March 28, 1939. A. L. FLETCHER ET AL 2,151,756

METAL-CLAD SWITCH GEAR

Filed Oct. 9, 1937 3 Sheets-Sheet 1

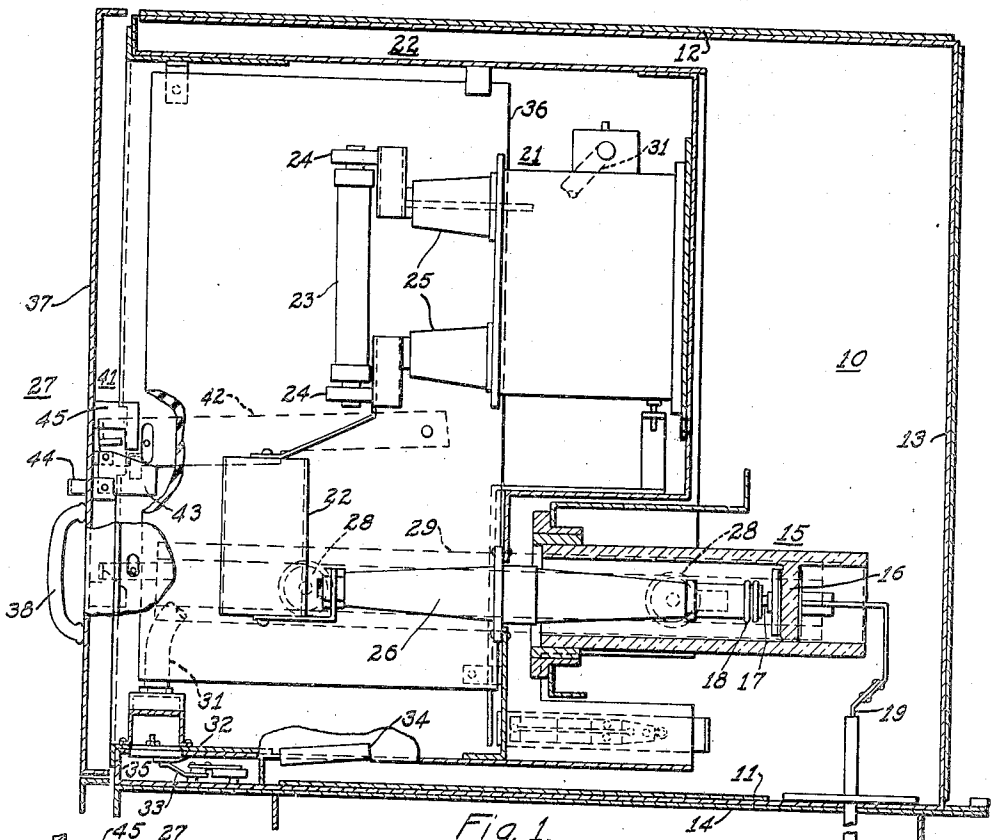


Fig. 1.

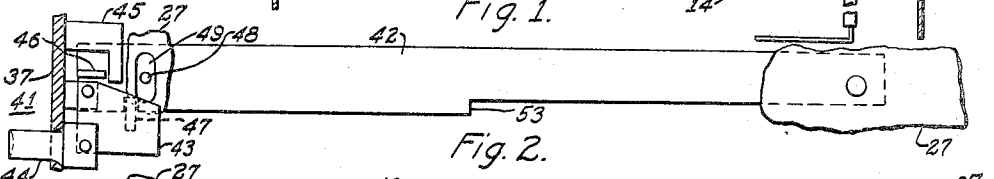


Fig. 2.

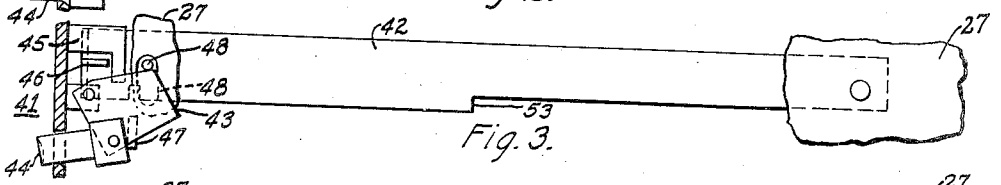


Fig. 3.

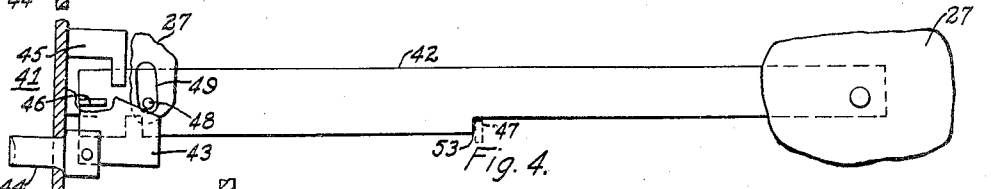


Fig. 4.

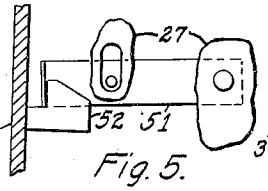


Fig. 5.

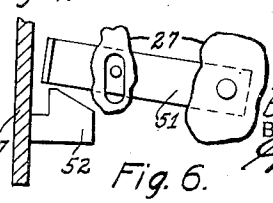


Fig. 6.

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METAL-CLAD SWITCH GEAR

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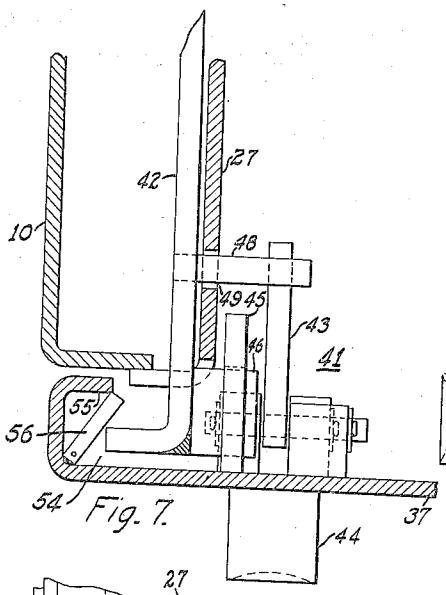


Fig. 7.

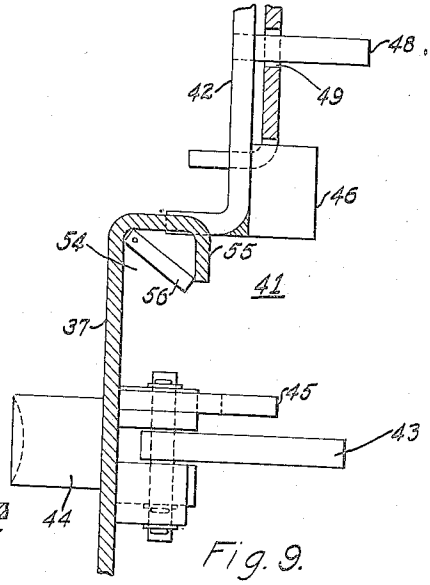


Fig. 9.

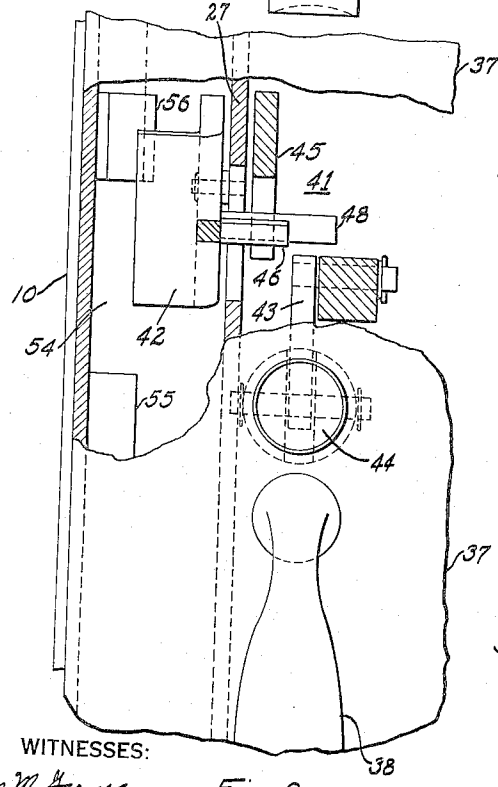


Fig. 8.

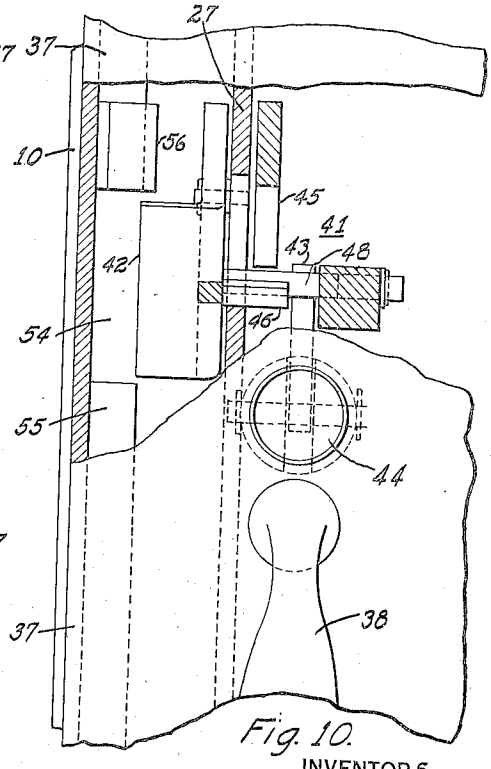


Fig. 10.

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METAL-CLAD SWITCH GEAR

Filed Oct. 9, 1937 3 Sheets-Sheet 3

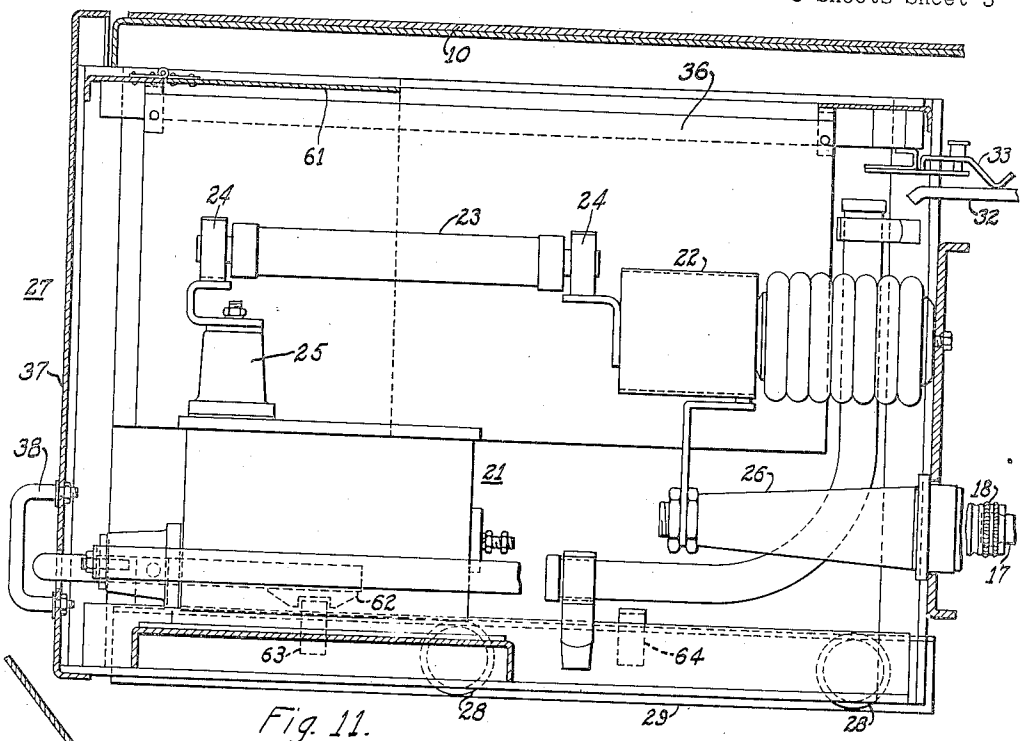


Fig. 11.

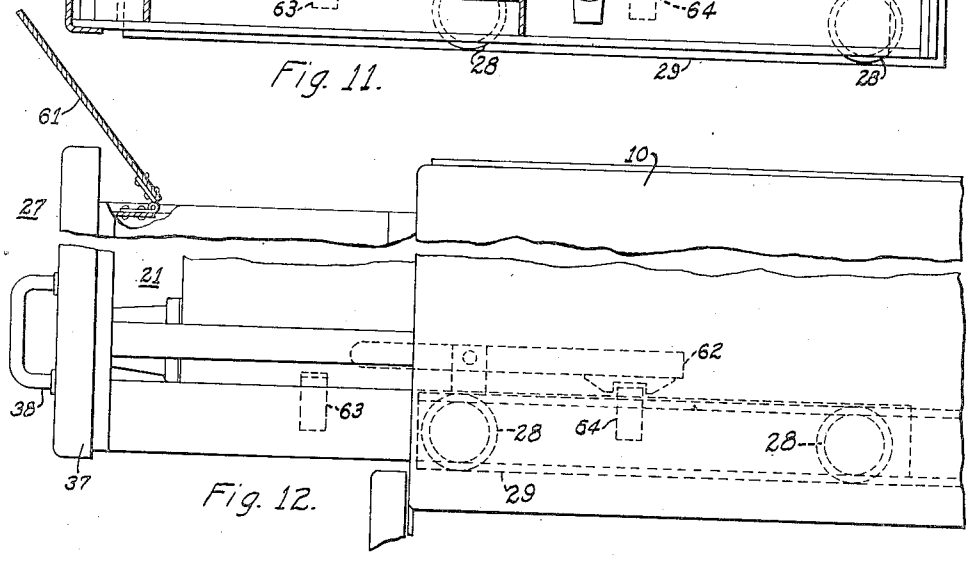


Fig. 12.

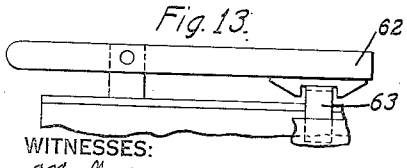


Fig. 13.

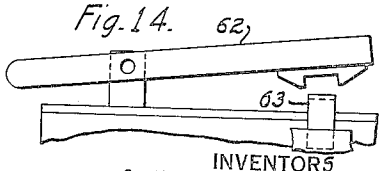


Fig. 14.

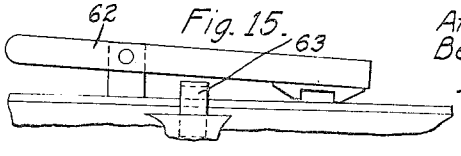


Fig. 15.

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UNITED STATES PATENT OFFICE

2,151,756

METAL-CLAD SWITCH GEAR

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Application October 9, 1937, Serial No. 168,203

12 Claims. (Cl. 175—298)

Our invention relates, generally, to switchgear apparatus, and, more particularly, to switchgear apparatus of the metal-clad type wherein all energized parts are normally enclosed within metal housings or casings.

In the construction of metal-clad switchgear it is the usual practice to provide a compartment or super-structure above the main structure for housing the potential transformers, fuses and current limiting resistors which are required for energizing the instruments and relays associated with the switchgear equipment. Access to the fuses for the potential transformers is usually provided through a door on the front of the transformer compartment which makes it possible to inspect and replace the fuses when necessary. However, in prior structures there is danger of the inspector coming in contact with the energized terminals of the fuse supports, which are on the high potential side of the transformers, since no provision is made for disconnecting the transformer from the power conductors while the inspection is being made.

An object of our invention, generally stated, is to provide for so mounting a potential transformer in a switchgear structure that the transformer may be readily disconnected from a high potential power conductor.

A more specific object of our invention is to provide an enclosed compartment for housing a potential transformer and its associated apparatus wherein the apparatus in the compartment may be readily deenergized without deenergizing the power conductor to which it is normally connected.

Another object of our invention is to provide an enclosed compartment for housing a potential transformer and associated apparatus to which access cannot be had while the apparatus is energized.

A further object of our invention is to provide for so interlocking the door to a compartment for housing electrical apparatus that the door cannot be opened while the apparatus is connected to a power conductor and the apparatus cannot be connected to the conductor while the door is opened.

Other objects of the invention will be explained fully hereinafter or will be apparent to those skilled in the art.

In accordance with one embodiment of our invention potential transformers and their fuses and current limiting resistors are mounted on a drawout truck with disconnecting contacts for the primary and secondary circuits which permits withdrawing the transformers and fuses to a disconnected position before handling the fuses or associated equipment. An interlock mechanism is provided for the door to the transformer compartment to prevent opening the door unless the truck is fully withdrawn to the disconnected position, thereby deenergizing the fuses and the transformers. When the door is open with the truck in the disconnected position, the interlock prevents moving the truck to the connected position without first closing the door.

For a fuller understanding of the nature and objects of our invention, reference may be had to the following detailed description taken in conjunction with the accompanying drawings, in which:

Figure 1 is a view, partially in side elevation and partially in section, of a potential transformer and its supporting structure embodying our invention;

Figs. 2, 3, and 4 are enlarged detailed views showing various positions of the interlocking mechanism utilized in the structure illustrated in Fig. 1;

Figs. 5 and 6 are enlarged views showing the closed and the opened positions of the latch for the door of the transformer and fuse compartment;

Figs. 7 and 8 are enlarged views in plan and front elevation, respectively, of a portion of the truck and cell structure showing the door and the interlocking device in the closed position;

Fig. 9 is a view, similar to Fig. 7, showing the door in the opened position;

Fig. 10 is a view, similar to Fig. 8, showing the interlocking device in a disengaged position;

Fig. 11 is a view, partially in side elevation and partially in section, of a modification of the invention;

Fig. 12 is a view, in side elevation, of a portion of the structure shown in Fig. 11, with the potential transformer in the disconnected position; and,

Figs. 13, 14 and 15 are detailed views showing the latching device for the truck in various positions.

Referring now to the drawings, and particularly to Fig. 1, the structure shown comprises a sheet metal housing or cell 10 having a bottom 11, top 12, back wall 13 and side walls (not shown). The housing 10 is designed to rest upon the top 14 of a steel cubicle, such as is usually utilized to enclose heavy-duty circuit breakers and other switch-gear apparatus.

As shown, an insulating sleeve 15, which may be composed of porcelain or other suitable material, is mounted horizontally near the bottom of the housing 10. The sleeve 15 is provided with a partition 16 in which is mounted a stationary contact member 17, which is normally engaged by a contact member 18 of the flexible sleeve type usually utilized for the main disconnect contacts on removable circuit breakers. The contact member 17 is connected to a conductor 19 which extends through the top wall 14 of the

supporting cubicle and may be connected to one of the main power conductors or buses usually located near the top of the cubicle structure.

In accordance with the usual practice in high voltage installations, a potential transformer 21 is provided for reducing the voltage applied to the instruments and relays associated with the switching equipment. The usual current limiting resistor 22 and fuse 23 are provided for the protection of the potential transformer 21. The fuse 23 is of the removable type and is mounted in fuse clips 24 disposed on supporting studs or terminals 25 on the transformer 21. One terminal of the resistor 22 is connected to one end of a horizontally mounted terminal 26, the other end of which is disposed inside of the sleeve 15 and carries the contact member 18, thereby connecting the potential transformer 21 to the conductor 19. The terminal 26 may be of the condenser bushing or any other type suitable for high tension service.

In order that the fuse clips 24 may be readily deenergized when it is necessary to remove the fuse 23 for inspection or replacement and also that the resistor 22 and the transformer 21 may be inspected without danger to the inspector, the transformer 21, the resistor 22, the fuse 23 and the terminal 26 are all mounted in a removable truck structure 27. The truck 27 is mounted on rollers 28 which run in channel-shaped tracks 29 disposed on the sides of the housing 10, thereby permitting the entire truck assembly to be moved outwardly to a disconnected position in which the contact member 18 is disengaged from the contact member 17 to deenergize the transformer 21 and its associated apparatus.

When the truck 27 is in the disconnected position, the secondary terminal of the transformer 21, which is connected through a conductor 31 and a contact member 32 on the truck 27 to stationary contact fingers 33 in the housing 10, is also disconnected, thereby completely isolating the transformer 21.

The outward movement of the truck 27 is normally limited by stop members 34 disposed on the side of the truck to engage an upwardly extending flange 35 on the bottom of the housing 10. However, if it is desired to remove the transformer entirely from the housing the truck may be raised sufficiently to permit the stops 34 to clear the flange 35.

Since most alternating current power systems are three phase, the truck 27 is designed to contain three transformer units similar to the one shown. However, the truck may be constructed to contain any number of units. Insulating barriers 36 may be provided between the terminals of the different units, as shown.

In order that access may be had to the transformer compartment, a hinged door 37 is provided on the front of the truck 27. The door 37 is provided with handles 38 for withdrawing the truck from the operating position and for opening the door.

With a view towards affording maximum safety for the operator at all times, a mechanical interlocking mechanism 41 is provided. The interlocking mechanism is designed to prevent the door 37 from being opened unless the truck 27 is fully withdrawn to the disconnected position, thereby deenergizing the transformer 21 and its associated apparatus. The interlocking device also functions to prevent the truck 27 from being inserted to the operating position without the door being closed. In this manner, access to the transformer compartment can be gained only when the apparatus in the compartment is deenergized.

As shown more clearly in Figs. 2 to 4 and 7 to 10, inclusive, the interlocking mechanism 41 comprises an interlocking bar 42, which is pivotally mounted on one side of the truck 27; an operating plate 43, which is pivotally mounted on the inside of the door 37; a push button 44 for actuating the plate 43 to raise the interlocking bar 42; a hook member 45, which is secured to the inside of the door 37 and disposed to engage a laterally extending projection 46 on one side of the interlocking bar 42 when the truck is in the operating position, and a lug 47 so disposed on the side of the housing 10 that it is engaged by the interlocking bar 42 when the truck is in the operating position, as shown in Fig. 2, and also when the truck is withdrawn to the disconnected position, as shown in Fig. 4.

The interlocking bar 42 is provided with a pin 48 which extends through a slot 49 in the side of the truck 27 and is engaged by the operating plate 43 to raise the interlocking bar 42 to the position shown in Fig. 3 when the push button 44 is depressed. In this manner the bar 42 may be raised to disengage the lug 47 and permit the truck to be withdrawn from the housing by means of the handles 38.

However, it will be seen that it is impossible to open the door 37 while the truck 27 is in the operating position, since the projection 46 on the bar 42 would be engaged by the member 45 on the door 37 to prevent the door from being opened. Furthermore, the door is held closed by a latch 51 which is pivotally mounted on the opposite side of the truck from the interlocking mechanism to engage a hook member 52 secured to the door 37.

When the truck 27 is withdrawn to the disconnected position and the push button 44 released, the bar 42 drops to the position shown in Figs. 4 and 10 in which a shoulder 53 on the bar 42 engages the lug 47 on the housing 10. It will be seen that the end of the bar 42 is lowered sufficiently to permit the hook member 45 to pass over the projection 46, thereby permitting the door 37 to be opened. The door may now be opened by releasing the latch 51 from the hook 52 which may be accomplished at this time by the operator reaching around the side of the door 37 to raise the latch 51 which is now accessible from the side of the truck.

As shown in Figs. 7 to 10, the end of the bar 42 is so bent at right angles that it extends into a slot 54 provided in the flange 55 of the door 37 when the door is swung to the open position, as shown in Fig. 9. In this manner the truck 27 is prevented from being inserted into the housing 10 while the door is open, since the bar 42 is prevented from being raised by the end of the bar striking the flange 55 on the door 37, thereby preventing the shoulder 53 from being disengaged from the lug 47 on the side of the housing 10.

Furthermore, a member 56 is diagonally disposed across a portion of the flange 55 on the door 37 to be above the laterally extending end of the bar 42 so long as the door is only partially closed, thereby preventing the interlocking mechanism from being released to permit the truck to be inserted into the housing, which makes it necessary for the door to be fully closed before the truck can be inserted to the operating

position, in which the contact member 18 engages the contact member 17 to energize the transformer 21.

In the modification of the invention shown in Figs. 11 to 15, in which corresponding parts are designated by the same reference characters as in Figs. 1 to 10, the potential transformers 21 are mounted near the bottom of the truck structure which permits the fuses 23 to be mounted horizontally instead of vertically. Therefore, access to the fuses 23 is gained through a door 61 which is hinged at the top of the truck structure. The truck 27 is mounted on rollers 28 and may be withdrawn from the operating position to deenergize the transformer 21 and its associated apparatus in the manner hereinbefore described. The truck is retained in the operating position by a latch 62 which is pivotally mounted at one side of the housing on the track 29.

When it is desired to withdraw the truck from the housing to gain access to the fuses 23, the end of the latch 62, which projects through the front of the truck, may be lowered (as shown in Fig. 14) to cause the latch to disengage a lug 63 which is secured to the movable truck 27. The truck 27 may then be withdrawn to the position shown in Fig. 12 in which the latch 62 engages a lug 64 similar to the lug 63 on the truck 27.

When the truck 27 is fully withdrawn to the disconnected position, as shown in Fig. 12, the edge of the door 61 will clear the front of the housing 10, thereby permitting the door to be opened to gain access to the fuses 23 as well as the transformers 21 and the current limiting resistors 22.

When it is desired to insert the truck into the housing, the latch 62 may be disengaged from the lug 64 by pressing down on the handle of the latch, access to which may be had from the side of the housing. However, it is necessary that the door 61 be closed before the truck can be fully inserted into the housing, since, as shown in Fig. 2, the door 61 is so hinged at the top of the truck structure that it will prevent the truck from being fully inserted into the housing to the operating position, in which position the contact member 18 engages the contact member 17 to energize the transformer 21. Therefore, it will be seen that in this structure access cannot be gained to the transformer compartment until the truck has been withdrawn to a position in which the transformer is deenergized and the truck cannot be restored to the operating position until after the door 61 has been closed to close the compartment.

From the foregoing description it is apparent that we have provided a simplified and economical structure which makes it possible to completely disconnect an instrument transformer and its associated apparatus from a high tension power conductor and which insures a maximum degree of safety for the operator. While the structure herein described is designed for utilization in switchgear apparatus of the metal clad type, it will be understood that the present structure may be utilized readily in apparatus of other types.

Since numerous changes may be made in the above described construction, and different embodiments of the invention may be made without departing from the spirit and scope thereof, it is intended that all matter contained in the foregoing description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

We claim as our invention:

1. In switchgear apparatus, in combination, a housing, a truck structure removably disposed in said housing, electrical apparatus mounted in said truck structure, a power conductor disposed in the housing, means carried by the truck for connecting said apparatus to the power conductor when the truck is fully inserted in the housing, said apparatus being deenergized when the truck is withdrawn from the housing a predetermined distance, a door on the truck for permitting access to said apparatus when opened, means for preventing the opening of the door unless the truck is withdrawn from the housing said predetermined distance, and releasable means for normally limiting the outward movement of the truck.

2. In switchgear apparatus, in combination, a housing, a truck structure removably disposed in said housing, electrical apparatus mounted in said truck structure, a power conductor disposed in the housing, means carried by the truck for connecting said apparatus to the power conductor when the truck is fully inserted in the housing, said apparatus being deenergized when the truck is withdrawn from the housing a predetermined distance, a door on the truck for permitting access to said apparatus when opened, means for preventing the opening of the door unless the truck is withdrawn from the housing said predetermined distance, and means for preventing the insertion of the truck into the housing to connect the apparatus to the power conductor without the door being closed.

3. In switchgear apparatus, in combination, a housing, a truck structure removably disposed in said housing, electrical apparatus mounted in said truck structure, a power conductor disposed in the housing, means carried by the truck for connecting said apparatus to the power conductor when the truck is fully inserted in the housing, said apparatus being deenergized when the truck is withdrawn from the housing a predetermined distance, a door on the truck for permitting access to said apparatus when opened, means for preventing the opening of the door unless the truck is withdrawn from the housing said predetermined distance, means for preventing the insertion of the truck into the housing to connect the apparatus to the power conductor without the door being closed, and means on the truck cooperating with means on the housing for normally limiting the outward movement of the truck.

4. In switchgear apparatus, in combination, a housing, a truck structure removably disposed in said housing, electrical apparatus mounted in said truck structure, a power conductor disposed in the housing, means carried by the truck for connecting said apparatus to the power conductor when the truck is fully inserted in the housing, said apparatus being deenergized when the truck is withdrawn from the housing a predetermined distance, a door on the truck for permitting access to said apparatus when opened, means for preventing the opening of the door unless the truck is withdrawn from the housing said predetermined distance, means for preventing the insertion of the truck into the housing to connect the apparatus to the power conductor without the door being closed, and means on the truck cooperating with means on the housing for normally limiting the outward movement of the truck, said last named means being disposed to permit the truck to be removed entirely from the housing.

5. In switchgear apparatus, in combination, a housing, a truck structure removably disposed in said housing, electrical apparatus mounted in said truck structure, a power conductor disposed in the housing, means carried by the truck for connecting said apparatus to the power conductor when the truck is fully inserted in the housing, said apparatus being deenergized when the truck is withdrawn from the housing a predetermined distance, a door on the truck for permitting access to said apparatus when opened, means for preventing the opening of the door unless the truck is withdrawn from the housing said predetermined distance, means for preventing the insertion of the truck into the housing to connect the apparatus to the power conductor without the door being closed, and manually releasable means for normally limiting the outward movement of the truck from the housing.

6. In switchgear apparatus, in combination, a housing, a truck structure removably disposed in said housing, electrical apparatus mounted in said truck structure, a power conductor disposed in the housing, means carried by the truck for connecting said apparatus to the power conductor when the truck is fully inserted in the housing, said apparatus being deenergized when the truck is withdrawn from the housing a predetermined distance, a door on the truck for permitting access to said apparatus when opened, and means on the truck for preventing the opening of the door unless the truck is withdrawn from the housing said predetermined distance.

7. In switchgear apparatus, in combination, a housing, a truck structure removably disposed in said housing, electrical apparatus mounted in said truck structure, a power conductor disposed in the housing, means carried by the truck for connecting said apparatus to the power conductor when the truck is fully inserted in the housing, said apparatus being deenergized when the truck is withdrawn from the housing a predetermined distance, a door on the truck for permitting access to said apparatus when opened, and means on the housing for preventing the opening of the door unless the truck is withdrawn from the housing said predetermined distance.

8. In switchgear apparatus, in combination, a housing, a truck structure removably disposed in said housing, electrical apparatus mounted in said truck structure, a power conductor disposed in the housing, means carried by the truck for connecting said apparatus to the power conductor when the truck is fully inserted in the housing, said apparatus being deenergized when the truck is withdrawn from the housing a predetermined distance, a door on the truck for permitting access to said apparatus when opened, and means on the housing for preventing the opening of the door unless the truck is withdrawn from the housing said predetermined distance, said door being disposed to prevent the insertion of the truck into the housing to connect the apparatus to the power conductor without the door being closed.

9. In switchgear apparatus, in combination, a housing, a truck structure removably disposed in said housing, electrical apparatus mounted in said truck structure, a power conductor disposed in the housing, means carried by the truck for connecting said apparatus to the power conductor when the truck is fully inserted in the housing, said apparatus being deenergized when the truck is withdrawn from the housing a predetermined distance, a door on the truck for permitting access to said apparatus when opened, and an interlocking bar on the truck cooperating with means on the door for preventing the opening of the door unless the truck is withdrawn from the housing said predetermined distance.

10. In switchgear apparatus, in combination, a housing, a truck structure removably disposed in said housing, electrical apparatus mounted in said truck structure, a power conductor disposed in the housing, means carried by the truck for connecting said apparatus to the power conductor when the truck is fully inserted in the housing, said apparatus being deenergized when the truck is withdrawn from the housing a predetermined distance, a door on the truck for permitting access to said apparatus when opened, and an interlocking bar on the truck cooperating with means on the door for preventing the opening of the door unless the truck is withdrawn from the housing said predetermined distance, said interlocking bar being disposed to releasably latch said truck in the housing in the operating position and also in the disconnected position.

11. In switchgear apparatus, in combination, a housing, a truck structure removably disposed in said housing, electrical apparatus mounted in said truck structure, a power conductor disposed in the housing, means carried by the truck for connecting said apparatus to the power conductor when the truck is fully inserted in the housing, said apparatus being deenergized when the truck is withdrawn from the housing a predetermined distance, a door on the truck for permitting access to said apparatus when opened, an interlocking bar on the truck cooperating with means on the door for preventing the opening of the door unless the truck is withdrawn from the housing said predetermined distance, said interlocking bar being disposed to releasably latch said truck in the housing in the operating position and also in the disconnected position, and manually operable means on the door for releasing said bar from the latched position.

12. In switchgear apparatus, in combination, a housing, a truck structure removably disposed in said housing, electrical apparatus mounted in said truck structure, a power conductor disposed in the housing, means carried by the truck for connecting said apparatus to the power conductor when the truck is fully inserted in the housing, said apparatus being deenergized when the truck is withdrawn from the housing a predetermined distance, a door on the truck for permitting access to said apparatus when opened, an interlocking bar on the truck cooperating with means on the door for preventing the opening of the door unless the truck is withdrawn from the housing said predetermined distance, said interlocking bar being disposed to releasably latch said truck in the housing in the operating position and also in the disconnected position, manually operable means on the door for releasing said bar from the latched position, and means on the door for preventing the unlatching of said bar to insert the truck into the housing while the door is open.

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