

Structure Closure System

The invention to which this application relates is a door system of a type which is particularly, although not necessarily exclusively, useful with respect to door systems for relatively large openings in relatively large buildings.

When providing screens or doorways for large structures, such as, for example, aircraft hangars in which one or more aircraft are housed for storage, maintenance, paint stripping, paint spraying servicing and / or repair or to divide large warehouses and factories to retain heat/cold, prevent the ingress of dirt or to contain the migration of toxic particulate during manufacturing processes, the fabric forming the screen or doorway is frequently subject to the effect of external wind pressure or negative/positive air pressure inside the building such that the closing and opening of the curtain/screen cannot be performed in a controlled manner. Furthermore it can cause the curtain/screen to break away causing injury to personnel and damage to equipment stored or positioned in or around the area to the front or rear of the screen/curtain before it can be firmly anchored to the floor.

With this form of door structure, the curtain can be held in a closed position, typically with an edge of the opening or by abutting against another curtain structure which is drawn from an opposing edge of the opening. The curtain is then locked or secured in this position. When required, the curtain(s) is/are pulled and/or pushed towards the edge of the opening with movement guided by the track system to open the opening.

A problem which is experienced with this type of system, and one which is particularly prevalent as the size of the openings and hence door structures increase, is that when the curtains are freed so as to be moved between closed and open conditions, the same can act in the manner of a sail and be subject to

significant movement by airflows such as those caused by wind. This is a particular problem where the interior of the building is a relatively controlled, still, environment and a wind is blowing outside the building. When the curtain is released the wind tends to catch the curtain and blow the same inwards. When one considers that these curtains may be many metres in height and width, and of considerable weight, it will be appreciated that the uncontrolled movement of the same represent significant danger to personnel and a risk of damage to potentially expensive items and structures within the building should the curtains be blown onto the same.

The aim of the present invention is to provide a door system which allows the problem indicated above to be reduced and hence the safety and efficiency of the door system to be improved.

In a first aspect of the invention there is provided a closure system for an opening in a structure, said closure system including at least one first, curtain, layer, and wherein the system includes a second layer said second layer provided in a form to allow a greater amount of air to flow through the same than the first layer.

In one embodiment the first layer is positioned to face towards a source of air flow. In one embodiment this may be to be positioned to face externally of the structure and the second layer lies between the opposing side of the first layer and the interior of the structure. Alternatively the first layer can be positioned internally in an opening in the structure and may for example face an area with negative or positive pressure with respect to another area on the opposing side of the layer.

In one embodiment one or both of the first and second layers are suspended from guide means at the top edge of the opening. In one embodiment the first layer and the second layer extend across the opening when in a closed condition.

Preferably the first and second layers are provided with separate guide means and are separately movable between open and closed positions with respect to the opening.

In one embodiment the second layer is formed as a lattice or netting and in one embodiment is provided to be similar to air cargo netting, and the first layer is formed of a sheet material.

Typically, in use, the first and second layers are held or locked when in the open and/or closed conditions. However, the same need to be freed to allow the same to be moved between said open and closed conditions. When this happens the first layer is susceptible to being blown into the building by the wind. In accordance with the invention, the second layer is held at, or moved to, a closed condition before the movement of the first layer. In this way the second layer acts a safety means to prevent and/or absorb movement of the first layer when blown. As the second layer allows airflow therethrough this can be more safely moved between the open and closed conditions.

In a further aspect of the invention there is provided a method of moving a door closure system between open and closed conditions, said system having a first layer and a second layer and wherein prior to moving the first layer between at least one of the closed and open conditions the second layer is provided in the closed condition.

Preferably the second layer is provided to allow air flow to pass therethrough to a greater degree than the first layer and the

passage of the air flow does not cause significant movement of the second layer.

In one embodiment the first and second layers of the door system are independently movable so as to allow the second layer to act as a safety barrier for items and personnel within the building while the first layer is being moved between open and closed conditions.

In whichever embodiment it is provided that the first layer of the door system is never freed to be moved without the second layer being present and positioned across the opening

In a preferred embodiment when the first layer is being moved, and particularly when being moved from the open to the closed condition, the second layer is fixed to the ground in a line which is not parallel with the direction of movement of the first layer but rather is provided in a line which diverges from the line of travel of the first layer. Once the first layer has been fully deployed and fixed in position the second layer can be repositioned and anchored along a line parallel with the first layer. This feature allows the first layer to be more freely moved as the gap between the first and second layer allows the effect of the wind and pressure to still be taken into account yet allows the first layer to still be freely movable.

In a further aspect there is provided a door structure for an opening in a building, said structure including a first layer formed substantially of sheet material and a second layer formed with a plurality of apertures therein to allow air flow therethrough, said first and second layers independently movable between open and closed conditions.

Specific embodiments of the invention will now be described with reference to the accompanying drawings wherein;

Figure 1 illustrates a first layer of the door system in accordance with one embodiment of the invention;

Figure 2 illustrates an end elevation of the door system in accordance with one embodiment of the invention; and

Figures 3a and b illustrate the door system in use with an opening of a building.

Referring firstly to Figure 1 there is illustrated a first layer 4 of the door system 2 of the invention. The first layer forms the external face of the door system and it is seen how the same is formed from a series of sections 4' of solid sheet material and the first layer is largely impervious to wind and rain and other environmental elements. The use of the sheet material allows the door system to be relatively large in area and allows the same to be moved in a concertina fashion to an open condition. For normal or "day to day" access a smaller door 8 can be used rather than having to move the entire structure.

In accordance with the invention, the door system, 2 has the first, outer layer 4 suspended via trolley wheels 10 as shown in Figure 1 and a second layer 18 is suspended by a similar, but preferably separate set of trolley wheels 12 as shown in Figure 2, from tracks 14, 16 respectively. Figure 2 shows the top parts of the first and second layers 4, 18 of the door system 2 in section along line AA of Figure 1.

The tracks 14, 16 are mounted at the top edge 20 of the opening 22 which the door system 2 is provided to close. The second layer 18 is positioned inwardly of the first layer 4 and faces

towards the interior 24 of the building. The second layer, in this embodiment is formed of a series of crisscrossed elongate lengths which form a netting or lattice structure and is supported from guide track 16. The first and second layers are provided to be separately and independently movable along their respective tracks 14, 16.

Turning to Figures 3a and b there is illustrated the door system 2 in use. The second layer netting structure is shown of an exaggerated mesh size for illustration purposes but it should be appreciated that the netting mesh size will be typically smaller.

The building 26 has a side wall 28 with opening 22 which is to be opened and closed using the door system 2 in accordance with the invention.

In Figure 3a the opening 22 is shown closed by the door system 2 and is shown from the exterior of the building such that the first layer 4 of the door system completely closes the opening 22 and the second layer 18 is shown in broken lines as it is hidden from view from the exterior of the building but does also extend across the opening 22. In order to open the opening the first layer 4 is released from a locked position and pushed as indicated by arrow 30 to one side 32 of the opening. As it moves along the guide track 14, the sheet material of the first layer can fold, typically in a concertina fashion. The second layer is not moved at all and remains in the closed condition as is illustrated in Figure 3b where the first layer 4 is shown having been partially moved to an open condition and part 18' of the second layer is now visible.

Once the movement of the first layer 4 has been achieved to the fully open condition and lies adjacent edge 32, the same is locked in that position and the second layer 18 can then be

moved, again as indicated by arrow 30 to the open condition, typically lying behind the first layer.

To move the door system 2 from the open condition to the closed condition, the second layer 18 is first moved to the closed condition in the opposite direction to arrow 30, followed by the movement of the first layer 4 to the closed condition.

Although this embodiment shows the first and second layers being moved to one edge of the opening to achieve the open condition, it should be appreciated that the invention can equally be used with door systems where there is a centre join of the first and/or second layers with the parts on either side of the join being moved to opposing edges of the opening.

Thus, although the door system in accordance with the invention may take longer to open than a door of only one layer, the second layer acts as a safety barrier for personnel and items within the building as the first layer is being moved. Thus, in accordance with the invention, even when the first layer has been freed for movement and was caught by the wind and blown inwardly of the building, the second layer will act to absorb and limit the inward movement of the first layer as it still extends across the opening thereby preventing the first layer from moving too far into the building. Furthermore, as the second layer is provided in a form which allows the passage of air therethrough, when it is required to move that layer, the same is not caught or under the influence of the wind and therefore is not as susceptible as the first layer of being blown inwardly of the building and so can be moved safely.

Claims

1. A closure system for an opening in a structure, said closure system including at least one first, curtain, layer, and wherein the system includes a second layer, said second layer provided in a form to allow a greater amount of air to flow through the same than the first layer.
2. A system according to claim 1 wherein the first layer is positioned to face towards a source of air flow.
3. A system according to claim 1 wherein the first layer is positioned to face externally of the structure and the second layer is positioned on the side of the first layer to the interior of the structure.
4. A system according to claim 1 wherein the first layer is positioned internally of the opening in the structure and faces an area with negative or positive pressure with respect to another area on the opposing side of the layer.
5. A system according to claim 1 wherein one or both of the first and second layers are suspended from guide means at the top edge of the opening.
6. A system according to claim 1 wherein the first layer and the second layer extend across the opening when in a closed condition.
7. A system according to claim 1 wherein the first and second layers are separately movable between open and closed positions with respect to the opening.

8. A system according to claim 1 wherein the second layer has a plurality of apertures therein.
9. A system according to claim 8 wherein the second layer is formed as a lattice or netting is provided to be similar to air.
10. A system according to any of the preceding claims wherein the first layer is made substantially of sheet material.
11. A system according to claim 1 wherein the first and second layers are selectively held or locked when in the open and/or closed conditions.
12. A system according to claim 11 wherein the second layer is held at, or moved to, a closed condition before the movement of the first layer.
13. A method of moving a door closure system between open and closed conditions, said system having a first layer and a second layer and wherein prior to moving the first layer between at least one of the closed and open conditions the second layer is provided in the closed condition.
14. A method according to claim 13, wherein when the first and second layers are in a closed condition the first layer is first moved to the open condition.
15. A method according to claim 13 wherein when the first and second layers are in an open condition the second layer is first moved to the closed condition.
16. A method according to claim 13 wherein airflow can pass through the second layer to a greater degree than the first layer.

17. A method according to claim 13 wherein the first and second layers of the door system are independently movable so as to allow the second layer to act as a safety barrier for items and personnel within the building while the first layer is being moved between open and closed conditions.

18. A method according to claim 13 wherein the first layer of the door system is never freed to be moved without the second layer being positioned across the opening

19. A method according to claims 13-18 wherein the first layer forms the external face of the door system with respect to the opening of the structure in which the same is positioned.

20. A method according to claim 13 wherein the second layer is fixed to the ground along a line which diverges from the line of travel of the first layer.

21. A method according to claim 20 wherein once the first layer has been fully deployed and fixed in position the second layer can be repositioned and anchored along a line parallel with the first layer.

22. A door structure for an opening in a building said structure including a first layer formed substantially of sheet material and a second layer formed with a plurality of apertures therein to allow airflow therethrough, said first and second layers independently movable between open and closed conditions.

23. A structure according to claim 22 wherein the first layer is only movable between at least one of the open and closed conditions when the second layer is in the closed position.