INSULATED FIRE PANEL SHUTTER

Field of the invention

The present invention relates to an insulated fire panel shutter, in particular to one which can also serve as a security shutter.

Background art known to the applicant

Fire can spread extremely quickly with the result that it can rapidly get out of control. In order to minimize this risk in structures, it is desirable that openings such as doors or windows in buildings; shafts in mines; and passageways in modes of transport used on land or sea, are provided with ways for preventing fire from passing through them and spreading to other areas. Fire doors or shutters tend to be used (e.g. SG 200905226-7) and these must be capable of resisting the effects of a fire for a period of time often stipulated by legislative regulations with the result that individuals can either safely escape the fire or if trapped, are relatively safe until the fire is dealt with. Nevertheless, enormous heat can be generated by such fires and heat transfer across the face of a fire door and in particular a fire shutter is possible given enough time. When subjected to the effects of fire, fire shutters can turn red hot and emit radiated heat to the other side of the shutter. In some cases, this radiated heat may be sufficient to cause material in the fire free area to eventually ignite and permit the fire to spread further. In addition, so-called 'fire doors' or 'fire shutters' tend not to be viewed as security doors or shutters. Accordingly, a need still exists to provide a fire shutter which meets both the requirements of preventing the initial spread of the fire and resisting heat transfer with the passage of time during a fire i.e. to act as a better heat insulator. In addition, a need also exists for a fire shutter which can also serve as a security shutter.

Summary of the invention

With the foregoing in view, the invention in one aspect resides broadly in an insulated fire panel shutter adapted to close off an area including:

a guide, adapted to receive a shutter and having one or more retractable members moveable between a retracted and extended position; and

a shutter, moveable between an open and closed position and formed from a plurality of panels each of which is moveable between a stowed and deployed position;

their arrangement being such that as the guide receives the shutter during shutter closure, the panel arrangement alters from a stowed side by side relationship to a deployed stacked end to end relationship.

Preferably the shutter is adapted to bias the one or more of the retractable members into the retracted position as the shutter moves from its open to its closed position and when in the closed position, the shutter no longer biases the one or more retractable members enabling the one or more retractable members to move from the retracted to the extended position, enabling the guide to engage the front and rear face of the or each panel.

The retractable members are moveable between retracted and extended positions because they are fitted with a plurality of biasing hinges.

One retractable member may in principle be sufficient as in its extended position, it will narrow the clearance which exists between the guide and the thickness of the or each panel making up the shutter when the shutter is in its closed position. However, having a pair of opposed retractable members adapted to move from a retracted to expanded position to narrow the clearance from opposed sides of the guide would be more advantageous. This is because if only one retractable member was used, it would have to be able to urge the face of the panel it was not coming into contact with against the rest of the guide to narrow the clearance existing either side of the shutter, and given the mass of the or each panel the urging force would have to be very great. It would be better if the movement to narrow the clearance gap between the guide and either side of the shutter were carried out by moving retractable members towards opposed faces of the shutter.

Typically, shutters which include more than one shutter panel are usually designed so that each shutter panel is pivotally connected to another. In the present invention however, if multiple shutter panels are employed, it is preferable if at least some of the panels are not pivotally connected to each other. It is even more preferable if none of the panels were pivotally connected. Furthermore, conventional pivotally connected shutters tend only to be stowable in one of two manners. Either the slats (or panels) of the shutter are rotatably

stowed about an axle or translationally stowed along a straight or curved guide when the shutter is in the open position. If the guide is straight, the movement of the panels will be a purely translational movement. If the guide is curved the movement will involve both translation and either a degree of rotation or revolution. In respect of the present invention however preferably, during movement of the shutter, at least one panel undergoes translational movement in two directions, the final position of the panel being parallel with but within a different plane to the first.

Such an arrangement would allow the panel arrangement to change from a side by side relationship in a 'door open' position to a stacked top to bottom relationship in the 'door closed' position during deployment of the panels to form the shutter thus closing off the area.

Such a form of movement would be advantageous over for example, conventional translational stowing as it is likely to involve space (if not volume) saving especially if the side by side arrangement is one where the front face of one panel faces the rear face of another and more than one panel undergoes the same type of movement resulting in the stacking of panels.

Preferably, the insulated fire panel shutter is provided with means adapted to enable at least some or each of the panels to be stowed in a parallel overlying front face to rear face facing relationship when the shutter is in the open position.

This is preferably achieved by a pair of opposed sloping (relative to the horizontal) shelves. The slope may be friction compensating or greater and a plurality of such shelf stowed panels would be in a staggered relationship if each of the panels were of the same size and shape.

In order to prevent or reduce the possibility of heat transfer during a fire, preferably, the guide is fitted with one or more intumescent strips. In such form, at least one intumescent strip is fitted to a retractable member.

There are several ways in which the bias exerted on the or each retractable member may be eliminated, for example, the retractable member may possess an aperture into which the member exerting the bias moves into once the shutter is in the closed position. However, preferably, the or each retractable member is fitted with a camber which eliminates the bias

exerted on the or each retractable member by the shutter when the shutter is in the closed position, enabling the movement of the or each retractable member from its retracted to its extended position when the shutter is in its closed position.

The camber has the advantage that the shutter may be opened or closed easily during day to day operations simply by reversing the direction of the drive motor. If an aperture were used instead of a camber, a further means of retracting the member exerting the bias from the aperture would need to be installed and operated before the shutter could be opened again.

The panel could simply comprise a normal panel employed in conventional fire panel shutters. However, the panel of the present invention has been specifically designed for use with (and thus forms part of) the present invention. However, the panel itself may be considered to be new and inventive in its own right and could be used with a conventional fire panel shutter.

Accordingly, preferably, the or each panel is an insulated metal panel. In such form, the metal panel includes

a) frame having a front and rear face;
b) a sheet of material fitted to and extending across the front and rear faces of the frame; and
c) a thermally resistant wadding housed within the volume between the sheets of material and perimeter of the frame.

Preferably, the frame is metal and the exterior faces of the sheets of material are covered with a metal sheet in a sliding fit arrangement. Such an arrangement has been found to reduce thermal conductivity through the panel to a minimum compared with conventional panels forming fire shutters as there are no screws securing the sheets to the frame.

In fact there is no metal to metal contact between the sheets and the frame, reducing any heat transfer between them by conduction to zero.

Preferably, the panel is formed from a plurality of metal components, which do not contact each other in the finished panel to form an insulated metal panel. This has the advantage of

preventing conduction of heat from one metal component to another and from one face of the panel to the other. In such form, the metal is steel and includes a box frame and front and rear steel sheets. In such form, the front and rear steel sheets are folded and fitted to a flame retardant board. Such an arrangement of a box frame, together with front and rear sheets made from metal (ideally steel) also provide a level of security not typically available to (for example) a normal fire door when closed.

This is because the ability to 'kick down' or 'sledge hammer through' a conventional locked fire door is relatively facile but a steel construction including a box frame and front and rear sheeting is another matter. The box frame could be strengthened by, for example, including diagonal or a number of horizontal or vertical metal (ideally steel) cross bars.

Preferably the wadding comprises a ceramic material and a silica fabric material. It has been found that the use of multiple types of wadding components better prevent heat transfer through the material than just a single type of wadding.

Preferably, when the shutter is closed, the metal components forming each of the panels do not contact each other. Such an arrangement has the advantage of minimizing heat transfer between panels by conduction. In such form, the metal components between adjacent panels are kept apart by a separating member. Again, in such form, the separating member is formed from a ceramic material.

Preferably, movement of the panels to form the shutter is actuated by a chain and sprocket mechanism powered by a driver motor. This is beneficial over hand actuation as the shutter is heavy and would be difficult to open if it were not powered in some way.

The present invention may be used to close off a vertical shaft for example in a mine. In such form, the guide would be sloped towards the horizontal. However, the invention is more usually to be associated with conventional horizontal passageways, doorways or the like.

Preferably therefore, the guide will be a vertical guide in its normal attitude of operation.

Preferably, the guide includes two metals as it is preferable if precision portions of the guide are made from material which can be extruded whilst non precision portions do not have to

be. In such form, the extrudable material is aluminum. Although aluminium has a relatively low melting point (around 660 ° C) and as a result would normally be considered unsuitable as a material associated with a fire barrier, it has the advantage that as it may be extruded, it can be manufactured to high engineering tolerances.

Such high tolerances are required if the clearance fit has to be precise. The aluminium in the guide is intended to be strong enough to withstand normal wear and tear during everyday use and in the event of a fire, once the insulated fire panel shutter has closed, it will not matter whether the aluminium component melts or buckles under the heat.

To save on weight and expense, instead of using solid metal for the non-extruded portion of the guide, fire rated cement board covered with metal could be used instead.

Preferably, the panels forming the shutter are provided with complementary inter-locking members adapted to lock the panels together once the shutter is formed. Such an arrangement serves to add a further level of security to the shutter as without this form of locking, it is conceivable that the panels may be sufficiently flexed at their midpoint to enable entry by an intruder if the shutter is down in a security rather than a fire shutter capacity.

Although the number and/or placement of the inter-locking members need not extend across the entire length of each panel, in order for example to save on the cost of the production of a panel, in such form, the complementary inter-locking members extend across the length of each panel.

Further, in such form, the complementary inter-locking members are in the form of a tongue and groove arrangement.

Preferably, the shutter once formed is also provided with a flexible flame baffle sheet adapted to span any gap between the top of the shutter once formed and the top of a doorway to which the insulated fire panel shutter is fitted to. Such an arrangement will thus provide an additional barrier in this 'gap area' to any flames, heat and/or smoke in the event of a fire.

In another aspect, the invention resides broadly in a building or structure incorporating an insulated fire panel shutter as specified herein.

Brief description of the drawings

In order that the invention may be more readily understood and put into practical effect, reference will now be made to the accompanying sheets of drawings wherein:

FIG. 1 is a perspective view of an insulated fire panel shutter of the present invention in its closed position and fittable to a doorway with its protective cover removed to expose the shutter panel storage facility, sprocket and chain mechanism and drive motor which operates the shutter.

FIG. 2 is a perspective view of the insulated fire panel shutter of FIG. 1 in its open position showing the panels making up the shutter of the insulated fire panel shutter in their stowed position.

FIG. 3 is a perspective view of the insulated fire panel shutter of FIG. 1 in its closed position with the protective cover fitted.

FIG. 4 is a perspective view of the insulated fire panel shutter of FIG. 1 in its open position with the protective cover fitted.

FIG. 5 is a rear elevation of the insulated fire panel shutter of FIG. 1 in its closed position with the protective cover removed.

FIG. 6 is a side elevation of the insulated fire panel shutter of FIG. 1 in its closed position.

FIG. 7 is a plan view of the insulated fire panel shutter of FIG. 1 in its closed position with the protective cover removed.

FIG.s 8 -11 are sectional views of the insulated fire panel shutter of FIG. 1 during various stages of opening/closing of the shutter (without separator blocks {see FIG.s 18 & 19} in place to show the chains).

FIG. 12 is an isometric view of one of the guides forming part of the insulated fire panel shutter of FIG. 1.

FIG. 13 is a partially exploded view of the guide of FIG. 12.

FIG. 14 is a sectional view through the upper end portion of the guide of FIG. 12 when the insulated fire panel shutter is in its closed position showing opposed retractable members in their extended position.

FIG. 15 is a sectional view through the upper end portion of the guide of FIG. 12 when the insulated fire panel shutter is in its open position, showing the opposed retractable members of FIG. 14 biased into their retracted position.

FIG. 16 is a sectional view through the lower end portion of the guide of FIG. 12 (without separator blocks {see FIG.s 18 & 19} in place) when the insulated fire panel shutter is in its closed position, showing the opposed retractable members of FIG. 14 in its extended position due to opposed cambers at the lower end of the guide.

FIG. 17 is a sectional view through the lower end portion of the guide of FIG. 12 (without separator blocks {see FIG.s 18 & 19} in place) when the insulated fire panel shutter is beginning to open, showing the opposed retractable members of FIG. 14 beginning to be biased into their retracted position.

FIG. 18 is a side elevation of a panel forming the shutter panel of the insulated fire panel shutter of FIG. 1 inclusive of separator blocks.

FIG. 19 is an isometric sectional view through part of the insulated panel of FIG. 18 showing the arrangement of materials employed in the make-up of the panel inclusive of separator blocks.

FIG. 20 is an isometric sectional view through the insulated fire panel shutter of FIG. 1 to show one of the cassette panels housing a chain and sprocket drive mechanism for the shutter panel.

FIG. 21 is a side elevation of the cassette panel of FIG. 20 showing the cassette and chain and sprocket drive mechanism.

FIG. 22 is a plan view of the cassette panel of FIG. 20 showing the cassette and chain and sprocket drive mechanism.

Description of the preferred embodiments

FIG. 1 is a perspective view of an insulated fire panel shutter generally referenced 10, fittable to a doorway and adapted to close off an area in the event of a fire. It is shown in its closed position devoid of a protective cover to show some of its moving/working parts. The insulated fire panel shutter 10 includes a pair of opposed mild steel panel cassettes 11 each being fitted to one end of a vertical (steel covered fire rated cement board) guide 12. Mounted to each cassette 11 is a chain and sprocket assembly 13 which is connected to opposite ends of a steel transmission shaft 14 drivable by a drive motor 15 mounted on one of the cassettes 11.

In addition, a panel shelf 16 is also mounted to each cassette 11 in an opposed arrangement which act as a storage facility for some of the insulated panels 17 (see FIG. 2) used to form the shutter 18 of the insulated fire panel shutter 10 when in the open position. Each cassette 11 is also fitted with a panel guide 19 adapted to direct the movement of stowed panels 17 in use (see later). FIG.s 3 and 4 show the insulated fire panel shutter 10 with the protective cover 20 on in its closed and open position respectively.

In the event of a fire the shutter 18 in its closed position will offer a degree of protection to the components mounted to the cassettes 11, however, an additional degree of protection is provided by a flexible flame baffle sheet 21 made of fire rated fabric which spans the gap between the two cassettes 11 and downwardly depends from the top of the insulated fire panel shutter 10 in front of the chain and sprocket assembly 13. The top of the sheet 21 in its normal attitude of operation being fitted to a rod connected to the top of the insulated fire panel shutter 10 and spanning the gap between the cassettes 11, whilst the bottom of the sheet 21 is connected to the top of the last of the insulated panels 17, this final panel 17 being adapted to form the uppermost panel of the shutter 18 in the shutter's closed position. This baffle sheet 21 has the advantage of being able to bridge any existing gap which may be present between the fire panel shutter 10 and the top of the doorway that it is fitted to. Such a sheet 21 will thus provide an additional barrier in this 'gap area' to any flames, heat and/or smoke and is shown more clearly in FIG.s 5 and 7.

FIG.s 8-11 show how each of the panels 17 are connected to the chain and sprocket assembly 13. As shown, the cassette 11 containing the drive motor 15 includes a vertical endless chain 13a linking the drive motor 15 to a drive sprocket 13b and a horizontal endless chain 13c connecting the drive sprocket 13b to a winder sprocket 13d. A free chain 13e connected to the cassette 11 at one end, rides over the winder sprocket 13d and is linked to a side wall of a panel 17. Another section of free chain 13f connects this panel 17 to the next panel 17 and this process repeats until each of the panels 17 are connected. The same arrangement (save for the endless chain connecting the drive motor 15 to the drive sprocket 13b) occurs with the other cassette (see also FIG.s 20-22).

FIG.s 8-11 also show how the shutter 18 is formed as the panels 17 stowed in a parallel staggered overlying front face to rear face facing relationship on the shelves 16 move along shelves 16 and (guided by panel guides 19) down the guides 12 when actuated by the drive motor 15.

FIG.s 12 and 13 show one of the guides 12 in more detail. Each guide 12 once assembled comprises essentially an elongate square 'C' shaped member when seen in cross section with a pair of opposed retractable members 22 housed within and forming part of the guide 12. Each retractable member 22 comprises a series of contiguous ceramic plates bolted to an elongate steel strip that extends along the length of the guide 12 and towards its bottom end each retractable member 22 terminates with a ceramic plate camber 23. Each retractable member 22 is connected to the rest of the guide 12 by three biasing hinges 24 enabling each retractable member 22 to move between a retracted and extended position relative to the rest of the guide 12. The hinges 24 bias each retractable member 22 towards the extended position. The front face of each retractable member 22 is fitted with a strip of intumescent material 25 and adjacent each retractable member 22, is an aluminium guide rail 26.

The lowest panel 17 of the shutter 18, where it passes between the guides 12 is fitted at the base of its front and rear faces with a ceramic biasing member 27 (four in all). The function of these biasing members 27 is to bias each pair of opposed retractable members 22 into their respective retracted position as the shutter 18 moves from its open to its closed position. When the lowest panel 17 of the shutter 18 reaches the ground the space created by the camber 23 is slightly greater than the thickness of the ceramic biasing member 27 enabling each retractable member 22, to move from its retracted to its extended position, permitting

the guide 12 to engage the front and rear face of each panel 17 making up the shutter 18 (see FIG.s 14-17).

FIG.s 18 and 19 show more detail of the nature of one of the insulated panels 17. As can be seen, each panel 17 is formed from a rectangular steel box frame 28, the volume defined by the inner perimeter of the frame being filled with a ceramic blanket wadding 29. A sheet of silica fabric material 30 extends across both the front and rear faces of the frame 28 to trap the wadding 29 located within the frame 28. A further ceramic blanket 29 also extends across both the front and rear faces of the frame 28 over the silica fabric material 30. The blankets 29 and materials 30 are secured to the front and rear faces of the frame 28 by a series of elongate ceramic plates 31 that are screwed to the frame 28.

The series of elongate ceramic plates 31 although flush with the width of the frame 28, extend slightly beyond the top and bottom of the frame 28. A further sheet of silica fabric 30 extends across the entire exterior face of each of the ceramic framed ceramic blankets 29 and is secured to the ceramic frame 31 using the same screws which bolt the ceramic frame 31 to frame 28. Finally, the front and rear face of the panel 17 is covered in a skin of sheet steel 32. The top and bottom portions of each sheet 32 each possess two 90 degree folds to form respective 'n' and 'u' shapes in cross section, enabling each sheet 32, in a 'sliding fit', to be fitted to each respective set of the upper and lower ceramic plates 31. The ends of the respective 'n' and 'u' shaped folds of each sheet 32 are so sized and shaped as not to contact frame 28 once the sheets 32 have been slid into place (and also after any expansion may have taken place after heating in for example, the event of a fire).

A ceramic end cap 33 composed of a series of elongate ceramic plates 34 (which are 'n' shaped in cross section) is screwed to opposing side walls of the frame 28 to prevent the sheets 32 from sliding off, the end cap 33 being flush with the top and bottom of the series of elongate ceramic plates 31.

The opposed side walls of each panel 17 also include opposed upper guide rollers 35 fitted with a pair (upper and lower) of lifting shafts 36 and opposed lower guide rollers 37 each fitted with a lead-in panel guide 38. One end of the free chain 13e connected to the cassette 11 connects to the upper lifting shaft 36 and free chain 13f connects to the lower lifting shaft 36 and the upper lifting shaft of the next panel 17. The lead in panel guide 38 is somewhat

similar to an old fashioned rotatable handle used to wind car windows up and thus consists of two components the arm 38a and the handle 38b. The purpose of the arm 38a is to distance the handle 38b or otherwise 'offset' the handle 38b with respect to the rest of the guide roller 37 enabling free chain 13f to pass vertically down the side wall of the panel 17 without interfering with the handle 38b.

In addition, a plurality of elongate ceramic separators 39 protrude beyond the top of the sheet 32 covered ceramic plates 31 and, 'sit' on the top wall of frame 28 of all but the uppermost panel 17. These contiguous separators 39 in cross section are similar to an inverted 'T' in shape and form the tongue in an otherwise tongue 39 and groove 40 system. A similar plurality of elongate ceramic separators 40 are also screwed to the bottom wall of each frame 28, are 'n' shaped in cross-section and protrude beyond the bottom of the sheet 32 covered ceramic plates 31.

The arrangement between respective tongue 39 and groove 40 ceramic separators is such that when respective separators 39, 40 come into contact with each other i.e. when one panel 17 sits on another, during shutter 18 formation, there is an air gap between the fold of steel 32 running along the top face of the ceramic plates 31 of the lower panel 17 and the fold of steel 32 running along the bottom face of the ceramic plates 31 of the adjacent panel 17 above it. This air gap prevents conduction of heat between panels 17. In addition the design of the tongue 39 and groove 40 is such that the walls of the upwardly extending leg of the inverted 'T' are sloping inwardly slightly and contact between the tongue and groove only occurs between the feet of the groove 40 and the base of the inverted 'T' 39. This arrangement minimizes the risk of the tongue 39 and groove 40 system 'sticking' when the shutter 10 is being opened again.

Although the plates 31 and 34 and the separators 39 and 40 are shown in a contiguous arrangement in this embodiment, in an alternative non illustrated embodiment, they need not be and as such their number may be reduced to save costs.

FIG.s 20-22 show one of the cassettes 11 in more detail albeit with the drive motor 15 and its endless connecting chain to the driver sprocket 13b missing.

In operation, assuming the insulated fire panel shutter 10 is in its open position, upon

actuation of the drive motor 15, the driver sprocket 13b and transmission shaft 14 begin to rotate. The first panel 17, (the base of which is permanently maintained between the guides 12 enabling its ceramic biasing members 25 to retain the retractable members 22 in their retracted position) connected by the free chains as a consequence, begins to lower. As it does so the opposed upper guide rollers 35 eventually pass between and thus engage with the aluminium guide rails 26.

Soon afterwards, the next panel 17 in the sequence (connected to the first panel by free chain 13f) and currently stowed on the shutter panel storage facility begins to ride up the angled slope of the shelves 16 (via the upper guide rollers 35) and the lead in panel guides 38 eventually engage with the panel guides 19 to aid in directing the lower end of this next panel 17 such that the lower guide rollers 37 are able to pass between and thus engage with the aluminium guide rails 26. At this point, this next panel's translational motion changes direction from being one in the direction up the slope of the shelves 16 to vertically downward, whereupon the upper guide rollers 35 eventually pass between and thus engage with the aluminium guide rails 26.

The descent of this next panel 17 terminates when the feet of the separators 40 on the lower wall of the frame 28 of this panel 17 contact the base of the inverted 'T' of the separators 39 on the upper wall of the frame 28 of the lower panel 17 to leave an air gap between the metal portions of each panel 17.

During this time the next panel in the sequence is following on from the previous one, the final panel 17 connected to the blanket 21 steadily moving as well.

As the biasing members 27 of the first panel 17 pass the cambers 23, the biasing hinges 24 are able to bias the retractable members 22 into their extended positions to contact the now fully formed and fully closed shutter 18, with the blanket 21 deployed as well. In the event of a fire, the heat will trigger the intumescent material 25 and this will generate a seal between the guides 12 and the shutter 18. Under normal operating conditions, to open the shutter 18, the drive motor 15 is simply put into reverse.

CLAIMS

1. An insulated fire panel shutter adapted to close off an area including:

a guide, adapted to receive a shutter and having one or more retractable members moveable between a retracted and extended position; and

a shutter, moveable between an open and closed position and formed from a plurality of panels each of which is moveable between a stowed and deployed position;

their arrangement being such that as the guide receives the shutter during shutter closure the panel arrangement alters from a stowed side by side relationship to a deployed stacked end to end relationship.

2. An insulated fire panel shutter as claimed in claim 1, wherein the shutter is adapted to bias the one or more of the retractable members into the retracted position as the shutter moves from its open to its closed position and when in the closed position, the shutter no longer biases the one or more retractable members enabling the one or more retractable members to move from the retracted to the extended position, enabling the guide to engage the front and rear face of the or each panel.

3. An insulated fire panel shutter as claimed in claim 1 or claim 2, wherein some or each of the panels are stowed in an parallel overlying front face to rear face facing staggered relationship when the shutter is in the open position.

4. An insulated fire panel shutter as claimed in any one of the preceding claims, wherein during movement of the shutter, at least one panel undergoes translational movement in two directions, the final position of the panel being parallel with but within a different plane to the first.

5. An insulated fire panel shutter as claimed in any one of the preceding claims, wherein the guide is fitted with one or more intumescent strips.

6. An insulated fire panel shutter as claimed in claim 5, wherein at least one intumescent strip

is fitted to a retractable member.

7. An insulated fire panel shutter as claimed in any one of the preceding claims, wherein the or each retractable member is fitted with a camber adapted to eliminate the bias exerted on the or each retractable member by the shutter when the shutter is in the closed position.

8. An insulated fire panel shutter as claimed in any one of the preceding claims, wherein the or each panel includes a plurality of metal components, which do not contact each other in the finished panel to form an insulated metal panel.

9. An insulated fire panel shutter as claimed in claim 8, wherein the metal panel includes:

a) a frame having a front and rear face;
b) a sheet of material fitted to and extending across the front and rear faces of the frame; and
c) a thermally resistant wadding housed within the volume between the sheets of material and perimeter of the frame.

10. An insulated fire panel shutter as claimed in claim 8 or claim 9, wherein the frame is metal and the exterior faces of the sheets of material are covered with a metal sheet in a sliding fit arrangement.

11. An insulated fire panel shutter as claimed in any one of claims 8-10, wherein the wadding comprises a ceramic material and a silica fabric material.

12. An insulated fire panel shutter as claimed in any one of claims 8-11, wherein the metal is steel.

13. An insulated fire panel shutter as claimed in any one of the preceding claims, wherein when the shutter is closed, the metal components forming each of the panels do not contact each other.

14. An insulated fire panel shutter as claimed in claim 13, wherein the metal components between adjacent panels are kept apart by a separating member.

15. An insulated fire panel shutter as claimed in claim 14, wherein the separating member is a

ceramic material.

16. An insulated fire panel shutter as claimed in any one of the preceding claims, wherein movement of the shutter is actuated by a chain and sprocket mechanism powered by a driver motor.

17. An insulated fire panel shutter as claimed in any one of the preceding claims, wherein the guide is a vertical guide in its normal attitude of operation.

18. An insulated fire panel shutter as claimed in any one of the preceding claims, wherein the panels forming the shutter are provided with complementary inter-locking members adapted to lock the panels together once the shutter is formed.

19. An insulating fire panel shutter as claimed in claim 18, wherein the complementary inter-locking members extend across the length of each panel.

20. An insulated fire panel shutter as claimed in claim 18 or claim 19, wherein the complementary inter-locking members are in the form of a tongue and groove arrangement.

21. An insulated fire panel shutter as claimed in any one of the preceding claims, wherein the shutter once formed is also provided with a flexible flame baffle sheet adapted to span any gap between the top of the shutter once formed and the top of a doorway to which the insulated fire panel shutter is fitted to.

22. A building or structure incorporating an insulated fire panel shutter as claimed in any one of the preceding claims.