

FIRE PARTITIONS AND SHUTTER APPARATUS THEREFOR

Field of the Invention

The present invention relates to fire partitions and a shutter mechanism therefor. It is suitable for use where there is limited horizontal space. In particular, it relates to fire doors and other partitions having glass panels therein and a shutter mechanism which releases during a fire to prevent the spread of the fire through the glass opening, thereby improving fire integrity. Most particularly, it relates to a lift landing door being such a door and to such a mechanism on a lift landing door.

Background Art

Fire doors are well-known, being doors that have been made to withstand fire up to a certain length of time. For instance, a lift landing door might normally be expected to withstand a fire for up to sixty minutes before the fire will spread from the landing into a lift shaft. This is intended to prevent fire spreading from one floor in a building to another. The same principle applies for preventing fire spreading from one room to another on the same landing.

Fire doors are frequently either solid in appearance or have a single glass panel within them to allow one to see through. In such instances, the glass panel also has to be fire-rated, typically for sixty minutes. This means that when there is a fire, the glass also has to withstand it for sixty minutes or more. Unfortunately, fire-rated vision glass is very unstable, suffers frequent early failure during a fire, requires laborious installation and is expensive.

Additionally, the problem with such normal fire glass is that it transmits heat radiation straight through from the side of the fire to the other side. Moreover, fire-rated glass is susceptible to damage during normal operation and, if not replaced immediately, would render the door ineffective to perform its role.

Objects Of The Invention

Embodiments of the present invention alleviate some of the problems with the prior art, for example some of those indicated above in a fire partition, at least partially.

Summary of the Invention

According to one aspect of the present invention, there is provided shutter apparatus attachable to a fire partition to move to cover a portion of said partition during a fire, comprising:

- shutter means movable from a first state to a second state; and
- shutter release means for automatically releasing said shutter means in the event of a fire, to move from said first state to said second state
- wherein the shutter means comprises a plurality of shutters,
- wherein movement of said shutters to said second state telescopes said shutters out relative to each other.

Preferably the apparatus further comprises shutter runner means for guiding said shutter means during its movement from said first state to said second state. These may include a runner on each side of said shutter means.

One of said runner means and said shutter means may have protrusions thereon and the other may have cooperating portions to cooperate with said protrusions during movement of said shutter means to said second state to limit the movement of said shutter means.

Usefully, one of said runner means and said shutter means has protrusions thereon and the other has cooperating portions to cooperate with said protrusions during movement of said shutter means to said second state to limit the movement of said shutter means.

All the shutters of said plurality of shutters can overlap each other at at least one place, in said first state. Then no more than two of all the shutters of said plurality of shutters overlap each other at any one place, in said second state.

The protrusions may be provided on at least two of said shutters and said step portions may be provided in at least two pairs, one step portion of each pair being on each runner means and extending a certain distance towards the other of its pair, each pair being at a different position along said runner means, said certain distance being different for each pair.

The shutter means may be steel. The shutter release means may be temperature sensitive.

Preferably, the shutter release means comprises a fusible link for melting in the event of a fire. The fusible link might be chosen to melt at temperatures above 80°C. The shutter means may move into said second state due to the effect of gravity

According to another aspect of the present invention, there is provided fire partition means comprising:

- a portion that is at least partially non-opaque; and
- shutter apparatus as defined in the first aspect;
- wherein said apparatus is arranged such that
- when said shutter means is in said first state, at least part of said non-opaque portion is exposed;
- when said shutter means is in said second state, it covers said at least part of said non-opaque portion.

The non-opaque portion may be a glass panel.

The partition means may be a fire door. The partition means may be a lift-landing door.

The shutter apparatus in the above partition means may be provided on the opposite side of the door from which a fire is expected.

The shutter release means in the above partition means may be arranged to affect release based on the temperature on the other side of the door from that on which it is mounted.

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According to a third aspect of the present invention, there is provided a fire door having a glass panel therein and a fire shutter mechanism, said mechanism comprising:

- at least two slidable shutters movable from respective first positions above said glass panel to second positions covering said glass panel;

- a heat sensitive release mechanism holding said shutters in their first positions to release them in a fire; and

- a pair of runners, one each side of said shutters for guiding them after release to slide to their second positions; wherein

- at least one of said slidable shutters has protrusions at each side protruding therefrom; and

- each runner has an extent towards the other that changes, including at least one change with a step function, such that during the sliding of the shutters the protrusions encounter the steps of the step function to limit movement of the at least one shutter,

- wherein movement of said shutters to said second state telescopes said shutters out relative to each other.

At least two of said shutters may have said protrusions, which extend different amounts widthwise across the respective shutters, and there may be at least two step portions along each runner, the steps on a runner existing at least partially at different horizontal positions relative to each other, whereby the at least two of said shutters having protrusions encounter and stop at different steps.

Usefully, the present invention allows larger areas of glass in such partitions and glass that allows normal vision therethrough.

The invention includes a fire door having a glass panel and a shutter mechanism for covering the glass panel in the event of a fire. Three steel shutter plates are held in the first position by a fusible link, such that it is usually possible to look through the glass panel. In the event of a fire, the fusible link melts, thereby releasing the shutter plates so that they telescope out and completely cover the glass panel. This prevents the spread of fire through the opening for the glass, even when the glass has disintegrated or is otherwise breached.

Brief Description of the Drawings

The present invention will be further described by way of non-limitative example with reference to the accompanying drawings, in which : -

Figure 1 is a view of a pair of fire doors according to an embodiment of the invention;

Figure 2 is a cross-section through a portion of figure 1 with the shutter mechanism retracted;

Figure 3 is a cross-section through a portion of figure 1 with the shutter mechanism released; and

Figure 4 is a cross-section through a second portion of the doors of figure 1.

Description

An example of an embodiment of the present invention is shown in figures 1 to 4.

Figure 1 shows the back of a pair of lift landing doors 10a, 10b. These are open, i.e. spaced apart, and, for the most part, are mirror images of each other.

Each door is mainly sheet metal 12 (of layers 12a and 12b) with a vision panel opening in it, in the top half towards the centre. There is a glass panel 14 in the vision opening and a shutter mechanism, generally indicated as 16, extending above the glass panel 14 and along both sides of the glass panel 14. The present invention is particularly concerned with the glass panel 14 and shutter mechanism 16.

The vision opening, glass panel 14 and shutter mechanism can be seen in more detail in figure 2, which is a section through line B-B in door 10a in figure 1. The glass panel 14 is ordinary float glass, laminated for strength, as may be necessary for use in lift landing doors, with laminations bonded together by PVB. This is clamped in place by a metal surround 18, attached to the back of the sheet metal 12 of door 10a.

Shutter mechanism 16 includes left and right steel shutter runners 20a, 20b, which extend up the sides of the glass 14 almost to the top of the door.

The shutter runners 20a, 20b contain and guide a shutter made up of three sliding steel shutter plates 22, 24, 26. The shutter plates 22, 24, 26 are shown in a first, retracted state, with each shutter in a respective first position, in figures 1 and 2, where the three plates overlap to a considerable degree. They are shown in a second, extended state, with each shutter in a respective second position, in figure 3, where they fully cover the glass panel 14 from behind.

In the first state, the third and outer-most plate 26 overlaps second plate 24 which itself overlaps first plate 22. On the other hand, in the second state, the three plates have telescoped out to almost three times the length they cover in the first state. As can be seen in figure 3, there is only a small overlap between the first plate 22 and the second plate 24 and between the second plate 24 and the third plate 26. In this second state, the extended shutter plates 22, 24, 26 fully cover the glass panel 14 from a direct line from behind - i.e. looking straight through the glass from in front, one would only see shutter plates.

The slidable shutter plates are held in the first state by a release mechanism in the form of a fusible link 28. They transform into the second state by being released and falling. More particularly, they telescope out because the first plate 22 is only allowed to fall a certain, first distance, the second plate 24 is only allowed to fall a certain, second distance, further than the first distance, while the third plate 26 is allowed to fall furthest, through a certain third distance.

The first, second and third distances are limited by the cooperation of first and second tabs 30 and 32 on both sides of the tops of the third and second plates 22, 24, respectively, with first and second step portions 34 and 36 in the shutter runners 20a, 20b. More particularly, tabs 30 extend rearwardly from and part way across the top of first plate 22. Tabs 32 extend rearwardly from and part way across the top of second plate 24.

The edges of the sliding plates at all times are held within the runners, to maintain fire integrity, to ensure smooth working and to prevent them falling out. The gap between the left shutter runner 20a and the right shutter runner 20b is widest at the tops of the runners. Its gap narrows in a step manner at two positions at 34 and 36. The width between the two shutter runners is sufficient above first step portions 34 for the width of the first tabs 30 but the gap between the two runners is too narrow below first step portions 34. Thus the first plate is prevented from descending any further by first tabs 30 resting on first step portions 34. In a similar manner, the gap between the shutter runners above second step portions 36 is wide enough to accommodate the second tabs 32 but the gap below second step portions 36 is not wide enough. Thus, whilst descending, second plate 24 is stopped by second tabs 32 encountering second step portions 36. Finally, third plate 26 is prevented from descending any further by a stop portion 38, which runs between the bases of the two shutter runners 20a, 20b.

With their edges in the shutter runners 20a and 20b, the telescoped out overlapping shutter plates 22, 24, 26 completely cover the glass panel 14 directly from behind.

The release mechanism is in the form of a fusible link 28. One end of this is attached to a portion at the top of the door, which is an extension of the metal sheet 12b from the front of the door, bent backwards then downwards, while the other is connected to near the top of the third plate 26. In this embodiment the link 28 is in the form of two metal parts bonded together by solder and which holds the shutter plates up in their retracted state in normal circumstances but which melts under the heat of fire, for instance, at 80° C or above, thereby releasing the shutter.

In normal circumstances the landing doors 10a, 10b of the lift are kept closed. During a fire on a landing the temperature on the front side of the door is elevated. This temperature is conducted by metal 12 of the door, round to the fusible link 28 at the rear. Once the fusible link has reached the release temperature (e.g. above 80° C), the solder in the fusible link 28 melts, thus releasing the three sliding shutter plates 22, 24, 26. Thus, although the direct temperature on the fusible link 28 may not reach the release temperature early, it still reaches the release temperature relatively early.

The three shutter plates fall with the top of the first plate 22 coming to rest against step 34, the top of the second plate 36 coming to rest against step 36 and the bottom of the third plate 26 coming to rest against the stop portion 38. The glass 14 may then melt or break or otherwise fail in the fire, but the fire cannot spread beyond as it is blocked by the shutters.

The runners and shutter plates are made of steel and therefore do not burn. However, they may distort in the heat. In the case of the plates, because the front gets hot whilst the rear is cooler, they tend to bend with their middles moving towards the front of the door, thereby reducing the gap between the plates and the door, leaving less room for the fire to pass through. Indeed they maintain fire integrity (that is with no opening or other gap greater than 6mm x 150mm). Additionally, the plates prevent direct heat radiation from the fire, which passes through the glass, from igniting anything behind the door.

The embodiment described above includes three movable shutter plates. Of course, there may be other numbers from one upwards, e.g. one, two, four etc.

The shutter mechanism has been described so far with only movable plates. However, in an alternative possibility, a stationary backing plate extends from near the top of the door to a point just below first step portion 34, behind the first plate 22. Thus, when the shutter mechanism is in the second state, the top of the first plate 22 still overlaps the bottom of the backing plate. This completes the prevention of a fire gaining access to the rear of the door from over the top of the first plate 22.

In the described embodiment, the last sliding plate is stopped from below. This is preferred as the stop portion serves as an additional barrier to fire creeping underneath the shutter plates. However, the last shutter could have tabs to cooperate with step portions in the runners, in a similar manner to the other two sliding shutters. In such an instance, it would be preferred to seal the glass off from the fire by a further stationary plate or the like, the top of which would be overlapped by the base of the last sliding plate.

Further, in the described embodiment, there are two tabs 30, 32 one at each end of the

tops of their relevant shutter plates 22, 24. However, that is not essential; they could be replaced with flanges extending all the way across the tops of the plates. Such flanges would similarly cooperate with the steps in the runners. Other systems using protrusions on the sliding shutters cooperating with portions on the runners could similarly be used. Indeed it is not necessary to use the runners at all to limit the downward movement of the plates. Movement limiting means can be present on the metal sheeting 10, extending rearwards at a position just above the opening, or on a stationary backing plate, to limit the fall of the first plate. Similar means on the first plate could be used to limit the fall of the second plate, etc.

Additionally, any protrusions on the sliding plates can be directed towards the front of the door, rather than towards its back. However, it might make it more difficult to lift the plates back from their second positions to their first ones. The protrusions need not be at the tops of the plates, but can be at their bases. Of course, in the case of only a single movable plate that could, if wanted, only be stopped by a stop portion 38.

For the release mechanism, the release temperature for the fusible link can be selected as required according to the environment. If earlier release is wanted, the drop temperature could be less, although this makes a mistaken release more likely. On the other hand it should not be so high that the glass has already failed before release. Alternatively, the fusible link can be replaced with other heat sensitive means. For instance, a thermoplastic strip which melts or a bimetallic strip could be used to effect the drop, eg. by removing a pin or magnet etc. or by causing a hook to turn. Other means are also equally possible.

The above embodiments rely upon gravity to effect the movement of the plates. However, other means are possible for instance by the use of springs to push the plates down. This would even allow the plates to move into position from the side or from below. If springs are used, then they could be released directly by a release mechanism, rather than the plates themselves being released. As an alternative to springs, gravity also can be used to effect movement of the plates from below or the side by the use of weights and cables or chains through hollow portions of the doors in a similar manner to weight-overbalanced sash windows.

The invention as described so far, only relates to the shutter mechanism. However, other aspects of the present invention will now be described with reference to figure 4. In particular, figure 4 shows overlapping portions 42, 44 of the two doors 10a, 10b of figure 1. The metal plates 12a, 12b of the doors bend round 90° at the edges where the doors meet to cooperate with each other. After the edge portions extend rearwards a little way, inner plates 12b on both doors bend through a further 90° back towards the centres of the doors and extend a short distance further in a rim.

However, the outer plates 12a on these edges to give the edges a stepped appearance. In the case of left hand door 10a, the outer plate 12a follows the inner plate 12b towards the centre before extending rearwards and then again towards the door centre. In the case of right hand door 10b, the outer plate 12a does not follow the inner plate 12b towards the centre but immediately extends away from the door before extending rearwards and then back towards the centre again. Thus the left-hand door 10a appears wider towards its front than at its rear; the wider front portion being first wide portion 42, and right hand door 10b appears to be the opposite, being wider at its rear than its front, the wider rear portion being second wide portion 44. Additionally, the depth of first wide portion 42 is slightly less (by, for example, 2 mm) than the corresponding portion of door 10b. When the doors are closed together, first wide portion 42 overlaps second wide portion 44, thereby maintaining fire integrity between the two doors. In this instance, the depth of first wide portion 42 is slightly less than that of second wide portion 44, to ensure a good fit. Moreover, during a fire, this fit is maintained or even improved, as opposed to a standard, grooved fit between doors; in a fire the fit distorts, making a larger gap.

The invention has been described so far on the basis that the fire is on one side of the glass and the shutter on the other. However, it will work if they are both on the same side. The invention can even be installed where that is expected, with suitable consideration given to the appropriate release temperature and aesthetics.

The non-opaque or vision panel in the door or other partition has been exemplified by glass. This is because glass is most usual, being able to take greater heat. However, with the present invention that might no longer be required. Thus plastic could be used

instead of glass - that being cheaper, less easy or satisfying for vandals to break and less dangerous when broken.

The invention has, so far, also only been described with respect to lift doors. However, it can be equally applicable to any other type of fire door or even to stationary fire partitions, such as walls or outer windows, that allow light into a room. If outside windows are prevented from breaking, then there will be less oxygen for a fire to consume. Further, because of the greater reliability of the present invention, larger areas of glass can be provided in fire doors and partitions, thus increasing the amount of light passing through, reducing energy consumption and making it more pleasant for the people around.

Whilst only one specific embodiment has been described in detailed and numerous alternatives have also been mentioned, the inventions are not limited to just these. Instead, the scope of the invention covers everything has just been described so far and everything falling within the scope of the appended claims.

CLAIMS

1. Shutter apparatus attachable to a fire partition to move to cover a portion of said partition during a fire, comprising:
 - shutter means movable from a first state to a second state; and
 - shutter release means for automatically releasing said shutter means in the event of a fire, to move from said first state to said second state,
 - wherein the shutter means comprises a plurality of shutters,
 - wherein movement of said shutters to said second state telescopes said shutters out relative to each other.
2. Apparatus according to claim 1, further comprising shutter runner means for guiding said shutter means during its movement from said first state to said second state.
3. Apparatus according to claim 2, wherein said shutter runner means comprise a runner on each side of said shutter means.
4. Apparatus according to claim 2 or 3, wherein one of said runner means and said shutter means has protrusions thereon and the other has cooperating portions to cooperate with said protrusions during movement of said shutter means to said second state to limit the movement of said shutter means.
5. Apparatus according to claim 4, wherein said cooperating portions comprise step portions on said shutter runner means.
6. Apparatus according to claim 6, wherein all the shutters of said plurality of shutters overlap each other at at least one place, in said first state.
7. Apparatus according to claim 6, wherein no more than two of all the shutters of said plurality of shutters overlap each other at any one place, in said second state.

8. Apparatus according to any one of claims 6 to 7, when dependent on at least claim 5, wherein said protrusions are provided on at least two of said shutters and said step portions are provided in at least two pairs, one step portion of each pair being on each runner means and extending a certain distance towards the other of its pair, each pair being at a different position along said runner means, said certain distance being different for each pair.
9. Apparatus according to any one of the preceding claims, wherein the shutter means is steel.
10. Apparatus according to any one of the preceding claims, wherein the shutter release means is temperature sensitive.
11. Apparatus according to claim 10, wherein the shutter release means comprises a fusible link for melting in the event of a fire.
12. Apparatus according to claim 11, wherein the fusible link melts at temperatures above 80°C.
13. Apparatus according to any one of the preceding claims, wherein the shutter means move into said second state due to the effect of gravity.
14. Fire partition means comprising:
 - a portion that is at least partially non-opaque; and
 - shutter apparatus according to any one of the preceding claims; wherein said apparatus is arranged such that when said shutter means is in said first state, at least part of said non-opaque portion is exposed;
 - when said shutter means is in said second state, it covers said at least part of said non-opaque portion.

15. Partition means according to claim 14, where said non-opaque portion is a glass panel.

16. Partition means according to claim 14 or 15, being a fire door.

17. Partition means according to claim 16, being a lift-landing door.

18. Partition means according to any one of claims 14 to 17, wherein the shutter apparatus is provided on the opposite side of the door from which a fire is expected.

19. Partition means according to any one of claims 14 to 18, wherein the shutter release means is arranged to affect release based on the temperature on the other side of the door from that on which it is mounted.

20. A fire door having a glass panel therein and a fire shutter mechanism, said mechanism comprising:

- at least two slidable shutters movable from respective first positions above said glass panel to second positions covering said glass panel;

- a heat sensitive release mechanism holding said shutters in their first positions to release them in a fire; and

- a pair of runners, one each side of said shutters for guiding them after release to slide to their second positions; wherein

- at least one of said slidable shutters has protrusions at each side protruding therefrom; and

- each runner has an extent towards the other that changes, including at least one change with a step function, such that during the sliding of the shutters the protrusions encounter the steps of the step function to limit movement of the at least one shutter,

- wherein movement of said shutters to said second position telescopes said shutters out relative to each other.

21. A fire door according to claim 20, wherein at least two of said shutters have said protrusions, which extend different amounts widthwise across the respective shutters, and there are at least two step portions along each runner, the steps on a runner existing at least partially at different horizontal positions

relative to each other, whereby the at least two of said shutters having protrusions encounter and stop at different steps.

22. Shutter apparatus, partition means or a fire door substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

ABSTRACT**FIRE PARTITIONS AND SHUTTER APPARATUS THEREFOR**

A fire door has a glass panel and a shutter mechanism for covering the glass panel in the event of a fire. Three steel shutter plates are held in the first position by a fusible link, such that it is usually possible to look through the glass panel. In the event of a fire, the fusible link melts, thereby releasing the shutter plates so that they telescope out and completely cover the glass panel. This prevents the spread of fire through the opening when the glass is breached.

Figure 3.