When the moving set of contacts 86 is connected with the test contacts 88, connection is made to circuits by which the operation of the switch can be tested while it is free from the power circuit.

To put the switch in service, the movable or truck portion is adapted to be rolled on its wheels by the operator into the disconnect position and thereafter racking means are provided for forcibly moving the truck into the "in" position during which movement the frictional engagement of the automatic disconnecting switches takes place.

The racking device consists essentially of interconnecting rack and pinion members carried by the fixed and movable switch gear respectively, as shown most clearly in Figs. 1 and 2. The rear wall 14 of the cell is provided with a transverse angle 92 to the upstanding leg of which is secured a bracket 94 having spaced vertical webs 96 between which is pivotally supported a substantially horizontal rack 98, as shown in Figs. 8 and 9. Said rack 98 is provided with gear teeth 100 on the top surface thereof which are adapted to engage a pinion gear carried by the truck as will presently appear. In the normal position of the rack when the truck is in its "full-out" position, the forward end of said rack is adapted to be lowered slightly below the horizontal position, as is shown in Fig. 8, wherein the lower end of an adjusting screw 102 therein is adapted to be in engagement with the lower horizontal face 104 of bracket 94 which acts as a stop to limit further downward movement of the rack.

A pinion and rack housing is carried by the rear wall 22 of the truck in position to receive the forwardly extending end of rack 98 when the truck is moved into the cell. Said housing, as shown most clearly in Fig. 12, includes the upper and lower supporting flanges 106 and 108 which are adapted to be secured by bolts to the upper and lower transverse supporting angles 110 and 112 carried by the rear wall 22. Said housing is provided with an integral upper journal block 114 in which one end of the horizontal shaft 116 is journaled, and a lower bifurcated journal block 118 at one side of the journal block 114 and directly beneath the rack 98 when it is disposed adjacent the housing. Said lower journal block 118 supports a rack-lifting lever 122 which is journaled between the bifurcations 120 thereof on a shaft 124 extended between said bi-

furcations. Said rack-lifting lever, as shown in Figs. 2 and 4, includes an upstanding arm 126 which is received between bifurcations 120 directly beneath rack 98, and a forwardly extending arm 128 which is provided with an offset boss 130 at its extended end. The upstanding arm 126 is further provided with a roller 132 which is journaled between bifurcations 134 thereof on a pin 136, which roller lies directly beneath and is adapted to engage the bottom of the rack 98. Said shaft 124 is extended beyond the journal block 118 and provides a pivotal support for a lock-plunger lever 138 which is adapted to be rotated about said shaft independently of the rack lifting lever 122. That bifurcation 120 of said housing that is adjacent the lever 138 is provided with a vertical guide passage 140 behind the journal for shaft 124, and is further provided with a slot 142 which is in vertical alignment with and is open into the passage 140.

A lock-plunger 144 which is vertically-movable in the passage 140 has a horizontal slot 146 in one side thereof which receives a pin 148 carried by an arm 150 of the lock-plunger lever 138, whereby upon rotation of lever 138, the plunger 144 will be raised and lowered for purposes hereinafter to be described. The slot 142 is somewhat wider than the diameter of pin 146 whereby to permit a certain amount of horizontal movement of the pin in the slot as the arm 150 is rotated about its pivotal shaft 124.

A block 152 is welded to the arm 138 directly beneath the boss 130 on the rack-lifting lever 122 in position to engage the boss and rotate the rack-lifting lever in unison with the lock-plunger lever in the clockwise rotation of the latter.

The horizontal operating shaft 116 which has its one end journaled in the bearing block 114 has its other and opposite end journaled in a bearing block 156 which is carried by an outstanding bracket 158 secured to the supporting framework of the truck. As shown most clearly in Fig. 4, a pinion gear 154 is fixed to said operating shaft 116 adjacent the bearing block 114 in position to overlie and engage the teeth of rack 98 when the rack is elevated by lever 122 into a horizontal position.

Said bracket 158 is further provided with an integral outstanding projection 160, Fig. 4, which constitutes a journal for a horizontal shaft 162 disposed below and normal to the shaft 116. Said shaft 162 is journaled at its forward end, at the front of the truck and cell, in a bracket 164 and is provided at its rear end with a worm 166 which derives a worm wheel 168 carried by shaft 116. The shaft 162 is provided at its forward end with a pin 170 which is adapted to be engaged by a crank (not shown) by which the shaft 162 and accordingly the pinion 154 is adapted to

be rotated in either direction. It will be evident that rotation of the crank in one direction will cause the clockwise rotation of the pinion gear 154, Fig. 2, whereby to draw the truck into the cell when the gear and rack are in engagement and that the rotation of the gear in the opposite direction will cause the truck to be moved outwardly of the cell.

Manually operable means are provided to cooperate with the vertical lock-plunger 144 to lock the truck against movement caused by the racking pinion 154. Said means includes a long abutment block 172 which is welded to the right side of the rack, as viewed in Fig. 4, and a second but shorter abutment block 174 which is likewise secured to the rack and is spaced from the block 172 to provide an opening 176 therebetween into which the plunger 144 is adapted to enter. The ends of said blocks, as shown most clearly in Fig. 2, are slightly bevelled at the bottom thereof to facilitate the upward movement of pin 144 into a position behind the ends thereof. A third block 178 is secured to the left side of said rack as viewed in Fig. 4, substantially opposite block 174 which is adapted, in the lowered position of the rack shown in Fig. 8, to engage an abutment 180 on the pinion housing, Fig. 12, whereby to limit the movement of the truck into the cell in the lowered position of the rack. With the rack and housing in the position shown in Figs. 8 and 9, the switch is in its disconnect position. The lock-plunger 144 is adapted to be manually operated into and out of locking position by means of a finger lever 182, Fig. 1, which is pivotally connected at 183 to the lower depending end of a cam lever 184 carried by the left side, as in Fig. 7, of switch frame 38 of the right hand switch unit. Said finger lever 182 is adapted to be pulled forwardly from the position shown in Fig. 1 into a position in which the vertical face 186 of a notch in its lower edge is adapted to engage the front panel 28 of the truck whereby to hold the finger lever releasably in its forward position. Said finger lever is connected operatively with the arm 188 of the lock plunger lever 138 by means of an offset link 190 which is pivoted to the pin 183 and is also pivoted to a shoulder screw 184a which is clamped rigidly to the arm 188 in a slot 190a therein. The shoulder screw 184a is adapted to be clamped in various positions in the slot 190a to effect angular adjustment of the lock-plunger lever.

Means are provided to interlock said finger lever 182 with the operating mechanism of the interrupter whereby to prevent movement of said finger lever into its forward position and the consequent unlocking of the rack, except when the interrupter is in fully open position. To this end, a cam lever 184, Fig. 11, is pivoted to the left side of the switch frame 38 of the right hand switch unit at 192

and is provided with an upper arcuate cam face 194, Fig. 5, which in the position of lever 184 in Fig. 1, is struck about a center coincident with that of the shaft 196 of the switch operating mechanism for the interrupter. Said shaft 196 extends outwardly through the switch frame of the interrupter and has fixed thereto a bifurcated crank 198, Fig. 10, which has pivotally connected between the bifurcations thereof at its lower end an operating shaft 200 which is connected at its forward end with the switch closing solenoid of the operating mechanism 68. Said crank is provided with an integral cam 202 which lies closely adjacent the switch frame 38; and said cam is provided with an arcuate lower end face 204 which is struck about the axis of shaft 196. Said cam 202 is further provided with a substantially vertical cam face 206 which, in the position of the crank 198, in Fig. 5, is struck about the pivot point 192 of the cam lever 184 and is adapted to cooperate in the position of the parts shown in Fig. 5 with the arcuate cam face 206a of the cam lever 184, which is also struck about the pivot point 192 thereof. In the switch open position of the interrupter shown in Fig. 5, the finger lever 182 is free to move into and out of rack locking position, the cam face 204 being disposed in a forward position where it is out of interference with the cam face 194 of the cam lever 184. In this position, however, in which the rack is unlocked, the cam face 206a of said cam lever is disposed behind the cam face 206 of crank 198, thus to prevent closing movement of the switch.

In this position, the cam face 206 of the breaker crank is substantially normal to the pivotal point 192 of the cam lever. When the parts are moved to the position shown in Fig. 1 wherein the racking device is locked, the crank arm 198 is free to move between switch open and switch closed positions, but in the switch closed position thereof prevents the operation of finger lever 182 to release the lock on the racking device. Thus, it is evident that to close the breaker, the racking device must first be locked and that when the breaker is closed, it is impossible to release the locking device for the rack.

The operation of the truck racking device is as follows:

When the truck is rolled into the cell from its "fully out" position wherein it is completely out of the cell into the "disconnect" position, the interconnecting members of the racking device carried by the truck and cell are brought into the relative positions shown in Figs. 8 and 9 wherein the rack is in its lowered position and the front face of the abutment block 178 thereof is in engagement with the abutment face 180 of the rack housing. The truck is thus prevented from further manual movement into the cell.

In the "disconnect" position of the truck,

the pinion 154 is disposed above but out of engagement with the rack teeth 100 and the lock-plunger lever and rack raising lever are in the dotted position of Fig. 2, wherein the roll 132 of the rack-raising lever is in its forward and lowered position. If now it is desired to continue the movement of the switch into the cell, the interrupter, if closed, must be opened to rotate the crank arm 198 in a clockwise direction and permit the forward movement of the manually-operated finger lever 182 thus to rotate the lock plunger lever in a clockwise direction and cause the lock-plunger 144 to drop from in front of the block 174 and unlock the truck. Movement of the lock plunger lever in a clockwise direction due to the engagement of block 152 thereof with the boss 130 of the rack lifting lever, causes the latter to be rotated simultaneously in a clockwise direction to raise the roller 132 thereof into engagement with the bottom surface of the rack to raise the rack and effect engagement of the rack teeth with the pinion 154. In the upper position of roller 132, the pivot pin 136 thereof is slightly back of the vertical plane including the pivot point 124 and is adapted to rest against the inclined front face 208 of the left hand bifurcation 120 of the rack housing, Fig. 12. The rack lifting lever is held in this over-center position by the weight of the rack, thus to hold the rack, when once raised, in engagement with the pinion independently of the block 152 on the lock plunger lever. The clockwise rotation of the rack lifting lever into the aforesaid position causes the disengagement of the abutment 178 and block 180 and conditions the racking device for movement of the truck into the cell.

As heretofore described, the unlocking movement of the racking device also effects the movement of the cam lever 184 into the position shown in Fig. 5 wherein it temporarily locks the breaker against closing movement. In this position of the truck, the operating crank for the racking device can be operated in a direction to rotate the pinion 154 in a clockwise direction, as viewed in Fig. 1, whereby to effect the cooperation of the pinion and rack to draw the truck slowly but forcibly into its circuit controlling position. When the switch is in the position shown in Fig. 1, the finger lever 182 can be released to lower the lock plunger lever 188 and raise the plunger 144 into a position behind the block 172 thus to lock the racking device against operation. However, it will be obvious that during the horizontal movement of the pin 144 beneath the block 172 of the rack, it is impossible to so raise the locking plunger 144 and thus it is impossible to move the cam lever 184 into a position wherein the switch can be closed during the operation of the racking device.

To remove the switch from the position

shown in Fig. 1, it is first necessary that the interrupter be in open position, thus to permit the finger lever to be pulled outwardly and unlock the racking device by the clockwise rotation of lever 188. The pinion gear 154 can then be rotated in a counterclockwise direction by its operating crank during which rotation the truck will be moved outwardly from the cell structure until the pinion gear 154 is directly over the blank end portion 210 of the rack in which position the truck can be pulled out by hand into its "fully out" position entirely free from the cell. During the drawing out motion of the truck, the weight of the rack holds the rack lifting lever 126 in its upper position as shown in Fig. 2 until the roller 132 thereof reaches the inclined portion 212 at the extreme end of the rack, whereupon lever 122 drops to the position shown in dotted lines in Fig. 2.

In describing the operation of the racking device, no reference has been made to the previously mentioned "test" position of the truck, wherein the cooperating fixed and movable secondary disconnects 88 and 86 are in engagement. Means are provided automatically to arrest the movement of the truck in the "test" position wherein the locking plunger 144 is disposed beneath and is therefore free to enter into the space 176 between the blocks 174 and 172. To this end, a cam block 214 is secured to a transverse angle 215 carried by the top wall 12 of the cell structure. Said cam block has cam projections 216, 218 disposed one behind the other and adapted to be engaged successively by a roller 220 carried by an arm 222 pivoted intermediate its ends at 224 to the truck. Said arm 222 is pivoted at its forwardly extended end to a vertical tripping bar 226, Fig. 7, which is formed in two sections which are adjustably bolted together at 228. Said tripping bar is guided for vertical movement by a plate 230 secured to the forwardly extended leg of angle 53 of the truck and is provided at its lower end with an offset portion having a vertical slot 232 within which the finger lever 182 is slidably received. The weight of said tripping bar 226 and the forwardly extended end of lever 222 causes the lever to occupy the position shown in Fig. 1 in which the roll 220 thereof is in its uppermost position and the top edge of said lever is in engagement with the stop 234 supported by the top wall 24 of the truck. In this elevated position, the roller is adapted to be engaged and depressed successively by the cam projections 218, 216 as the truck is racked out of the cell. The slot 232 in the tripping lever 226 is so arranged that in the normal position of the parts shown in Figs. 1 and 7, the bottom of the slot 232 is in engagement with the lower edge of the finger lever 182. When the roll 220 is in a position to be beneath and be depressed by the cam projection 218, the locking plunger 144 is directly

beneath the space 176 between the blocks 172 and 174 of the rack, and due to the upward movement of the tripping lever 226 caused by the cam, the finger lever 182 is raised sufficiently to unlatch the abutment 186 thereof from the panel 28 whereby to permit the lock-plunger lever to rotate counterclockwise by gravity and raise the lock plunger 144 into position in the space 176 wherein the truck is locked. In this position, the switch may either be returned to its "in" position or, by holding the finger lever 182 in a forward position, the operating crank for the pinion gear 154 may be turned sufficiently to allow the roller 220 to pass into the depression beyond the cam projection 218. In this position, the finger lever 182 will again stay latched. Subsequent movement of the truck out of the cell will cause a second tripping of the finger lever 182 in a similar manner when roller 220 is depressed by the second and foremost cam projection 216. Thus it will be seen that the final movement of the switch from the cell automatically throws the locking plunger upwardly into locking position leaving the interrupter free to open and close.

The invention may be otherwise modified without departing from the scope of the invention.

I claim:

1. An electric switch gear including a cell, a truck movable into and out of said cell, a switch carried by said truck having switch operating mechanism, cooperating contact members carried by said cell and truck, force-multiplying means connecting said truck and cell for moving said truck into and out of said cell, means to lock said force-multiplying means against operation, and manual means operable independently of said switch operating mechanism for controlling the operation of said locking means.

2. An electric switch gear including a stationary frame having fixed line terminals, a truck having a switch mounted thereon, said switch having operating mechanism and also having terminals adapted to cooperate with the terminals of said frame, means for moving said truck toward and away from said frame, means to lock said truck moving means against operation, manual means operable independently of said switch operating mechanism for controlling said locking means, and means governed by the condition of the switch for controlling the operation of said manual means.

3. In an electric switch gear, the combination of an enclosing cell, a truck having a switch mounted thereon and adapted to be moved horizontally into and out of a circuit controlling position in said cell, cooperating switch and line terminals carried by said truck and cell, force-multiplying means carried by the truck and cell arranged to effect the movement of said truck into and out of circuit con-

trolling position, locking means for disabling said force-multiplying means with the truck in either one of two positions, manual means controlling said locking means, and means governed by the condition of the switch for preventing operation of said manual means to release said truck except when the switch is in open position.

4. An electric switch gear including a stationary frame, a truck movable horizontally toward and away from said frame, cooperating isolation contacts carried by said truck and frame, mechanism including interconnecting members carried by the frame and truck for moving said truck a predetermined distance toward and away from said frame to effect engagement and disengagement of said isolation contacts, and locking means engageable with one of said interconnecting members in any one of a plurality of different parts thereof for securing said truck in a plurality of horizontally spaced positions relative to said frame.

5. An electric switch gear including a stationary frame, a truck movable horizontally toward and away from said frame, a switch mounted on said truck having switch operating mechanism, cooperating isolation contacts carried by said truck and frame, force-multiplying mechanism including interconnecting members carried by said frame and truck for moving said truck toward and away from said frame to effect engagement and disengagement of said contacts, manually-controlled means engageable with one of said members in any one of a plurality of parts thereof for locking said truck moving mechanism with the truck in a plurality of horizontally spaced positions, and means engageable with a movable part of said switch operating mechanism for governing the unlocking operation of said locking means.

6. An electric switch gear including a stationary frame, a truck movable horizontally toward and away from said frame, a switch mounted on said truck having switch operating mechanism, cooperating isolation contacts carried by said truck and frame, mechanism including interconnecting members carried by said frame and truck for moving said truck toward and away from said frame to effect engagement and disengagement of said contacts, means engageable with one of said members in a plurality of different parts thereof to lock said truck in either of two horizontally spaced positions, manual means for controlling the operation of said locking means, and means interlocking said manual control means with said switch operating mechanism arranged to lock said manual control means against release of said truck except in the switch open position of said switch operating mechanism and also to lock said switch operating mechanism against switch closing movement in any but

the truck locked position of said manual control means.

7. An electric switch gear including a stationary frame, a truck movable horizontally toward and away from said frame, a switch mounted on said truck having switch operating mechanism, cooperating isolation contacts carried by said truck and frame, mechanism including interconnecting members carried by said frame and truck for moving said truck toward and away from said frame to effect engagement and disengagement of said contacts, means to lock said truck in either of two horizontal positions, manual means for controlling the operation of said locking means, means interlocking said manual control means with said switch operating mechanism arranged to lock said manual control means against release of the truck in the switch closed position of said switch operating mechanism and also to lock said switch operating mechanism against movement to switch closed position when said manual control means is in a truck unlocked position, and means to prevent the operation of said manual control means to unlock said switch operating mechanism during the movement of the truck between the aforesaid horizontal positions.

8. An electric switch gear including a cell having line terminals therein, a cooperating truck movable horizontally into and out of a circuit controlling position in said cell, a switch mounted on said truck having switch terminals adapted to engage said line terminals during the respective final and initial movements of said truck into and out of circuit controlling position in said cell, racking mechanism including interconnecting members carried by said cell and truck arranged to effect the aforesaid final and initial movements of the truck, means engageable with one of said members to lock said truck against movement, manual means operable from the front of the truck for connecting said members, said manual means also constituting means for releasing said truck locking means, and means governed by the open and closed condition of the switch for locking said manual means against operation.

9. An electric switch gear including a cell having line terminals, a horizontally movable truck having cooperating switch terminals, a forwardly extended rack carried by the cell, a rack receiving housing carried by the truck having a pinion arranged to cooperate with said rack to effect movement of said truck into and out of terminal engaging position in said cell, means operable from the front of the cell for effecting the engagement of said rack and pinion, said means also constituting locking means for securing said truck in a plurality of horizontal positions in the cell, and mechanism operable from the front of said cell for actuating said pinion.

10. An electric switch gear including an enclosing cell, a truck movable horizontally into and out of a circuit controlling position in said cell, cooperating isolation contacts carried by said cell and truck, a rack carried by a rear wall of said cell and extended forwardly into said cell, a housing carried by said truck adapted to receive the extended end of said rack, a pinion gear carried by said truck in position to be engaged by said rack, said rack being normally biased into a lowered position free from said pinion, means carried by said rack to engage and arrest the movement of the truck into the cell in the lowered position thereof, means to raise said rack out of said position and into engagement with said pinion gear, a latch carried by said truck, abutments carried by said rack, and manual means to move said latch into locking engagement with said abutments whereby to arrest the movement of the truck.

11. An electric switch gear including a stationary frame, a truck movable toward and away from said frame, a circuit interrupter mounted on said truck, cooperating isolation contacts carried by said frame and interrupter, operating mechanism for said interrupter, interconnecting members carried by said frame and truck for effecting horizontal movement of said truck into contact engaging position, means engageable with one of said interconnecting members for locking said truck in a plurality of horizontal positions, and means engageable with a movable part of said interrupter operating mechanism and governed by the open and closed condition of the interrupter for controlling the operation of said manual locking means.

12. An electric switch gear including a stationary frame, a truck having a circuit interrupter mounted thereon, cooperating isolation contacts carried by said frame and truck, force-multiplying means including co-acting members carried by the cell and frame for moving said truck away from said frame to separate said contacts, means engageable with one of said members in a plurality of different parts thereof to lock said truck against such movement, manual means controlling the unlocking of said locking means, and means governed by the condition of the interrupter arranged to lock said manual means against release of said locking means when said interrupter is in closed condition.

13. An electric switch gear including a stationary frame, a truck, cooperating isolation contacts carried by said frame and truck, a circuit interrupter carried by said truck, force-multiplying means including cooperating racking members carried by said frame and truck arranged to move said truck toward said frame to effect engagement of said isolation contacts, rocking means movable

into engagement with one of said members to prevent such movement, manual means for controlling the movement of said locking means, and means governed by the condition of said interrupter preventing the movement of said locking means to unlocked position unless said interrupter is in open condition.

14. The combination with an electric switch gear having relatively fixed and movable portions of circuit terminals carried by said fixed portion, a circuit interrupter carried by said movable portion having interrupter terminals adapted to cooperate with said fixed terminals, cooperating racking members carried by said fixed and movable portions for effecting the horizontal movement of said interrupter into and out of terminal engaging position, means to lock said interrupter in a plurality of definite horizontally spaced positions during its horizontal movement, and interlocking mechanism associated with said interrupter arranged to prevent the operation of said locking means except when the interrupter is fully open, and means associated with said racking means arranged to prevent the operation of said locking means to lock said interrupter except in the aforesaid horizontal positions of said interrupter.

15. The combination with an electric switch gear having fixed and movable portions of circuit terminals carried by said fixed portion, a circuit interrupter carried by said movable portion having interrupter terminals adapted to cooperate with said fixed terminals, a rack carried by said fixed portion, a pinion gear carried by said movable portion, said rack and pinion adapted to be normally out of engagement, means to lock said truck in a plurality of horizontal positions, manual means controlling the operation of said locking means, means also operated by said manual means to move said rack into position to engage said pinion gear, said latter means arranged to hold said rack in pinion-engaging position irrespective of subsequent movement of said manual locking means into and out of switch locking position.

16. The combination with an electric switch gear having fixed and movable portions of circuit terminals carried by said fixed portion, a circuit interrupter carried by said movable portion having interrupter terminals adapted to cooperate with said fixed terminals, cooperating rack and pinion members carried by said fixed and movable portions by which said interrupter is adapted to be moved into and out of terminal engaging position, cooperating means carried by said fixed and movable portions for arresting the horizontal movements of said interrupter in a plurality of positions, manual means controlling the operation of said locking means, and means controlled by said

manual means for effecting the initial engagement of said rack and pinion members simultaneously with the unlocking of said switch, said means adapted thereafter to hold said racking members in cooperating engagement during subsequent locking and unlocking of the switch and withdrawal of the switch by said racking mechanism.

17. The combination of fixed circuit terminals, a truck type switch having switch terminals, means to move said switch into and out of a position in which said switch and circuit terminals are in engagement, means to lock said switch in either of two horizontal positions with respect to said fixed terminals, manual means for controlling said locking means, and means governed by the closed and open condition of said switch arranged to prevent the operation of said locking means except in the fully open position of the switch, and means associated with said locking means arranged to prevent the operation of said locking means to unlock said interrupter except in the aforesaid horizontal positions of said switch.

18. The combination of an enclosing cell having fixed circuit terminals, a truck type circuit interrupter having interrupter terminals adapted to cooperate with said fixed terminals, cooperating rack and pinion members carried by said cell and truck, said rack adapted normally to occupy a lowered position in which it is free from said pinion gear, cooperating abutments carried by said truck and rack arranged in the lowered position of the latter to prevent the manual movement of said truck into the cell, rack-elevating means carried by said truck, locking means arranged to arrest the horizontal movement of said truck in a plurality of positions, manually controlled means for said locking means also constituting means to operate said rack-raising means for effecting the engagement thereof with said pinion gear, and means to maintain said rack and pinion in cooperating engagement during subsequent locking and unlocking of the truck.

19. The combination of an enclosing cell and fixed circuit terminals, a truck type switch having switch terminals adapted to cooperate with said fixed terminals, force-multiplying means including cooperating racking means carried by said truck and cell arranged to move said truck a predetermined distance toward and away from its terminal-engaging position, means to lock said truck a predetermined distance away from its terminal engaging position, manual means controlling the locking and unlocking of said locking means, and cooperating means carried by said truck and cell arranged to effect the automatic operation of said locking means to lock said truck against movement in either direction in response to the movements of

said truck both into and out of its enclosing cell.

20. Electric switch gear including the combination of a cell having horizontal line terminals therein, a truck type switch movable horizontally into and out of said cell and having horizontal terminals which engage and disengage with said line terminals, means including an intermeshing rack and gear carried respectively by said cell and switch for moving said switch into and out of engagement with said line terminals, and means for effecting the disengagement and re-engagement of said rack and gear for interrupting the outward movement of said switch in a predetermined partially-withdrawn position thereof.

21. Electric switch gear including the combination of a cell having horizontal line terminals therein, a truck type switch movable horizontally into and out of said cell and having horizontal terminals which engage and disengage said line terminals, means including an intermeshing pinion and rack carried respectively by said switch and cell for moving said switch into and out of engagement with said line terminals, and means for moving said rack toward and away from said gear to effect the engagement and disengagement of said rack and gear.

22. Electric switch gear including the combination of a cell having horizontal line terminals therein, a truck type switch movable horizontally into and out of said cell and having horizontal terminals which engage and disengage said line terminals, means including an intermeshing pinion and rack carried respectively by said switch and cell for moving said switch into and out of engagement with said line terminals, said switch having operating mechanism for opening and closing it, means for moving said rack into and out of engaging position with said gear, and means controlled by the condition of said operating mechanism for governing the operation of said rack-moving means.

23. Electric switch gear including the combination of a cell having horizontal line terminals therein, a truck-type switch movable horizontally into and out of said cell and having horizontal terminals which engage and disengage said line terminals, means including an intermeshing pinion and rack carried respectively by said switch and cell for moving said switch into and out of engagement with said line terminals, and switch locking mechanism releasably engageable with said rack for locking the switch within said cell.

24. Electric switch gear including the combination of a cell having horizontal line terminals therein, a truck-type switch movable horizontally into and out of said cell and having horizontal terminals which engage and disengage said line terminals, means in-

cluding an intermeshing pinion and rack carried respectively by said switch and cell for moving said switch into and out of engagement with said line terminals, and switch locking mechanism releasably engageable in a plurality of positions with said rack for locking the switch in a plurality of positions in said cell.

25. Electric switch gear including the combination of a cell having horizontal line terminals therein, a truck-type switch movable horizontally into and out of said cell and having horizontal terminals which engage and disengage said line terminals, means including an intermeshing pinion and rack carried respectively by said switch and cell for moving said switch into and out of engagement with said line terminals, and switch locking mechanism releasably engageable in a plurality of positions with said rack for locking the switch in a plurality of positions in said cell, and means governed by the condition of the switch for governing the operation of said locking mechanism.

26. Electric switch gear including the combination of a cell having horizontal line terminals therein, a truck-type switch movable horizontally into and out of said cell and having horizontal terminals which engage and disengage said line terminals, means including an intermeshing pinion and rack carried respectively by said switch and cell for moving said switch into and out of engagement with said line terminals, said rack being vertically movable and being normally in a low position and adapted to engage a part of said switch as it is moved into said cell to limit further movement thereof, and means to raise said rack from engagement with such part and into mesh with said gear for permitting the rotation of said gear to move the switch further into said cell.

27. Electric switch gear including the combination of a cell having horizontal line terminals therein, a truck-type switch movable horizontally into and out of said cell and having horizontal terminals which engage and disengage said line terminals, means including an intermeshing pinion and rack carried respectively by said switch and cell for moving said switch into and out of engagement with said line terminals, said rack being vertically movable and being normally in a low position and adapted to engage a part of said switch as it is moved into said cell to limit further movement thereof, means to raise said rack from engagement with such part and into mesh with said gear for permitting the rotation of said gear to move the switch further into said cell, and means controlled by the condition of the switch for governing the raising of said rack.

In testimony whereof, I have signed my name to this specification.

FREDERICK H. MACNEIL. 130