(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 521 634 A1**

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
07.08.2019 Bulletin 2019/32

(51) Int Cl.:
F04D 29/38 *(2006.01)* ***F04D 29/54*** *(2006.01)*
A47F 3/04 *(2006.01)*

(21) Application number: **19154456.8**

(22) Date of filing: **30.01.2019**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(30) Priority: **31.01.2018 US 201862624483 P**

(71) Applicant: **Carrier Corporation**
Palm Beach Gardens, FL 33418 (US)

(72) Inventor: **DYGERT, Ryan K.**
Syracuse, NY New York 13221 (US)

(74) Representative: **Dehns**
St. Bride's House
10 Salisbury Square
London EC4Y 8JD (GB)

(54) AXIAL FAN WITH TIP FENCES

(57) An axial flow fan includes a generally hollow casing 30 defining an inlet end 40 and an outlet end 42 of the axial flow fan. A diameter of the casing 30 increases from the inlet end 40 to the outlet end 42. An impeller 22 is rotatably mounted within the casing 30. The impeller 22 includes a hub 26 and a plurality of fan blades 24 extending from a root 44 located at the hub 26 to a blade tip 32. A diameter of the blade tip 32 of each of the plurality of fan blades 24 increases from the inlet end 40 to the outlet end 42. A tip fence 52 is located at the blade tip 32 of at least one of the plurality of fan blades 24 and a length of the tip fence 52 measured perpendicular to the fan blades 24 is greater than a thickness of the at least one of the plurality of fan blades 24.

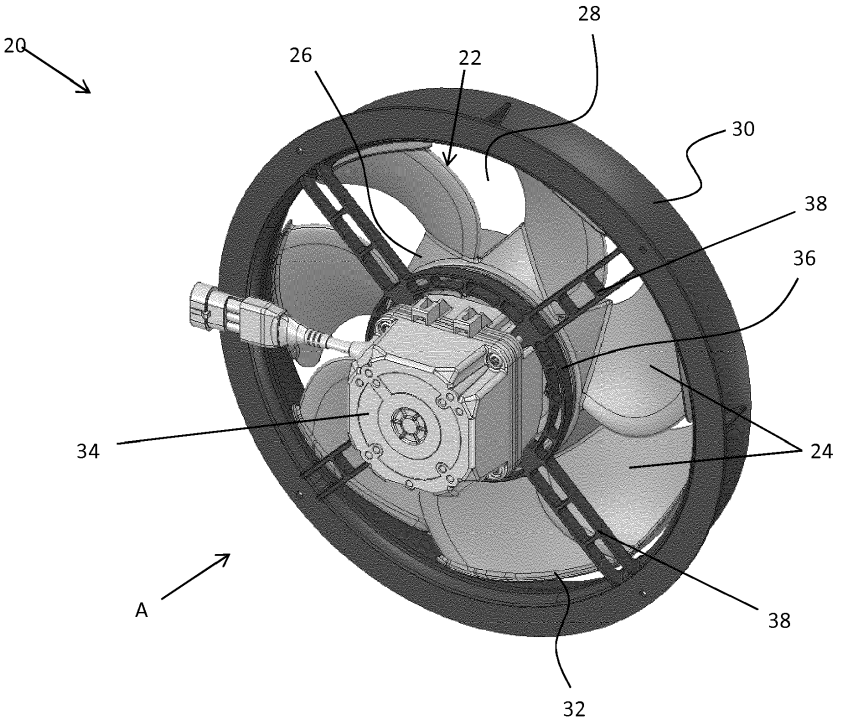

FIG. 1

EP 3 521 634 A1

Description

[0001] The present invention relates to an axial flow fan. The axial flow fan may be for use in a refrigerated display merchandiser where food and/or beverages are displayed.

[0002] Typically, supermarkets and convenient stores are equipped with display cases or merchandisers, which may be open or provided with doors, for presenting fresh food or beverages to customers, while maintaining the fresh food and beverages in a refrigerated environment. The refrigeration systems of such merchandisers commonly employ a conventional refrigeration cycle and include an evaporator and evaporator fan operatively associated with the refrigerated interior of the cabinet, as well as a condenser, a condenser fan, and compressor. A refrigerant is circulated by a compressor through refrigerant lines connecting the compressor, the condenser, and the evaporator in a conventional manner to form a closed circuit. Typically, cold, moisture-bearing air is provided to the product display zone of the display case by passing air over the heat exchange surface of the evaporator. As the refrigerant evaporates within the evaporator coil, heat is absorbed from the air passing over the evaporator so as to lower the temperature of the air.

[0003] Proper selection of the evaporator fan is important to operation of a display merchandiser. Although the display case has a relatively low pressure duty requirement, the path of the air provided to the evaporator fan is torturous and includes multiple 90 degree turns and downstream obstructions. Accordingly, integration of axial fan without affecting both performance and noise of the merchandiser can be challenging.

[0004] According to a first aspect, the invention provides an axial flow fan including a generally hollow casing defining an inlet end and an outlet end of the axial flow fan. A diameter of the casing increases from the inlet end to the outlet end. An impeller is rotatably mounted within the casing. The impeller includes a hub and a plurality of fan blades extending from a root located at the hub to a blade tip. A diameter of the blade tip of each of the plurality of fan blades increases from the inlet end to the outlet end. A tip fence is located at the blade tip of at least one of the plurality of fan blades and a length of the tip fence measured perpendicular to the fan blades is greater than a thickness of the at least one of the plurality of fan blades.

[0005] Optionally, an axial clearance, measured parallel to the diameter of the casing, is defined between the tip fence of each of the plurality of fan blades and an adjacent surface of the casing and the axial clearance remains constant between the inlet end and the outlet end of the axial flow fan with a tolerance of +/- 1mm.

[0006] Optionally, an outer diameter of the hub increases from the inlet end to the outlet end.

[0007] Optionally, the increase in the diameter of the hub from the inlet end to the outlet end is generally equal to the increase in the diameter of the casing from the inlet end to the outlet end.

[0008] Optionally, the hub has a radially stepped configuration extending in the circumferential direction.

[0009] Optionally, a ratio of the axial length of the tip fence to the thickness of the at least one of the plurality of fan blades is between 2 and 10.

[0010] Optionally, the tip fence has a generally constant thickness, or alternatively a thickness of the tip fence varies.

[0011] Optionally, each of the plurality of fan blades includes a first surface and a second, opposite surface, and the tip fence extends beyond both the first surface and the second surface of the at least one of the plurality of fan blades.

[0012] Optionally, each of the plurality of fan blades has a leading edge and a trailing edge, and the tip fence extends beyond at least one of the leading edge and the trailing edge of the at least one of the plurality of fan blades.

[0013] Optionally, the tip fence is integrally formed with the at least one of the plurality of fan blades.

[0014] Optionally, the casing has a bellmouth contour.

[0015] Optionally, the casing further comprises a stationary hub oriented in alignment with the hub and a plurality of structural members extending radially outward from the stationary hub to couple the casing to the stationary hub.

[0016] Optionally, at least one of the stationary hub and the plurality of structural members has one or more openings to allow an airflow to pass there through.

[0017] Optionally, the axial flow fan is mounted in a refrigerated display cabinet.

[0018] Optionally, the hub and the plurality of fan blades are formed separately, or alternatively the hub and the plurality of fan blades are integrally formed.

[0019] According to another aspect, the invention provides, a refrigerated merchandiser including an axial flow fan as discussed above. The refrigerated merchandiser includes a cabinet defining a product display area and having a compartment separate from the product display area. An air circulation circuit fluidly couples the compartment and the product display area and the axial flow fan is an air circulating fan for moving a flow of air axially through the air circulation circuit. The impeller is a fan rotor rotatably mounted within the casing and having the hub and the plurality of fan blades extending from a root located at the hub to a blade tip. A diameter of the blade tip of each of the plurality of fan blades increases along an axial length of the air circulating fan. An axial length of the tip fence is greater than a thickness of the at least one of the plurality of fan blades.

[0020] Optionally, a ratio of the axial length of the tip fence to the thickness of the at least one of the plurality of fan blades is between 2 and 10.

[0021] Optionally, a clearance is defined between a blade tip of the plurality of fan blades and a surface of the casing and the clearance remains constant between the inlet end and the outlet end of the axial flow fan.

[0022] Optionally, a diameter of the hub increases over an axial length of the air circulating fan, and the increase in the diameter of the hub over the axial length of the air circulating fan is generally equal to the increase in the diameter of the casing over the axial length of the air circulating fan.

[0023] Optionally, an opening is defined between the casing and the hub, and a width of the opening remains generally constant over the axial length of the axial flow fan.

[0024] The following description relates to certain preferred embodiments and should not be considered limiting in any way. With reference to the accompanying drawings, like elements are numbered alike:

FIG. 1 is perspective view of a fan assembly;
FIG. 2 is a front view of the fan assembly of FIG. 1;
FIG. 3 is a back view of the fan assembly of FIG.;
FIG. 4 is a cross-sectional view of the fan assembly of FIG. 1;
FIG. 5 is a perspective detailed view of a fan blade of the fan assembly of FIG. 1;
FIG. 6 is a side view of the fan blade of FIG. 5; and
FIG. 7 is a schematic diagram of a refrigerated display merchandiser including a fan assembly.

[0025] A detailed description of one or more embodiments of the disclosed apparatus and method are presented herein by way of exemplification and not limitation with reference to the Figures.

[0026] With reference to FIGS. 1-4, a fan assembly 20 utilized, for example in a heating, ventilation and air conditioning (HVAC) system to draw air over an evaporator is illustrated. In the illustrated example, the fan assembly 20 is an axial flow fan; however, it should be understood that other suitable types of fans, such as a mixed flow fan for example, are also within the scope of the disclosure.

[0027] The fan assembly 20 includes a fan rotor or impeller 22 including a plurality of fan blades 24. The plurality of fan blades 24 is generally equidistantly spaced about an outer periphery of a rotor hub 26 and extends radially outwardly from the hub 26 into an opening 28 defined between the hub 26 and an outer casing 30. As shown, the radially outer end 32 of each of the fan blades 24 is separate. Accordingly, the fan rotor 22 does not include a fan shroud. The fan blades 24 may be separate components coupled to the hub 26, or alternatively, the blades 24 and hub 26 may be integrally formed, such as from an injection molded plastic for example.

[0028] A motor 34 operably coupled to the fan rotor 22, such as via a shaft or another coupling means, such as a belt, rope, or chain for example, may be used to rotate the fan hub 26 and the fan blades 24 about the fan axis X to cause air A to be drawn in and pass through the opening 28. The motor 34 may be oriented such that an axis of rotation of the motor 34 is arranged generally parallel to or coaxial with the fan axis X. In the illustrated example, the fan assembly 20 includes a stationary hub 36 arranged adjacent the rotor hub 26 and connected to the casing 30 via one or more structural members 38. As shown, the structural members 38 may be generally hollow to minimize interference with the airflow A. The motor 34 may be affixed to the stationary hub 36 at the inlet 40 of the fan assembly 20. However, other configurations are also contemplated herein. In operation, the fan rotor 22 is rotated at relatively high speeds to induce the flow of air A through the casing 30, and in the process it creates a swirl in the direction of the fan rotation, such that the air A may have both an axial component and a tangential component.

[0029] With specific reference to the cross-sectional view of the fan assembly 20 shown in FIG. 4, the casing 30 is formed having a bellmouth contour extending towards the outlet end 42 thereof. As a result, the inner diameter of the casing 30, generally increases from the inlet end 40 of the fan assembly 20 to the outlet end 42 of the fan assembly 20. The bellmouth contour of the casing 30 diffuses the radial flow at the outlet 42 of the fan assembly 20 to facilitate turning of the airflow A. Similar to the casing 30, the outer diameter of the rotor hub 26 may gradually increase along the path of the airflow A through the fan assembly 20. In an embodiment, the increase in the diameter of the rotor hub 26 is generally equal to the increase in the inner diameter of the casing 30 such that the width of the opening 28 defined between the rotor hub 26 and the casing 30 remains generally constant between the inlet end 40 and the outlet end 42 of the fan assembly 20. As used herein with reference to the clearance between the rotor hub 26 and the casing 30 includes a tolerance of +/- 1mm.

[0030] To accommodate the increase in diameter of the rotor hub 26, the hub 26 has a radially stepped configuration extending in the circumferential direction. Inclusion of the radial steps eliminates the need for undercuts in the associated production tooling that would otherwise form on the downstream surfaces of the blades. This reduces tooling complexity without sacrificing airflow performance benefit.

[0031] The fan rotor 22 may include any number of fan blades 24. In the illustrated example, the rotor 22 includes seven fan blades 24. However, it should be understood that a fan assembly 20 having any configuration including two or more blades 24 is contemplated herein. The plurality of fan blades 24 may be, but need not be substantially identical.

[0032] With reference now to FIG. 5, each fan blade 24 has a root 44 where the fan blade 24 attaches to the hub 26 and a tip 32 at the outer extremity of the blade 24, opposite the root 44. Each blade 24 additionally has a leading edge 46 located upstream with respect to a direction of rotation and a trailing edge 48 location downstream with respect to the direction of rotation. The leading and trailing edges 46, 48 are joined together at the root 44 and the tip 32. In this example, the fan blades 24 have a sweep, for example in the direction opposite the

direction of fan rotation X, referred to as reverse or backward sweep. However, fan blades 24 having a sweep in the direction of the fan rotation, also referred to as forward sweep, and fan blades 24 having no sweep such that the tips 32 of the fan blades 24 are arranged generally within a plane are also contemplated herein.

[0033] The "span" of the fan blade 24 as referred to herein is intended to describe the distance between the root 44 and the tip 32. In the illustrated example, the span varies along each of the fan blades 24, such as between a leading and trailing edge 46, 48 for example. As shown in the FIGS., the fan blades 24 may include a radially expanding tip 32. Accordingly, the span of the fan blade 24 generally increases from adjacent a first edge, such as the leading edge 46 for example, to a second, opposite edge, such as the trailing edge 48 for example. As a result, the distance between the inner surface 50 of the casing 30 and a first portion of a fan blade 24 is greater than the distance between the inner surface 50 of the casing 30 and a second portion of the fan blade 24. However, arrangements where the span of the fan blade 24 gradually increases from the trailing edge 48 to the leading edge 46 and embodiments where the span changes over only a portion of the fan blade 24 are also contemplated herein.

[0034] Disposed at the tip 32 of each fan blade 24 is a fence 52. The tip fence 52 may be removably coupled to the fan blade 24, or alternatively, may be integrally formed therewith. Where the tip fence 52 is integrally formed with the blade 24, the fan rotor 22 may be formed by a straight-pull injection molding process, or through an additive manufacturing process.

[0035] Each tip fence 52 may span the entire peripheral length of the tip 32, or alternatively, may extend over only a portion of the periphery of the fan blade 24. In the illustrated example, the tip fence 52 extends forward of the leading edge 46 of the fan blade 24 but is truncated adjacent the trailing edge 48 of the fan blade 24. However, configurations where the tip fence 52 does not extend to the leading edge 46 and/or extends beyond the trailing edge 48 are also possible.

[0036] As best shown in FIGS. 4 and 6, the tip fence 52 extends generally perpendicular to the body of the fan blade 24 and has an axial length greater than the thickness of the fan blade 24. The axial length of the tip fence 52 may be at least double and up to about 5 times, or about 10 times the thickness of the fan blade 24. Further, the tip fence 52 may have a generally constant thickness, or alternatively, may gradually decrease in thickness away from the fan blade 24. The tip fence 52 generally extends beyond at least one of a first surface 54 and a second, opposite surface 56 of the fan blade 24. In the illustrated example, the tip fence 52 extends axially beyond both the first surface 54 and the second surface 56 to form a partial shroud for a corresponding fan blade 24. The tip fence 52 manages the clearance gap leakage flow across the blade tip 32 and reduces sensitivity to inflow distortion, thereby reducing noise. As previously described, the clearance between the rotor hub 26 and an adjacent surface of the casing 30 is generally constant within a nominal tolerance of +/- 1mm. This clearance is defined between the tip fence 52 of each fan blade 24 and the casing 30.

[0037] With reference now to FIG. 7, an example of a refrigerated display merchandiser 100 is illustrated. The refrigerated display merchandiser 100 includes an outer cabinet 102 and an inner cabinet liner 104 that defines within its bounds a product display region 106. The product display region 106 may be open, as shown in the FIG., or enclosed. Refrigerated goods 108 may be stored on shelves 110, which are mounted in a known manner within the product display region 106. Several orifices 112 may direct cool air from a back wall 114 into the product display region 106. The air is configured to cool the display space 106 and refrigerate the products 108 contained therein.

[0038] The refrigerated display merchandiser 100 houses one or more components associated with a vapor-refrigeration cycle. For example, an evaporator 120, may be disposed within the merchandiser 100, in a compartment 122 separate from the product display area 106. Although the compartment 122 is illustrated as being located below the product display area 106, systems where the compartment 122 is located behind or above the product display area 106 are also possible.

[0039] Cool air passing over the evaporator 120 is circulated by an air circulation mechanism 124, such as fan assembly 20 for example, into the product display region 106 through the air flow passages defined by the orifices 112 formed in the wall 114 of the cabinet 100 into the product display area 106 to maintain the products 108 located therein a desired temperature. As shown, the air circulation mechanism 124 is mounted between the outer cabinet 102 and the inner cabinet liner 104 such that the air flow provided to the mechanism 124 has a tortuous path including multiple 90 degree turns. By using the fan assembly 20 having a radially expanding rotor hub 26 and casing 30 as the air circulation mechanism 124, the ability of the flow to turn 90 degrees at the fan outlet to enter the downstream portion of the cabinet is improved. As a result, losses of the fan assembly 20 are reduced.

[0040] The term "about" is intended to include the degree of error associated with measurement of the particular quantity based upon the equipment available at the time of filing the application.

[0041] The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the present disclosure. As used herein, the singular forms "a", "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms "comprises" and/or "comprising," when used in this specification, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, oper-

ations, element components, and/or groups thereof.

[0042] While the present disclosure has been described with reference to an exemplary embodiment or embodiments, it will be understood by those skilled in the art that various changes may be made and equivalents may be substituted for elements thereof without departing from the scope of the present invention, as defined by the claims. In addition, many modifications may be made to adapt a particular situation or material to the teachings of the present invention without departing from the scope thereof, as defined by the claims. Therefore, it is intended that the present invention not be limited to the particular embodiment disclosed as the best mode contemplated for carrying out this present invention, but that the present invention will include all embodiments falling within the scope of the claims.

Claims

1. An axial flow fan comprising:

a generally hollow casing (30) defining an inlet end (40) and an outlet end (42) of the axial flow fan, wherein a diameter of the casing increases from the inlet end to the outlet end;
an impeller (22) rotatably mounted within the casing, the impeller including:

a hub (26);
a plurality of fan blades (24) extending from a root (44) at the hub to a blade tip (32), wherein a diameter of the blade tip of each of the plurality of fan blades increases from the inlet end to the outlet end; and
a tip fence (52) located at the blade tip of at least one of the plurality of fan blades, wherein a length of the tip fence measured perpendicular to the fan blades is greater than a thickness of the at least one of the plurality of fan blades.

2. The axial flow fan of claim 1, wherein an axial clearance (28), measured parallel to the diameter of the casing (30), is defined between the tip fence (52) of each of the plurality of fan blades (24) and an adjacent surface of the casing and the axial clearance remains constant between the inlet end (40) and the outlet end (42) of the axial flow fan, preferably with a tolerance of +/- 1mm.

3. The axial flow fan of claim 1 or 2, wherein an outer diameter of the hub (26) increases from the inlet end (40) to the outlet end (42).

4. The axial flow fan of claim 3, wherein the increase in the diameter of the hub (26) from the inlet end (40) to the outlet end (42) is generally equal to the increase in the diameter of the casing (30) from the inlet end to the outlet end.

5. The axial flow fan of any preceding claim, wherein the hub (30) has a radially stepped configuration extending in the circumferential direction.

6. The axial flow fan of any preceding claim, wherein a ratio of the axial length of the tip fence (52) to the thickness of the at least one of the plurality of fan blades (24) is between 2 and 10.

7. The axial flow fan of any preceding claim, wherein the tip fence (52) has a generally constant thickness.

8. The axial flow fan of any of claims 1 to 6, wherein a thickness of the tip fence (52) varies.

9. The axial flow fan of any preceding claim, wherein each of the plurality of fan blades (24) includes a first surface and a second, opposite surface, and the tip fence (52) extends beyond both the first surface and the second surface of the at least one of the plurality of fan blades.

10. The axial flow fan of any preceding claim, wherein each of the plurality of fan blades (24) has a leading edge (46) and a trailing edge (48), and the tip fence (52) extends beyond at least one of the leading edge and the trailing edge of the at least one of the plurality of fan blades.

11. The axial flow fan of any preceding claim, wherein the tip fence (52) is integrally formed with the at least one of the plurality of fan blades (24).

12. The axial flow fan of any preceding claim, wherein the casing (30) has a bellmouth contour.

13. The axial flow fan of any preceding claim, wherein the casing (30) further comprises:

a stationary hub (26) oriented in alignment with the hub (26); and
a plurality of structural members (38) extending radially outward from the stationary hub to couple the casing to the stationary hub; and optionally
wherein at least one of the stationary hub and the plurality of structural members has one or more openings to allow an airflow to pass therethrough.

14. The axial flow fan of any preceding claim, wherein the hub (26) and the plurality of fan blades (24) are formed separately, or wherein the hub and the plurality of fan blades are integrally formed.

15. A refrigerated merchandiser comprising an axial flow fan as claimed in any preceding claim, the refrigerated merchandiser also comprising:

a cabinet (102) defining a product display area (106) and having a compartment (122) separate from the product display area; and
an air circulation circuit (124, 112) fluidly coupling the compartment and the product display area;
wherein the axial flow fan is an air circulating fan for moving a flow of air axially through the air circulation circuit.

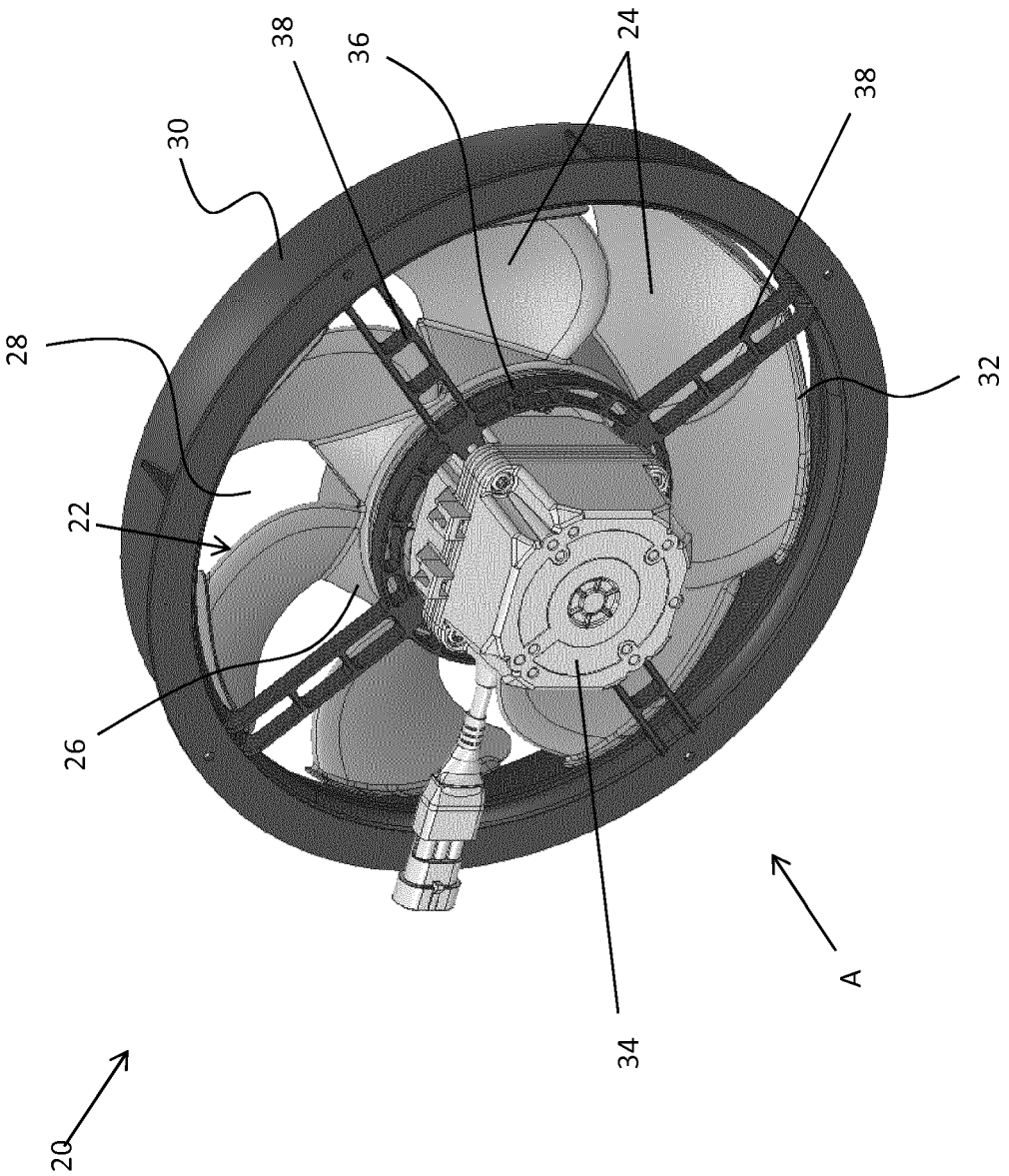

FIG. 1

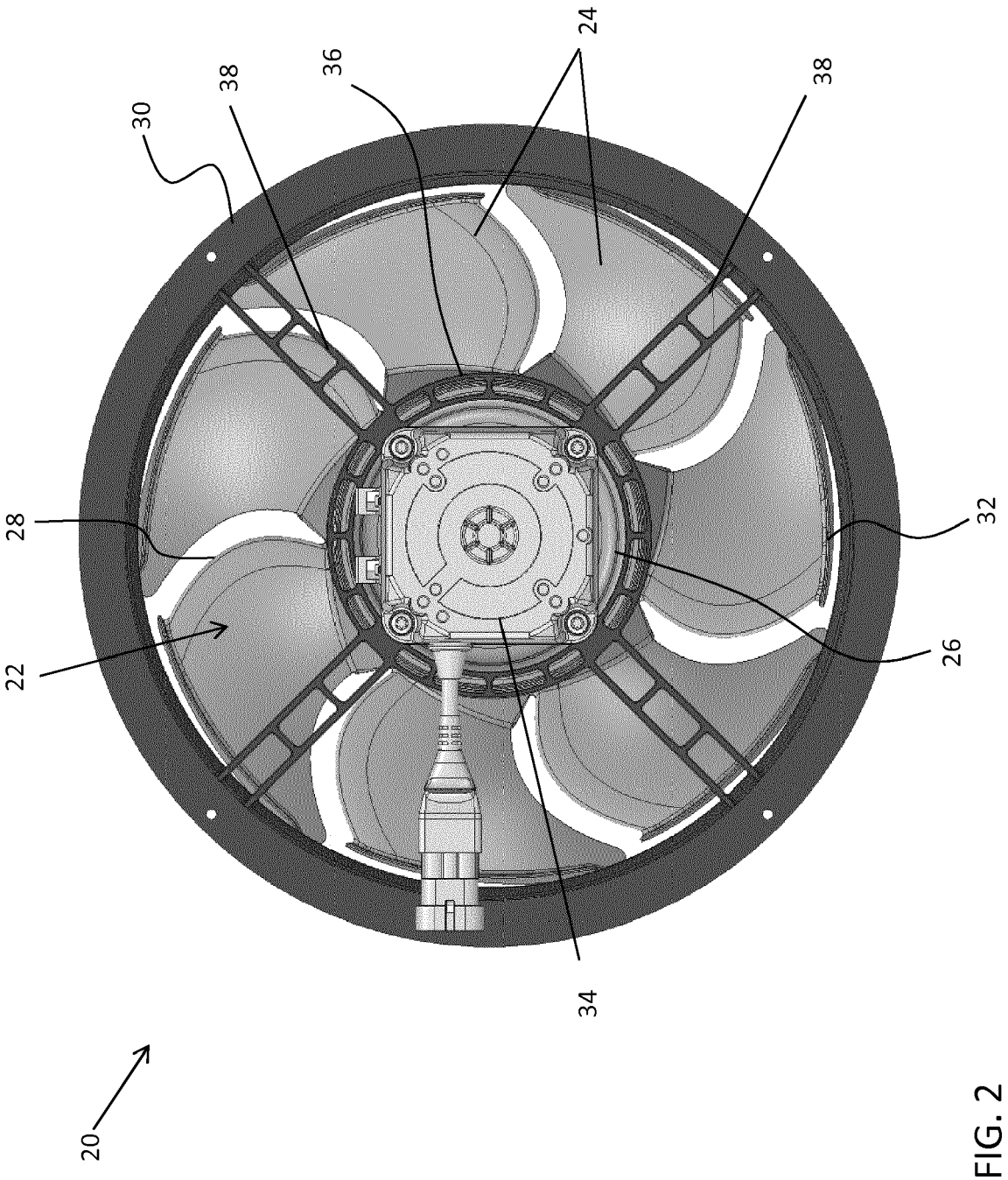

FIG. 2

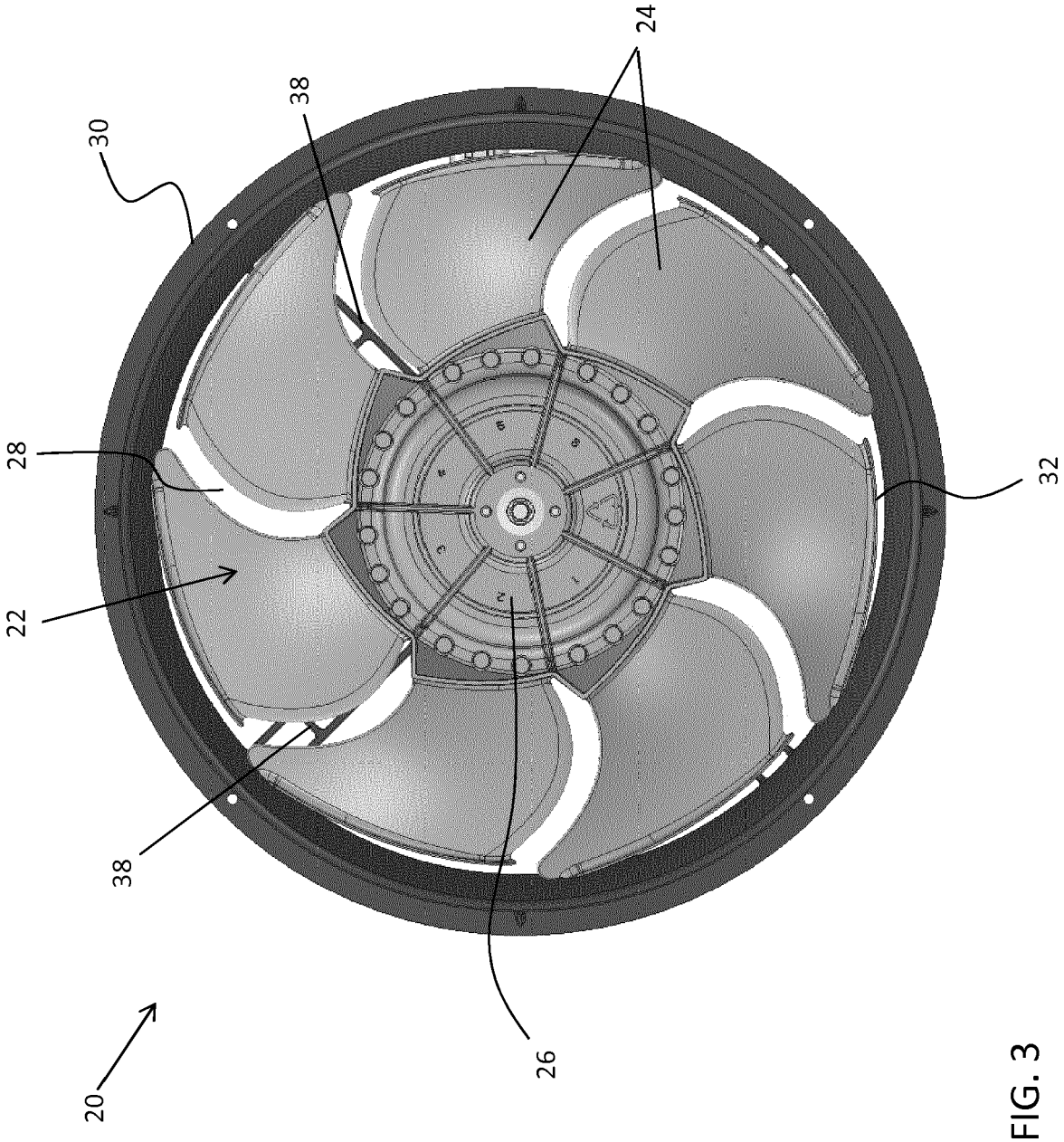

FIG. 3

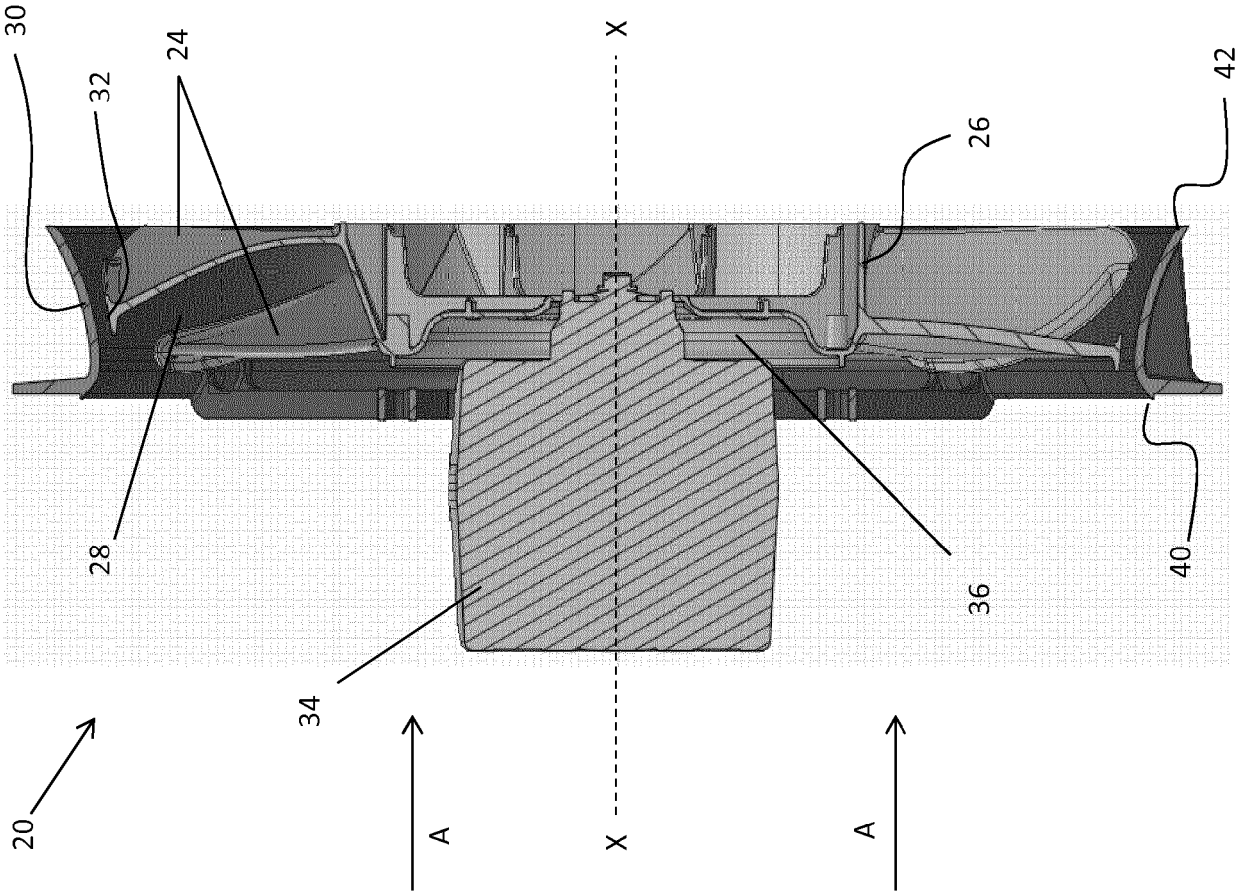

FIG. 4

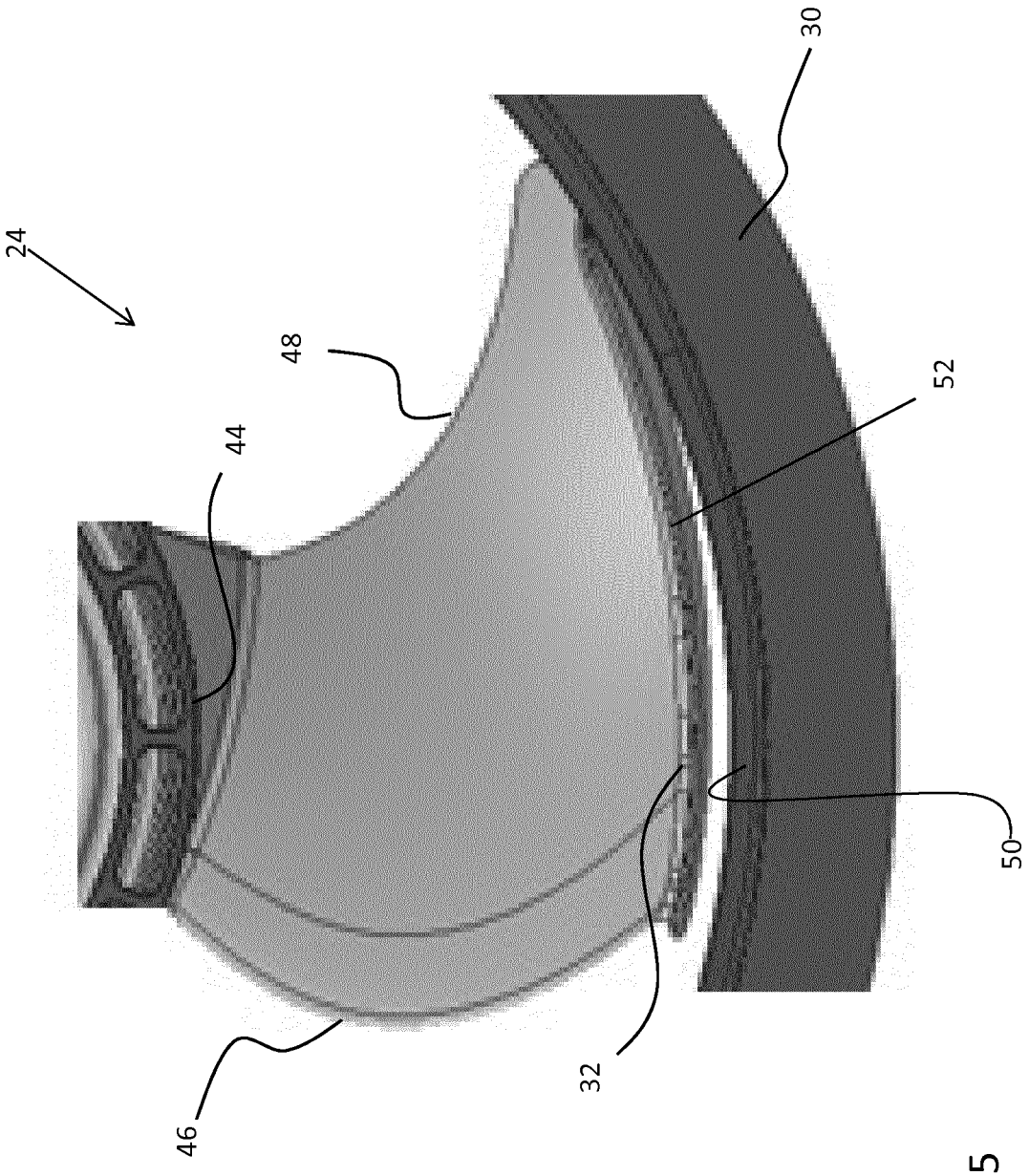

FIG. 5

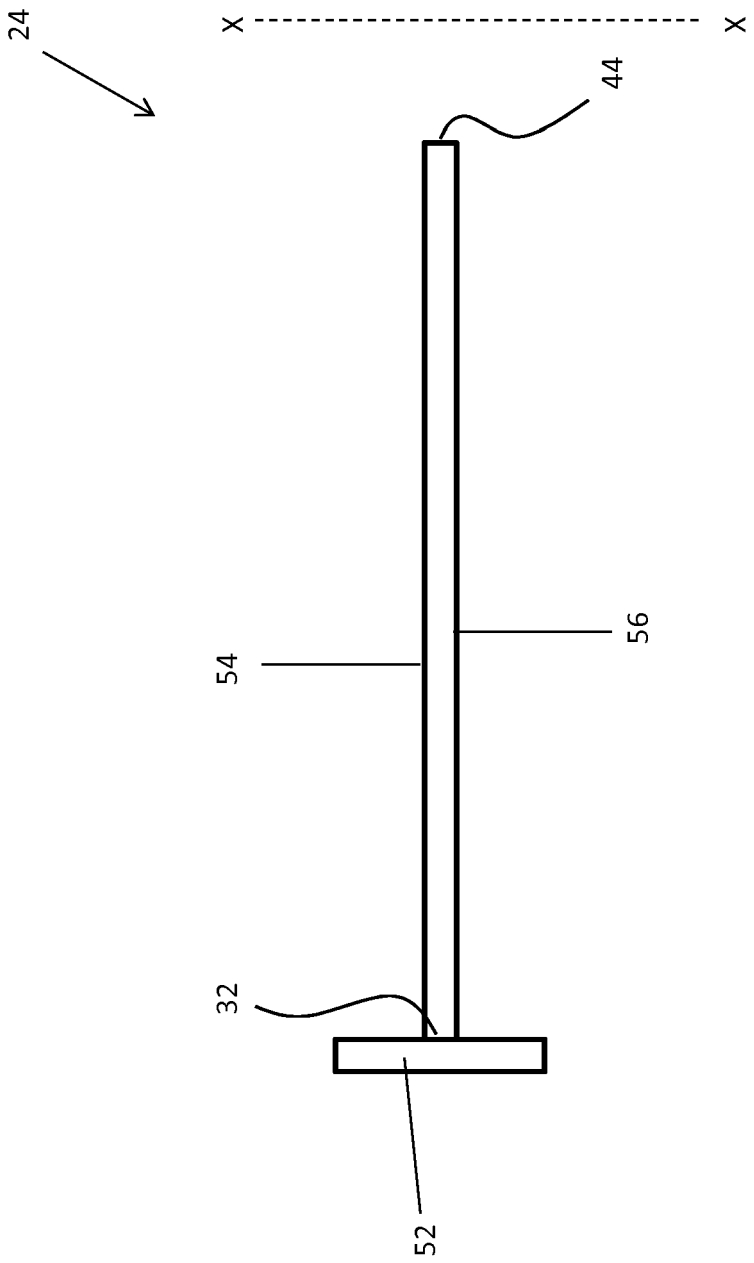

FIG. 6

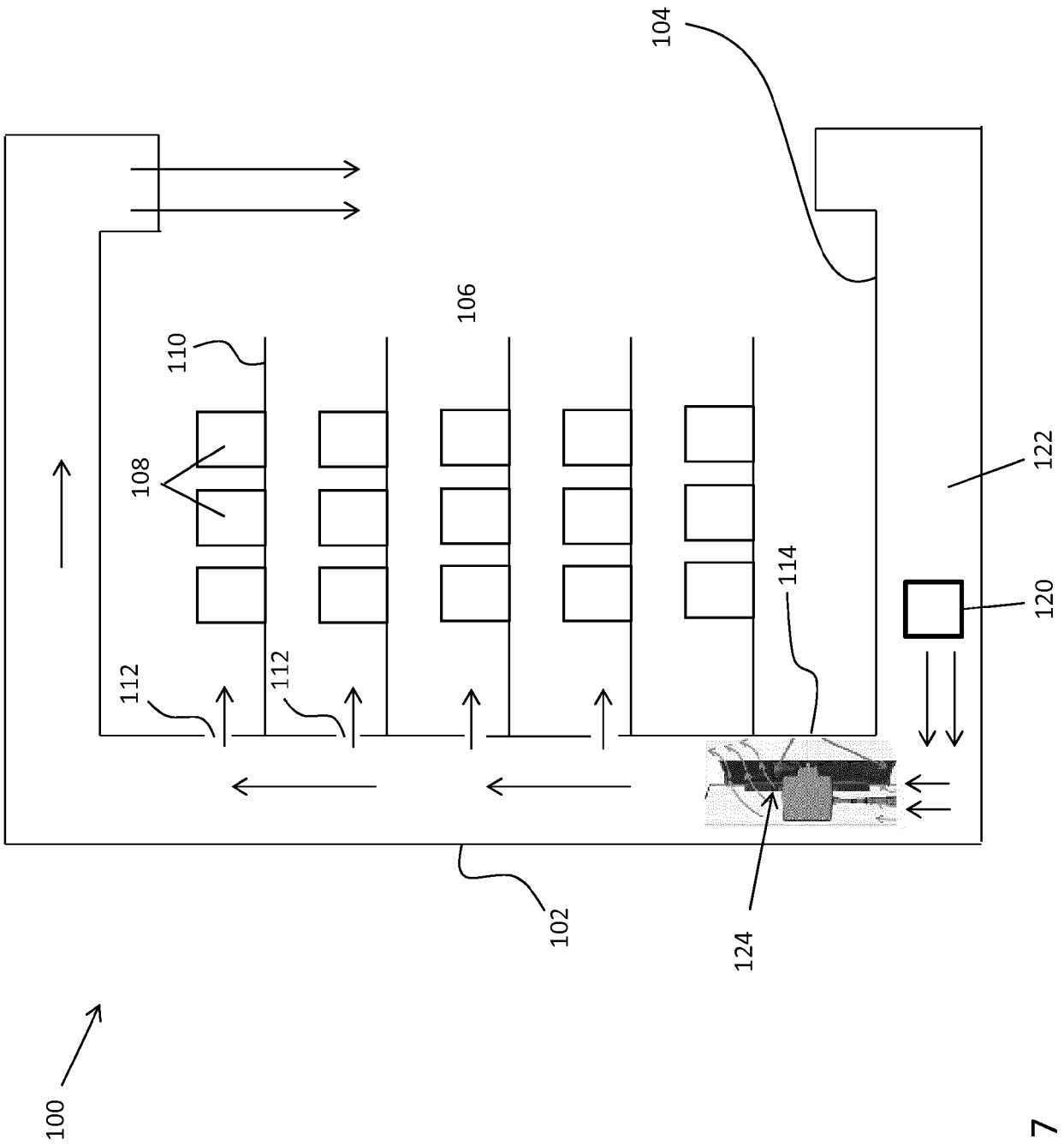

FIG. 7

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 19 15 4456

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	GB 2 050 530 A (PAPST MOTOREN KG) 7 January 1981 (1981-01-07) * abstract * * page 1, line 3 - page 2, line 119 * * figures * -----	1-4, 6-12,14 1-15	INV. F04D29/38 F04D29/54 A47F3/04
X Y	WO 00/04292 A1 (KEENLINK INTERNATIONAL LTD [CN]; LECKEY DAVID [GB]; LU WEN CAN [CN]) 27 January 2000 (2000-01-27) * abstract * * page 14, line 25 - page 16, line 5 * * figures 1-4 * -----	1-4,6-8, 11-14 5,9,10, 13,15	
Y A	FR 1 399 313 A (ROTRON MFG COMPANY) 14 May 1965 (1965-05-14) * page 1, paragraph 1 - page 4, paragraph 2 * * figures * -----	1-4,6-15 5	
Y A	WO 2014/162552 A1 (MITSUBISHI ELECTRIC CORP [JP]) 9 October 2014 (2014-10-09) * abstract * * figures * -----	5 1-4,6-15	TECHNICAL FIELDS SEARCHED (IPC) F04D A47F
Y A	EP 2 050 365 A1 (SANYO ELECTRIC CO [JP]) 22 April 2009 (2009-04-22) * abstract * * figures * -----	15 1-14	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	4 June 2019	Kolby, Lars

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 19 15 4456

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

04-06-2019

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB 2050530 A	07-01-1981	DE 3017226 A1	20-11-1980
		DE 3017943 A1	20-11-1980
		FR 2456865 A1	12-12-1980
		GB 2050530 A	07-01-1981
		JP S5629098 A	23-03-1981
WO 0004292 A1	27-01-2000	AU 4923499 A	07-02-2000
		WO 0004292 A1	27-01-2000
FR 1399313 A	14-05-1965	NONE	
WO 2014162552 A1	09-10-2014	AU 2014247827 A1	08-10-2015
		CN 105102822 A	25-11-2015
		EP 2982866 A1	10-02-2016
		JP 5971667 B2	17-08-2016
		JP WO2014162758 A1	16-02-2017
		US 2016025101 A1	28-01-2016
		WO 2014162552 A1	09-10-2014
		WO 2014162758 A1	09-10-2014
EP 2050365 A1	22-04-2009	AU 2008203824 A1	23-04-2009
		CN 101396212 A	01-04-2009
		EP 2050365 A1	22-04-2009
		HK 1125805 A1	28-10-2011
		JP 5033563 B2	26-09-2012
		JP 2009079877 A	16-04-2009
		SG 151161 A1	30-04-2009
		US 2009084124 A1	02-04-2009

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82