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(56) Documents Cited:
GB 0763801 A **US 5938524 A**

(58) Field of Search:
UK CL (Edition X) **F4V**
INT CL **F24F**
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(54) Abstract Title: **Ventilation Damper System**

(57) A damper system for use in controlling air flow in a ventilation apparatus (23) comprises a number of openings (3) in a frame (1), with a number of movable damper members (4) mounted therein. The members (4) are preferably rotatable between open and closed positions, their movement being controlled by a common actuator arrangement, whereby rotation of one damper member (4) effects rotation of the other damper members (4). The arrangement comprises an electric actuator (5) connected to an axle (18) of one damper member (4) which rotates a centrally housed assembly of gears (20), respectively linked to the remaining damper members (4). The closable openings (3) are each linked to an inlet/outlet port (35) (23) to control air flow through the ports (35).

Also disclosed is an arrangement wherein a module containing dampers comprises ducts providing air flow communication with inlet/outlet ports, the ducts providing a transition between the chambers and ports at least one having different cross sections.

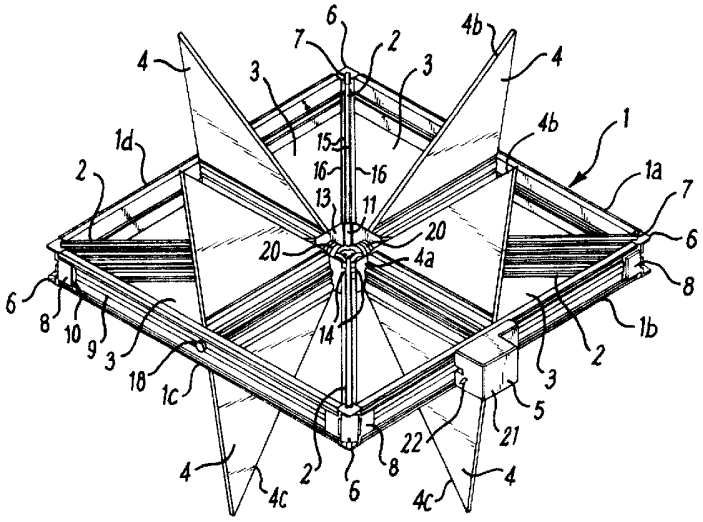

FIG 2

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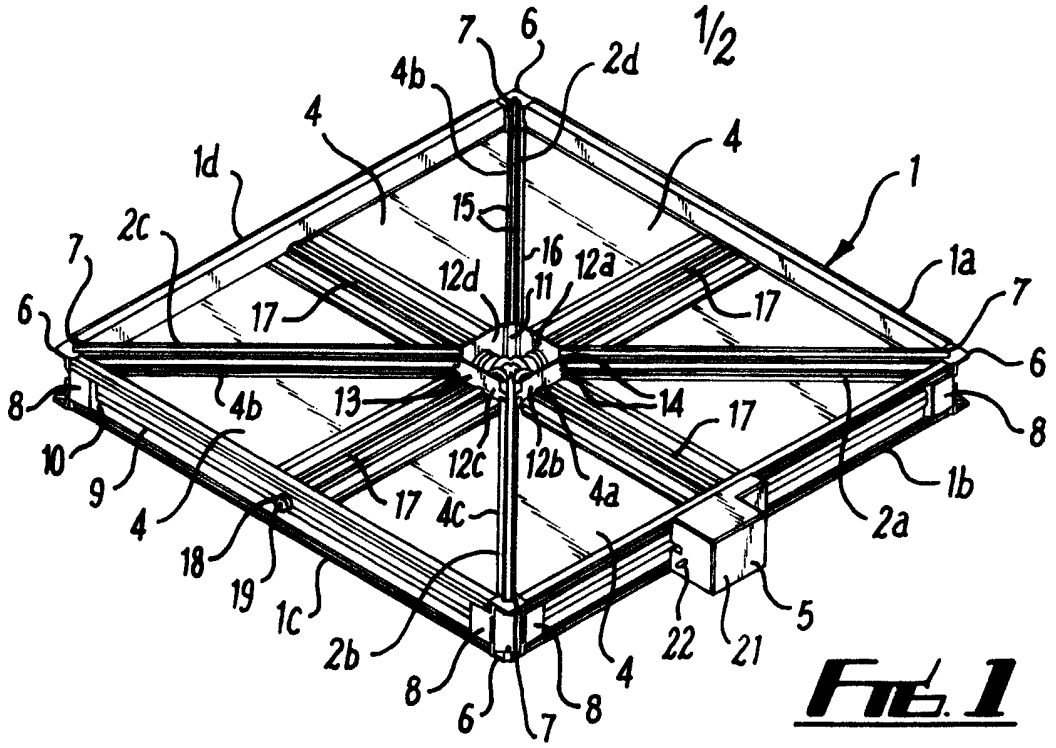
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FIG. 1

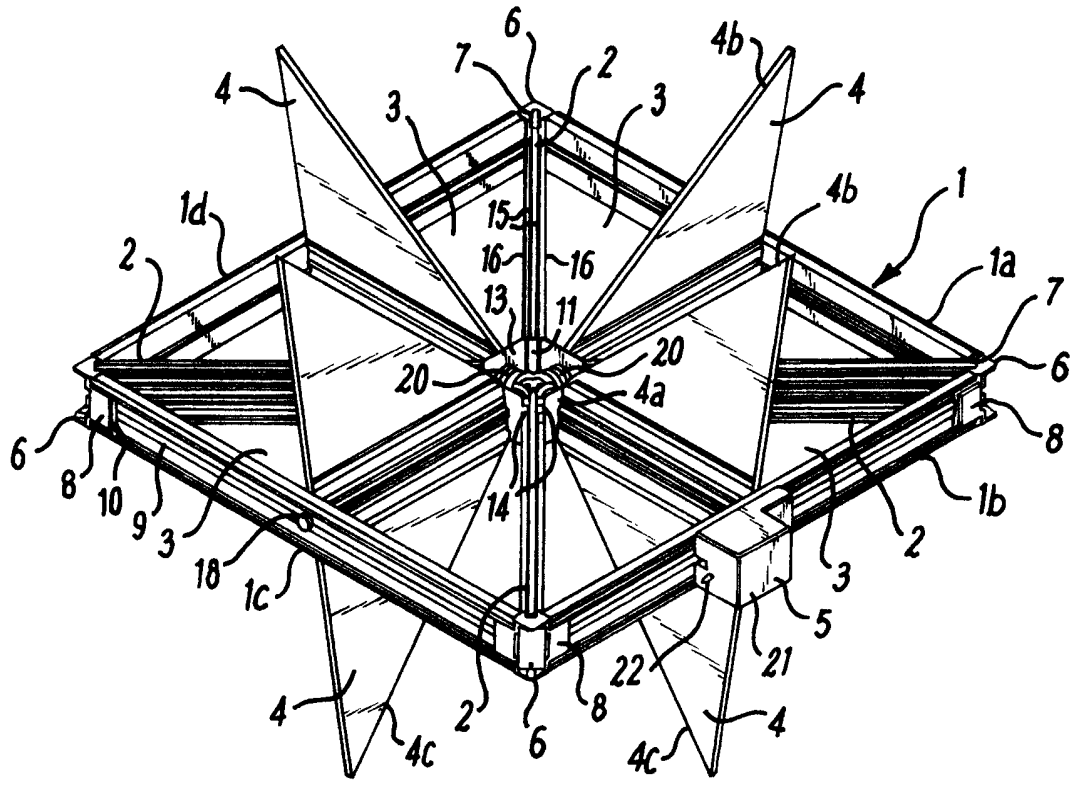
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FIG. 2

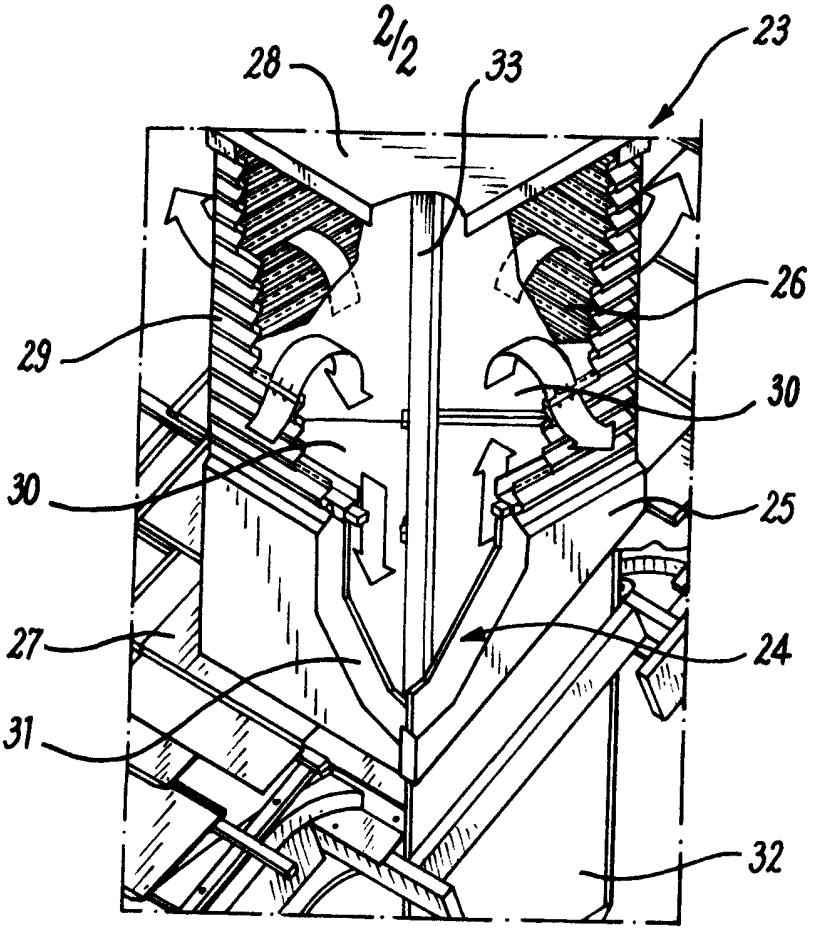

FIG. 3

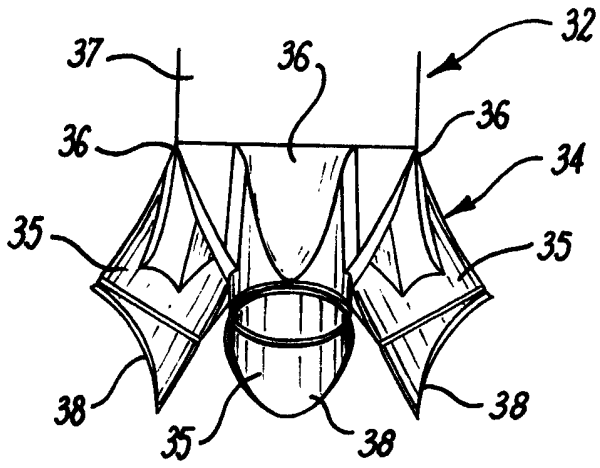

FIG. 4

DAMPER SYSTEM FOR BUILDING VENTILATION APPARATUS

This invention relates to a damper system for controlling air flow through multiple inlet/outlet ports of ventilation apparatus.

A known passive ventilation apparatus for ventilating a room or other internal space of a roofed building has an internally-partitioned four-section inlet/outlet terminal mounted on the roof.

The four partitioned sections or conduits communicate with separate ventilation chambers which are linked respectively by ducting to four inlet/outlet diffuser ports which are ceiling mounted within the internal building space. Wind blowing across the roof terminal is directed downwardly into the building space through one or more of the diffuser ports, whilst simultaneously hot air can escape through one or more of the other ports. In this way the building space can be effectively ventilated without requiring expensive air conditioning or other powered ventilation apparatus.

The inlet/outlet ports are provided with a damper system comprising paddles movable between open and closed positions within pipes communicating with the ports. The damper system has an actuation arrangement for the paddles comprising a respective electrical actuator which controls movement of each paddle.

With this arrangement the use of separate ports with respective actuators can be inconvenient with regard to construction and

installation.

One object of the invention is to provide a damper system having an actuator arrangement which can be convenient to manufacture and install.

According to one aspect of the invention therefore there is provided a damper system for controlling air flow through multiple inlet/outlet ports of ventilation apparatus comprising:

a plurality of openings for communication with the inlet/outlet ports;

a plurality of damper members movable relative to the openings for controlling air flow therethrough;

and an actuator arrangement for effecting movement of the damper members,

characterised in that, the actuator arrangement comprises a common actuator and a mechanical linkage between the damper members and the actuator, so that the damper members are movable together by the common actuator.

With this arrangement, the damper system can be manufactured with only a single actuator to move all of the damper members together whereby manufacture and installation can be facilitated. In a particularly preferred embodiment the openings are provided together in a common unit which may be incorporated in or associated with a module of the

ventilation apparatus having the multiple inlet/outlet ports mounted together, whereby the use of a single actuator is especially convenient with regard to manufacture, installation and design flexibility. The invention is however not restricted to this and the damper system may be used with any combination and arrangement of ports whether directly or closely associated with the damper system or separate or remote therefrom linked by ducting or otherwise.

With regard to the mechanical linkage between the damper members and the actuator, this may comprise a rotatable linkage whereby a rotatable output of the actuator is transmitted by one or more rotatable axles and one or more rotatable gears to rotatable inputs for the damper members.

Thus, the arrangement may comprise an assembly of meshed gears such as bevel gears, a first axle rotatably linking the assembly to the actuator, and a plurality of second axles respectively linking the assembly to the damper members.

Each damper member may be of the form of a shutter or paddle or other solid generally planar element which may be pivotally mounted so as to be rotatable between different positions relative to the respective opening.

The damper members may be movable between open and closed positions and/or between different open positions at which there are

different degrees of closure of the openings. Where the openings are provided within a common unit this may comprise a frame.

The frame may have the aforesaid gear assembly mounted therein, particularly within a housing in a central region thereof.

The frame may be generally polygonal, particularly square or rectangular, with transverse partitions defining therebetween said openings of generally polygonal form, particular triangular.

The openings may be all of the same shape.

In one embodiment there are four openings of generally isosceles triangular form.

The damper members may be generally of the same shape as the openings.

The common actuator may comprise an electric motor.

The damper system may be used in a passive ventilation apparatus for ventilating an internal space of a roofed building whereby the ventilation apparatus may have an external roof terminal and inlet/outlet ports within the room space.

The roof terminal may comprise a hollow body for mounting on a roof structure, having an internal space separated by partitions into multiple conduits communicating below the roof structure with respective chambers to which the inlet/outlet ports are connected, the body having differently directed open side walls, e.g. louvred side walls, to permit air

flow therethrough into and out of the chambers, and the aforesaid damper system being used to control air flow through the inlet/outlet ports. The damper system may be incorporated within or adjacent the chambers or with the inlet/outlet ports or otherwise.

The inlet/outlet ports may each have a duct with a first end connected via a respective one of the openings of the damper system to a respective one of the ventilation chambers, and a free second end providing a respective inlet/outlet port. The ports may be incorporated in a common module having a plurality of the said ducts.

The duct ends may be of different shape whereby the ducts are provided with a graduated transition therebetween. The transition may be between a polygonal first end e.g. a generally triangular first end, and a curved second end e.g. a circular second end. The shape of the first end may be generally the same as the shape of the respective damper system opening and/or the cross-sectional shape of the chambers.

Thus, and in accordance with a second aspect of the present invention there is provided ventilation apparatus for ventilating an internal space of a roofed building comprising a roof terminal having differently directed open sides thereto in communication with respective conduits within the terminal leading to respective chambers, multiple inlet/outlet ports for location within the internal building space, said module having ducts providing air flow communication respective with the inlet/outlet

ports and the chambers, a damper system with multiple openings respectively interposed between the ducts and the chambers and actuator operated damper members movable relative to the openings to control air flow therethrough, the ducts providing a transition between the chambers and ports at least one and preferably all with different cross-sections thereto, preferably with polygonal cross-section chambers and curved cross-section ports, particularly as hereinbefore described.

The multiple ports may be integrated in a common module as hereinbefore described although alternatively the ports may be separate.

The damper members may be provided in a common unit with a single common actuator as described above although alternatively separate damper members and/or separate actuators may be used.

The invention will now be described further by way of example only and with reference to the accompanying drawings in which:

Figure 1 is a perspective diagrammatic view of one form of a damper system according to the invention in a closed condition;

Figure 2 is a perspective diagrammatic view of the damper system of Figure 1 in an open condition;

Figure 3 is a cut away diagrammatic perspective view of a ventilation apparatus with a damper system according to Figures 1 and 2; and

Figure 4 is a perspective diagrammatic view of an inlet/outlet module.

As shown in Figures 1 and 2, a damper system comprises a square frame 1 having diagonal internal partitioning walls 2a-2d defining four generally triangular openings 3, each opening 3 having a solid, generally planar, rigid generally triangular shutter 4 rotatably mounted therein, for rotation by an electric actuator 5 between an open position wherein each shutter 4 is in an upright arrangement perpendicular to the plane of the frame (Figure 2) and a closed position wherein each shutter 4 is in a level arrangement extending across said opening 3 parallel to the plane of the frame (Figure 1).

The square frame 1 has strip shaped walls 1a-1d joined together by corner brackets 6, the bodies of which have inwardly directed channels 7 for receiving outer ends of the strip-shaped partitioning walls 2a-2d. The brackets have arms 8 which interengage the outer walls 1a-1d by cooperating grooves 9, 10.

The partitioning walls 2a-2d are equal in length and are received at an outer end by the channels 7 of the corner brackets 6, and extend diagonally inwardly therefrom and are fixed at an opposite inner end to corners between side walls 12a-12d of a generally square, centrally located housing 13.

An arrangement of inter-engaging configurations 14 is provided on the said inner ends and side walls 12a-12d.

The partitioning walls 2a-2d each have two elongate outwardly

facing surfaces 15 each providing abutments in the form of a lip 16 projecting into the respective opening 3.

The openings 3 are generally triangular (isosceles) in shape, having a central axis, with the axial apex of each triangular-shaped opening 3 being flattened due to the respective inner wall 12a-12d.

Each shutter 4 has a generally triangular shape and central axis 17, corresponding to that of the openings 3. The apex of each shutter residing on the central axis 17 is also flattened, to provide a flat abutment surface 4a for interaction with the respective inner wall 12a-12d.

Each shutter 4 has a pair of opposite diagonal edges 4b, 4c, and in a level (closed) position, the edge 4b rests upon one said lip 16 with edge 4c abutting the underside of the opposing lip 16 within the respective opening 3.

Each shutter 4 has a channel (not shown) along its central axis 17, within which an axle 18 is fixed. Each axle 18 extends beyond the opposite peripheries of the shutter 4 at its ends.

An outer end 19 of each axle 18 is pivotally mounted centrally of the respective side wall 1a-1d of the frame 1, and an inner end (not shown) projects into the central housing 13 and has a bevel gear 20 fixed thereon.

The respective bevel gears 20 of the four shutters 4 are meshed

with each other and each is arranged substantially perpendicularly to each next adjacent bevel gear 20, whereby the rotation of one gear 20 effects the rotation of all of the other gears 20.

The aforesaid electric actuator 5 is drivably connected to the outer end 19 of one axle 18 and has a box-shaped housing 21 mounted on one outer wall 1a of the frame 1, enclosing an electric motor (not shown), and electrical connections 22 for connection to an external power supply and controls (not shown).

The motor when powered operates to rotate the connected axle 18 through approximately 90° between the open and closed positions of the respective shutter 18. By virtue of the gears 20 this effects simultaneous rotation of the other shutters 18 between the same positions. Limit switches or other controls may be provided to arrest operation of the motor when the edges 4b, 4c of each shutter 4 abuts the respective pair of lips 16, and also when each shutter 18 is in the fully open position.

As shown in Figures 3 and 4 the damper system described above is used in a passive ventilation apparatus 23 for ventilating a room space within a roofed building.

The ventilation apparatus 23 has a chamber structure 24 and an external terminal 25.

The external terminal 25 comprises a square-section hollow body 26 mounted on the roof 27. The body 26 has a top cover 28 and side

walls with louvres 29 to allow airflow into and out of the hollow body 26. Beneath the louvres 29 there is a lower solid-walled part 31. The hollow body 26 has internal diagonal upright partition walls 33 which separate the interior of the body into four upright chambers 30 which are closed at the top and at their lower regions extend downwardly via the lower solid walled part 31 into the underlying roof space with a hollow structure 32. The chamber structure 24 defined by part 31 and box structure 32 has four triangular section chambers which terminate at their bottom ends at ceiling level in the room space.

The damper system described above is mounted across the bottom end of the box structure 32 of the chamber structure 24 with each opening 3 being in alignment with the bottom end of a respective one of the four chambers 30. The triangular cross-sections of the chambers 30 are identical with those of the openings.

As shown in Figure 4, an inlet/outlet module 34 is fitted at ceiling level over the damper system. This module 34 comprises four ducts 35, each duct 35 having an upper end 36 fixed to the frame of the damper system and a lower free end 38.

The upper free ends 36 are triangular, identical with the openings in the frame of the damper system and are fixed to such openings. The lower free ends 38 are circular (with shaped cowls as shown).

The ducts 35 are provided with a smooth graduated transition

between the triangular-shaped configuration at the upper ends 36 and the circular configuration at the free ends 38 permitting smooth airflow therethrough.

As discussed above in connection with the known passive ventilation apparatus, the terminal acts to direct inflow of air through whichever louvred side wall faces the prevailing wind, and the other louvred side walls allow rising hot air to escape into the environment. The four triangular chambers 30 direct the flow of air between the louvred side walls and the ducts 35 without requiring powered ventilation equipment. In the room space hot air rises through one or more of the open circular ends 38 and fresh air is directed downwardly through one or more of the other open ends 38.

The use of the common actuator with the mechanical linkage defined by the axles and bevel gears facilitates incorporation of the damper system with the module 34 which integrates the four ducts with smooth triangular to circular transition.

It is of course to be understood that the invention is not intended to be restricted to the details of the above embodiment, which are described by way of example only. In particular there may be any suitable number of openings 30 of any suitable shape. Also, although reference is made to ceiling mounting of the module 34, this may be mounted below the ceiling or at any other position within any suitable

building space. Also the module 34 need not be applied directly to the box chamber structure 32; it may be linked thereto by ducting or the like and the ports may even be separate rather than assembled together in a common module. The damper system may be sandwiched between the module 34 and the box structure 32 or may be otherwise arranged e.g. being incorporated in the box structure 32 even above the lower end thereof to which the module is connected.

CLAIMS

1. A damper system for controlling air flow through multiple inlet/outlet ports (35) of ventilation apparatus (23) comprising:

a plurality of openings (3) for communication with the inlet/outlet ports (35);

a plurality of damper members (4) movable relative to the openings (3) for controlling air flow therethrough; and

an actuator arrangement for effecting movement of the damper members (4),

wherein the actuator arrangement comprises a common actuator (5) and a mechanical linkage between the damper members (4) and the actuator (5), so that the damper members (4) are movable together by the common actuator (5).

2. A damper system according to claim 1, wherein the openings (3) are provided together in a common unit (1) which is incorporated in or associated with a module of the ventilation apparatus (23) having the multiple inlet/outlet ports (35) mounted together.

3. A damper system according to claim 1, wherein the damper system is used with any combination and arrangement of ports (35) whether directly or closely associated with the damper system or separate or remote therefrom linked by ducting or otherwise.

4. A damper system according to any of claims 1-3 wherein the

mechanical linkage between the damper members (4) and the actuator (5) comprises a rotatable linkage.

5. A damper system according to claim 4, wherein the rotatable linkage comprises a rotatable output of the actuator (5) which is transmitted by one or more rotatable axles (18) and one or more rotatable gears (20) to rotatable inputs for the damper members (4).

6. A damper system according to claim 5, wherein the rotatable linkage comprises an assembly of meshed gears (20), a first axle (18) rotatably linking the assembly to the actuator (5) and a plurality of second axles (18) respectively linking the assembly to the damper members (4).

7. A damper system according to any one of claims 5 or 6 wherein the gears (20) comprise bevel gears.

8. A damper system according to any of claims 1-7 wherein each damper member (4) is of the form of a shutter or paddle or other solid generally planar element.

9. A damper system according to any one of claims 1-8 wherein the damper members (4) are pivotally mounted so as to be rotatable between different positions relative to the respective opening (3).

10. A damper system according to any one of claims 1-9 wherein the damper members (4) are movable between open and closed

positions and/or between different open positions at which there are different degrees of closure of the openings (3).

11. A damper system according to any one of claims 2, or 4-10 when dependent upon claim 2, where the openings (3) provided within the common unit (1) comprise a frame.

12. A damper system according to claim 11, wherein the gear assembly (20) is mounted within the frame (1) within a housing (13) in a central region thereof.

13. A damper system according to any one of claims 11-12 wherein the frame (1) is generally square or rectangular, with transverse partitions (2a-2d) defining therebetween said openings (3) of generally triangular shape.

14. A damper system according to any one of claims 1-13, wherein the damper members (4) are generally of the same shape as the openings (3).

15. A damper system according to any one of claims 1-14, wherein the common actuator (5) comprises an electric motor.

16. A damper system according to any one of claims 1-15, wherein the damper system is used in a passive ventilation apparatus (23) for ventilating an internal space of a roofed building whereby the ventilation apparatus (23) has an external roof terminal (25) and inlet/outlet ports (35) within the room space.

17. A damper system according to claim 16, wherein the roof terminal (25) comprises a hollow body (26) for mounting on a roof structure (27) having an internal space separated by partitions (33) into multiple conduits communicating below the roof structure (27) with respective chambers (30) to which the inlet/outlet ports (35) are connected, the body (26) having differently directed open side walls to permit air flow therethrough into and out of the chambers (30) and the damper system being used to control air flow through the inlet/outlet ports (35).

18. A damper system according to claim 17, wherein the inlet/outlet ports (35) each have a duct with a first end (36) connected via a respective one of the openings (3) of the damper system to a respective one of the ventilation chambers (30) and a free second end (38) providing a respective inlet/outlet port (35).

19. A damper system according to claim 18 wherein the duct ends (36, 38) are of different shape whereby the ducts (35) are provided with a graduated transition therebetween.

20. A damper system according to claim 19, wherein the transition is between a polygonal first end (36) and a curved second end (38).

21. A ventilation apparatus (23) for ventilating an internal space of a roofed building comprising a roof terminal (25) having differently directed open sides thereto in communication with respective

conduits within the terminal (25) leading to respective chambers (30), multiple inlet/outlet ports (35) for location within the internal building space, said module having ducts providing air flow communication respective with the inlet/outlet ports (35) and the chambers (30), a damper system with multiple openings (3) respectively interposed between the ducts and the chambers (30) and actuator operated damper members (4) movable relative to the openings (3) to control air flow therethrough, the ducts providing a transition between the chambers (30) and ports (35) at least one having different cross-sections thereto, with polygonal cross-section chambers (30) and curved cross-section ports (35).

22. A ventilation apparatus according to claim 21, wherein the multiple ports (35) are integrated in a common module.

23. A ventilation apparatus according to any one of claims 21 or 22 wherein the damper members (4) are provided in a common unit with a single common actuator (5).

24. A damper system or a ventilation system, substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

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Application No: GB0506970.3 **Examiner:** Iwan Thomas

Claims searched: 1 **Date of search:** 14 August 2006

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X	1-4, 8-12, 14 & 15 at least	GB 763801 A (AKTIEBOLAGET) See whole document, especially figures1-3
X	1-5, 8-12, 15 & 16 at least	US5938524 A (CUNNINGHAM) See whole document

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art
Y	Document indicating lack of inventive step if combined with one or more other documents of same category	P	Document published on or after the declared priority date but before the filing date of this invention
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^{X} :

F4V

Worldwide search of patent documents classified in the following areas of the IPC

F24F

The following online and other databases have been used in the preparation of this search report

Online: WPI, EPODOC