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(54) **AIR VENT FOR VENTILATION SYSTEMS**

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(52) **U.S. Cl.** ..... **454/115**

(57) **ABSTRACT**

An air vent is provided that is capable of delivering a distributed divergent air flow with a predominant direction of flow that can be changed within a wide range of mutually perpendicular directions. In one embodiment, the air vent has an outlet grid that is generally ball shaped and that is rotatably mounted at an end of an air duct for rotation about its center. Each of the multiple outlet openings of the grid points to a direction that is different from pointing directions of all other outlet openings so that a divergent air flow is obtained. By rotating the ball shaped grid about its center, the predominant direction of air flow can nevertheless be changed in a within a wide range.

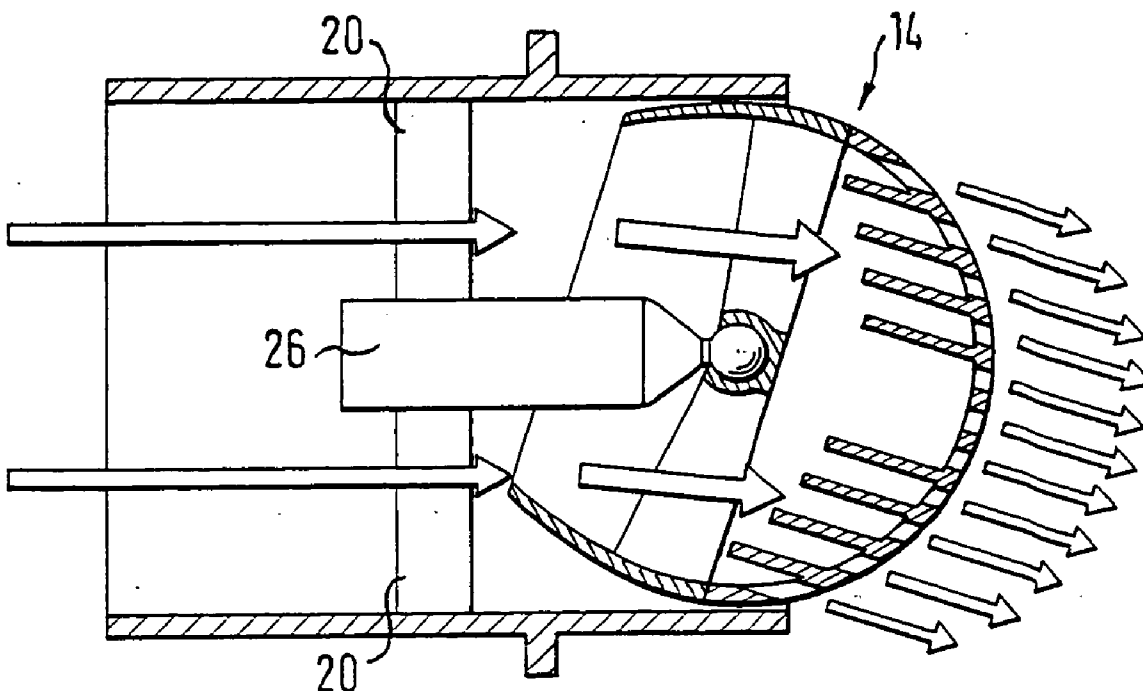
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**Related U.S. Application Data**

(62) Division of application No. 10/388,790, filed on Mar. 14, 2003.



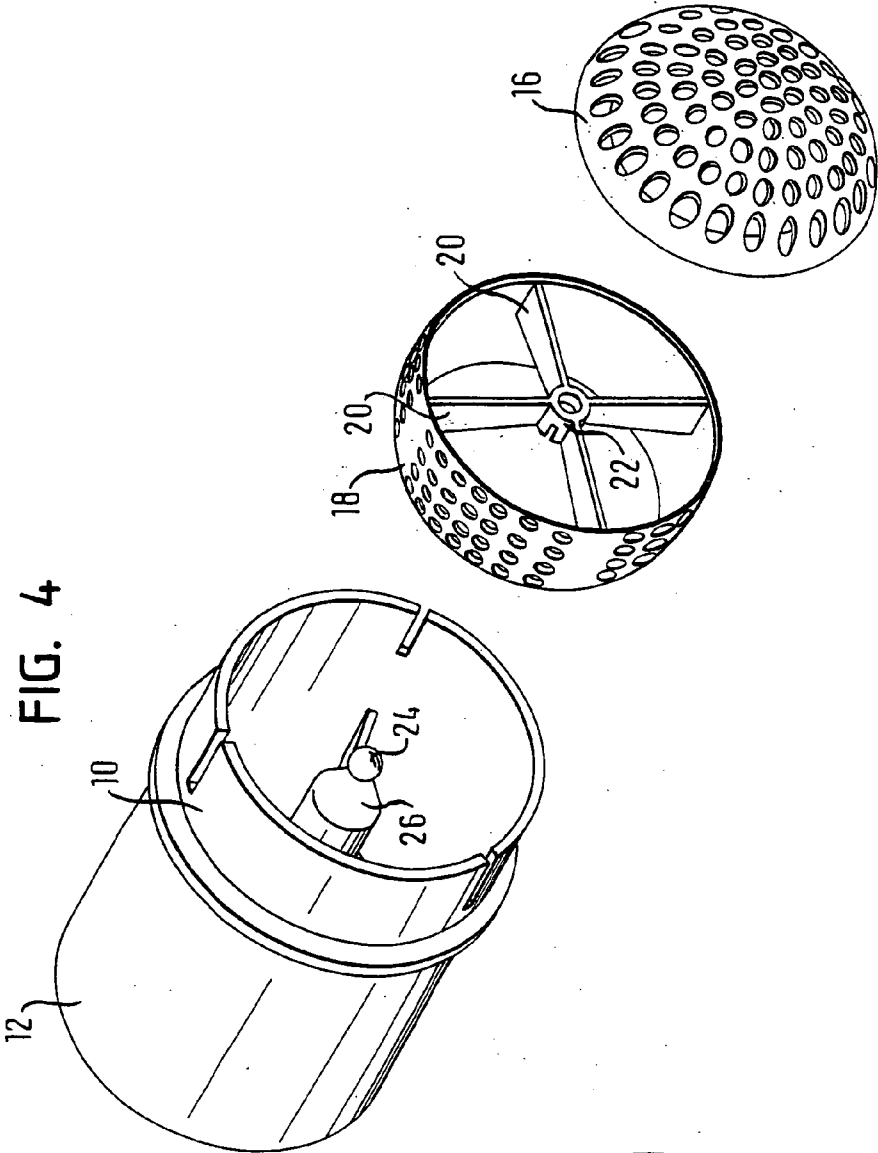


FIG. 4

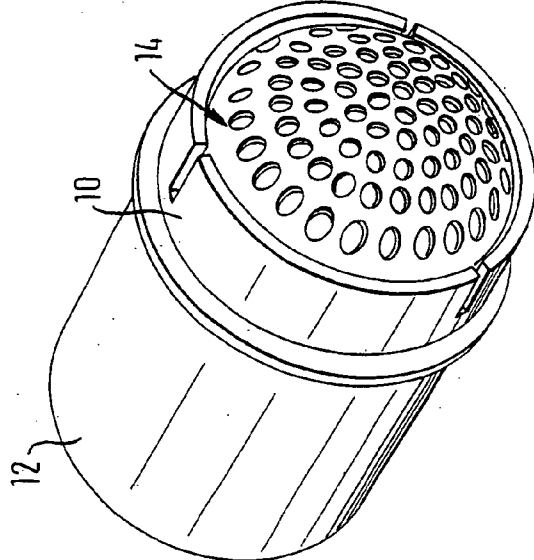


FIG. 1

FIG. 2

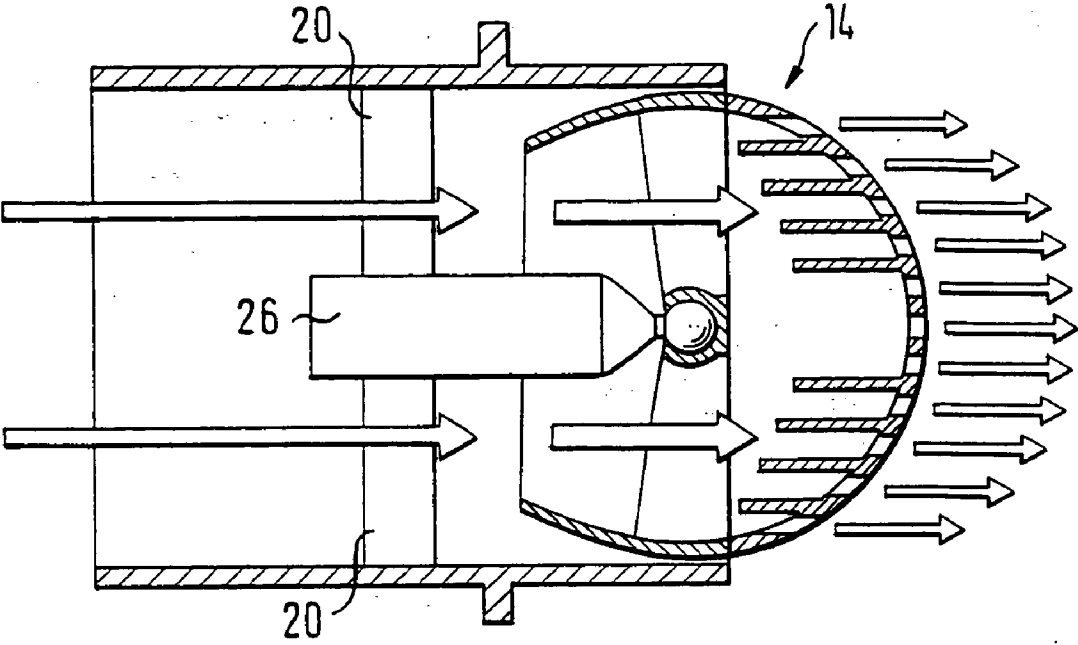


FIG. 3

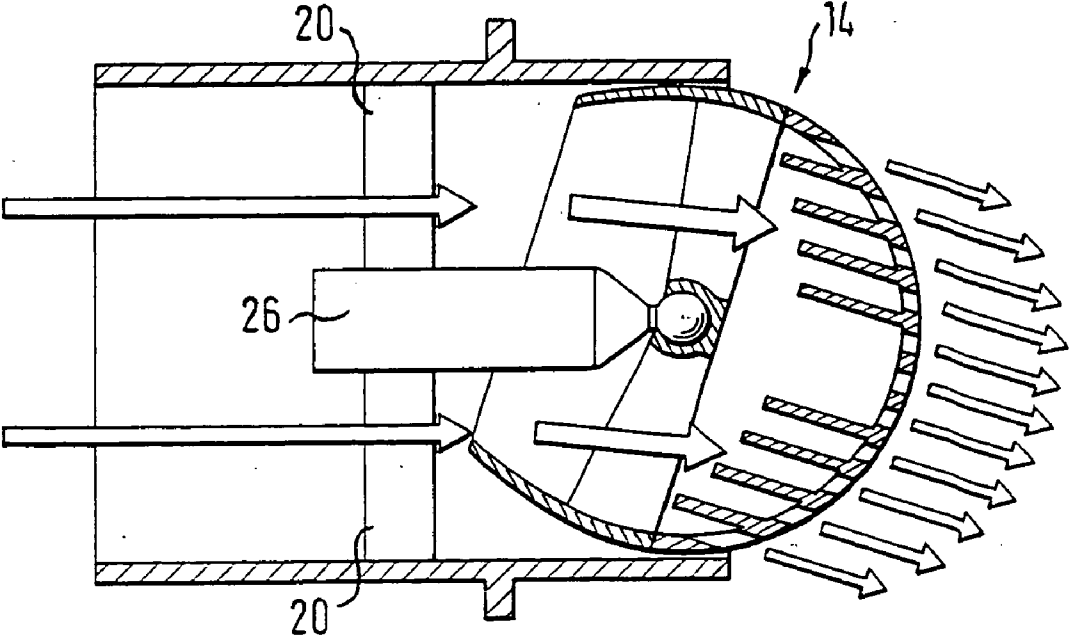


FIG. 5

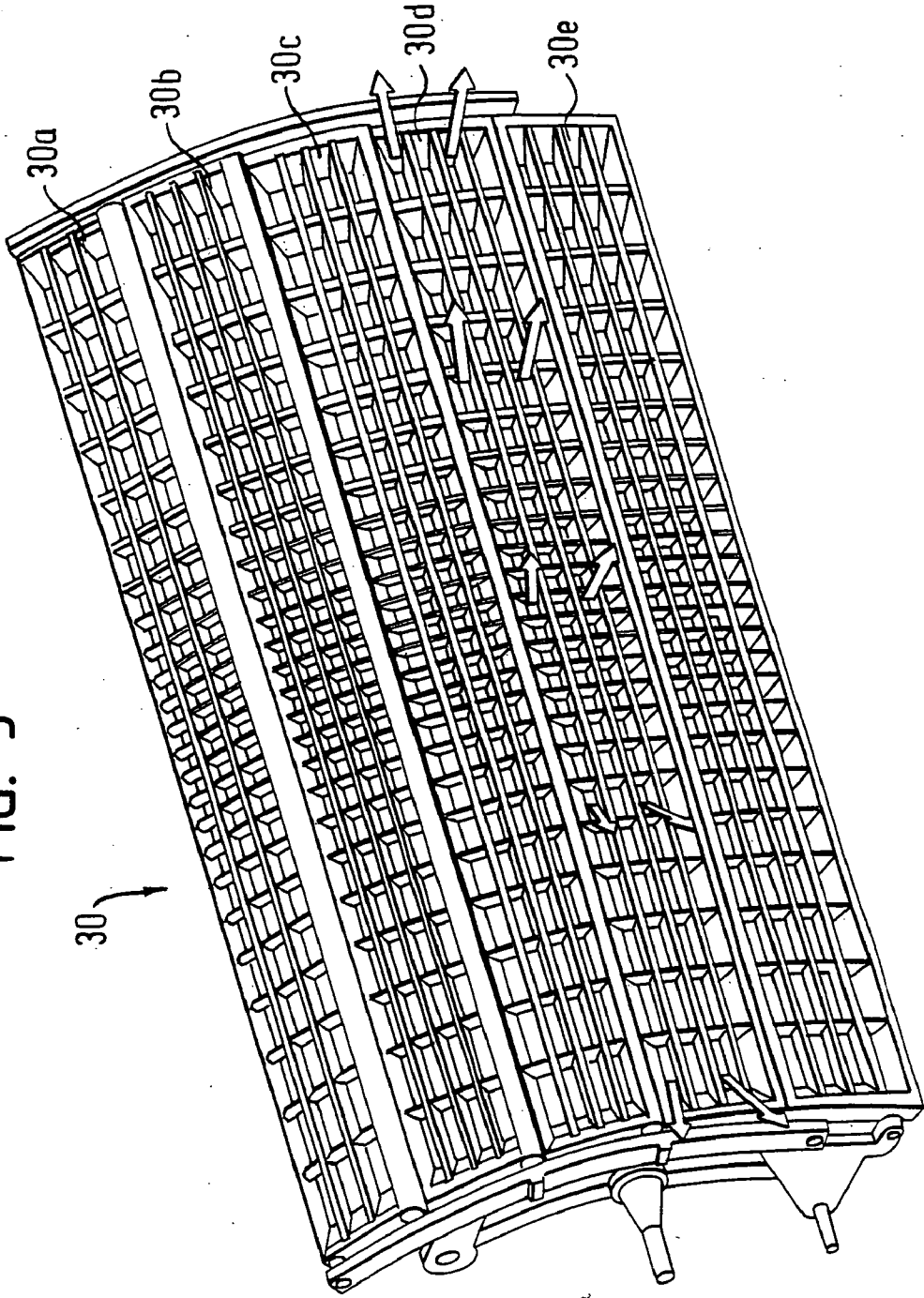


FIG. 7

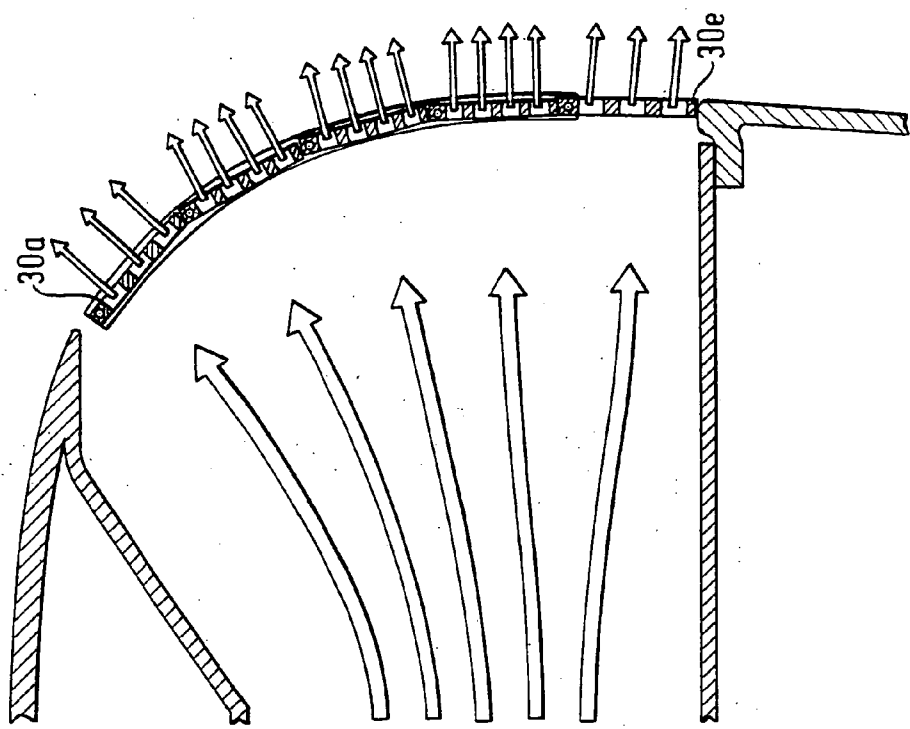


FIG. 6

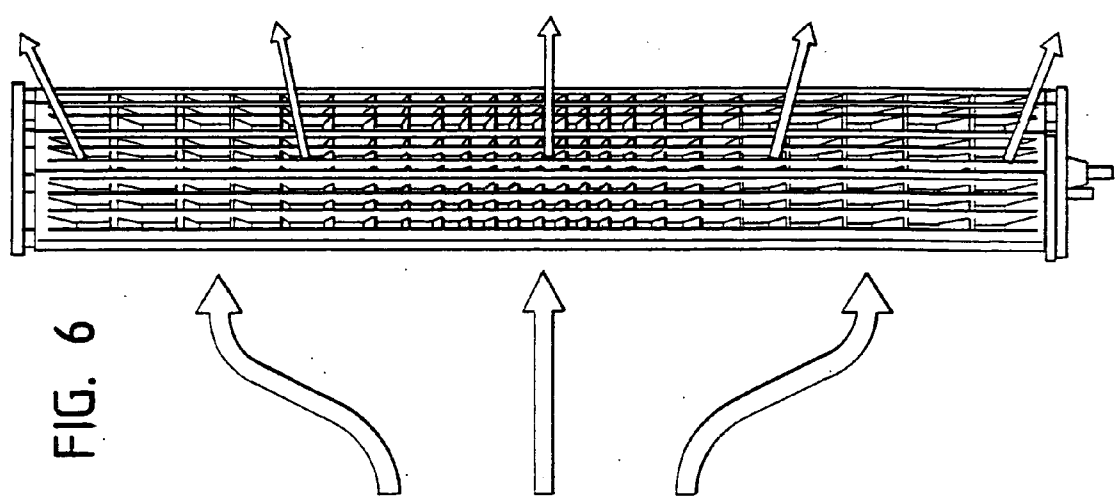


FIG. 9

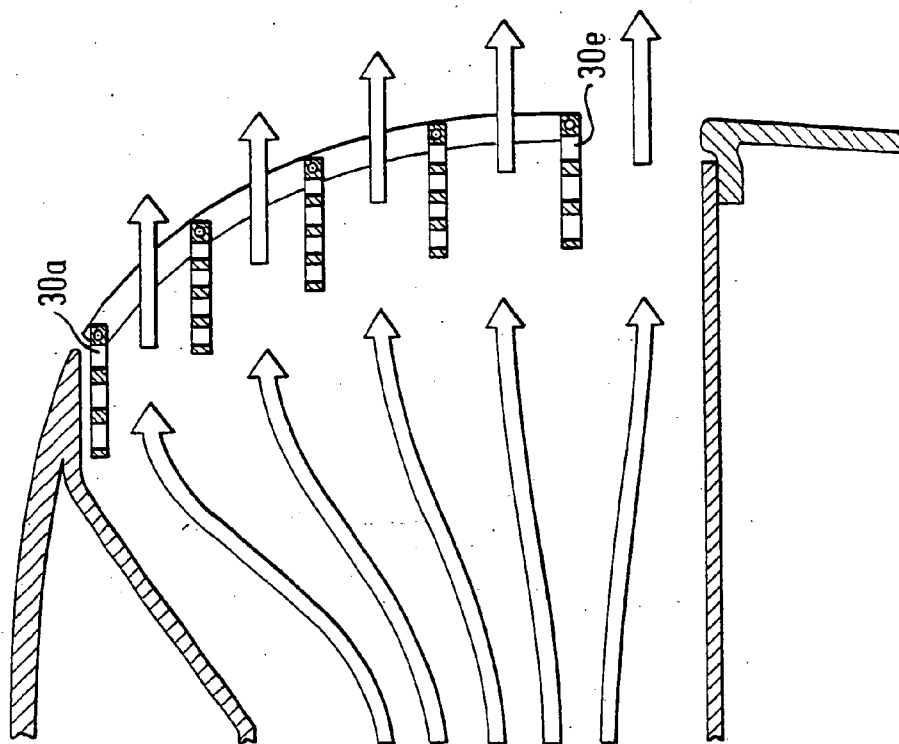
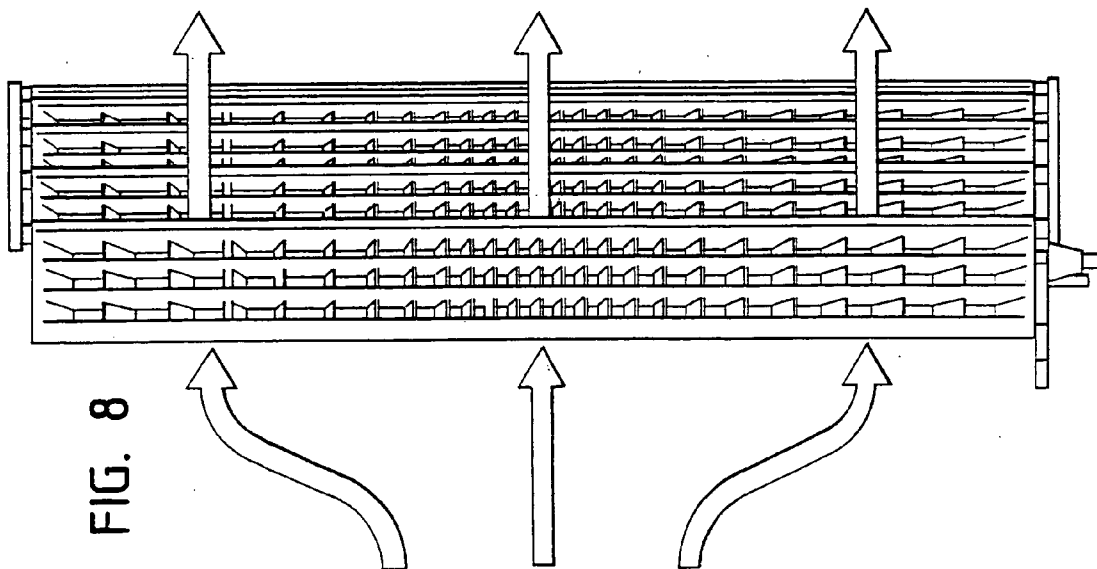


FIG. 8



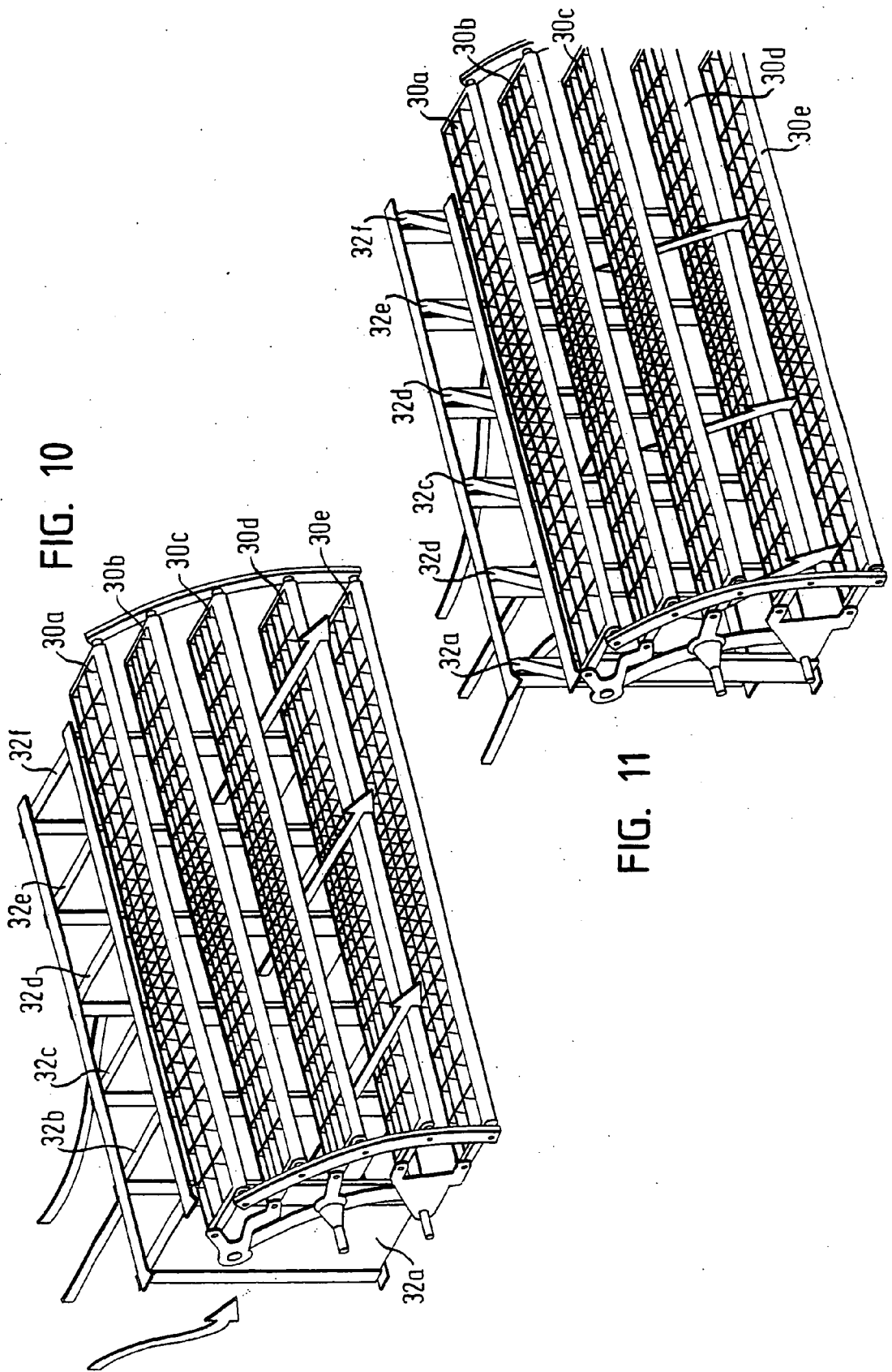


FIG. 10

FIG. 11

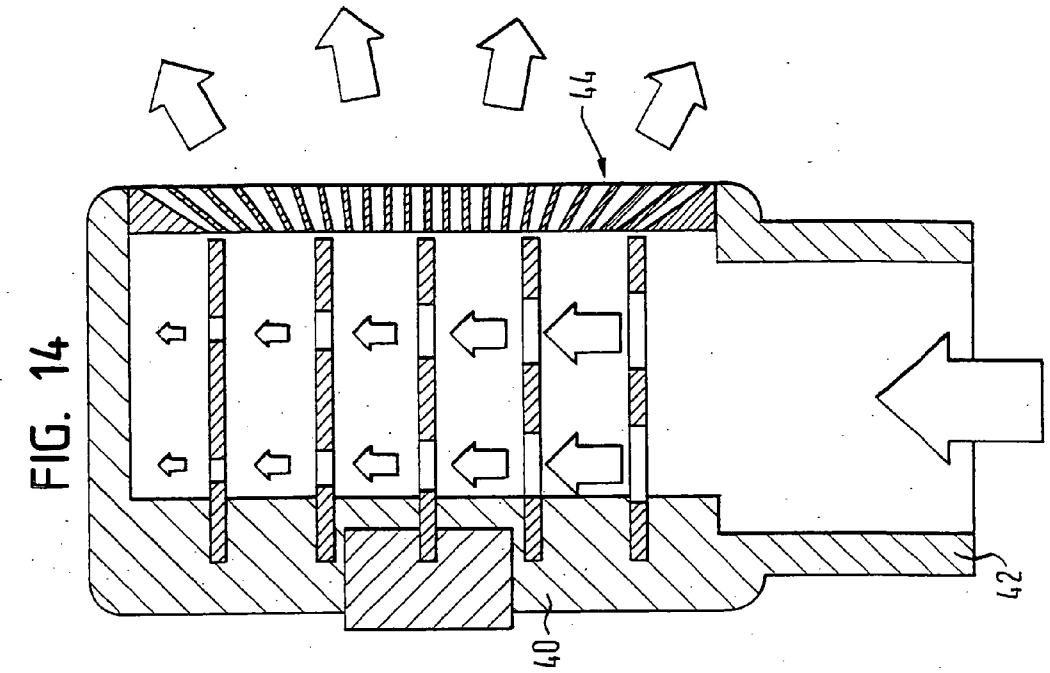


FIG. 14

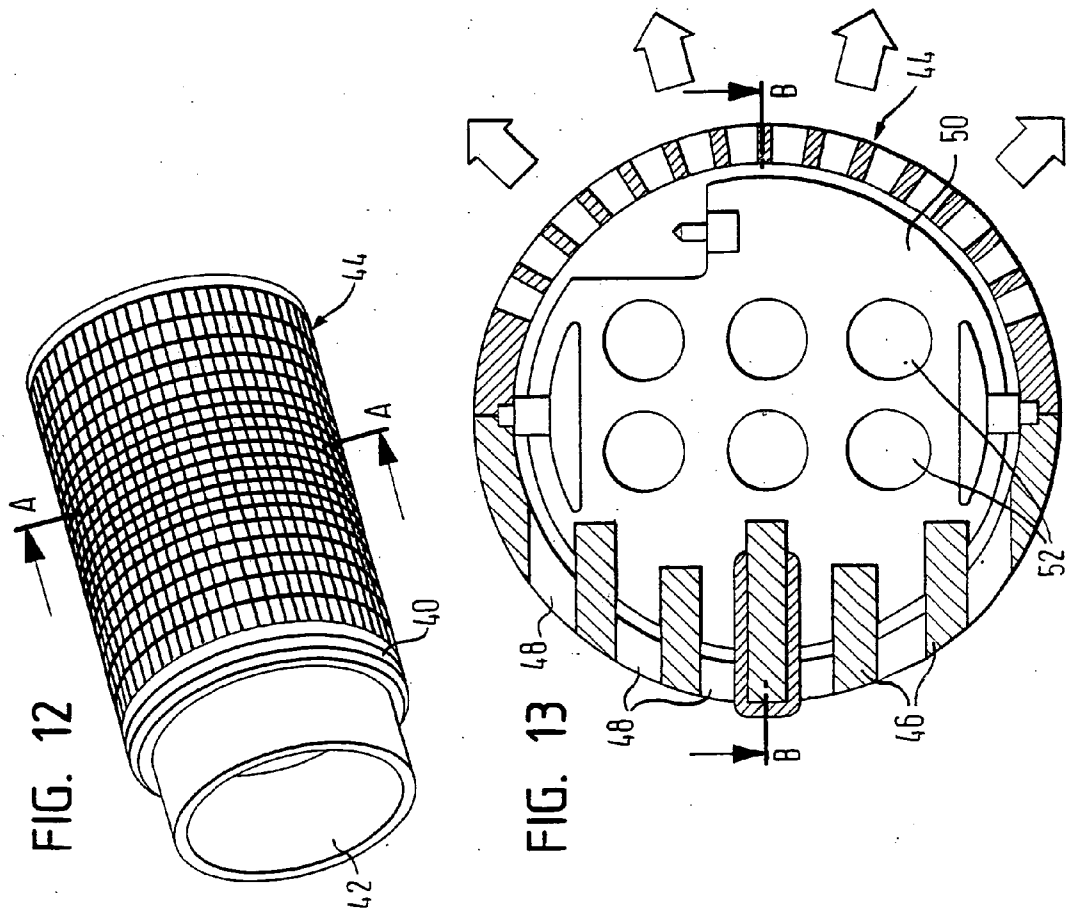
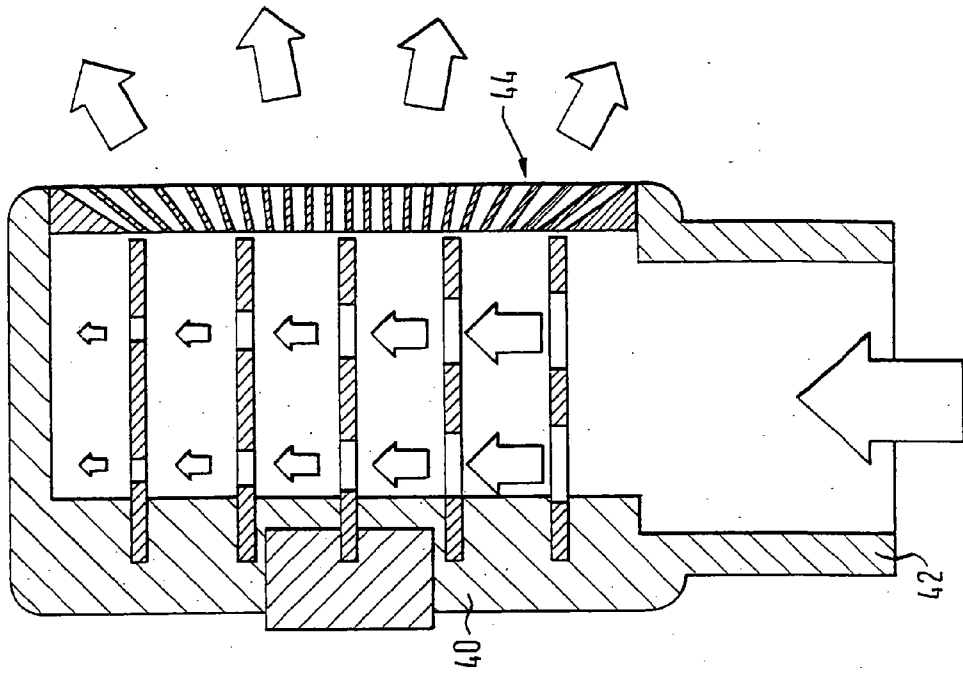


FIG. 13

FIG. 12



**AIR VENT FOR VENTILATION SYSTEMS**

RELATED APPLICATION

[0001] This application is a divisional of co-pending patent application Ser. No. 10/388,790, filed Mar. 14, 2003.

FIELD OF THE INVENTION

[0002] The present invention relates to an air vent for ventilation systems, especially in vehicles.

[0003] Conventional air vents in vehicles have an outlet opening with a set of parallel lamellas that are jointly pivoted to deflect an air flow. When an air flow is to be deflected both horizontally and vertically, a second set of lamellas is provided upstream from a first set, and the first and second sets of lamellas are pivoted about mutually perpendicular axes. With an air vent of this configuration, an air flow can be deflected in a wide range between “up” and “down” and between “left” and “right”, but always remains a directed flow, causing turbulence and local zones of high air flow velocities within the vehicle cabin whereas little movement of air occurs in other regions.

BACKGROUND OF THE INVENTION

[0004] The present invention provides an air vent that is capable of delivering a distributed divergent air flow with a predominant direction of flow that can be changed within a wide range of mutually perpendicular directions.

BRIEF SUMMARY OF THE INVENTION

[0005] In a first embodiment of the invention, the air vent has an outlet grid that is generally ball shaped and that is rotatably mounted at an end of an air duct for rotation about its center. Each of the multiple outlet openings of the grid points to a direction that is different from pointing directions of all other outlet openings so that a divergent air flow is obtained. By rotating the ball shaped grid about its center, the predominant direction of air flow can nevertheless be changed in a within a wide range.

[0006] In a second embodiment of the invention, the air vent has an outlet grid formed of a plurality of parallel grid vanes the ends of which are pivotally mounted at the outlet end of an air duct. Each grid vane has multiple air escape openings. The grid vanes can be pivoted between a condition where they together form a substantially continuous grid surface, providing a distributed or divergent air flow, and multiple conditions where they define parallel air escape slots and act as lamellas to provide a directed air flow.

[0007] In a third embodiment of the invention, an air vent device is comprised of a cylindrical duct member that has a first end connected to an air duct, a second end closed by a wall and a circumferential wall that forms an air outlet grid. Multiple air escape openings of the grid point into different directions, delivering a distributed or divergent flow of air. Preferably, movable air deflection flaps are mounted within the cylindrical duct member so that a predominant orientation of air flow can be adjusted.

[0008] Three different embodiments of the air vent are shown in the accompanying drawings and are defined in the following claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] Further features and advantages of the invention will become apparent from the following description of preferred embodiments with reference to the appending drawings. In the drawings:

[0010] **FIG. 1** is a perspective view of an air vent with a ball shaped grid that can be rotated about its center;

[0011] **FIG. 2** is a sectional view of an air duct end with the ball shaped grid in a first position;

[0012] **FIG. 3** is a sectional view of an air duct end with the ball shaped grid in a second position;

[0013] **FIG. 4** is an exploded view of the air vent in **FIG. 1**;

[0014] **FIG. 5** is a perspective view of an air vent with an outlet grid formed of a plurality of parallel pivotal grid vanes;

[0015] **FIGS. 6 and 7** illustrate a distributed air flow delivered by the air vent of **FIG. 6**;

[0016] **FIGS. 8 and 9** illustrate a directed air flow delivered by the air vent of **FIG. 6**;

[0017] **FIG. 10** is a perspective view of an embodiment generally similar to that in **FIG. 6**, but having a set of air deflection baffles upstream from the grid vanes;

[0018] **FIG. 11** is a view similar to that in **FIG. 11**, but showing the deflection baffles in a pivoted position;

[0019] **FIG. 12** is a perspective view of an air vent with a cylindrical duct member;

[0020] **FIG. 13** is a schematic radial section of the duct member; and

[0021] **FIG. 14** is a schematic axial section of the duct member.

[0022] An air vent as shown in **FIGS. 1 to 4** has a cylindrical tube section **10** with one end connected to an end of an air duct **12** and another end fitted with an outlet grid **14**. Outlet grid **14** is generally ball shaped and is assembled of a substantially semispherical shell member **16** and an annular support member **18**. Support member **18** has an outer surface spherically curved to a radius identical with that of shell member **16** so that shell member **16** and support member **18** together form a ball portion which is about 60 to 80 percent of a total 360° ball.

[0023] Support member **16** and shell member **18** each have multiple outlet openings each of which forms a minute air escape nozzle. Each of these multiple air escape nozzles may point into a different direction so that, as a whole, outlet grid **14** acts to provide a distributed or divergent flow of air from an air stream supplied through air duct **12**. Alternatively, as illustrated in **FIGS. 2 and 3**, these nozzles may all point into the same direction to provide a rather directed air flow.

[0024] Support member **18** has four integrally molded baffle elements **20** that extend radially and are spaced circumferentially at 90° from each other. Baffle elements **20** have radially inner ends joined by a hub member **22**. Hub member **22** is pivotally mounted on a ball member **24** carried on a free end of an axially extending grid carrier stud **26**. As

seen in FIGS. 2 and 3, grid carrier stud 26 is coaxial with air duct 12 and is mounted therein with radial strut members 28.

[0025] By virtue of pivotally mounting support member 18 on grid carrier stud 26, outlet grid 14 may be rotated in any direction about its center, as materialized by ball member 24. Accordingly, and as understood by contemplating FIGS. 2 and 3, an air flow supplied by the air vent, whether directed or divergent, may be easily oriented in space by simply rotating outlet grid 14, manually or by means of a convenient adjustment mechanism (not shown).

[0026] Turning now to the embodiment shown in FIGS. 5 to 11, an air vent has an outlet grid, generally designated at 30, composed of five parallel grid vanes 30a, 30b, 30c, 30d and 30e. Each of these grid vanes is pivotally mounted in a frame (not shown). The pivot axes of grid vanes 30a to 30e are parallel and spaced from each other so that, in a condition shown in FIGS. 5, 6 and 7, they jointly assume parallel pivotal positions where they together form a substantially continuous grid surface. Each grid vane has multiple air escape openings that widen horizontally from the center to both lateral ends, as seen in FIG. 5, thereby providing a horizontally distributed air flow. Generally, each air escape opening is a nozzle defined by air deflection surfaces oriented in a way determined by a particular design.

[0027] In a pivotal condition shown in FIG. 8 and 9, grid vanes 30a to 30e are substantially horizontally aligned to define five parallel air escape slits as illustrated. In this condition, the air vent supplies a rather directed flow of air.

[0028] With reference to FIGS. 10 and 11, a set of baffle members is provided upstream of outlet grid 30. Specifically, six parallel and vertically extending baffle members 32a to 32f are arranged upstream of outlet grid 30. Each baffle member 32a to 32f is mounted pivotally on a vertical axis. By jointly pivoting baffle members 32a to 32f, an air flow delivered by the air vent can be given a predominant orientation, whether directed or divergent.

[0029] With reference now to FIGS. 12 to 14, an embodiment of an air vent is shown wherein a cylindrical duct member 40 has a first end connected to a sleeve 42 for connection to an air duct and a second end closed by a wall. A circumferential envelope area of duct member 40 is formed as an outlet grid 44 with multiple outlet openings. As seen in FIG. 14, each outlet opening is defined by directive wall sections and acts as a nozzle. As these outlet openings are all located in a cylindrically curved wall section, adjacent openings in a circumferential direction point to different directions so that the outlet grid delivers a divergent flow of air. In addition, outlet openings close to either axial end of the outlet grid are inclined away from an imaginary radial plane located midway between the axial ends of the outlet grid, the angle of inclination being the greater the closer an outlet opening is to an axial end of the outlet grid. As a result, the air flow delivered by the air vent through outlet grid 44 is divergent both in a radial plane and in an axial plane of the duct member 40, as illustrated by arrows in FIGS. 13 and 14.

[0030] An envelope wall section opposite outlet grid 44 is provided with parallel elongate outlet slots 46 separated by webs 48 which extend in the axial direction of duct member 40. Pivotally mounted inside of duct member 40 are generally circular baffle plates 50. Each baffle plate 50 is mounted on an axis that extends diametrically of duct member 40, and all baffle plates are linked for joint pivotal movement between a radial position as seen in FIG. 14 and any of a wide range of pivotal positions inclined to either side of the radial position. Baffle plates 50 are provided with through holes 52 that allow an axial passage of air flow within duct member 40 in spite of the radial extension of baffle plates 50. As seen in FIG. 14, through holes 52 are the wider the closer the corresponding baffle plate 50 is to connection sleeve 42.

[0031] On the side of outlet slots 46, the air vent delivers a directed flow of air, the direction of which is adjusted by jointly pivoting baffle plates 50. On the side of outlet grid 44, although a divergent flow of air is supplied, a predominant direction of air flow is obtained by adjusting baffle plates 50 to any pivotal position different from the radial position shown in FIG. 14.

[0032] In addition, the air vent as a whole can be rotated about the axis of duct member 40 if connection sleeve 42 is received in an end of an air duct with a sliding fit that permits rotation, so that the air vent can deliver either of a directed or a divergent flow of air in any direction.

1. An air vent for ventilation system in a vehicle, comprising an outlet grid having multiple outlet openings, wherein said outlet grid is generally ball shaped and is rotatably mounted at an end of an air duct for rotation about its center.

2-17. (canceled)

18. An air vent for a ventilation system in a vehicle, comprising an outlet grid having several parallel grid vanes, each of said grid vanes being pivotally mounted in a frame and having multiple outlet openings, said grid vanes being jointly movable to assume pivotal positions where they together form a substantially continuous surface, and said grid vanes further being jointly movable to assume pivotal positions where they together define parallel air outlet slits.

19. The air vent according to claim 18, wherein each of said outlet openings is a nozzle defined by air deflection surfaces.

20. The air vent according to claim 19, wherein said nozzles point in diverging directions.

21. The air vent according to claim 18, wherein a set of movable baffle members is mounted in the frame upstream of said grid vanes.

22. The air vent according to claim 21, wherein said baffle members are jointly pivotal about parallel axes that are perpendicular to pivotal axes of the grid vanes.

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