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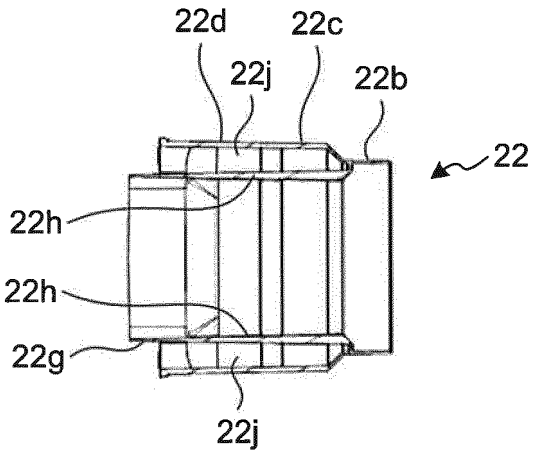
(54) **DUCT CONNECTION PORT AND VENTILATION DEVICE**

(57) A duct connection port (22) to be mounted to a heat exchange ventilator that is a ventilator for connection to a ventilation duct includes an outer hull and an inner hull (22h). The outer hull includes cylindrical parts (22b, 22c, and 22d) to be connected to ducts. The inner hull (22h) defines a passage for a ventilation air flow. The inner hull is disposed inside the cylindrical parts (22c, 22d) defining a part of the outer hull, and is spaced away from the cylindrical parts (22c and 22d). The cylindrical parts (22b, 22c, and 22d) defining the outer hull are integral with the inner hull (22h).

FIG.7



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Description

Field

[0001] The present invention relates to a duct connection port that is mounted to a ventilator, and the ventilator.

Background

[0002] Ventilators including a heat exchange ventilator have duct connection ports for connection to ducts. The duct connection ports are formed integrally with or separately from a ventilator body. If the duct connection ports are formed separately from the ventilator body, the plurality of duct connection ports required per ventilator can be used as common parts. Forming the duct connection ports and the ventilator body separately from each other also increases flexibility in packing of the ventilator.

[0003] If a ventilator is to be installed in a cold region where dew condensation takes place in winter, in some case, a heat-insulating layer is disposed on the duct and the duct connection port for the purpose of preventing dew condensation.

[0004] A ventilator disclosed in Patent Literature 1 includes an air passage unit and a heat-insulating unit that are assembled together.

Citation List

Patent Literature

[0005] Patent Literature 1: Japanese Patent No. 5079137

Summary

Technical Problems

[0006] For the above-mentioned invention disclosed in Patent Literature 1, the duct connection port is defined by the assemblage of the air passage unit and the heat-insulating unit, which incurs costs for making the heat-insulating unit as well as for assembling the air passage unit and the heat-insulating unit together. Additionally, an increased parts count also increases the weight and impairs ease of the assemblage.

[0007] The present invention has been made in view of the above, and an object of the present invention is to obtain a duct connection port that eliminates the necessity of assembling an air passage unit and a heat-insulating unit together and suppresses increase of a parts count.

Solution to Problems

[0008] To solve the above-stated problems and achieve the object, the present invention provides a duct connection port that is to be mounted to a ventilator for connection to a ventilation duct. The duct connection port includes an outer hull including a cylindrical part to be connected to the duct, and an inner hull provided inside the outer hull in a spaced relation to the outer hull and defines a passage for a ventilation air flow. The outer hull and the inner hull are integral with each other.

Advantageous Effects of Invention

[0009] The duct connection port according to the present invention eliminates the necessity of assembling the air passage unit and the heat-insulating unit together, and can suppress the increase of the parts count.

Brief Description of Drawings

[0010]

FIG. 1 is a perspective view of a heat exchange ventilator according to a first embodiment of the present invention.

FIG. 2 is an exploded perspective view of the heat exchange ventilator according to the first embodiment.

FIG. 3 is a perspective view of a duct connection port of the heat exchange ventilator according to the first embodiment.

FIG. 4 is a top view of the duct connection port of the heat exchange ventilator according to the first embodiment.

FIG. 5 is a front view of the duct connection port of the heat exchange ventilator according to the first embodiment.

FIG. 6 is a side view of the duct connection port of the heat exchange ventilator according to the first embodiment.

FIG. 7 is a sectional view of the duct connection port of the heat exchange ventilator according to the first embodiment.

FIG. 8 is a perspective view of the duct connection port as seen from a mounting surface of the duct connection port of the heat exchange ventilator according to the first embodiment.

FIG. 9 is a plan view of the heat exchange ventilator according to the first embodiment.

FIG. 10 is a side view of the heat exchange ventilator according to the first embodiment.

FIG. 11 is a top view of a duct connection port of a different structure of the heat exchange ventilator according to the first embodiment.

FIG. 12 is a front view of the duct connection port of the different structure of the heat exchange ventilator according to the first embodiment.

FIG. 13 is a side view of the duct connection port of the different structure of the heat exchange ventilator according to the first embodiment.

FIG. 14 is a sectional view of the duct connection port of the different structure of the heat exchange

ventilator according to the first embodiment.

FIG. 15 is a top view of a duct connection port of a different structure of the heat exchange ventilator according to the first embodiment.

FIG. 16 is a front view of the duct connection port of the different structure of the heat exchange ventilator according to the first embodiment.

FIG. 17 is a side view of the duct connection port of the different structure of the heat exchange ventilator according to the first embodiment.

FIG. 18 is a sectional view of the duct connection port of the different structure of the heat exchange ventilator according to the first embodiment.

Description of Embodiment

[0011] A detailed description of duct connection ports and a ventilator according to an embodiment of the present invention is provided hereinafter with reference to the drawings. It is to be noted that this embodiment is not restrictive of the invention.

First Embodiment

[0012] FIG. 1 is a perspective view of a heat exchange ventilator according to the first embodiment of the present invention. FIG. 2 is an exploded perspective view of the heat exchange ventilator according to the first embodiment. The heat exchange ventilator 30 is the ventilator according to the first embodiment and includes duct connection ports 22 mounted to its body casing 1. The body casing 1 is a sheet-metal formed product and is in the shape of a hexahedral box having a top plate 12, side plates 13, 14, 15, and 16, and a bottom plate 17. Each of styrene formed products 6, 7, 8, 9, 10, and 11, which define a box, is mounted on an inner side of a corresponding one of the top plate 12, the side plates 13, 14, 15, and 16, and the base plate 17. Installed in the box-shaped structure defined by the styrene formed products 6, 7, 8, 9, 10, and 11 are an air supply blower 3a and 3b, an air exhaust blower 4a and 4b, and a heat exchanger 2. Wires (not illustrated) drawn from the air supply blower 3a and 3b and the air exhaust blower 4a and 4b are connected to a terminal block inside a circuit box 18 through an opening (not illustrated). That is, power lines and signal lines can be connected to the air supply blower 3a and 3b and the air exhaust blower 4a and 4b via the terminal block of the circuit box 18 in the heat exchange ventilator 30. Electric dampers that are capable of switching between heat exchange ventilation and non-heat exchange ventilation are mounted in openings 16a formed in the side plate 16. If the motorized dampers are not mounted, the openings 16a are closed with closing plates 19.

[0013] The styrene formed product 11 serves as a drain pan. An upper surface of the styrene formed product 11 is coated with a resin. Acrylonitrile butadiene styrene (ABS) can be used as the resin coating the upper surface of the styrene formed product 11, but the coating is not limited to this.

[0014] The heat exchanger 2 includes a supply air passage and an exhaust air passage formed independently of each other, and heat exchange is effected between air passing through the supply air passage and air passing through the exhaust air passage. Detailed descriptions of the supply air passage and the exhaust air passage are omitted. A rib frame body 5 mounted to the styrene formed product 7 engages an angular part of the heat exchanger 2 and thus separates the supply air passage from the exhaust air passage. An outside-air dust filter frame unit 20 is provided on a windward side of the supply air passage of the heat exchanger 2. A room-interior-return-air dust filter frame unit 21 is provided on a windward side of the exhaust air passage of the heat exchanger 2. The outside-air dust filter frame unit 20 and the room-interior-return-air dust filter frame unit 21 are removable from the side plate 14.

[0015] A description is provided next as to the duct connection port 22. FIG. 3 is a perspective view of the duct connection port of the heat exchange ventilator according to the first embodiment. FIG. 4 is a top view of the duct connection port of the heat exchange ventilator according to the first embodiment. FIG. 5 is a front view of the duct connection port of the heat exchange ventilator according to the first embodiment. FIG. 6 is a side view of the duct connection port of the heat exchange ventilator according to the first embodiment. FIG. 7 is a sectional view of the duct connection port of the heat exchange ventilator according to the first embodiment. FIG. 7 is the sectional view taken along line VII-VII in FIG. 4. The duct connection ports 22 are mounted in air passage openings 13a and 15a formed in the side plates 13 and 15.

[0016] Depending on mounting position, each of the duct connection ports 22 serves as any one of a port intended for supply of air into a room interior, a return air inlet, an exhaust air outlet, and an outside-air inlet. The duct connection port 22 includes a base 22a and cylindrical parts 22b, 22c, and 22d. The base 22 serves as a mounting base when mounted to the side plate 13 or 15. The cylindrical parts 22b, 22c, and 22d are of tubular shape. An inside of the cylindrical part 22b defines an air passage that allows a flow of supply or exhaust air coming from the heat exchange ventilator 30 to pass therethrough. In the first embodiment, the cylindrical part 22b has an outside diameter of 125 mm and is connectable to a duct having an inside diameter of 125 mm. The cylindrical parts 22c and 22d, which are cylinders of different diameters, are arranged stepwise relative to the cylindrical part 22b. In the first embodiment, the cylindrical part 22c has an outside diameter of 150 mm, while the cylindrical part 22d has an outside diameter of 175 mm. It is to be noted that the individual outside diameters of the cylindrical parts 22b, 22c, and 22d are not limited to the above values.

[0017] Formed in the base 22a are through holes 22f

that allow screws to pass therethrough when the duct connection port 22 is mounted to the side plate 13 or 15.

[0018] FIG. 8 is a perspective view of the duct connection port as seen from a mounting surface of the duct connection port of the heat exchange ventilator according to the first embodiment. Formed on the mounting surface of the base 22a that is to be attached to the side plate 13 or 15 is a guide projection 22g that projects as a positioning part. When the duct connection port 22 is mounted to the side plate 13 or 15, the guide projection 22g fits in the air passage opening 13a or 15a, thereby positioning the duct connection port 22. To prevent leakage of the air from the heat exchange ventilator 30, a packing is preferably affixed to the guide projection 22g of the duct connection port 22 and the mounting surface of the base 22a that is to be attached to the side plate 13 or 15.

[0019] As illustrated in FIG. 7, the guide projection 22g is formed as an extension of an inner hull 22h that defines an air passage of the duct connection port 22. The guide projection 22g is contiguous with the inner hull 22h. The inner hull 22h, which defines the air passage, and the guide projection 22g are inwardly spaced away from the cylindrical parts 22c and 22d, thereby forming air spaces 22j. The cylindrical parts 22c and 22d define a part of an outer hull of the duct connection port 22. The air spaces 22j serve as heat-insulating layers that function to prevent dew condensation.

[0020] As illustrated in FIG. 7, the inner hull 22h defining the air passage is formed integrally with the guide projection 22g, the base 22a, and the cylindrical parts 22b, 22c, and 22d that define the outer hull of the duct connection port 22. In the first embodiment, the duct connection port 22 is a single-piece, resin formed product.

[0021] The cylindrical part 22d is similar to a shape having its outer side truncated by planes parallel to a central axis of the cylindrical part 22d. In the first embodiment, the cylindrical part 22d having the outside diameter of 175 mm is of a shape truncated by planes that are parallel to the inner hull 22h and adjoin an outer peripheral surface of the cylindrical part 22c having the outside diameter of 150 mm. Truncated portions 22e are formed in an opposed relation to each other with the cylindrical part 22d interposed therebetween. In other words, the cylinder having the outside diameter of 175 mm has its opposite sides cut, such that each of the opposite sides has its radial dimension reduced by 12.5 mm. A tape that seals a gap between the duct and the cylindrical part 22d generally has a width of 50 mm. If the gap between the duct and the cylindrical part 22d increases, in order to seal the gap, the tape has a smaller width for a duct part to adhesively overlie, so that there is a possibility of sealing performance deterioration. For this reason, an amount by which the cylindrical part 22d is radially cut is preferably 12.5 mm maximum.

[0022] FIG. 9 is a plan view of the heat exchange ventilator according to the first embodiment. FIG. 10 is a side view of the heat exchange ventilator according to the first embodiment. FIG. 10 illustrates the heat exchange ventilator 30 as seen from the side plate 14. Because the cylindrical part 22d has the truncated portions 22e formed partly thereon as illustrated in FIG. 3, the base 22a, which serves as the mounting base when the duct connection port 22 is mounted to the side plate 13 or 15, can have a decreased height dimension. In this way, the heat exchange ventilator 30 can have a decreased outside dimension as illustrated in FIG. 10.

[0023] As described with reference to FIG. 3, the duct connection port 22 enables the duct having the inside diameter of 125 mm to be connected to the cylindrical part 22b. The duct connection port 22 also enables a duct having an inside diameter of 150 mm to be connected to the cylindrical part 22c. The duct connection port 22 also enables a duct having an inside diameter of 175 mm to be connected to the cylindrical part 22d. In other words, the duct connection port 22 can be connected to the ducts of different inside diameters. Because the ducts of different inside diameters can be connected directly without use of any member that changes the duct diameter, pressure loss can be reduced as compared to a case where the member which changes the duct diameter is used. Therefore, the use of the duct connection port 22 can increase ventilation capacity of the heat exchange ventilator 30.

[0024] A description is provided as to a process of mounting the duct connection port 22 in the air passage opening 13a or 15a of the side plate 13 or 15. The guide projection 22g fits in the air passage opening 13a or 15a, thereby temporarily positioning the duct connection port 22 at the air passage opening 13a or 15a. The duct connection port 22 is screwed to the side plate 13 or 15 through the through holes 22f formed in the base 22a serving as the mounting base. Because the use of the guide projection 22g can temporarily position the duct connection port 22 at the air passage opening 13a or 15a, it is unlikely that workability is impaired even when visibility is poor or when a foothold is unstable.

[0025] The air spaces 22j positioned above and below the inner hull 22h serve as the heat-insulating layers, thereby eliminating the necessity of providing the duct connection port 22 with heat insulators such as styrene formed products respectively at its top and bottom.

[0026] FIG. 11 is a top view of a duct connection port of a different structure of the heat exchange ventilator according to the first embodiment. FIG. 12 is a front view of the duct connection port of the different structure of the heat exchange ventilator according to the first embodiment. FIG. 13 is a side view of the duct connection port of the different structure of the heat exchange ventilator according to the first embodiment. FIG. 14 is a sectional view of the duct connection port of the different structure of the heat exchange ventilator according to the first embodiment. FIG. 14 is the sectional view taken along line XIV-XIV in FIG. 11. The duct connection port 23 includes a base 23a, and cylindrical parts 23b, 23c, and 23d. The base 23a serves as a mounting base when mounted to the side plate 13 or 15. The cylindrical parts

23b, 23c, and 23d are of tubular shape. Truncated portions 23e are formed in an opposed relation to each other with the cylindrical part 23d interposed therebetween. Formed in the base 23a are through holes 23f that allow screws to pass therethrough when the duct connection port 23 is mounted to the side plate 13 or 15. A guide projection 23g is formed as an extension of an inner hull 23h that defines an air passage of the duct connection port 23. The guide projection 23g is contiguous with the inner hull 23h. The inner hull 23h, which defines the air passage, and the guide projection 23g are inwardly spaced away from the cylindrical parts 23c and 23d, thereby forming an air space 23j. The cylindrical parts 23c and 23d define a part of an outer hull of the duct connection port 23. The air space 23j serves as a heat-insulating layer that functions to prevent dew condensation. As illustrated in FIGS. 11 to 14, the inner hull 23h, which defines the air passage of the duct connection port 23, and the guide projection 23g are formed in an inwardly spaced relation to the cylindrical parts 23c and 23d defining the part of the outer hull, such that the air space 23j can be formed along the entire periphery of the inner hull 23h defining the air passage.

[0027] FIG. 15 is a top view of a duct connection port of a different structure of the heat exchange ventilator according to the first embodiment. FIG. 16 is a front view of the duct connection port of the different structure of the heat exchange ventilator according to the first embodiment. FIG. 17 is a side view of the duct connection port of the different structure of the heat exchange ventilator according to the first embodiment. FIG. 18 is a sectional view of the duct connection port of the different structure of the heat exchange ventilator according to the first embodiment. FIG. 18 is the sectional view taken along line XVIII-XVIII in FIG. 15. The duct connection port 24 includes a base 24a, and cylindrical parts 24b, 24c, and 24d. The base 24a serves as a mounting base when mounted to the side plate 13 or 15. The cylindrical parts 24b, 24c, and 24d are of tubular shape. Truncated portions 24e are formed in an opposed relation to each other with the cylindrical part 24d interposed therebetween. Formed in the base 24a are through holes 24f that allow screws to pass therethrough when the duct connection port 24 is mounted to the side plate 13 or 15. A guide projection 24g is formed as an extension of an inner hull 24h that defines an air passage of the duct connection port 24. The guide projection 24g is contiguous with the inner hull 24h. The inner hull 24h, which defines the air passage, and the guide projection 24g are inwardly spaced away from the cylindrical parts 24c and 24d, thereby forming an air space 24j. The cylindrical parts 24c and 24d define a part of an outer hull of the duct connection port 24. The air space 24j serves as a heat-insulating layer that functions to prevent dew condensation. The air space 24j of the duct connection port 24 illustrated in FIGS. 15 to 18 is formed along the entire periphery of the inner hull 24h defining the air passage.

[0028] The duct connection ports 23 and 24, which have their air spaces 23j and 24j that serve as the heat-insulating layers, eliminate the need for heat insulators, thereby reducing their parts counts, such that the duct connection ports 23 and 24 can be lightweight and enable cost reduction. Moreover, each of the duct connection ports 23 and 24, which includes the single-piece providing both the air passage unit and the heat-insulating unit, eliminates the necessity of assembling the air passage unit and the heat-insulating unit together, thereby enabling reduction of the assembly cost.

[0029] Each of the duct connection ports 22, 23, and 24 according to the first embodiment is the single-piece, resin formed product having no undercuts and thus can be removed from a mold when the mold is opened in one direction. For this reason, mold preparation cost can be reduced.

[0030] The above description has been provided as to the heat exchange ventilator 30 including the heat exchanger 2; however, the duct connection ports 22, 23, and 24 are also applicable to a ventilator not having a heat exchanger 2.

[0031] The above structures illustrated in the embodiment are illustrative of contents of the present invention, can be combined with other techniques that are publicly known and can be partly omitted or changed without departing from the gist of the present invention.

Reference Signs List

[0032] 1 body casing; 2 heat exchanger; 3a, 3b air supply blower; 4a, 4b air exhaust blower; 5 rib frame body; 6, 7, 8, 9, 10, 11 styrene formed product; 12 top plate; 13, 14, 15, 16 side plate; 13a, 15a air passage opening; 16a opening; 17 base plate; 18 circuit box; 19 closing plate; 20 outside-air dust filter frame unit; 21 room-interior-return-air dust filter frame unit; 22, 23, 24 duct connection port; 22a, 23a base; 22b, 22c, 22d cylindrical part; 22e truncated portion; 22f through hole; 22g guide projection; 22h inner hull; 22j, 23j, 24j air space; 30 heat exchange ventilator.

Claims

1. A duct connection port to be mounted to a ventilator for connection to a ventilation duct, the duct connection port comprising:

   an outer hull including a cylindrical part to be connected to the duct; and
   an inner hull defining a passage for a ventilation air flow, the inner hull being provided inside the outer hull in a spaced relation to the outer hull, wherein the outer hull and the inner hull are integral with each other.

2. The duct connection port according to claim 1, further comprising

a positioning part projecting from a mounting surface of the duct connection port to be mounted to the ventilator,
wherein the positioning part is formed as an extension of the inner hull, the positioning part being contiguous with the inner hull, the positioning part being positioned at the ventilator by fitting in an opening formed in the ventilator.

3. The duct connection port according to claim 1 or 2, wherein:

the outer hull includes the cylindrical part fittingly engaging an inner periphery of the duct; and
the cylindrical part is of a cylindrical shape having an outer side truncated by a plane parallel to the inner hull.

4. A ventilator comprising:

a casing that is box-shaped;
a blower housed in the casing; and
the duct connection port according to any one of claims 1 to 3, the duct connection port being mounted to the casing.

FIG.1

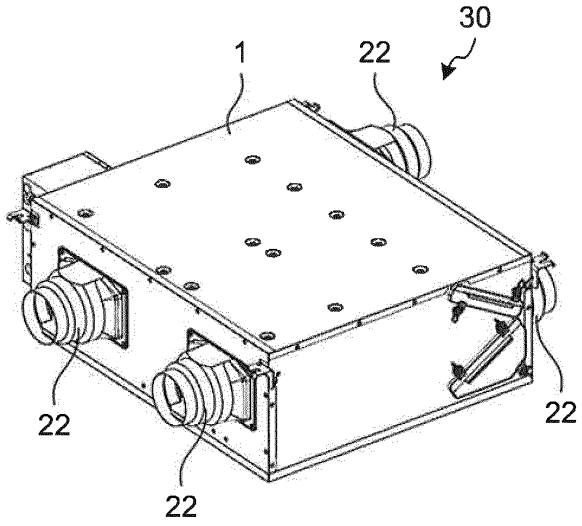
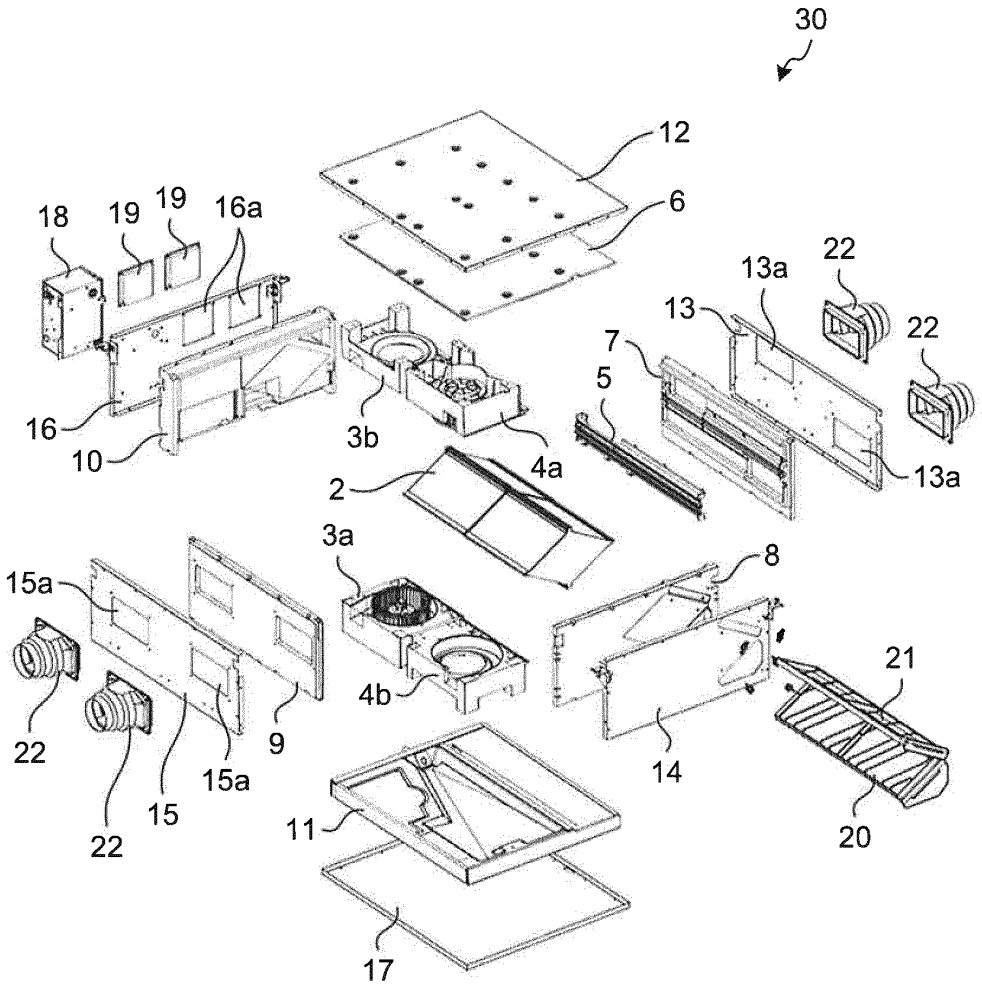

30
1
22
22
22
22

FIG.2


30
12
6
18
19
19
16a
13a
22
13
22
7
5
16
10
3b
4a
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9
15a
14
22
15
11
20
17

FIG.3

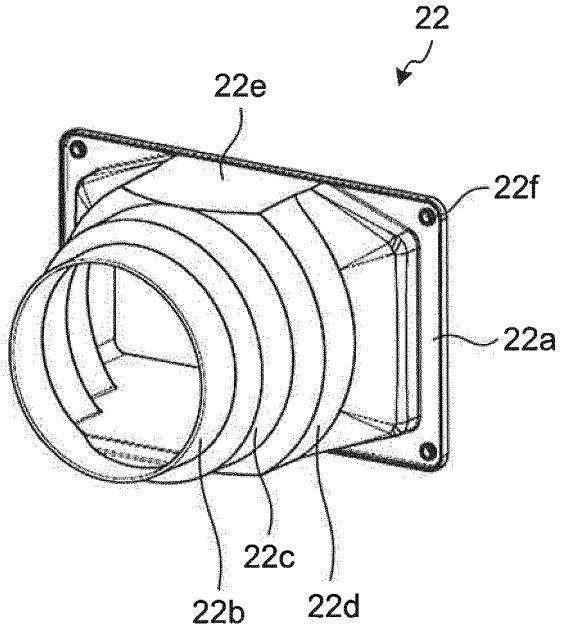


FIG.4

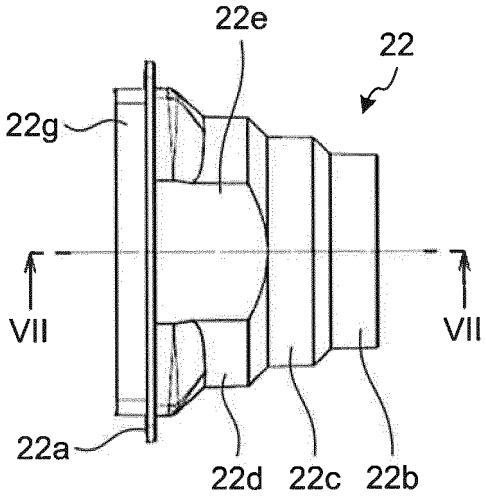


FIG.5

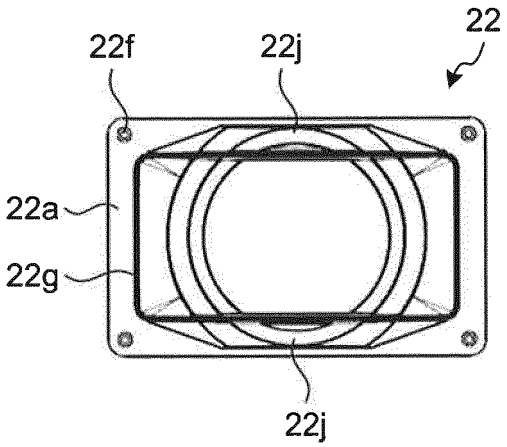


FIG.6

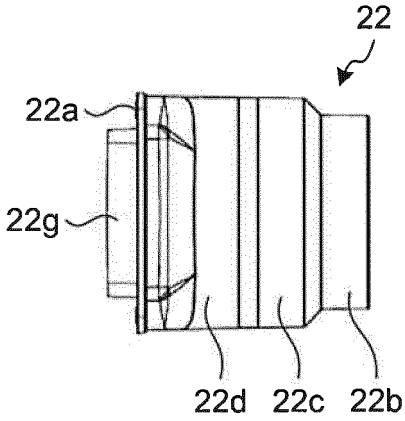


FIG.7

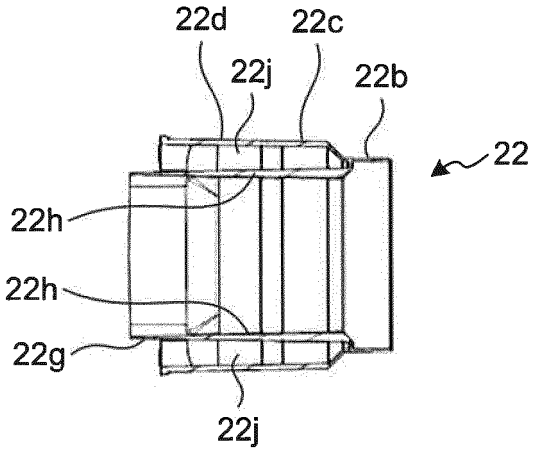


FIG.8

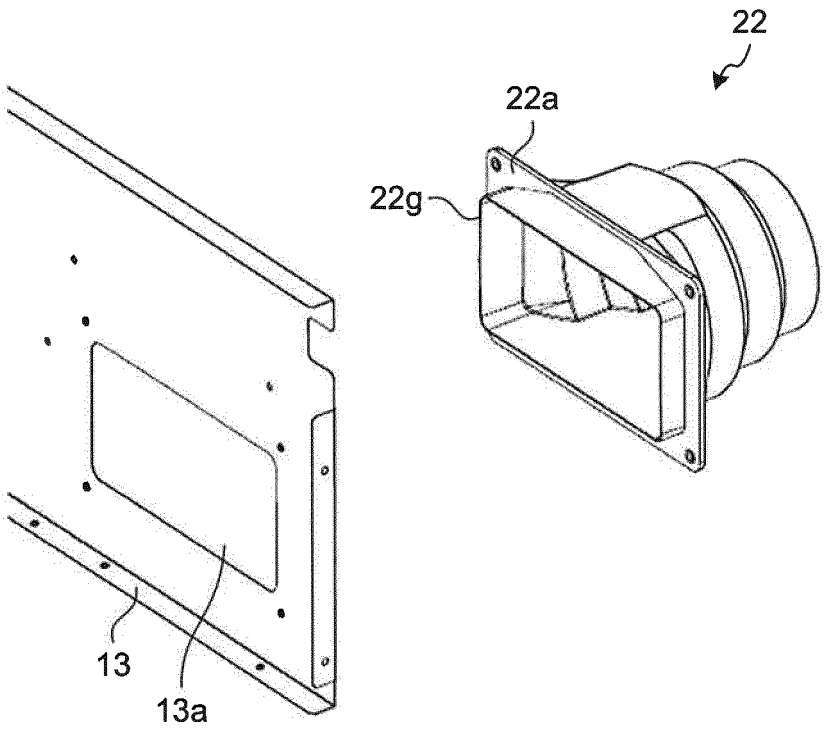


FIG.9

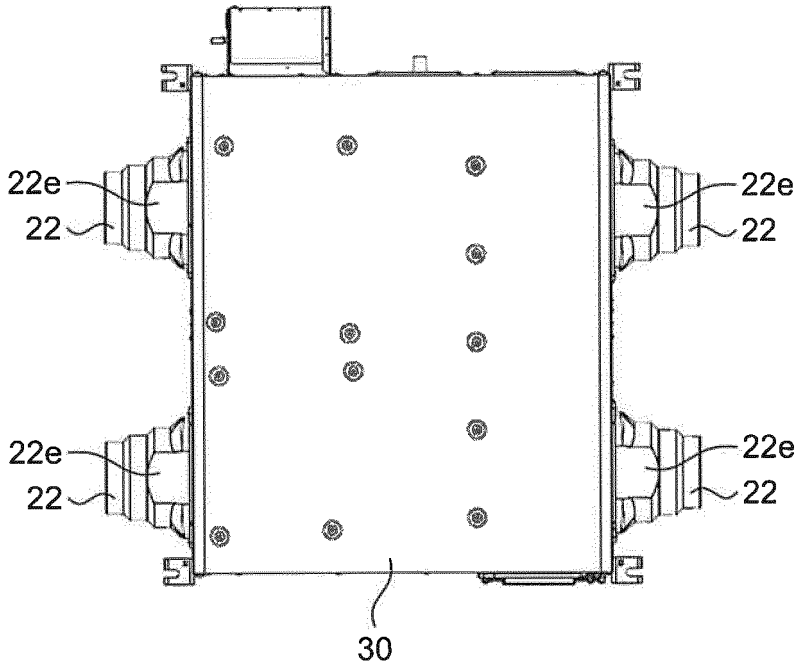


FIG.10

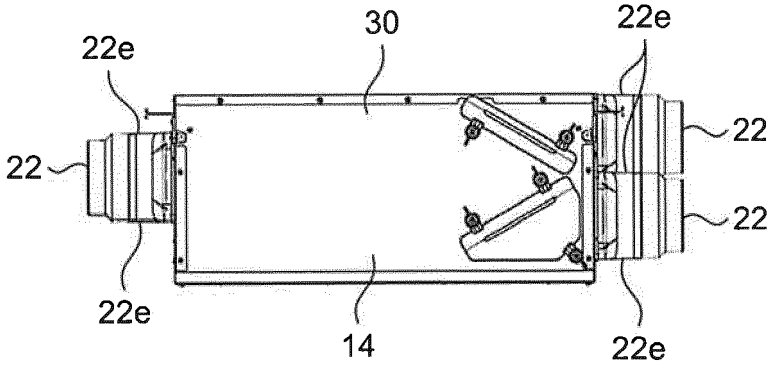


FIG.11

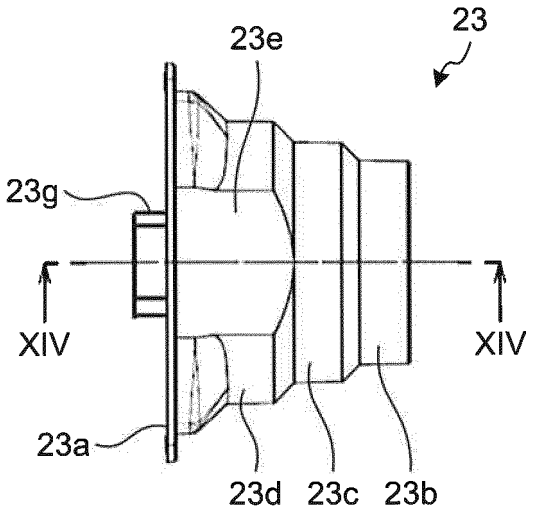


FIG.12

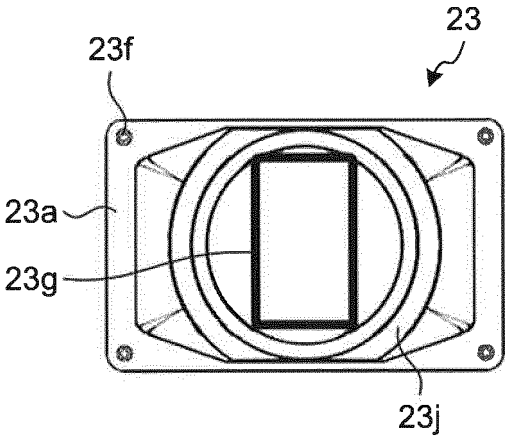


FIG.13

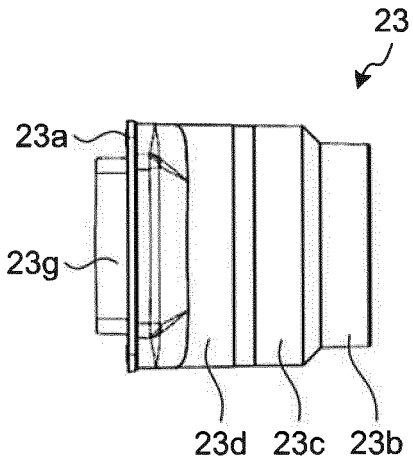


FIG.14

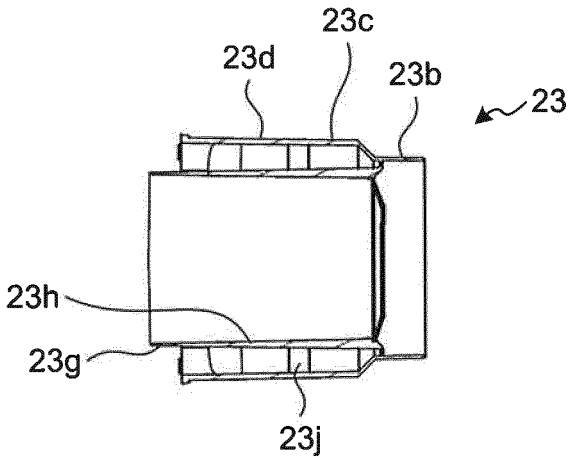


FIG.15

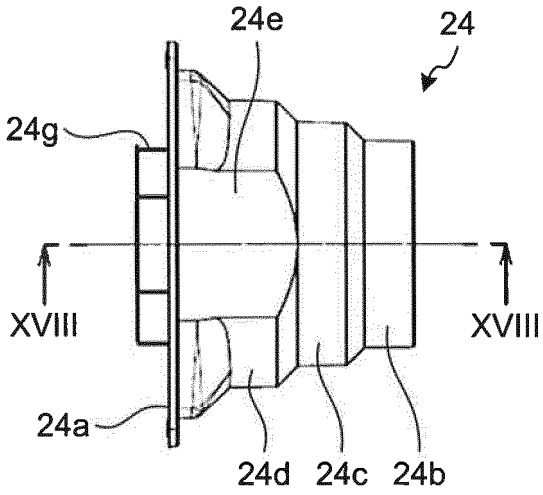


FIG.16

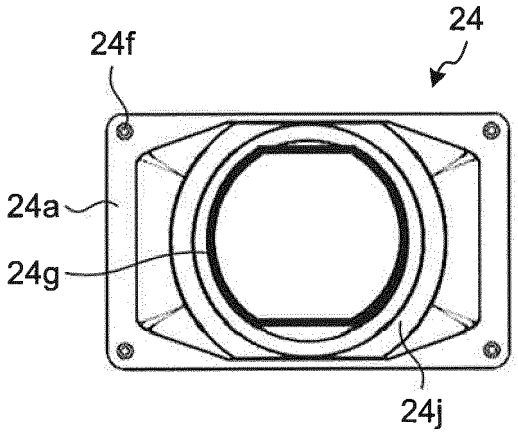


FIG.17

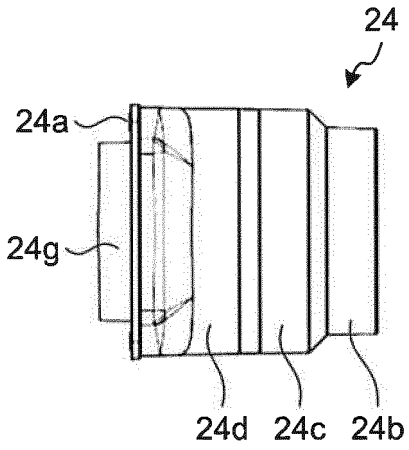
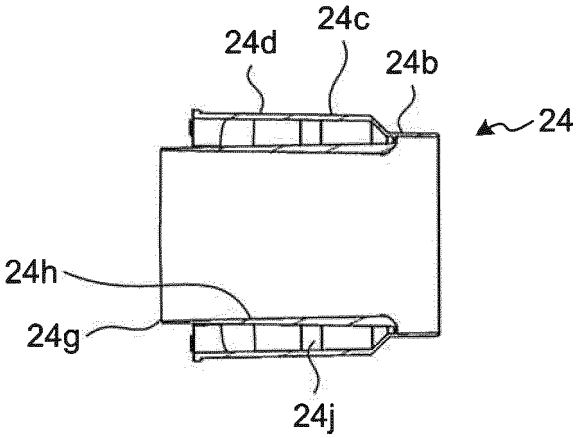


FIG.18



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2017/020002

A. CLASSIFICATION OF SUBJECT MATTER
F24F13/02(2006.01)i, *F24F7/08*(2006.01)i, *F24F13/20*(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F24F13/02, F24F7/08, F24F13/20

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2017
Kokai Jitsuyo Shinan Koho 1971-2017 Toroku Jitsuyo Shinan Koho 1994-2017

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	JP 2003-166738 A (Sanyo Electric Co., Ltd.), 13 June 2003 (13.06.2003), paragraphs [0012] to [0038]; fig. 1 to 8 (Family: none)	1 2-4
Y	WO 2010/116466 A1 (Mitsubishi Electric Corp.), 14 October 2010 (14.10.2010), paragraphs [0012] to [0033]; fig. 1 to 7 & EP 2416079 A1 paragraphs [0012] to [0033]; fig. 1 to 7 & TW 201035500 A & KR 10-2011-0124778 A & CN 102317695 A	2-4
X	JP 10-141732 A (Sanyo Electric Co., Ltd.), 29 May 1998 (29.05.1998), paragraphs [0009] to [0013]; fig. 1 to 3 (Family: none)	1,4

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
09 August 2017 (09.08.17)	22 August 2017 (22.08.17)
Name and mailing address of the ISA/ Japan Patent Office 3-4-3,Kasumigaseki,Chiyoda-ku, Tokyo 100-8915,Japan	Authorized officer Telephone No.

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 5079137 B **[0005]**