AN ACTIVE AIRFLOW INHIBITING APPARATUS

The invention relates to an active airflow inhibiting apparatus for an entranceway, and particularly a doorway.

Various styles of doors are used at the entrances of retail spaces, such as shopping centres (malls), supermarkets or other stores.

A common style of door is the automatic sliding door. Two sets of automatic sliding doors are often provided in series to form a draught lobby which acts as an airlock to prevent wind from entering the building. However, in high traffic areas, it is common for both sets of doors to be open at the same time, thus providing a direct path for air to pass through the door. This can lead to unpleasant draughts. In addition, airflow may occur through a door as a result of temperature differentials across the door. Airflow through a door (whether from draughts or induced by temperature differentials) increases the power output requirements of HVAC systems within the building.

Over door heaters are often used to try to mask the incoming draught to improve customer experience. However, these devices consume large amounts of energy and do not address the problem itself. Another option is to provide an air curtain across the doorway. However, these devices are not able to prevent infiltration where there is a large pressure differential or under windy conditions.

Experience has shown that any physical barrier, even an automatically opening door, can lead to a reduction in the number of people entering a store and that stores have started keeping the doors open throughout all of the working hours to minimise this effect. In this case, the energy costs through the passage of heated or cooled air out of the building and replaced by ambient air can be substantial.

It is therefore desirable to provide an airflow inhibiting apparatus which addresses the disadvantages of existing solutions.

In accordance with an aspect of the invention, there is provided an active airflow inhibiting apparatus for an entranceway including: a structure comprising one or more air mover

devices configured to be positioned adjacent an entranceway of a building and defining a passage therethrough for accessing the entranceway; an airflow sensor configured to provide an output indicative of speed and direction of airflow through the entranceway or at the one or more air mover devices; and a controller connected to the one or more air mover devices and the airflow sensor; wherein the controller is configured to receive the output of the airflow sensor and to control an output of the one or more air mover devices based on the received output so as to generate a differential pressure across the one or more air mover devices which inhibits (i.e. minimises or prevents) airflow through the entranceway, and wherein the one or more air mover devices form an archway.

The one or more air mover devices may be air multiplier devices.

The plurality of air mover devices may form a plurality of arches (or a pair of uprights).

The plurality of arches may be nested within one another in a single plane.

The plurality of arches may be arranged side by side (i.e. in series).

The one or more air mover devices may be configured to generate an area of negative pressure which entrains the airflow and/or an area of positive pressure which repels the airflow.

The apparatus may comprise a plurality of said structures and each of the plurality of said structures may be configured to be positioned adjacent a different entranceway of the same building.

The controller may be configured to synchronise the operation of the air mover devices with the opening of a door of the entranceway based on the output of an activation sensor.

The activation sensor may be located within the passage defined by the structure.

The array of air mover devices may be configured to be located externally to the entranceway.

The air multiplier device may include an air inlet; a pair of first air outlets and a pair of second air outlets, wherein the pair of first air outlets are located on opposing sides of the air multiplier device and the pair of second air outlets are located on opposing sides of the air multiplier device and wherein the pair of first air outlets and the pair of second air outlets are arranged in a back-to-back relationship such that they face in opposite directions; a pump for passing air from the air inlet to the pair of first air outlets and the pair of second air outlets; wherein the air multiplier device has a first configuration in which the air from the air inlet is directed to the pair of first air outlets and a second configuration in which the air from the air inlet is directed to the pair of second air outlets and wherein the air multiplier device is configured to operate in one of the first and second configurations to allow bidirectional airflow.

The airflow sensor may be configured to provide an output indicative of speed and direction of airflow through the entranceway at a plurality of vertical positions through the entranceway.

The airflow sensor may comprise a plurality of sensor elements located at different vertical positions.

The controller may be configured to determine an optimised set of outputs for the plurality of structures. The controller may be configured to determine a set of outputs for the one or more air mover devices of the plurality of structures which are dependent on one another.

The controller may be configured to control the output of the air mover devices so as to generate a differential pressure which varies with vertical position.

The air mover devices may comprise a plurality of air mover devices which are spaced around a common circle to generate a vortical airflow.

The plurality of air mover devices may be arranged so that their airflow axes lie tangential to the common circle.

CLAIMS

1. An active airflow inhibiting apparatus for an entranceway comprising:

a structure comprising one or more air mover devices configured to be positioned adjacent an entranceway of a building and defining a passage therethrough for accessing the entranceway;

an airflow sensor configured to provide an output indicative of speed and direction of airflow through the entranceway or at the one or more air mover devices; and

a controller connected to the one or more air mover devices and the airflow sensor;

wherein the controller is configured to receive the output of the airflow sensor and to control an output of the one or more air mover devices based on the received output so as to generate a differential pressure across the one or more air mover devices which inhibits airflow through the entranceway, and

wherein the one or more air mover devices form an archway.

2. The active airflow inhibiting apparatus as claimed in claim 1, wherein the one or more air mover devices are air multiplier devices.

3. The active airflow inhibiting apparatus as claimed in claim 2, wherein the one or more air mover devices comprise a plurality of air mover devices and wherein the plurality of air mover devices form a plurality of arches.

4. The active airflow inhibiting apparatus as claimed in claim 3, wherein the plurality of arches are nested within one another in a single plane.

5. The active airflow inhibiting apparatus as claimed in claim 3, wherein the plurality of arches are arranged side by side.

6. The active airflow inhibiting apparatus as claimed in claim 5, wherein the one or more air mover devices are configured to generate an area of negative pressure which entrains the airflow and/or an area of positive pressure which repels the airflow.

7. The active airflow inhibiting apparatus as claimed in any preceding claim, wherein the apparatus comprises a plurality of said structures and wherein each of the plurality of said structures is configured to be positioned adjacent a different entranceway of the same building.

8. The active airflow inhibiting apparatus as claimed in claim 7, wherein the controller is configured to determine a set of outputs for the one or more air mover devices of the plurality of structures which are dependent on one another.

9. The active airflow inhibiting apparatus as claimed in any preceding claim, wherein the controller is configured to synchronise the operation of the one or more air mover devices with the opening of a door of the entranceway based on the output of an activation sensor.

10. The active airflow inhibiting apparatus as claimed in claim 9, wherein the activation sensor is located within the passage defined by the structure.

11. The active airflow inhibiting apparatus as claimed in any preceding claim, wherein the one or more air mover devices are configured to be located externally to the entranceway.

12. The active airflow inhibiting apparatus as claimed in claim 3, wherein the air multiplier device comprising:

an air inlet;

a pair of first air outlets and a pair of second air outlets, wherein the pair of first air outlets are located on opposing sides of the air multiplier device and the pair of second air outlets are located on opposing sides of the air multiplier device and wherein the pair of first air outlets and the pair of second air outlets are arranged in a back-to-back relationship such that they face in opposite directions;

a pump for passing air from the air inlet to the pair of first air outlets and the pair of second air outlets;

wherein the air multiplier device has a first configuration in which the air from the air inlet is directed to the pair of first air outlets and a second configuration in which the air from the air inlet is directed to the pair of second air outlets and wherein the air multiplier device is configured to operate in one of the first and second configurations to allow bidirectional airflow.

13. The active airflow inhibiting apparatus as claimed in any preceding claim, wherein the airflow sensor is configured to provide an output indicative of speed and direction of airflow through the entranceway at a plurality of vertical positions through the entranceway.

14. The active airflow inhibiting apparatus as claimed in any preceding claim, wherein the airflow sensor comprises a plurality of sensor elements located at different vertical positions.

15. The active airflow inhibiting apparatus as claimed in claim 13 or 14, wherein the controller is configured to control the output of the one or more air mover devices so that the differential pressure varies with vertical position.

16. The active airflow inhibiting apparatus as claimed in any preceding claim, wherein the output of the one or more air mover devices is controlled by changing a fan speed setting.

17. The active airflow inhibiting apparatus as claimed in any preceding claim, wherein the one or more air mover devices comprise a plurality of air mover devices which are spaced around a common circle to generate a vortical airflow.

18. The active airflow inhibiting apparatus as claimed in claim 17, wherein the plurality of air mover devices are arranged so that their airflow axes lie tangential to the common circle.