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(54) **RADIAL BLOWER**

(57) A radial blower (1) comprises a housing, which defines a conveying space (3) with an inlet aperture (8) and an outlet aperture (10), an impeller (2) accommodated within the conveying space (3), an electric motor (11) arranged outside the conveying space (3) in a motor support (14), which is formed directly by the housing (3) and which axially protrudes into the conveying space (3) so that the conveying space (3) at least partially envelops the stator (16) of the motor (11).

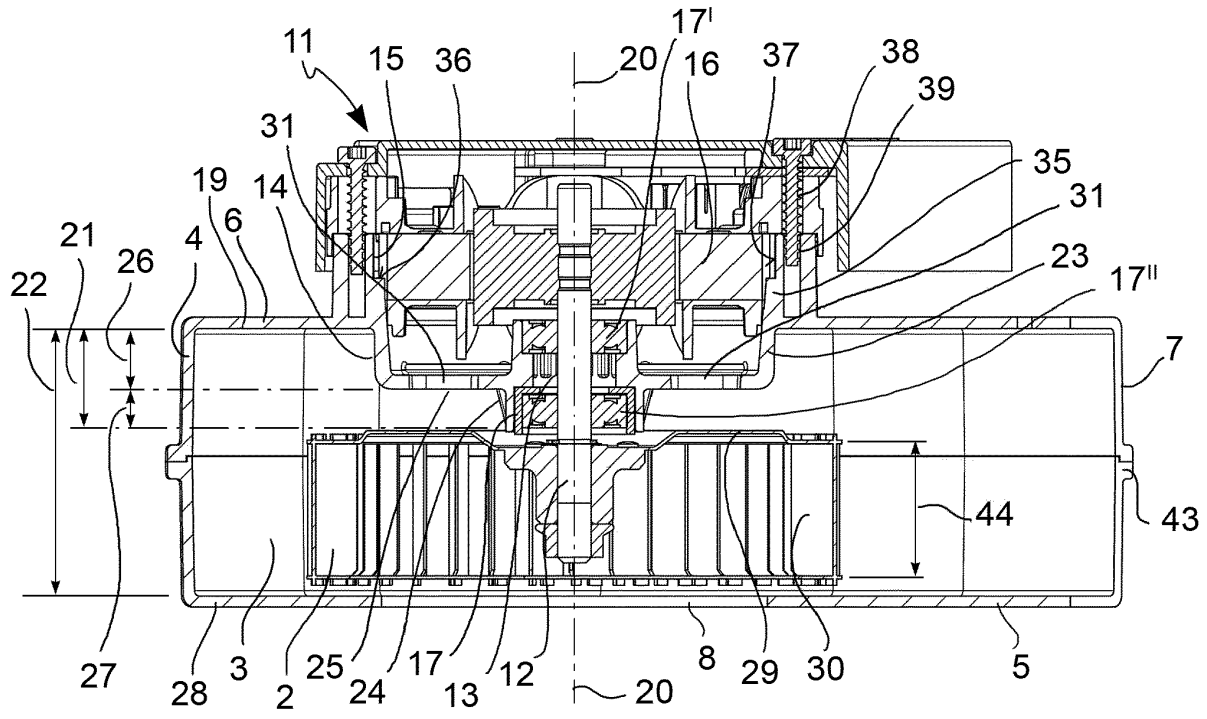

FIG. 3

EP 3 330 545 A1

Description

[0001] The present invention relates to a radial blower for moving air, e.g. for gas water heaters for domestic sanitary use with thermal powers up to 35 kW.

[0002] The known radial blowers comprise an impeller rotationally arranged within a substantially toroidal-shaped housing with two side walls and a peripheral wall. An inlet aperture is formed in one of the two side walls arranged in a radially inner, but not necessarily central position of the housing. A tangential portion with an outlet aperture is formed in the peripheral wall.

[0003] The impeller is rotational by means of an electric motor located outside the housing and connected to the side wall opposite to the inlet aperture. A driving shaft extends from the rotor of the motor through a passage aperture in the side wall inside the housing in which it integrally connects to the impeller.

[0004] The electric motor comprises its own housing or motor support with a stator seat which accommodates the motor stator and with one or more bearings to support the driving shaft and the rotor of the motor. The motor support is externally screwed to the side wall of the housing. In order to reduce the noise of the blower, dampers interposed between the motor support and the impeller housing, e.g. rubber or silicone bushes, are envisaged.

[0005] The fans of the prior art still have some disadvantages, such as:

the dimensions of the motor which restrict the freedom of choosing the positioning of the outlet aperture of the blower with respect to the outer walls of the water heater,
the design limits given by motor overheating,
the costs due to a large number of components to be manufactured, stocked and assembled,
the high consumption of electricity,
the noise caused by vibrations induced by the motor to the impeller housing.

[0006] It is the object of the present invention to provide a radial blower having features such as to overcome one or more of the drawbacks of the prior art.

[0007] It is an object of the invention to provide a radial blower in which the encumbrance of the motor restricts less the freedom of positioning of the blower inside an application.

[0008] Further objects of the invention are:

- improving motor cooling and reconciling motor cooling with the need for small dimensions,
- speeding up and simplifying assembly, reducing the manufacturing cost of the blower and simplifying assembly with the need for small dimensions,
- improving energy efficiency and reducing the noise of the radial blower.

[0009] This object is achieved by means of a radial blower according to claim 1. The dependent claims relate to preferred and advantageous embodiments.

[0010] According to an aspect of the invention, the radial blower comprises:

- a housing with a first side wall, a second side wall opposite to the first side wall and a peripheral wall, which jointly define a conveying space, wherein the first side wall forms an inlet aperture and the peripheral wall forms an outlet aperture,
- an impeller received within the conveying space,
- an electric motor arranged outside the conveying space,
- a motor support, which forms a stator seat in which a stator of the motor is received and locked, and a rotor seat for rotationally supporting a rotor of the motor and of a driving shaft,

wherein the motor support is formed directly by the second side wall and axially protrudes into the conveying space so that the conveying space at least partially envelops the stator and the rotor seat.

[0011] This makes it possible to move at least one part of the motor in the encumbrance of the conveying space, which is in all cases needed to convey and prepare the flow of air or gas to the outlet aperture of axial dimensions usually equal to the axial dimensions of the housing of the impeller. In this manner, the further axial encumbrance (in direction of the rotation axis of the impeller) due to the motor mounted outside the housing is reduced, and the housing and the outlet aperture can be positioned closer to an outer wall of an application, e.g. of a boiler.

[0012] The elimination of the motor support as separate component and of the connection members (screws, spacers, damper blocks), reduces the number of parts to be managed and assembled and the assembly time of the blower.

[0013] Making the motor support in one piece with the second side wall of the housing further reduces misalignments between the motor and the housing and respective vibrations (noise).

[0014] According to a further aspect of the invention, one or more through cooling apertures are formed in the second side wall, extending radially outside of the rotor seat and radially superimposed with the electric motor, in particular with the stator, so as to achieve a cooling communication between the stator (on the outer side of the second side wall) and the conveying space (on the inner side of the second side wall).

[0015] In this manner, a cooling air flow and a heat dissipation of intensity approximately proportional to the motor rotation speed, and thus to the heating intensity of the stator winding, is achieved.

[0016] According to a further aspect of the invention, an electronic control circuit of the electric motor is configured to truncate the current peaks in the windings of the stator, or, in other words, to supply a truncated amplitude wave current to the stator windings, as shown in

figure 6 compared with a non-truncated current pattern, shown in figure 7.

[0017] In this manner, a reduction of the maximum required power, and thus a reduction of the heating of the MOSFET switches, is achieved, as well as reduction of the torque ripple acting on the magnet of the rotor and of the vibrations induced in the impeller and in the housing.

[0018] This makes it possible, for example, to position the stator and/or the rotor in the respective housings of the motor support without the interposition of damping layers or damping elements and to keep the noise of the blower low in all cases.

[0019] In order to better understand the invention and appreciate its advantages, some examples of embodiments will be described below with reference to the figures, in which:

- figures 1 and 2 are perspective, exploded and assembled views of a radial blower according to the invention;
figure 3 is a radial section view (with respect to the rotation axis of the impeller) of a radial blower according to the invention;
figure 4 is a side view of the housing which shows a side wall forming a motor support and cooling apertures;
figure 5 is a view of figure 4 with a stator with electric board mounted in the motor support;
figure 6 shows the current pattern, truncated at extreme amplitudes, in a stator winding, compared with a current pattern without truncation, shown in figure 7.

[0020] With reference to the figures, a radial blower, indicated as a whole by reference numeral 1, comprises an impeller 2 arranged in rotational manner in a conveying space 3 defined inside a housing 4. The housing 4 has a substantially toroidal shape with a first side wall 5 and a second side wall 6 opposite to the first side wall 5, and a peripheral wall 7. An inlet aperture 8 is formed in the first side wall 5 for the gas or air to be conveyed in a radially inner, but not necessarily central position of housing 4. A substantially tangential portion 9, which defines an outlet 10 for gas or air, is formed in the peripheral wall 7.

[0021] An electric motor 11 is arranged outside the conveying space 3. The motor 11 is adapted to make the impeller 2 rotate by means of a driving shaft 12, which extends through a passage 13 formed in the second side wall 6 from outside the housing 4 into the conveying space 3, in which it connects, in rotationally integral manner, to the impeller 2.

[0022] A motor support 14 forms a stator seat 15, in which a stator 16 of the motor 11 is received and locked, and a rotor seat 17 for the rotary support of a rotor 18 of the motor 11 and of the driving shaft 12.

[0023] The motor support 14 is formed directly (or preferably in one piece) with the second side wall 6 and axially protrudes into the conveying space 3 so that the conveying space 3 at least partially envelops the stator 16 and the rotor seat 17.

[0024] This makes it possible to move at least one part of the motor 11 in the encumbrance of the conveying space 3, which is in all cases necessary to convey and prepare the flow of air or gas at the outlet aperture 10 of axial dimension usually equal to the axial dimensions of the housing 4. In this manner, the further axial clearance (in direction of the rotation axis of the impeller 2) due to the motor 11 mounted externally to the housing 4 is reduced, and the housing 4 and outlet aperture 10 can be positioned closer to an outer wall of an application, e.g. a boiler, in which the blower 1 is arranged.

[0025] The elimination of the motor support as separate component and of the connection members (screws, spacers, damper blocks), reduces the number of parts to be managed and assembled and the assembly time of the blower.

[0026] Making the motor support 14 directly as part of the second side wall 6 further reduces misalignments between the motor 11 and the housing 4 and respective vibrations (noise).

[0027] According to an embodiment, the second side wall 6 comprises a radially outer portion 19, which is substantially flat and perpendicular to the rotation axis 20 of the motor 11 and of the impeller 2. The motor support 14 protrudes, with respect to the radially outer portion 19, axially into the conveying space 3, by an axial length 21 of at least one fourth of a (maximum) axial height 22 of the conveying space 3. Preferably, the ratio of the axial length 21 to the maximum axial height 22 is in the range from 0.25 to 0.5, advantageously from 0.35 to 0.44, even more advantageously the ratio is about 0.39.

[0028] According to an embodiment, the motor support portion 14 which protrudes into the conveying space 3 has a tapered shape towards a free end, preferably formed by an axially more external first portion 23 and adjacent to the radially outer portion 19, and an axially more internal second portion 24, which is radially tapered with respect to the first portion 23, e.g. at a step which forms an intermediate portion 25, which may be planar and perpendicular with respect to the rotation axis 20 or inclined with respect to the rotation axis by an inclination angle from 45° to 135°, preferably from 75° to 105°.

[0029] Preferably, the axial length 26 of the first portion 23 is either equal to or greater than the axial length 27 of the second portion 24.

[0030] Preferably, the first portion 23 and the second portion 24 both have an outer cylindrical or truncated-cone shape which is concentric to the rotation axis 20.

[0031] The first portion 23 accommodates at least one portion of the stator 16 and preferably also at least one part of the rotor 18, while the second portion 24 internally forms at least one part of the rotor seat 17, e.g. a seat for a bearing.

[0032] By virtue of the geometrical features described

above, in particular of the tapered shape of the part 23, 24, 25 protruding inside the conveying space 3, the motor support 14 invades the conveying space in such a manner not to negatively interfere with the conveying of the air or gas.

[0033] In the embodiment shown in the figures, the maximum axial height 20 denotes the distance between the inner surface of the radially outer portion 19 of the second side wall 6 and an opposite inner surface of a radially outer portion 28 of the first lateral wall 5, also preferably planar and perpendicular to the axis of rotation 20.

[0034] According to an embodiment, the maximum axial width 44 of the blades 30 of the impeller 2 is less than 2/3 of the maximum axial height 22 of the conveying space 3, preferably the ratio between the maximum axial width 44 of the blades 30 and the maximum axial height 22 of the conveying space 3 is in the range of 1/3 to 2/3, advantageously from 2/5 to 3/5, even more advantageously from 0.45 to 0.6. The impeller 2, and particularly the blades 30, are positioned adjacent to the first side wall 5 and have an axial width which is smaller than the axial width of the outlet aperture 10, which may be equal to the maximum axial height 22 of the conveying space 3. Indeed, for the purpose of conveying power, the impeller does not need to be as wide as the housing, but in order to obtain an optimum output flow and for the need for connection compatibility, the outlet aperture must have a predetermined width, which can be greater than the axial width of the impeller 2. Precisely in these conditions it is advantageous to make the impeller 2 with axial dimensions smaller than the axial dimensions of the outlet aperture 10 and to occupy at least part of the space not occupied by the impeller 2 with the motor 11.

[0035] According to an embodiment, the impeller 2 comprises a support wall 29 which connects the blades 30 of the impeller 2 to the driving shaft 12 and which defines the impeller 2 on the side of the second side wall 6, and is shaped as an circular disc extended from the driving shaft 12 to a region that is radially external to the motor support 14 or at least to its first portion 23.

[0036] In this manner, the flow of gas or air sucked through the inlet aperture 8 is conveyed in circumferential and radial direction along the support wall 29 of the impeller 2, which screens at least this main flow of air or gas from the motor support 14, and vice versa.

[0037] According to a further aspect of the invention, one or more through cooling apertures 31 are formed in the second side wall 6, positioned and extending radially outside the rotor seat 17 and radially superimposed with the position of the electric motor 11, in particular with the stator 16, so as to provide a cooling communication between the stator 16 (arranged on the outer side of the second side wall 6) and the conveying space 3 (formed on the inner side of the second side wall 6).

[0038] In this manner, a partial cooling air flow and a heat dissipation of intensity approximately proportional to the rotation speed of the motor 11, and thus to the heating intensity of the stator winding, is achieved.

[0039] Alternatively or additionally, a circumferential air flow along the peripheral wall 7 caused by the rotation of the impeller 2 creates a vacuum at the cooling apertures 31, which in turn determines at least one part of the partial cooling flow for the cooling of the stator 16 of the motor 11, and also of the power components of an electronic control board 33 connected to the stator 16.

[0040] Advantageously, the cooling aperture or apertures 31 are formed in the intermediate portion 25 of the motor support 14, e.g. a circumferential succession of apertures 31 (e.g. circular, triangular or trapezoidal) alternating with radial connection ribs 34.

[0041] The cooling of the motor 11 through the cooling apertures 31 advantageously makes it possible to use a motor 11 without own coolant fan and therefore of further reduced axial dimensions.

[0042] According to a further aspect of the invention, the electronic control circuit 33 of the electric motor 11 is configured to truncate the current peaks in the stator windings, or in other words, to supply the stator windings with a wave current having truncated amplitude at the current peaks.

[0043] In this manner, a reduction of the maximum required power and thus a reduction of the heating of the MOSFET switches is achieved, as well as a reduction of the torque ripple acting on the magnet of the rotor 18 and of the vibrations induced in the impeller 2 and in the housing 4.

[0044] This implies a lower request for motor cooling, which may be easily satisfied by means of the cooling apertures 31.

[0045] Furthermore, the reduction of torque ripple makes it possible, for example, to accommodate the stator 16 and/or the rotor 18 in the respective housings 15, 17 of the motor support 14 without the interposition of damping layers or elements, and to keep the noise of the blower 1 low in all cases.

[0046] According to the embodiment shown in the figures, the electric motor is a unilateral bearing motor and the rotor seat 17 forms a first bearing seat 17' and a second bearing seat 17" which are coaxial. The bearing seats 17', 17" may be formed one facing towards the outside and the other facing towards the inside of the conveying space 3. This positioning facilitates the mounting of the motor and allows the use of fewer components to fix the rotating part.

[0047] The bearings are preferably smooth cylindrical annular bearings or rolling bearings.

[0048] According to a preferred embodiment (Figures 1, 3), the stator seat 15 is formed in an annular wall 35, preferably circular and continuous. The annular wall 35 defines a shoulder 35 which forms an axial abutment surface for the stator 16 and one or more side surfaces 37, which achieve the engagement by clamping of the stator 16, preventing transverse displacements in the axial direction.

[0049] The stator 16 may comprise one or more snap-

coupling portions which interact with respective counter-coupling portions of the motor support 14 to facilitate the provisional or definitive positioning and/or connection thereof.

[0050] The stator 16 may further form a plurality of fixing holes 38 aligned with corresponding fixing holes 39 formed in the second side wall 6 and/or with corresponding fixing holes 40 formed in a protective lid 41 (possibly provided with cooling apertures or cooling slots) and/or with fixing holes 42 of an electronic control board 33 for fixing the motor 11, by means of screws, to the housing 4. Advantageously, the fixing holes 39 in the second side wall 6 are arranged so that the position of the electronic board 33 may be varied as required.

[0051] This makes it possible to vary the position of the electrical connections of the electric board 33 according to the inner dimensions in the boiler in which the blower 1 will be installed.

[0052] Advantageously, the housing 4 is made of plastic material.

[0053] The housing 4 may comprise two half-shells made separately, e.g. by molding, and successively joined, e.g. by snap-fastening or by means of a plurality of hooks 43 which can be moved in a snapping manner into respective fastening positions.

[0054] To further reduce the noise of the blower 1, a damping layer or element (not shown), e.g. made of rubber, may be provided interposed between the rotor 18 and the motor support 14 and/or between the stator 16 and the motor support 14.

Claims

1. A radial blower (1), comprising:

- a housing (3) with a first side wall (5), a second side wall (6) opposite to the first side wall and a peripheral wall (7), which jointly define a conveying space (3), wherein the first side wall (5) forms an inlet aperture (8) and the peripheral wall (7) forms an outlet aperture (10),
- an impeller (2) accommodated within the conveying space (3),
- an electric motor (11) arranged within the conveying space (3),
- a motor support (14), which forms a stator housing (15) in which a stator (16) of the motor (11) is accommodated, and a rotor seat (17) for the rotational support of a motor shaft (12) connected to a rotor (18) of the motor (11),

characterized in that the motor support (14) is directly formed by the second side wall (6) and axially protrudes into the conveying space (3) so that the conveying space (3) at least partially envelops the stator (16) and the rotor seat (17).

2. A radial blower (1) according to claim 1, wherein the second side wall (6) comprises a radially outer portion (19) which is substantially flat and perpendicular to the rotation axis (20) of the impeller (2), wherein the motor support (14) protrudes, with respect to the radially outer portion (19), into the conveying space (3) by an axial length (21) of at least one fourth of a maximum axial height (22) of the conveying space (3).

3. A radial blower (1) according to claim 2, wherein the ratio of the axial length (21) to the maximum axial height (22) is in the range from 0.25 to 0.5, advantageously from 0.35 to 0.44, even more advantageously the ratio is about 0.39.

4. A radial blower (1) according to any one of the preceding claims, wherein the motor support portion (14) which protrudes into the conveying space (3) forms an axially more outer first portion (23) and an axially more inner second portion (24) which is radially tapered with respect to the first portion (23), and a step which forms an intermediate portion (25) which is either perpendicular with respect to the rotation axis (20) or inclined with respect to the rotation axis (20) with an inclination angle from 75° to 105°.

5. A radial blower (1) according to claim 4, wherein the axial length (26) of the first portion (23) is either equal to or greater than the axial length (27) of the second portion (24).

6. A radial blower (1) according to claim 4 or 5, wherein the first portion (23) and the second portion (24) each have a cylindrical or truncated-cone outer shape which is concentric with the rotation axis (20), and the first portion (23) receives at least one part of the stator (16), while the second portion (24) internally forms at least one part of the rotor seat (17), in particular a seat for a bearing.

7. A radial blower (1) according to any one of the preceding claims, wherein the impeller (2) comprises a support wall (29) which connects blades (30) of the impeller (2) to the motor shaft (12) and which delimits the impeller (2) on the side of the second side wall (6), said support wall (29) being shaped as a circular disc extending from the driving shaft (12) upto a region which is radially outer with respect to a portion (23, 24, 25) of the motor support (14) protruding into the conveying space (3).

8. A radial blower (1) according to one of the preceding claims, wherein one or more through cooling apertures (31) are formed in the second side wall (6), said through cooling apertures (31) being positioned and extending radially outside rotor housing (17) and radially superimposed with the position of the stator

(16) of the electric motor (11), wherein said cooling apertures (31) provide a cooling communication between the stator (16) and the conveying space (3).

9. A radial blower (1) according to claim 8, wherein the cooling apertures (31) form a circumferential sequence of the apertures (31) alternating with radial connection ribs (34).

10. A radial blower (1) according to claim 8, wherein the motor (11) has no own cooling fan other than the impeller (2).

11. A radial blower (1) according to any one of the preceding claims, wherein an electronic control circuit (33) of the electric motor (11) is configured so as to truncate the current peaks in the windings of the stator (16).

12. A radial blower (1) according to any one of the preceding claims, wherein the stator (16) and the rotor (18) are supported in the motor support (14) without the interposition of damping layers or elements.

13. A radial blower (1) according to any one of the preceding claims, wherein the stator (16) comprises one or more snap-coupling portions which interact with respective counter-coupling portions of the motor support (14) to facilitate the positioning and/or connection thereof.

14. A radial blower (1) according to any one of the preceding claims, wherein the stator (16) forms a plurality of fixing holes (38) aligned with corresponding fixing holes (39) formed in the second side wall (6) and with corresponding fixing holes (40) formed in a protective lid (41) and with fixing holes (42) of an electronic control board (33) of the motor (11) for fixing, by means of screws, the motor (11) to the housing (4), wherein the fixing holes (39) in the second side wall (6) are arranged so that the position of the electronic board (33) may be varied as required.

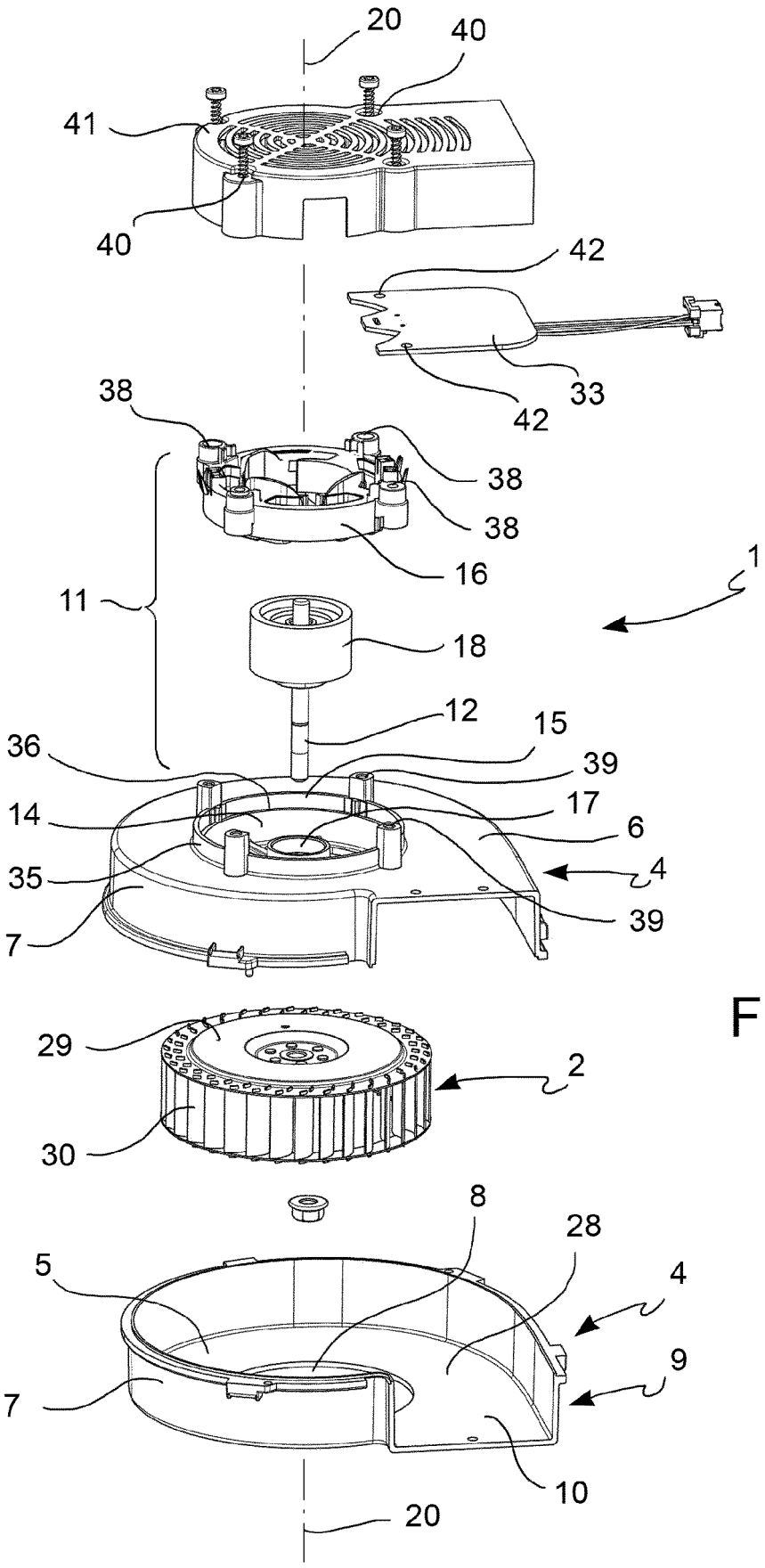
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FIG. 1

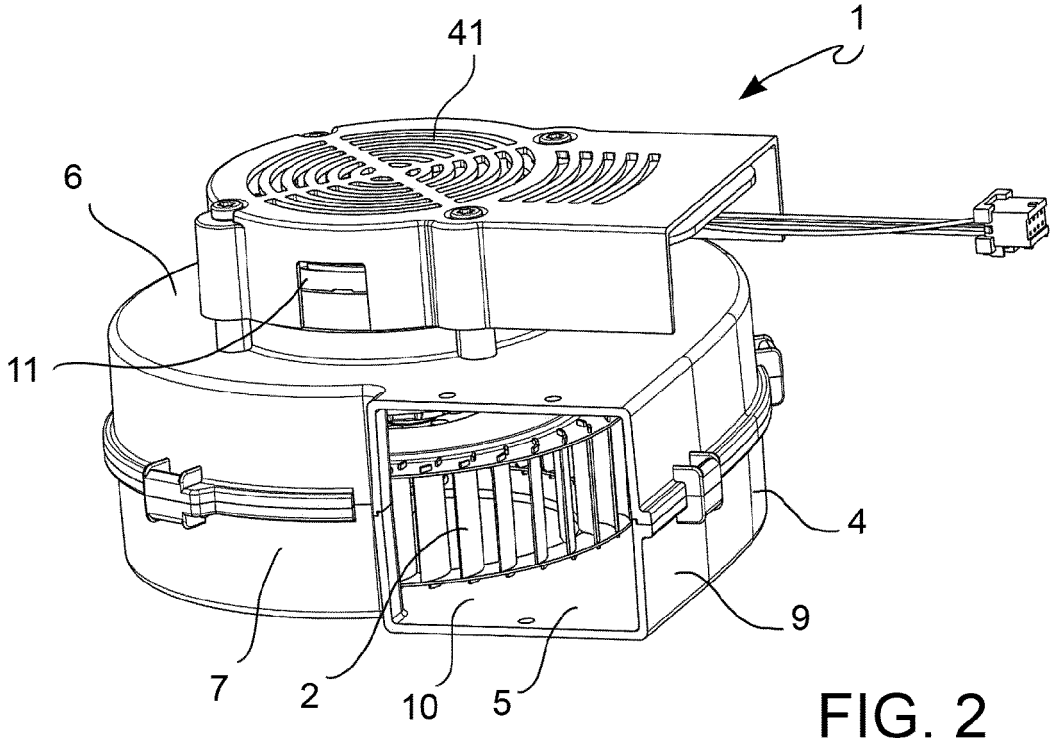
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FIG. 2

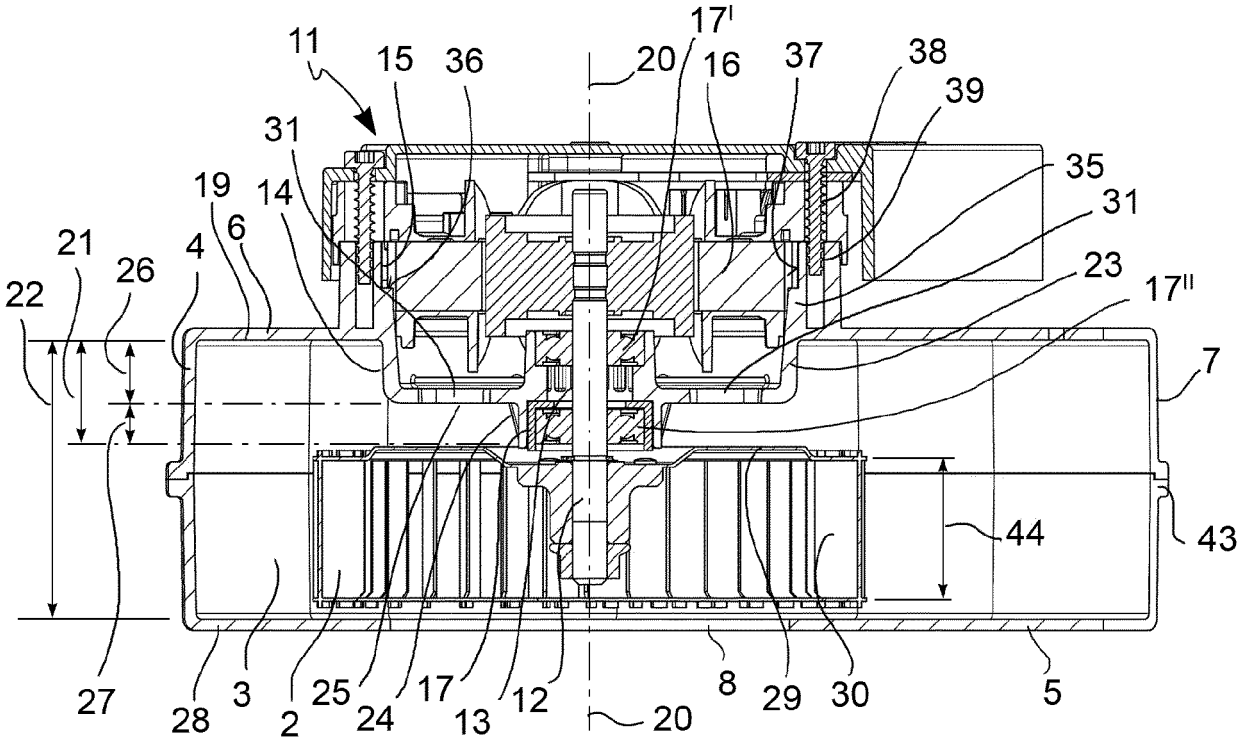
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FIG. 3

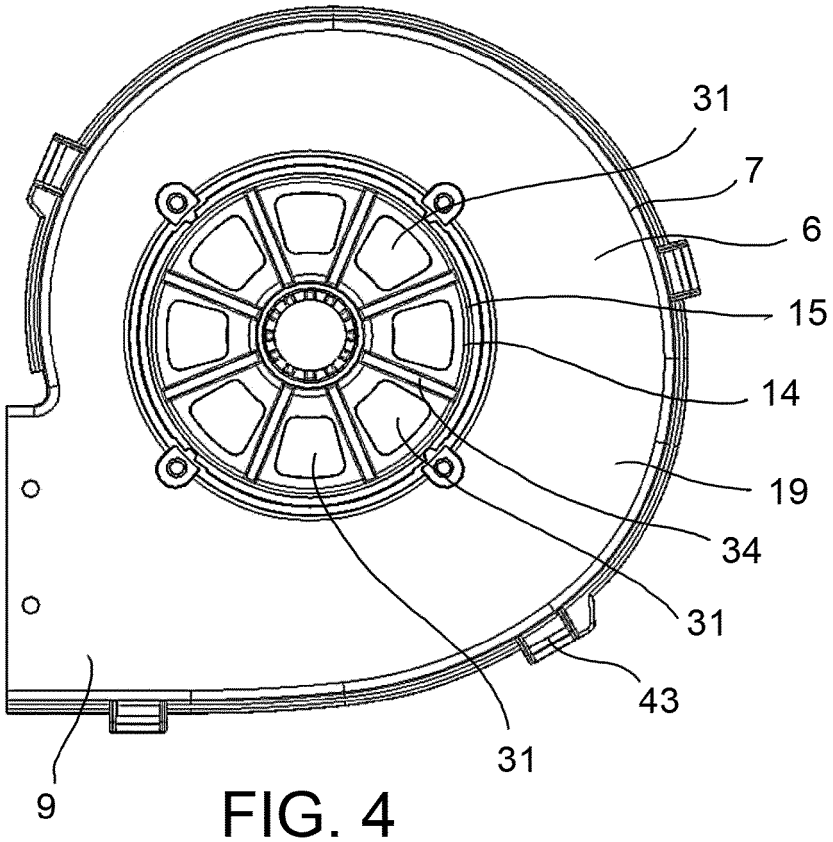

FIG. 4

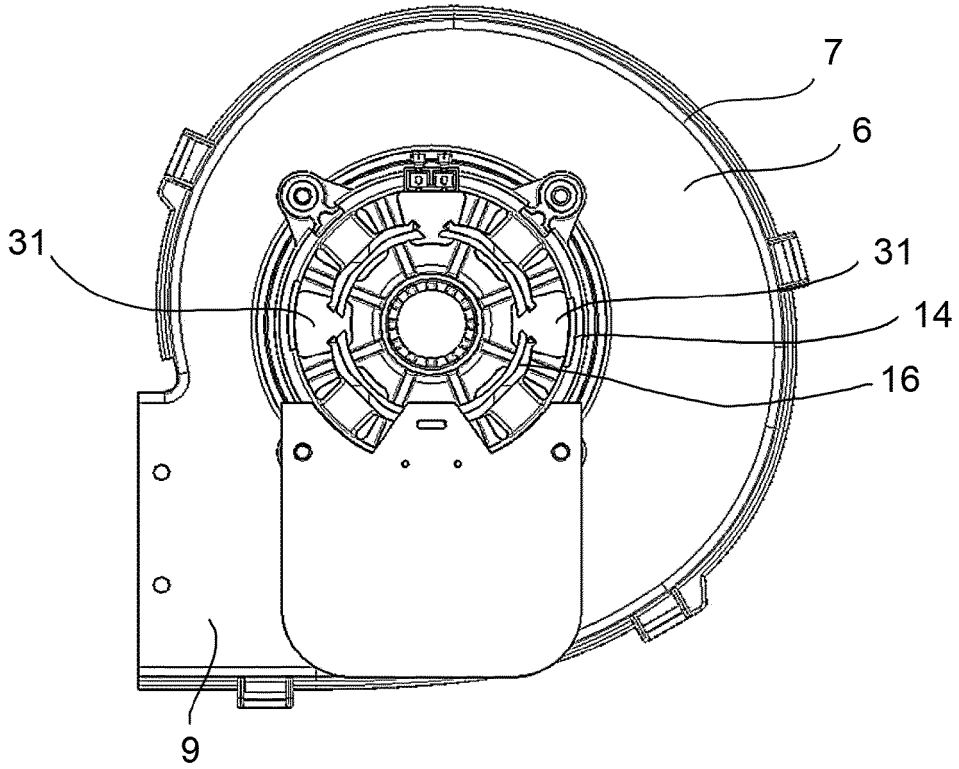

FIG. 5

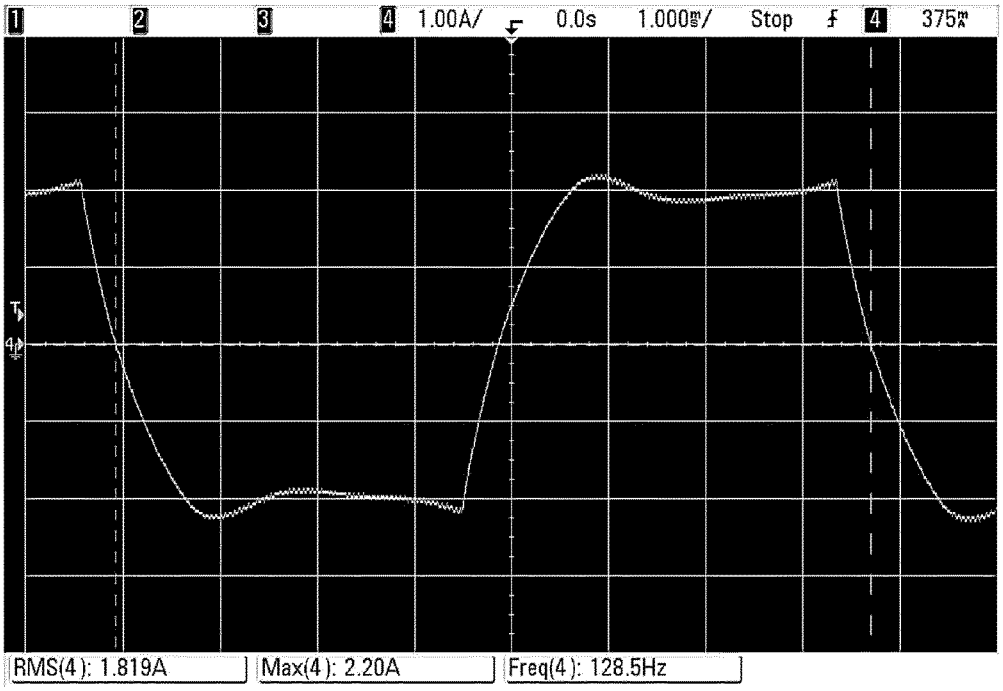
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FIG. 6

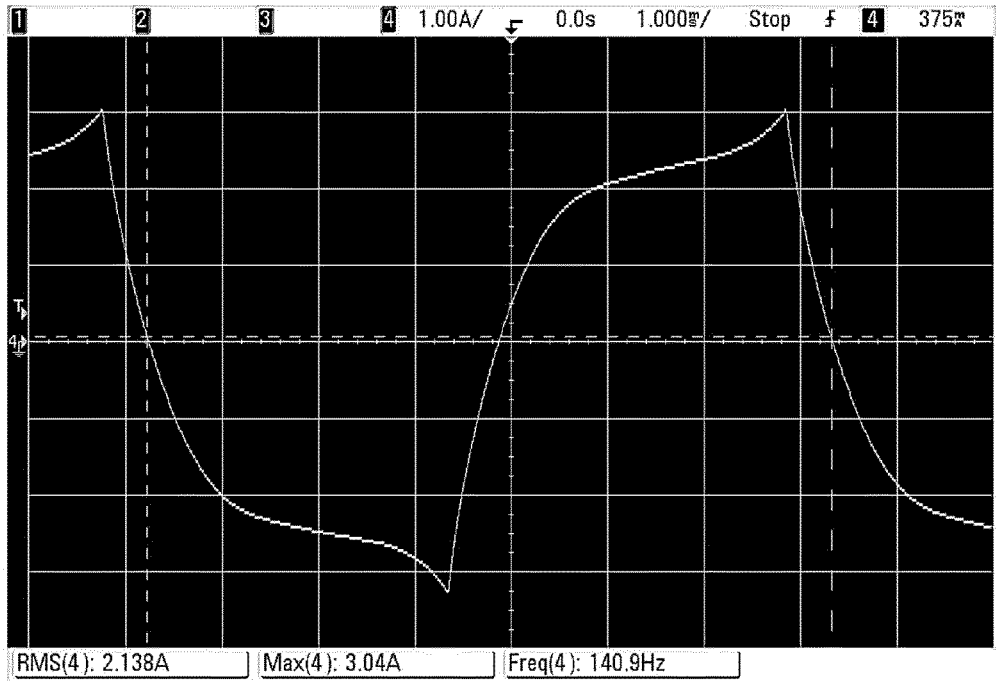
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FIG. 7

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EUROPEAN SEARCH REPORT

Application Number
EP 17 20 1511

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	EP 0 408 221 A2 (IBM [US]; TORIN LTD [GB]) 16 January 1991 (1991-01-16) * abstract; figures 8,9 *	1-14	INV. F04D25/06 F04D25/08 F04D29/42 F04D29/58
X	WO 2016/059776 A1 (PANASONIC IP MAN CO LTD [JP]) 21 April 2016 (2016-04-21) * abstract; figure 1 *	1-14	
X	DE 10 2013 204138 A1 (BSH BOSCH UND SIEMENS HAUSGERÄTE GMBH [DE]) 11 September 2014 (2014-09-11) * abstract; figures 1,2 *	1-14	
X	US 2013/101451 A1 (DICKINSON ROGER [US] ET AL) 25 April 2013 (2013-04-25) * abstract; figure 2 *	1-14	

TECHNICAL FIELDS SEARCHED (IPC)
F04D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	14 March 2018	de Martino, Marcello

CATEGORY OF CITED DOCUMENTS

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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 17 20 1511

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14-03-2018

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0408221 A2	16-01-1991	DE 69012244 D1	13-10-1994
		EP 0408221 A2	16-01-1991
		GB 2234012 A	23-01-1991
		JP H0350398 A	04-03-1991
WO 2016059776 A1	21-04-2016	CN 106715922 A	24-05-2017
		EP 3208472 A1	23-08-2017
		JP 5957712 B1	27-07-2016
		JP WO2016059776 A1	27-04-2017
		US 2017261005 A1	14-09-2017
		WO 2016059776 A1	21-04-2016
DE 102013204138 A1	11-09-2014	CN 105308328 A	03-02-2016
		DE 102013204138 A1	11-09-2014
		EP 2971788 A1	20-01-2016
		WO 2014139776 A1	18-09-2014
US 2013101451 A1	25-04-2013	US 2013101451 A1	25-04-2013
		WO 2013059783 A1	25-04-2013

EPO FORM P0459

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