United States Patent [19]

Sakats

[11] **3,748,621**

[45] **July 24, 1973**

[54] **LOCKING MECHANISM**

[75] Inventor: **Gerald Sakats,** Arlington Heights, Ill.

[73] Assignee: **S & C Electric Company,** Chicago, Ill.

[22] Filed: **Sept. 25, 1972**

[21] Appl. No.: **292,263**

[52] **U.S. Cl.** **337/173,** 337/144, 337/172, 337/201, 337/205, 200/50

[51] **Int. Cl.** **H01h 71/10**

[58] **Field of Search** ..... 317/114, 116; 337/144, 173, 174, 175, 196, 201, 205; 200/50 AA, 50 B

[56] **References Cited**

UNITED STATES PATENTS

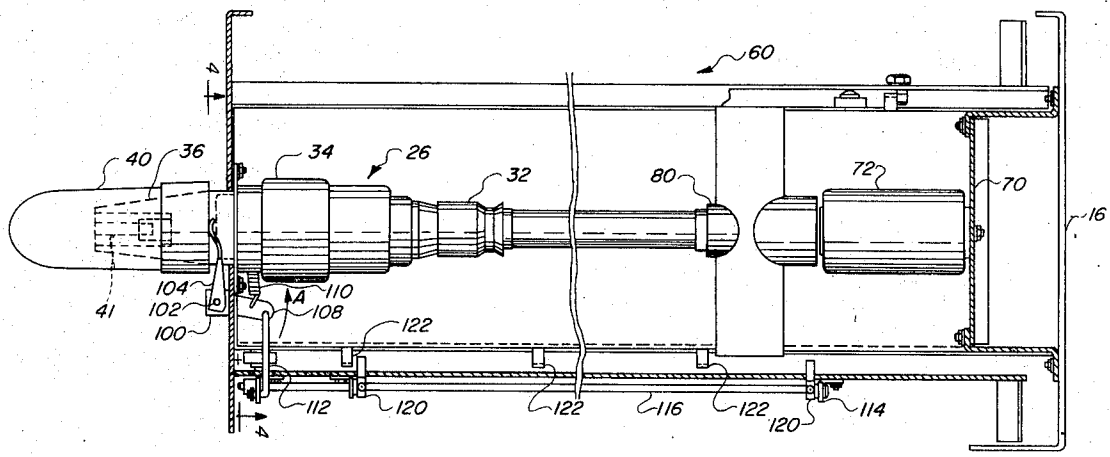
2,314,693	3/1943	Dickinson	337/175
3,274,356	9/1966	Godfrey	337/201 X
3,339,118	8/1967	Harner et al.	337/201
3,437,768	4/1969	Miller et al.	200/50 AA

Primary Examiner—Bernard A. Gilheany
Assistant Examiner—F. E. Bell
Attorney—Ronald L. Engel, Jay G. Taylor et al.

[57] **ABSTRACT**

A locking mechanism for a removable roller mounted fuse drawer of a high voltage fuse enclosure. Locking levers are mounted on a first shaft adjacent loadbreak connectors so that when the loadbreak connectors are connected to fuse terminals they engage blocking levers causing the levers and shaft to pivot. The shaft is interconnected by a linkage arrangement to a second shaft adjacent the roller mounted fuse drawer. Mounted on the second shaft are blocking cams which engage stops on the fuse drawer to prevent movement of the fuse drawer when the loadbreak connectors are connected. When the loadbreak connectors are manually disconnected from the fuse terminals breaking the circuit to the fuses, the blocking levers and first shaft pivot causing the linkage arrangement to rotate the second shaft and move the blocking cams out of engagement with the drawer stops thus permitting the fuse drawer to be removed from the fuse enclosure. The fuse drawer can then be removed so that the fuses can be tested or replaced. The blocking cams prevent replacement of the fuse drawer in the fuse enclosure if any of the loadbreak connectors are reconnected to the fuse terminals after the fuse drawer is removed from the fuse enclosure. Thus, the fuse drawer can neither be opened nor closed any time a loadbreak connector is connected to the circuit thus preventing either opening of the fuse drawer when the fuses are under electrical load or closing the fuse drawer into an electrically loaded circuit.

5 Claims, 5 Drawing Figures



2 Sheets-Sheet 1

Fig. 1

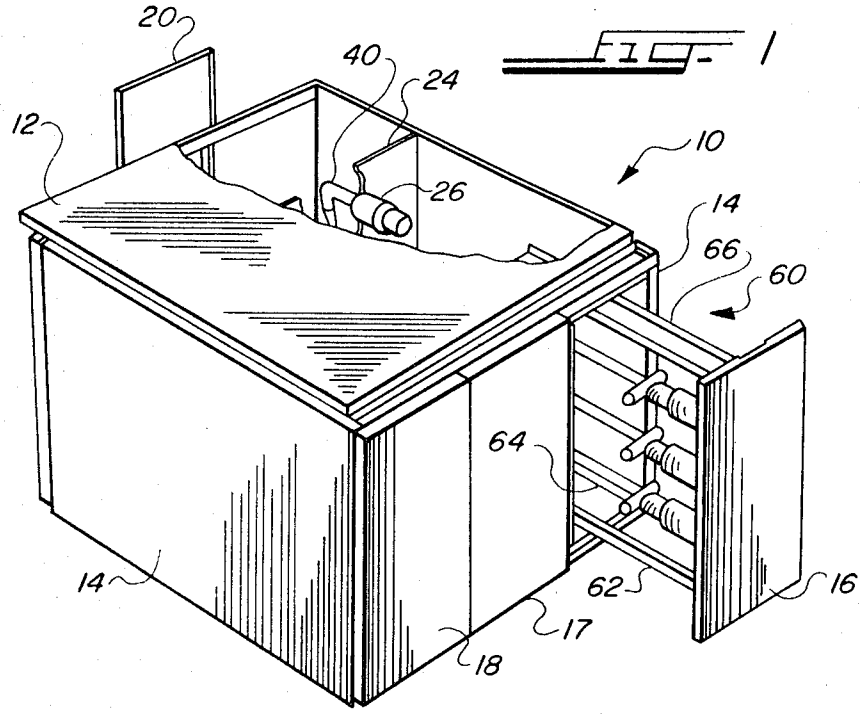
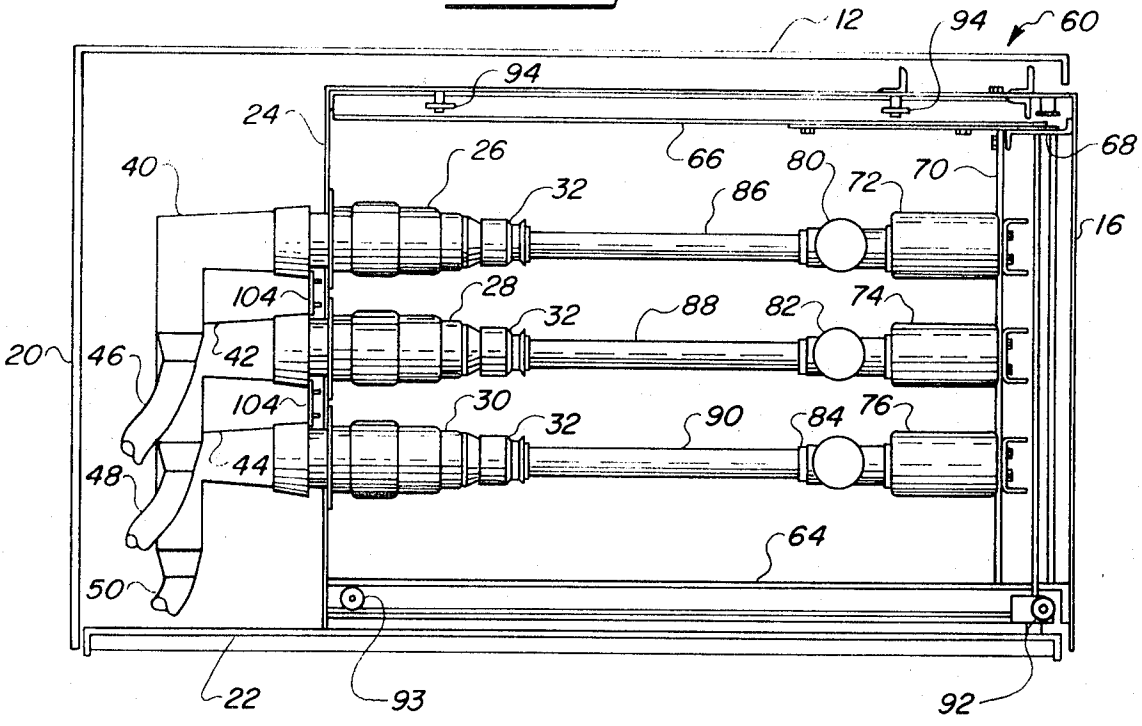
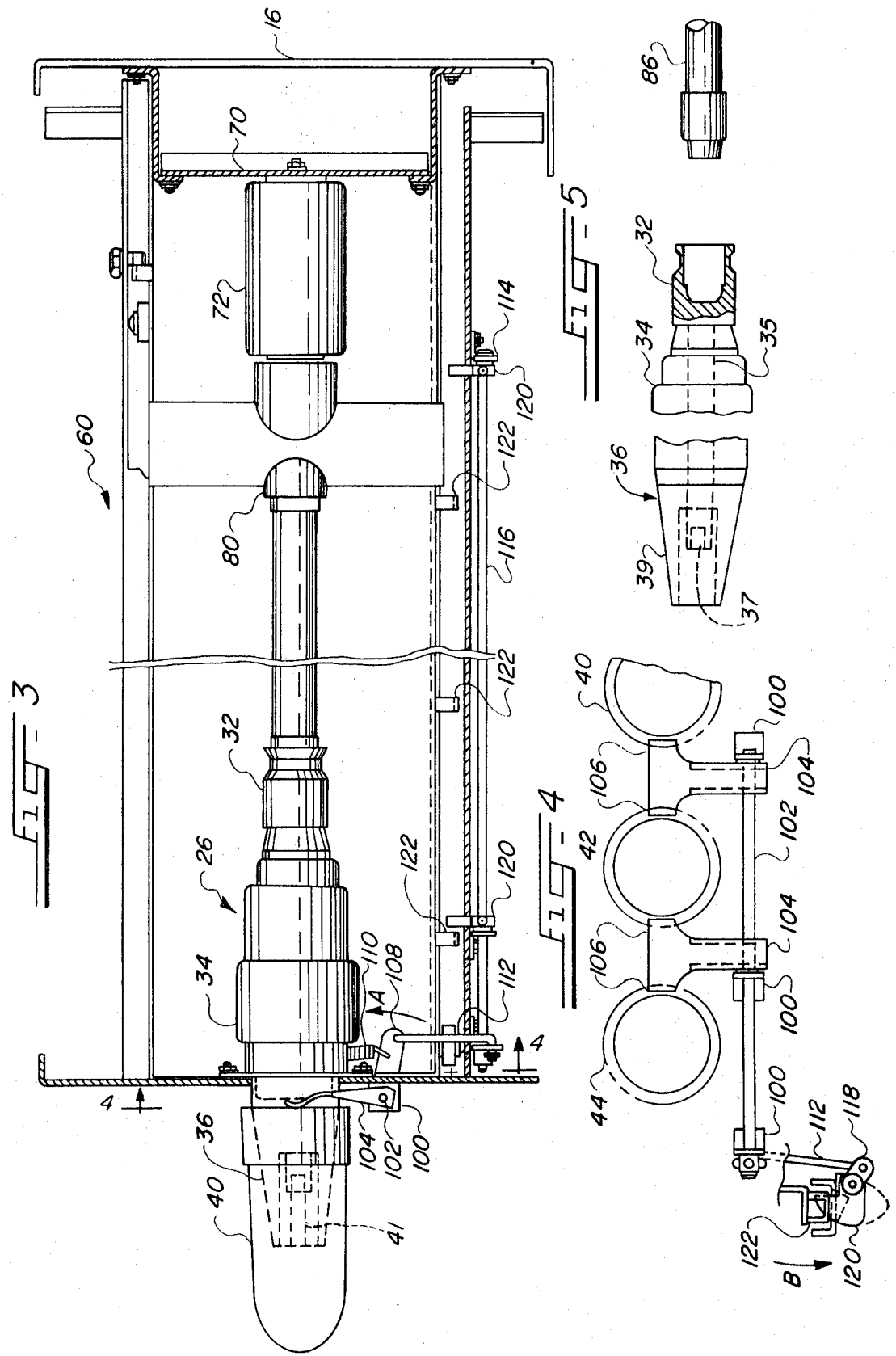


Fig. 2




16
70
72
60
80
32
26
34
36
40
41
4
110
108
112
114
120
122
116
100
102
104
FIG - 3
86
32
34
35
36
39
37
FIG - 5
40
42
44
106
100
104
102
112
118
122
120
B
FIG - 4

LOCKING MECHANISM

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to locking mechanisms, and more particularly to locking mechanisms to prevent the opening and closing of fuse drawers of high voltage fuse enclosures while the fuses are under electrical load.

2. Description of the Prior Art

Metal enclosed switchgear assemblies including power fuses for disributors of electric power and circuit isolation are well known in the art. Provisions for servicing this equipment is essential. Such metal enclosed switchgear assemblies are typically of the three phase electrical current variety requiring three separate fuses for each of the three phases of electrical current. For example, U. S. Pat. No. 3,576,509 - Bernatt discloses a typical prior art configuration of a metal enclosed loop switch with draw out fuses, fuse isolator switches and ground switches. In such prior art fuse enclosures, the fuses are drawer mounted so that opening of the fuse drawer disconnects one end of the fuses and exposes the fuses so that they can be removed from the fuse drawer for testing and/or replacement.

However, to prevent damage to the fuse and to prevent exposing the serviceman to possible electrical shock and injury, it is necessary to terminate the flow of electrical current through the fuses prior to opening of the fuse drawer. If, for example, the fuse drawer is opened while the fuse is under load, an arc will be created as the fuses break contact with the female fuse contacts thus creating the potential of damage to either the contact or the end of the fuse. Further, at high voltages, the arc may continue to stretch as the fuse drawer is withdrawn, thus creating the risk of injury to the serviceman.

To avoid such risks, the prior art fuse enclosures have typically included an interrupter switch which isolates the fuses from the circuit before the fuse drawer can be opened.

However, there has been a trend in the electric utility industry in recent years to perform loadbreak switching of electrical circuits with separable insulated terminals rather than by conventional interrupter switches. These separable insulated terminals commonly known as loadbreak connectors are single pole tool operated devices which do not have interlocks. Loadbreak connectors require a degree of operator skill and judgment in their operation. Where loadbreak connectors are utilized in metal enclosed fuse enclosures to disconnect the fuses from the electric load, it is necessary to remove all loadbreak connectors before the fuse drawer can be opened. If any of the loadbreak connectors are connected when the drawer is opened, an arc is created when the fuse breaks contact with the female contact. If the loadbreak connectors are connected before the fuse drawer is closed, a pre-strike arc will be formed as the fuse approaches the female contact. Any time such an arc is formed, there is potential for equipment damage and injury to the serviceman.

Typically, in prior art fuse enclosure construction, the loadbreak connectors are positioned on the opposite side of the fuse enclosure from the fuse drawer. Thus, the serviceman is not able to observe the loadbreak connectors when opening and closing the fuse drawer. If the serviceman inadvertently forgets to disconnect the loadbreak connector or inadvertently reconnects the connectors after the fuse drawer has been opened, the serviceman is not able to observe this condition without moving around to the opposite side of the fuse enclosure.

Consequently, it would be a highly desirable advance in the art to provide a locking mechanism for the fuse drawer that would prevent either the opening or closing of the fuse drawer when the loadbreak connectors are connected to the circuit.

BRIEF SUMMARY OF THE INVENTION

A fuse drawer locking mechanism in accordance with the present invention is adapted to be used in conjunction with a high voltage switchgear assembly comprising a fuse drawer mounted for reciprocal movement between an open position and a closed position. A fuse mounting is affixed to the fuse drawer and connected to an electrical power source. A fuse is mounted on the fuse mounting and a female fuse contact is mounted in alignment with the fuse drawer so that when the fuse drawer is moved to its closed position the fuse electrically connects the fuse contact placing the fuse in the electric circuit and when the fuse drawer is moved to its open position the fuse electrically disconnects from the fuse contact. A loadbreak connector is connected to the fuse contact and is electrically connected to an electrical load. The loadbreak connector is adapted to be manually disconnected from the fuse contact to break electrical contact with the fuse contact thus terminating the flow of electrical current through the fuse.

A fuse drawer locking mechanism in accordance with the present invention comprises a blocking means positioned to engage the loadbreak connector when the loadbreak connector is connected to the fuse contact so that the blocking means moves to a first position. When the loadbreak connector is disconnected from the electrical contact, the blocking means disengages the loadbreak connector permitting the blocking means to move to a second position. Lock means are operably connected to the blocking means so that the lock means engages the fuse drawer to prevent reciprocal movement of the fuse drawer when the blocking means is in its first position. When the blocking means is in its second position after the loadbreak connector has been disconnected from the fuse contact, the lock means disengages the fuse drawer to permit reciprocal movement of the fuse drawer. In this manner, the fuse drawer is prevented from being moved from its closed position to its open position when the loadbreak connector is connected to the fuse contact. Further, once the fuse drawer is opened, the fuse drawer is prevented from being moved to its closed position if a loadbreak connector is connected to the fuse contact.

The advantages of the present invention should be apparent. The fuse drawer locking mechanism locks the fuse drawer in its closed position preventing removal of the fuse drawer any time the loadbreak connector is connected to the electrical contact and the fuse is under electrical load. However, once the loadbreak connector has been removed breaking the electrical circuit to the fuse, the locking mechanism unlocks the drawer permitting the fuse drawer to be opened and the fuse to be removed for testing and/or replacement. Further, if the loadbreak connector is reconnected to the fuse contact while the fuse drawer is open, the locking mechanism prevents the fuse drawer

from being closed until the loadbreak connector is disconnected. In this manner, the formation of a pre-strike arc between the fuse contact and the fuse is prevented.

Further, the present invention is particularly adaptable to be used in equipment having a plurality of fuses mounted in a fuse drawer and a corresponding plurality of loadbreak connectors electrically connected to each fuse.

Thus, it is an object of the present invention to provide a fuse drawer locking mechamism that permits the fuse drawer to be opened only when all fuses have been electrically disconnected from the electrical circuit.

A further object of the present invention is to provide a locking mechanism for a fuse drawer that prevents closing of the fuse drawer whenever a loadbreak connector is attached to a fuse contact.

These and other objects, advantages, and features of the present invention will hereinafter appear, and for the purposes of illustration, and not of limitation, an exemplary embodiment of the present invention is illustrated in the accompanying drawings.

BRIEF DSCRIPTION OF THE DRAWINGS

FIG. 1 is an upper left front partially fragmentary perspective view of a preferred embodiment of the present invention.

FIG. 2 is a cross sectional partially fragmentary view of the preferred embodiment illustrated in FIG. 1.

FIG. 3 is a top cross sectional view of the preferred embodiment of the present invention.

FIG. 4 is a partially fragmentary view taken substantially along line 4—4 in FIG. 3.

FIG. 5 is a fragmentary partially sectional view of the fuse and fuse contact.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference to FIGS. 1, 2, and 3, enclosure 10 comprises top 12 and right and left sides 14. The front of enclosure 10 comprises fuse drawer cover 16 and panels 17 and 18 and the back of enclosure 10 comprises three removable cover panels 20. A bottom member 22 connected to contact support partition 24 provides a track surface for drawer roller 93. Typically, enclosure 10 is mounted to an appropriate fixture such as a concrete pad.

Mounted within enclosure 10 is a contact support partition 24 upon which are mounted fuse contacts 26, 28, and 30. Fuse contacts 26, 28, and 30 are substantially identical and comprise hollow female receptacles 32 (see FIG. 5) mounted upon electrical insulators 34 which electrically isolate fuse contacts 26, 28 and 30 from contact support partition 24. Insulators 34 extend through contact support partition 24 and mounted on the end thereof are frustrum contacts 36. Female contact 37 within conico-frustrum insulator 39 of frustrum contacts 36 are electrically connected to female receptacle 32 by conductors 35 (shown by dotted lines in FIG. 5) through insulators 34. Connected to frustrum contacts 36 are loadbreak connectors 40, 42, and 44. Loadbreak connectors 40, 42, and 44 have essentially hollow tapered ends which mate with frustrum contacts 36 and male contacts 41 (shown in dotted lines in FIG. 3) which connect with female contacts 37. Electrical conductors 46, 48, and 50 are connected to loadbreak connectors 40, 42, and 44 respectively and are electrically connected to an electrical load (not shown). Thus, an electrical circuit is formed from the loadbreak connectors 40, 42, and 44 through frustrum contacts 36 to femal receptacles 32 of the fuse contacts 26, 28 and 30.

Fuse drawer assembly 60 comprises lower roller guides 62 and 64 mounted on fuse drawer cover 16. Upper roller guide 66 is mounted on flange 68 which is attached to fuse drawer cover 16. Mounted between lower roller guides 62 and 64 and upper roller guide 66 is fuse mounting bracket 70. Mounted on fuse mounting bracket 70 are insulators 72, 74, and 76, and mounted on insulators 72, 74, and 76 are stationary fuse mountings 80, 82, and 84. Fuses 86, 88, and 90 are mounted on stationary fuse mountings 80, 82 and 84 in an essentially cantilever fashion so that when fuse drawer assembly 60 is removed from enclosure 10, fuses 86, 88, and 90 disengage female receptacles 32 (see FIG. 5). Stationary fuse mountings 80, 82 and 84 are electrically connected to a power source (not shown) so that when fuses 86, 88, and 90 are in engagement with female receptacle 32 in electrical circuit is formed from the power source through fuses 86, 88, and 90 to the electrical load.

Fuse drawer assembly 60 is mounted so that it can be removed from enclosure 10 by rolling on lower roller 92, drawn roller 93 and upper roller 94 as illustrated in FIG. 1.

Pivotally mounted to contact support partition 24 by support flanges 100 is first shaft 102 (see FIGS. 3 and 4). Mounted on first shaft 102 are blocking levers 104 which have formed at the free end thereof engaging ears 106 which engage the edge of loadbreak connectors 40, 42, and 44 when loadbreak connectors are connected to frustrum contacts 36. Mounted to the bottom of first shaft 102 and extending through contact support partition 24 is linkage lever 108. Linkage lever 108 is spring-biased by a spring 110 so that it is constantly urged in the direction of arrow A in FIG. 3. Pivotally connected to the free end of linkage lever 108 is link 112. Pivotably mounted on support flanges 114 mounted to enclosure 10 is second shaft 116. Mounted at one end of second shaft 116 is linkage lever 118 which is pivotably connected to line 112. Thus, when first shaft 102 pivots linkage lever 108 in the direction as shown by arrow A in FIG. 3, linkage lever 118 pivots second shaft 116 in the direction of arrow B in FIG. 4. Mounted along the length of second shaft 116 are blocking cams 120. Mounted along lower roller guide 62 are drawer stops 122 which engage locking cams 120 to prevent the removal of fuse drawer assembly 60 when locking cams 120 are in the position shown by the solid lines in FIG. 4.

Operation of the present invention is substantially as follows. If a serviceman wishes to remove the fuse drawer assembly 60 from enclosure 10, the serviceman removes cover panel 20 from the back off enclosure 10 to expose loadbreak connectors 40, 42, and 44. The serviceman using an appropriate insulated tool removes loabreak connectors 40, 42, and 44 from frustrum contacts 36 of fuse contacts 26, 28, and 30 thereby breaking the electrical circuit to fuses 86, 88, and 90. When loadbreak connector 40, 42, 44 are removed, they disengage ears 106 on blocking levers 104 permitting the spring bias of the spring 110 to pivot linkage lever 108, first shaft 102 and blocking levers 104 in the direction of arrow A as shown in FIG. 3. When linkage lever 108 pivots, link 112 causes linkage

lever 118 and second shaft 116 to pivot in the direction of arrow B in FIG. 4 causing blocking cams 120 to pivot to the position shown by the dotted lines in FIG. 4. In this position, blocking cams 120 disengage drawer stops 122 releasing fuse drawer assembly 60 so that it may be pulled out of enclosure 10 by the serviceman. As fuse drawer assembly 16 is removed from enclosure 10, fuses 86, 88, and 90 disengage female receptacles 32 on fuse contacts 26, 28 and 30 thus disconnecting fuses 86, 88, and 90 from the electrical circuit. Once fuse drawer assembly 60 has been removed, fuses 86, 88, and 90 can be removed from stationary fuse mountings 80, 82, and 84 so that they may be tested and/or replaced as necessary.

It should be apparent that as long as loadbreak connectors 40, 42, and 44 are connected to frustrum contacts 36, blocking cams 120 engage drawer stops 122 preventing removal of fuse drawer assembly 60. Thus, the serviceman cannot accidentally or inadvertently remove the fuse drawer assembly while the fuses 86, 88, and 90 are under electrical load. Further, if after fuse drawer assembly 60 has been removed from enclosure 10 one of the loadbreak connectors 40, 42, or 44 is inadvertently reconnected to frustrum contact 36, blocking cams 120 are pivoted back into alignment with drawer stops 122 so that drawer assembly 60 cannot be pushed back into enclosure 10. This latter feature prevents an accidental pre-strike arc being created as fuses 86, 88, and 90 approach female receptacles 32 thus preventing damage to female receptacles 32 or fuses 86, 88, and 90. Thus, it should be apparent that if at any time loadbreak connectors 40, 42, and 44 are connected to frustrum contacts 36, it is impossible to either remove or replace fuse drawer assembly 60.

Once the serviceman has completed the necessary testing and/or replacement of fuses 86, 88, and 90, fuse drawer assembly 60 can be reinserted into enclosure 10 (provided loadbreak connectors 40, 42, and 44 are not connected). As fuse drawer assembly 60 is reinserted in the enclosure 10, the ends of fuses 86, 88, and 90 engage female receptacles 32 completing the electrical circuit with fuse contacts 26, 28, and 30. Once the fuse drawer assembly 60 has been reinserted into enclosure 10, loadbreak connectors 40, 42, and 44 can be reconnected to frustrum contacts 36 completing the electrical circuit through fuses 86, 88, and 90 and cover panel 20 can be replaced to fully enclose enclosure 10.

The present invention as illustrated in the preferred embodiment provides substantial advantages in both operator and equipment safety. Since fuse drawer assembly 60 cannot be removed until all of the loadbreak connectors 40, 42, and 44 have been removed, it is impossible for the serviceman to remove fuse drawer assembly 60 while any one of the fuses 86, 88, and 90 are carrying electrical current. Thus, possible damage to the euqipment from electrical arcs or danger to the serviceman are eliminated. Further, as was pointed out above, since fuse drawer assembly cannot be reinserted into enclosure 10 when any of the loadbreak connectors 40, 42, and 44 are connected to the frustrum contacts 36, it is impossible for the serviceman to inadvertently replace one of the loadbreak connectors and thereby cause a pre-strike arc as the ends of the fuses 86, 88, and 90 approach female receptacles 32. Consequently, the possibility of equipment damage or serviceman injury is substantially eliminated.

It should also be further understood that various changes, modifications, and variations in the structure and function of the present invention may be affected without departing from the spirit and scope of the present invention as defined in the appended claims.

I claim:

1. In a high voltage switchgear assembly, the assembly comprising a fuse drawer mounted for reciprocal movement between an open position and a closed position, a fuse mounting affixed to the drawer and connected to an electrical power source, a fuse mounted on the fuse mounting, a fuse contact mounted in alignment with the drawer being adapted to receive and make electrical contact with the fuse when the drawer is moved to its closed position and electrically disconnected the fuse when the drawer is moved to its open position, a loadbreak connector electrically connected to the fuse contact and to an electrical load, the loadbreak connector being adapted to be disconnected from the fuse contact to break electrical contact with the fuse contact, a fuse drawer locking mechanism comprising:

blocking means for engaging thee loadbreak connector when the loadbreak connector is connected to the fuse contact so that said blocking means moves to a first position, and for disengaging the loadbreak connector when the loadbreak connector is disconnected from the fuse contact so that said blocking means moves to a second position; and

lock means operably connected to said blocking means so that said lock means engages the fuse drawer to prevent reciprocal movement of the fuse drawer when said blocking means is in its first position, and so that said lock means disengages the fuse drawer to permit reciprocal movement of the fuse drawer when the loadbreak connector is disconnected from the fuse contact,

whereby the fuse drawer is prevented from being moved from its closed position to its open position and from its open position to its closed position until the loadbreak connector is disconnected from the fuse contact.

2. A fuse drawer locking mechanism as claimed in claim 1 wherein said blocking means comprises

a first pivotably mounted shaft;

a blocking lever mounted on the first shaft and being adapted to engage the loadbreak connector when the loadbreak connector is connected to the fuse contact so that said blocking lever and said first shaft are pivoted to a first position, and to disengage the loadbreak connector when the loadbreak connector is disconnected from the fuse contact so that said blocking lever and said first shaft are pivoted to a second position;

a second pivotably mounted shaft; and

interconnecting means operably interconnecting said first and second shafts so that said second shaft is moved to a first positon when said first shaft is moved to its first position and so that said second shaft is moved to a second position whe said first shaft is moved to its second position.

3. A fuse drawer locking mechanism as claimed in claim 2 wherein said lock means comprises:

cam means mounted on said second shaft and being adapted to engage the fuse drawer to prevent reciprocal movement of the fuse drawer when said second shaft is in its first position and to disengage the

fuse drawer to permit reciprocal movement of the fuse drawer when said second shaft is in its second position.

4. A fuse drawer locking mechanism as claimed in claim 3 further comprising a multiplicity of abutments mounted on the fuse drawer and wherein said cam means comprises a multiplicity of engaging cams mounted along the length of said second shaft, said cams being positioned to engage one or more of said abutments when said second shaft is in its first position.

5. A fuse drawer locking mechanism as claimed in claim 2 wherein said interconnecting means comprises:

a first lever mounted at a first end on said first shaft;

a second lever mounted at a first end on said second shaft;

a linkage member connecting the second ends of said first and second levers.

* * * * *