

FIRE RATED GLASS DOOR

INTRODUCTION

5

This invention relates to a barrier assembly for location in an opening in a structure. The barrier assembly is intend for use in a window or door opening and it will be convenient to hereinafter describe the invention in relation to this particular use. It should be appreciated however that the
10 invention has wider application beyond its use in window or door openings.

BACKGROUND

Prior barrier assemblies have generally included a timber frame means
15 around the perimeter of the opening surrounding a panel member such as a window sash or door leaf. This type of barrier assembly has become financially unpopular as the cost of timber and the cost of working with timber has increased. Instead metals such as steel and aluminium have replaced timber as the preferred material for the framing means, and metal/glass
20 composite constructions are the preferred materials for the panel member. Metal is preferred as it is durable and, in relation to aluminium, easy to extrude into the required shape. Furthermore metal is less likely to combust when exposed to fire, which facilitates obtaining a fire rating for the barrier assembly. Glass has become popular for aesthetic reasons.

25

Unfortunately metal has a greater coefficient of expansion than timber which causes the components of the barrier assembly to expand when exposed to extreme heat. Where the expansion is irregularly retarded the elements of the barrier assembly can bend and buckle, which can lead to the
30 development of gaps around the barrier assembly. The gaps may in turn permit the passage of smoke and flame passed the barrier assembly causing the barrier assembly to fail as a barrier to the fire. Where the panel member

includes a glass component, bending of the barrier assembly may cause the glass to crack and again fail as a barrier.

A further problem specific to barrier assemblies having a movable panel member is that to restrict the passage of fire the framing means generally include a lip extending around the frame for engaging the peripheral edge of the panel member such as a window sash or door leaf. This restricts the movement of the door leaf or window sash to one direction out of the plane of the frame. This can limit the potential use of the door as it can restrict the flow of traffic through the opening.

A prior barrier assembly is described in US patent 4281481, which includes framing means in the form of metal header and jamb members for location around the perimeter of an opening in a structure. The framing means is fixed to the structure using screws. The header and jamb members each include a lip element to be engaged by the panel member when in a close position. This restricts movement of the panel member to one direction only, namely away from the lip element. The structure includes expansion cavities at either side of the header to allow expansion of the jambs, and to a lesser degree the header, when the barrier assembly is exposed to extreme heat. The patent does not describe the panel member, more specifically the door panel, as being formed from a material, which would expand when exposed to heat. Furthermore the framing means of the barrier assembly could not accommodate expansion of the panel member. Therefore should a barrier assembly be formed according to the US patent with a metal or metal/glass composite panel member, the panel member would buckle, with the glass possibly cracking, and fail to act as a barrier when exposed extreme heat.

It would be advantageous to produce a barrier assembly which addressed these problems.

SUMMARY OF INVENTION

It is an object of this invention to provide a barrier assembly, which can accommodate expansion of its components when subjected to heat. It is a
5 related object of this invention that the barrier assembly be designed to minimise the restricting affect it has on the flow of traffic through the barrier assembly.

According to this invention there is provided a barrier assembly for
10 location in an opening in a structure, including framing means for location adjacent the perimeter of the opening and being formed at least in part from metal, panel member locatable within the opening providing a barrier relative to the opening, the panel member being formed at least in part from metal, wherein the framing means and or panel member define a void for
15 accommodating expansion of the framing means and the panel member. It should be appreciated that where the barrier assembly is exposed to extreme heat the metal framing means and panel member will be capable of expanding into the void.

20 It is preferred that the framing means include vertical jamb members and a horizontal header member each including an intumescent seal, positioned to direct expansion of the jamb and header member towards the panel member. It is further preferred that the panel member also include a substantially planer member and having a peripheral frame formed adjacent
25 the edge of the planer member. An intumescent seal is positioned on the peripheral frame to direct expansion of the peripheral frame towards the framing means. It should be appreciated that in the event of exposure to extreme heat the panel member and framing means will expand towards each other facilitating sealing of the opening, a feature which has significance
30 should the barrier assembly be used to provide a barrier to a fire. It also negates the requirement of providing a doorstep or lip on the header and jamb members to achieve a seal in the case of a fire. This in turn permits the panel

member to move through either side of the opening through an arc of at least 180 degrees. It should be appreciated that by allowing movement of the panel member through 180 degrees this will minimise the restricting affect it has on the flow of traffic through the barrier assembly, potentially make the barrier assembly more useful and aesthetically pleasing.

It is further preferred that the jamb members, header member and peripheral frame include insulation in the form of calcium silicate board. It is further preferred that the board cover the supporting element of the jamb members, header member and peripheral frame along with the planer member. This feature facilitates protection of the components of the barrier assembly in the event of a fire. More specifically where the planer member is a glass panel the insulation protects the planer member where the heat will have its greatest effect, namely at its edges.

15

It is further preferred that the jamb members, header members and/or peripheral frame include fixed and preferably movable capping between which is defined the void. The movable capping is designed to slide relative to the fixed capping to allow the void to decrease in size.

20

It is further preferred that the jamb members, header member and peripheral frame be covered in aluminium cladding to provide an aesthetically appealing outer surface.

25

It will be convenient to hereinafter describe the invention in greater detail by reference to the accompanying drawing, which illustrate in a diagrammatic form, one embodiment of the invention. The particularity of the drawings and the detailed description is not to be understood as superseding the generality of the accompanying claims.

30

BRIEF DESCRIPTION OF DRAWINGS

Figure 1 is a front elevation of a barrier assembly according to the invention.

5

Figure 2 is a cross sectional view of a portion of the barrier assembly along the section line A-A of Figure 1.

Figure 3 is a cross sectional view of a portion of the barrier assembly along the section line B-B of Figure 1

10

Figure 4 is a cross sectional view of a portion of the barrier assembly along the section line C-C of Figure 1

Figure 5 is a cross-sectional view of a portion of the barrier assembly along the sectional line D-D of Figure 1.

15

DESCRIPTION OF THE PREFERRED EMBODIMENTS

20

Reference is first made to Figure 1, wherein the overall barrier assembly according to the present invention is shown. The barrier assembly shown is a door assembly however it should be appreciated that the barrier assembly is also applicable to fixed and movable window and wall panel assemblies. The barrier assembly shown consists of a fully glazed, steel framed, double acting, pivot hung, double leaf door-set mounted to a partition wall.

25

Each panel member or door leaf 11 consists of a fixed capping preferably in the form of rectangular hollow steel sections 32 welded together to form the peripheral frame 12. All four faces of the peripheral frame 12 at the sill edge are protected with at least one layer of insulation preferably calcium silicate board 44. Two fixing points are provided at each of the two vertical

30

edges. One fixing point is at the head of the peripheral frame 12 whilst the second is at the bottom. The panel members or door leaves 11 are fixed to the partition wall by welding the fixed capping 32 to the rectangular hollow steel section which in turn are welded to mild steel plates (not shown) fixed to the partition wall using two anchors per plate. The gap between the frame and partition wall is filled with ceramic fibre and sealed with a fillet of a sand/cement grout to each face of the partition wall. The planer member which is preferably fire glass 14 is made of suitable fire-resistant glass, such as a ceramic-based glass.

10

Each panel member or door leaf 11 is supported on a floor spring 26 cast into the partition wall sill and fitted with a stainless steel cover and bottom strap 22. A corresponding top pivot 24 is provided at the head 20 of each panel member or door leaf 11. A mortise lockset 28 is fitted in the bottom horizontal rail of each panel member or door leaf 11 near the centre of the opening. To facilitate the opening and closing of the panel members or door leaves 11, door handles 18 are provided.

The floor spring 26 and top pivot 24 co-operate to allow the panel members or door leaves 11 to pivotally swing inwards or outwards, allowing greater flexibility. Typically, the angle of swing of the panel member or door leaf 11 is 90° in either direction.

Figure 2 is a cross-sectional view of the panel member or door leaf 11 taken along the sectional line A-A in Figure 1. The top edge of the panel member or door leaf 11 and the bottom of the framing means on stiles 16 are illustrated. The front and back faces of the stiles 16 and the faces adjacent to the fire glass 14 on the panel member or door leaf 11 are protected by at least one layer of calcium silicate board 44. The outer perimeter face of the peripheral frame 12 at the head and the stiles 16 is covered with an intumescent strip 42, 46. In between the calcium silicate boards 44, there is a support element preferably a rectangular hollow steel section made of mild

30

steel 38. The calcium silicate board 44 on the fire-exposed and unexposed faces of the rectangular hollow steel support element 38 is fixed with screws 34 through the fixed capping 32.

5 At the head of the stile 16, an additional folded steel channel or movable capping 40 is press-fitted over the steel capping 32 to form a void to accommodate thermal expansion of the panel members or door leaves 11. It should be appreciated that the void may alternatively or additionally be associated with the panel member or door leaf 11. A further intumescent seal 10 42, 46 is then placed over the outer perimeter face of the capping 32, 40 and the seal 42, 46 and steel capping 32, 40 are then covered with a folded aluminium decorative cladding 30 fixed to the steel capping with a suitable adhesive.

15 Figure 3 is a cross-sectional view of the panel member or door leaf 11 taken along the sectional line B-B in Figure 1. It illustrates the bottom section of the panel member or door leaf 11. Layers of calcium silicate board 44 protect the faces adjacent to the fire glass 14. At the bottom of the peripheral frame 12, there is a layer of intumescent strip 46. In the centre of the 20 peripheral frame 12, there is a support element made of mild steel 38, followed by two layers of calcium silicate board 44 below it. The calcium silicate board 44 on both faces of the rectangular hollow section 38 is fixed with screws 34 through the fixed capping 32.

25 Again, a further intumescent seal 46 is then placed over the outer perimeter face of the capping 32 and the seal 46 and steel capping 32 are then covered with a folded aluminium decorative cladding 30 fixed to the steel capping with a suitable adhesive.

30 Figure 4 is a cross-sectional view of the panel member or door leaf 11 taken along the sectional line C-C in Figure 1. The side section of the panel member or door leaf 11 and the sides of the stiles 16 are illustrated. As the

assembly is substantially the same as the description of Figure 2, the drawing needs no further elaboration.

Figure 5 is a cross-sectional view of the panel members or door leaves 11 taken along the sectional line D-D in Figure 1. The meeting edges of the panel members or door leaves 11 at or near the centre of the opening when the door assembly 10 is closed are illustrated. The structure of each panel member or door leaf is essentially identical. Again, each panel member or door leaf has a fire glass 14. Calcium silicate board 44 surrounds the faces adjacent to each fire glass. There is a support element 38 in the centre of the peripheral frame 12 between the calcium silicate boards 44. At the outer perimeter of the peripheral frame 12 there is a layer of intumescent strip 46. The calcium silicate boards are secured to the support elements 38 by M6 screws 34 through the fixed capping 32. A further intumescent seal 46 is then placed over the outer perimeter face of the capping 32 and the intumescent seal 46 and steel capping 32 are then covered with a folded aluminium decorative cladding 30 fixed to the steel capping with a suitable adhesive.

It should be appreciated that whilst Figure 2 is the only illustration of the framing means including a void associated with the header member it should be appreciated that the jamb members and or peripheral frame may also include a void.

When the fire door assembly 10 is subjected to extreme heat, the aluminium cladding 30 and fixed capping 32 will expand. Referring to Figure 2, the panel member or door leaf 11 will eventually come into contact with the stiles 16. In the usual case, the peripheral frame 12 will start to bend and deform, eventually cracking the fire glass 14 because of the bending force. However, in the present invention, there is a hollow 43 between the fixed capping 32 and the movable capping 40, allowing the movable capping 40 to slide along the surface of the fixed capping 32. In this way, the integrity of the

structure of the panel members or door leaves 11 is maintained. Further, the calcium silicate boards 44 insulate the joints from heat damage.

5 During tests conducted on the said assembly, the fire door was subjected to a standard fire resistance test for 242 minutes at temperatures of up to 1300°C. The barrier assembly maintained its integrity for the whole duration of the test, although at the end of the test, the aluminium cladding on the fire exposed face had melted, revealing the steel capping underneath.

10 Finally it is to be understood that various alterations, modifications an/or additions may be introduced to the invention without departing from the spirit or ambit of the invention as defined by the accompanying claims.

Claims:

1. A barrier assembly for location in an opening in a structure, including framing means for location adjacent the perimeter of the opening and being formed at least in part from metal, at least one panel member locatable within the opening providing a barrier relative to the opening, the panel member being formed at least in part from metal, wherein the framing means and / or the peripheral frame of the panel member define a void accommodated within the framing means and / or the peripheral frame of the panel member for accommodating expansion of the framing means and the panel member.
2. A barrier assembly according to claim 1 wherein the framing means includes a header member and a pair of jamb members extending substantially perpendicular to the header member, the panel member includes a substantially planar member and having a peripheral frame formed adjacent the edge of the planar member, each of the jamb members, the header member and the peripheral frame include a support element extending longitudinally thereof, and the support element is covered with insulation.
3. A barrier assembly according to claim 2 wherein the insulation is calcium silicate board which is attached to the support element using screws.
4. A barrier assembly according to claim 2 or 3 including an intumescent strip covering the support element positioned to expand the panel member and framing means relative to each other.
5. A barrier assembly according to claim 4 including a fixed capping covering the insulation and the intumescent strip, the fixed capping being attached to the support element using screws.
6. A barrier assembly according to claim 5 including a movable capping located adjacent the fixed capping and spaced there from to provide the void wherein the movable capping can move relative to the fixed capping to reduce the void.

7. A barrier assembly according to claim 6 wherein the movable capping is associated with the framing means only.

5 8. A barrier assembly according to claim 6 or 7 wherein the framing means and peripheral frame are substantially surrounded by aluminium cladding which is adhesively connected thereto.

9. A barrier assembly according to claim 8 including a further intumescent
10 strip positioned adjacent the aluminium cladding and covering the movable and or fixed capping for expansion of the framing means and panel member towards each other.

10. A barrier assembly according to 9 including further insulation adjacent
15 the edge of the planar member whereby the planar member is spaced from the support element by the further insulation.

11. A barrier assembly according to any one of the preceding claims wherein the panel member is a door leaf.

20

12. A barrier assembly according to any one of the preceding claims wherein the panel member is a window sash.

13. A barrier assembly according to any one of the preceding claims
25 wherein the panel member pivots about a vertical edge through an arc of at least 180 degrees.

14. A barrier assembly according to claim 13 wherein the arc is greater than
30 180 degrees.

30

15. A barrier assembly substantially as hereinbefore described and illustrated.