

DESCRIPTION

SWITCHBOARD

5 TECHNICAL FIELD

[0001] The present invention relates to a switchboard, and particularly to a switchboard that is favourable for the application to a structure which opens/closes connection between a power supply side isolating portion,
10 a load side isolating portion and a moving equipment by moving the moving equipment (or a drawer type equipment) in the switchboard.

BACKGROUND OF THE INVENTION

[0002] In the switchboard used for a high voltage
15 receiving and distributing system, a moving equipment provided with a switch such as a circuit breaker is formed as a unit, and a manner of storage which stacks one unit or multi-units and stores it or them in the switchboard, is employed. In such switchboard, by moving the moving
20 equipment in a depth direction of the switchboard between an operating position and an isolating position, the connection between the power supply side isolating portion, the load side isolating portion and the moving equipment is opened/closed.

25 [0003] Here, a Patent Document 1 discloses a manner that provides, in the switchboard, a shutter mechanism that prevents the power supply side isolating portion and the load side isolating portion from being exposed when the moving equipment is drawn. In addition, the power supply
30 side isolating portion and the load side isolating portion

are shielded by different shutters. And a wheel guide for guiding the moving equipment when pushing the moving equipment into a unit room is provided on a bottom plate of the switchboard and disposed independently of a driving plate that drives the shutter. Further, a protrusion
5 called "striker" for pushing the driving plate driving the shutter is formed in the moving equipment.

[0004] By pushing the moving equipment into the unit room, the driving plate is pushed by the striker, and the shutter
10 is driven through the driving plate, then the shutter is opened and the power supply side isolating portion and the load side isolating portion are exposed.

Patent Document 1: Japanese Patent Application Kokai Publication No. 6-253424

15 **SUMMARY OF THE INVENTION**

[0005] In the conventional switchboard, however, the power supply side isolating portion and the load side isolating portion are shielded by the different shutters, and the switchboard requires a space for moving these
20 shutters. Thus, there is a need to increase a clearance between the power supply side isolating portion and the load side isolating portion. And a space for arranging the mechanism that drives the shutter is also needed. For this reason, there arises a problem that the
25 switchboard becomes large and a cost of the switchboard rises because of increase of adjustment work and increase in the number of parts.

It is therefore an object of the present invention to provide a switchboard that is capable of realizing a

compact and low-cost switchboard while taking account of safety.

[0006] In order to solve the above problem, according to claim 1, a switchboard comprises: a bushing which holds
5 a power supply side isolating portion and a load side isolating portion while insulating the power supply side isolating portion and the load side isolating portion; a moving equipment which forms connections between the power supply side isolating portion and a power supply
10 side contact terminal and between the load side isolating portion and a load side contact terminal by establishing respective contacts between the power supply side isolating portion and the power supply side contact terminal and between the load side isolating portion and
15 the load side contact terminal; a unit room in which the moving equipment is stored; a shutter plate which shields the power supply side isolating portion and the load side isolating portion together with the bushing when the moving equipment is positioned in an isolating position,
20 and exposes the power supply side isolating portion and the load side isolating portion also partitions the unit room together with the bushing when the moving equipment is positioned in an operating position; and a driving plate which shields the power supply side isolating
25 portion and the load side isolating portion together with the bushing by raising the shutter plate when the moving equipment is positioned in the isolating position, and exposes the power supply side isolating portion and the load side isolating portion also partitions the unit room
30 together with the bushing by lowering the shutter plate

when the moving equipment is positioned in the operating position.

[0007] With this, by using one shutter plate, it becomes possible to partition the unit room together with the
5 bushing. And also by driving the shutter plate through the driving plate, it is possible to shield and expose the power supply side isolating portion and the load side isolating portion while allowing an overlapping arrangement of the bushing and the shutter plate. Hence,
10 the mechanism that drives the shutter plate can be simplified, and a size of the bushing can be shortened, also the space for moving the shutter can be reduced, then it is possible to realize the compact and low-cost switchboard while taking account of safety.

15 [0008] According to the switchboard of claim 2, an opening for exposing the load side isolating portion is formed on the shutter plate, a cutout portion for exposing the power supply side isolating portion is formed in the bushing, and when the moving equipment is positioned in
20 the isolating position, the opening overlaps the bushing and thereby closing the opening by the bushing, and the cutout portion overlaps the shutter plate and thereby covering the cutout portion by the shutter plate, and when the moving equipment is positioned in the operating
25 position, the opening shifts to a lower position than the bushing and thereby exposing the load side isolating portion via the opening, and an upper edge portion of the shutter plate shifts to a lower position than the cutout portion and thereby exposing the power supply side
30 isolating portion via the cutout portion.

With this, by using one shutter plate, it becomes possible to partition the unit room together with the bushing. And also by moving the shutter plate upwards and downwards through the driving plate, it is possible to shield and
5 expose the power supply side isolating portion and the load side isolating portion, and it is possible to realize the compact and low-cost switchboard while taking account of safety.

[0009] According to the switchboard of claim 3, the
10 driving plate is configured so that the moving equipment can be mounted onto the driving plate, and a front side of the driving plate is supported so that the moving equipment can be mounted onto the driving plate, and a back side of the driving plate is raised by a spring so
15 that the shutter plate moves upwards when the moving equipment is positioned in the isolating position.

With this, it becomes possible to change a slope of the driving plate with the movement of the moving equipment, and thereby driving the shutter plate upwards and
20 downwards without requiring a sophisticated mechanism for driving the shutter plate.

[0010] According to the switchboard of claim 4, a lower edge portion of the shutter plate and an edge portion of the back side of the driving plate are connected with
25 each other so that the shutter plate can move up and down with a change of slope of the driving plate.

With this, it becomes possible to drive the shutter plate upwards and downwards with the change of the slope of the driving plate without increasing the number of the

parts, and the mechanism for driving the shutter plate can be simplified.

[0011] According to the switchboard of claim 5, wheel guides that guide the moving equipment along a moving
5 direction of the moving equipment are formed at both side ends of the driving plate.

With this, it becomes possible to correctly guide the moving equipment to the isolating position and the operating position and to eliminate the need to provide
10 the wheel guide on the bottom plate. Further, the wheel guide also serves to reinforce the driving plate. Consequently, the workability of assembly can be improved and the number of the parts can also be reduced, then it is possible to realize the compact and low-cost
15 switchboard.

[0012] As explained above, according to the present invention, it becomes possible to partition the unit room by the shutter plate, and possible to shield and expose the power supply side isolating portion and the load side
20 isolating portion while allowing the overlapping arrangement of the bushing and the shutter plate. It is therefore possible to realize the compact and low-cost switchboard while taking account of safety.

BRIEF DESCRIPTION OF THE DRAWINGS

25 [0013]

[Fig.1] is a sectional view showing a schematic system diagram of a switchboard before moving a moving equipment that is installed in the switchboard to an operating position, according to one embodiment of the present
30 invention.

[Fig.2] is a sectional view showing the schematic system diagram of the switchboard when the moving equipment installed in the switchboard of Fig. 1 is moved to the operating position.

5 [Fig.3] is a perspective view showing an arrangement state of a shutter plate and a driving plate before moving the moving equipment installed in the switchboard of Fig. 1 to the operating position.

[Fig.4] is a perspective view showing the arrangement
10 state of the shutter plate and the driving plate when the moving equipment installed in the switchboard of Fig. 1 is moved to the operating position.

[Fig.5] is a perspective view schematically showing a configuration of the moving equipment installed in the
15 switchboard of Fig. 1.

BEST MODE FOR CARRYING OUT THE INVENTION

[0014] A switchboard according to the present invention will be explained below with reference to drawings.

Fig.1 is a sectional view showing a schematic system
20 diagram of the switchboard before moving a moving equipment that is installed in the switchboard to an operating position, according to one embodiment of the present invention. Fig.2 is a sectional view showing the schematic system diagram of the switchboard when the
25 moving equipment installed in the switchboard of Fig. 1 is moved to the operating position. Fig.3 is a perspective view showing an arrangement state of a shutter plate and a driving plate before moving the moving equipment installed in the switchboard of Fig. 1 to the
30 operating position. Fig.4 is a perspective view showing

the arrangement state of the shutter plate and the driving plate when the moving equipment installed in the switchboard of Fig. 1 is moved to the operating position. Fig.5 is a perspective view schematically showing a configuration of the moving equipment installed in the switchboard of Fig. 1.

[0015] In Fig. 1 to Fig. 5, the switchboard is provided with a unit room 10 that stores a moving equipment 21. The moving equipment 21 is formed as a unit, and is stored in the unit room 10 with one unit or multi-units stacked. Here, an upward and downward direction of the unit room 10 is partitioned by a unit table 11, and the moving equipment 21 is held on the unit table 11.

Further, a driving plate 16 which is configured so that the moving equipment 21 can be mounted onto the driving plate 16 is provided above the unit table 11. A front side of the driving plate 16 is supported by a supporting portion 18 so that the moving equipment 21 can be mounted onto the driving plate 16. A back side of the driving plate 16 is supported by a spring 17 that moves an edge portion of the back side of the driving plate 16 up and down. Here, the supporting portion 18 allows the driving plate 16 to slope while restraining the front side of the driving plate 16 from moving upwards. For instance, the front side of the driving plate 16 could be secured by a screw having looseness.

[0016] Furthermore, as shown in Figs. 3 and 4, wheel guides 16a that guide the moving equipment 21 along a moving direction of the moving equipment 21, are formed at both side ends of the driving plate 16. The wheel guide 16a

guides a wheel 26 of the moving equipment 21, and could have an L-shaped or]-shaped (shape of Japanese letter "コ") cross section to reinforce the driving plate 16.

At a back of the unit room 10, a power supply side isolating portion 12 that forms an isolating part on a power supply side or a busbar side and a load side isolating portion 13 that forms an isolating part on a load side, are provided. The power supply side isolating portion 12 and the load side isolating portion 13 are held while being insulated by a bushing 14. Here, the bushing 14 is formed so that a lower side of the unit room 10 is open and the load side isolating portion 13 is exposed. Further, the bushing 14 is provided with a cutout portion 15 that exposes the power supply side isolating portion 12.

[0017] In addition, at the back of the unit room 10, a shutter plate 19 which shields the power supply side isolating portion 12 and the load side isolating portion 13 exposed through the bushing 14 and partitions the unit room 10 together with the bushing 14, is provided. The shutter plate 19 is supported so as to be able to move up and down with the shutter plate 19 and the bushing 14 overlapping. A lower edge portion of the shutter plate 19 is connected with the edge portion of the back side of the driving plate 16, then the shutter plate 19 can move up and down with a change of the slope of the driving plate 16. On the shutter plate 19, an opening 20 for exposing the load side isolating portion 13 is formed.

[0018] Here, as shown in Figs. 1 and 3, when the moving equipment 21 is positioned in an isolating position, the shutter plate 19 can shield the power supply side isolating

portion 12 and the load side isolating portion 13 together with the bushing 14. When the moving equipment 21 is positioned in the operating position, the shutter plate 19 can expose the power supply side isolating portion 12 and the load side isolating portion 13 and also partition the unit room 10 together with the bushing 14.

Further, when the moving equipment 21 is positioned in the isolating position, the driving plate 16 can shield the power supply side isolating portion 12 together with the bushing 14 by raising the shutter plate 19. When the moving equipment 21 is positioned in the operating position, the driving plate 16 can expose the power supply side isolating portion 12 and the load side isolating portion 13 and also partition the unit room 10 together with the bushing 14 by lowering the shutter plate 19. That is to say, by the shutter plate 19 working with this driving plate 16, the bushing 14 and the unit table 11, the unit room 10 is partitioned.

[0019] The moving equipment 21 is provided with a power supply side contact terminal 22 and a load side contact terminal 23 which form connections with the power supply side isolating portion 12 and with the load side isolating portion 13 respectively by contact with the power supply side isolating portion 12 and with the load side isolating portion 13 respectively. The power supply side contact terminal 22 and the load side contact terminal 23 are so connected to each other as to open/close by a switch 25 through a fuse 24. On a bottom surface of the moving equipment 21, the wheels 26 for moving the moving equipment 21 on the driving plate 16 are provided.

[0020] As shown in Figs. 1 and 3, in the case where the moving equipment 21 is positioned in the isolating position, the moving equipment 21 is drawn from the unit room 10 and is unloaded from the driving plate 16. That is, the load side isolating portion 13 and the load side contact terminal 23 separate, and the connection between the load side isolating portion 13 and the load side contact terminal 23 is cut off. And also the power supply side isolating portion 12 and the power supply side contact terminal 22 separate, and the connection between the power supply side isolating portion 12 and the power supply side contact terminal 22 is cut off.

[0021] When the moving equipment 21 is unloaded from the driving plate 16, the edge portion of the back side of the driving plate 16 is raised by the spring 17, and the shutter plate 19 moves upwards with increase in the slope of the driving plate 16. With this mechanism, the opening 20 of the shutter plate 19 shifts to a position where the opening 20 overlaps the bushing 14, and the shutter plate 19 shifts to a position where the shutter plate 19 overlaps the cutout portion 15 of the bushing 14, then the power supply side isolating portion 12 and the load side isolating portion 13 are shielded by the shutter plate 19.

And when moving the moving equipment 21 to the operating position, the moving equipment 21 is moved and mounted onto the driving plate 16 while the wheel 26 of the moving equipment 21 being guided by the wheel guide 16a, and the moving equipment 21 is pushed into the unit room 10.

[0022] And as shown in Figs. 2 and 4, when the moving equipment 21 is moved to the operating position, the spring 17 is pressed by weight of the moving equipment 21, and the slope of the driving plate 16 decreases. Then the shutter plate 19 moves downwards with decrease in the slope of the driving plate 16. With this mechanism, the opening 20 of the shutter plate 19 shifts to a position where the opening 20 does not overlap the bushing 14, and the shutter plate 19 shifts to a position where the shutter plate 19 does not overlap at least a part of the cutout portion 15 of the bushing 14, then the power supply side isolating portion 12 is exposed through the shutter plate 19 via the cutout portion 15 and also the load side isolating portion 13 is exposed through the shutter plate 19 via the opening 20.

And by establishing the contact between the load side isolating portion 13 and the load side contact terminal 23, the connection between the load side isolating portion 13 and the load side contact terminal 23 is formed. And also by establishing the contact between the power supply side isolating portion 12 and the power supply side contact terminal 22, the connection between the contact between the power supply side isolating portion 12 and the power supply side contact terminal 22 is formed.

[0023] With this, by using one shutter plate 19, it becomes possible to partition the unit room 10 together with the bushing 14. And also by driving the shutter plate 19 through the driving plate 16, it is possible to shield and expose the power supply side isolating portion 12 and the load side isolating portion 13 while allowing

the overlapping arrangement of the bushing 14 and the shutter plate 19. Hence, the mechanism that drives the shutter plate 19 can be simplified, and the size of the bushing 14 can be shortened, also the space for moving
5 the shutter plate 19 can be reduced, then it is possible to realize the compact and low-cost switchboard while taking account of safety.

[0024] Further, by forming the wheel guides 16a at both side ends of the driving plate 16, it becomes possible
10 to correctly guide the moving equipment 21 to the isolating position and the operating position and to eliminate the need to provide the wheel guide 16a on the unit table 11. Further, the wheel guide 16a also serves to reinforce the driving plate 16. Consequently, the workability of
15 assembly can be improved and the number of the parts can also be reduced, then it is possible to realize the compact and low-cost switchboard.

[0025] Here, in the above embodiment, since the power supply side contact terminal 22 and the load side contact
20 terminal 23 contact the power supply side isolating portion 12 and the load side isolating portion 13 respectively, the manner that employs the moving equipment 21 provided with the switch 25 has been explained. However, the moving equipments other than the moving equipment
25 21 could be used.

In addition, in the above embodiment, although the manner that partitions the unit room 10 by one shutter plate 19 has been explained, it could be possible to partition the unit room 10 by a plurality of the shutter plates.

[0026] Furthermore, in the above embodiment, the manner that shields the both of the power supply side isolating portion 12 and the load side isolating portion 13 by the shutter plate 19 has been explained. However, when the
5 moving equipment 21 is positioned in the isolating position, it could be possible to shield only the power supply side isolating portion 12 with the proviso that no voltage is applied to the load side isolating portion 13.

10 Moreover, in the above embodiment, the manner that exposes the power supply side isolating portion 12 through the shutter plate 19 via the cutout portion 15 of the bushing 14 and exposes the load side isolating portion 13 through the shutter plate 19 via the opening 20 has
15 been explained. However, it could be possible that the load side isolating portion 13 is exposed through the shutter plate 19 via the cutout portion 15 of the bushing 14 and the power supply side isolating portion 12 is exposed through the shutter plate 19 via the opening 20. For
20 example, a relationship of the arrangement; the bushing 14 located on an upper side and the shutter plate 19 located on a lower side, could be reversed. Or the arrangement of right and left positions of the power supply side isolating portion 12 and the load side isolating portion
25 13 could be reversed.

CLAIMS

1. A switchboard comprising:
 - a bushing which holds a power supply side isolating portion and a load side isolating portion while
5 insulating the power supply side isolating portion and the load side isolating portion;
 - a moving equipment which forms connections between the power supply side isolating portion and a power supply side contact terminal and between the load
10 side isolating portion and a load side contact terminal by establishing respective contacts between the power supply side isolating portion and the power supply side contact terminal and between the load side isolating portion and the
15 load side contact terminal;
 - a unit room in which the moving equipment is stored;
 - a shutter plate which shields the power supply side isolating portion and the load side isolating portion together with the bushing when the moving
20 equipment is positioned in an isolating position, and exposes the power supply side isolating portion and the load side isolating portion also partitions the unit room together with the bushing when the moving equipment is positioned in an
25 operating position; and
 - a driving plate which shields the power supply side isolating portion and the load side isolating portion together with the bushing by raising the shutter plate when the moving equipment is
30 positioned in the isolating position, and exposes

the power supply side isolating portion and the load side isolating portion also partitions the unit room together with the bushing by lowering the shutter plate when the moving equipment is positioned in the operating position.

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2. The switchboard as claimed in claim 1, wherein:
an opening for exposing the load side isolating portion is formed on the shutter plate,
10 a cutout portion for exposing the power supply side isolating portion is formed in the bushing, and when the moving equipment is positioned in the isolating position, the opening overlaps the bushing and thereby closing the opening by the bushing, and the cutout portion overlaps the shutter plate and thereby covering the cutout portion by the shutter plate, and
15 when the moving equipment is positioned in the operating position, the opening shifts to a lower position than the bushing and thereby exposing the load side isolating portion via the opening,
20 and an upper edge portion of the shutter plate shifts to a lower position than the cutout portion and thereby exposing the power supply side isolating portion via the cutout portion.

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3. The switchboard as claimed in claim 1 or 2, wherein:
the driving plate is configured so that the moving equipment can be mounted onto the driving plate,
30 and a front side of the driving plate is supported

so that the moving equipment can be mounted onto the driving plate, and a back side of the driving plate is raised by a spring so that the shutter plate moves upwards when the moving equipment is
5 positioned in the isolating position.

4. The switchboard as claimed in any one of the preceding claims 1 to 3, wherein:
10 a lower edge portion of the shutter plate and an edge portion of the back side of the driving plate are connected with each other so that the shutter plate can move up and down with a change of slope of the driving plate.

15 5. The switchboard as claimed in any one of the preceding claims 1 to 4, wherein:
wheel guides that guide the moving equipment along a moving direction of the moving equipment are formed at both side ends of the driving plate.