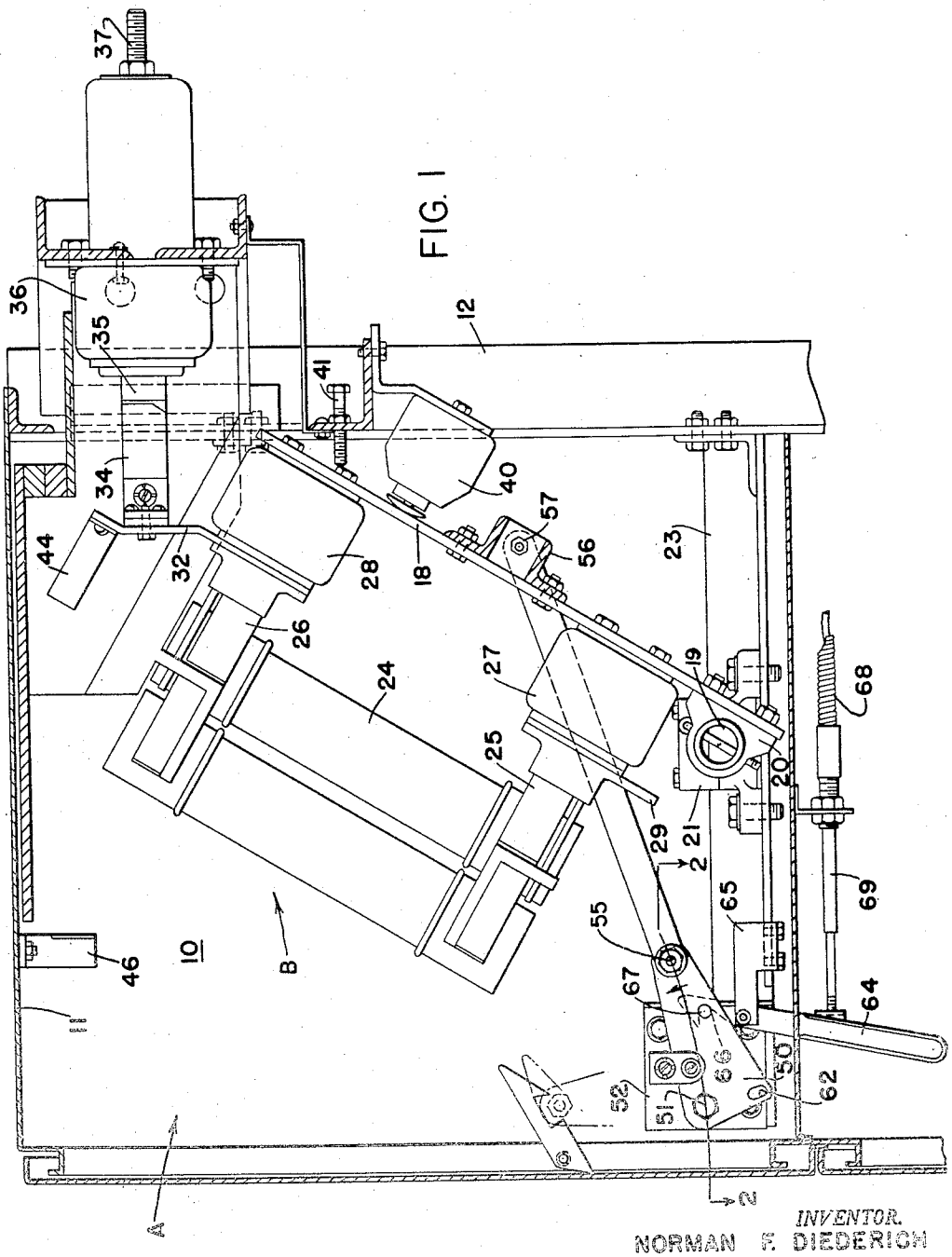
March 24, 1959 N. F. DIEDERICH 2,879,347

ELECTRIC SWITCH

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FIG. 1



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ELECTRIC SWITCH

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FIG. 2

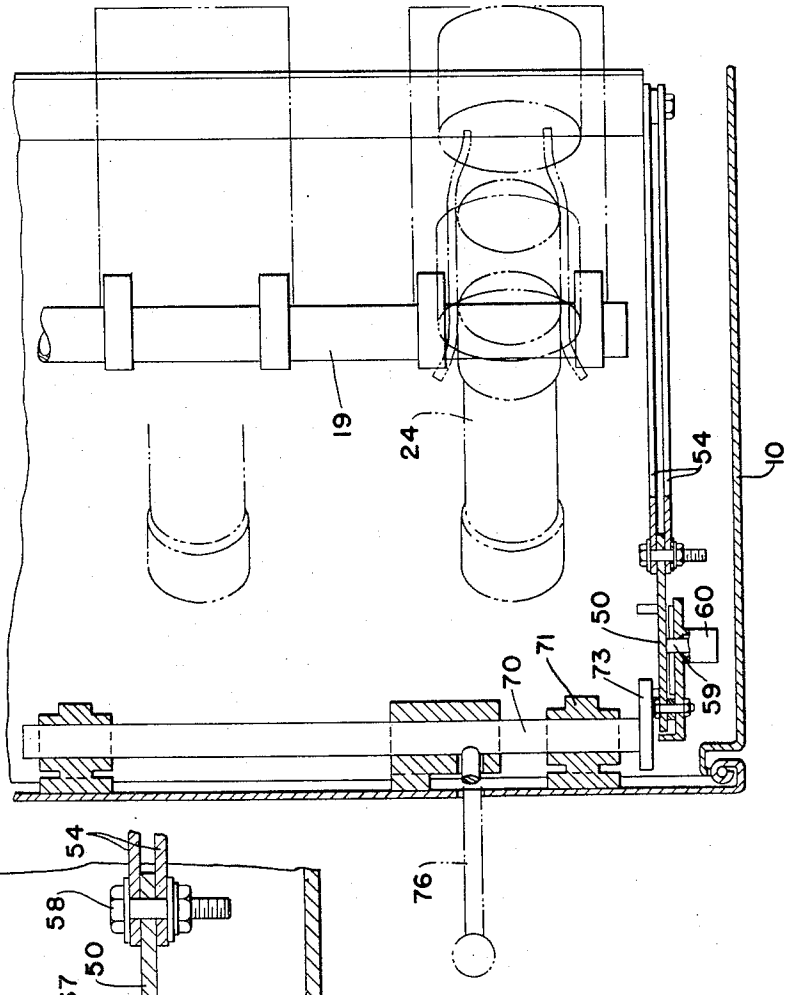
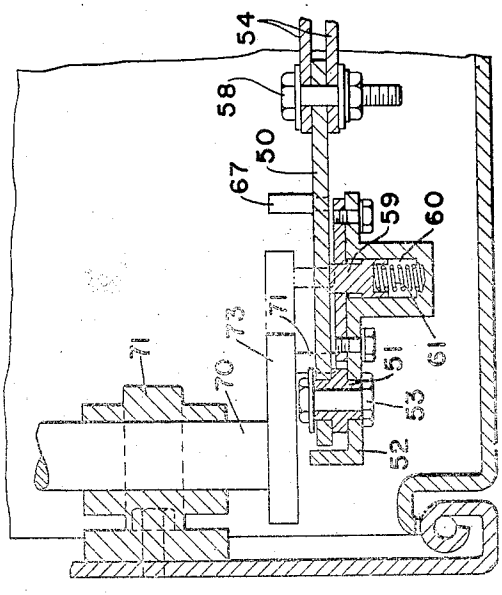


FIG. 6



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ELECTRIC SWITCH

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FIG. 3

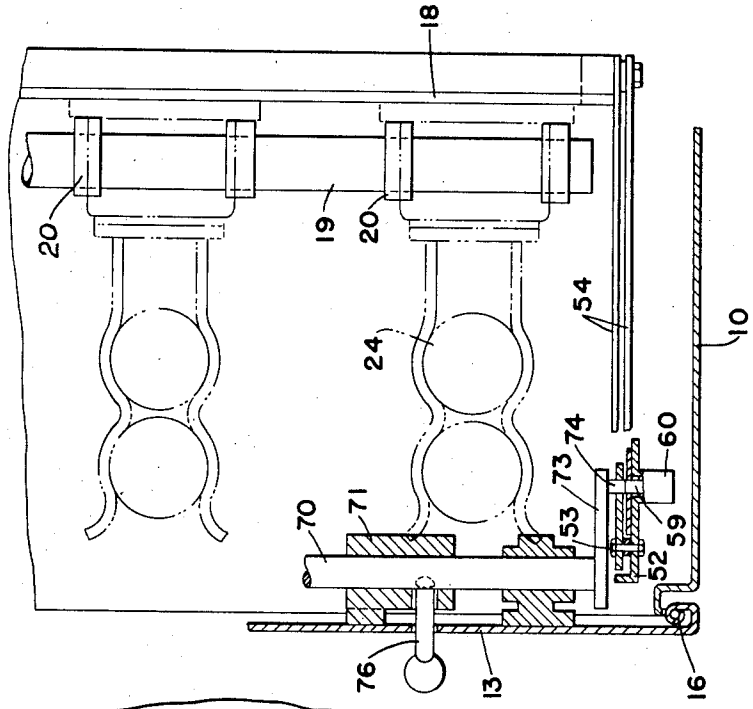
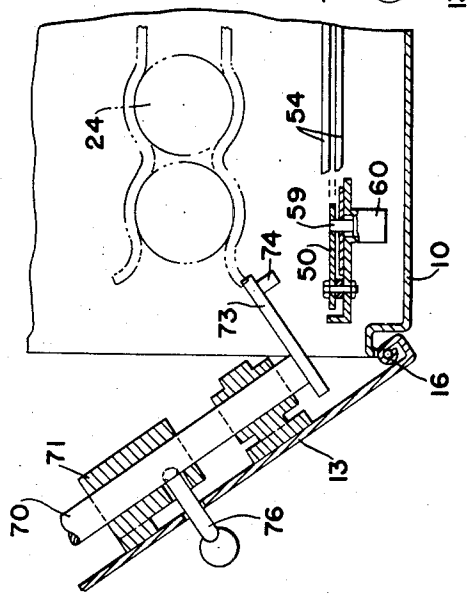


FIG. 4



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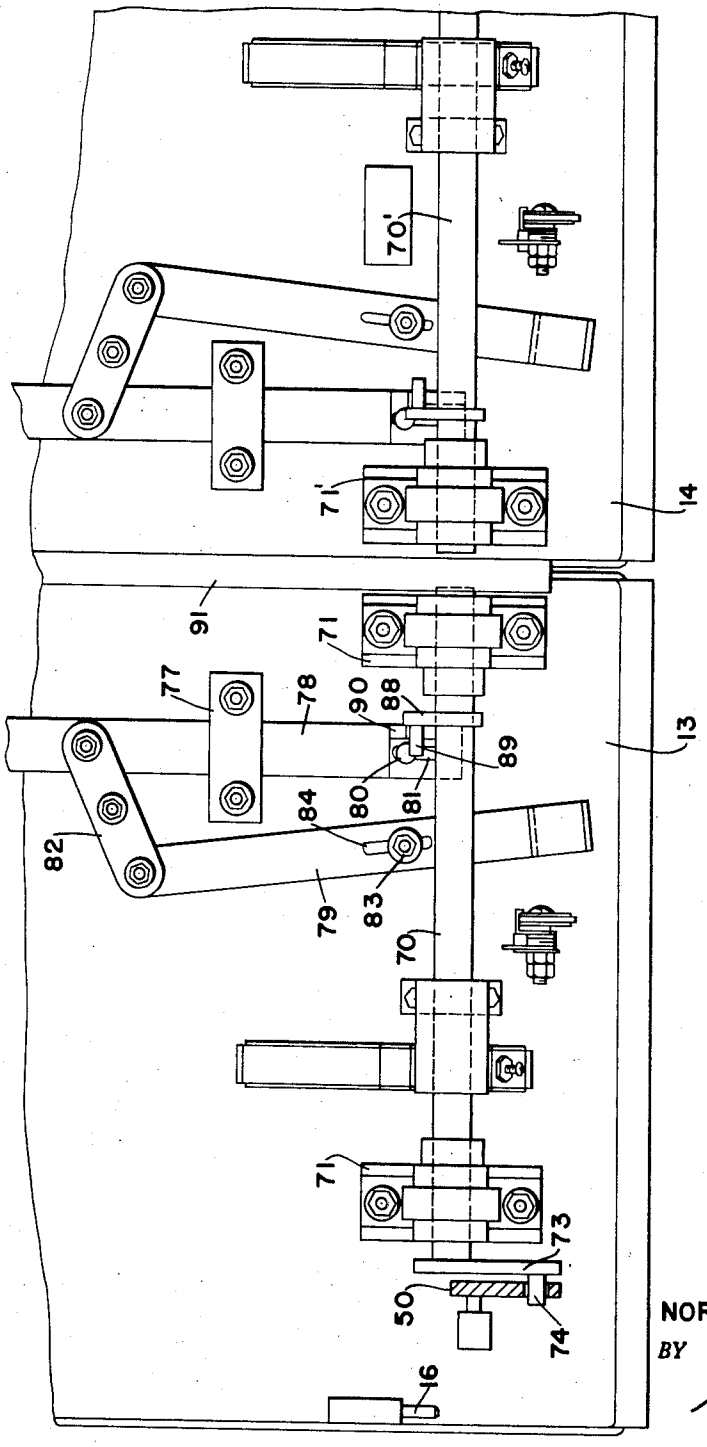


FIG. 5

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2,879,347

ELECTRIC SWITCH

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Application May 25, 1955, Serial No. 510,889

12 Claims. (Cl. 200—50)

This invention pertains to the art of electrical power controls and more particularly to electrical power controls of the totally enclosed type.

The invention is of particular value where high electrical voltages must be connected and disconnected to other electrical apparatus, as well as being fused, and will be described with particular reference thereto, although it will be appreciated that the invention is not so limited.

Apparatus for this general purpose is normally referred to as a fused disconnect switch.

It is conventional to place high voltage switches and fuses inside of an enclosing cabinet to prevent accidental contact with any electrically energized part thereof. Such cabinet is usually provided with an access opening and covering doors, to enable an electrician to replace or inspect the fuses.

One of the problems with apparatus of this type is to insure that there are no exposed electrically energized members or surfaces with which an electrician might come in contact whenever the doors of the access opening are opened.

It is known to provide a movable panel inside of the cabinet on which the fuses are mounted, the panel moving forward when the doors are opened to make the fuses readily accessible through the access opening. Usually the movable contacts for the disconnect switch are mounted on this panel so that as the panel is moved forward, the disconnect switch is automatically opened. This panel is also of a size to completely fill the inside of the cabinet in its forward position and prevent anything from being inserted to the back of the panel whereby it might come in contact with the electrically energized parts.

One such arrangement is described in the patent to Schwarz et al., No 1,826,370, dated October 6, 1931. In this patent an operating lever is provided externally of the cabinet for moving the panel from a position where the fuses are remote from the access opening and the switch contacts are closed, to a position where the fuses are accessible from the opening and the switch contacts are opened. An interlocking arrangement is provided so that the door cannot be opened until the panel is in the switch open position, and other interlocking arrangements are provided so that when the door is open, the panel may not be moved to the switch closed position.

This patent presents the difficulty that there are two separate interlocking arrangements leaving the possibility that if one of the arrangements should get out of order, then it is possible that the door could be opened when the fuses are electrically energized or the switch closed while the door is open.

Still another arrangement is described in the patent to Ferguson, No. 2,669,624, dated February 16, 1954. In this patent, movement of the door from a closed to an opened position automatically serves to move the panel from the switch closed to the switch opened position.

With this arrangement the door of necessity must be part-way open before the panel has moved to the switch

open position and with the door part-way open, it is possible for something to be inserted inside of the cabinet while the fuses are still electrically energized.

In either event, it will be seen that the possibility exists that the door may be opened while some exposed part on the inside of the cabinet is electrically energized.

The present invention contemplates a fused disconnect of the general type referred to which overcomes all of the above objections and others, and provides an arrangement which is simple in construction, foolproof in operation, and insures that the switch must be in the opened position before the door can be opened.

In accordance with the present invention, electrical apparatus is provided including a cabinet having an access opening, a door or doors movable to open and close said opening, a switch inside the cabinet having an open and closed position, mechanism in the cabinet for actuating the switch, locks for the doors and operating means for the door lock so arranged as to first open the switch if it happens to be closed.

Further, in accordance with the invention, the arrangement is such that when the door is open, the operating means is physically disconnected from the switch operating mechanism.

Still further in accordance with the invention, the arrangement is such that the doors may be reclosed and locked without closing the switch.

The principal object of the invention is the provision of a new and improved enclosed electrical switch which insures that the access door cannot be opened until the switch is open.

Another object of the invention is the provision of a new and improved enclosed electrical switch which disengages the operating mechanism for the switch as the door is opened.

Still another object of the invention is the provision of a new and improved arrangement in a safety fuse disconnect of the general type described wherein a single operating lever controls both the unlocking of the door and the opening and closing of the switch.

Still another object of the invention is the provision of a new and improved safety fuse disconnect wherein the operating mechanism for the switches are mounted on the door and are moved out of engagement with the switch actuating mechanism, as the door is opened.

Still another object of the invention is the provision of a new and improved safety fuse disconnect of the general type described wherein the operating lever for controlling the opening and closing of the switch, and the locking and unlocking of the door are common to each other.

Still another object of the invention is the provision of new and improved safety fuse connect of the general type described wherein a common control lever controls the opening and closing of the switch and the locking and unlocking of the access door, and is so arranged that the doors may be closed and locked without reclosing the switch.

The invention may take physical form in certain parts and combinations of parts, a preferred embodiment of which will be described in detail in this specification and illustrated in the accompanying drawings which are a part hereof and wherein:

Figure 1 is a side cross-sectional view through the cabinet of a fused disconnect switch embodying the present invention, the apparatus being shown in the switch closed position;

Figure 2 is a fragmentary cross-sectional view of Figure 1 taken approximately on the line 2—2 thereof;

Figure 3 is a view similar to Figure 2 but showing the apparatus in the switch open position;

Figure 4 is a fragmentary view of Figure 3 and showing the door in the partly opened position;

Figure 5 is a fragmentary elevational view of the back side of the access doors and in particular showing the locking mechanism for the doors and the operating mechanism for moving the switch from the opened to the closed position; and,

Figure 6 is a fragmentary enlarged view with portions in section of the locking mechanism for holding the apparatus in the switch-open position when the doors are opened.

Referring now to the drawings wherein the showings are for the purpose of illustrating the invention only and not for the purposes of limiting same, the figures show a cabinet A of relatively conventional construction and including side **10**, a top **11**, and internal frame members including a vertical frame **12** spaced from the front of the cabinet and a horizontal frame member **23** spaced from the top **11** which provides supports for the apparatus to be mounted in the cabinet. While only one horizontal frame member **23** is shown, obviously one will be employed on each side of the cabinet. The cabinet A also includes a pair of doors **13**, **14** pivoted to the sides **10** of the cabinet on their remote vertical edges by means of pintles **16**. While two doors are shown, obviously the invention is not so limited and one door could be provided. Also it is possible to pivot the doors other than as shown, for example on a horizontal axis either at the upper or lower edge of the doors. The doors may form a removable panel. The arrangement shown is preferred.

Mounted interiorly of the cabinet is a switch and fuse assembly B. This assembly includes a base panel **18** having blocks **20** on its lower corners holding a horizontally extending pintle shaft **19**, in turn pivoted in bearings **21** mounted one on each of the horizontal frame members **23**.

The panel **18** is thus movable, and in the preferred embodiment movable by a pivoting action, from the retracted position shown in Figure 1, which may be referred to as the switch closed position wherein the panel slopes upwardly into the rear of the cabinet, to a forward position where the panel **18** is generally vertical and close to the doors **13**, **14**. This is the switch open position.

The panel **18** preferably has dimensions such that it will extend generally from one side to the other of the cabinet and a vertical height such that it will reach substantially to the top **11** of the cabinet. This panel **18** may thus be said to substantially close the access opening provided by the doors **13**, **14** when the panel **18** is in the forward position.

On the left or front face of the panel **18**, electrical cartridge type fuses **24** are mounted in pairs of aligned clips **25**, **26**, in turn mounted on electrical insulators **27**, **28** respectively. These insulators **27**, **28** space the fuses **24** from the base **18**, and when the base is in the forward position, as above described, it will be seen that the fuses are readily accessible when the doors **13**, **14** are open. Other means of mounting the fuses may be employed.

Any number of fuses may be employed depending upon the characteristics of the electric current with which the apparatus is to be employed. Normally three phase electrical current is used in most industrial establishments in this country, and accordingly the preferred number of fuses is three. Figure 3 shows two fuses but as the installation of the third is the same as the two illustrated, the third fuse has been omitted from the showings.

The lower fuse clip **25** is provided with a terminal lug **29** to which electrical connections, not shown, can be made to other electrical apparatus positioned within the cabinet or externally therefrom. The upper fuse clip **26** is provided at its base adjacent to the insulator **28** with an upwardly extending electrically conductive arm **32**, having mounted thereon a conventional hairpin type

electrical contact **34** which slides over a blade type contact **35** to form the contacts of the electrical disconnect switch. The blade **35** is mounted on an electrical insulator **36** which is of the feedthrough type, and the terminal for energizing the blade **35** is indicated at **37**. The terminal **37** is connected to the terminals of a high voltage power source, not shown.

With the switch and fuse assembly in the positions shown, it will be seen that the fuses will be electrically energized but that as the panel **18** is moved from the position shown in Figure 1 toward the doors **13**, **14**, the contacts **34**, **35** will be separated and the fuses will thus become electrically de-energized.

An interlock switch **40** is provided engaged by the panel **18** as it moves to the retracted position shown in Figure 1. This switch controls the energization of contactors (not shown) with the cabinet. Also there is an adjustable stop **41** for adjusting the retracted position of the panel **18**.

The arm **32** also has a hairpin contact **44** extending forwardly, that is, in the opposite direction from the hairpin contact **34**. When the panel is in the forward position this contact **44** engages a blade contact **46** mounted on the top **10**. Thus the fuses are not only disconnected from the high voltage power source but are grounded to the frame of the cabinet.

The mechanism for moving the switch and fuse assembly B from the retracted or switch closed position shown in Figure 1 to the forward or switch open position (with which the present invention is primarily concerned) is mounted in part in the cabinet and in part on the doors. This mechanism, as will appear, is so arranged that, when the doors are opened, the mechanism on the door is mechanically disengaged from the mechanism mounted in the cabinet. Also, the mechanism on the door is interlocked with the locking arrangement for the door.

The mechanism in the cabinet consists of a crank arm **50** pivoted at its left end, as viewed in Figure 1, on a sleeve shaft **51** with a horizontal axis which in turn is mounted on a bracket **52** mounted on the front or left hand end of the horizontal frame member **23**. A nut and bolt **53** hold the sleeve **51** in assembled relationship with the bracket **52**.

The other end of the crank arm **50** is pivoted to a drag link **54** by means of a bolt **55**, the other end of which drag link **54** is pivoted to a bracket **56** by means of a bolt **57** which bracket **56** in turn is mounted on the underside of the panel **18**. In Figure 1 the crank **50** and drag link **54** are fully extended and the combined length is maximum. As the crank **50** is rotated in a counterclockwise direction, as shown in Figure 1, about the axis of the sleeve **51**, the combined length will be shortened and the panel **18** will be rotated to the left, that is, to the forward and vertical position. This is the switch open position.

Means are provided for locking the crank **50** in this position. Such means in the embodiment shown are in the form of a pin **59** reciprocally supported in a socket **60** and biased by a spring **61** towards the crank **50**. The crank **50** is provided with an opening **62** so located that when the crank member **50** is rotated to the full counterclockwise position, the pin **59** will extend thereinto. The width of the crank **50** is such that otherwise the pin bears against the slides on the side of the crank.

Means are also provided for preventing movement of the panel **18** to the switch open position unless contactors normally mounted in the same cabinet, and not shown in the figures, have previously opened. Such means in the embodiment shown comprise a lever **64** pivoted between its ends on a bracket **65** mounted on the horizontal frame member **23**. Such lever has a notch **66** adjacent its upper end which engages over a pin **67** extending sidewardly from the crank **50** to prevent movement of the crank **50** in a counterclockwise direction. The other end of the lever **64** is connected through a flexible cable **68**

and tension control member 69 to the mainline contactors, not shown. As the mainline contactors open, the control rod 69 moves to the left to cause the notch 66 to clear the pin 67, thus releasing the crank 50 for counterclockwise rotation. This insures that the load is removed when the switch is rotated out of the closed position.

The mechanism for operating the crank 50 is, in accordance with the invention, disengaged therefrom when the door is opened. This may be accomplished in several ways but in the preferred embodiment this mechanism is mounted on and moves with the doors as they open, to accomplish this function.

The mechanism on the doors for operating the crank 50 is shown in particular detail in Figure 5. As shown in Figure 5, a shaft 70 is rotatably supported in bearings 71 on the inner side of the door 13. In a like manner a shaft 70' is mounted in bearing 71' on the inner side of the door 14. The shafts 70—70' are axially aligned. The remote ends of the shafts 70—70' are each provided with a crank 73 extending sidewardly from the shafts and at a point spaced from the shafts, the cranks have a pin 74 extending generally sidewardly therefrom. The axis of the shaft 70 when the doors 13, 14 are closed is approximately aligned with the axis of rotation of the crank 50, and the spacing of the pin 74 from the axis of the shaft 70 is such that the pin 74 will engage in the hole 62 of the crank 50. This relationship is clearly shown in Figure 3. It will be noted that when the pin 74 is in the opening 62, the pin 59 is pushed against the spring 61 out of the opening 62. Thus the locking action of the pin 59 is released. However, as soon as the doors are opened, as shown in Figure 4, the pin 74 is withdrawn and the pin 59 moves into the opening 62 to lock the crank 50 against rotation. Other disengageable means may be employed.

An operating handle 76 extends forwardly from the shaft 70 through the door 13 where it is accessible for manual operation. A similar arrangement exists on the door 14.

Locking means for the doors are also provided. Such means in the embodiment shown comprise chute bolts 78, 79 on each door. The chute bolt 78 is slideable along a vertical line of movement and is held in place by a slide bracket 77 and a slide pin 80 which extends through and flanges over a slotted opening 81 in the bolt 78. The chute bolt 79 is mechanically coupled to the chute bolt 78 by means of a center pivoted lever arm 82 and the chute bolt 79 is slideably supported on the door by means of a bolt 83 extending through a slotted opening 84 and the bolt 79. Thus the chute bolts 78, 79 move in opposite directions on generally parallel lines of movement simultaneously one with the other. Their length is such as to engage portions of the cabinet when extended. Obviously other locking means could be employed.

A crank arm 88 mounted on the shaft 70 has a sidewardly extending pin 89 which engages in the slot of a dog 90 mounted on the lower end of the chute bolt 78. As the shaft 70 is rotated, the chute bolts 78, 79 are also actuated. The arrangement is such that the chute bolts have a substantial longitudinal movement from the fully locked position to the unlocked position. Also, the pin 89 and dog 90 form a lost motion movement so that the panel will have moved a substantial distance before the pin 89 engages the dog 90 and commences to move the chute bolts. The members are all so related to the movement of the panel 18 that the doors 13, 14 are not unlocked until the panel 18 has been moved almost fully to the switch open position. At this point, the doors 13, 14 become unlocked and can be opened. It will be noted that the door 14 has a sidewardly extending flange 91 which overlaps the inner edge of the door 13 making it impossible to open the door 14 until the door 13 has been entirely unlocked and is ready to open.

It will be further noted that the operating mechanism on the door 14 is identical to that shown on the door 13 and includes a handle not shown. To open the doors, both handles must be operated.

It will be appreciated that other forms of door locking mechanism may be employed from that shown, the important thing being that the same operating lever for unlocking the doors also moves the panel 18 from the switch closed to the switch open position.

As pointed out, when the doors are opened, the pin 74 is withdrawn from the hole 62 in the crank 50. Any actuation of the handle 76 after the doors are once opened can have no effect on the position of the panel 18. However, as soon as the doors are closed, actuation of the handle first locks the doors and then moves the panel 18. Other arrangements can be provided for disengaging the handle from the panel operating mechanism in the cabinet.

Occasionally it is desirable to close and lock the doors without moving the panel 18 to the switch closed position. In the embodiment of the invention described, the width of the crank 50 and the location of the pin 74 are such that it is possible to do this by moving the handle 76 to a half-way position when the doors are opened. When the doors are then reclosed, the pin 74 entirely clears the crank 50. Further movement of the handle 76 in a locking direction locks the doors but as the pin 74 is clear of the crank 50, no movement of the panel 18 occurs. When it is desired to again move the panel 18 to the switch closed position, the handle 76 is moved to unlock the doors, the doors are opened and the handle 76 is moved to a position so that the pin 74 will again be aligned with the opening 52 as the doors are closed.

The handle has been shown as mounted on the doors. Obviously the handle could be placed on the cabinet with an arrangement on the door so as to mechanically disengage the handle from the panel as the door is opened.

It will thus be seen that an embodiment of the invention has been described wherein the operating handle for operating the disconnect switch is completely disengaged from the switch when the access doors are opened. Furthermore, the arrangement is such that the door locking mechanism cannot be released to unlock the doors until the panel 18 has been moved to the switch open position.

Obviously there are other ways of accomplishing these functions other than by the specific embodiment of the invention described. Thus modifications and alterations of this invention differing radically from the embodiment described will occur to others upon a reading and understanding of this specification. It is my intention to include all such modifications and alterations insofar as they come within the scope of the appending claims.

Having thus described my invention, I claim:

1. In apparatus of a general type described, a cabinet having an access opening, a disconnect switch in said cabinet, mechanism mounted in said cabinet for operating said disconnect switch, a door for said access opening and a lock on said door coacting with said cabinet, and mechanism on said door operable when the door is closed to operate both said mechanism and said lock, said door mechanism being movable with the door as the door is opened into inoperable relationship with said mechanism.

2. In apparatus of the general type described, a cabinet having an access opening, a disconnect switch in said cabinet having a closed position and an open position, mechanism in said cabinet for operating said switch, a door movable to open and close said access opening, a lock on said door for locking same in a closed position, and mechanism on said door operable when the door is closed to both work said mechanism to open and close said disconnect switch, and to operate said lock, said mechanism in the cabinet including means coacting with said door for locking the cabinet mechanism in the switch open position as the door is opened.

3. In apparatus of the general type described including in combination a cabinet having an access opening, a disconnect switch in said cabinet having an opened and closed position, mechanism in said cabinet for operating said disconnect switch, a door movable to open and close said access opening, a lock on said door, and means on said door for operating both said mechanism and said lock when said door is closed, said means moving with said door as it is opened out of engagement with said mechanism, said mechanism including locking means to lock said mechanism in a switch open position as the door is opened.

4. In apparatus of the general type described comprising in combination a cabinet having an access opening, a disconnect switch in said cabinet having an opened and closed position, mechanism mounted in said cabinet for operating said disconnect switch, a door movable to open and close said access opening and including a lock, and operating means for said door lock and mechanism, including a member mechanically engaged with said mechanism when the door is closed and disengaged from said mechanism when the door opens.

5. The combination of claim 4 wherein means are provided for locking said mechanism in place as said door opens.

6. The combination of claim 4 wherein initial movement of said operating means operates said mechanism to move the switch to the open position and subsequent movement operates said door lock.

7. In electrical apparatus a cabinet having an access opening, a disconnect switch in said cabinet and having an opened and closed position, mechanism mounted in said cabinet for operating said switch, a door movably mounted to open and close said access opening, a door lock having a locked and unlocked position, means for operating said mechanism and door lock including a handle, said handle having at least three positions, namely 1—door locked, 2-door unlocked and mechanically engaged to said mechanism, and 3—door unlocked and mechanically unengaged with said mechanism.

8. The combination of claim 7 wherein opening of said door disengages said means from said mechanism and said handle may then be adjusted to either the second or third position.

9. Apparatus of the type described comprising in combination a cabinet having an access opening, a disconnect switch in said cabinet and having an open and closed position, a first member movably mounted in said

cabinet and mechanically connected to said switch to operate same, a door on said cabinet and movable to open and close said access opening, a second member movably mounted on the inside of said door and engaging said first member when the door is closed to operate said first member, said second member being out of engagement with said first member when the door is opened and means including a handle extending to the outside of said door for moving said second member.

10. The combination of claim 9 wherein said door has a lock and movement of said second member also operates said lock.

11. The combination of claim 9 wherein a lock engages said first member as said door is opened to lock said first member in the switch open position.

12. In apparatus of the general type described comprising in combination a cabinet having an access opening, a panel in said cabinet movable toward and away from said opening and mounting the movable contact of a disconnect switch which contact opens as said panel moves towards said opening, fuses mounted on the side of said panel toward said opening, a crank member inside of said cabinet connected to said panel for moving same towards and away from said opening and having an opening spaced from the axis of rotation, a door for opening and closing said opening, a lock for said door, a crank member mounted on said door having a pin engageable with the opening of said cabinet crank member when the door is closed and disengaging therefrom when the door is opened, a handle extending through said door for operating said crank member, and free play mechanism connecting said handle with said door lock.

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