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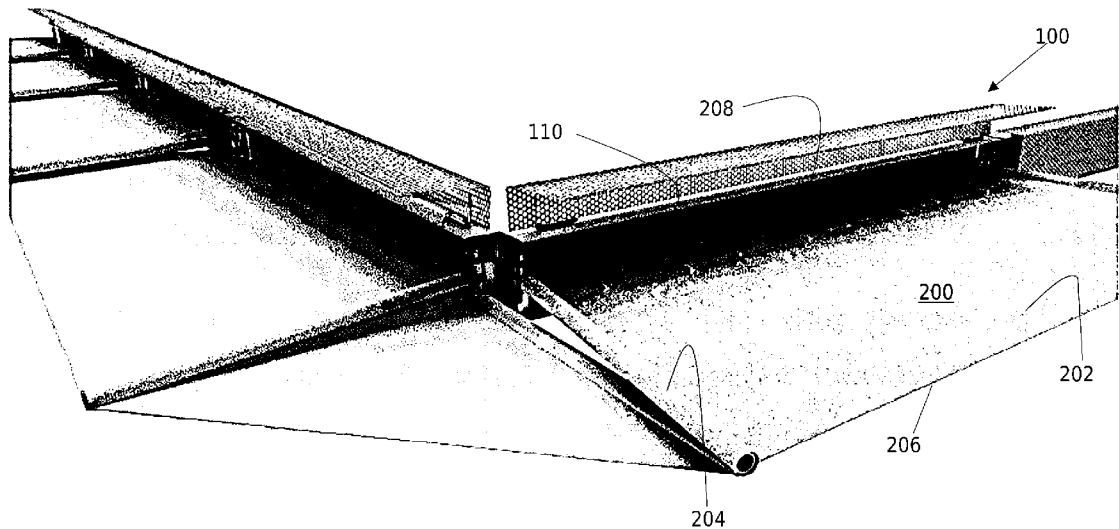


Figure 5

(57) Abstract: The present invention concerns a deployable fire barrier assembly, system and method of use for at least partially impeding the spread of fire along an external surface of a structure during a fire event. In one form, the assembly includes a frame mountable to the external surface of the structure; and a barrier movably coupled to the frame and configured to be deployable from a non-operable position in which the barrier is stowed against the external surface of the structure to an operable position in which the barrier extends outwardly from the structure to at least partially impede the fire.



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## A FIRE BARRIER ASSEMBLY AND METHOD OF USE THEREOF

## TECHNICAL FIELD

[0001] The present invention relates to a fire barrier assembly and system and methods of use thereof for preventing a fire spreading about an external surface of a structure.

## BACKGROUND

[0002] The facade or external appearance of a structure, such as, a building, is typically one of the most important visual aspects of the structure from a design standpoint.

[0003] Modern building practices utilising structural steel and reinforced concrete have dramatically changed the types of facades used. A decrease in load-bearing walls has resulted in a corresponding decrease in traditional masonry facades but an increase in modern cladding systems that are suspended from or attached to a structure or building to form a facade.

[0004] Such modern cladding systems typically use metallic panels made from light-weight metals, such as, e.g., aluminium composite materials, and are becoming increasingly popular due to the many advantages they present. For example, the systems are typically able to be manufactured with relative ease and at a reasonably low cost; the metallic panels have a visually appealing external appearance that is able to be further modified with relative ease; and the systems are light weight and relatively maintenance free once fitted.

[0005] Despite the above, a problem associated with such systems is that polyethylene is commonly used as a core material for such metallic panels and is highly combustible. For example, the rapid spread of the fire that broke out in the Grenfell Tower block of flats in the UK in 2017 has been attributed to the building's exterior cladding, which was comprised of aluminium-polyethylene cladding.

[0006] The Grenfell Tower fire and numerous other preventable tragedies around the globe have led to the development of new building regulations and standards concerning cladding fire standards.

[0007] As such, a further and resultant problem associated with modern cladding systems is that there are currently thousands, if not millions, of existing buildings that each pose a significant fire risk with non-compliant aluminium-polyethylene cladding. Further, the costs associated with re-cladding such buildings are high, if not financially prohibitive, resulting in no action being taken to address the buildings at risk.

## SUMMARY OF INVENTION

[0008] Embodiments of the present invention provide a fire barrier assembly, system and method of use, which may at least partially overcome at least one of the abovementioned problems or provide a consumer with a useful or commercial choice.

[0009] According to a first aspect of the present invention, there is provided a fire barrier assembly for location about an external surface of a structure, said assembly including:

a frame mountable to the external surface of the structure;

a barrier coupled to the frame and configured to extend outwardly from the structure to at least partially impede fire spreading along the external surface of the structure.

[0010] According to a second aspect of the present invention, there is provided a deployable fire barrier assembly for location about an external surface of a structure, said assembly including:

a frame mountable to the external surface of the structure; and

a barrier movably coupled to the frame and configured to be deployable from a non-operable position in which the barrier is stowed against the external surface of the structure to an operable position in which the barrier extends outwardly from the structure to at least partially impede fire spreading along the external surface of the structure.

[0011] According to a third aspect of the present invention, there is provided a fire barrier system for location about a structure, said system including:

a plurality of the assembly as defined in first aspect arranged in series about a perimeter of the structure.

[0012] According to a fourth aspect of the present invention, there is provided a deployable fire barrier system for location about a structure, said system including:

a plurality of the assembly as defined in the second aspect arranged in series about a perimeter of the structure, each assembly configured to individually deploy in response to a fire being detected to at least partially impede the fire spreading along an external surface of the structure.

[0013] Advantageously, the assembly and the system of the present invention provide a barrier or plurality of barriers that when deployed deflect radiant heat away from an above external surface of the structure thereby impeding the spread of fire along the external surface during a fire event. The assembly and system are able to be readily fitted with new compliant cladding panels or retrofitted to non-compliant cladding panels, the latter providing an interim cost effective solution before a structure is reclad.

[0014] As used herein, the term "structure" may be any manufactured or constructed structure having an external surface defined by one or more external walls. Generally, the structure may be a building or component thereof. Typically, the structure may be a commercial or residential building,

preferably a building having cladding.

[0015] Cladding may generally include any materials applied to provide a skin or layer over an external wall of a structure, such as, e.g., a building. Usually, the materials may include a plurality of panels configured to be mounted to the external surface of the building, typically via a bracket or frame mounting system, to provide insulation, weather resistance and a desired aesthetic effect. The panels may typically be metallic panels. Examples of preferred cladding systems are described in the following PCT applications: PCT/AU2013/001284; and PCT/AU2017/050488, which are herein incorporated by reference in their entireties.

[0016] As indicated above, the present invention provides a fire barrier configured to be located against an external surface of a structure and be deployed when fire is detected to at least partially impede the fire from spreading along the external surface of the structure. A person skilled in the art, however, will appreciate that the fire barrier of the present invention may be configured to be located on other suitable structures, such as, e.g., moveable structures, including vehicles, and marine structures, including watercraft, piers or jetties and the like.

[0017] The barrier may be of any suitable size, shape and construction and formed from any suitable material or materials capable of at least partially impeding a fire.

[0018] Generally, the barrier may include a panel formed from substantially fire-resistant or fire-retardant material or materials and configured to extend outwardly from the structure in a substantially horizontal orientation, if fixed or when deployed and in the operable position.

[0019] The barrier may have any suitable shape for aligning with adjacent barriers around a structure. Typically, the barrier may have a substantially rectangular, oblong or triangular shape, or any combination or variation thereof. Preferably, the barrier may be substantially rectangular or triangular in shape.

[0020] The barrier may be of integral construction or may be formed from two or more barrier pieces.

[0021] In some embodiments, the barrier may be a rigid panel. For example, the barrier may include a panel member having two opposed surfaces, including an upper surface and an opposed lower surface when in the operable position. The opposed surfaces may extend substantially parallel to one another and be interconnected by opposing sidewalls and/or end walls, including opposed sidewalls, an outer end wall and an opposed inner end wall nearest the external surface of the structure when deployed. The panel member may have an elongate shape with a longitudinal axis extending between the two opposed sidewalls.

[0022] The panel member may be of any suitable thickness. For example, the panel member

may have a thickness of at least 10mm, at least 15mm, at least 20mm, at least 25mm, at least 30mm, at least 35mm, at least 40mm, at least 45mm, at least 50mm, at least 55mm, at least 60mm, at least 65mm, at least 70mm, at least 75mm, at least 80mm, at least 85mm, at least 90mm, at least 95mm or even at least 100mm between the opposed surfaces of the panel member. Typically, the panel member may have a thickness of about 10mm to 50mm, preferably about 20mm to 40mm.

[0023] In such embodiments, the panel member may be at least partially formed from a substantially fire-resistant or fire-retardant material or materials, typically the latter. For example, the panel member may be at least partially formed from gypsum, perlite, calcium silicate, fly ash, sodium silicate, potassium silicate, magnesium oxide or a combination thereof, preferably a mixture comprising magnesium oxide.

[0024] In some such embodiments, the panel member may be operatively associated with a frame for supporting the panel member. The frame may include one or more frame members joined end to end. Each frame member may typically be constructed from metal, preferably aluminium, titanium or a composite thereof.

[0025] The panel member may be fastened to the frame with one or more mechanical fasteners, such as, e.g., rivets or threaded fasteners.

[0026] In some such embodiments, the panel member may be operatively associated with a cover configured at least partially cover an outer surface of the panel member and provide a desired aesthetic appearance when the barrier is in the non-operable position. The cover may include a cover panel attachable to the panel member for at least partially covering the lower surface when deployed or external surface when in the non-operable position. Preferably, the cover panel may fit over the panel member and the frame, if present, and be fastened in place by one or more mechanical fasteners or the like. The cover will be described in further detail later.

[0027] In other embodiments, the barrier may be a flexible panel. For example, the barrier may be configured to be stowed in a folded or rolled arrangement when in the non-operable position and be held taut in a substantially planar arrangement when in the operable position. Generally, the barrier may be held taut by at least one support arm or frame member when in the operable position. This will be described later.

[0028] The flexible panel may again have a pair of opposed surfaces, including an upper surface and an opposed lower surface when in the operable position. The barrier may also include opposed side edges, an outer edge and an opposed inner edge nearest the external surface of the structure when the barrier is deployed. Again, the flexible panel may have an elongate shape having a longitudinal axis extending between the opposed side edges.

[0029] The barrier may be formed from a substantially fire-resistant or fire-retardant material or

materials, typically the latter. For example, the barrier may be formed from polybenzimidazole (PBI), aramids, FR cotton, coated nylon, polyhydroquinone-dimidazopyridine (PIPD), melamine, modacrylic or any combination thereof. In some embodiments, the barrier may be formed from an aromatic nylon of the type sold by DuPont under the trade mark NOMEX™.

[0030] When deployed, the barrier may extend outwardly any suitable distance from the external surface of the structure to at least partially impede the fire spreading. For example, the barrier may have a width, as measured between the inner and outer end walls or edges, of at least 200mm, at least 220mm, at least 240mm, at least 260mm, at least 280mm, at least 300mm, at least 320mm, at least 340mm, at least 360mm, at least 380mm, at least 400mm, at least 420mm, at least 440mm, at least 460mm, at least 480mm, at least 500mm, at least 520mm, at least 540mm, at least 560mm, at least 580mm, at least 600mm, at least 620mm, at least 640mm, at least 660mm, at least 680mm, at least 700mm, at least 720mm, at least 740mm, at least 760mm, at least 780mm, at least 800mm, at least 820mm, at least 840mm, at least 860mm, at least 880mm, at least 900mm, at least 920mm, at least 940mm, at least 960mm, at least 980mm, at least 1,000mm, at least 1,020mm, at least 1,040mm, at least 1,060mm, at least 1,080mm, at least 1,100mm, at least 1,120mm, at least 1,140mm, at least 1,160mm, at least 1,180mm, at least 1,200mm, at least 1,220mm, at least 1,240mm, at least 1,260mm, at least 1,280mm, at least 1,300mm, at least 1,320mm, at least 1,340mm, at least 1,360mm, at least 1,380mm, at least 1,400mm, at least 1,420mm, at least 1,440mm, at least 1,460mm, at least 1,480mm, or even at least 1,160mm. Generally, the barrier may have a width of between about 550mm and about 1,000mm, preferably between about 600mm and about 800mm.

[0031] By extending outwardly from the structure, the barrier advantageously deflects radiant heat away from cladding above the barrier thereby at least partially impeding the spread of fire in a fire event.

[0032] As indicated above, the barrier may be movably coupled to the frame mountable to an external surface of the structure. The frame may be of any suitable size, shape and construction and may be formed from any suitable material or materials.

[0033] Typically, the frame may include at least one frame member mountable to the structure, either directly or indirectly.

[0034] In some embodiments, the frame may be formed from two or more frame members joined together to form the frame, preferably four frame members.

[0035] Each frame member may have an elongate shape. Each frame member may include a pair of opposed ends and may extend longitudinally between the pair of opposed ends, typically in a linear direction.

[0036] Each frame member may be formed from metal, such as, e.g., aluminium, titanium or a composite thereof. Each frame member may preferably be an extrusion.

[0037] Each frame member may be of any suitable profile shape to be mountable to the external surface of the structure and have the barrier be movably coupled thereto.

[0038] For example, in some embodiments, each frame member may include at least a structure facing wall and at least one sidewall extending orthogonally away from a longitudinal side edge of the structure facing wall. The structure facing wall and the at least one sidewall may together define a frame member having a substantially L-shaped profile shape. In such embodiments, the frame member may be joined together with other like frame members to form a frame in which the sidewalls of each frame member may extend along and outward from an outer periphery of the frame to together at least partially enclose the barrier when in the non-operable position.

[0039] In other embodiments, each frame member may include at least one structure facing wall and a pair of opposed sidewalls each extending orthogonally away from a longitudinal side edge of the structure facing sidewall to define a frame member having a substantially U- or C-shaped profile shape.

[0040] Each frame member may preferably be mountable to the structure via the structure facing wall. For example, the structure facing wall may include one or more openings extending through the wall for receiving one or more mechanical fasteners therethrough for fastening the frame member and thereby the frame to the structure.

[0041] As indicated above, the frame may be mountable directly or indirectly to the structure. For example, in some embodiments, the frame may be mounted to an existing cladding member to indirectly mount the frame to the structure. In other embodiments, the frame may be directly mounted to the external surface of the structure. In such embodiments, the frame may preferably be mounted between adjacent cladding members to provide an integrated deployable fire barrier assembly or system.

[0042] The barrier may be movably coupled to the frame in any suitable way so as to be deployable from the non-operable position to the operable position. For example, the barrier and the frame may be coupled together in a sliding arrangement, a hinged arrangement, a pivoting arrangement, a rolling arrangement or a folded arrangement.

[0043] Typically, the coupling may further include one or more biasing mechanisms so that movement of the barrier to the operable position moves under the force of the biasing mechanism. The biasing mechanism include one or more springs, such as, e.g., coil, torsion or leaf springs. Of course, a person skilled in the art will appreciate that other types of biasing mechanisms such as magnets or magnetized elements and the like may be used.

[0044] In some embodiments in which the barrier is a panel member, the barrier and the frame may be hingedly coupled together such that the barrier is able to pivot about the hinge between the non-operable and operable positions. Preferably, the inner end wall of the panel member may be hingedly coupled to the frame by a hinge mechanism such that the panel member may pivot about the hinge mechanism between the non-operable and operable positions.

[0045] In such embodiments, the barrier may be pivotable between a raised position corresponding to the non-operable position in which the panel member extends in a substantially vertical orientation and a lowered position corresponding to the operable position in which the panel member extends outwardly from the structure, preferably in a substantially horizontal orientation.

[0046] In such embodiments, the biasing mechanism may include one or more torsion springs operatively associated with the lower end wall of the panel member for biasing the panel member into the operable position.

[0047] In other embodiments in which the barrier is a flexible panel, the barrier may be movably coupled to the frame by at least one support arm pivotally coupled to the frame for angular movement about a generally vertical axis. The angular movement may range about 180° relative to the frame, typically about 135° relative to the frame, preferably about 110° relative to the frame.

[0048] The at least one support arm may be pivotable between a folded position corresponding to the non-operable position in which the at least one arm is folded against the frame and an extended position corresponding to the operable position in which the at least one support arm extends away from the frame.

[0049] In such embodiments, the flexible panel may be attached or fastened to the frame at one end, either directly or indirectly, and attached or fastened at an opposite end to a shaft of the support arm such that when the support arm pivots to the extended position the flexible panel is drawn out of the frame and held taut between the at least one support arm and the frame in the operable position. If indirectly attached or fastened to the frame, the flexible panel may be operatively associated with a roller pivotally coupled to the frame such that the flexible panel is drawn from the roller when deployed to the operable position.

[0050] In such embodiments, the biasing mechanism may again include one or more torsion springs operatively associated with the frame and the at least one arm for biasing the at least one arm into the extended position.

[0051] In preferred embodiments, the flexible panel may be attached or fastened to a pair of support arm pivotally coupled to opposite sides of the frame.

[0052] In such embodiments, the flexible panel may be attached or fastened to each support

arm, either directly or indirectly, such that when the support arms pivot to the extended position the flexible panel is drawn out of the frame and held taut between the arms in the operable position. If indirectly attached or fastened to a support arm, the flexible panel may be operatively associated with a roller located on the arm such that the flexible panel is drawn from the roller when deployed to the operable position. Preferably, each support arm may include a roller. In some such embodiments, at least one of the two arms may further include a cover deflecting member for assisting in deflecting the cover out of the way when the barrier is deployed.

[0053] In yet other embodiments in which the barrier is a flexible panel, the barrier may be movably coupled to the frame by a scissor mechanism. The scissor mechanism may include a pair of scissor arms extending between the frame and an outer end of the flexible panel in a linked and criss-crossed arrangement.

[0054] Each arm may have a pair of opposed ends and an elongate body extending longitudinally between the opposed ends. The opposed ends may include an inner end and an opposed outer end. The arms may be pivotally linked together about midway along each of their lengths, typically via a pivot pin.

[0055] The inner end of each arm may be pivotally and slidably coupled to the frame. The outer end of each arm may be pivotally and slidably coupled to the flexible panel via barrier frame member. The barrier frame member may be attached to or fastened along an outer end of the flexible panel, typically via one or more mechanical and/or chemical fasteners.

[0056] In use, the arms may be movable between a folded position corresponding to the non-operable position in which the arms fold against one another against the frame and an extended position corresponding to the operable position in which the arms extend away from the frame. In the extended position, the flexible panel is drawn out of the frame and held taut between the barrier frame member and the frame in the operable position.

[0057] In some such embodiments, the biasing mechanism may include one or more coil springs operatively associated with the respective inner ends of each arm to bias the inner ends to slide together and thereby urge the arms into the extended and operable position. Preferably, the one or more coil springs may be tension coil springs, although compression coil springs are also envisaged.

[0058] Again, in such embodiments, the inner end of the flexible panel may be directly or indirectly attached or fastened to the frame. If indirectly, the flexible panel may be operatively associated with a roller pivotally coupled to the frame such that the flexible panel is drawn from the roller when deployed to the operable position by the scissor mechanism.

[0059] As indicated above, the assembly may typically further include a cover for at least

partially covering the frame and the barrier, and preferably for retaining the barrier in the non-operable position against the force of the biasing mechanism.

[0060] The cover may be sized and shaped to at least partially cover the frame and the barrier, preferably entirely cover the barrier.

[0061] The cover may include at least one cover panel. The cover panel may include a pair opposed surfaces, including an outer surface and an opposed inner surface. The opposed surface may extend substantially parallel to one another and be interconnected by opposing edges. In some embodiments, the cover panel may include one or more sidewalls extending away from the opposing edges for at least partially enclosing the frame.

[0062] Typically, the outer surface of the cover panel may have an external appearance configured to match an external appearance of adjacent cladding. However, it is envisaged that the outer surface of the cover panel may have any suitable external appearance to achieve a desired aesthetic effect, particularly with adjacent cladding.

[0063] The cover may preferably be releasably coupled to the frame so that the cover may be released when fire is detected to deploy the barrier. Any suitable releasable coupling mechanism may be used. The releasable coupling mechanism may typically be operatively associated with a portion of the frame and a portion of a sidewall of the cover.

[0064] In some embodiments, the cover and the frame may be coupled together by a latch mechanism, preferably an electronic latch mechanism. In such embodiments, the latch mechanism may be remotely operated to release and deploy the barrier. In some such embodiments, the latch mechanism may be operatively connected to one or more flame, smoke and/or thermal sensors configured to detect fire or the presence of fire and in response release the latch mechanism.

[0065] In other embodiments, the cover and the frame may be releasably coupled together by one or more mechanical fasteners configured to fail/release when subjected to high temperatures associated with or indicative of fire, such as, e.g., bolts. Typically, such bolts are formed from heat-sensitive metals and alloys, e.g., metals and alloys including one or more of the following characteristics low melting, cold worked, age hardened, transformation hardened or hardenable, or inherently brittle and prone to thermal shock.

[0066] The bolt may be configured to fail at any suitable temperature indicative of fire. For example, the bolt may be configured to fail at about 150°C, about 200°C, about 250°C, about 300°C, about 350°C, about 400°C, about 450°C, about 500°C, about 550°C, or even about 600°C. Typically, the bolt may be configured to fail at a temperature ranging from about 200°C to about 400°C.

[0067] In some embodiments, the cover may be releasably coupled to the frame along one side

and hingedly coupled to the frame along an opposite side, typically with a hinge mechanism.

[0068] In some such embodiments, the hinge mechanism may be associated with a biasing mechanism so that the cover pivots about the hinge mechanism and away from the barrier under the force of the biasing mechanism when the releasable coupling releases. Again, the biasing mechanism may include one or more springs, such as, e.g., coil, torsion or leaf springs.

[0069] In other such embodiments, the inner surface of the cover may include a deflecting member for deflecting the cover away from the barrier when the releasable coupling releases. The deflecting member may be of any suitable size and shape. Typically, the deflecting member may provide a deflecting surface configured to interact with the barrier and/or the at least one arm when deployed and defect the cover out of the way.

[0070] In some embodiments, the cover may include at least two cover segments hingedly coupled together. The at least two cover segments may include a first cover segment hingedly coupled to the frame and a second cover segment hingedly coupled to the first cover segment along one edge and releasably coupled to the frame along an opposite edge. In such embodiments, the first cover segment may be hingedly coupled to the frame with a hinge mechanism, typically associated with a biasing mechanism so that the first cover segment pivots about the hinge mechanism and away from the barrier under the force of the biasing mechanism when the releasable coupling releases. Again, the biasing mechanism may include one or more springs, such as, e.g., coil, torsion or leaf springs.

[0071] In some embodiments, the barrier or assembly may further include an actuator or actuating mechanism for moving the cover and frame relative to one another for deployment of the barrier.

[0072] Any suitable type of actuator or actuating mechanism may be used. The actuator or actuating mechanism may be manually actuated or by using a drive, preferably the latter.

[0073] If using a drive, the actuator or actuating mechanism may include one or more hydraulic or pneumatic rams, or an electric motor for moving the cover relative to the frame.

[0074] In preferred embodiments, the actuator or actuating mechanism may include one or more linear actuators each capable of moving between an extended position and a retracted position.

[0075] The linear actuators may include a pneumatic ram, a hydraulic ram or a rigid chain actuator (also known as a linear chain actuator, push-pull actuator, electric chain actuator, zip chain actuator or column forming chain actuator).

[0076] In some embodiments in which the barrier is a flexible panel, the barrier may be coupled to the frame and an inner surface of the cover and be configured to be drawn out of the frame and

held taut between the frame and the cover when deployed in the operable position. If indirectly attached or fastened to the frame, the flexible panel may be operatively associated with a roller pivotally coupled to the frame such that the flexible panel is drawn from the roller when deployed.

[0077] In such embodiments, the cover may be pivotally mountable to the frame at an upper end such that the lower end is pivotable relative to the frame. The cover may be pivotally mounted in any suitable way, typically via a hinge mechanism. The cover and the frame may preferably further include a biasing mechanism in the form of one or more torsion springs for biasing the lower end of the cover panel away from the frame. The biasing mechanism may be operatively associated with the hinge mechanism. Preferably, the barrier may be coupled between lower ends of the cover and the frame such that the barrier is drawn out by the pivoting of the lower end of the cover away from the frame.

[0078] In preferred such embodiments, the cover and the frame may be further coupled together by one or more tethers or cables extending therebetween and configured to prevent the lower end of the cover over-pivoting relative to the frame when deployed.

[0079] As indicated above, the present invention also provides a deployable fire barrier system for location about a structure to at least partially impede fire spreading along an external surface of the structure. The system in the broadest form may include a plurality of the assembly as hereinbefore described arranged in series about a perimeter of the structure, each assembly configured to individually deploy in response to fire being detected.

[0080] In some embodiments, the barriers of adjacently positioned assemblies may at least partially overlap when deployed to provide a continuous barrier or impediment to the spread of a fire during a fire event.

[0081] In other embodiments, the barriers of adjacently positioned assemblies may extend substantially flush with one another to provide a substantially continuous barrier or impediment to the spread of a fire during a fire event.

[0082] In some embodiments, the plurality of assemblies may be serially arranged to extend about the structure at multiple heights. For example, a multi-storey building structure may include a plurality of assemblies arranged in series about the structure at each, or in between each, storey.

[0083] The assemblies may be mounted to existing cladding or may be directly mounted to the structure between adjacent cladding panels.

[0084] In some embodiments, the system may further include one or more fire stop members configured to be fitted in between existing cladding panels and the structure to at least partially impede a fire spreading between a cladding panel and the structure. Generally, each fire stop

member may extend behind each cladding panel. In some embodiments, the fire stop member may extend across a structure facing surface of the cladding panel. In other embodiments, the fire stop member may be extend across the structure facing surface of the cladding panel in a substantially horizontal orientation. In preferred embodiments, the fire stop member may extend entirely behind each cladding panel so as to effectively compartmentalise the cladding panel.

[0085] The fire stop members may be of any suitable size, shape and construction and formed from any suitable material or materials. Each fire stop member may be of integral construction or may be formed from two or more pieces, typically the latter.

[0086] Generally, the fire stop members may be configured to be mountable to one or both of a structure facing surface of the cladding panel and the structure. Each fire stop may be mounted in any suitable way known in the art, such as, e.g., one or more mechanical fasteners and/or with a bracket or fastening mechanism. The fire stop members may be fitted when the cladding panels are fitted or may be retrofitted to existing cladding panels, such as, e.g., non-compliant cladding panels.

[0087] Typically, the fire stop member may be formed from one or more substantially fire-resistant or fire-retardant material or materials, typically the latter. For example, the fire stop member may be formed from one or more of mineral wool, gypsum, perlite, calcium silicate, fly ash, sodium silicate, potassium silicate, magnesium oxide or a combination thereof.

[0088] In some such embodiments, each fire stop member may include a core of compressed mineral wool, a core wrapping configured to constrain the mineral wool core in a compressed state or form and an outer coating for at least partially containing the core and the core wrapping. In use, the core wrapping is configured to melt in a fire event and enable the compressed mineral wool core to expand, fill the outer coating and at least partially impede fire spreading between the panel and the structure.

[0089] In such embodiments, the outer coating may be an aluminium extrusion, heat resistant plastic/silicone extrusion or an at least partially folded metal roll.

[0090] In such embodiments, the core wrapping may be a wrap formed from a plastic material or materials capable of melting in a fire event, such as, e.g., a class 1 flammable material. Examples of such materials include a polyethylene wrap sold by DuPont under the trade mark TYVEK™.

[0091] In other such embodiments, the fire stop member may include at least one frame member configured to extend across an inner surface of a panel member or a corresponding surface of the structure and a strip of at least fire-retardant fabric attached to or fastened to the at least one frame member and configured to at least partially impede a fire spreading between the cladding panel and the structure, and preferably for compartmentalising the fire.

[0092] In such embodiments, the at least one frame member may preferably include a clamping arrangement for clamping and holding the strip in place.

[0093] For example, the clamping arrangement may include two frame members arranged to extend substantially parallel to one another and clamp the strip therebetween.

[0094] Conversely, the clamping arrangement may include at least one frame member including a pair of opposed clamping members extending longitudinally at least partially along the frame member for clamping and holding the strip in place.

[0095] In such embodiments, the strip may be formed from polybenzimidazole (PBI), aramids, FR cotton, coated nylon, polyhydroquinone-dimidazopyridine (PIPD), melamine, modacrylic or any combination thereof. In preferred such embodiments, the strip may be formed from an aromatic nylon of the type sold by DuPont under the trade mark NOMEX™.

[0096] In some such embodiments, the at least one frame member may further include an intumescent coating configured to swell when exposed to heat indicative of a fire event. The intumescent coating may be any suitable composition known in the art, such as, ammonium polyphosphate, pentaerythritol and melamine; and sodium silicates and graphite, for example.

[0097] In yet other such embodiments, the fire stop member may include a strip configured to extend across an inner surface of a panel member or a corresponding surface of the structure to at least partially impede a fire spreading between the cladding panel and the structure, preferably compartmentalising the fire. The strip may include a core formed of magnesium oxide and enveloped in a fire-retardant outer coating. The fire-retardant outer coating may include silicone, graphene, glass mesh and metal (e.g., steel or stainless steel) material or materials. In preferred such embodiments, the strip may include a stainless steel fire-retardant outer coating extending across a single side of the strip, preferably a structure-facing surface when the strip extends across an inner surface of a panel member.

[0098] Advantageously, the fire stop member is resistant to moisture and vermin allowing free drainage and ventilation within the cavity between the cladding panel and the structure. Moreover, each fire stop member may further advantageously function as a stiffener in reinforcing each cladding panel.

[0099] In use, each fire stop member may advantageously compartmentalise radiant heat within a cavity defined by the fire stop member, the cladding panel and the structure thereby preventing heat within the cavity from contributing to spreading of fire in a fire event. Further, in some embodiments the fire stop member may advantageously function as a heat sink for at least partially absorbing radiant heat to thereby at least partially impede spreading of the fire in a fire event.

[00100] In some embodiments, the deployable fire barrier system of the present invention may form part of an overall fire protection system for a structure. For example, the fire barrier assemblies of the system may be coordinated with one or more sensors and a building controller for selective deployment when a fire event is detected.

[00101] According to a fifth aspect of the present invention, there is provided a fire protection system for a structure, said system including:

one or more sensors located within the structure;

a fire barrier system in accordance with the third or fourth aspects of the present invention for location about a perimeter of the structure, said system including a plurality of fire barrier assemblies, each configured to extend outwardly from the structure when deployed to at least partially impede fire spreading along an external surface of the structure; and

a building controller in communication with the one or more sensors, said controller configured to continuously monitor said one or more sensors and selectively deploy one or more fire barrier assemblies of the fire system when a fire event is detected by the one or more sensors or upon receiving a manual command.

[00102] The system may include one or more characteristics of the assembly and the system as hereinbefore described.

[00103] The structure may preferably be a building.

[00104] The one or more sensors may include smoke and/or heat sensors.

[00105] The controller may take the form of a base station located in the structure. The controller may include a microcomputer, including one or more processors and a memory.

[00106] The controller may be addressable and may report its operational status to an external device when polled.

[00107] As indicated, the controller may be in communication with the one or more sensors and continuously monitor operational status. The controller may be in wireless or wired communication with the one or more sensors.

[00108] The controller may be operatively connected to the fire barrier system, preferably a wired connection. The controller may selectively deploy one or more fire barriers by activating an actuating mechanism or latch mechanism associated with each fire barrier assembly. Preferably, the controller may deploy the one or more fire barriers in an automated manner.

[00109] In operation, the system may selectively deploy fire barrier assemblies located adjacent the fire event to at least partially contain the spread of the fire event. In some embodiments, the system may selectively deploy fire barrier assemblies in a cascading arrangement around the fire event.

[00110] The system may further include a sprinkler system fitted within the structure. The sprinkler system may be configured to be selectively activated by the controller during a fire event. Conversely, each sprinkler of the system may include a heat sensitive fuse configured to fail and activate the sprinkler during a fire event.

[00111] The system may include one or more sirens for signalling when a fire event has occurred. The controller may be operatively connected to the one or more sirens for activating the sirens.

[00112] The controller may include a communications module for communication with external devices and/or emergency services.

[00113] In some embodiments, the communications module may be in the form of a modem enabling controller to communicate via a wired or wireless network.

[00114] In some embodiments, the communications module may be a wireless communications module, such as, e.g., a wireless network interface controller, such that the sensor may wirelessly connect to the base station or the server through a wireless network (e.g., Wi-Fi (WLAN) communication, Satellite communication, RF communication, infrared communication, or Bluetooth™).

[00115] In yet other embodiments, the communications module may include at least one modem configured to be in wireless communication with external devices or emergency services for the transmission of data. In some such embodiments, the modem may be a cellular modem. In other embodiments, the modem may be a radio modem.

[00116] According to a sixth aspect of the present invention, there is provided a method of at least partially impeding fire spreading along an external surface of a structure, said method including:  
providing one or more of the deployable fire barrier assembly of the first aspect; and  
deploying the barrier of the assembly to the operable position when fire is detected to at least partially impede the fire spreading past the barrier.

[00117] The method may include one or more characteristics of the assembly and/or system as hereinbefore described.

[00118] For example, in some embodiments said deploying may be manually controlled, preferably remotely manually controlled.

[00119] In other embodiments, said deploying may be automated. For example, in some such embodiments, one or more assemblies may be selectively deployed in response to a fire event being detected by one or more sensors operatively associated with the one or more assemblies.

[00120] In yet other embodiments, said deploying may be in response to one or more mechanical

fasteners, configured to retain the barriers in the non-operable position, failing/releasing when subjected to high temperatures associated with or indicative of a fire event.

[00121] Any of the features described herein can be combined in any combination with any one or more of the other features described herein within the scope of the invention.

[00122] The reference to any prior art in this specification is not, and should not be taken as an acknowledgement or any form of suggestion that the prior art forms part of the common general knowledge.

#### BRIEF DESCRIPTION OF DRAWINGS

[00123] Preferred features, embodiments and variations of the invention may be discerned from the following Detailed Description which provides sufficient information for those skilled in the art to perform the invention. The Detailed Description is not to be regarded as limiting the scope of the preceding Summary of Invention in any way. The Detailed Description will make reference to a number of drawings as follows:

[00124] Figure 1 is a perspective view of a deployable fire barrier assembly according an embodiment of the present invention with the barrier deployed;

[00125] Figure 2 is a side view of the deployable fire barrier assembly shown in Figure 1;

[00126] Figure 3 is a perspective view of a deployable fire barrier assembly according another embodiment of the present invention with the barrier deployed;

[00127] Figure 4 is a side view of the deployable fire barrier assembly shown in Figure 3;

[00128] Figure 5 is a perspective view of a plurality of fire barrier assemblies according to another embodiment of the present invention with the barriers deployed;

[00129] Figure 6 is an exploded perspective view of one of the fire barrier assemblies shown in Figure 5;

[00130] Figure 7 is a sectional side view of part of a fire barrier assembly according to another embodiment of the present invention. The assembly is shown mounted to a structure in a non-deployed state;

[00131] Figure 8 is a section side view of the part of the fire assembly shown in Figure 7 but in a partially deployed state;

[00132] Figure 9 is a sectional side view of part of a fire barrier assembly according to another embodiment of the present invention. The assembly is shown mounted to a structure in a non-

deployed state;

[00133] Figure 10 is a sectional side view of the part of the fire barrier assembly shown in Figure 9 but in a partially deployed state;

[00134] Figures 11A to 11C respectively show sectional side views and an upper perspective view of a fire barrier assembly according to another embodiment of the present invention;

[00135] Figures 12A to 12C respectively show a sectional side view and upper perspective views of a fire barrier assembly according to another embodiment of the present invention;

[00136] Figure 13 is a perspective view of a plurality of fire barrier assemblies according to another embodiment of the present invention with one assembly shown partially deployed and without a barrier;

[00137] Figure 14 is a partially exploded side perspective view of a fire barrier assembly as shown in Figure 13;

[00138] Figures 15A and 15B respectively show side views of a fire barrier assembly according to another embodiment of the present invention in non-deployed and deployed states;

[00139] Figures 16A and 16B respectively show side views of a fire barrier assembly according to another embodiment of the present invention in non-deployed and deployed states

[00140] Figure 17 is an upper perspective view of a deployable fire barrier system including a plurality of deployable fire barrier assemblies according to an embodiment of the present invention mounted to an external surface of a structure;

[00141] Figure 18 is a sectional end view of a fire stop member according to an embodiment of the present invention fitted to an underside of a cladding panel;

[00142] Figure 19 is an upper perspective view of a fire stop member according to another embodiment of the present invention fitted to an underside of a cladding panel;

[00143] Figure 20 is an upper perspective view of a fire stop member according to another embodiment of the present invention fitted to an underside of a cladding panel;

[00144] Figure 21 is an upper perspective view of the fire stop member shown in Figure 20;

[00145] Figure 22 is a schematic drawing showing a fire protection system according to an embodiment of the present invention;

[00146] Figure 23 is a photograph of a test barrier according to an embodiment of the present

invention prior to fire testing;

[00147] Figure 24 is a photograph of a test barrier according to another embodiment of the present invention prior to fire testing;

[00148] Figure 25 is a photograph of the test barrier shown in Figure 23 during fire testing;

[00149] Figure 26 is a photograph of the test barrier shown in Figure 24 during fire testing; and

[00150] Figure 27 is a graph plotting temperature against time for the fire testing shown in Figures 25 and 26.

#### DETAILED DESCRIPTION

[00151] Figures 1 to 16 show various embodiments of a deployable fire barrier assembly (100) and parts thereof of the present invention. Figures 17 to 21 show various embodiments of a deployable fire barrier system (500) and components thereof of the present invention. Figure 22 shows a fire protection system (2200) according to an embodiment of the present invention. Lastly, Figures 23 to 27 show fire testing of embodiments of the assembly (100) and results.

[00152] Figures 1 and 2 show a first embodiment of the deployable fire barrier assembly (100) for location about an external surface of a building (900).

[00153] The assembly (100) includes a frame (110) mountable to the external surface of a building (900); and a barrier in the form of a panel (200) that is movably coupled to the frame (110). The panel (200) is deployable from a non-operable position in which the panel (200) is stowed against the external surface of the building (900) to an operable position in which the panel (200) extends outwardly from the building (900) to at least partially impede fire spreading along the external surface of the building (900) in a fire event.

[00154] In this embodiment, the barrier is a rigid panel (200) that has substantially rectangular shape and is formed from fire-retardant materials.

[00155] Best shown in Figure 1, the panel (200) has two opposed surfaces, including an upper surface (202) and an opposed lower surface (not visible). The opposed surfaces (202) extend substantially parallel to one another and are interconnected by opposing sidewalls and/or end walls, including opposed sidewalls (204), an outer end wall (206) and an opposed inner end wall (208) nearest the external surface of the building (900). The panel (200) has an elongate shape with a longitudinal axis extending between the two opposed sidewalls (204).

[00156] The panel (200) has a thickness of between about 10mm to 40mm.

[00157] As indicated, the panel (200) is formed from fire-retardant materials, namely between

about 30% to 60% magnesium oxide.

[00158] Referring again to both Figures 1 and 2, the panel (200) is mounted to a panel frame (210) comprising two or more panel frame members joined end to end. The panel frame (210) extends about a periphery of the panel (200) and supports the panel (200). The panel frame (210) is formed from aluminium. The panel (200) and the panel frame (210) are fastened together with one or more mechanical fasteners, such as, e.g., threaded fasteners, rivets or bolts.

[00159] Best shown in Figure 2, the assembly (100) includes a cover (220) configured to cover the lower surface of the panel (200), i.e., the outer surface when the panel (200) is in the non-operable position, and provide a desired aesthetic appearance when the panel (200) is in the non-operable position and stowed against the external surface of the building (900). The cover (220) also at least partially covers the frame (210) and is fastened in place by one or more mechanical fasteners, such as, e.g., threaded fasteners, rivets or bolts.

[00160] As shown, the panel (200) when deployed extends outwardly from the external surface of the building (900) a distance of between about 600mm and about 800mm. By extending outwardly from the building (900), the panel (200) advantageously deflects radiant heat away from cladding above the panel (200) thereby providing an effective barrier to impede the spread of fire during a fire event.

[00161] Referring again to Figure 1, the panel (200) is movably coupled to the frame (110), which is mounted to the external surface of the building (900).

[00162] The frame (110) in this embodiment is formed from four frame member (112) joined together end to end to define a rectangular frame (110). Each frame member (112) is directly mounted to the external surface of the building (900) via one or more mechanical fasteners, such as, e.g., threaded fasteners, rivets or bolts.

[00163] Each frame member (112) has an elongate shape extending longitudinally between a pair of opposed ends in a linear direction. Each frame member (112) is an extrusion formed from aluminium.

[00164] In this embodiment, the frame members (112) each have an L-shaped profile shape defined by a building facing wall (114; i.e., structure facing wall) and an outer sidewall (116) extending orthogonally outward along an outer longitudinal side edge of the frame member (112). When joined together, the L-shaped frame members (112) provide an outer sidewall to the frame (110) that extends outwardly from an outer periphery of the frame (110) to at least partially enclose the panel (200) when in the non-operable position.

[00165] As shown in both Figures 1 and 2, the panel (200) is hingedly coupled by a hinge

mechanism to the frame (110) via the panel frame (210) such that the panel (200) is able to pivot about the hinge mechanism between the non-operable and operable positions.

[00166] When deployed, the panel (200) pivots from a raised position corresponding to the non-operable position in which the panel (200) extends in a substantially vertical orientation to a lowered position corresponding to the operable position in which the panel (200) extends outwardly from the building (900) as shown in a substantially horizontal position. A pair of tethers (230) extending between the frame (110) and the panel frame (210) ensure the panel (200) does not over pivot when deployed. The tethers (230) can be a chain or wire tether.

[00167] In this embodiment, the assembly (100) includes a biasing mechanism in the form of one or more torsion springs (not shown) that are each operatively associated with the hinge mechanism for biasing the panel (200) into the operable position when deployed.

[00168] The assembly (100) further includes a releasable coupling mechanism (not visible) in the form of one or more mechanical fasteners configured to fail/release when subjected to high temperatures associated with or indicative of fire, such as, e.g., fire fail bolts. The fire fail bolts are formed from heat-sensitive metals and alloys, e.g., metals and alloys including one or more of the following characteristics low melting, cold worked, age hardened, transformation hardened or hardenable, or inherently brittle and prone to thermal shock.

[00169] In use, the fire fail bolts couple the cover (220) and/or the panel frame (210) to the frame (110) to retain the panel (200) in the non-operable position against the force of the biasing mechanism until deployed.

[00170] The fire fail bolts are configured to fail when exposed to a temperature ranging from about 200°C to about 400°C. The temperature being indicative of a fire event.

[00171] Figures 3 and 4 show a second embodiment of the deployable fire barrier assembly (100) for location about an external surface of a building (900). For convenience, features that are similar or correspond to features of the first embodiment will be referenced with the same reference numerals.

[00172] The assembly (100) again includes a frame (110) mountable to the external surface of the building (900); and a barrier in the form of a panel (200) that is movably coupled to the frame (110). The panel (200) is deployable from a non-operable position in which the panel (200) is stowed against the external surface of the building (900) to an operable position in which the panel (200) extends outwardly from the building (900) to at least partially impede fire spreading along the external surface of the building (900) in a fire event.

[00173] In this embodiment, the panel (200) is hingedly coupled by a hinge mechanism to the

frame (110) such that the panel (200) is able to pivot about the hinge mechanism between the non-operable and operable positions.

[00174] The assembly (100) again includes a biasing mechanism in the form of one or more torsion springs (not shown) that are each operatively associated with the hinge mechanism for biasing the panel (200) into the operable position when deployed.

[00175] The assembly (100) again includes a cover (220) configured to cover the lower surface of the panel (200), i.e., the outer surface when the panel (200) is in the non-operable position, and provide a desired aesthetic appearance when the panel (200) is in the non-operable position and stowed against the external surface of the building (900).

[00176] Unlike in the first embodiment, however, the cover (220) in this embodiment is not fastened to the panel (200). Rather, the cover (220) is in the form of a cover panel that is separately hingedly coupled by a hinge mechanism to an upper frame member of the frame (110). In use, the cover (220) is pivotable about the hinge mechanism between a lowered position in which the cover (220) covers the panel (200) when in the non-operable position and a raised position in which the cover (220) pivots clear of the panel (200) to enable the panel (200) to deploy to the operable position.

[00177] Both the panel (200) and the cover (220) in this embodiment each include a biasing mechanism in the form of one or more torsion springs (not shown) that are each operatively associated with respective hinge mechanisms for biasing the cover (220) into the raised position and the panel (200) into the operable position when deployed, respectively.

[00178] The assembly (100) again includes a releasable coupling mechanism (not visible) in the form of one or more mechanical fasteners configured to fail/release when subjected to high temperatures associated with or indicative of a fire event, such as, e.g., fire fail bolts.

[00179] The fire fail bolts couple the cover (220) to the frame (110) against the force of the biasing mechanism and to retain the panel (200) in the non-operable position against the force of the biasing mechanism until deployed in response to a fire event.

[00180] Figures 5 to 10 show a third embodiment of the deployable fire barrier assembly (100) for location about an external surface of a building (900). For convenience, features that are similar or correspond to features of the first or second embodiments will again be referenced with the same reference numerals.

[00181] Referring to Figure 5, the assembly (100) again includes a frame (110) mountable to the external surface of the building (900; not shown); and a barrier in the form of a panel (200) that is movably coupled to the frame (110). The panel (200) is deployable from a non-operable position in which the panel (200) is stowed against the external surface of the building (900; not shown) to an

operable position in which the panel (200) extends outwardly from the building (900; not shown) to at least partially impede fire spreading along the external surface of the building (900; not shown) in a fire event.

[00182] In this embodiment, the panel (200) is a flexible panel configured to be stowed in a rolled arrangement when in the non-operable position and be held taut in a substantially planar arrangement when in the operable position.

[00183] The panel (200) again has a pair of opposed surfaces, including an upper surface (202) and an opposed lower surface (not visible) when in the operable position. The panel (200) also includes opposed side edges (204), an outer edge (206) and an opposed inner edge (208) nearest the external surface of the building (900; not shown) when the panel (200) is deployed. Again, the panel (200) has an elongate shape having a longitudinal axis extending between the opposed side edges (204).

[00184] The panel (200) is formed from a substantially fire-retardant material, namely an aromatic nylon of the type sold by DuPont under the trade mark NOMEX™.

[00185] As with the first embodiment, when deployed, the panel (200) extends outwardly from the external surface of the building (900; not shown) a distance of between about 600mm and about 800mm to advantageously deflect radiant heat away from cladding above the panel (200) thereby providing an effective barrier to impede the spread of fire during a fire event.

[00186] Referring to Figure 6, the panel (200) is movably coupled to the frame (110) by a pair of support arms (300).

[00187] The frame (110) in this embodiment is formed from a single frame member (112) having a substantially U-shaped profile shape defined by a building facing wall (114; i.e., structure facing wall) and a pair of sidewalls (116) each extending orthogonally outward along an outer longitudinal side edge of the frame member (112). The outer sidewalls (116) at least partially enclose the panel (200) when in the non-operable position.

[00188] As shown in Figures 7 and 8 and Figures 9 and 10, the frame (110) can be fastened to cladding (910) on a building (900) or to the external surface of the building (900), respectively, via one or more mechanical fasteners, such as, e.g., threaded fasteners, rivets or bolts.

[00189] Referring back to Figure 6, the pair of support arms (300) are each pivotally coupled at either end of the frame (110) for angular movement about a generally vertical axis. The angular movement range of each arm (300) is about 110° relative to the frame.

[00190] The arms (300) are pivotable between a folded position corresponding to the non-operable position in which the arms (300) are folded against the frame (110) and an extended position

corresponding to the operable position in which the arms (300) extend away from the frame (110).

[00191] In this embodiment, the panel (200) is fastened to a shaft (302) of each arm (300) such that when the arms (300) pivot to the extended position the panel (200) is drawn out of the frame (110) and held taut between the arms (300) in the operable position.

[00192] Like with the first and second embodiments, the assembly (100) in this embodiment includes a biasing mechanism in the form of one or more torsion springs (not shown) that are operatively associated with each arm (300) for biasing the arms (300) into the extended positions.

[00193] Again, like with the first and second embodiments, the assembly (100) in this embodiment includes a cover (220) for at least partially covering the panel (200) and the frame (110) and retaining the panel (200) in the non-operable position against the force of the biasing mechanism.

[00194] The cover (220) is in the form of a cover panel having a pair of opposed surfaces, including an outer surface (222) and an opposed inner surface (224). The opposed surfaces extend substantially parallel to one another and are interconnected by opposing edges. The cover panel further includes upper and lower sidewalls (226) extending orthogonally from upper and lower side edges of the cover panel.

[00195] Referring to Figures 7 and 8, the cover (220) is hingedly coupled along the upper sidewall (226) to an upper sidewall (116) of the frame (110) by two hinge mechanisms (230) so that the cover (220) is able to pivot about the hinge mechanisms (230) between a lowered position, shown in Figure 7, corresponding to the non-operable position and a raised position, shown in Figure 8, corresponding to the operable position.

[00196] As with the earlier embodiments, the assembly (100) in this embodiment again includes a releasable coupling mechanism (not visible) in the form of one or more mechanical fasteners configured to fail/release when subjected to high temperatures associated with or indicative of a fire event, such as, e.g., fire fail bolts.

[00197] The fire fail bolts couple a lower portion of the cover (220) to a lower sidewall (116) of the frame (110) to retain the panel (200; not shown) in the non-operable position against the force of the biasing mechanism until deployed.

[00198] Figures 7 and 8 and Figures 9 and 10 respectively show different embodiments of the cover (220) depending on whether the frame (110) is fastened to cladding (910) on a building (900) as shown in Figures 7 and 8 or directly to the external surface of the building (900) as shown in Figures 9 and 10.

[00199] Referring to Figures 7 and 8, the cover (220) in this embodiment include an angled deflecting member (240) extending upwardly from a lower sidewall (226) at an angle relative to the

inner surface (224) for deflecting the cover (220) to pivot about the hinge mechanisms (230) to the raised position away from the panel (200; not shown) when the panel (200; not shown) is deployed.

[00200] Referring to Figures 9 and 10 and as indicated above, in this embodiment the frame (110) of the assembly (100) is configured to be directly fastened to the external surface of the building (900). This advantageously enables the assembly (100) to be fitted or retrofitted between adjacent cladding panels (910).

[00201] The cover (220) in this embodiment include a curved deflecting member (240) extending between the lower and upper sidewalls (226) and having a concave curvature. Again, the deflecting member (240) is configured to deflect the cover (220) to pivot about the hinge mechanisms (230) to the raised position away from the panel (200; not shown) when the panel (200; not shown) is deployed.

[00202] In this embodiment and because the assembly is fitted between cladding panels (910), the cover (220) includes an offset hinge mechanism (230) to provide clearance relative to adjacent the cladding panel (910) for the cover (200) to pivot to the raised position as shown in Figure 10.

[00203] Figures 11A to 11C show a fourth embodiment of the deployable fire barrier assembly (100) for location about an external surface of a building (900; not shown). For convenience, features that are similar or correspond to features of the first, second or third embodiments will again be referenced with the same reference numerals.

[00204] The assembly (100) in this embodiment is much the same as the third embodiment and again includes a frame (110) mountable to the external surface of the building (900; not shown); and a barrier in the form of a panel (200) that is movably coupled to the frame (110). The panel (200) is deployable from a non-operable position in which the panel (200) is stowed against the external surface of the building (900; not shown) to an operable position in which the panel (200) extends outwardly from the building (900; not shown) to at least partially impede fire spreading along the external surface of the building (900; not shown) in a fire event.

[00205] In this embodiment, however, the cover (220) is in the form of two cover panels (220A, 220B) each having a pair of opposed surfaces, including an outer surface (222) and an opposed inner surface (224). The opposed surfaces extend substantially parallel to one another and are interconnected by opposing edges.

[00206] Best shown in Figure 11A, a first cover panel (220A) is hingedly coupled to an upper sidewall (116) of the frame (110) by a hinge mechanism (230) so that the cover panel (220) is able to pivot about the hinge mechanisms (230) between a lowered position (shown), corresponding to the non-operable position, and a raised position, shown in Figures 11B and 11C, corresponding to the operable position. A second cover panel (220B) is hingedly coupled to the first cover panel

(220A) also by a hinge mechanism (230) and is releasably coupled to a lower sidewall (116) of the frame (110) to retain the panel (200; not shown) in the non-operable position against the force of the biasing mechanism until deployed. The second cover panel (220B) is releasably coupled again by fire fail bolts (not shown) configured to fail/release when subjected to high temperatures associated with or indicative of a fire event.

[00207] As shown in Figures 11B and 11C, when deployed, the second cover panel (220B) pivots relative to the first cover panel (220A), which pivots relative to the upper sidewall (116) of the frame (110), away from the panel (200) under the force of the biasing mechanism to enable the panel (200) to be deployed.

[00208] Shown only in Figure 11C, in some embodiments, one of the pair of support arms (300) includes a cover deflecting member in the form of a roller (1200) configured to deflect the first cover panel (220A) and thus the second cover panel (220B) clear of the panel (200) when deployed.

[00209] Figures 12A to 12C show a fifth embodiment of the deployable fire barrier assembly (100) for location about an external surface of a building (900; not shown). For convenience, features that are similar or correspond to features of the first, second or third embodiments will again be referenced with the same reference numerals.

[00210] The assembly (100) in this embodiment is much the same as the fourth embodiment and again includes a frame (110) mountable to the external surface of the building (900; not shown); and a barrier in the form of a panel (200; not visible in Figure 12B) that is movably coupled to the frame (110). The panel (200; not visible in Figure 12B) is deployable from a non-operable position in which the panel (200) is stowed against the external surface of the building (900; not shown) to an operable position in which the panel (200) extends outwardly from the building (900; not shown) to at least partially impede fire spreading along the external surface of the building (900; not shown) in a fire event.

[00211] Referring briefly to Figure 12C, in this embodiment, however, the panel (200) further includes edge curtains (209) associated with both side edges and the outer end edge of the panel (200).

[00212] Best shown in Figure 12A, the cover panel (220) is hingedly coupled to an upper sidewall (116) of the frame (110) by a hinge mechanism (230) so that the cover panel (220) is able to pivot about the hinge mechanisms (230) between a lowered position (shown), corresponding to the non-operable position, and a raised position, shown in Figure 12C, corresponding to the operable position. The cover panel (220) is releasably coupled again by fire fail bolts (1202) configured to fail/release when subjected to high temperatures associated with or indicative of a fire event.

[00213] As shown, the assembly (100) includes a biasing mechanism in the form of torsion

springs (1204) operatively associated with each arm (300) for biasing the arms (300) into the extended positions.

[00214] Figures 13 and 14 show a fifth embodiment of the deployable fire barrier assembly (100) for location about an external surface of a building (900; not shown). For convenience, features that are similar or correspond to features of the first, second or third embodiments will again be referenced with the same reference numerals.

[00215] Referring to Figure 13, the assembly (100) again includes a frame (110) mountable to the external surface of the building (900; not shown); and a barrier in the form of a panel (200; not shown) that is movably coupled to the frame (110). The panel (200; shown in Figure 14 only) is deployable from a non-operable position in which the panel (200; shown in Figure 14 only) is stowed against the external surface of the building (900; not shown) to an operable position in which the panel (200; shown in Figure 14 only) extends outwardly from the building (900; not shown) to at least partially impede fire spreading along the external surface of the building (900; not shown) in a fire event.

[00216] Referring to Figure 14, the assembly (100) in this embodiment again includes a flexible panel (200) configured to be stowed in a rolled arrangement when in the non-operable position and be held taut in a substantially planar arrangement when in the operable position.

[00217] The panel (200) is formed from a substantially fire-retardant material, namely an aromatic nylon of the type sold by DuPont under the trade mark NOMEX™.

[00218] As with the third embodiment, when deployed, the panel (200) extends outwardly from the external surface of the building (900; not shown) a distance of between about 600mm and about 800mm to advantageously deflects radiant heat away from cladding above the panel (200) thereby providing an effective barrier to impede the spread of fire during a fire event.

[00219] Referring to Figure 13, the panel (200; not shown) is movably coupled to the frame (110) by a scissor mechanism. The scissor mechanism includes a pair of scissor arms (400) extending between the frame (110) and an outer edge (206; not shown) of the panel (200) via a panel frame member (210) extending along and fastened to the outer edge (206; not shown). The arms (400) extend in a linked and criss-crossed arrangement.

[00220] Each arm (400) includes a pair of opposed ends and an elongate body extending longitudinally between the opposed ends. The opposed ends include an inner end and an opposed outer end. The arms (400) are pivotally linked together about midway along each of their lengths, via a pivot pin (410).

[00221] The inner end of each arm (400) is pivotally and slidably coupled to the frame (110). The

outer end of each arm (400) is pivotally and slidably coupled to the panel frame member (210).

[00222] In use, the arms (400) are movable between a folded position corresponding to the non-operable position in which the arms (400) fold against one another against the frame (110) and an extended position corresponding to the operable position in which the arms (400) extend away from the frame (110). In the extended position, the panel (200; shown only in Figure 14) is drawn out from a roller associated with the frame (110) and held taut between the panel frame member (210) and the frame (110) in the operable position.

[00223] Like with the first to fourth embodiments, the assembly (100) in this embodiment includes a biasing mechanism in the form of one or more tension coil springs operatively associated with the respective inner ends of each arm (400) to bias the inner ends to slide together and thereby urge the arms (400) into the extended and operable position.

[00224] Referring to both Figures 13 and 14, the assembly (100) in this embodiment includes a cover (220) for at least partially covering the panel (200) and the frame (110) and retaining the panel (200) in the non-operable position against the force of the biasing mechanism.

[00225] The cover (220) in this embodiment is in the form of a cover panel fastened to the panel frame member (210). The cover (210) in this embodiment is not hingedly coupled to the frame (110) but rather moves with the panel frame member (210) to the extended position when the panel (200; shown only in Figure 14) is deployed.

[00226] As with the earlier embodiments, the assembly (100) in this embodiment again includes a releasable coupling mechanism (not visible) in the form of one or more mechanical fasteners configured to fail/release when subjected to high temperatures associated with or indicative of a fire event, such as, e.g., fire fail bolts.

[00227] The fire fail bolts couple the cover (220) and/or the panel frame member (210) to the frame (110) to retain the panel (200; not shown) in the non-operable position against the force of the biasing mechanism until deployed.

[00228] Figures 15A and 15B show a sixth embodiment of the deployable fire barrier assembly (100) for location about an external surface of a building (900; not shown). For convenience, features that are similar or correspond to features of the first, second, third, fourth or fifth embodiments will again be referenced with the same reference numerals.

[00229] Referring to both Figures 15A and 15B, the assembly (100) again includes a frame (110) mountable to the external surface of the building (900); and a barrier in the form of a panel (200; shown in Figure 15B only) that is movably coupled to the frame (110). The panel (200) is deployable from a non-operable position shown in Figure 15A in which the panel (200; shown in Figure 15B only)

is stowed against the external surface of the building (900; not shown) to an operable position as shown in Figure 15B in which the panel (200; shown in Figure 15B only) extends outwardly from the building (900; not shown) to at least partially impede fire spreading along the external surface of the building (900; not shown) in a fire event.

[00230] Referring to Figure 15B, in this embodiment the cover (220) is hingedly coupled by a hinge mechanism to the frame (110) along an upper end edge such that a lower end edge of the cover (220) is able to pivot about the hinge mechanism and retract and extend the panel (200), coupled between lower end portions of the frame (110) and the cover (220), between the non-operable and operable positions.

[00231] The assembly (100) again includes a biasing mechanism in the form of one or more torsion springs (not shown) operatively associated with the hinge mechanism and one or more gas struts (1500) extending between the frame (110) and the cover (220) for biasing the cover (220) into the operable position when deployed.

[00232] Referring again to both Figures 15A and 15B, the assembly (110) includes fire fail bolts for coupling the cover (220) to the frame (110) to retain the panel (200; shown in Figure 15B only) in the non-operable position against the force of the biasing mechanism until deployed.

[00233] In addition to the one or more gas struts (1500), the assembly (100) further includes tethers (1502; shown in Figure 15B only) for stabilising the panel (200) when deployed.

[00234] Figures 16A and 16B show a seventh embodiment of the deployable fire barrier assembly (100) for location about an external surface of a building (900; not shown). For convenience, features that are similar or correspond to features of the first, second, third, fourth, fifth or sixth embodiments will again be referenced with the same reference numerals.

[00235] This embodiment is almost identical to the sixth embodiment save that instead of one or more torsion springs and gas struts, the assembly (100) includes an actuating mechanism in the form of a electric chain actuator (1602) for driving the cover (220) to pivot relative to the frame (110) and thus deploy the panel (200).

[00236] Figures 17 to 21 show various embodiments of a deployable fire barrier system (500) and components thereof according of the present invention.

[00237] Referring to Figure 17, this figure shows an embodiment of the deployable fire barrier system (500) for location about a building (900; i.e., structure) to at least partially impede fire spreading along an external surface of the building (900).

[00238] The system (500) includes a plurality of the assembly (100) of the third embodiment as shown in Figures 5 to 10 arranged in series about the perimeter of the building (900), each assembly

(100) being configured to individually deploy in response to a fire event.

[00239] As shown, the panels (200) of adjacently positioned assemblies (100) at least partially overlap when deployed to provide a substantially continuous barrier or impediment to the spread of fire.

[00240] As shown in Figures 7 and 8 and Figures 9 and 10, the system (500) can be directly mounted to the external surface of the building (900) as shown in Figure 17 or can be retrofitted to existing cladding.

[00241] Figures 18 to 21 show various embodiments of a fire stop member (510) configured to be used with the system (500; not shown) to impede the spreading of fire between existing cladding panels (910; shown only in Figures 18 to 20) and an external surface of the building (900; not shown). In some embodiments, multiple fire stop members (510) may be used with the system (500; not shown).

[00242] Each fire stop member (510) is configured to extend entirely across a rear surface of a cladding panel (910; shown in Figures 17 to 19 only) in a substantially horizontal orientation so as to effectively compartmentalise the panel (910; shown in Figures 18 to 20 only) during a fire event.

[00243] The fire stop member (510) is mountable to a rear surface of a cladding panel (910; shown only in Figures 18 to 20) via one or more mechanical fasteners and/or with a bracket or fastening mechanism.

[00244] The fire stop member (510) can be fitted when cladding panels (910; shown only in Figures 18 to 20) are fitted or may be retrofitted to existing cladding panels (910; shown only in Figures 18 to 20), such as, e.g., with non-compliant cladding panels.

[00245] Referring to Figure 18, in this embodiment the fire stop member (510) includes a core (512) of compressed mineral wool, a core wrapping (514) configured to constrain the core (512) in a compressed state or form, and an outer coating in the form of a frame member (516) for fastening to the rear surface of a cladding panel (910) and for at least partially containing the core (512) and the core wrapping (514).

[00246] In use, the core wrapping (514) is configured to melt in a fire event and enable the core (512) to expand, fill the outer coating and at least partially impede fire spreading between the panel (910) and an external surface of the building (900; not shown)

[00247] The frame member (516) is an aluminium extrusion.

[00248] The core wrapping (514) is a polyethylene wrap sold by DuPont under the trade mark TYVEK™.

[00249] Referring to Figure 19, in this embodiment the fire stop member (510) includes a strip configured to extend across a rear surface of a cladding panel (910) for impeding a fire spreading between the cladding panel (910; shown only in Figure 20) and the building (900) and compartmentalising the fire.

[00250] The strip includes a core (518) formed of magnesium oxide and a fire-retardant outer coating (519) enveloping the core (518)

[00251] The fire-retardant outer coating (519) may be formed from silicone, graphene, glass mesh and metal (e.g., steel or stainless steel) material or materials.

[00252] Referring to Figures 20 and 21, in this embodiment a first fire stop member (510A) includes two frame members (516) configured to extend across and be fastened to a rear surface of a cladding panel (910; shown only in Figure 20) in a substantially parallel and horizontal arrangement and a strip (517) of fire-retardant material configured to be clamped between the frame member (516) for impeding a fire spreading between the cladding panel (910; shown only in Figure 20) and the building (900; not shown) and compartmentalising the fire.

[00253] The strip (517) is formed from an aromatic nylon of the type sold by DuPont under the trade mark NOMEX™.

[00254] The two frame members (516) include an intumescent coating configured to swell when exposed to heat indicative of a fire event.

[00255] A second fire stop member (510B) in the form of a strip extends across a rear surface of the cladding panel (910), above the first fire stop member (510A), for further impeding fire spreading between the cladding panel (910) and the building (900; not shown) and compartmentalising the fire. The strip includes a core (not shown) formed of magnesium oxide and a fire-retardant coating (519B) extending across a structure facing surface of the strip. The coating (519B) is formed from one or more layers of stainless-steel material.

[00256] Figure 22 shows a fire protection system (2200) according to an embodiment of the present invention.

[00257] The system (2200) includes one or more sensors (2210) configured to detect heat or smoke within a building (900); a deployable fire barrier system (500), as herein before described with reference to Figures 17 to 21, for location about a perimeter of the building (900); and a building controller (2220) in communication with the one or more sensors, said controller (2220) configured to continuously monitor the one or more sensors (2210) and selectively deploy one or more fire barrier assemblies (100) of the fire barrier system (500) when a fire event (990) is detected by the one or more sensors (2210) or upon receiving a manual command.

[00258] The one or more sensors (2210) include smoke and/or heat sensors.

[00259] The controller (2220) takes the form of a base station located in the building (900). The controller (2220) includes a microcomputer (2222), including one or more processors and a memory.

[00260] The controller (2220) is addressable and reports its operational status to an external device when polled.

[00261] As indicated, the controller (2220) is in communication with the one or more sensors (2210) and continuously monitor their operational status. The controller (2220) can be in wireless or wired communication with the one or more sensors (2210).

[00262] The controller (2220) is operatively connected to the fire barrier system (500) via a wired connection, and selectively deploys one or more fire barriers (200) by activating an actuating mechanism or latch mechanism associated with each fire barrier assembly (100). The controller (2220) typically deploys the one or more fire barriers (200) in an automated manner.

[00263] In operation, the system (2200) selectively deploys fire barrier assemblies (100) located adjacent a fire event (990) to at least partially contain the spread of the fire event (990). In some embodiments, the system (2200) can selectively deploy fire barrier assemblies (100) in a cascading arrangement around the fire event (990).

[00264] The controller (2220) include a communications module for communication with external devices and/or emergency services (980). The communications module is in the form of a modem enabling the controller (2220) to communicate via a wired or wireless network.

## EXPERIMENTS

[00265] The following experiments are provided to demonstrate the effectiveness of the assembly (100) of the present invention as a fire barrier. The example is not to be considered limiting on the scope and ambit of the present invention as hereinbefore described.

### *Experiment 1*

[00266] Referring to Figures 19 and 20, fire tests were conducted at Ignis Solutions in Canberra, Australia.

[00267] The tests were conducted on a BS 8414 large scale external wall test rig. The fire events simulated a projecting window fire impacting on an external facade.

[00268] Referring to Figure 19, in this first test a 10mm ResCom™ magnesium oxide board was fixed to the test rig wall with a shelf brackets. This test was conducted to investigate the effectiveness of a rigid panel barrier as depicted in the first and second embodiments of the assembly (100).

[00269] Referring to Figure 20, in this second test a fire grade curtain was fixed over two arms affixed to the test rig wall. This test was conducted to investigate the effectiveness of a flexible panel barrier as depicted in the third and fourth embodiments of the assembly (100). In this test, a pair of thermocouples were located approximately 500mm above the curtain to monitor the temperature during the fire testing.

[00270] Figures 21 and 22 respectively show the first and second tests during simulated fire events.

[00271] Referring to Figure 21, in this photograph the ResCom™ magnesium oxide board in the first test can be seen clearly deflecting or directing the fire away from the wall surface above and preventing direct flame impingement on the wall surface.

[00272] Referring to Figure 22, in this photograph the fire grade curtain in the second test can also be seen deflecting or directing the fire away from the wall surface above and preventing direct flame impingement on the wall surface.

[00273] Referring to Figure 23, this graph plots the temperature readings from the thermocouples in the second test during the first four minutes of the simulated fire event.

[00274] As shown, the fire grade curtain shielded the wall from high temperatures with a maximum temperature of about 200°C being recorded.

[00275] By way of comparison, during a simulated fire event without any barriers, corresponding temperatures in the order of 800°C -900°C were recorded.

[00276] In summary, the first and second fire tests both demonstrated that the fire barrier assembly concept is effective in mitigating high temperatures on a wall surface above the barrier. Although compliant panel cladding has a capacity to withstand temperatures of up to 600°C, the testing demonstrated that the barriers were effective in maintaining the wall surface temperature well below 600°C suggesting the fire barrier assembly concept may be an effective interim solution for use with non-compliant panel cladding.

[00277] In the present specification and claims (if any), the word '*comprising*' and its derivatives including '*comprises*' and '*comprise*' include each of the stated integers but does not exclude the inclusion of one or more further integers.

[00278] Reference throughout this specification to '*one embodiment*' or '*an embodiment*' means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment of the present invention. Thus, the appearance of the phrases '*in one embodiment*' or '*in an embodiment*' in various places throughout this specification are not necessarily all referring to the same embodiment. Furthermore, the particular features, structures,

or characteristics may be combined in any suitable manner in one or more combinations.

[00279] In compliance with the statute, the invention has been described in language more or less specific to structural or methodical features. It is to be understood that the invention is not limited to specific features shown or described since the means herein described comprises preferred forms of putting the invention into effect. The invention is, therefore, claimed in any of its forms or modifications within the proper scope of the appended claims (if any) appropriately interpreted by those skilled in the art.

## CLAIMS

1. A deployable fire barrier assembly for location about an external surface of a structure, said assembly including:
  - a frame mountable to the external surface of the structure; and
  - a barrier movably coupled to the frame and configured to be deployable from a non-operable position in which the barrier is stowed against the external surface of the structure to an operable position in which the barrier extends outwardly from the structure to at least partially impede fire spreading along the external surface of the structure.
2. The assembly of claim 1, wherein the barrier is formed from substantially fire resistant or fire retardant material or materials.
3. The assembly of claim 1 or claim 2, wherein the barrier is formed from polybenzimidazole (PBI), aramids, FR cotton, coated nylon, polyhydroquinone-dimidazopyridine (PIPD), melamine, modacrylic, an aromatic nylon or any combination thereof.
4. The assembly of any one of claims 1 to 3, wherein when deployed the barrier extends outwardly between about 600mm and about 800mm from the external surface of the structure.
5. The assembly of any one of claims 1 to 4, wherein the barrier is a panel member and wherein the barrier and the frame are hingedly coupled together such that the barrier is able to pivot about the hinge between the non-operable and operable positions.
6. The assembly of claim 5, wherein the barrier is pivotable between a raised position corresponding to the non-operable position in which the panel member extends in a substantially vertical orientation and a lowered position corresponding to the operable position in which the panel member extends outwardly from the structure.
7. The assembly of claims 5 or claim 6, further including a biasing mechanism in the form of one or more torsion springs operatively associated with the hinge mechanism for biasing the panel member into the operable position.
8. The assembly of any one of claims 1 to 4, wherein the barrier is a flexible panel moveably coupled to the frame by at least one support arm pivotally coupled to the frame for angular movement about a generally vertical axis.
9. The assembly of claim 8, wherein the at least one support arm is pivotable between a folded position corresponding to the non-operable position in which the at least one support arm is folded against the frame and an extended position corresponding to the operable position in which the at least one arm extends away from the frame.

10. The assembly of claim 8 or claim 9, wherein the flexible panel is attached or fastened to the frame at one end and attached or fastened at an opposite end to a shaft of the support arm such that when the support arm pivots to the extended position the flexible panel is drawn out of the frame and held taut between the at least one support arm and the frame when in the operable position.
11. The assembly of any one of claims 8 to 10, further including a biasing mechanism in the form of one or more torsion springs operatively associated with the frame and the at least one support arm for biasing the at least one support arm into the extended position.
12. The assembly of any one of claims 8 to 11, wherein the at least one support arm includes a pair of support arms each attached or fastened to the flexible panel and pivotally coupled to opposite sides of the frame.
13. The assembly of any one of claims 1 to 4, wherein the barrier is a flexible panel movably coupled to the frame and a scissor mechanism, said scissor mechanism including a pair of scissor arms extending between the frame and an outer end of the flexible panel in a linked or criss-crossed arrangement.
14. The assembly of claim 13, wherein the scissor arms are movable between a folded position corresponding to the non-operable position in which the arms fold against one another against the frame and an extended position corresponding to the operable position in which the arms extend away from the frame, and wherein the outer end of each arm is pivotally and slidably coupled to the flexible panel via a barrier frame member such that when in the extended position the flexible panel is drawn out of the frame and held taut between the barrier frame member and the frame in the operable position.
15. The assembly of claim 13 or claim 14, further including a biasing mechanism in the form of one or more coil springs operatively associated with respective inner ends of each scissor arm to bias the inner ends to slide together and thereby urge the arms into the extended and operable position.
16. The assembly of any one of claims 1 to 15, further including a cover for at least partially covering the frame and the barrier and configured to releasably retain the barrier in the non-operable position against a force of a biasing mechanism.
17. The assembly of claim 16, wherein the cover is hingedly coupled to the frame along one side and releasably coupled to the frame along an opposite side.
18. The assembly of claim 16 or claim 17, wherein the cover and the frame are releasably coupled together by an electronic latch mechanism configured to be remotely operated to deploy the barrier.

19. The assembly of claim 16 or claim 17, wherein the cover and the frame are releasably coupled to together by one or more mechanical fasteners configured to fail when subjected to high temperatures associated with or indicative of fire.
20. The assembly of claim 16 or claim 17, further including an actuator or actuating mechanism for moving the cover and the frame relative to one another for deployment of the barrier.
21. The assembly of any one of claims 16 to 20 when dependent on any one of claims 1 to 4, wherein the cover is hingedly connected to the frame along an upper end such that the lower end is pivotable relative to the frame and wherein the barrier is a flexible panel coupled to lower ends of the frame and the cover such that the barrier is drawn out by the pivoting of the lower end of the cover away from the frame to the operable position.
22. A fire barrier system for location about a structure, said system including:  
a plurality of deployable fire barrier assemblies in accordance with any one of claims 1 to 21 arranged in series about a perimeter of the structure, each assembly configured to be selectively deployable in response to a fire being detected to at least partially impede the fire spreading along an external surface of the structure.
23. The system of claim 22, wherein the barriers of adjacent positioned assemblies at least partially overlap when deployed to provide a continuous barrier or impediment to fire spreading during a fire event.
24. The system of claim 22, wherein the barrier of adjacently positioned assemblies extend substantially flush with one another to provide a substantially continuous barrier or impediment to fire spreading during a fire event.
25. The system of any one of claims 22 to 24, wherein the plurality of deployable fire barrier assemblies are serially arranged to extend about the structure at multiple heights.
26. A fire protection system for a structure, said system including:  
one or more sensors located within the structure;  
a fire barrier system in accordance with any one of claims 22 to 25 fitted to the structure; and  
a building controller in communication with the one or more sensors, said controller configured to continuously monitor said one or more sensors and selectively deploy one or more fire barrier assemblies of the fire barrier system when a fire is detected by the one or more sensors or upon receiving a manual command.
27. The system of claim 26, wherein the one or more sensors include smoke and heat sensors.
28. The system of claim 26 or claim 27, wherein the controller is operatively connected to the fire barrier system to selectively deploy one or more of the fire barrier assemblies by activating an

actuating mechanism or latch mechanism associated with each fire barrier assembly.

29. The system of any one of claims 26 to 28, wherein the controller autonomously deploys one or more of the fire barrier assemblies.

30. The system of any one of claims 26 to 29, wherein the controller autonomously deploys fire barrier assemblies located adjacent a detected fire to at least partially contain the fire.

31. The system of any one of claims 29 to 30, further including a sprinkler system fitted within the structure, said sprinkler system configured to be selectively activated by the controller in response to a fire being detected.

32. A method of at least partially impeding fire spreading along an external surface of a structure, said method including:

fitting one or more deployable fire barrier assemblies in accordance with any one of claims 1 to 21 to the external surface of the structure; and

selectively deploying a barrier of one or more of the deployable fire barrier assemblies when a fire is detected to at least partially impede the fire spreading past the barrier.

33. The method of claim 32, wherein said selectively deploying is automated in response to a fire being detected by one or more sensors operatively associated with the one or more assemblies.

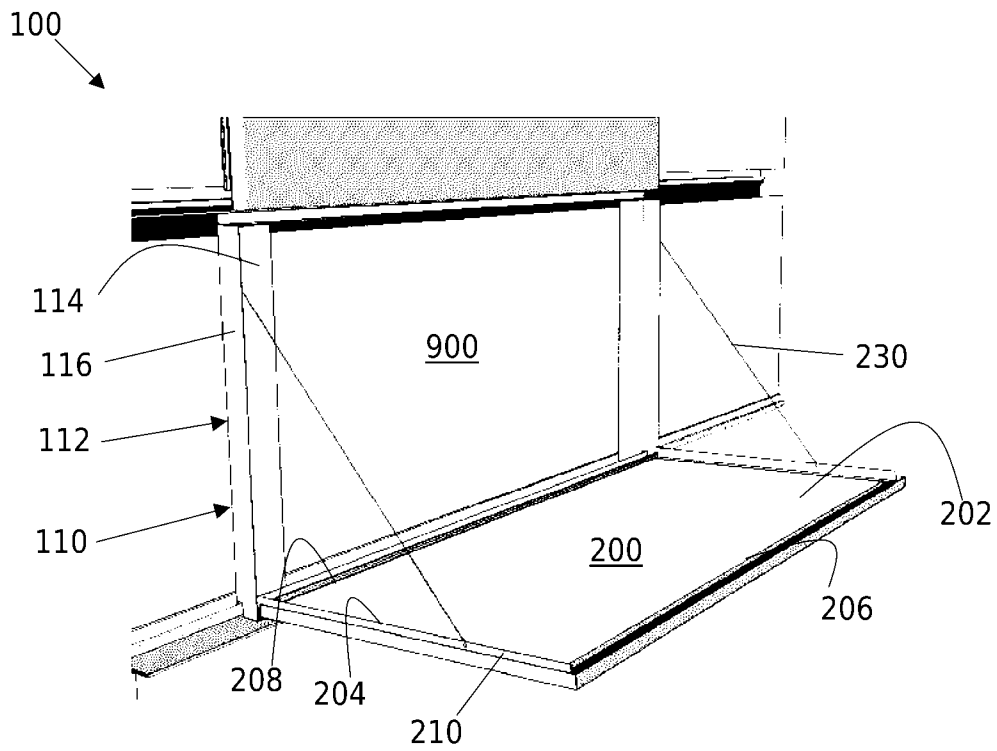


Figure 1

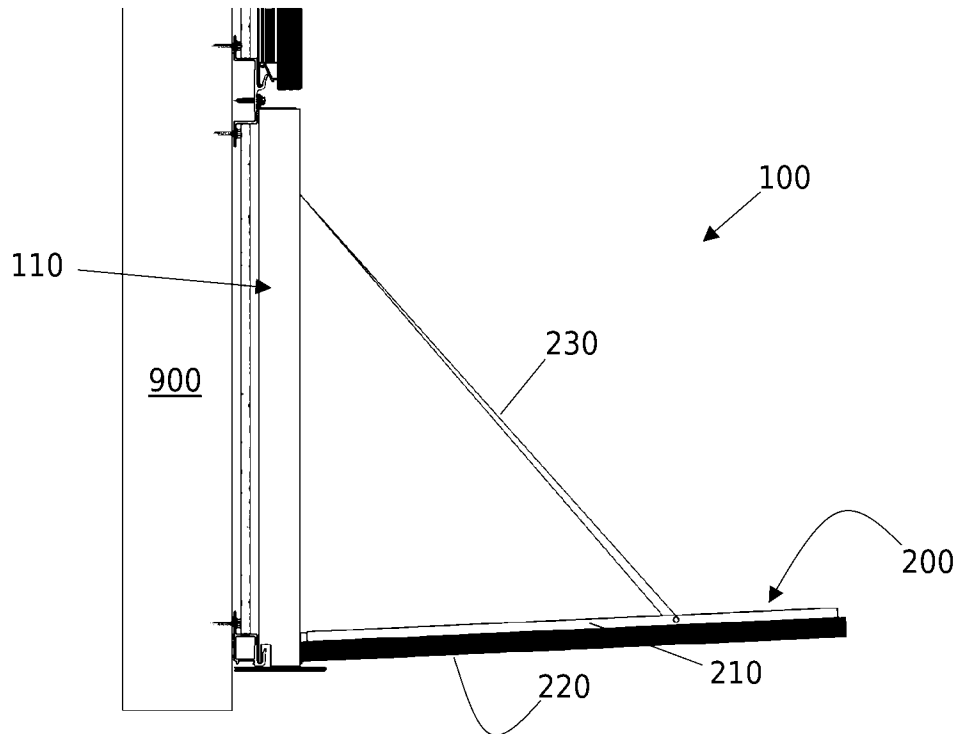


Figure 2

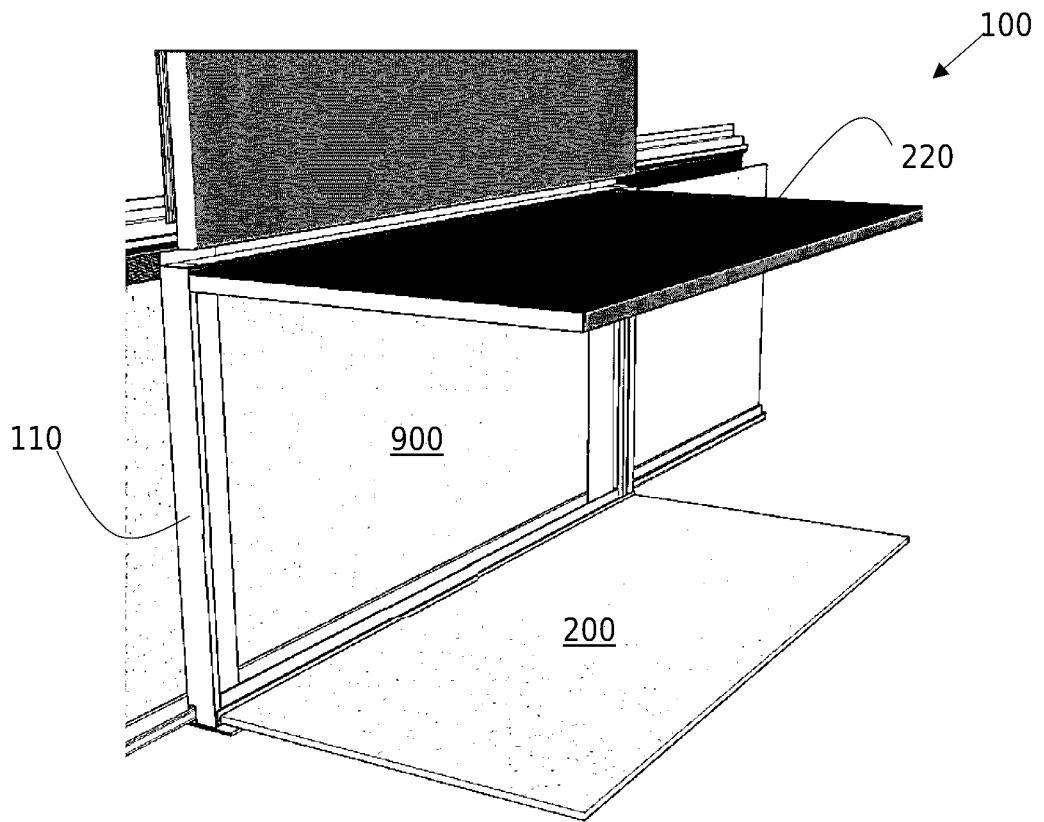


Figure 3

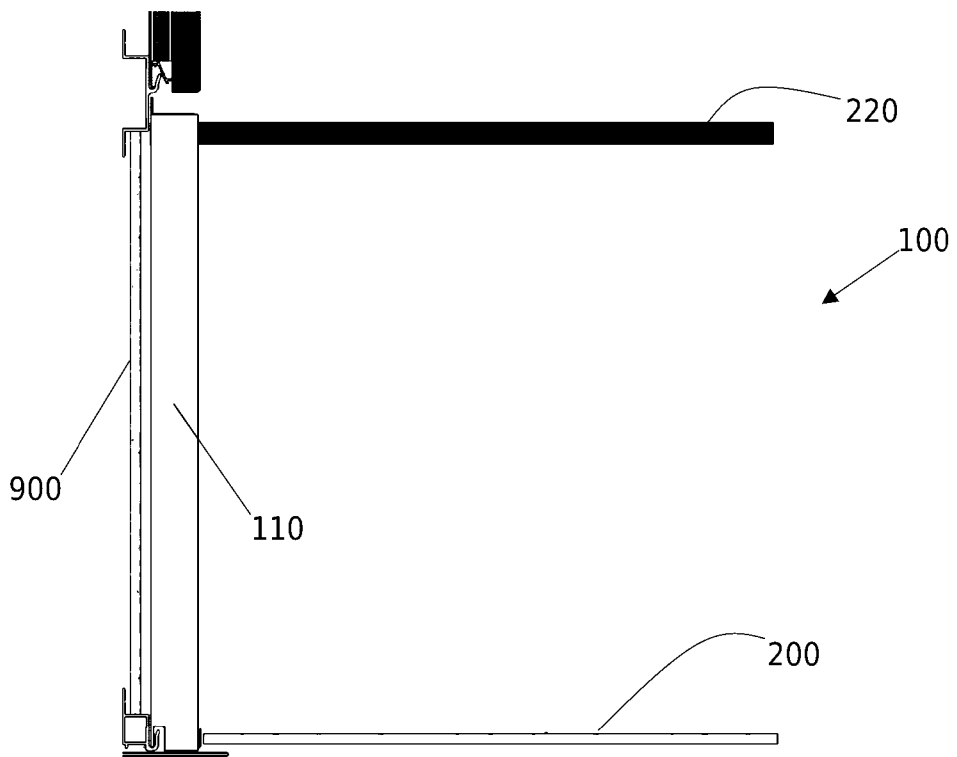


Figure 4

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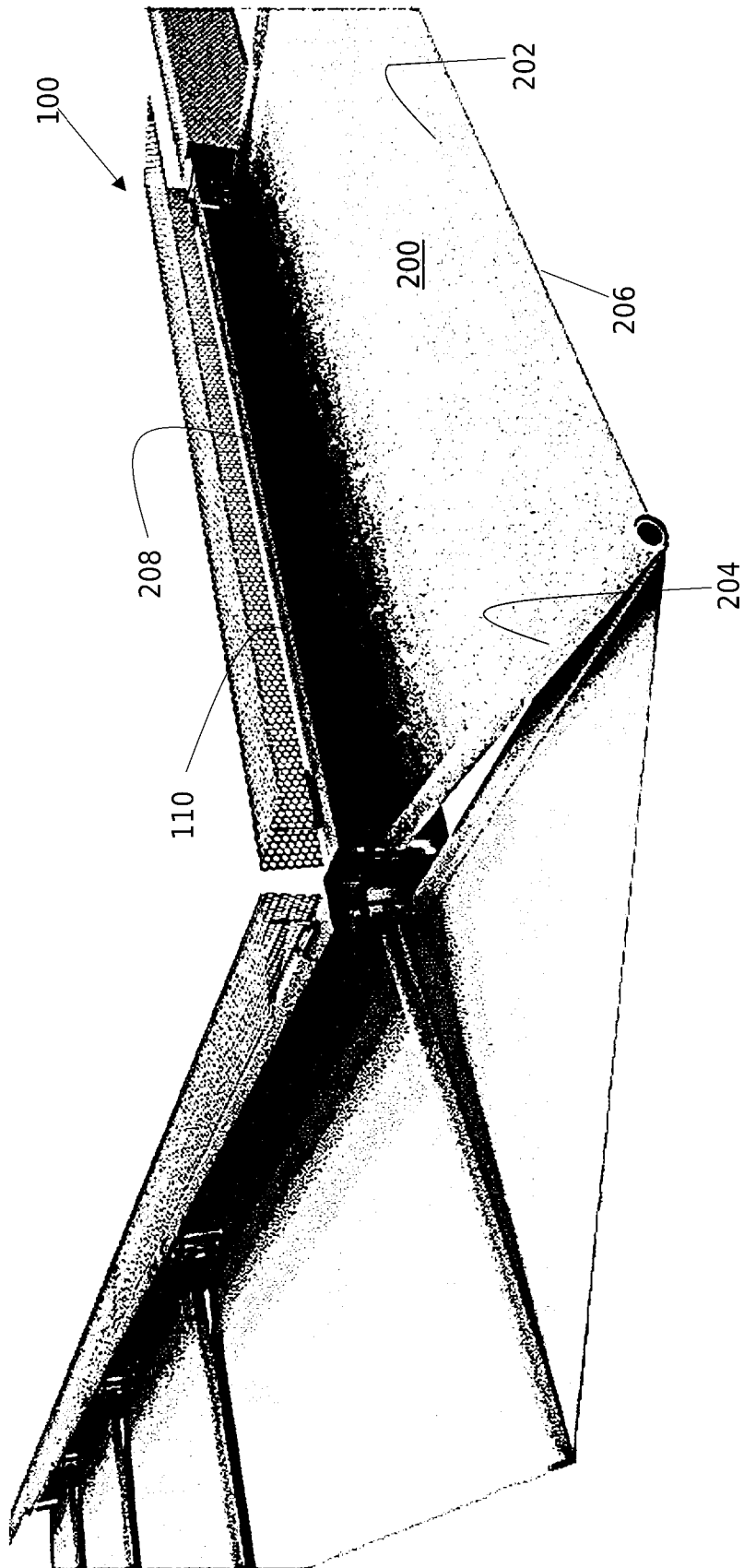


Figure 5

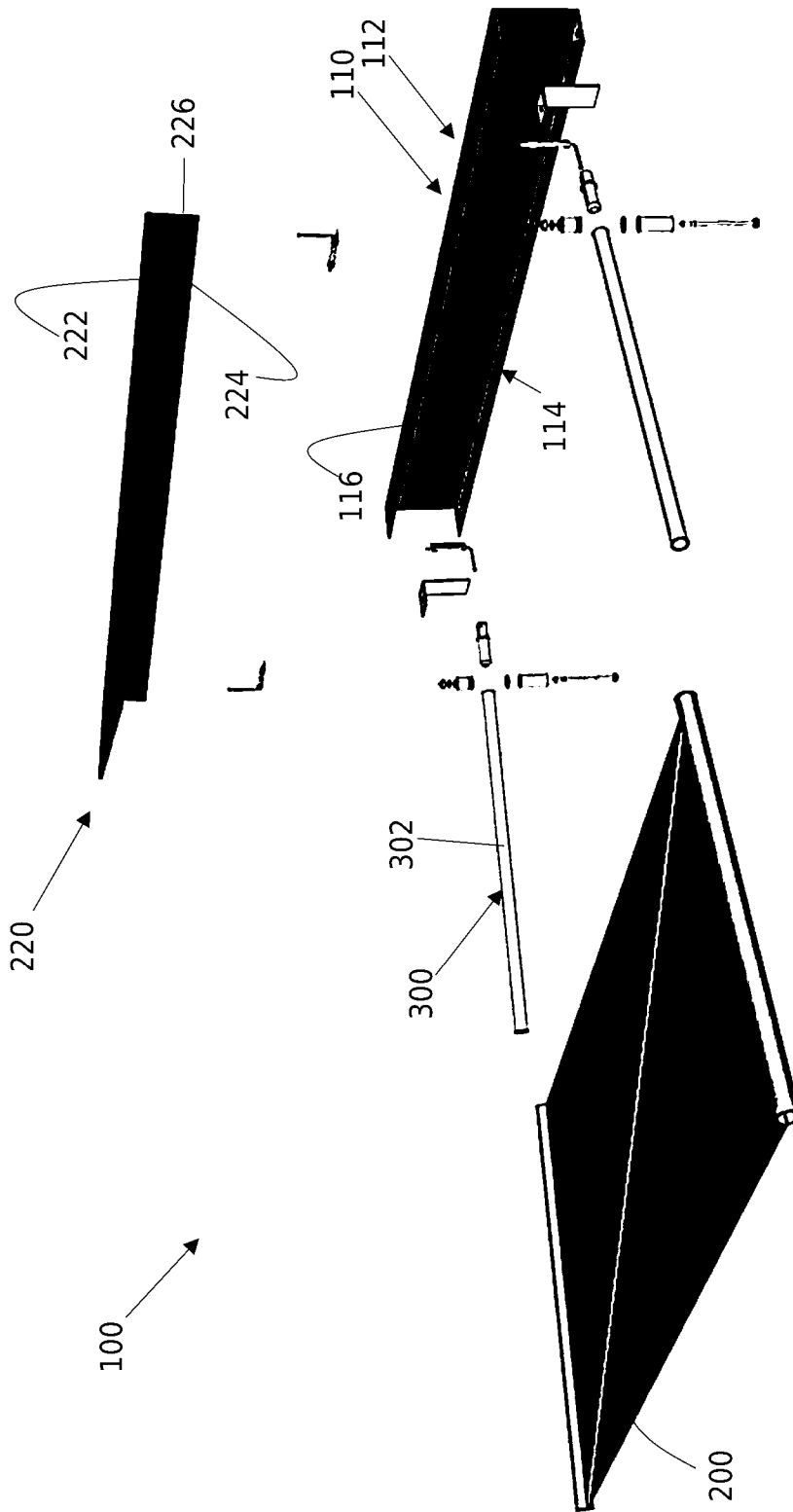


Figure 6

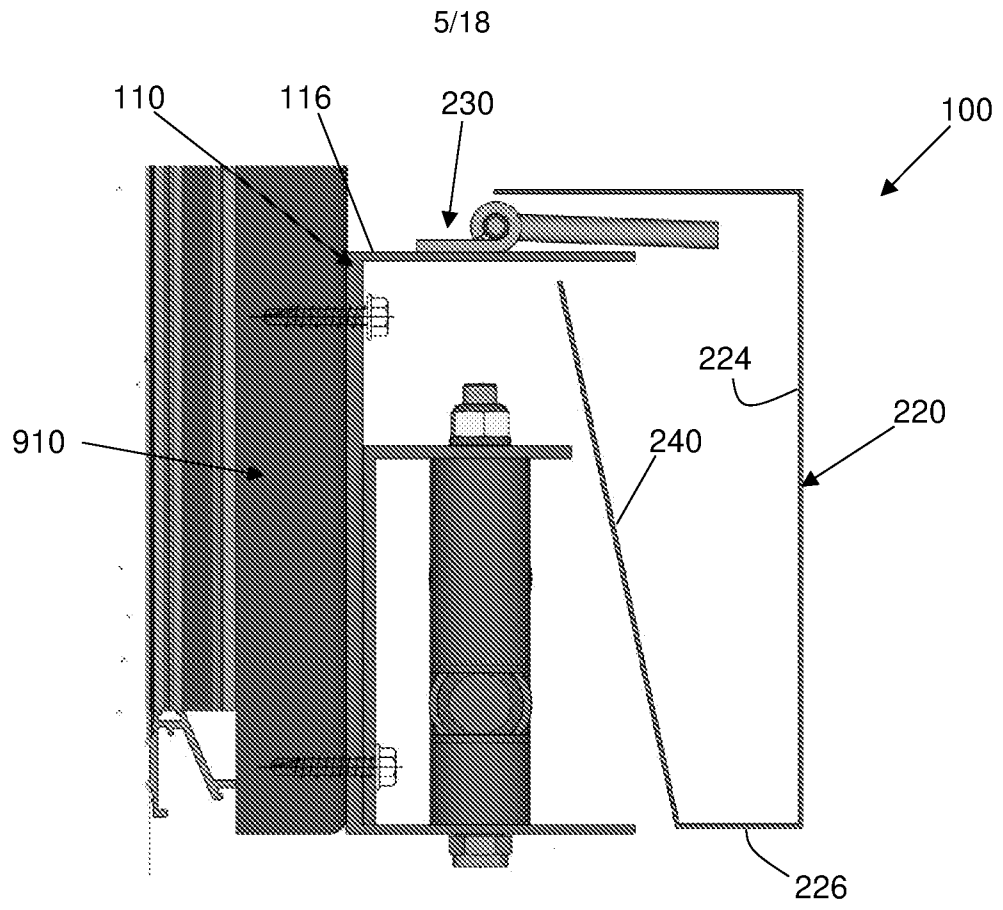


Figure 7

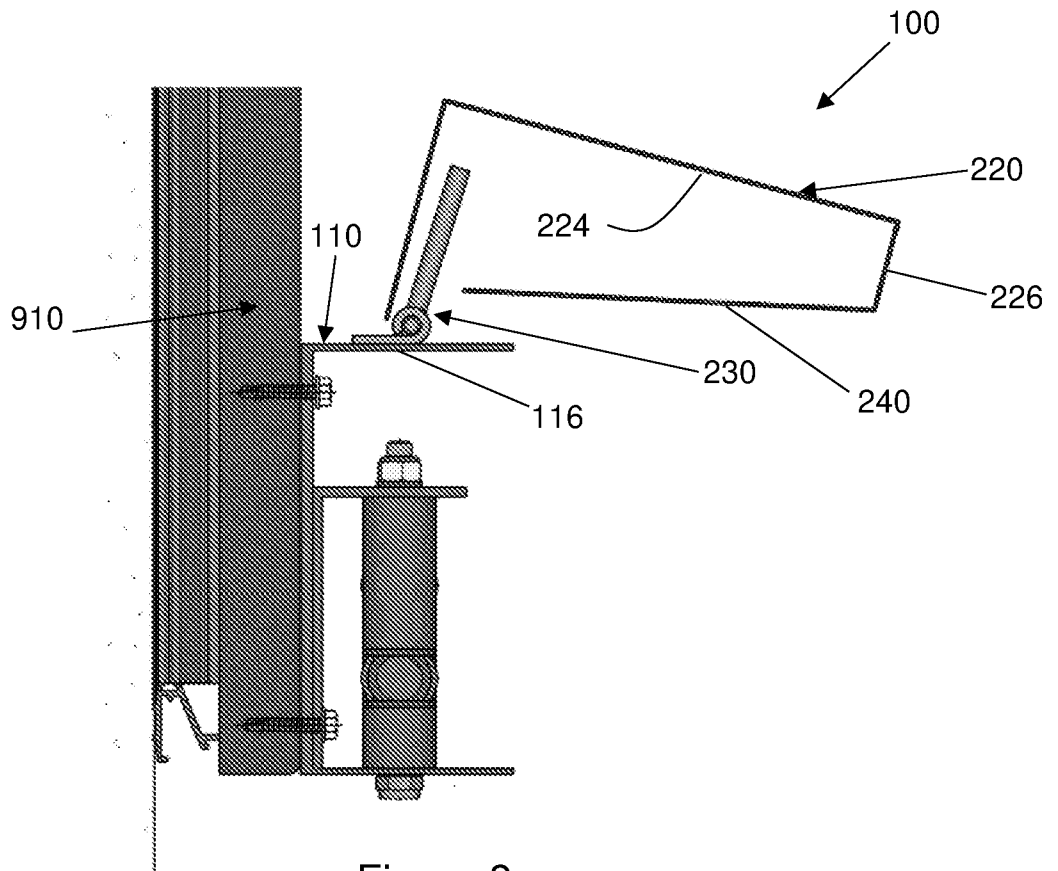


Figure 8

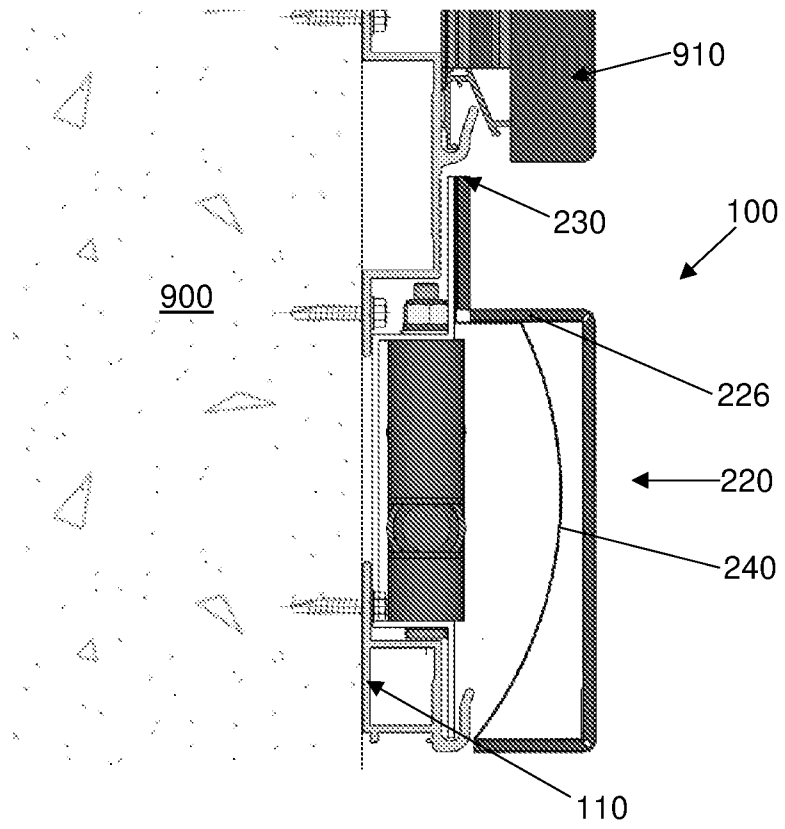


Figure 9

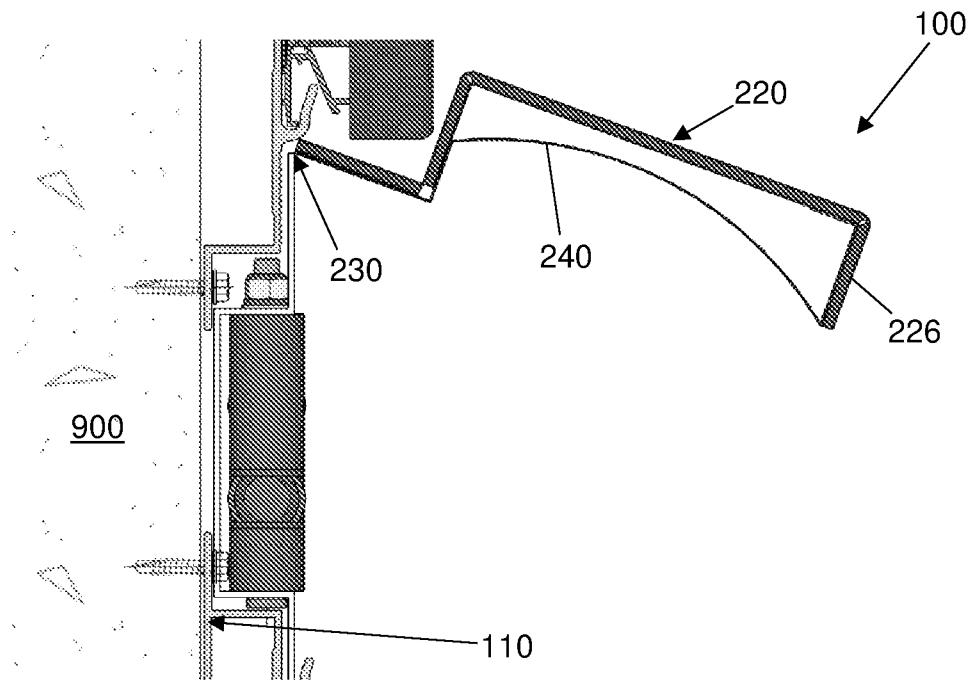


Figure 10

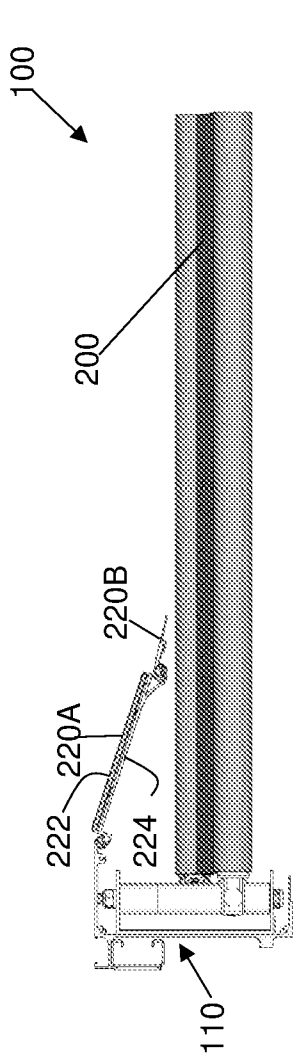


Figure 11B

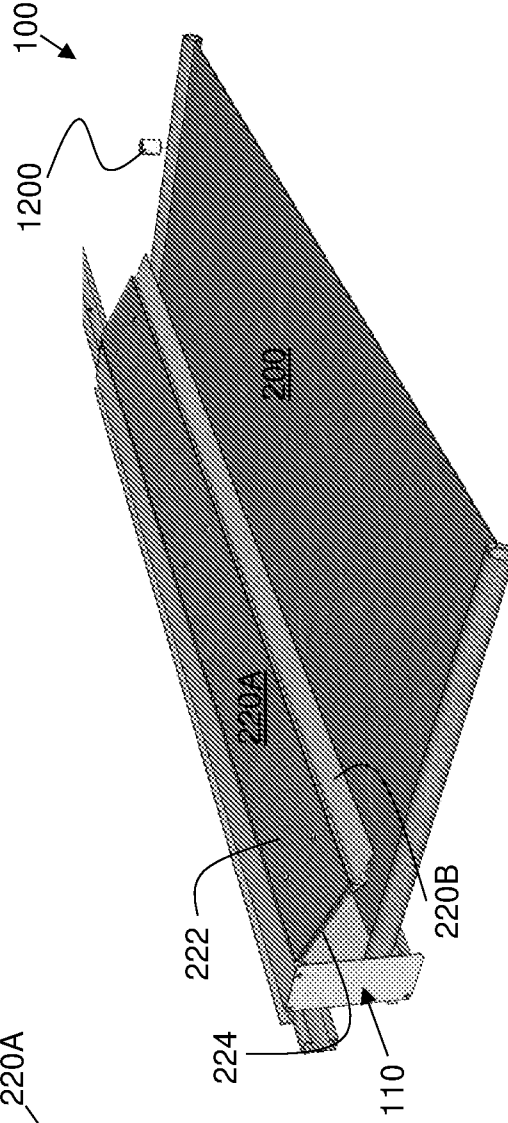


Figure 11C

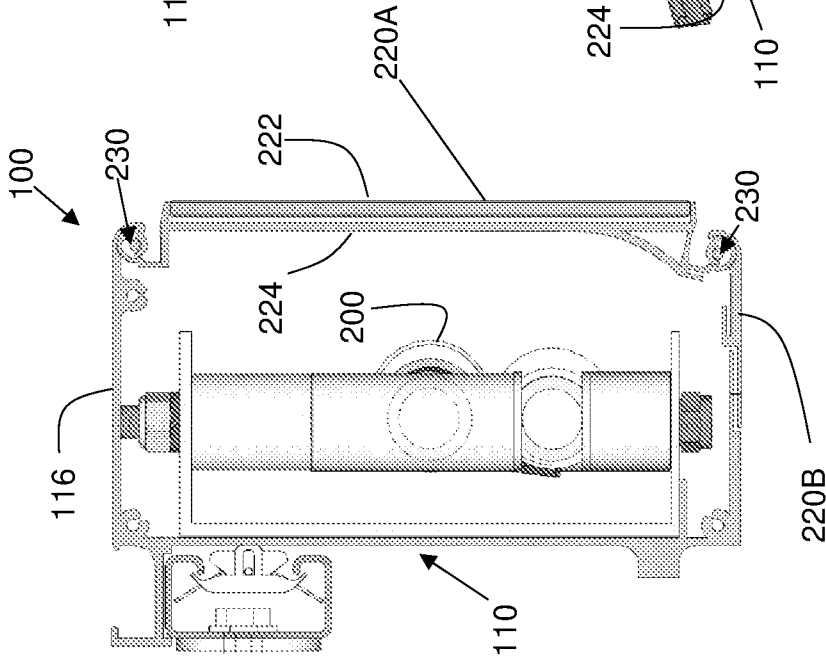


Figure 11A

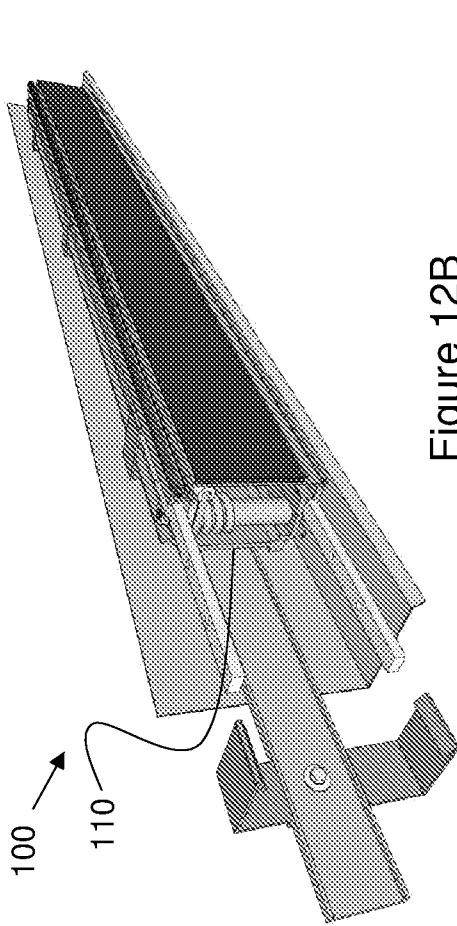


Figure 12B

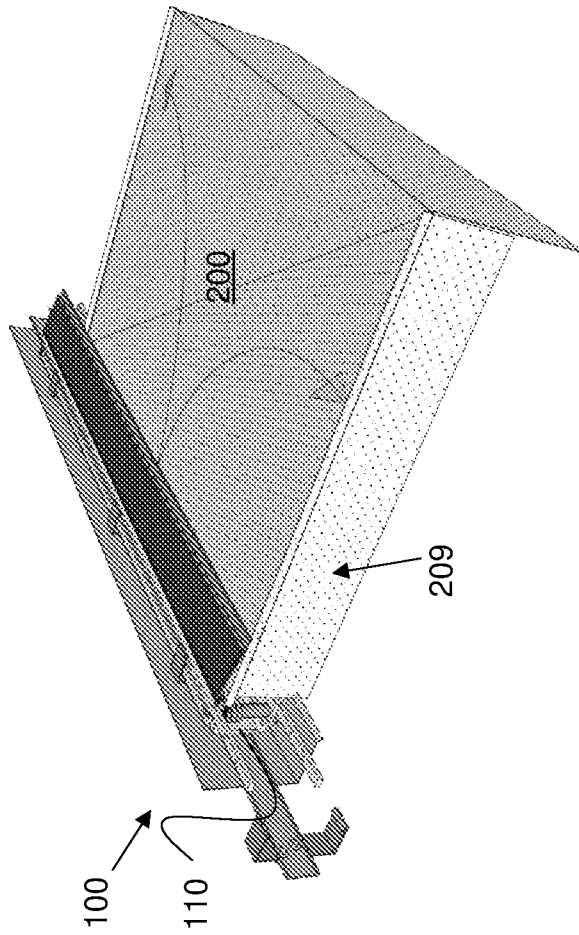


Figure 12C

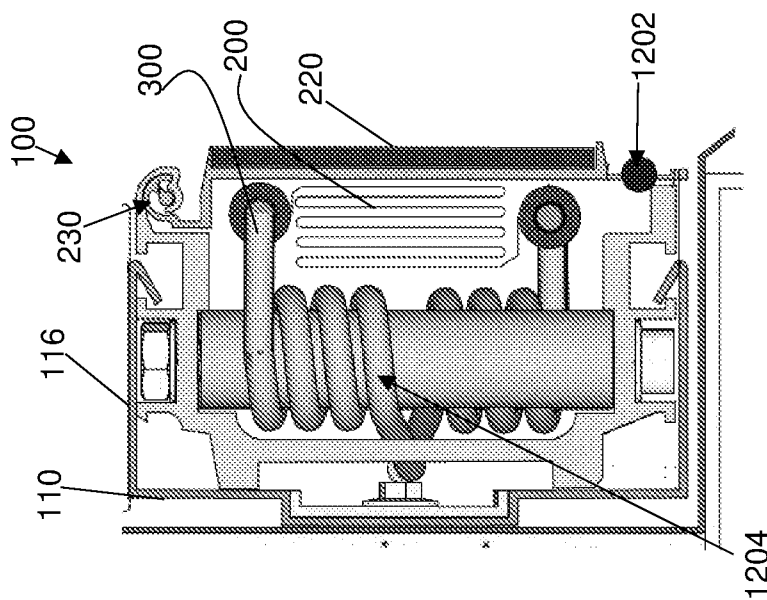


Figure 12A

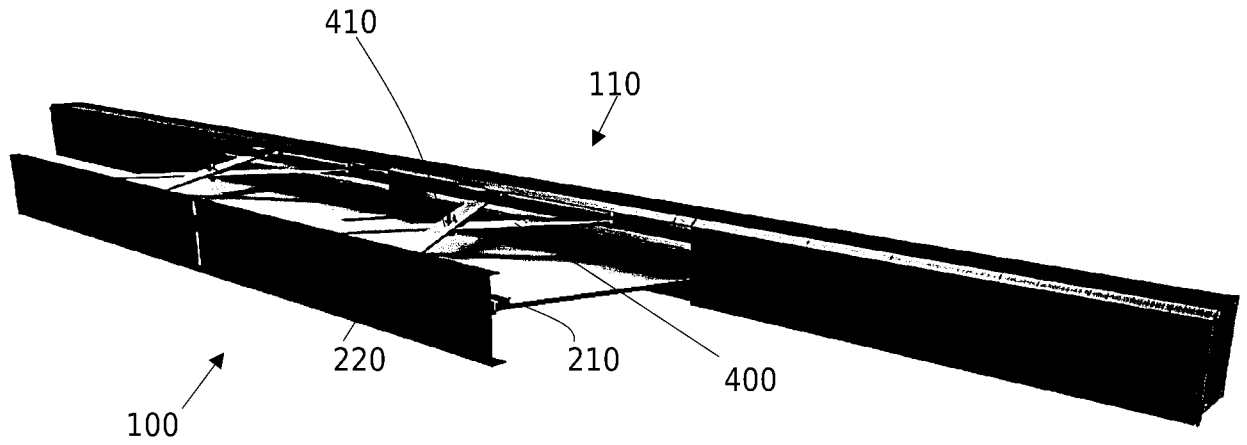


Figure 13

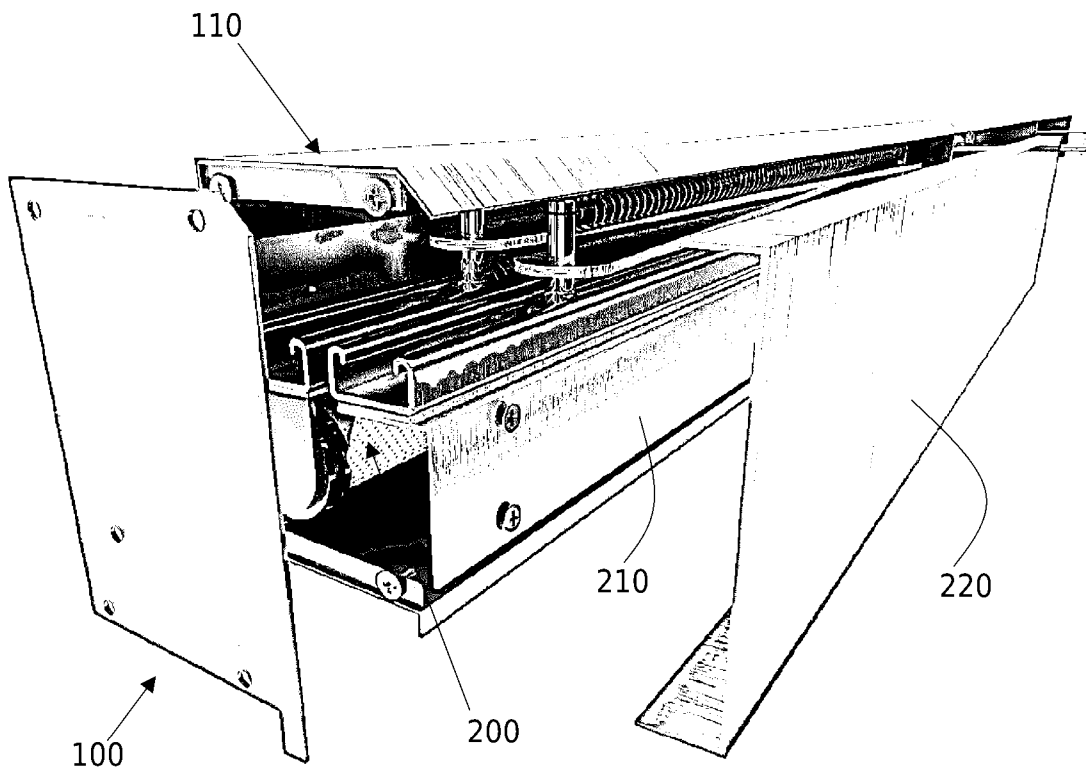


Figure 14

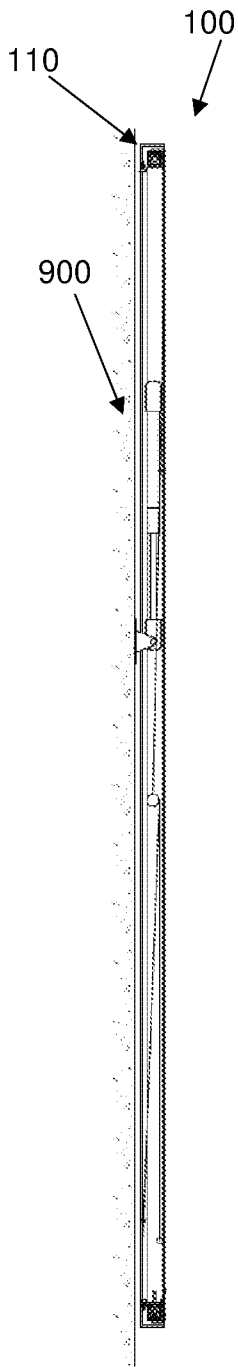


Figure 15A

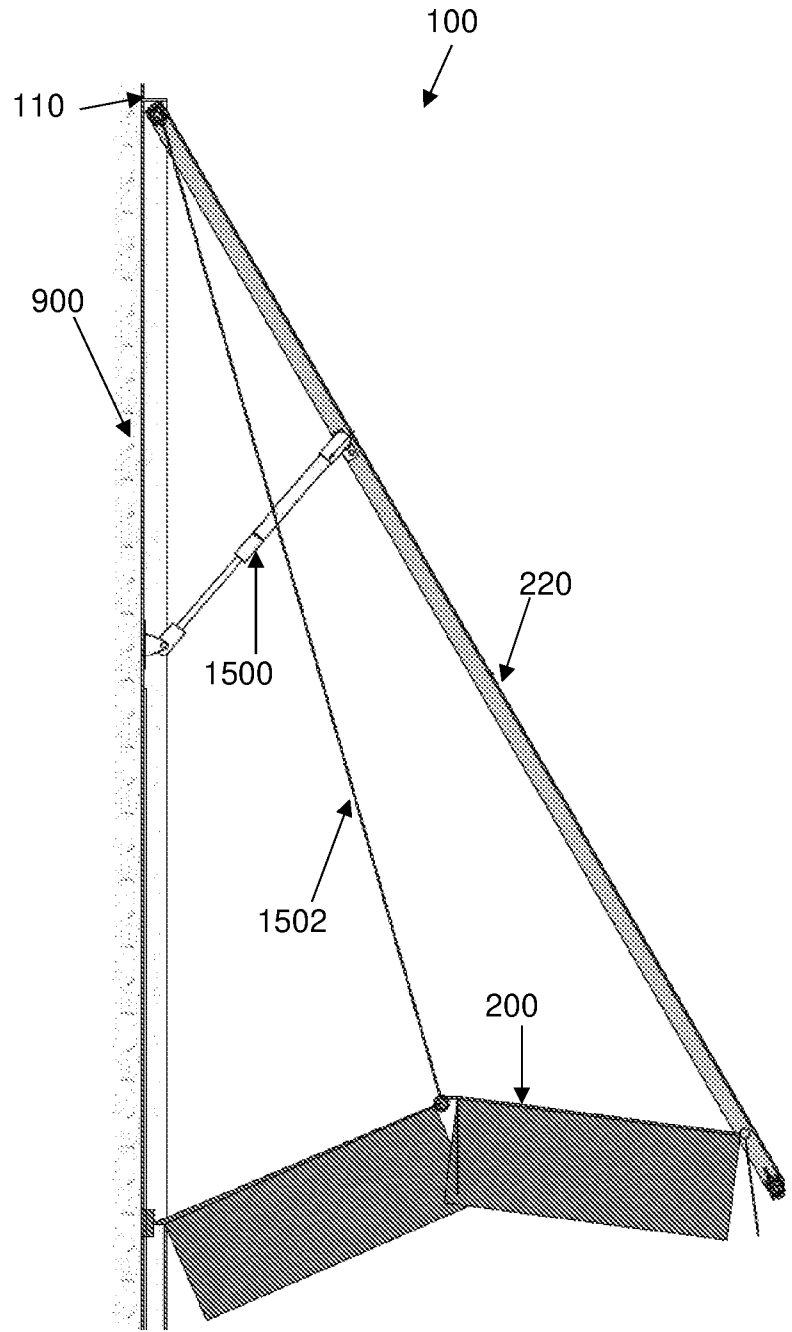


Figure 15B

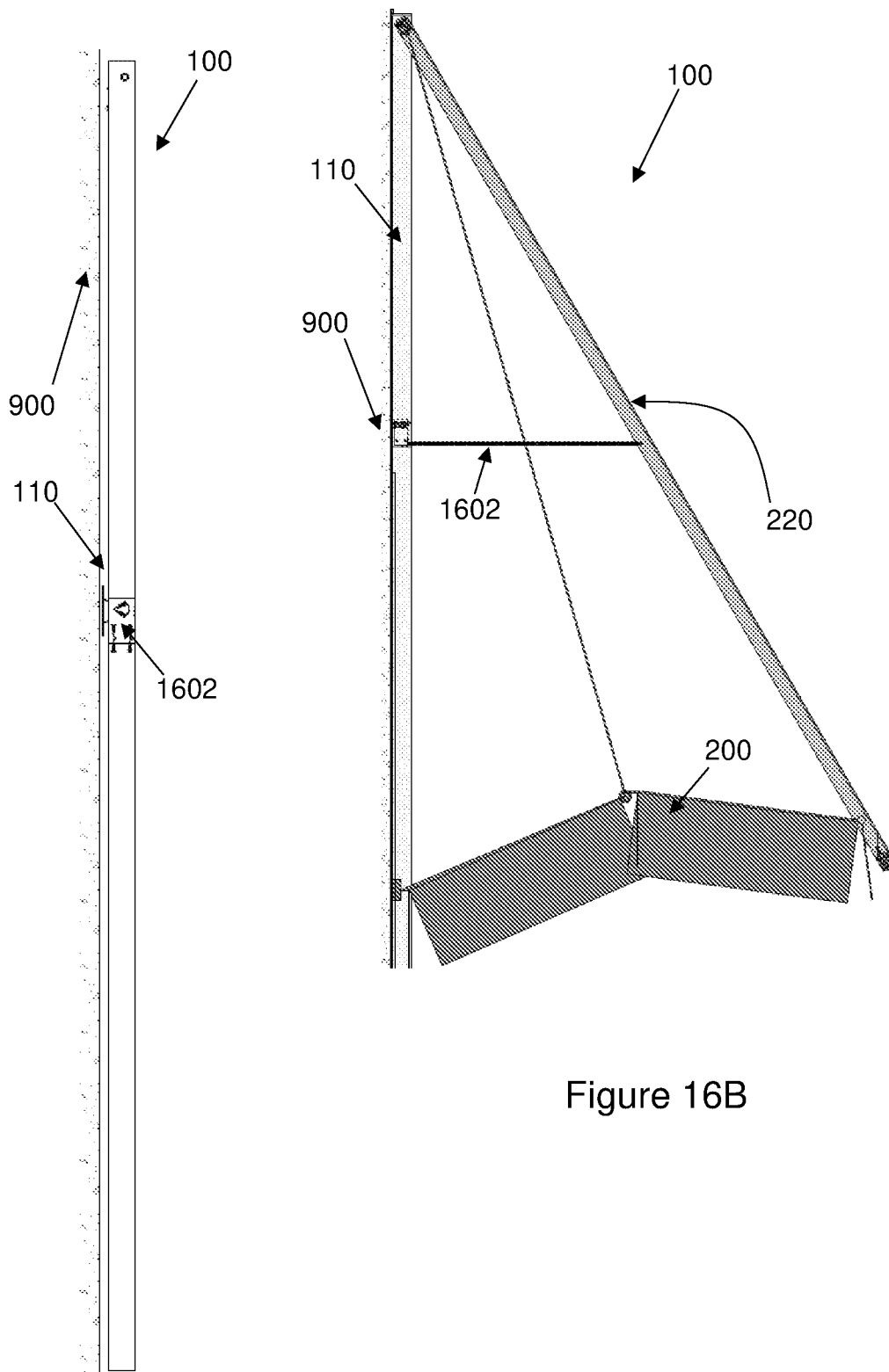


Figure 16A

Figure 16B

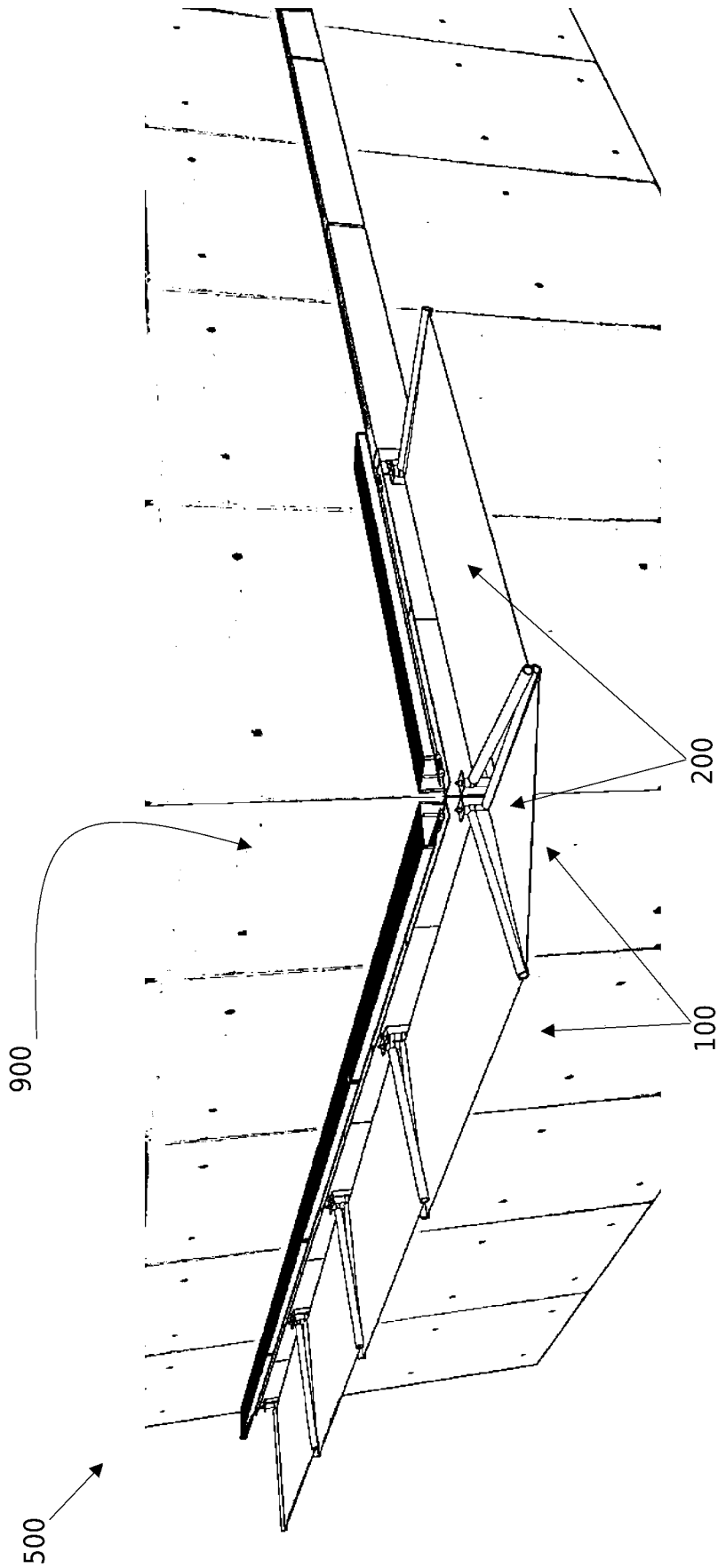


Figure 17

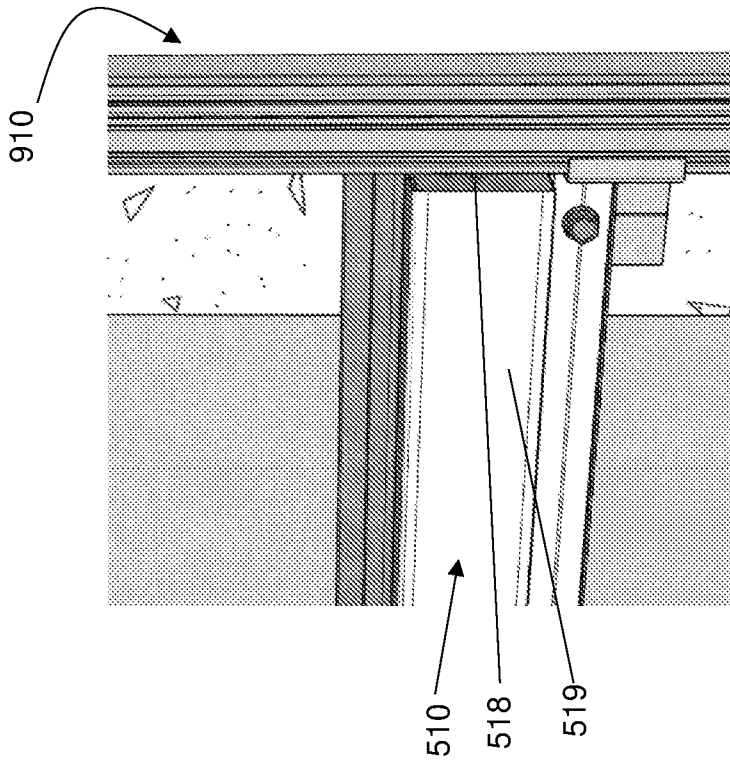


Figure 19

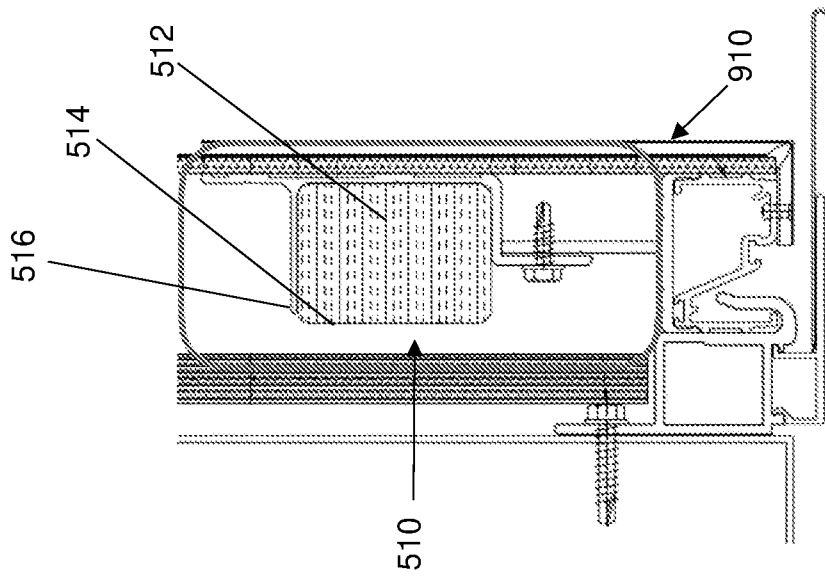


Figure 18

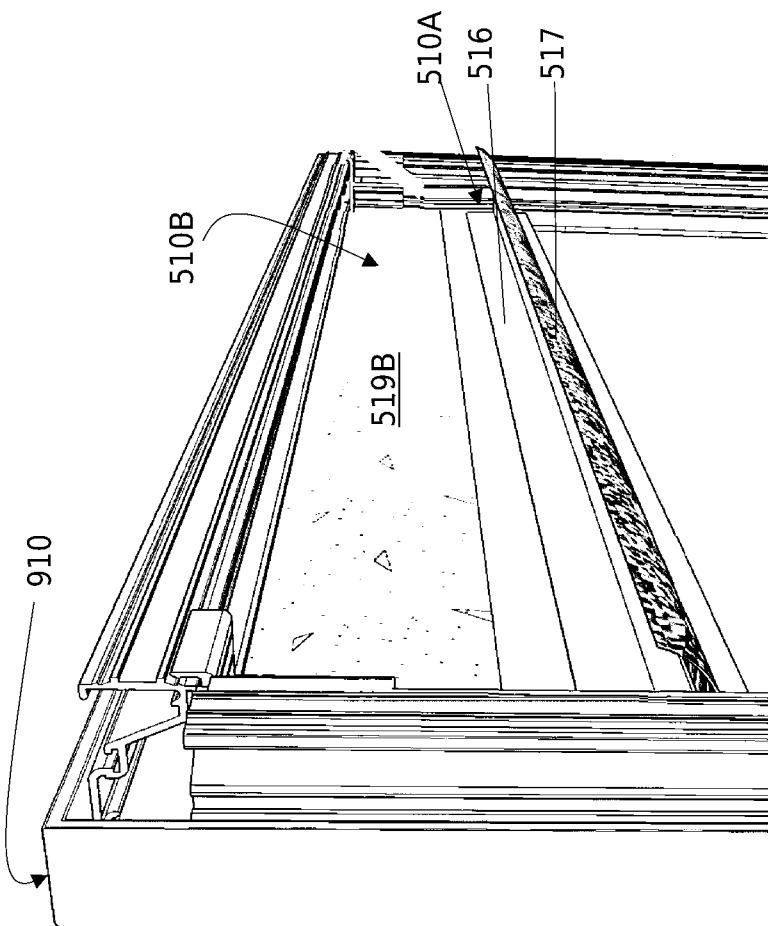


Figure 20

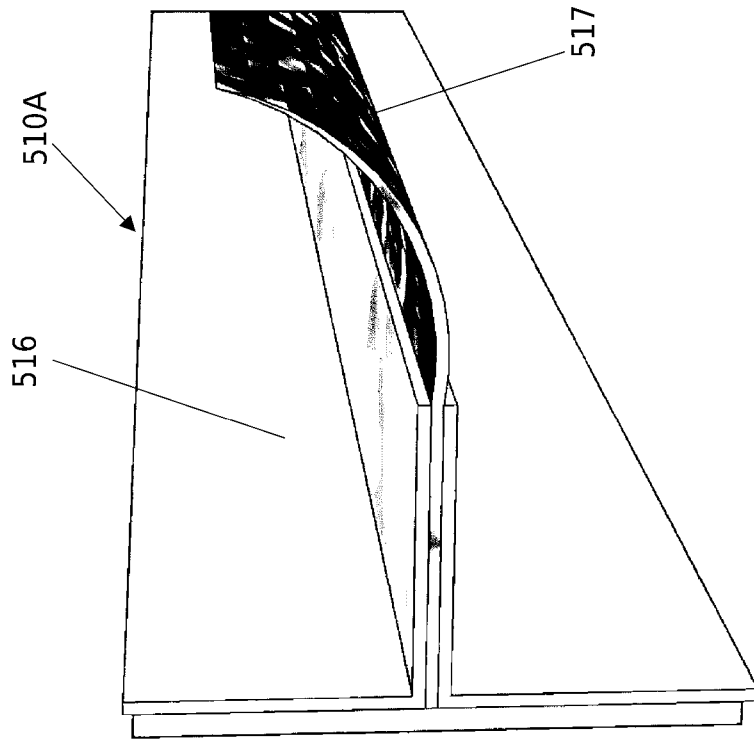


Figure 21

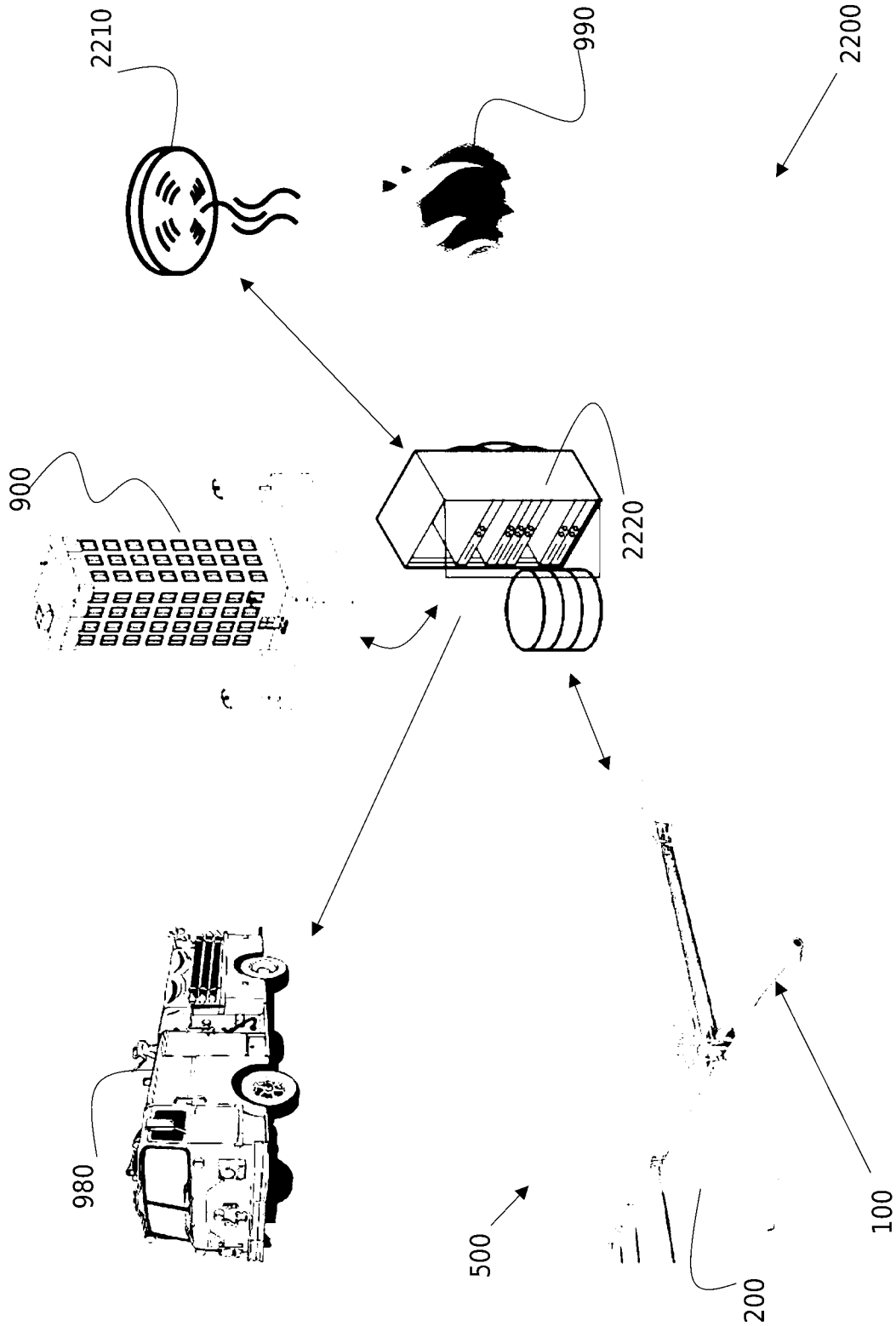


Figure 22

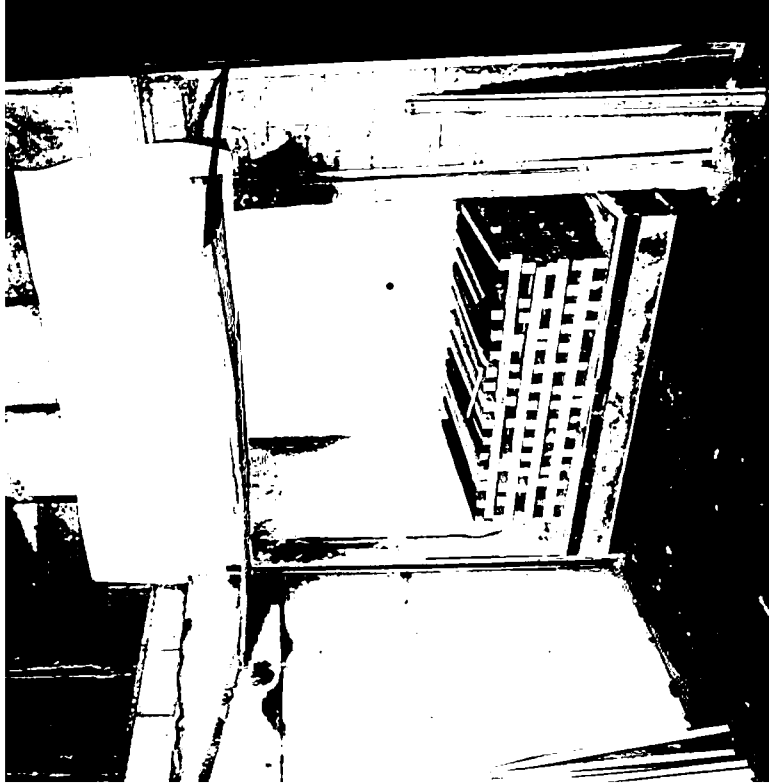


Figure 24



Figure 23

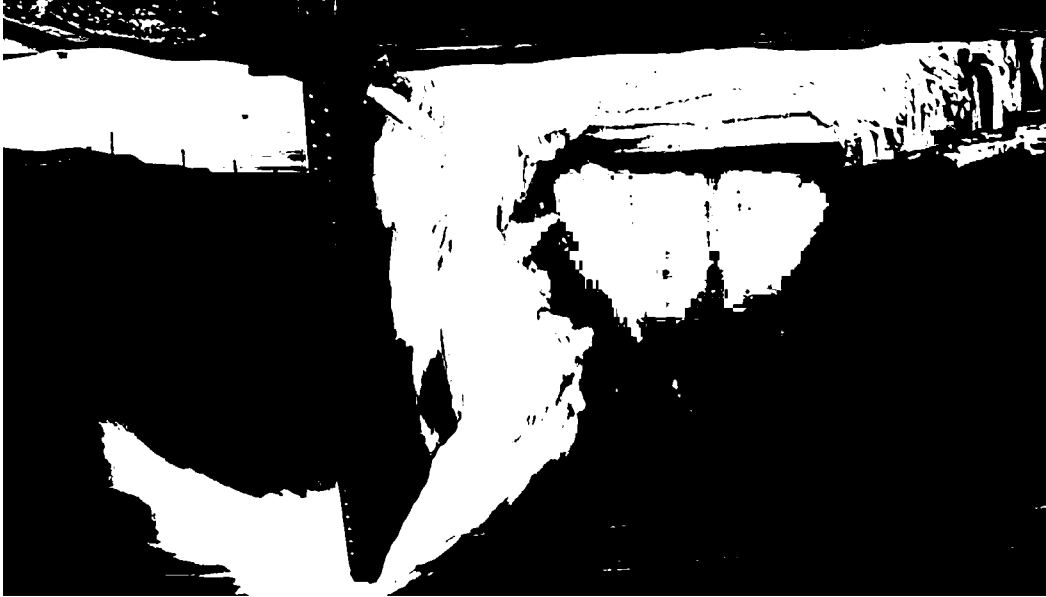


Figure 26

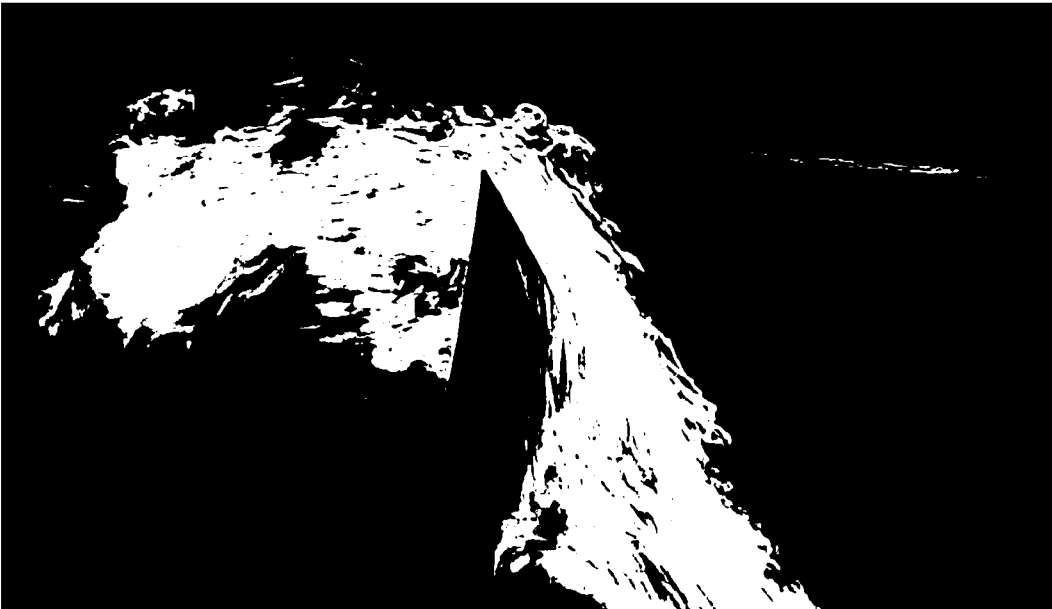


Figure 25

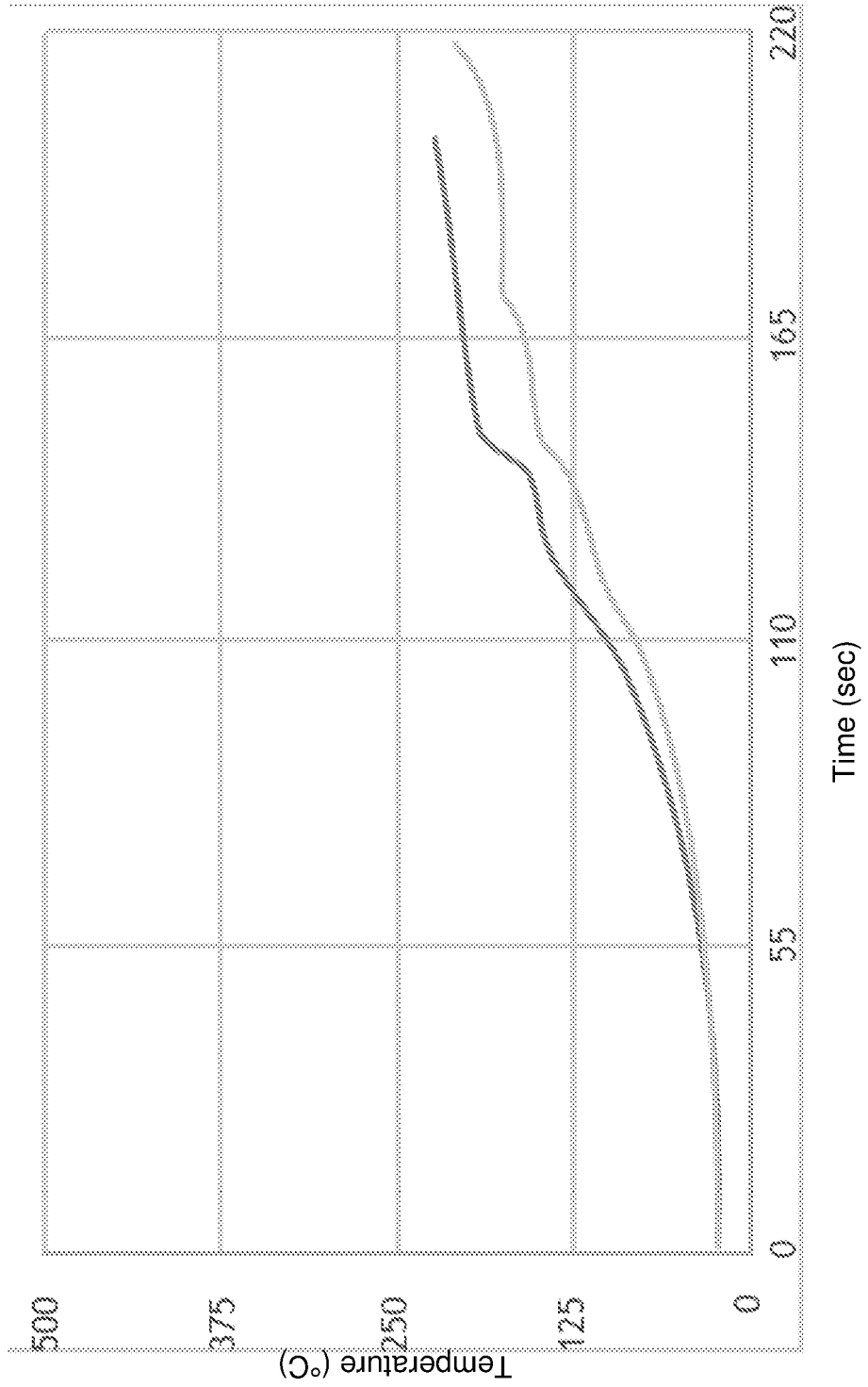


Figure 27

## INTERNATIONAL SEARCH REPORT

International application No.  
**PCT/AU2020/050455**

<b>A. CLASSIFICATION OF SUBJECT MATTER</b> <b>A62C 2/06 (2006.01) A62C 2/10 (2006.01) E04B 1/94 (2006.01)</b>		
According to International Patent Classification (IPC) or to both national classification and IPC		
<b>B. FIELDS SEARCHED</b>		
Minimum documentation searched (classification system followed by classification symbols)		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
Database: EPODOC; CPC/IPC Symbols: A62C2/06, A62C2/10, A62C2/12/LOW, A62C3/0257, A62C3/02, E04B1/94/LOW, A62C3/002/LOW, A62C3/0214, A62C3/14 and Keywords: Hinge, Retract, Pivot, Fold, Extend, Collapse Revolve, Rotate, High, Low, Upper, Storey, Level, Floor, Veranda, Balcony, Window, Door, Frame, Opening, Passage, Portal, Fire, Flame and like words.		
Applicant/Inventor Names Searches using "Day S" or "Lee Richard" or "Hughes B" or "Hughes Brown" as Applicant; "Day Simon" or "Lee Richard" or "Hughes B" or "Hughes Brown" as Inventor; and Fire or Flames as keywords.		
Applicants/Inventors name searched in internal databases provided by IP Australia.		
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	Documents are listed in the continuation of Box C	
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C		<input checked="" type="checkbox"/> See patent family annex
* Special categories of cited documents:		
"A" document defining the general state of the art which is not considered to be of particular relevance	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention	
"D" document cited by the applicant in the international application	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone	
"E" earlier application or patent but published on or after the international filing date	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art	
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family	
"O" document referring to an oral disclosure, use, exhibition or other means		
"P" document published prior to the international filing date but later than the priority date claimed		
Date of the actual completion of the international search 28 July 2020	Date of mailing of the international search report 28 July 2020	
<b>Name and mailing address of the ISA/AU</b>  AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA Email address: pct@ipaaustralia.gov.au	<b>Authorised officer</b>  Kiran Karve AUSTRALIAN PATENT OFFICE (ISO 9001 Quality Certified Service) Telephone No. +61262832824	

**INTERNATIONAL SEARCH REPORT**

International application No.

C (Continuation).

DOCUMENTS CONSIDERED TO BE RELEVANT

**PCT/AU2020/050455**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	KR 100676475 B1 (HANWON FORUM ARCHITECTURE DESIGN GROUP) 30 January 2007 Figures 1, 4, 5; Paragraphs [0008], [0038], [0039]	1 - 7, 22 - 32
X A	KR 101657601 B1 (YUWON ARCHITECTURAL FIRM CO. LTD) 19 September 2016 Figures 5, 6; Paragraph [0010] Paragraphs [0038], [0039]	1 - 2, 4 - 6, 13 - 15, 32 - 33 26 - 30
X	KR 100615031 B1 (JUNG-IL ENGINEERING CO. LTD.) 22 August 2006 Figures 6, 8	1 - 2, 4 - 6, 16 - 17, 19, 32

**INTERNATIONAL SEARCH REPORT**

Information on patent family members

International application No.

**PCT/AU2020/050455**

This Annex lists known patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

<b>Patent Document/s Cited in Search Report</b>		<b>Patent Family Member/s</b>	
<b>Publication Number</b>	<b>Publication Date</b>	<b>Publication Number</b>	<b>Publication Date</b>
KR 100676475 B1	30 January 2007	KR 100676475 B1	30 Jan 2007
KR 101657601 B1	19 September 2016	KR 101657601 B1	19 Sep 2016
KR 100615031 B1	22 August 2006	KR 100615031 B1	22 Aug 2006

**End of Annex**