A quick release explosion port cover for an electrical switchboard

Title

International Patent Classification(s)

H02B 1/44 (2006.01)

Application No: 2005220259

Date of Filing: 2005.10.10

Priority Data

Number 2004905865

Date 2004.10.11

Country AU

Publication Date: 2006.04.27

Publication Journal Date: 2006.04.27

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ABSTRACT

A cover for an outlet opening (3) in a wall of a cell located in an electrical switchboard, the outlet opening (3) being for the discharge of gases from an interior of the cell during an explosion. The cover includes a metal mesh (13) and a retaining plate (15). The retaining plate (15) is attached to a portion of the cell wall adjacent to the outlet opening (3). An upper portion (23) of the mesh (13) is sandwiched between the wall of the cell and an upper portion (25) of the retaining plate (15) with the side edges (23) and bottom edges (29) of the mesh (13) being slightly spaced from the corresponding side and bottom edges of the outlet opening (3). In response to forces generated by an explosion within the cell, at least a portion of the mesh (13) separates from the retaining plate (15) to thereby assist the discharge of gases generated by the explosion from the interior of the cell through the outlet opening (3).
FIGURE 1
Invention Title: A quick release explosion port cover for an electrical switchboard

The following statement is a full description of this invention, including the best method of performing it known to us:
A QUICK RELEASE EXPLOSION PORT COVER FOR AN ELECTRICAL
SWITCHBOARD

FIELD OF THE INVENTION

The present invention relates to a quick release explosion port for an electrical switchboard. More particularly, the present invention relates to a cover for an explosion discharge port in a cell of an electrical switchboard.

BACKGROUND OF THE INVENTION

Electrical switchboards are used to distribute and control electrical energy to various groups of equipment in an electrical installation. An explosion protected electrical switchboard typically includes a plurality of segregated cabinet-like cells which each house various switching and control equipment such as circuit breakers, contactors and relays. In addition, switchboards usually have some form of ventilation/explosion discharge duct located behind the cells to which each cell is connected via a discharge port in a rear wall of each cell. The discharge port is an outlet opening in the rear wall of a cell. The duct extends to an associated chimney and provides a means for ventilating each cell. Further, if an explosion occurs within a cell, the discharge port, the duct and associated chimney provides a path for the explosive gases generated to escape from the switchboard into the surrounding atmosphere.

An explosion within a cell of an electrical switchboard can occur for a variety of reasons. For example, in the event of the equipment within a cell malfunctioning or the ingress of foreign particles, a short circuit may occur, causing sparks and/or conductive materials contained within the cell to heat to the point where they react with the surrounding air. This can result in the insulating material surrounding the conductive material burning and the occurrence of an explosion.

A problem associated with prior electrical switchboards is that if an explosion does occur within a cell the gases generated are not able to escape from the cell via the outlet opening in the wall quickly enough. Hence the forces generated by the explosion increases pressure in the interior of the cell with the resulting outcome in some instances being the forceful opening of the front door of the cell. Accordingly, any person standing at the front of the electrical switchboard will be directly impacted by the force of the explosion which may lead...
to serious injury or even death. Whilst strengthened cell doors and heavy duty locking mechanisms can be utilised to assist in preventing the forceful opening of cell doors, and thereby protect nearby persons from injury, the cost of manufacturing such cells is significant.

In the past, attempts have been made to alleviate this problem by making the outlet opening at the rear of each cell bigger, such that the gases generated in the event of an explosion can more easily escape to the duct and associated chimney located at the rear of the cells. However, the problem with increasing the size of the outlet opening in each cell is that the gases generated in an explosion in one cell are more easily able to enter the outlet openings of neighbouring cells via the duct. Consequently, neighbouring cells and the equipment contained therein is also effected by the explosion.

Another way to alleviate the problem is to increase the volume of each cell such that the forces generated by an explosion can be readily absorbed by the cell without exceeding the cells design limits. However, increasing the volume of the cells increases manufacturing costs. Further, the overall size of the electrical switchboard becomes larger and consequently more floor space is occupied by the switchboard.

It would be desirable to permit the gases generated by an explosion in one cell to readily escape the cell whilst at the same time minimising the likelihood of the gases entering neighbouring cells.

Any discussion of documents, devices, acts or knowledge in this specification is included to explain the context of the invention. It should not be taken as an admission that any of the material formed part of the prior art base or the common general knowledge in the relevant art in Australia or elsewhere on or before the priority date of the claims herein.

**SUMMARY OF THE INVENTION**

In accordance with the present invention there is provided a cover for an outlet opening in a wall of a cell located in an electrical switchboard. The outlet opening is for the discharge of gases from within the cell during an explosion. The cover includes a releasable member and a retaining member. The retaining member is configured to attach to a portion of the cell wall adjacent to the outlet opening. The releasable member is secured to the retaining member such that,
in response to forces generated by an explosion within the cell, at least a portion of the releasable member separates from the retaining member to thereby assist the discharge of gases generated by the explosion from the interior of the cell through the outlet opening.

The retaining member may extend around the entire periphery of the outlet opening and may be configured to be secured to the wall on an interior side of the cell. In this regard, the retaining member can be secured to the wall by one or more threaded fasteners. The releasable member is preferably secured to the retaining member via at least one frangible fastener. In a particularly preferred embodiment, the frangible fasteners are plastic screws.

Preferably the outlet opening is located in a vertical wall of the cell and the retaining member extends around the entire periphery of the releasable member. Further, an upper portion of the releasable member may be sandwiched between an interior portion of the cell wall adjacent to an upper portion of the outlet opening and an upper portion of the retaining member. In the event of an explosion within the cell, a lower portion of the releasable member may separate from the retaining member before the upper portion. Further, the releasable member may completely separate from the retaining member and enter a duct located behind of the cell. In this regard, the releasable member is prevented from movement towards the interior of the cell by the engagement of an outer periphery of the releasable member with the retaining member. Further, the outer periphery of the releasable member may overlap with the retaining member.

In a particularly preferred embodiment, the releasable and retaining members are both planar with the releasable member being a metal mesh. The retaining member is preferably a metal retaining plate having a series of holes which correspond with a series of holes in the wall of the cell around the periphery of the outlet opening. The threaded fasteners can be located through the series of holes to secure the retaining plate to the wall of the cell. The releasable member may also have a series of mounting holes which correspond with mounting holes in the retaining plate. The plastic screws can be located through the mounting holes to secure the releasable member to the retaining plate.
BRIEF DESCRIPTION OF THE DRAWINGS

Further benefits and advantages of the present invention will become apparent from the following description of a preferred embodiment of the invention. The preferred embodiment should not be considered as limiting any of the statements in the previous section. The preferred embodiment will be described with reference to the following Figures in which:

Figure 1 is a perspective view of an electrical switchboard with two cells each having an outlet opening for ventilation and the discharge of gas from within the cell during an explosion, in accordance with the prior art.

Figure 2 is a perspective view of the cover according to an embodiment of the invention mounted on the outlet opening in the interior rear wall of a cell of the type shown in Figure 1.

Figure 3 is a perspective view of the cover of Figure 2 viewed from the exterior of the cell.

Figure 3A is a section view along line A-A of Figure 2 showing in dotted lines the releasable member of the cover partially separated from the retaining plate following an explosion within the cell.

Figure 4 is a front view of the releasable member of the cover according to an embodiment of the invention.

Figure 5 is a front view of the retaining member of the cover according to an embodiment of the invention.

Figure 6 is a front view of the releasable member attached to the retaining member according to an embodiment of the invention.

DESCRIPTION OF PREFERRED EMBODIMENT

With reference to the accompanying drawings there is shown a cover 1 for covering an outlet opening 3 in a wall 5 of a cell 7 in an electrical switchboard 9. The switchboard 9 typically includes a plurality of cells 7 which each house various switching and control equipment such as circuit breakers, contactors and relays (not shown in the drawings). In addition, the switchboard 9 usually has a duct and associated chimney (not shown in the drawings) provided behind the cells 7, to which each cell 7 is connected via the outlet opening 3 in the wall 5 of the cell 7.
The cover 1 includes a releasable member and a retaining member. The retaining member is preferably in the form of a metal retaining plate 15 which has a central opening 19 which is slightly smaller than the outlet opening 3. The releasable member is preferably in the form of a metal mesh 13 which is sized to completely cover the central opening 19 in the retaining plate 15.

The cover 1 is preferably attached to the wall 5 of the cell 7 by a plurality of threaded fasteners which are preferably in the form of metal screws 17. The metal screws 17 secure the retaining plate 15 of the cover 1 to a portion of the wall 5 of the cell 7 which is adjacent to the outlet opening 3. The metal screws 17 are inserted through a series of holes 16 in the retaining plate 15 and corresponding series of holes in the wall 5 of the cell 7. The metal screws 17 are preferably maintained in place by engaging with a corresponding screw holder 18. The retaining plate 15 is secured to the wall 5 on an interior side of the cell 7, as depicted in Figure 2.

The metal mesh 13 is secured to the retaining plate 15 by frangible fasteners which are preferably in the form of plastic screws 21. In this regard, the plastic screws 21 are inserted through a series of holes 20 provided in both the retaining plate 15 and the mesh 13 and retained in place by metal bushes 22.

As can be best seen from figures 2 and 3, the retaining plate 15 is secured to the wall 5 by metal screws 17 inserted from the interior side of the cell 7, whereas the mesh 13 is secured to the retaining plate 15 via plastic screws 21 inserted from the exterior side of the cell 7. In addition, with particular reference to Figures 3 and 3A, an upper portion 23 of the mesh 13 is sandwiched between the wall 5 of the cell 7 and an upper portion 25 of the retaining plate 15. In an alternative embodiment, the upper portion 23 of the mesh 13 can be hinged to the upper portion 25 of the retaining plate 15.

As is best shown in figure 3, the mesh 13 is sized such that the side edges 27 and bottom edge 29 of the mesh 13 are slightly spaced from the corresponding side and bottom edges of the outlet opening 3. This arrangement ensures that in the event of an explosion occurring within the cell 7, the mesh 13 will be able to move without being impinged by the side and bottom edges of the outlet opening 3.
Depending upon the force generated in the event of an explosion, one or more of the plastic screws 21 may break or be ripped away from the retaining plate 15 or mesh 13. Due to the upper portion 23 of the mesh 13 being sandwiched between the wall 5 of the cell 7 and the retaining plate 15, the lower portion of the mesh 13 will in most instances move towards the duct and away from the interior of the cell 7, as shown in dotted lines in Figure 3A, prior to the upper portion 23 of the mesh 13 being released. In extreme cases the forces generated by the explosion will completely remove the mesh 13 from the retaining plate 15 such that the central opening 19 in the retaining plate 15 becomes clear of obstruction.

As the mesh 13 is prevented from moving in a direction toward the interior of the cell 7 by the engagement of the mesh 13 with the retaining plate 15, the gases generated during an explosion are not able to readily force entry to cells adjoining the cell in which the explosion occurs. Accordingly, the various switching and control equipment located in adjoining cells is protected from the gases generated by the explosion due to the retention of the mesh 13 against the retaining plate 15. In addition, harmful ionized gases generated by the explosion in the adjoining cell are attracted to the mesh 15 due to its metallic properties, thereby reducing the likelihood of ionized gases entering the adjoining cells through the openings in the mesh 13. In this regard, the openings in the mesh 13 are preferably each approximately 0.5mm in diameter and spaced approximately 0.3mm apart over the entire surface of the mesh 13.

Whilst the releasable member is preferably in the form of a mesh 13 to allow some ventilation to the cell 7 during normal operation of the switchboard, in an alternative form of the releasable member a solid metal plate may be utilised.

The cover according to the present invention ensures that in the event of an explosion within a cell, the need to discharge the gases effectively is balanced against the requirement of ensuring that gas is not able to enter adjoining cells. Further, the ability of the mesh 13 to partially or completely separate from the retaining plate 15 and allow the gases to escape the cell 7 is achieved without sacrificing the ingress protection rating of the cell 7. Further, as the forces generated by the explosion within the cell 7 are able to be discharged quickly and effectively, a much smaller cell volume can be utilised. In addition, the door 31 of
the cell 7 does not require excessive strengthening as the forces generated by
the explosion are quickly and effectively dissipated by the discharge of gases
through the central opening 19 of the retaining plate 15.

As cells 7 which utilise the present invention can be smaller than
conventional cells, the length of bus-bars used in the electrical switchboard 9, and
associated energy losses, is reduced. Accordingly, the cover according to the
present invention results in a distinct cost reduction in manufacturing.

As the present invention may be embodied in several forms without
departing from the essential characteristics of the invention, it should be
understood that the above described embodiment should not be considered to
limit the present invention but rather should be construed broadly. Various
modifications and equivalent arrangements are intended to be included within the
spirit and scope of the invention.
THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A cover for an outlet opening in a wall of a cell located in an electrical switchboard, the outlet opening being for the discharge of gases from an interior of the cell during an explosion, the cover including a releasable member and a retaining member, the retaining member being configured to attach to a portion of the cell wall adjacent to the outlet opening, the releasable member being secured to the retaining member such that, in response to forces generated by an explosion within the cell, at least a portion of the releasable member separates from the retaining member to thereby assist the discharge of gases generated by the explosion from the interior of the cell through the outlet opening.

2. A cover as claimed in claim 1 wherein the releasable member is secured to the retaining member via at least one frangible fastener.

3. A cover as claimed in claim 1 or 2, wherein the retaining member extends around the entire periphery of the outlet opening.

4. A cover as claimed in claim 3, wherein the retaining member is configured to be secured to the wall on an interior side of the cell.

5. A cover as claimed in claim 4, wherein the retaining member is secured to the wall by one or more threaded fasteners.

6. A cover as claimed in any one of the preceding claims wherein the retaining member extends around an entire periphery of the releasable member.

7. A cover as claimed in any one of the preceding claims wherein the outlet opening is in a vertical wall of the cell.

8. A cover as claimed in claim 7 wherein an upper portion of the releasable member is configured to be sandwiched between an interior portion of the cell wall adjacent to an upper portion of the outlet opening and an upper portion of the retaining member.
9. A cover as claimed in claim 7 or 8 wherein in the event of an explosion within the cell, a lower portion of the releasable member separates from the retaining member before an upper portion.

10. A cover as claimed in claim 9 wherein the releasable member completely separates from the retaining member and enters a duct located behind the cell.

11. A cover as claimed in any one of the preceding claims wherein the releasable member is planar.

12. A cover as claimed in any one of the preceding claims wherein the retaining member is planar.

13. A cover as claimed in claim 2 wherein the at least one frangible fastener includes one or more plastic screws.

14. A cover as claimed in any one of the preceding claims wherein the release member is prevented from movement towards the interior of the cell by the engagement of an outer periphery of the releasable member with the retaining member.

15. A cover as claimed in claim 14 wherein the outer periphery of the releasable member overlaps with the retaining member.

16. A cover as claimed in any one of the preceding claims wherein the releasable member is a metal mesh.

17. A cover as claimed in any one of the preceding claims wherein the retaining member is a metal retaining plate.

18. A cell of an electrical switchboard, the cell having an outlet opening in a wall of the cell which is covered with a cover as claimed in any one of the preceding claims.
19. A cover substantially as hereinbefore described with reference to Figures 2 to 6 of the accompanying drawings.

DATED this 10th day of October 2005

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FIGURE 3