

Oct. 16, 1956

A. T. HAWKINS ET AL

2,767,266

DRAW-OUT SWITCH GEAR.

Filed March 25, 1954

3 Sheets-Sheet 1

FIG. 1

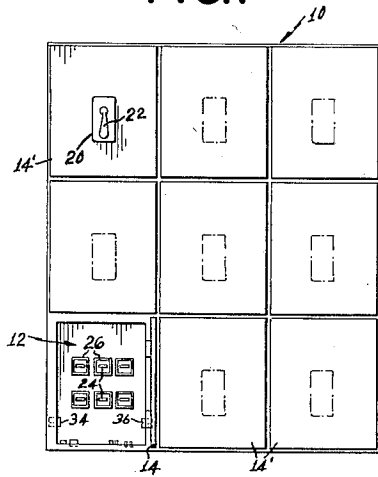


FIG. 2

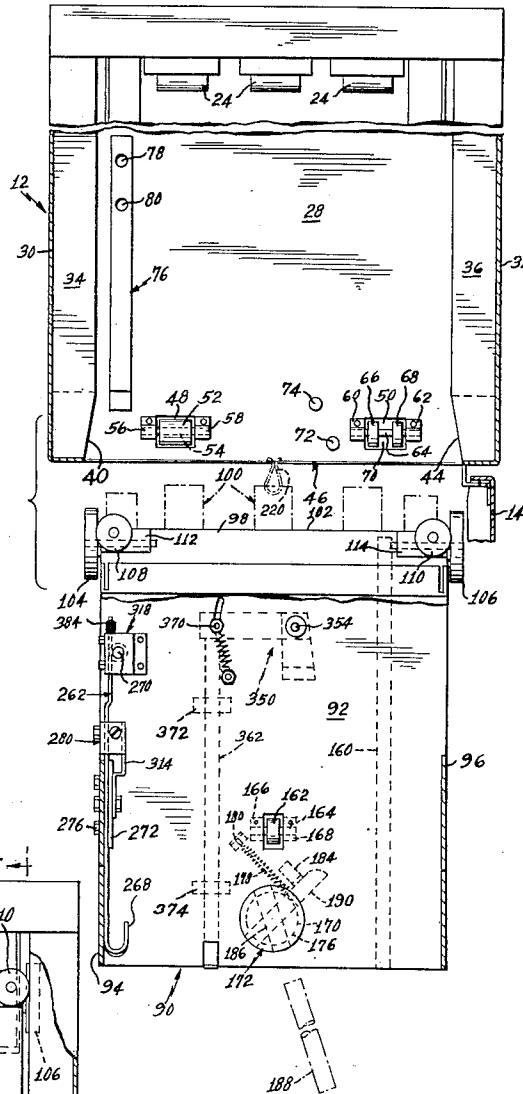


FIG. 3

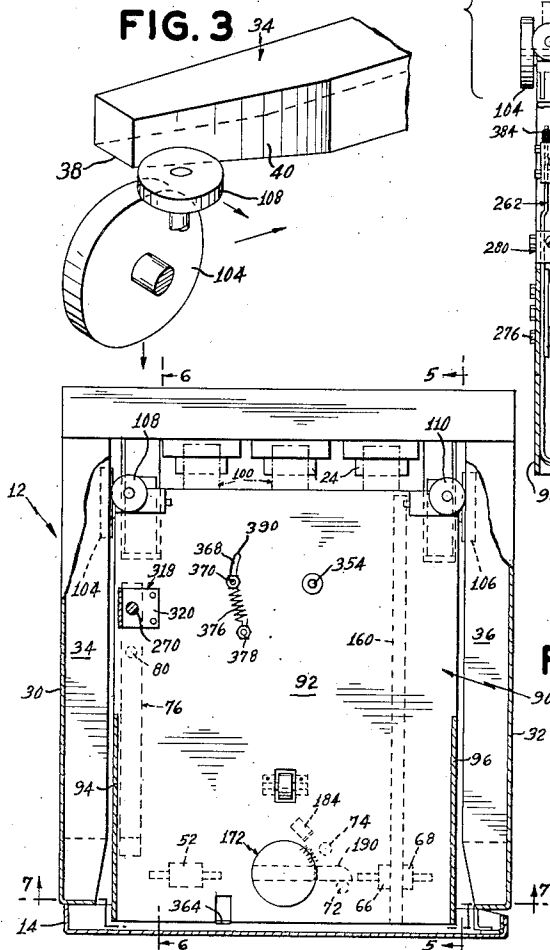


FIG. 4

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3 Sheets-Sheet 2

FIG. 5

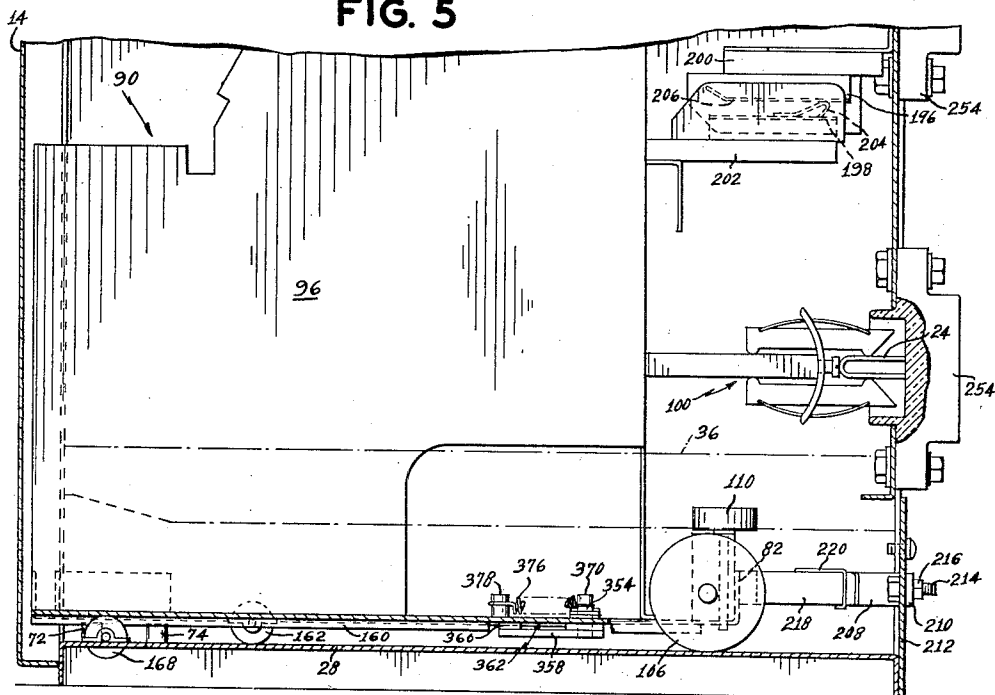


FIG. 6

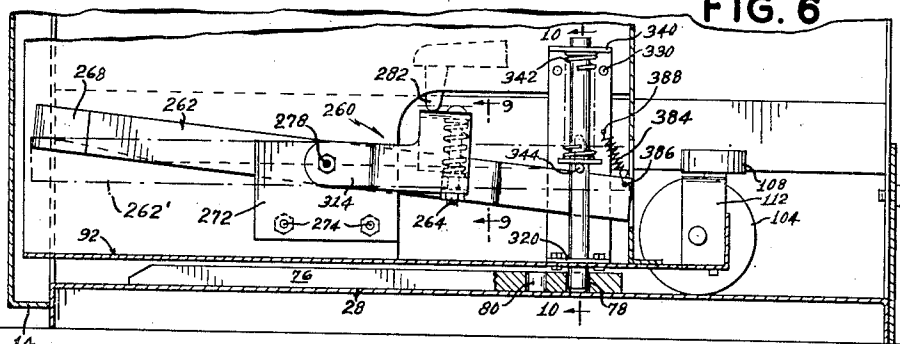
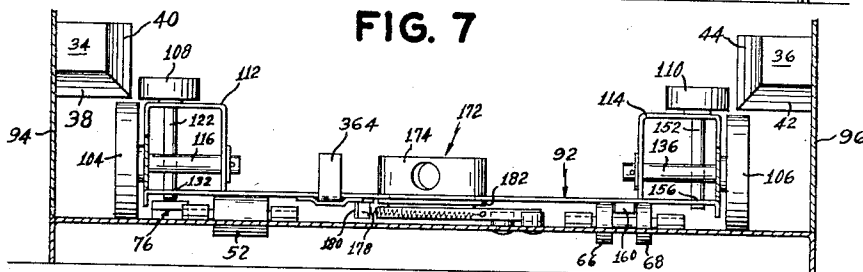


FIG. 7



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3 Sheets-Sheet 3

FIG. 8

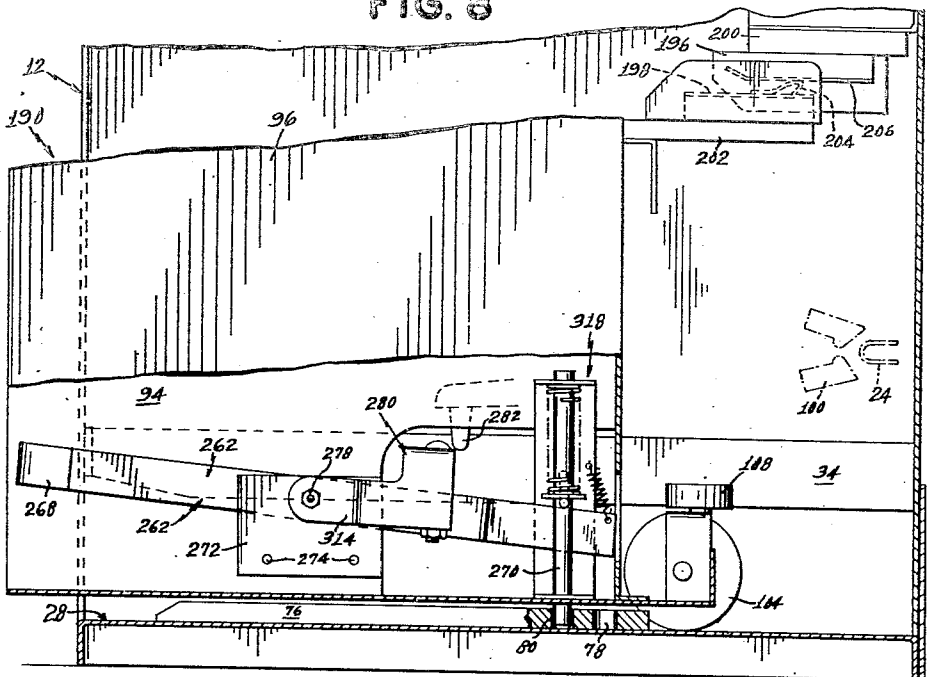


FIG. 10

FIG. 9

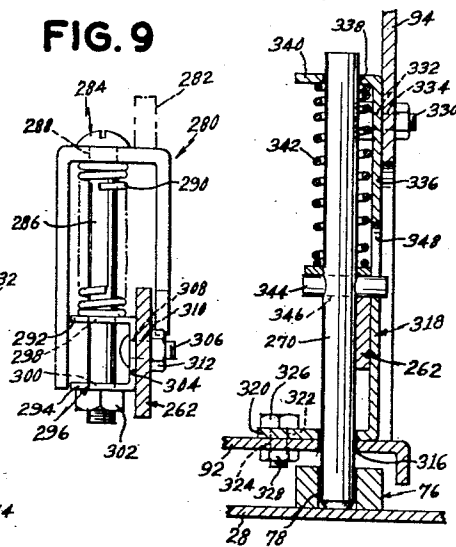
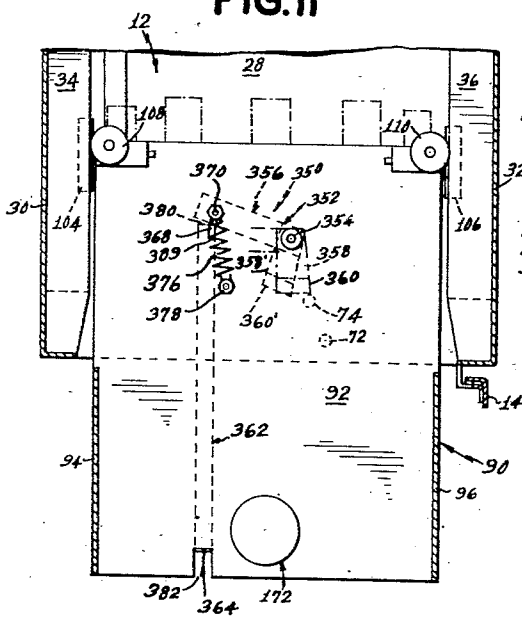


FIG. 11



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1

2,767,266

DRAW-OUT SWITCH GEAR

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Application March 25, 1954, Serial No. 418,552

16 Claims. (Cl. 200—50)

The present invention relates to a drawout switch gear for use, for example and not by way of limitation, in a power center or at a control center.

More specifically, the present invention relates to a drawout switch gear, of the type provided with line contacts of the plug-in type for engagement with companion stationary contacts, such as that disclosed in the application of Ervin E. Willis, Serial No. 329,165, filed Jan. 2, 1953 and assigned to the assignee of the subject application.

It is an object of the present invention to provide means whereby a comparatively heavy switch gear may be readily inserted and automatically aligned in its chassis.

Another object is to provide a simple and efficient arrangement for camming a drawout switch gear into an aligned disposition thereof, in its chassis from different relative disposition of the switch gear as it is inserted into the chassis.

A further object is to provide for safe and positive operation of the drawout switch gear through the provision of an interlock arrangement which permits the breaker thereof to be closed only when properly latched into the operating or test position thereof and automatically opens said breaker when the switch gear is withdrawn from its operating or test position.

One object of this invention is to provide means to prevent the switch gear from accidentally falling out of the cell during the withdrawal of the switch gear therefrom.

Another object of this invention is to provide means for grounding the carriage of the switch gear to the chassis when the carriage is fully inserted within the chassis, and when in the intermediate test position.

Still another object of the invention generally provides for a drawout switch mechanism of improved construction.

The above and other objects, features and advantages of the present invention will be more fully understood from the following description considered in connection with the accompanying illustrative drawings.

In the drawings:

Fig. 1 is an elevational view illustrating the front panel of a bank of chassis with the door to one of the chassis opened and its associated carriage removed therefrom;

Fig. 2 is a plan view of the drawout switch gear, parts of the chassis being illustrated in section and parts of the carriage being broken away for purposes of illustration and the carriage being shown in position withdrawn from the chassis;

Fig. 3 is a partially exploded fragmentary perspective view, on an enlarged scale, illustrating one of the camming-in rails and the associated rollers for this purpose on the carriage;

Fig. 4 illustrates a plan view partially sectioned of the chassis and carriage illustrating the fully engaged condition of the contacts, the carriage being in the operative position thereof;

Fig. 5 is an elevational sectional side view, on a larger

2

scale, taken on line 5—5 of Fig. 4, and illustrates the carriage in its fully engaged position within the chassis and illustrates the fully engaged position of the main contacts and the grounding contacts and the contacts used for the test purpose;

Fig. 6 is a partial sectional side view, on a larger scale, taken on line 6—6 of Fig. 4 illustrating the carriage in its fully engaged position within the chassis and further illustrating a novel latch mechanism for holding the carriage in said position with respect to the chassis;

Fig. 7 is a partial sectional front view, on a larger scale, of the front of the chassis taken on line 7—7 of Fig. 4 illustrating the carriage in its fully inserted position within the chassis;

Fig. 8 is a partially sectioned side elevational view similar to that of Fig. 5 with the carriage in a partially withdrawn position with respect to the chassis, the testing position, and further illustrates the novel locking mechanism for holding the carriage in said partially withdrawn position;

Fig. 9 is a sectional view, on a larger scale, taken on line 9—9 of Fig. 6 illustrating the mechanism for tripping the circuit breaker when the carriage is removed from a fully inserted position or from its partially withdrawn position;

Fig. 10 is a sectional view, on a larger scale, taken on line 10—10 of Fig. 6 illustrating the stud mechanism, of the novel locking mechanism for positioning the carriage with respect to the chassis in a fully inserted condition and a partially withdrawn condition; and

Fig. 11 is a sectional plan view illustrating a portion of the chassis and the base portion of the carriage, the carriage being shown partially removed from the chassis in order to illustrate a novel safety mechanism for preventing the carriage from being inadvertently withdrawn from the chassis.

Referring now to the drawings in detail which illustrate the best mode presently contemplated of practicing the invention, the bank of cells or chassis is generally indicated at 10 with one cell 12 having its associated carriage 90 removed therefrom, the door 14 thereto being opened. Door 14' is a door similar to that of door 14 and is shown in its closed position, the doors 14 and 14', each having a plate 20 from which the lever arm operating handle 22 of the circuit breaker projects. The single cell or enclosure 12 is provided at the rear thereof with stationary blade-like contacts 24, which as here shown, are mounted in position by the insulated support member 26, with the longer dimension in a horizontal position.

Referring now more particularly to Figs. 2 and 4, the single cell 12, disposed within the bank of cells 10, is constituted by a base 28, two vertical side walls 30 and 32 on which are provided confronting guide members or bars 34 and 36, respectively, guide bar 34 being disposed on wall 30 and guide bar 36 being disposed on wall 32. An enlarged fragmentary portion of guide bar 34 is shown in Fig. 3 illustrating the manner in which two side portions 38 and 40 thereof, are tapered in horizontal and vertical directions, respectively, the purposes for which will be hereinafter further explained. In a similar manner, guide bar 36 is tapered on two surfaces 42 and 44, respectively. It will be noted that the base 28 defines a rollerway with the confronting surface of each guide bar. Adjacent the front opening 46 of the cell 12, there is provided laterally spaced openings 48 and 50 in base 28 of cell 12, as best seen in Fig. 2. A roller 52 substantially fills the opening 48, said roller being mounted for free rotary movement therein by a pin 54, the opposite ends of which are positioned by elements 56 and 58 provided in the base 28 of cell 12. The cell 12 is also provided with spaced similar elements 60 and 62 at the opposite sides of the previously men-

tioned opening 50 for positioning the end of the pin member 64. Said pin member mounts the laterally spaced rollers 66 and 68, to provide the space 70 therebetween. However, it will be understood that the rollers 66 and 68 may be formed of a single roller which is undercut to provide said space 70. In addition to the rollers, the cell 12 is also provided with the spaced lugs or studs 72 and 74 which are mutually displaced, both longitudinally and transversely of the base 28 of cell 12 as illustrated in Figs. 2, 4 and 11, the function of said lugs will be hereinafter further explained. Mounted on base 28 on each of the cells 12 near wall 30 is a positioning bar 76 having openings 78 and 80, as best illustrated in Figs. 2 and 6. The aligned apertures 78 and 80 are used in positioning and locking the carriage 90 in a fully inserted position thereof within the chassis and in a test position thereof within the chassis, as hereinafter described in detail.

Carriage 90 is provided with a suitable automatic circuit breaker mechanism, such as disclosed in the aforementioned copending application. The carriage comprises a base or support member 92 which is provided at the periphery thereof with the upwardly directly upstanding wall members 94 and 96 (Figs. 2 and 6). A wall member or mounting plate 98 is secured between side walls 94 and 96 and extends therebetween for mounting plug-in type circuit breaker contacts, generally indicated at 100, at the surface 102 of wall 98 thereof, the plug-in contacts 100 projecting from the aforesaid surface. Adjacent to the rear or inner end of the carriage, the base member 92 is provided with laterally aligned vertical rollers 104 and 106 which are adapted to ride under the tapered portions 38 and 42 of guide bars 34 and 36, respectively, in the previously mentioned rollerways, and are used for a purpose which will be hereinafter explained. Also provided adjacent the rear of the carriage are horizontal rollers 108 and 110 which are adapted to ride on the tapered sides 40 and 44 of guide bars 34 and 36, respectively. The manner in which the rollers are secured to the carriage is best illustrated in Fig. 7, wherein a U-shaped or inverted channel 112 is welded to the base plate 92 proximate to side 94 of carriage 90, and U-shaped or inverted channel 114 is welded in a similar manner to the base plate proximate to side 96. Vertical roller 104 is provided on an axle 116 which is journaled in the inverted channel 112 and vertical roller 106 is provided on an axle 136 which is similarly journaled in the inverted channel 114. Horizontal roller 108 is provided on an axle 122 which extends through the channel 112 and is journaled in the base plate 92, as at 132. Horizontal roller 110 is similarly provided on an axle 152 which extends through the channel 114 and is journaled in the base plate 92, as at 156.

The usual drawout switch gear is a comparatively heavy unit. When being inserted into its chassis, one end is frequently lifted above or below the other end and this adds to the difficulty encountered in the insertion of the switch gear. Pursuant to one feature of the present invention, the switch gear is readily aligned in proper disposition as it is inserted into its chassis regardless of the relative disposition of the ends thereof. In this connection, it will be noted that when the inner end of the carriage is inserted into the chassis, the horizontal rollers 104 and 106 engage the tapered guide portions 38 and 42, respectively, to cam the carriage in a vertical direction into a horizontal disposition thereof whether the opposite carriage end is being held at a level above or below said inner end. In addition, rollers 108 and 110 engage tapered portions 40 and 44 of guide bars 34 and 36, respectively, for camming the carriage in a horizontal direction thereby facilitating the alignment of the carriage with the cell 12 in both a horizontal and a vertical direction, in order that track 160 can be better inserted between rollers 66 and 68. The need for align-

ing track 160 between rollers 66 and 68 will be hereinafter further explained.

Carriage 90 is also provided with a roller 162 mounted on the underside thereof and projecting therethrough, carried thereby by means of pin 164 which is positioned with respect to the underside of base 92 of the carriage by means of positioning elements 166 and 168. Roller 162 together with rollers 104 and 106 provide a three-point support for carriage 90 both when it is without the cell 12 and within the cell 12, the reason for which will be hereinafter further explained.

As previously indicated, the plug-in contacts 100 are quite heavy and are provided with suitable strong spring pressure for maintaining good contact pressure with the stationary blade contacts 24. Fig. 5 illustrates the fully inserted position of the blade contacts 24 and the companion plug-in contacts 100 in the operative disposition of the carriage in the cell. A substantially great degree of force on the part of the operator, is ordinarily necessary for him to push the carriage, from the position just prior to full engagement of the contacts to the position as illustrated in Fig. 5 to provide for the full engagement of the companion contacts.

In order to facilitate the full engagement of the companion contacts, a mechanism of the type claimed in the copending application of Ervin E. Wills, Serial No. 329,165, filed January 2, 1953 and assigned to the assignee hereof, is provided so that it may be accomplished by only one operator without too much physical exertion. For this purpose, the base 92 of the carriage 90 is apertured as at 170 (Figs. 2, 4 and 7), adjacent the front edge thereof. A circular rotary member 172 is disposed within said aperture, said member having an enlarged portion 174 which overlies the aperture at the upper surface of the base 92 and a narrowed neck portion 176 which extends through the aperture 170. The spring member 178 is provided at the lower surface of base 92, one end thereof being secured to a retaining element 180, and the other end being secured to arm 190, which is secured to another enlarged portion 182 of rotary member 172. Retaining element 180 is connected to the underside of base 92 and enlarged portion 182 is also on the underside thereof. A detent member 184 is also provided at the lower surface of base 92, the function of which will presently appear. Rotary member 172 is provided with a diametrically extending circular passageway 186 for removably receiving a companion rod or bar 188 therein.

When the carriage is moved into the chassis from an outermost position to an innermost position, arm 190, which is secured to rotary member 172, is initially disposed in abutment with the previously mentioned stop or detent member 184 by the spring 178. After the carriage is partially inserted within the cell 12 and rotary member 172 commences to enter therein, arm 190 is in such a position that it can clear vertically upstanding stud or lug 72 on the base 28 of cell 12. However, as said arm 190 continues to move with its carriage in a direction for full insertion thereof within said compartment, companion lug or stud 74 will be in the path of movement thereof so that said arm will abut against said latter lug and be rotated away from the detent member 184. Just prior to the time that plug-in contacts 100 make initial contact with the companion stationary contact 24 in order to effect the full engagement of said contacts, the bar 188 is inserted in the opening provided therefor in the rotary member 172 and said bar is rotated in a clockwise direction so that the arm 190 will now move into engagement with the lug 72. No inward movement of the carriage occurs during the movement of the arm from the lug 74 to the lug 72. However, continued rotation of the bar 188 in the same direction, with the arm 190 in engagement with the lug 72 causes pivotal movement of said arm about lug 72, which serves as a fulcrum therefor, and the carriage is moved forwardly into the cell, for the full engagement

of the stationary contacts 24 and the companion plug-in contacts 100. By means of this, the carriage can be placed in an operative position with the circuit breaker connected to the power line, and the rod 188 may then be withdrawn and the spring 178 which had expanded upon rotation of the arm 190 to engage the lug 72, contracts and returns the arm to abutment with the inner lug 74. Thereafter, when it is desired to disengage the companion contacts, the rod 188 is again inserted into the rotary member 172 and the rod is now rotated in a counterclockwise direction so that the arm 190 will lever against the inner lug 74, as a fulcrum, to effect the disengagement of the contacts. When the carriage is withdrawn sufficiently for the arm 190 to disengage the lug 74, the spring 178 will carry said arm into engagement with the detent 184. Lug 74 has an additional function in addition to levering out the carriage, as hereinafter further explained.

Pursuant to another feature of the present invention, provision is made for an automatically operated mechanism, for locking the carriage in two positions within the cell. In circuit breakers of the present type, it is necessary to provide means for partially withdrawing the carriage from its associated cell in order to test the various solenoids and relays, without energizing the load power center. In order to test the various solenoids and relays, it is necessary to have an auxiliary pair of contacts to conduit control power from the supply for energizing the solenoids and relays. Further, in this connection, it will be noted that in order to energize the solenoids and relays mounted on the circuit breaker, which is movable, auxiliary contacts must be provided to conduct control power from the supply, which is stationary, to the breaker. Provision is therefore made for a pair of auxiliary contacts 196 and 198, respectively, mounted on insulating members 200 and 202. Auxiliary contact 196 is connected at the back of cell 12 to a source of electrical energy. Auxiliary contact 198 is connected to the relays and solenoids of the circuit breaker. When auxiliary contacts 196 and 198 are engaged, an electric path is complete to conduct energy from the control power supply to the relays and solenoids on the breaker. Auxiliary contact 198 has a spring finger 204 thereon for engagement with portion 206 of auxiliary contact 196 when the auxiliary contacts are in their fully engaged position. As shown in Fig. 5, the auxiliary contacts 196 and 198 are fully engaged at the same time that the main stationary contacts 24 are engaged with the main movable contacts 100. Fig. 8 clearly illustrates the manner in which the auxiliary contacts remain engaged in a test position of the carriage while the main stationary and the main movable contacts are disengaged.

Pursuant to another feature of the present invention, provision is made for grounding the movable metallic carriage 90 to the metallic cell 12. For this purpose, as best illustrated in Fig. 5, a single blade 208 having an L or flange portion 210 is held against the back wall 212 of the chassis by means of bolt 214 and nut 216. A two prong finger-like contact 218 is welded to member 82 which is formed from a part of an extension of the base portion 92 of carriage 90 and is adapted to fit over the single finger-like contact 208 and is held pressed against it by means of a substantially U-shaped resilient element 220. Carriage 90 is thereby maintained at the same ground or reference potential, as is the cell 12. Spring blade 208 and dual finger contact 218 are of sufficient length such that they are in engagement with each other so long as auxiliary blades 204 and 206 of the auxiliary contacts are in engagement with each other, thereby maintaining said carriage grounded during the test operation also.

The main contacts generally shown at 24 and 100 are preferably of the type disclosed and claimed in the copending application of Ervin E. Wills, Serial No. 389,245, filed October 30, 1953, and assigned to the assignee of the subject invention. One of the advantages of this par-

ticular plug-in contact is the provision of a contact wiping action. Stationary contact 24 is brought out of the back wall 212 of cell 12 through an insulating member 254 in order to connect said stationary contact to an electrical power source.

Pursuant to another feature of the present invention, provision is made for mechanical interlock which is generally indicated by the reference numeral 260, Figs. 2, 4, 6 and 8. The interlock 260 comprises a manually operable latch member or lever bar 262 which is pivotally mounted at the inner surface of the wall 94 of the carriage, as at 278. At the outer end thereof, said lever is provided with a handle 268 and at the other end thereof provision is made for engagement with a downwardly spring biased stud or lock member 270. Lever 262 pivots through an area set off on the side of the carriage and denoted by the side wall 94 and a side plate 272 which is secured to wall 94 by means of bolts 274 and nuts 276. Wall 94 and plate 272 support a pivot bar 278 about which lever 262 pivots. Also pivoting on pivot 278 is a substantially U-shaped yoke member 280 which is best illustrated in Fig. 9, which operates the trip bar 282 (Fig. 8) for tripping the circuit breaker, whenever lever 262 is rotated about pivot 278. Within yoke member 280 is a stud or bolt generally shown at 284, the shank of which, 286, passes through an opening 288 in the base of said yoke and passes through a resilient spring 290, which biases the yoke against the trip means 282, and then through the legs 292 and 294 of a U-shaped bracket generally indicated at 296 through respective apertures 298 and 300 in said leg portions. Said bracket 296 is secured for movement along shank portion 286 of bolt 284 by means of nut 302 which is threaded thereon. Lever arm 262 is connected to the head portion or base portion 304 of bracket 296 by means of bolt 306 which passes through opening 308 and said base portion 304 and opening 310 in said lever 262. Lever 262 is held against base portion 304 by means of nut 312 which is threaded for engagement with said bolt 306. Viewing Fig. 8, a slight rotation in a counterclockwise direction of lever 262 about pivot 278 will move bracket 296 carried thereby, which movement will be transferred to said yoke 280 by means of spring 290, and thereby effectively move trip bar 282, whereby said circuit breaker is tripped. The purpose of moving trip bar 282 for tripping the circuit breaker will become apparent hereinafter. In order to complete the action of movement of said yoke 280, an outwardly extending portion 314 thereof, which is disposed on the outer portion of plate 272, is pivoted on pivot 278. Hence, it can be readily seen that the aforesaid yoke 280 will follow the movement of the lever 262 in a counterclockwise direction viewing Fig. 8 and pivot about the aforesaid pivot 278 in order to trip said circuit breaker and will also follow said lever 262 in a clockwise direction when it is so moved.

As was mentioned previously, positioning bar 76 is on the floor or base 28 of cell 12 and has two aligned apertures 78 and 80 therein, positioned in a manner such that when stud 270 engages aperture 78, carriage 90 will be releasably locked in a position such that movable contacts 100 are fully engaged with stationary contacts 24. And, when said carriage is in a position such that stud 270 is engaged with aperture 80, carriage 90 is releasably locked in a position such that the movable contacts 100 are fully disengaged from their associated stationary companion contacts 24, however, auxiliary contacts 196 and 198 will be engaged for the aforesaid testing purposes. Stud 270 is spring biased in a downward direction towards the base 28, and more particularly towards positioning bar 76, and is held in position for the aforesaid purpose to move through opening 316 in the base 92 of carriage 90, thereto by means of U-shaped member generally indicated at 318, the leg portion 320 of which is secured to said base 92 through openings 322 and 324, respectively, by means of bolt

326 which passes therethrough and is held thereagainst by means of nut 328. U-shaped member 318 is also mounted against side plate 94 of the aforesaid carriage by means of bolts 330 which pass through openings 332 and 334 in base portion 336 of the aforesaid U-shaped member and side wall 94, respectively. Stud 270 is spring biased for movement within said U-shaped member 318 and passes through opening 338 in leg portion 340 and through resilient spring 342 which is held against leg portion 340 and on stud 270 by means of a cross pin 344 which passes through opening 346 in the aforesaid stud 270. Base portion 336 of U-shaped frame 318 has a longitudinal slot 348 through which pin 344 is guided for vertical movement therein. The extent of the axial movement of pin 344 is limited by the aforesaid slot 348, and the extent of the axial movement of stud 270 is also thereby limited. Spring 342 is held against movement by means of end plate 340 and pin 344, whose movement is limited by the aforesaid slot 348. As shown in Fig. 10, stud 270 is engaged within opening 78 and is lifted therefrom by means of lever 262 which passes under pin 344 transversely thereto for raising stud 270 in a vertical direction by pushing up on pin 344 and moving it within slot 348. Movement of pin 344 in the upward vertical direction raises stud 270 from opening 78. When lever arm 262 is released, stud 270 is forced into one of the openings 78 or 80 or against guide bar 76 by means of the downward force exerted by spring 342 on pin 344 and transmitted to said stud 270. In Fig. 8, stud 270 is shown engaged with opening 80, which opening is used to properly position carriage 90 in a test position to have the main contacts disengaged as mentioned previously.

Pursuant to another feature of the present invention, provision is made for a mechanism on the underside of carriage 90 under base 92 thereof for preventing inadvertent removal of the carriage from its associated cell, which may result in damage to the carriage by its being dropped to the floor or injury to the operator by having the carriage dropped on him. This novel feature uses the stud 74, which is also used in the illustrated embodiment of this invention to cam the carriage for disengaging the contacts. However, it is to be understood that another stud can also be used. The novel carriage withdrawal stop mechanism is generally indicated at 350 and is best illustrated in Figs. 2 and 11. Stop mechanism 350 comprises a substantially L-shaped member, generally indicated at 352, pivotable about pivot 354, which pivot is jointed to the base 92 of carriage 90 and projects substantially normally from the underside thereof. When carriage 90 is partially withdrawn from cell 12 as can be best seen in Fig. 11, arm 358 of member 352 is in the position shown dotted and dashed with lip portion 360 of arm 358 bearing against stud 74, for preventing further withdrawal of the carriage 90. In order for an operator to effect further withdrawal of the carriage 90 from the cell 12, it is necessary to move arm 358 with lip portion 360 to the position shown in full lines, arm 358 and lip 360 being denoted respectively as 358' and 360' in the aforesaid position and then carriage 90 can be moved past stud 74 and removed from cell 12. For facilitating the movement of arm 358 to the position denoted by arm 358', lever arm 362 having handle 364 is provided and is used to move arm 356 in a clockwise direction by abutting thereagainst. Movement of lever arm 356 effects movement of arm 358 as these arms are interconnected and pivot about pivot 354. The extended clockwise movement of member 352 is limited by slot 368 in the base 92 of chassis 90, by limiting the extent of travel of pin 370 which protrudes from arm 356 and through said slot 368 to the top side of base 92 of chassis 90. Lever arm 362 is aligned for movement translatable parallel to said carriage 90 by means of two brackets 372 and 374, illustrated in Figs. 2 and 7, said brackets may be formed of U-shaped channels and can be secured to the underside of carriage 90 to base 92, such as for example by spot

welding. Therefore, it will be apparent that the carriage can be fully disengaged from the chassis only by the deliberate act of an operator in operating lever 362, whereby to prevent inadvertent removal of the carriage. After the operator has moved carriage 90 past stud 74 in such a manner so that there is no further possibility of arm 358 engaging stud 74 and he releases handle 364 and thereby releases it from its forward position, there is no need to pull lever arm 362 to its original position. For this purpose, resilient spring 376 is provided having one end connected to stud 370 and another end connected to a stud 378 which is located on the top side 92 of carriage 90, spring 376 being tensioned such that it has sufficient force to move arm 356 in a counterclockwise direction and bear against the edge 380 of lever 362 to push it forward into its original position. The lever 362 is on the underside 92 of carriage 90 for a substantial portion thereof, the handle portion 364, in order to facilitate the gripping thereof, projects upwardly through recess portion 382 at the front end of carriage 90.

Assuming now that the carriage 90 is being moved into the cell 12 from a position where it is completely removed therefrom, as illustrated in Fig. 2, previously mentioned rollers 104 and 106 on the carriage will first be engaged in the companion guides 34 and 36, respectively. More particularly, rollers 108 and 110 will become engaged with tapered surfaces 40 and 44 on guide members 34 and 36, respectively, in order to cam the carriage to a substantially proper horizontal position so that track 160 can be easily engaged between rollers 66 and 68. An additional camming action is also provided by means of rollers 104 and 106 in conjunction with tapered surfaces 38 and 42 for camming the carriage in a vertical direction, also to assist in aligning track 160 with split rollers 66 and 68. Rollers 104 and 106, and rollers 108 and 110 are effective in conjunction with the corresponding tapered portions on guide bars 34 and 36 to relieve the operator of much of the stress necessary to properly position the carriage so that track 160 will ride between rollers 66 and 68. All that is necessary now, is for an operator to get the edge of the carriage to rest on the base 28 of cell 12, after which the aforesaid rollers and guide bars take over the necessary camming action for camming carriage 90 into cell 12 in such a position that track 160 will clearly align itself with rollers 66 and 68. Further movement of carriage 90 in cell 12 is easily accomplished by means of rollers 104 and 106 in the forward direction, roller 52 and rollers 66 and 68 support the back side of carriage 90 as it is being inserted within cell 12. Roller 162 is also used to assist in the movement of carriage 90 and is used in addition to provide the aforementioned three point support for carriage 90 when it is on the floor outside of its associated cell. Roller 162 is also instrumental in preventing injury to the rotary member 172 or to the stop mechanism 350. Inward movement of carriage 90 within cell 12 to a point just prior to the registry of contacts 100 and 24 is easily accomplished by the operator, however, further movement for engaging contacts 100 and 24 in their fully engaged position is accomplished by means of rotary member 172 which is disclosed and claimed in the aforementioned copending application, Serial No. 329,165.

While carriage 90 is being moved into cell 12 for engagement with their respective contacts, locking mechanism 260 is effective for maintaining the circuit breaker in a trip position. It can readily be seen from Figs. 6 and 8, that trip handle 282 will ride on the base of yoke member 280 and will be maintained in a trip position so long as the base of stud 270 rides on rail 76. Lever arm 262 is then held in the horizontal position shown by 262' in Fig. 6 by means of resilient spring 384 which is connected to lever 262 in opening 386 and to the base of U-shaped member 318 in opening 388. Spring 384 is stiff enough to hold lever 262 next to and bearing

against pin 344, which pin is fittably engaged within stud 270. So long as stud 270 is not engaged within one or the other of openings 78 or 80, the circuit breaker will be tripped since trip bar 282 will be in its raised position, which thereby trips the circuit.

As was mentioned previously, opening 78 is positioned in such a manner that when stud 270 is in engagement therewith, the carriage 90 is locked in position so that contacts 100 and 24 are fully engaged with each other, and no movement of the carriage or cells, or any other movement will unlock and disturb the relative positions of the carriage with respect to said cell.

However, it frequently becomes necessary to inspect and test the relays, solenoids and other mechanisms of the circuit breaker, and means are therefore provided to supply electrical energy from a control power supply to test the circuit breaker. Also, it is necessary for purposes of safety, to actually disengage the main contacts 24 and 100 and supply the necessary electrical energy for the test purposes by means of the auxiliary contacts 196 and 198. The carriage is then moved to its intermediate or test position which is determined by the engagement of stud 270 with opening 80. It is to be noted, that as soon as the lever 262 is moved to removed stud 270 from engagement with opening 78, the trip bar 282 is moved and the trip mechanism is operated and the circuit breaker is opened. It is to be understood that even though the breaker can again be closed when stud 270 is engaged within opening 80, there is no danger of injury as a result of high potential, since the opening 80 is positioned in conjunction with the size and length of the main contacts 24 and 100 so that they are fully disengaged when stud 270 is engaged within opening 80. However, as can be noticed from Fig. 8, when the main contacts are disengaged, the auxiliary contacts 196 and 198 are still engaged and can be used for the purposes of testing and inspecting the various mechanisms. Stud 270 and opening 80 also jointly lock carriage 90 with respect to cell 12, so that there is no danger of the carriage rolling out of its associated chassis and thereby injuring the operator or the carriage itself.

In moving the carriage from the intermediate position thereof, with stud 270 in opening 80, as illustrated in Fig. 8, and in moving the carriage from its fully engaged position illustrated in Fig. 6, with stud 270 in opening 78, so as to completely withdraw from said carriage its associated cell, another safety feature is provided by means of which the operator cannot inadvertently remove the carriage from its associated chassis. The mechanism is generally indicated at 350 in Fig. 11 and rides on the underside 92 of carriage 90 and has an L-shaped member 352, one leg of which will abut against stud 74 and thereby prevent the further removal of the carriage from its associated cell. This stop mechanism alerts the operator to the fact that he must now be careful in removing the carriage, since the cell will no longer be the main support for the carriage. In order for the operator to completely remove the carriage from the cell, it is necessary for him to move arm 358 to the position where said arm is denoted at 358' and thereby provide a clear path for the movement of arm 358. At this point, the operator must take hold of handle portion 364 and push it in a forward direction so that edge 380 of lever 362 will abut against arm 356 of the L-shaped member 352 and move said member in a counter-clockwise direction, thereby moving arm 358 out of engagement with stud 74. After arm 358 has cleared stud 74 and the operator releases handle portion 364, said handle portion will be moved back to its original position by means of spring 376 which exerts a counter-clockwise force on arm 356 of L-shaped member 352. Said spring 376 and arm 356 are effective jointly to move lever 362 back into its original position, so that when the carriage is again inserted into the cell, member 358 will always engage stud 74 when the operator attempts

to withdraw the carriage. Slot 368 in base 92 of carriage 90 is cut in such a direction, so that arm 356, when it is in its normal position will be held against end 389 of said slot and will be perpendicular to end 380 of lever arm 362. When carriage 90 is moved to a position just prior to removal from cell 12, as in Fig. 11, arm 358 is in its normal position and lies on a line connecting stud 74 and pivot 354, said line being skewed with respect to sides 94 and 96 of carriage 90. Pivot 354 and stud 74 are so displaced from each other so that when spring 376 moves stud 370 to side 390 of slot 368, arm 358 will also be skewed with respect to all the sides of the cell 12, and will be in such a direction that when spring 376 is in its normal position, lip 360 of arm 358 will abut against stud 74, and when stud 370 is moved towards the other end 390 of slot 368 arm 358 and lip 360 will be moved out of engagement with stud 74 to the position denoted by 358' and 360' for its associated lip, after which carriage 90 can be withdrawn from cell 12. When the carriage 90 is being inserted within its associated chassis, stud 74 will also abut against a side of arm 358, however, spring 376 is not strong enough to prevent the carriage from being moved into the chassis by having arm 358 abut against stud 74. Arm 358 is then caused to rotate about pivot 354 by the pressure of stud 74 thereagainst, until it is clear of stud 74 and then moves into its normal position so as to prevent the withdrawal of the carriage when lip 360 of arm 358 engages stud 74.

It will be understood by those skilled in the art that carriage 90 may be readily interchanged so far as circuit breakers of similar capacity are concerned. By this arrangement, therefore, one type of carriage unit and metal enclosure may be used interchangeably with removable units including circuit breakers of similar interrupting capacity. Also, the interchangeable use of one carriage with another cell will always embody all of the novel safety features disclosed and set forth hereinbefore.

While we have shown and described the preferred embodiment of our invention, it will be understood that various changes and modifications may be made in the present invention without departing from underlying idea or principles of the invention as will be obvious to those skilled in the art.

Having thus described our invention, what we claim and desire to secure by Letters Patent is:

1. A drawout switch mechanism comprising a chassis unit and a carriage unit mounted for relative movement and provided with companion contacts, means operable to releasably lock said units in contact making and in testing positions, respectively, thereof, said means being inoperable when said carriage is not in said positions, latching mechanism operable at a predetermined relative disposition of said units during withdrawal of said carriage from said test position to prevent a complete separation thereof, and means to release said latching mechanism, whereby to require a positive operation to effect a complete separation of said units.

2. A drawout switch mechanism comprising a chassis unit and a carriage unit mounted for relative movement and provided with companion contacts, means operable to releasably lock said units in contact making and in testing positions, respectively, thereof, latching mechanism operable at a predetermined relative disposition of said units to prevent a complete separation thereof, and means to release said latching mechanism, whereby to require a positive operation to effect a complete separation of said units, and levering means to lever said contacts into and out of engagement thereof, said levering means including a pair of levering studs provided on said chassis, and one of said studs being common to said latching mechanism.

3. A drawout switch mechanism comprising chassis means provided with first stationary contacts, carriage

means provided with companion first movable contacts and mounted for movement on said chassis for effecting engagement and disengagement, respectively, of said contacts, cooperating means on said chassis and carriage for releasably positioning the latter in predetermined positions thereof relative to said chassis, said cooperating means positioning said carriage in said chassis for engagement of said movable contacts with said stationary contacts in a first of said predetermined positions and positioning said carriage in a second of said predetermined positions for effectively disengaging said movable contacts from said stationary contacts, said chassis being provided with auxiliary stationary contacts and said carriage having companion auxiliary movable contacts thereon for engagement and disengagement therewith, said cooperating means comprising spaced apertures in said chassis and a releasable latch means provided on said carriage for automatic engagement with said apertures, one of said apertures being operative with said latch means to lock said carriage means in a fully inserted position thereof on said chassis means for engagement of said movable contacts and said stationary contacts, and another of said apertures being operative with said latch means for locking said carriage means in a partially withdrawn position thereof in which the first contacts are disengaged and said auxiliary contacts are engaged; whereby to test said switch mechanism.

4. A drawout switch mechanism comprising chassis means provided with stationary contacts, carriage means provided with companion movable contacts and mounted for movement on said chassis for effecting engagement and disengagement, respectively, of said contacts, cooperating means on said chassis and carriage for releasably positioning the latter in predetermined positions thereof relative to said chassis, said cooperating means comprising spaced apertures in said chassis and a releasable latch means provided on said carriage for automatic engagement with said apertures, one of said apertures being operative with said latch means to lock said carriage means in a fully inserted position thereof on said chassis means for engagement of said movable contacts with said stationary contacts, and another of said apertures being operative with said latch means for locking said carriage means in a partially withdrawn position thereof in which the companion contacts are disengaged, and means operable automatically by said latch means upon disengagement of said latch means from each of said apertures, respectively, for operating the trip means of a circuit breaker.

5. A drawout switch mechanism comprising chassis means provided with stationary contacts, carriage means provided with companion movable contacts and mounted for movement on said chassis for effecting engagement and disengagement, respectively, of said contacts, cooperating means on said chassis and carriage for releasably locking the latter in predetermined positions thereof relative to said chassis, said cooperating means comprising spaced apertures in said chassis and a releasable latch means provided on said carriage for automatic engagement with said apertures when said carriage is moved to said predetermined positions thereof, and means for automatically operating the trip means of a circuit breaker upon disengagement of said latch means from each of said apertures respectively.

6. A drawout switch mechanism comprising chassis means provided with stationary contacts, carriage means provided with companion movable contacts and mounted for movement on said chassis for effecting engagement and disengagement, respectively, of said contacts, an additional stationary contact being provided on said chassis means in electrical contact therewith and an additional movable contact being provided on said carriage means in electrical contact therewith whereby to ground said carriage means to said chassis means when said companion contacts are engaged.

7. A drawout switch mechanism, comprising a cell and a switch carriage provided with companion contact members, said cell having at least two opposed horizontal guide members on the vertical walls, said guide members each having a first tapered portion and a second tapered portion, said tapered portions being disposed in intersecting planes, and said carriage having means cooperating with each of said portions whereby to allow movement of said carriage in each of said planes within said cell for positioning said carriage for alignment thereof within said cell.

8. A drawout switch mechanism, comprising a cell and a switch carriage provided with companion contact members, means associated with said cell for positioning said carriage for alignment with guide means within said cell, said positioning means having first and second portions, said carriage having cam follower means for engagement with said positioning means, said carriage having first and second guide rollers on each side thereof positioned to make rolling contact with said first and second portions of said guide members, respectively, whereby to guide the carriage into said cell.

9. A drawout switch gear comprising chassis means open at the front thereof and provided with stationary contacts rearwardly of said open front, said chassis having horizontal and vertical cam surfaces adjacent said open front thereof, carriage means provided with movable contacts and mounted for movement on said chassis rearwardly of said open front, to effect engagement of said movable contacts with said stationary contacts, respectively, horizontally and vertically disposed rollers, respectively provided on said carriage and cooperating with said cam surfaces for camming said carriage into the open end of said chassis means for aligning said contacts.

10. A drawout switch mechanism comprising chassis means provided with stationary contacts, carriage means provided with companion movable contacts and mounted for movement on said chassis for effecting engagement and disengagement, respectively, of said contacts, cooperating means on said chassis and carriage for releasably positioning the latter in predetermined positions thereof relative to said chassis, said cooperating means comprising spaced apertures provided at the base of said chassis and a releasable latch means provided on said carriage for engagement with said apertures, one of said apertures being operative with said latch means to lock said carriage means in a fully inserted position thereof on said chassis means for engagement of said movable contacts with said stationary contacts, and another of said apertures being operative with said latch means for locking said carriage means in a partially withdrawn position thereof in which the companion contacts are disengaged; said latch means comprising a stud for engagement with said apertures; spring biasing means biasing said stud towards the base of said chassis and into said apertures when said stud is aligned therewith, and manually operable means for overcoming the bias of said spring and for removing said stud from an engaged position with one of said apertures, whereby to unlock said carriage from said chassis.

11. A drawout switch mechanism comprising chassis means having stationary contact means, carriage means having companion movable contact means, said carriage means being mounted for movement between an inoperative position in which it is withdrawn from said chassis and an operative position on said chassis in which said contacts are engaged, said carriage having a test position intermediate said operative and inoperative positions; cooperating means on said carriage and chassis for releasably locking said carriage in said intermediate and operative positions; respectively, automatically upon arrival thereof; and additional cooperating means on said carriage and said chassis for preventing the inadvertent separation of said carriage from said chassis during movement of the carriage from said test position to said withdrawn position thereof.

13

12. A drawout switch mechanism comprising chassis means having stationary contact means, carriage means having companion movable contact means, said carriage means being mounted for movement between an inoperative position in which it is withdrawn from said chassis and an operative position on said chassis in which said contacts are engaged, said carriage having a test position intermediate said operative and inoperative positions, cooperating means on said carriage and chassis for releasably locking said carriage in said intermediate and operative positions, respectively, automatically upon arrival thereat, and additional cooperating means on said carriage and said chassis for preventing the inadvertent separation of said carriage from said chassis during movement of the carriage from said test position to said withdrawn position thereof, said first mentioned cooperating means comprising detent means provided on said chassis for each of said test and operative positions of said carriage, complementary lock means provided on said carriage, and means for automatically engaging said lock in said detents in each of said test and operative positions.

13. A drawout switch mechanism comprising chassis means having stationary contact means, carriage means having companion movable contact means, said carriage means being mounted for movement between an inoperative position in which it is withdrawn from said chassis and an operative position on said chassis in which said contacts are engaged, said carriage having a test position intermediate said operative and inoperative positions, cooperating means on said carriage and chassis for releasably locking said carriage in said intermediate and operative positions, respectively, automatically upon arrival thereat, and additional cooperating means on said carriage and said chassis for preventing the inadvertent separation of said carriage from said chassis during movement of the carriage from said test position to said withdrawn position thereof, said additional cooperating means comprising latch means provided on said carriage, detent means provided on said chassis and disposed in the path of movement of said carriage from said intermediate to said withdrawn positions thereof, and manually operable latch-releasing means provided on said carriage whereby to require a positive operation to effect a complete separation of said units.

14. A drawout switch gear comprising chassis means open at the front thereof and provided with stationary

14

contact means rearwardly of said open front, said chassis having opposing side walls and a bottom wall therebetween, a guide member provided on each of said side walls upwardly from said bottom wall to define a rollerway between said bottom wall and the confronting surface of each guide member, said surface of each guide member having a vertical camming portion adjacent said open front, each guide member having a surface which confronts a similar surface on the other guide member, said latter surfaces each having a horizontal camming portion adjacent said open front, and carriage means provided with movable contact means and mounted for movement within said chassis to engage and disengage said contacts, said carriage having vertically disposed rollers operable in said rollerways, respectively, and cooperating with said vertical camming portions, and said carriage having horizontally disposed rollers operable along said latter surfaces, respectively, and cooperating with said horizontal camming portions, whereby movement of said vertical rollers along said vertical camming portions and movement of said horizontal rollers along said horizontal camming portions effects the camming of said carriage into the open front of said chassis for aligning said contacts.

15. A drawout switch gear as defined in claim 14, further characterized in the provision of a vertical roller and a horizontal roller at each side of the carriage adjacent the inner end of the carriage within said chassis with said horizontal rollers disposed above said vertical rollers.

16. A drawout switch gear as defined in claim 14, further characterized in the provision of a vertical roller and a horizontal roller at each side of the carriage adjacent the inner end of the carriage within said chassis with said horizontal rollers disposed above said vertical rollers, and an additional roller provided on said carriage intermediate of and rearwardly from said vertical rollers to provide a three point support for the carriage.

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