

April 6, 1954

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2,674,666

SWITCH-OPERATING MECHANISM INTERLOCK

Filed April 24, 1952

3 Sheets-Sheet 1

FIG. 1.

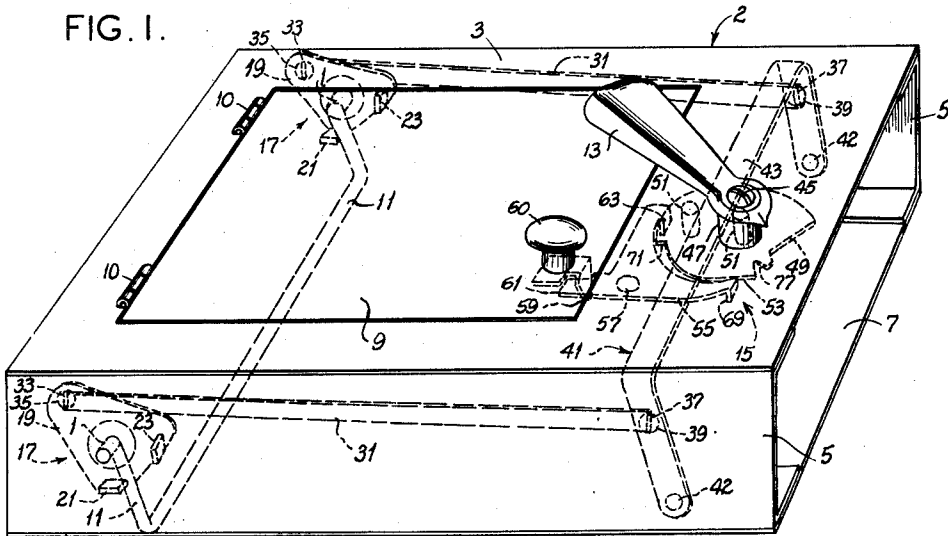
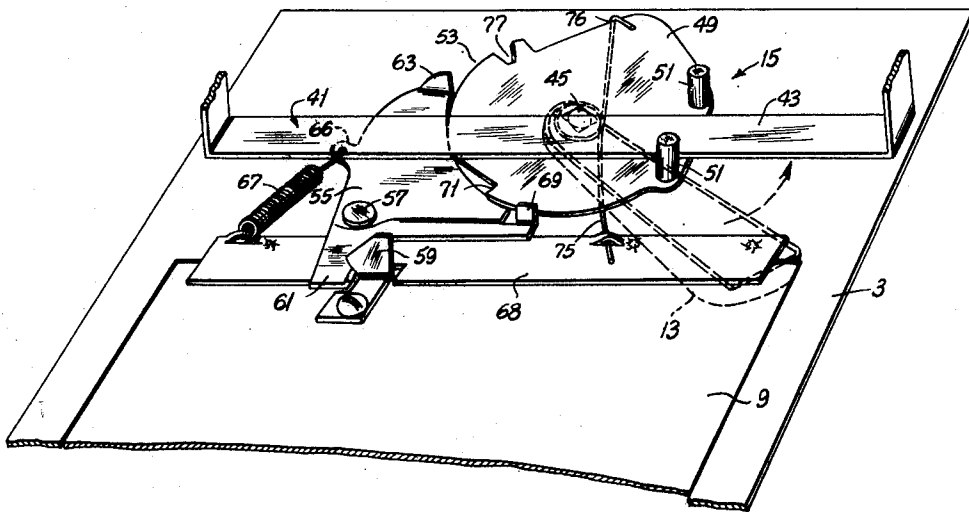


FIG. 2.



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FIG. 3.

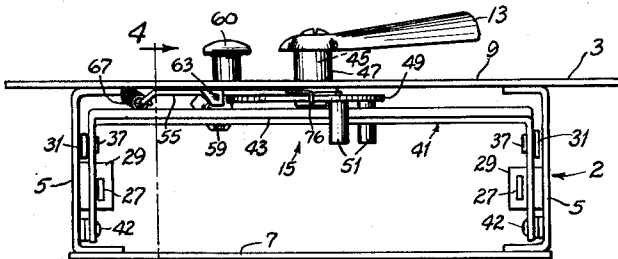


FIG. 4.

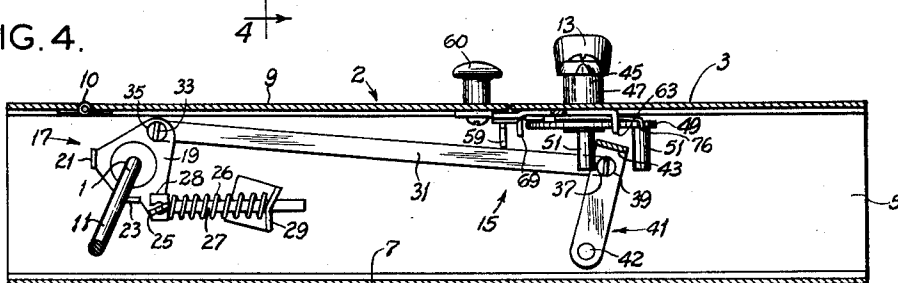


FIG. 5.

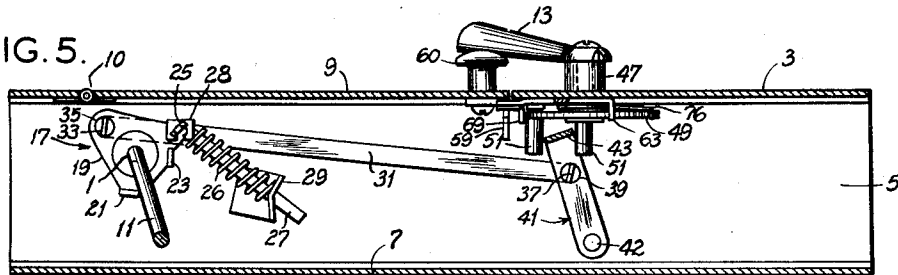
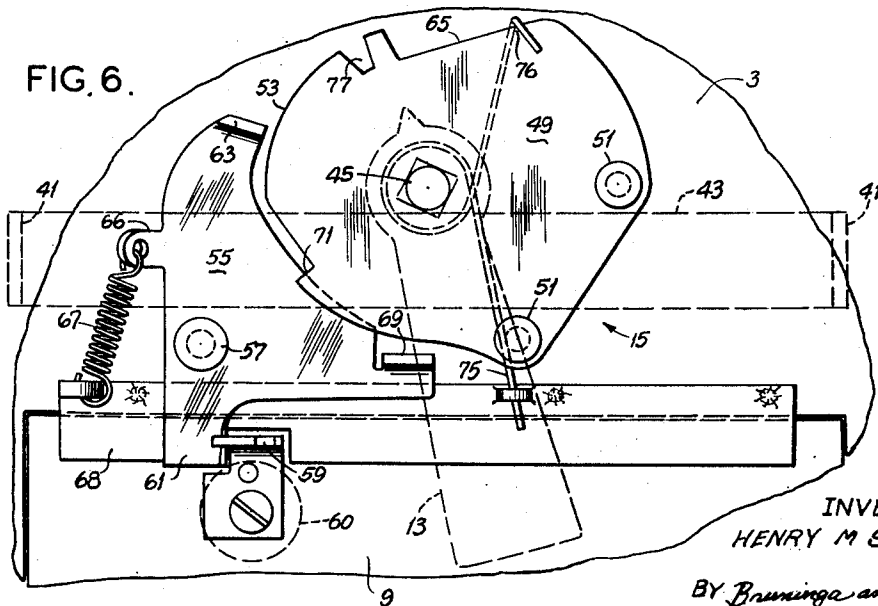


FIG. 6.



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FIG. 7.

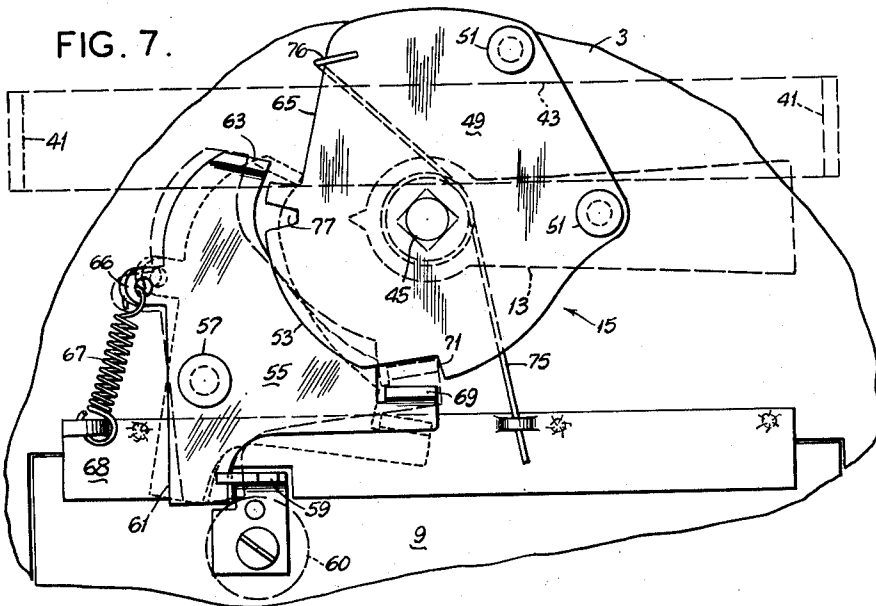
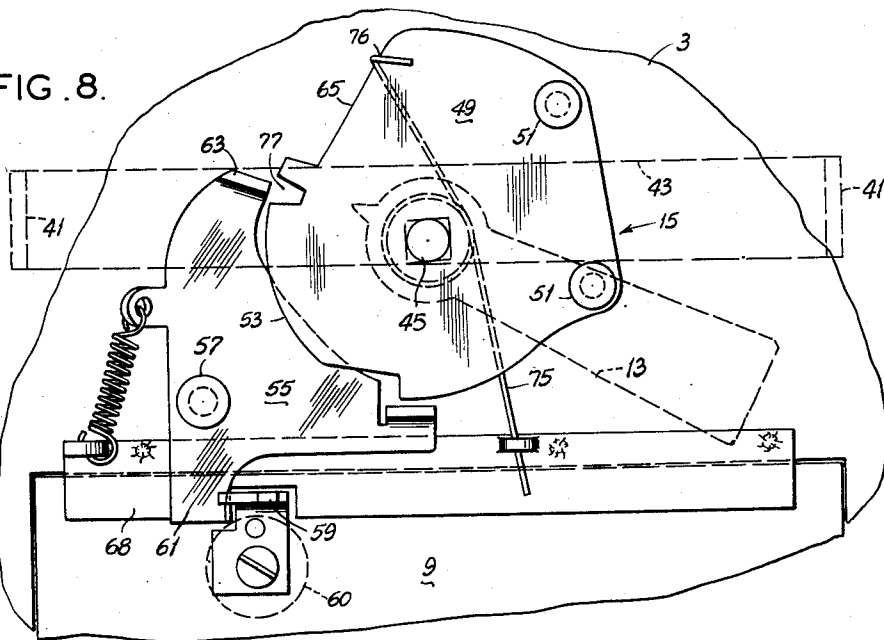


FIG. 8.



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SWITCH-OPERATING MECHANISM INTERLOCK

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13 Claims. (Cl. 200—50)

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This invention relates to switch-operating mechanism for enclosed switch gear, and more particularly to switch-operating mechanism for correlating manipulation of a switch-handle with an access door.

Electric power circuits of large capacity are commonly protected by an enclosed fused switch, examples of which are disclosed in United States Patents Nos. 2,332,633 and 2,450,705. Such devices generally include fuse holders accessible through a door in the front of the enclosure and switch contacts actuated by an exterior switch lever. There may also be a door interlock device operated by the switch lever for preventing an uninformed person from opening the door without first opening the switch. It is an object of this invention to provide in such devices improved switch-actuating and door-interlock mechanism.

In particular, it is desired to provide for movement of the switch lever in a plane parallel to the front face of the enclosure from a circuit-closed position blocking the door to a circuit-open position clear of the door, which switch-lever movement offers certain advantages over prior devices of this general type.

Another object of this invention is the provision of a rugged, inexpensive, non-jamming interlock mechanism.

A further object of this invention is the provision of such interlock mechanism wherein the door may be unlatched without opening of the circuit, but by a technique which is unobvious to uninformed persons. It is contemplated that a skilled technician may have occasion to open the door without opening the circuit, and the interlock mechanism of this invention is adapted to permit such opening of the access door by a technique that will be known only by the skilled technician.

In accomplishing these objectives, I provide an over-centering mechanism for imparting snap-action to the switch contacts. The over-centering mechanism is operated from a crossbar movable transversely of itself between circuit-open and circuit-closed positions. The switch handle is fixed on a shaft extending through the front of the enclosure and this shaft carries a combination switch-actuating and door-interlocking cam. A pair of spaced posts are arranged to project from the cam and straddle the crossbar so that the over-centering mechanism is actuated upon manipulation of the switch handle. This cam is also formed about a part of its periphery for locking cooperation with a latch member that

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is movable into and out of latching engagement with the door.

Other features of the invention will be in part apparent and in part pointed out in the following detail description taken in conjunction with the accompanying drawings in which:

Fig. 1 is an oblique view taken from the outside of the enclosed switch gear of this invention;

Fig. 2 is an oblique view of certain mechanism within the switch enclosure of Fig. 1;

Fig. 3 is an end view of the enclosed switch gear with the switch handle in circuit-open position;

Fig. 4 is a longitudinal section taken on the line 4—4 of Fig. 3, showing positions of parts for an open-circuit condition;

Fig. 5 is a view similar to that of Fig. 4 showing positions of parts for a closed-circuit condition;

Fig. 6 is an enlarged view taken from within the enclosure toward the front panel thereof showing positions of parts for a circuit-closed condition;

Fig. 7 is a view similar to that of Fig. 6 showing positions of parts for a circuit-open condition, with dotted and dashed lines showing alternative positions of a latch member; and,

Fig. 8 is a view similar to that of Fig. 6 showing parts in position for opening the door without opening the circuit.

Referring to Figs. 1, 2 and 3 of the drawings, there is shown an operating mechanism for a suitable switch (not shown) housed within an open-ended enclosure 2. The enclosure 2 is formed with a front panel 3, channel-shaped side panels 5 and a rear panel 7. On the rear panel 7 there is mounted one or more switches (not shown) which may include fuse holders, the details of which do not form a part of this invention but which are shown, for example, in United States Patent No. 2,310,918. The fuse holders generally face toward the front of the housing in the center portion thereof, and a door 9 is hinged at 10 on the front panel 3 so that fuses may readily be replaced. A crank 11 is journaled at its ends 1 in the side walls 5 to extend across the back 7 of the enclosure for actuating cooperation with the switch contacts.

In accordance with this invention, the circuit is controlled by an exterior switch handle or lever 13 which is mounted for rotary movement in a plane parallel to the front face 3 of the enclosure adjacent the door 9. The handle 13 is arranged to swing with snap-action between a circuit-closed position wherein the handle extends across the door (Figs. 5 and 6) and a cir-

circuit-open position wherein the handle extends clear of the door (Figs. 4 and 7). Latching mechanism 15 is also operated by the switch handle 13 to provide for safety interlock against opening of the door with the circuit closed.

Snap-action is imparted to the switch contacts by means of a lost-motion over-centering mechanism 17 located at the sides 5 of the enclosure and adapted for coupling the switch-operating handle 13 to the crank 11. This over-centering mechanism 17 comprises crank-actuating plates 19 pivoted on the ends 1 of the crank 11, one at each side of the enclosure. Each plate 19 has a pair of spaced crank-actuating lugs. A lug 21 is adapted to throw the crank 11 to circuit-closed position (Fig. 5) and a lug 23 is adapted to throw the crank to circuit-open position (Fig. 4). Each plate further has a lug 25 received within a bearing 28 formed at one end of an over-centering spring operator 27, the other end of which is received through a support 29 fixed to the adjacent side 5 of the enclosure.

The crank-actuating plates 19 are swung between alternative circuit-open and circuit-closed positions by associated links 31. Each link 31 is formed at one end with a lug 33, which is received through an aperture 35 of the associated plate 19. The other end of the link has a lug 37 received through an aperture 39 in an arm of a U-shaped member 41 which is pivoted at 42 on the side panels 5. A crossbar 43 of the member 41 extends across the enclosure beneath the front panel 3 and adjacent the handle 13.

The switch handle 13 is fixed upon the outer end of a shaft 45, which itself is rotary in a sleeve 47 that projects from the outer faces of the front panel 3 and which carries a cam plate 49. This cam plate has depending posts 51 spaced apart to straddle the crossbar 43, so that the cam 49 is effective to swing the member 41 toward and away from the over-centering mechanism 17 upon manipulation of the handle.

The cam plate 49 also forms a part of the interlock mechanism 15. As best shown in Figs. 6 to 8, the cam has an edge 53 shaped to act as a stop for a latch plate 55, and the latch plate 55 is pivoted at 57 on the panel 3 for movement into and out of latching engagement with the door 9. More particularly, a wedge-shaped latch hook 59 is secured on the door at the edge opposite its hinge 10 for cooperation with a projecting latching lug 61 of the latch plate. Movement of the latching lug 61 relative to the hook 59 is limited by a stop lug 63 formed on the latch plate for abutting cooperation with the edge 53 of the cam plate.

The cooperating edges of latching lug 61 and latch hook 59 are so configured (as seen in Figs. 2 and 3) that outward pull on knob 65 tends to rock plate 55 about its pivot 57 in a direction which disengages the latching parts 59 and 61. Such rocking of plate 55 is, however, prevented by engagement of stop lug 63 with edge 53, when the parts are in the closed-circuit position. It will be noticed that lug 61 is located relatively close to the pivot 57 as compared with the location of the stop lug 63, so that although the lug 63 may normally be spaced from the cam edge 53 to permit free rotation of the cam, yet the lug 63 will engage the cam edge when attempt is made to open the door with the cam in the circuit-closed position of Fig. 6.

Release of the latch is permitted upon rotation of the cam 49 by the switch handle 13 to a position such that edge 53 no longer prevents rocking of

plate 55 about its pivot 57. For example, in the open-circuit position of Fig. 7, a recessed edge portion 65 of the cam aligns with the stop lug 63. The stop lug 63 may then move into the recess 65 to free the latch part 61 of the latch hook 59 as indicated by the dotted lines of Fig. 7. The latch plate 55 is normally biased into latching engagement with the hook 59 by a coil spring 67. This spring 67 is secured at one end 68 upon the latch plate and at its other end upon a door-stop strip 68 of the enclosure.

A pawl lug 69 is also formed on the latch plate for engagement with the cam when the door is opened. This pawl 69 cooperates with a ratchet notch 71 formed on the cam for the purpose of preventing closing of the circuit when the door 9 is opened with the cam 49 in the position of Fig. 7. Upon opening of the door, the latch plate 55 is released at 61 and the spring 67 biases the pawl lug 69 into engagement with the cam surface 53, the cam then being in the position of Fig. 7 and the cam itself is rotated counterclockwise by a hairpin spring 75 to seat the pawl 69 in the ratchet notch 71 (dashed lines of Fig. 7). The spring 75 has one end secured in the strip 68 and its other end is hooked over the recessed edge portion 65 of the cam at 76. The pawl then prevents rotation of the switch handle 13 to its circuit-closed position unless the pawl 69 is first retracted either upon manipulation of the latch plate by an informed person or by the cooperation of the elements 59 and 61 upon reclosure of the door.

The over-centering mechanism 17 drives the parts either to their circuit-open or circuit-closed positions, so that in normal operation, the circuit would be opened in order to gain access to the fuses. There may be occasions, however, when it is desired to open the door 9 without opening the circuit, and this may be accomplished with the switch mechanism of this invention. Referring to Fig. 8, it will be noted the cam 49 has a small notch 77 in its periphery adjacent the recess 65. The position of this notch 77 is coordinated with the lost motion in the over-centering mechanism 17 and with the positioning of the switch handle 13 relative to the door, in such manner that the notch 77 will align with the stop lug 63 upon rotation of the switch handle an amount sufficient to clear the door 9 yet insufficient to throw the crank-actuating plates 19 over center and open the switch.

When the handle is positioned thus, the over-centering springs 26 exert a considerable bias upon the parts including the handle, and the handle barely clears the door, hence it is not apparent to the uninitiated that the door could be opened with the handle manipulated in this manner. A skilled technician competent to work on live equipment, however, may be properly informed of this feature. When the cam 49 is positioned as shown in Fig. 8 and the door opened, the stop lug 63 moves into the notch 77 to clear the latch elements 59 and 61. The ratchet notch 71 does not then receive the pawl 69, their relative positions being shown in Fig. 8, hence the handle 13 may be released to return to its circuit-closed position to indicate a closed-circuit condition.

From the above, it will be noticed that the switch-operating mechanism of this invention provides an improved switch-handle movement whereby the position of the handle relative to the access door serves as an indication of the circuit condition and as an indication that the

circuit should be opened prior to opening of the access door. Additionally, this correlation of door and switch-handle movement together with the over-centering action tends to prevent undesired opening of the access door with the circuit closed, since the special manipulation discussed above is thereby rendered inconvenient. Moreover, should the door be opened with the switch closed, either by the above technique or by manual manipulation of the latch plate, the door handle swings across the door opening to prevent reclosure of the door without first adjusting the mechanism, thereby avoiding possibility of jamming the mechanism, as was possible with prior switch gear of this general type.

The parts themselves are relatively few considering the various features provided, and the construction is rugged and troublefree. Moreover, the mechanism of this invention is adapted for use in conjunction with many types of prior switch gear. For example, the over-centering mechanism and the U-shaped bracket arrangement is, to some extent, standard and the switch operating herein disclosed may readily be used with such standard parts.

From the foregoing description, it is apparent that those skilled in the art will understand the structure, function and mode of operation of the invention herein disclosed and appreciate the advantages thereof. Although one embodiment has been disclosed in detail, it is to be understood that the invention is not limited thereto, but the drawings and description thereof are to be understood as being merely illustrative. It is realized that many modification and variations will present themselves to those skilled in the art without departing from the spirit of this invention or the scope thereof as set forth in the appended claims.

Having thus described the invention, what is claimed and desired to be secured by Letters Patent is:

1. In enclosed switch gear having a front panel provided with an access door; an exterior switch-operating lever mounted on the front panel for rotation in a plane parallel thereto from a circuit-closed position across the door to a circuit-open position clear of the door, and interior door-latch means including a part rotary with the switch-operating lever for locking the door when the lever is in its circuit-closed position and for unlocking the door when the switch lever is moved to its circuit-open position.

2. In enclosed switch gear having a front panel provided with an access door; an exterior switch-operating lever mounted on the front panel for rotation in a plane parallel thereto from a circuit-closed position across the door to a circuit-open position clear of the door, an interior cam driven by the switch-operating lever for movement between circuit-closed and circuit-open positions, and cam-locked latch means movable into and out of latching engagement with the door, said cam being shaped to lock the latch means in circuit-closed position and to release the latch means in circuit-open position.

3. In enclosed switch gear having a front panel provided with an access door; an exterior switch-operating lever mounted on the front panel for rotation in a plane parallel thereto from a circuit-closed position across the door to a circuit-open position clear of the door, an interior cam driven by the switch-operating lever for movement between circuit-closed and circuit-open positions, and a movable latch member

spring-biased into latching engagement with the door, said door having a wedge-shaped hook for retracting the latch member upon opening of the door, and said cam being shaped to lock the latch means against retraction in circuit-closed position and to release the latch means for retraction in circuit-open position.

4. In enclosed switch gear having a front panel provided with a hinged access door; switch-actuating mechanism including an interior switch-actuating member arranged to be moved between circuit-open and circuit-closed positions, a rotary shaft member extending through said panel adjacent said switch-actuating member, a cam carried on the inner end of said shaft member and having driving means offset from the rotary axis of the cam arranged for actuating cooperation with said switch-actuating member upon rotation of the cam between circuit-open and circuit-closed positions, and a switch handle carried on the outer end of said shaft member.

5. Enclosed switch gear as set forth in claim 4 further including a movable latch member spring-biased into latching engagement with the door, said door having a wedge-shaped hook for retracting the latch upon the application of opening force to the door, and said cam being shaped to lock the latch member against retraction in its circuit-closed position and release the latch member for retraction by the hook when in its circuit-open position.

6. Enclosed switch gear as set forth in claim 4 further including a latch plate pivoted on said front panel adjacent said cam and having a stop lug, said latch plate having a latching lug movable into and out of latching engagement with the door, and said cam being formed about its periphery with a portion engageable with said stop lug for limiting movement of the latch plate when the cam plate is in circuit-closed position and with a recessed portion adapted to receive said stop lug to permit movement of said latch plate upon rotation of the cam to its circuit-open position.

7. Enclosed switch gear as set forth in claim 6 wherein the latch plate further includes a pawl lug and spring means on the plate for biasing the pawl lug into engagement with the edge of said cam, the pawl being retained in a retracted position by the latching lug when the door is closed and being released when the door is opened, and said cam being formed with a ratchet notch adapted to receive said pawl lug when the cam is rotated to its circuit-open position, thereby to prevent rotation of the switch handle from its circuit-open position when the door is open.

8. Enclosed switch gear as set forth in claim 7 wherein the door has a wedge-shaped member projecting therefrom for cooperation with the latching lug on the latch plate, said wedge-shaped member being shaped to rotate the latch plate against its bias and withdraw the pawl lug from said ratchet notch upon reclosure of the door.

9. In enclosed switch gear having a front panel provided with a hinged access door; switch-actuating mechanism including a spring-biased over-centering device and an interior switch-actuating member adapted to be moved between circuit-open and circuit-closed positions, a rotary shaft member extending through said front panel adjacent said switch-actuating member, a cam plate carried on the inner end of said shaft member and having driving means

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offset from the rotary axis of the cam plate for actuating cooperation with said switch-actuating member, the switch-actuating member thereby being actuated against the bias of the over-centering device between circuit-open and circuit-closed positions upon rotation of the cam plate, a switch handle secured to the outer end of said rotary shaft, and a latch member movable into and out of locking engagement with the door, said cam plate being shaped to lock the latch member in circuit-closed position and to unlock the latch member when the cam plate is rotated against bias from circuit-closed position and prior to over-centering of the switch-actuating mechanism.

10. In enclosed switch gear having a front panel provided with a hinged access door; switch-actuating mechanism including an over-centering device and an interior switch-actuating member adapted to be moved between circuit-open and circuit-closed positions, a rotary shaft member extending through the front panel, a cam carried on the inner end of said shaft member and having driving means offset from the rotary axis for cooperation with said switch-actuating member, the cam thereby being biased by the over-centering device to circuit-open or circuit-closed positions, a switch handle secured to the outer end of said rotary shaft for rotation with the shaft in a plane parallel to the front panel from a circuit-closed position across the door to a circuit-open position clear of the door, a movable latch member spring-biased into latching engagement with the door, said door having a wedge-shaped hook for retracting the latch upon opening of the door and said cam being shaped to lock the latch member against retraction when in its circuit-closed position and to release the latch for retraction when in its circuit-open position.

11. Enclosed switch gear as set forth in claim 10 wherein said cam further includes notched means adapted to release the latch member for retraction when the cam and the switch handle are rotated an amount sufficient to clear the door but insufficient to over-center the switch-actuating mechanism.

12. In enclosed switch gear having a front panel and a hinged access door therein; switch-actuating mechanism including an over-centering device and a crossbar adapted to be moved

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transversely of itself against the bias of the over-centering device between circuit-open and circuit-closed positions, a rotary shaft extending through the front panel, a cam plate secured to the inner end of said shaft, said cam plate having post means offset from the rotary axis of the cam plate and straddling said crossbar, the cam plate thereby being biased by the over-centering mechanism to circuit-open or circuit-closed positions, and a switch handle secured to the outer end of said rotary shaft for rotation with the cam in a plane parallel to the front panel from a circuit-closed position across the door to a circuit-open position clear of the door.

15 13. In enclosed switch gear having a front panel and a hinged access door therein; switch-actuating mechanism including an over-centering device and a crossbar adapted to be moved transversely of itself against the bias of the over-centering device between circuit-open and circuit-closed positions, a rotary shaft extending through the front panel, a cam plate secured to the inner end of said shaft, said cam plate having post means offset from the rotary axis of the cam plate and straddling said crossbar, the cam plate thereby being biased by the over-centering mechanism to circuit-open or circuit-closed positions, a switch handle secured to the outer end of said rotary shaft for rotation with the cam in a plane parallel to the front panel from a circuit-closed position across the door to a circuit-open position clear of the door, and a movable latch plate adapted for cooperation with an edge of the cam plate, said latch plate being biased into latching engagement with the door and being retractable out of latching engagement with the door, and said cam plate being formed about its periphery with a portion adapted to limit movement of the latch plate when the cam is in its circuit-closed position.

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