



(51) International Patent Classification:

F04D 29/28 (2006.01) F04D 29/44 (2006.01)
F04D 29/42 (2006.01) B60H 1/00 (2006.01)

(21) International Application Number:

PCT/US2024/060146

(22) International Filing Date:

13 December 2024 (13.12.2024)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

18/540,001 14 December 2023 (14.12.2023) US

(71) Applicant: VALEO SYSTEMES THERMIQUES
[FR/FR]; 8 rue Louis Lormand, 78320 La Verriere (FR).

(72) Inventor; and

(71) Applicant: BARNEBEE, Cody [US/US]; 4100 N. Atlantic
Blvd., Auburn Hills, Michigan 48326 (US).

(72) Inventors: SHEVADE, Anshuman; Ceedeeyes IT Park,
No. 63, Phase 1 Rajivgandhi Salai Navalur, Tamil Nadu,
Chennai 600130 (IN). MARSHALL, Steven; 4100 N. At-
lantic Blvd., Auburn Hills, Michigan 48326 (US). MAYER,
Timothy; 4100 N. Atlantic Blvd., Auburn Hills, Michigan
48326 (US).

(74) Agent: BIALKOWSKI, Adam; 150 Stephenson Hwy.,
Troy, Michigan 48083 (US).

(81) Designated States (unless otherwise indicated, for every
kind of national protection available): AE, AG, AL, AM,

AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ,
CA, CH, CL, CN, CO, CR, CU, CV, CZ, DE, DJ, DK, DM,
DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,
HN, HR, HU, ID, IL, IN, IQ, IR, IS, IT, JM, JO, JP, KE, KG,
KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY,
MA, MD, MG, MK, MN, MU, MW, MX, MY, MZ, NA,
NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO,
RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH,
TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS,
ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, CV,
GH, GM, KE, LR, LS, MW, MZ, NA, RW, SC, SD, SL, ST,
SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ,
RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ,
DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT,
LU, LV, MC, ME, MK, MT, NL, NO, PL, PT, RO, RS, SE,
SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN,
GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— with international search report (Art. 21(3))

(54) Title: BLOWER DEVICE WITH AN INLET PRESWIRLER

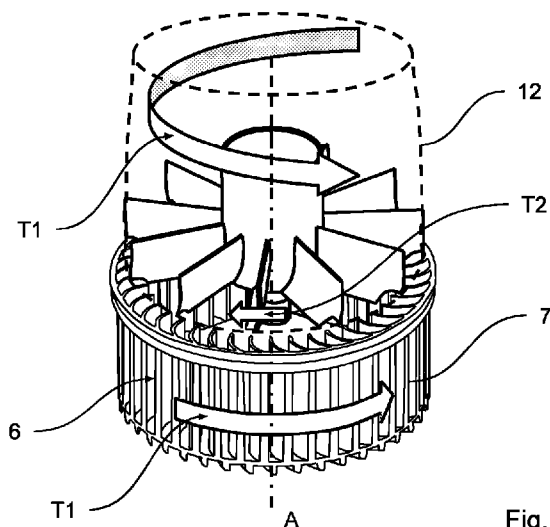


Fig. 2

(57) Abstract: A blower device for a heating, ventilation and air conditioning system, including: a blower housing defining an internal volume with an inlet and an outlet; a blower wheel with blower blades, arranged within the internal volume of the blower housing; a motor configured to rotate the blower wheel in a first direction around a central axis; a preswirl arranged within the inlet upstream of the blower wheel and including a plurality of vanes extending towards the blower wheel. Each vane of the plurality of vanes includes a first section and a second section, both extending along the central axis toward the blower wheel, with the second section being closer to the blower wheel than the first section is. The vanes of the plurality of vanes slope in a second direction as they extend along the central axis towards the blower wheel, the second direction being opposite to the first direction.

BLOWER DEVICE WITH AN INLET PRESWIRLER

TECHNICAL FIELD

- [1] The invention relates to the field of ventilation, heating and/or air conditioning installations, in particular for a motor vehicle. The invention relates in particular to a blower device for such an installation.

BACKGROUND OF THE INVENTION

- [2] Heating and/or ventilation and/or air conditioning (or HVAC) installations for a motor vehicle make it possible to distribute air in a vehicle interior and generally include an air duct in which there are arranged various means for heat treatment of the air. The means for heat treatment of the air are in particular heat exchangers, for heating and/or cooling, for example an air-heating radiator and an evaporator intended to cool the air.
- [3] The airflow circulating in the heating and/or ventilation and/or air conditioning installation is generated by a motor-fan unit, also called a blower device or air blower, which is mounted at the level of a blower housing of the installation, which channels the airflow. The airflow is directed, via the blower device, to one or more outlets of the installation opening into the passenger compartment, after having been heat-treated.

SUMMARY OF THE INVENTION

- [4] The object of the invention is a blower device for a heating, ventilation and air conditioning system, comprising: a blower housing defining an internal volume with an inlet and an outlet; a blower wheel with blower blades, arranged within the internal volume of the blower housing; a motor configured to rotate the blower wheel in a first direction around a central axis; a preswirler arranged within the inlet upstream of the blower wheel and including a plurality of vanes extending towards the blower wheel; wherein each vane of the plurality of vanes includes a first section and a second section, both extending along the central axis toward the blower wheel, with the second section being closer to the blower wheel than the first section is, wherein the vanes of the plurality of vanes slope in a second direction as they extend along the central axis towards the blower wheel, the second direction being opposite to the first direction.
- [5] In one example, the first section extends parallel to the central axis.
- [6] In one example, the second section extends along a curve.

- [7] In one example, the second section extends along an arch with radius between 10 and 20 mm.
- [8] In one example, the number of blower blades is uneven.
- [9] In one example, the number of vanes within the plurality of vanes is uneven.
- [10] In one example, the number of blower blades is between 5 and 41.
- [11] In one example, the number of vanes within the plurality of vanes is between 5 and 19.
- [12] In one example, the preswirler includes a core from which the vanes of the plurality of vanes radially extend, the core being hollowed so that air from the inlet can travel through the core to the blower wheel in addition to flowing around the core.
- [13] In one example, the core is a tube with a radius measuring between 10 and 40 mm degrees.
- [14] In one example, the inlet is constituted by a wall, with the vanes of the plurality of vanes extending from the wall.
- [15] In one example, the first section of each vane of the plurality of vanes extends along the central axis for a distance measuring between 1 and 35 mm.
- [16] In one example, the second section of each vane of the plurality of vanes extends along the central axis for a distance measuring between 1 and 45 mm.
- [17] In one example, the second section of each vane of the plurality of vanes extends perpendicularly from the central axis for a distance measuring between 1 and 15 mm.
- [18] In one example, each vane of the plurality of vanes extends along respective extension axis extending radially from central axis for a distance measuring between 20 and 100 mm.
- [19] In one example, the blower wheel includes blower core from which the blower blades extend.
- [20] In one example, the blower core is in form of a cone with an apex pierced by the central axis, and a side surface extending between the apex and the blower blades.
- [21] In one example, each vane of the plurality of vanes measures between X and Y along the central axis.
- [22] In one example, the blower blades extend for a distance along the central axis, the distance measuring between 30 and 85 mm.

BRIEF DESCRIPTION OF DRAWINGS

- [23] The present invention will be described in greater detail below with reference to the drawings. In the drawings:
- [24] Fig. 1 shows a blower device in a perspective view;

- [25] Fig. 2 shows a blower device according to the invention in a perspective view, with part of the housing removed;
- [26] Fig. 3 shows an example of a preswirl vane in side view;
- [27] Fig. 4 shows another example of a preswirl vane in side view;
- [28] Fig. 5 shows another example of a preswirl vane in side view;
- [29] Fig. 6 shows a preswirl and blower wheel from above, with a partial detailed view of a portion thereof; and
- [30] Fig. 7 shows a cross-sectional view of some elements of the blower device.

DETAILED DESCRIPTION OF THE INVENTION

- [31] Example embodiments will now be described more fully with reference to the accompanying drawings.
- [32] Generally, when a range is discussed and a term “between” is used in the context of two named, boundary values, such range is to be understood as including the boundary values.
- [33] Figs. 1 and 2 show a blower device in a perspective view, with Fig. 2 having some elements removed for better clarity. A blower device 1 intended for a heating, ventilation and air conditioning system is shown. The blower device 1 comprises a blower housing 3 defining an internal volume V with an inlet 4 and an outlet 5. In other words, the blower housing 3 forms an air channel for the airflow between the inlet 4 and the outlet 5. The inlet 4 can be connected to upstream channels of the HVAC system, while the outlet 5 can be connected to the downstream channels of the HVAC system. The blower device 1 includes a blower wheel 6 with blower blades 7, arranged within the internal volume V of the blower housing 3. The blower device 1 further includes a motor 8 configured to rotate the blower wheel 6 in a first direction T1 around a central axis A. Rotation of the blower wheel 6, in particular of its blower blades 7, forces (ensures) the airflow between the inlet 4 and the outlet 5. The blower device 1 further includes a preswirl 9 arranged within the inlet 4 upstream of the blower wheel 6. The preswirl 9 includes a plurality of vanes 10 and is intended to influence the airflow going therethrough.
- [34] In particular, the vanes 10 of the plurality of vanes 10 slope in a second direction T2 as they extend along the central axis A towards the blower wheel 6, the second direction T2 being opposite to the first direction T1. Because of such arrangement, if the incoming air is already rotating in the direction of the blower wheel 6 rotation, that is the first direction T1, the preswirl 9 disrupts the prerotation, thereby for example allowing to better uniformly fill the blower blades

7 of the blower wheel 6. The counter swirling removes the in-direction preswirling, which would have naturally reduced the performance of the blower device 1. Otherwise, the initial swirl "with" the blower wheel 6 would reduce the relative speed and hence relative momentum change of the air to the blower wheel 6.

[35] The first direction T1 can be clockwise, while the second direction T2 is counter-clockwise.

[36] Alternatively, the first direction T1 can be counter-clockwise, while the second direction T2 is clockwise.

[37] The preswirlers 9 can include a core 11 from which the vanes 10 of the plurality of vanes 10 radially extend, the core 11 being hollowed so that air from the inlet 4 can travel through the core 11 to the blower wheel 6 in addition to flowing around the core 11.

[38] In one example, the vanes 10 maintain their shape throughout their radial extension with respect to the central axis A.

[39] In the shown example, the vanes 10 maintain their shape with their radial extension with respect to the central axis A as long as possible, in this case up to the point when they encounter reduced diameter of the inner air channel, where they merge into the housing 3 substantially perpendicularly.

[40] The inlet 4 can be constituted by a wall 12. The vanes 10 of the plurality of vanes 10 can extend from the wall 12. The vanes 10 of the plurality of vanes 10 can also or alternatively extend from the core 11.

[41] Fig. 3 shows an example of the preswirlers 9 in side view, in particular a cross-section thereof showing its profile. The vanes 10 of the plurality of vanes 10 slope in a second direction T2 as they extend along the central axis A towards the blower wheel 6, the second direction T2 being opposite to the first direction T1.

[42] Fig. 4 shows another example of the preswirlers 9 in side view. Each vane 10 of the plurality of vanes 10 includes a first section S1 and a second section S2, both extending along the central axis A toward the blower wheel 6, with the second section S2 being closer to the blower wheel 6 than the first section S1 is. The vanes 10 of the plurality of vanes 10 slope in a second direction T2 as they extend along the central axis A towards the blower wheel 6, the second direction T2 being opposite to the first direction T1.

[43] The second section S2 can extend along a curve.

- [44] The second section S2 can extend along an arch with radius R1 between 10 and 20 mm. In one example, the second section S2 can extend along an arch with radius R1 measuring 14 mm.
- [45] The first section S1 of each vane 10 of the plurality of vanes 10 can extend along the central axis A for a distance x1 measuring between 1 and 35 mm. In one example, the first section S1 of each vane 10 of the plurality of vanes 10 can extend along the central axis A for a distance x1 measuring 10 mm.
- [46] The second section S2 of each vane 10 of the plurality of vanes 10 can extend along the central axis A for a distance x2 measuring between 1 and 45 mm. In one example, the second section S2 of each vane 10 of the plurality of vanes 10 can extend along the central axis A for a distance x2 measuring 15 mm.
- [47] The second section S2 of each vane 10 of the plurality of vanes 10 can extend perpendicularly from the central axis A for a distance x3 measuring between 1 and 15 mm. In one example, the second section S2 of each vane 10 of the plurality of vanes 10 can extend perpendicularly from the central axis A for a distance x3 measuring 7 mm.
- [48] Fig. 5 shows another example of a preswirl vane 10 in side view.
- [49] Shows another example of the preswirl vane 10 in side view. Each vane 10 of the plurality of vanes 10 includes the first section S1 and the second section S2, both extending along the central axis A toward the blower wheel 6, with the second section S2 being closer to the blower wheel 6 than the first section S1 is. The vanes 10 of the plurality of vanes 10 slope in a second direction T2 as they extend along the central axis A towards the blower wheel 6, the second direction T2 being opposite to the first direction T1.
- [50] The first section S1 can extend along a curve.
- [51] The first section S1 can extend along an arch with radius R1b measuring between 10 and 20 mm. In one example, the first section S1 can extend along an arch with radius R1b measuring 14 mm.
- [52] The first section S1 of each vane 10 of the plurality of vanes 10 can extend along the central axis A for a distance x1 measuring between 1 and 35 mm. In one example, the first section S1 of each vane 10 of the plurality of vanes 10 can extend along the central axis A for a distance x1 measuring 10 mm.

- [53] The second section S2 of each vane 10 of the plurality of vanes 10 can extend along the central axis A for a distance x_2 measuring between 1 and 45 mm. In one example, the second section S2 of each vane 10 of the plurality of vanes 10 can extend along the central axis A for a distance x_2 measuring 15 mm. In the shown example, the second section S2 extends along a straight line.
- [54] The second section S2 of each vane 10 of the plurality of vanes 10 can extend perpendicularly from the central axis A for a distance x_3 measuring between 1 and 15 mm. In one example, the second section S2 of each vane 10 of the plurality of vanes 10 can extend perpendicularly from the central axis A for a distance x_3 measuring 7 mm.
- [55] In one example, not shown here, both the first sections S1 and the second section S2 extend along a straight line.
- [56] In another example, not shown here, both the first sections S1 and the second section S2 extend along respective curves, which can be common.
- [57] Fig. 6 shows a preswirl and blower wheel from above, with a partial detailed view of a portion thereof.
- [58] The number of blower blades 7 can be uneven.
- [59] The number of blower blades 7 can be between 5 and 41. In one example, the number of blower blades 7 is 41.
- [60] The number of vanes 10 within the plurality of vanes 10 can be uneven.
- [61] The number of vanes 10 within the plurality of vanes 10 can be between 5 and 19. In one example, the number of vanes 10 within the plurality of vanes 10 can be 11.
- [62] Each vane 10 of the plurality of vanes 10 can extend along respective extension axis extending radially from central axis A for a distance x_5 measuring between 20 and 100 mm. In one example, each vane 10 of the plurality of vanes 10 can extend along respective extension axis extending radially from central axis A for a distance x_5 measuring 42 mm.
- [63] The core 11 can be a tube with a radius x_4 measuring between 10 and 40 mm. In one example, the core 11 can be a tube with a radius x_4 measuring 21 mm.
- [64] Fig. 7 shows a cross-sectional view of some elements of the blower device 1.

- [65] The blower wheel 6 can include blower core 13 from which the blower blades 7 extend. In one example, the blower blades 7 extend upwardly (upstream) from the blower core 13. The blower blades 7 can be then connected at their upper ends by a ring.
- [66] The blower core 13 can be in form of a cone with an apex 14 pierced by the central axis A, and a side surface 15 extending between the apex 14 and the blower blades 7.
- [67] Each vane 10 of the plurality of vanes 10 can measure between 10 and 50 mm along the central axis A. In one example, each vane 10 of the plurality of vanes 10 can measure between 25 mm along the central axis A.
- [68] The blower blades 7 can extend for a distance x10 along the central axis A, the distance x10 measuring between 30 and 85 mm. In one example, the blower blades 7 can extend for a distance x10 along the central axis A, the distance x10 measuring 70 mm.
- [69] The preswirl 9 can have an overall diameter D1 measuring between 60 and 170 mm. In one example, the preswirl 9 can have an overall diameter D1 measuring 127 mm.
- [70] The core 11 can extend for a distance x8 along the central axis A, the distance x8 measuring between 10 and 80 mm. In one example, the core 11 can extend for a distance x8 along the central axis A, the distance x8 measuring 55 mm.
- [71] The preswirl 9 can be distanced from the blower wheel 6 along the central axis by a distance x9 measuring between 3.5 and 6 mm. In one example, the preswirl 9 can be distanced from the blower wheel 6 along the central axis by a distance x9 measuring 3.5 mm.
- [72] The blower wheel 6 can have an overall diameter D2 measuring between 60 and 170 mm. In one example, the blower wheel 6 can have an overall diameter D2 measuring 140 mm.
- [73] The invention allows improving overall HVAC system performance by providing a significant pressure performance improvement, in particular when the air coming to the blower wheel 6 is already rotating due to geometry of the channel that precedes it. The invention allows to reduce the working point RPM (rotations per minute).

Claims

1. A blower device for a heating, ventilation and air conditioning system, comprising:
a blower housing defining an internal volume with an inlet and an outlet;
a blower wheel with blower blades, arranged within the internal volume of the blower housing;
a motor configured to rotate the blower wheel in a first direction around a central axis;
a preswirl arranged within the inlet upstream of the blower wheel and including a plurality of vanes extending towards the blower wheel;
wherein each vane of the plurality of vanes includes a first section and a second section, both extending along the central axis toward the blower wheel, with the second section being closer to the blower wheel than the first section is, wherein the vanes of the plurality of vanes slope in a second direction as they extend along the central axis towards the blower wheel, the second direction being opposite to the first direction.
2. The blower device according to claim 1, wherein the first section extends parallel to the central axis.
3. The blower device according to claim 1, wherein the second section extends along a curve.
4. The blower device according to claim 1, wherein the second section extends along an arch with radius between 10 and 20 mm.
5. The blower device according to claim 1, wherein the number of blower blades is uneven.
6. The blower device according to claim 1, wherein the number of vanes within the plurality of vanes is uneven.
7. The blower device according to claim 1, wherein the number of blower blades is between 5 and 41.
8. The blower device according to claim 1, wherein the number of vanes within the plurality of vanes is between 5 and 19.
9. The blower device according to claim 1, wherein the preswirl includes a core from which the vanes of the plurality of vanes radially extend, the core being hollowed so that air from the inlet can travel through the core to the blower wheel in addition to flowing around the core.

10. The blower device according to claim 9, wherein the core is a tube with a radius measuring between 10 and 40 mm degrees.
11. The blower device according to claim 1, wherein the inlet is constituted by a wall, with the vanes of the plurality of vanes extending from the wall.
12. The blower device according to claim 1, wherein the first section of each vane of the plurality of vanes extends along the central axis for a distance measuring between 1 and 35 mm.
13. The blower device according to claim 1, wherein the second section of each vane of the plurality of vanes extends along the central axis for a distance measuring between 1 and 45 mm.
14. The blower device according to claim 1, wherein the second section of each vane of the plurality of vanes extends perpendicularly from the central axis for a distance measuring between 1 and 15 mm.
15. The blower device according to claim 1, wherein each vane of the plurality of vanes extends along respective extension axis extending radially from central axis for a distance measuring between 20 and 100 mm.
16. The blower device according to claim 1, wherein the blower wheel includes blower core from which the blower blades extend.
17. The blower device according to claim 16, wherein the blower core is in form of a cone with an apex pierced by the central axis, and a side surface extending between the apex and the blower blades.
18. The blower device according to claim 1, wherein each vane of the plurality of vanes measures between X and Y along the central axis.
19. The blower device according to claim 1, wherein the blower blades extend for a distance along the central axis, the distance measuring between 30 and 85 mm.

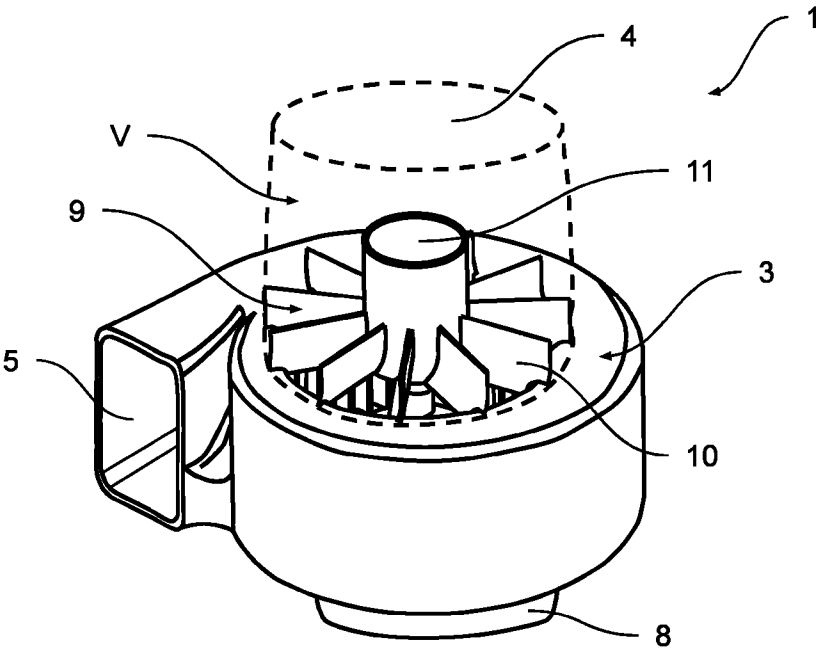


Fig. 1

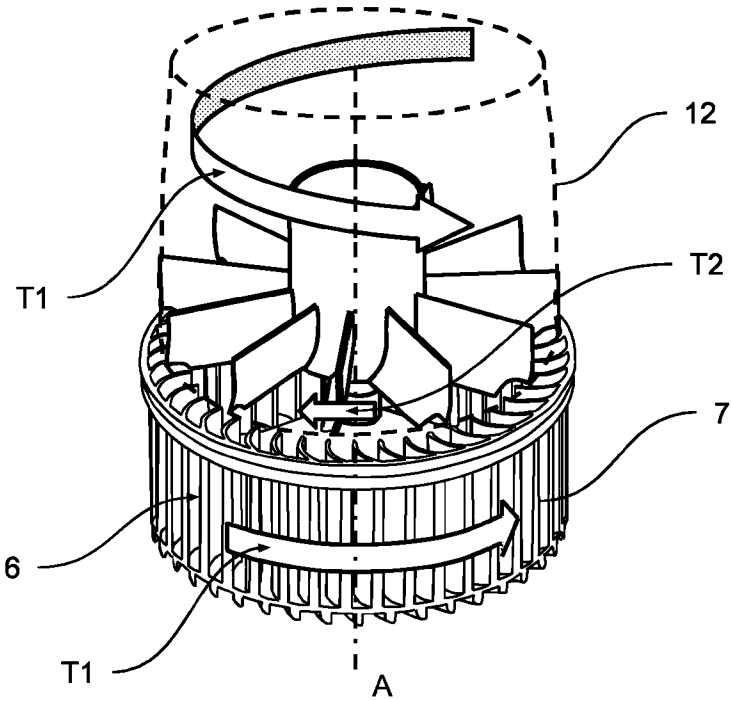


Fig. 2

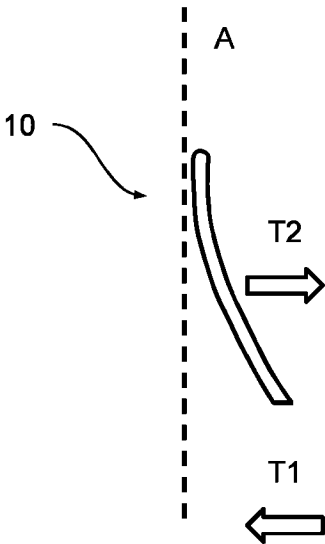


Fig. 3

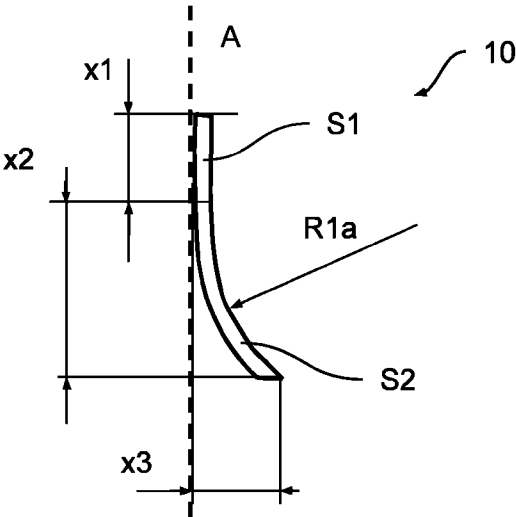


Fig. 4

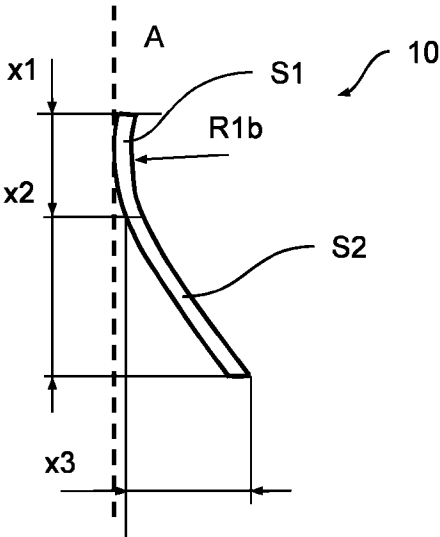


Fig. 5

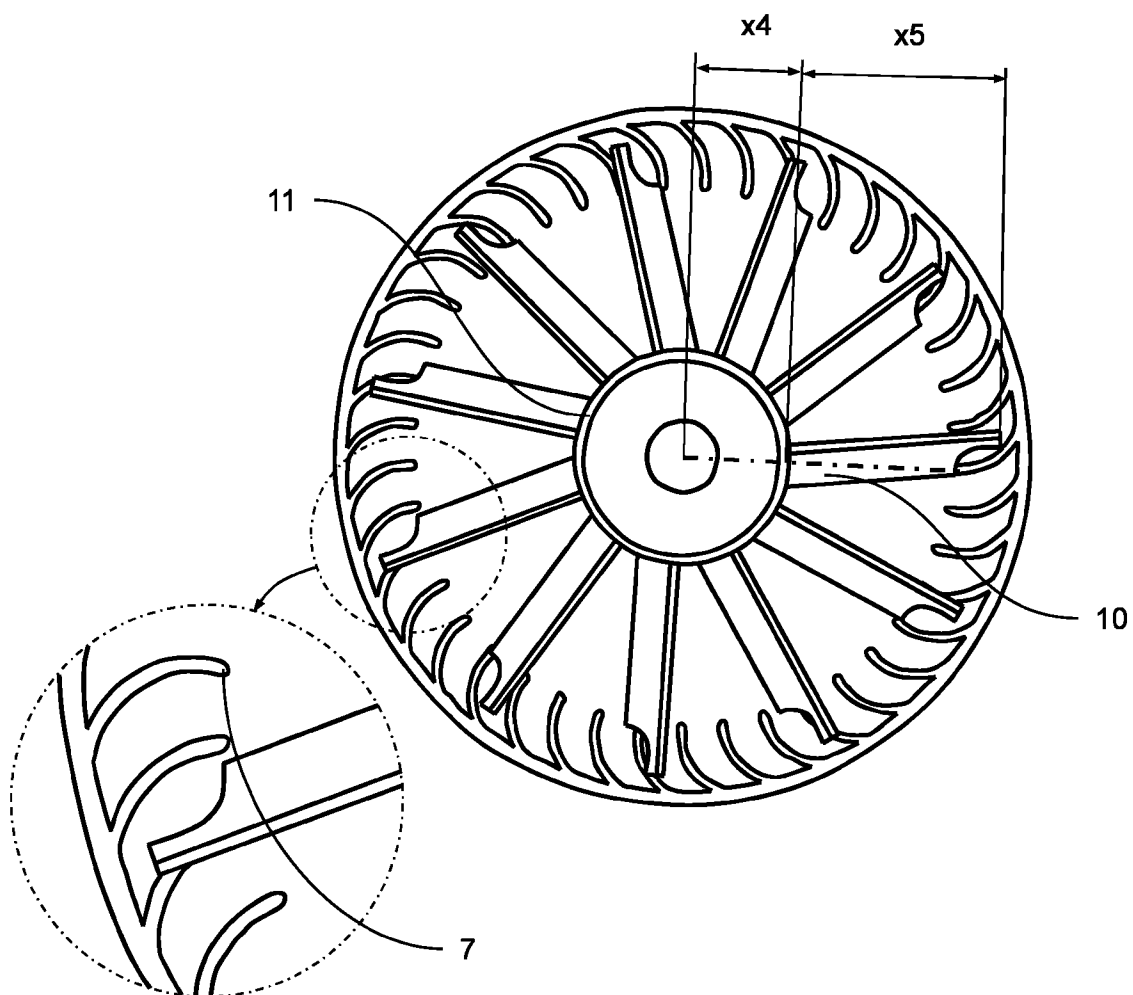


Fig. 6

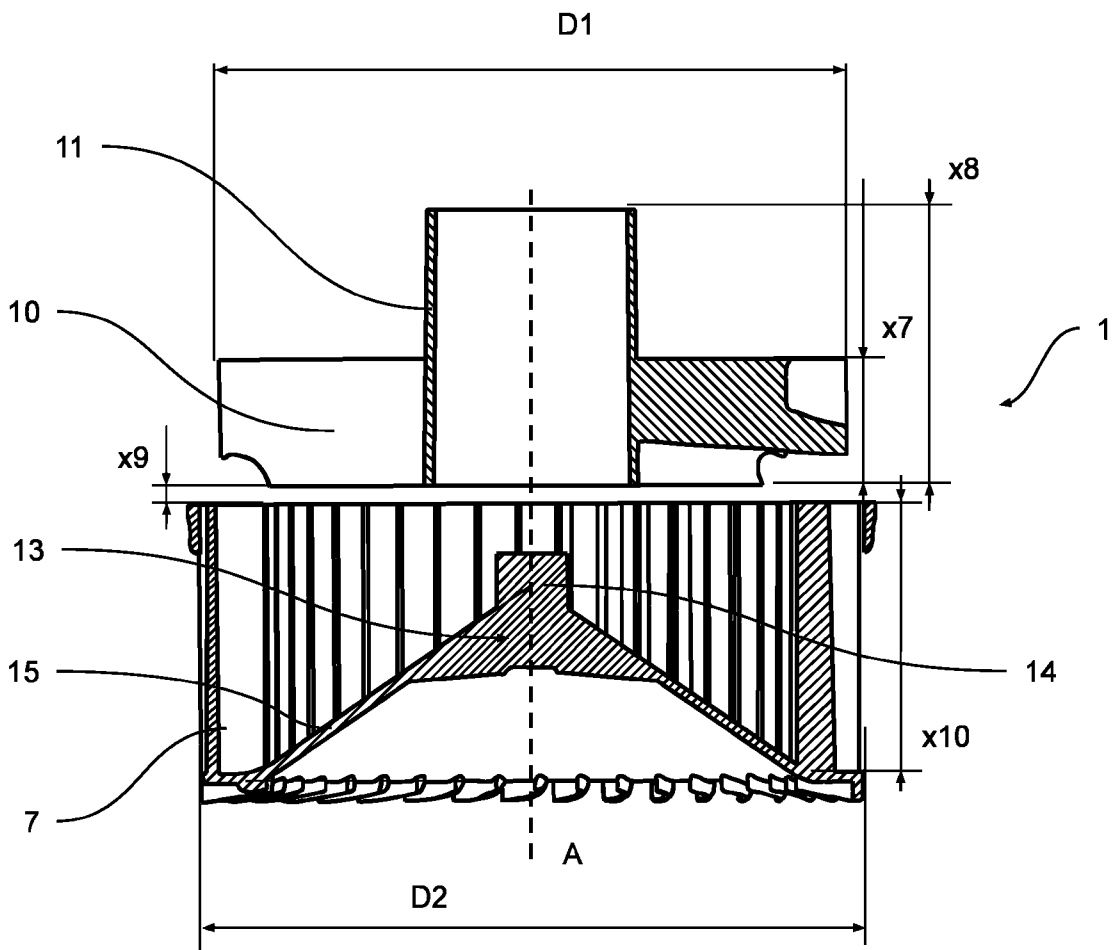


Fig. 7

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2024/060146

A. CLASSIFICATION OF SUBJECT MATTER INV. F04D29/28 F04D29/42 F04D29/44 B60H1/00 ADD.		
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) F04D B60H Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EPO-Internal		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 092 988 A (BOTROS MONIER BIBAWY [US]) 25 July 2000 (2000-07-25) column 3, line 57 - column 4, line 10 figures 1, 3, 4, 9 -----	1 - 19
X	JP H07 305696 A (DAIKIN IND LTD) 21 November 1995 (1995-11-21) figures 5, 6 -----	1 - 8, 11 - 19
A		9, 10
X	JP H05 195998 A (MITSUBISHI HEAVY IND LTD) 6 August 1993 (1993-08-06) figures 1-3 -----	1 - 19
A	US 2020/408216 A1 (ZHANG TIECHENG [JP] ET AL) 31 December 2020 (2020-12-31) paragraph [0037] figure 4 ----- - / - -	1 - 19
☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
* Special categories of cited documents : "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance;; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance;; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 28 February 2025		Date of mailing of the international search report 12/03/2025
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016		Authorized officer Oliveira, Damien

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2024/060146

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2021/340995 A1 (BRISENHEIM ERIK [SE]) 4 November 2021 (2021-11-04) figures 8-11d -----	1 - 19
A	US 2018/080470 A1 (KOGA JUN [JP] ET AL) 22 March 2018 (2018-03-22) figures 4, 12 -----	1 - 19

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2024/060146

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 6092988	A	25-07-2000	DE 69925071 T2	02-03-2006
			EP 0971131 A2	12-01-2000
			KR 20000012143 A	25-02-2000
			US 6092988 A	25-07-2000

JP H07305696	A	21-11-1995	NONE	

JP H05195998	A	06-08-1993	NONE	

US 2020408216	A1	31-12-2020	CN 112145458 A	29-12-2020
			US 2020408216 A1	31-12-2020

US 2021340995	A1	04-11-2021	DE 102018127718 A1	07-05-2020
			EP 3833873 A1	16-06-2021
			US 2021340995 A1	04-11-2021
			WO 2020094443 A1	14-05-2020

US 2018080470	A1	22-03-2018	CN 107429708 A	01-12-2017
			JP 6594019 B2	23-10-2019
			JP 2016200119 A	01-12-2016
			US 2018080470 A1	22-03-2018
			WO 2016166910 A1	20-10-2016
