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(54) MODULAR AIR FLOW DEVICE

(57) A modular air flow (1-1) device comprising: a first end module (3) forming a first end of the modular air flow device (1-1), the first end module (3) having a first axial outer end (3a), and a first axial inner end (3b), the first end module (3) being provided with a first airflow channel (3c) and a second airflow channel (3d), which extend from the first axial outer end (3a) to the first axial inner end (3b), wherein at the first axial outer end (3a) the inner diameter of the first airflow channel (3c) is larger than a radial distance from a central longitudinal axis (17) of the first end module (3) to an inner diameter surface of the first airflow channel furthest away from the central longitudinal axis; and a first fan (9) arranged in or connected to the first airflow channel (3c) at the first axial outer end (3a).

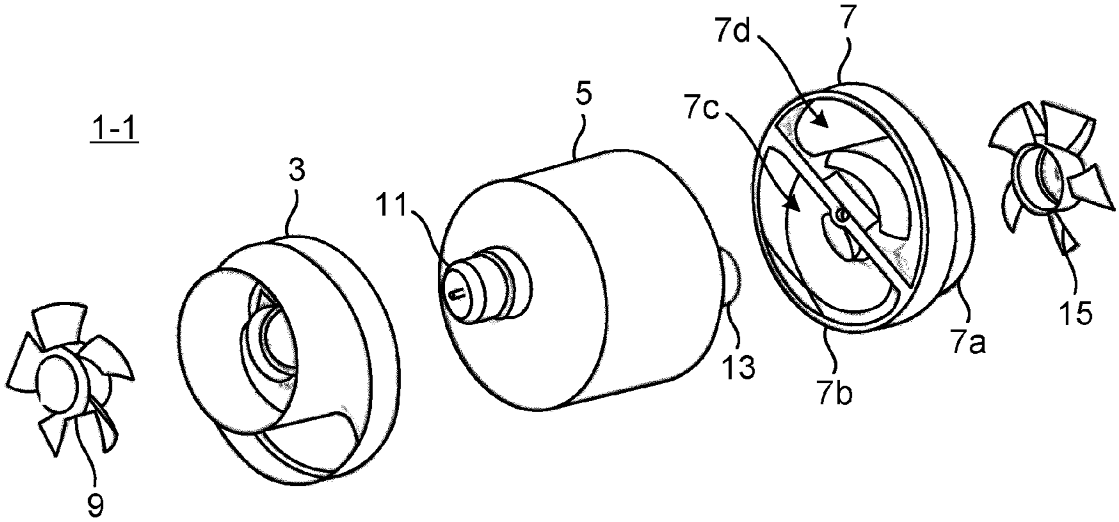

Fig. 2

Processed by Luminess, 75001 PARIS (FR)

Description

TECHNICAL FIELD

[0001] The present disclosure generally relates to airflow devices such as room ventilators.

BACKGROUND

[0002] Airflow devices such as room ventilators may be used for ventilating individual rooms in buildings.

[0003] CN 208 282 345 U discloses a device comprising air flow channels passing through a rotating heat exchanger. Each airflow channel includes a circular end portion fitted with a respective axial fan.

[0004] One issue with the device disclosed in CN 208 282 345 U is that it is relatively loud due to the limited size of the axial fans.

SUMMARY

[0005] The fans of CN 208 282 345 U are provided in a respective circular channel. The circular channels are relatively small, because half of the available space in cross-section, at the ends, is occupied by the other channel. Therefore, the axial fan will have to be small to fit in the circular channels. As a result, the fans have to be driven with a higher rotational speed for a given airflow.

[0006] An object of the present disclosure is thus to provide an airflow device which solves, or at least mitigates problems of the prior art.

[0007] There is hence according to a first aspect of the present disclosure provided a modular air flow device comprising: a first end module forming a first end of the modular air flow device, the first end module having a first axial outer end, and a first axial inner end, the first end module being provided with a first airflow channel and a second airflow channel, which extend from the first axial outer end to the first axial inner end, wherein at the first axial outer end the inner diameter of the first airflow channel is larger than a radial distance from a central longitudinal axis of the first end module to an inner diameter surface of the first airflow channel furthest away from the central longitudinal axis, and a first fan arranged in or connected to the first airflow channel at the first axial outer end.

[0008] By providing a first airflow channel with a diameter that is larger than the radial distance from the central longitudinal axis of the first end module to a radially outer boundary of the first airflow channel, a larger fan may be provided in the first airflow channel. Thus, the speed of the fan may be reduced for a given airflow compared to the solution in CN 208 282 345 U. The fan will therefore become quieter and will moreover require less power to be driven.

[0009] With "modular" is herein meant that the airflow device is composed of a plurality of individual modules, such as the first end module. The modules to be included in the airflow device may be selected based on user-requirements and/or the application in which the airflow device is to be used.

[0010] According to one example, the first fan has a diameter that is at least 95%, such as at least 98%, of the inner diameter of the first airflow channel.

[0011] According to one embodiment the inner diameter is at least 5%, at least 10%, at least 15%, at least 20%, at least 25%, at least 30%, or at least 35% larger than the radial distance from the central longitudinal axis to the inner diameter surface.

[0012] The inner diameter may be larger than the radial distance from the central longitudinal axis of the first end module to an outer surface of the first end module.

[0013] According to one embodiment at the first axial outer end the first airflow channel has a cross-sectional shape of a circle.

[0014] According to one embodiment at the first axial outer end the second airflow channel has a cross-sectional shape of a crescent.

[0015] According to one embodiment in a direction from the first axial outer end towards the first axial inner end the cross-sectional shape of each of the first airflow channel and the second airflow channel transitions to a circle sector having a central angle of at most 180 degrees.

[0016] The central angle may for example be in the range of 150-180 degrees.

[0017] One embodiment comprises a rotatable heat or enthalpy exchanger module configured to be arranged adjacent to the first axial inner end of the first end module.

[0018] According to one embodiment the first airflow channel is a first air outlet, and the second airflow channel is a first air inlet.

[0019] One embodiment comprises an outer tube, wherein the first end module is configured to be arranged in the outer tube.

[0020] According to one embodiment the modular air flow device is a room ventilator.

[0021] One embodiment comprises: a second end module forming a second end opposite to the first end, the second end module having a second axial outer end and a second axial inner end, the second end module being provided with a third airflow channel and a fourth airflow channel, which extend from the second axial outer end to the second axial inner end, wherein at the second axial outer end the inner diameter of the third airflow channel is larger than a radial distance from a central longitudinal axis of the second end module to an inner diameter surface of the third airflow channel furthest away from the central longitudinal axis, and a second fan arranged in or connected to the third airflow channel at the second axial outer end, wherein the first airflow channel is in fluid connection with the fourth airflow channel, and the second airflow channel is in fluid connection with the third airflow channel.

[0022] According to one example, at the second axial outer end the inner diameter is at least 5%, at least 10%, at least 15%, at least 20%, at least 25%, at least 30%, or at least 35% larger than the radial distance from the central longitudinal axis of the first end module to the inner diameter surface.

[0023] At the second axial outer end, the inner diameter may be larger than the radial distance from the central longitudinal axis of the second end module to an outer surface of the second end module.

[0024] According to one embodiment in a direction from the second axial outer end towards the second axial inner end the cross-sectional shape of each of the third airflow channel and the fourth airflow channel transitions to a circle sector having a central angle of at most 180 degrees.

[0025] The central angle may for example be in the range of 150-180 degrees.

[0026] According to one embodiment at the second axial outer end the third airflow channel has a cross-sectional shape of a circle.

[0027] According to one embodiment at the second axial end the fourth airflow channel has a cross-sectional shape of a crescent.

[0028] Generally, all terms used in the claims are to be interpreted according to their ordinary meaning in the technical field, unless explicitly defined otherwise herein. All references to "a/an/the member, apparatus, component, means, etc." are to be interpreted openly as referring to at least one instance of the member, apparatus, component, means, etc., unless explicitly stated otherwise.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029] The specific embodiments of the inventive concept will now be described, by way of example, with reference to the accompanying drawings, in which:

Fig. 1 schematically shows a perspective view of an example of a modular airflow device;

Fig. 2 is an exploded view of the modular airflow device in Fig. 1;

Fig. 3 is a front view of the modular airflow device in Fig. 1;

Fig. 4 is a perspective view of a first end module, seen from the first axial inner end;

Fig. 5 shows a longitudinal section of the modular airflow device in Fig. 1, illustrating the airflow;

Fig. 6 is a perspective view of another example of a modular airflow device; and

Fig. 7 shows a longitudinal section of the modular airflow device in Fig. 6, illustrating the airflow.

DETAILED DESCRIPTION

[0030] The inventive concept will now be described more fully hereinafter with reference to the accompanying drawings, in which exemplifying embodiments are shown. The inventive concept may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided by way of example so that this disclosure will be thorough and complete, and will fully convey the scope of the inventive concept to those skilled in the art. Like numbers refer to like members throughout the description.

[0031] Fig. 1 is an example of a modular airflow device 1-1. The airflow device 1-1 comprises a first end module 3, a rotatable heat or enthalpy exchanger module 5, and a second end module 7.

[0032] The airflow device 1-1 could alternatively be provided without the rotatable heat or enthalpy exchanger module 5. This concerns all examples disclosed herein.

[0033] The first end module 3 and the second end module 7 are arranged at opposite axial ends of the airflow device 1-1.

[0034] The rotatable heat or enthalpy exchanger module 5 is arranged axially between the first end module 3 and the second end module 7.

[0035] The first end module 3 is configured to be connected to a first end of the rotatable heat or enthalpy exchanger module 5. The second end module 7 is configured to be connected to a second end of the rotatable heat or enthalpy exchanger module 5. The modular airflow device 1-1- may thus be assembled from the first end module 3, the rotatable heat or enthalpy exchanger module 5, and the second end module 7, which all form modules of the airflow device 1-1.

[0036] The first end module 3 has a first axial outer end 3a and a first axial inner end 3b. The first end module 3 has an axial extension between the first axial outer end 3a and the first axial inner end 3b. The first axial outer end 3a and the first axial inner end 3b form opposite ends of the first end module 3.

[0037] The first end module 3 has a first airflow channel 3c extending through the first end module 3 from the first axial outer end 3a to the first axial inner end 3b. The first airflow channel 3c may for example be a first air outlet.

[0038] The first end module 3 has a second airflow channel 3d extending through the first end module 3 from the first axial outer end 3a to the first axial inner end 3b. The second airflow channel 3d may for example be a first air inlet.

[0039] The first airflow channel 3c and the second airflow channel 3d are arranged in parallel with each other.

[0040] The first airflow channel 3c and the second airflow channel 3d change cross-sectional shape as they extend from the first axial outer end 3a to the first axial inner end 3b, as will be explained in more detail in the following.

[0041] The modular airflow device 1-1 comprises a first fan 9, which in the present example is a first axial fan 9. The first axial fan 9 is arranged in the first airflow channel 3d at the first axial outer end 3a.

[0042] The second end module 7 is in this example identical to the first end module 3. The second end module 7 is arranged at a 180° angle relative to first end module 3, the second end module 7 having been rotated about a central longitudinal axis of the modular airflow device 1-1.

[0043] Fig. 2 shows an exploded view of the modular airflow device 1-1.

[0044] The airflow device 1-1 comprises a first motor 11 configured to drive the first axial fan 9. The first motor 11 is arranged in the first end module 3.

[0045] The second end module 7 has a second axial outer end 7a and a second axial inner end 7b. The second end module 7 has an axial extension between the second axial outer end 7a and the second axial inner end 7b. The second axial outer end 7a and the second axial inner end 7b form opposite ends of the second end module 7.

[0046] The second end module 7 has a third airflow channel 7c extending through the second end module 7 from the second axial outer end 7a to the second axial inner end 7b. The third airflow channel 7c may for example be a second air outlet.

[0047] The second end module 7 has a fourth airflow channel 7d extending through the second end module 7 from the second axial outer end 7a to the second axial inner end 7b. The fourth airflow channel 7d may for example be a second air inlet.

[0048] The first airflow channel 3c and the second airflow channel 3d are arranged in parallel with each other.

[0049] The third airflow channel 7c and the fourth airflow channel 7d change cross-sectional shape as they extend from the second axial outer end 7a to the second axial inner end 7b.

[0050] In the example, the first airflow channel 3c and the third airflow channel 7c are identical and the second airflow channel 3d and the fourth airflow channel 7d are identical.

[0051] The modular airflow device 1-1 comprises a second fan 15, which in the present example is a second axial fan 15. The second axial fan 15 is arranged in the third airflow channel 7d at the second axial outer end 7a.

[0052] The airflow device 1-1 comprises a second motor 13 configured to drive the second axial fan 15. The second motor 15 is arranged in the second end module 7.

[0053] The first airflow channel 3c is connected to the fourth airflow channel 7d. The first airflow channel 3c is axially aligned with the fourth airflow channel 7d. A first airflow passes through the airflow device 1-1 via the fourth airflow channel 7d and the first airflow channel 3c.

[0054] The second airflow channel 3d is connected to the third airflow channel 7c. The second airflow channel 3d is axially aligned with the third airflow channel 7c. A second airflow passes through the airflow device 1-1 via the second airflow channel 3d and the third airflow channel 7c.

[0055] In the present example, airflows through the airflow device 1-1 pass the rotatable heat or enthalpy exchanger module 5.

[0056] The airflow device 1-1 comprises a third motor (not shown), configured to drive the rotatable heat or enthalpy exchanger module to rotate. The third motor may for example be arranged in one of the first end module 3 and the second end module 7.

[0057] The rotatable heat or enthalpy exchanger module 5 may have a cylindrical shape. The rotatable heat or enthalpy exchanger module 5 comprises a plurality of axially extending heat exchanger channels extending along the longitudinal axis of the rotatable heat or enthalpy exchanger module 5.

[0058] The airflow device 1-1 has an outer tube (not shown), in which the first end module 3, the second end module 7 and the rotatable heat or enthalpy exchanger module 5 are arranged. The outer tube thus radially envelopes the first end module 3, the second end module 7 and the rotatable heat or enthalpy exchanger module 5. The outer tube may be a cover or housing.

[0059] The airflow device 1-1- is in use typically installed in a wall, with e.g. the first axial outer end 3a being provided on the outside of the building, and the second axial outer end 7a being provided on the inside of the building.

[0060] Fig. 3 shows a front view of the airflow device 1-1. In particular, the first axial outer end 3a of the first end module 3 is shown.

[0061] The first airflow channel 3c has the cross-sectional shape of a circle at the first axial outer end 3d. The second airflow channel 3d has the cross-sectional shape of a crescent at the first axial outer end 3d. The second airflow channel 3d is arranged adjacent to the first airflow channel 3c. The second airflow channel 3d partly surrounds the first airflow channel 3c. The first airflow channel 3c and the second airflow channel 3d may form part of a larger circle, which is defined by the outer perimeter of the first end module 3.

[0062] The first airflow channel 3c has an inner diameter d. The first end module 3 has a central longitudinal axis 17. The inner diameter d is larger than a radial distance a from the central longitudinal axis 17 to an inner diameter surface of the first airflow channel 3c furthest away from the central longitudinal axis 17. The radial distance a is measured at the first axial outer end 3a of the first end module 3. The first airflow channel 3c thus intersects and extends past the central longitudinal axis 17. The inner diameter d may be larger than the radius of the first end module 3 at the first axial outer end 3a.

[0063] Fig. 4 is the first end module 3 in perspective, depicting the first axial inner end 3b.

[0064] As the first airflow channel 3c extends through the first end module 3 from the first axial outer end 3a to the first axial inner end 3b its cross-sectional shape changes. The cross-sectional shape changes from circular-shaped to a circle sector having a central angle of at most 180 degrees.

[0065] The central angle may for example be in the range of 150-180 degrees.

[0066] As the second airflow channel 3d extends through the first end module 3 from the first axial outer end 3a to the first axial inner end 3b its cross-sectional shape changes. The cross-sectional shape changes from crescent-shaped to a circle sector having a central angle of at most 180 degrees.

[0067] The central angle may for example be in the range of 150-180 degrees.

[0068] Thus, both the first airflow channel 3c and the second airflow channel 3d will have about the same cross-sectional shape and area when they connect to the rotatable heat or enthalpy exchanger module 5.

[0069] Fig. 5 illustrates the airflow through the airflow device 1-1. A first airflow A flows into the airflow device 1-1 via the fourth airflow channel 7d, passes the rotatable heat or enthalpy exchanger module 5 and exits the airflow device 1-1 via the first airflow channel 3c. The first fan 9 sucks air from inside the airflow device 1-1 but could alternatively push air into the airflow device 1-1.

[0070] A second airflow B flows into the airflow device 1-1 via the second airflow channel 3d, passes the rotatable heat or enthalpy exchanger module 5 and exits the airflow device 1-1 via the third airflow channel 7c. The second fan 15 sucks air from inside the airflow device 1-1 but could alternatively push air into the airflow device 1-1.

[0071] The first airflow A and the second airflow B flow in opposite directions through the airflow device 1-1.

[0072] Fig. 6 shows another example of a modular airflow device. The modular airflow device 1-2 depicted in Fig. 6 is similar to the airflow device 1-1. The airflow device 1-2 has a first end module 3 and a rotatable heat or enthalpy exchanger module 5, which are the same as for the airflow device 1-1. The airflow device 1-2 has a second end module 7' which is similar to the first and second end modules 3 and 7. The second end module 7' does however not have a sleeve 20 for housing an axial fan in the third airflow channel, like the first and second end modules 3 and 7 have. The second end module 7' has a third airflow channel which otherwise is configured in the same manner as the third airflow channel 7c of the second end module 7. The second end module 7' is not provided with an axial fan in the third airflow channel 7c'.

[0073] The airflow device 1-2 comprises a second fan 19, in the present example a radial fan 19, which has its inlet connected to the third airflow channel at the second axial outer end of the second end module 7'. The inlet may be connected directly to the third airflow channel 7c'. The second end module 7' also has a fourth airflow channel 7d' which is configured like the fourth airflow channel 7d of the second end module 7.

[0074] The radial fan 19 has a radial fan outlet 21 which in the present example is angled at 90° relative to the central longitudinal axis of the airflow device 1-2.

[0075] The airflow device 1-2 is typically installed in a wall with the radial fan 19 being placed outside the building and the first end module 3 arranged inside the building but could alternatively be installed oppositely.

[0076] Fig. 7 shows the airflow through the airflow device 1-2.

[0077] The airflow device 1-2 comprises a second motor 13 configured to drive the radial fan 19.

[0078] An airflow C enters the airflow device 1-2 through the fourth airflow channel 7d' of the second end module 7'. The airflow C then passes through the rotatable heat or enthalpy exchanger module 5 and exits the airflow device 1-2 through the first airflow channel 3c.

[0079] An airflow D which is oppositely directed relative to the airflow C in the airflow device 1-2 enters the airflow device 1-2 through the second airflow channel 3d. The airflow D then passes through the rotatable hear exchanger 5 and exits the airflow device through the third airflow channel 7'c into the inlet of the radial fan 19. The airflow D then exits the airflow device 1-2 via the radial fan outlet 21.

[0080] The radial fan 19 sucks air from inside the airflow device 1-2 but could alternatively push air into the airflow device 1-2.

[0081] According to one alternative the modular airflow device could be provided with two radial fans, each connected to a respective one of the first end module and the second end module in the same way as illustrated with the radial fan 19 in the example of Figs 6-7. The first fan and the second fan may thus in this case be radial fans.

[0082] The inventive concept has mainly been described above with reference to a few examples. However, as is readily appreciated by a person skilled in the art, other embodiments than the ones disclosed above are equally possible within the scope of the inventive concept, as defined by the appended claims.

Claims

1. A modular air flow (1-1; 1-2) device comprising:

a first end module (3) forming a first end of the modular air flow device (1-1; 1-2), the first end module (3) having a first axial outer end (3a), and a first axial inner end (3b),

the first end module (3) being provided with a first airflow channel (3c) and a second airflow channel (3d), which extend from the first axial outer end (3a) to the first axial inner end (3b),
wherein at the first axial outer end (3a) the inner diameter (d) of the first airflow channel (3c) is larger than a radial distance (a) from a central longitudinal axis (17) of the first end module (3) to an inner diameter surface of the first airflow channel furthest away

from the central longitudinal axis (17); and

a first fan (9) arranged in or connected to the first airflow channel (3c) at the first axial outer end (3a).

2. The modular air flow device (1-1; 1-2) as claimed in claim 1, wherein the inner diameter (d) is at least 5%, at least 10%, at least 15%, at least 20%, at least 25%, at least 30%, or at least 35% larger than the radial distance (a) from the central longitudinal axis (17) to the inner diameter surface.

3. The modular air flow device (1-1; 1-2) as claimed in claim 1 or 2, wherein at the first axial outer end (3a) the first airflow channel (3c) has a cross-sectional shape of a circle.

4. The modular air flow device (1-1; 1-2) as claimed in any of the preceding claims, wherein at the first axial outer end (3a) the second airflow channel (3d) has a cross-sectional shape of a crescent.

5. The modular air flow device (1-1; 1-2) as claimed in any of the preceding claims, wherein in a direction from the first axial outer end (3a) towards the first axial inner end (3b) the cross-sectional shape of each of the first airflow channel (3c) and the second airflow channel (3d) transitions to a circle sector having a central angle of at most 180 degrees.

6. The modular air flow device (1-1; 1-2) as claimed in any of the preceding claims, comprising a rotatable heat or enthalpy exchanger module (5) configured to be arranged adjacent to the first axial inner end (3b) of the first end module (3).

7. The modular air flow device (1-1; 1-2) as claimed in any of the preceding claims, wherein the first airflow channel (3c) is a first air outlet, and the second airflow channel (3d) is a first air inlet.

8. The modular air flow device (1-1; 1-2) as claimed in any of the preceding claims, comprising an outer tube, wherein the first end module (3) is configured to be arranged in the outer tube.

9. The modular air flow device (1-1; 1-2) as claimed in any of the preceding claims, wherein the modular air flow device (1-1; 1-2) is a room ventilator.

10. The modular air flow device (1-1; 1-2) as claimed in any of the preceding claims, comprising:

a second end module (7; 7') forming a second end opposite to the first end (3), the second end module (7; 7') having a second axial outer end (7a) and a second axial inner end (7b),

the second end module (7; 7') being provided with a third airflow channel (7c; 7c') and a fourth airflow channel (7d, 7d'), which extend from the second axial outer end (7a) to the second axial inner end (7b),
wherein at the second axial outer end (7a) the inner diameter of the third airflow channel (7c; 7c') is larger than a radial distance from a central longitudinal axis of the second end module (7; 7') to an inner diameter surface of the third airflow channel (7c; 7c') furthest away from the central longitudinal axis; and

a second fan (15; 19) arranged in or connected to the third airflow channel (7c; 7c') at the second axial outer end (7b),
wherein the first airflow channel (3c) is in fluid connection with the fourth airflow channel (7d; 7d'), and the second airflow channel (3d) is in fluid connection with the third airflow channel (7c; 7c').

11. The modular air flow device (1-1; 1-2) as claimed in claim 10, wherein in a direction from the second axial outer end (7a) towards the second axial inner end (7b) the cross-sectional shape of each of the third airflow channel (7c; 7c') and the fourth airflow channel (7d; 7d') transitions to a circle sector having a central angle of at most 180 degrees.

12. The modular air flow device (1-1; 1-2) as claimed in claim 10 or 11, wherein at the second axial outer end (7a) the third airflow channel (7c; 7c') has a cross-sectional shape of a circle.

13. The modular air flow device (1-1; 1-2) as claimed in any of claims 10-12, wherein at the second axial outer end (7a) the fourth airflow channel (7d; 7d') has a cross-sectional shape of a crescent.

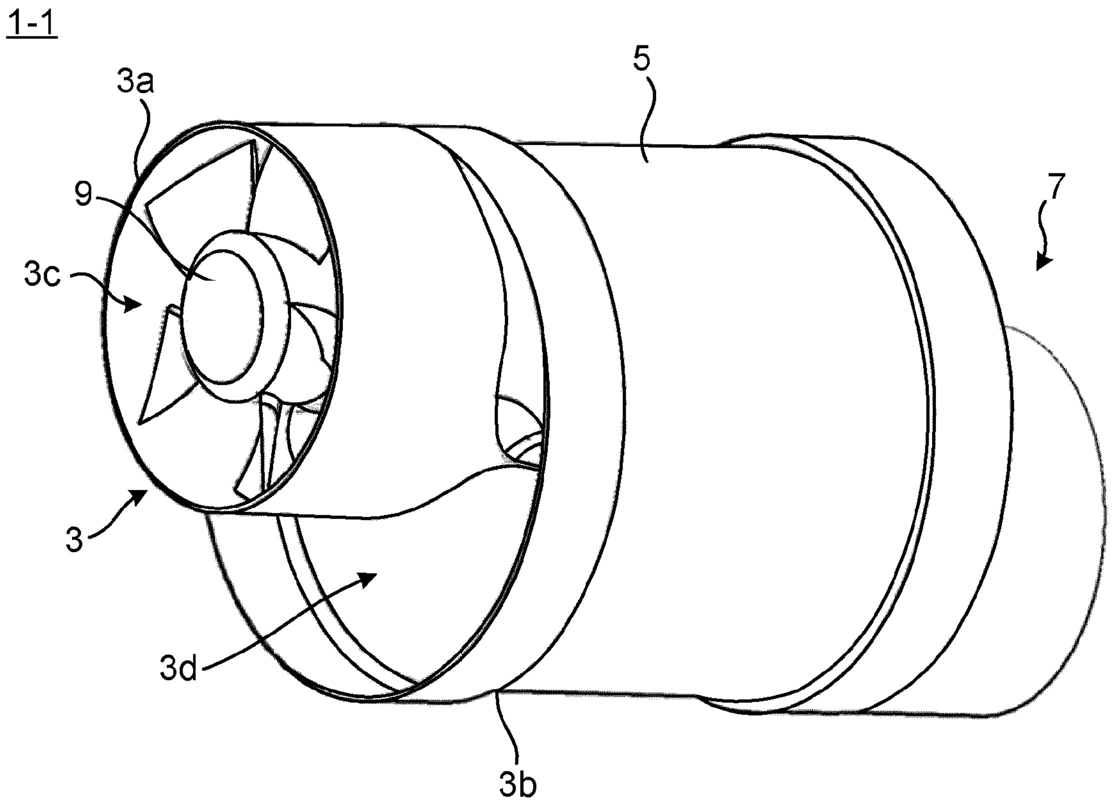

Fig. 1

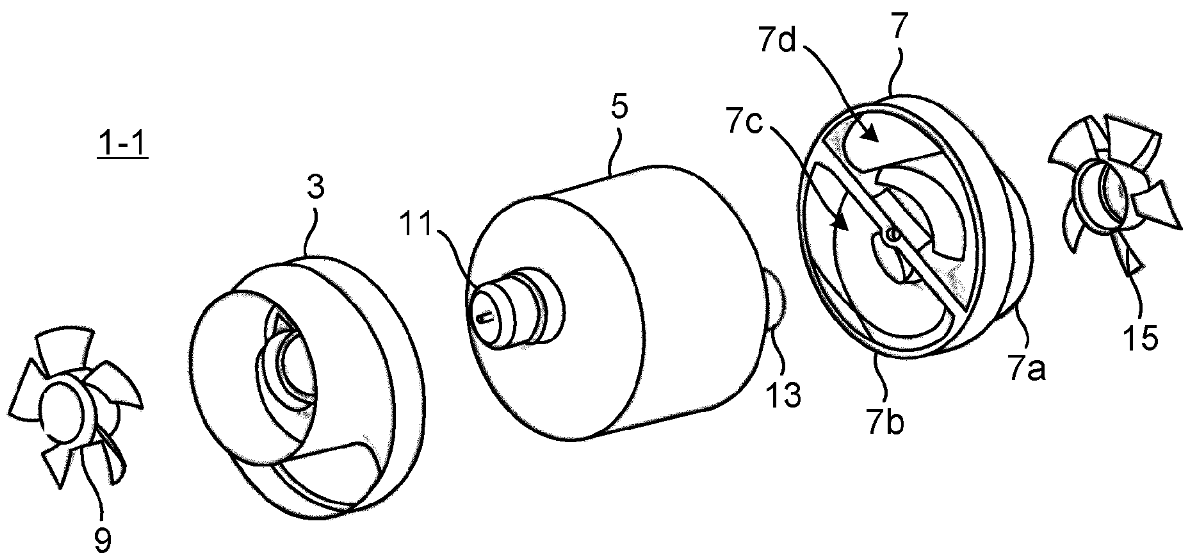

Fig. 2

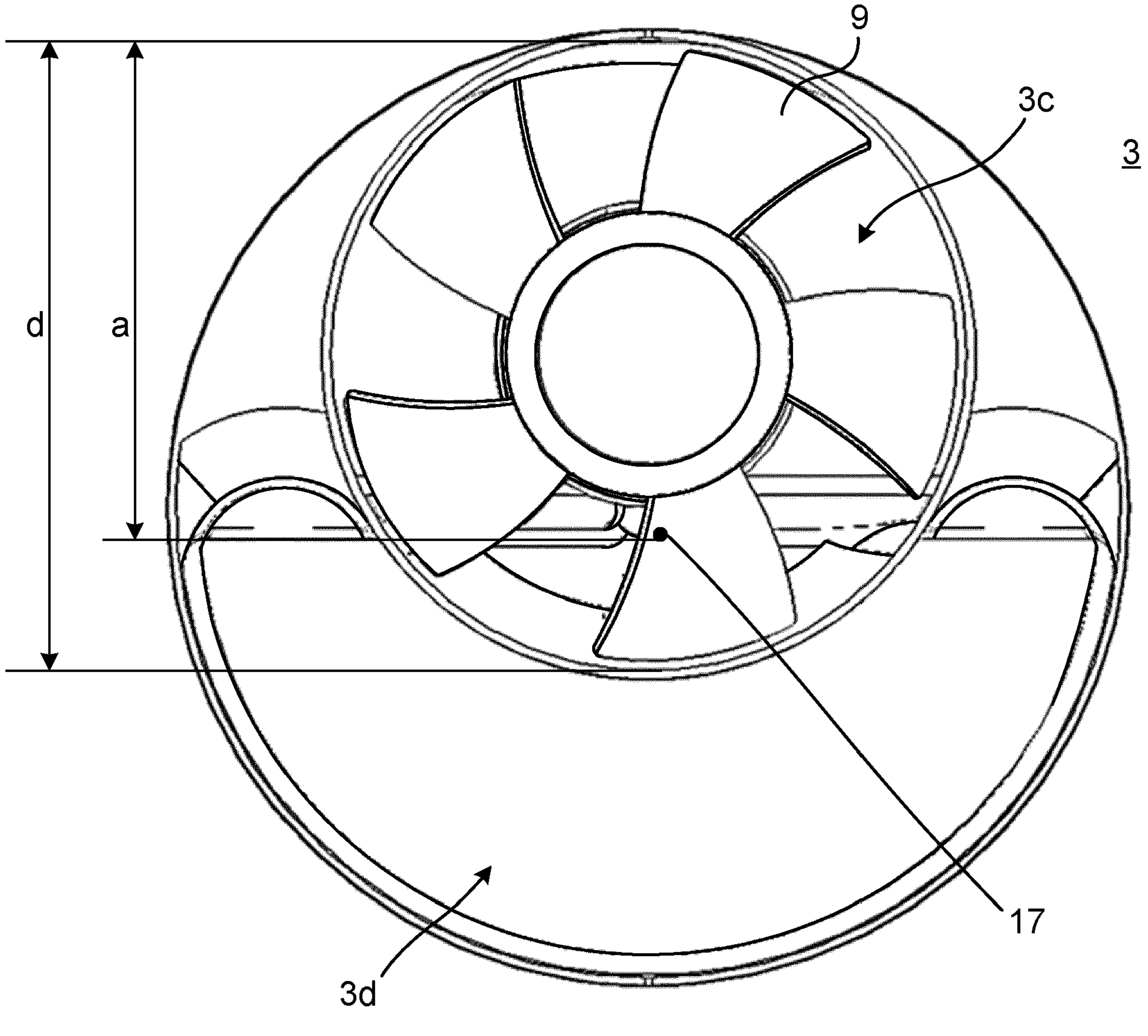

Fig. 3

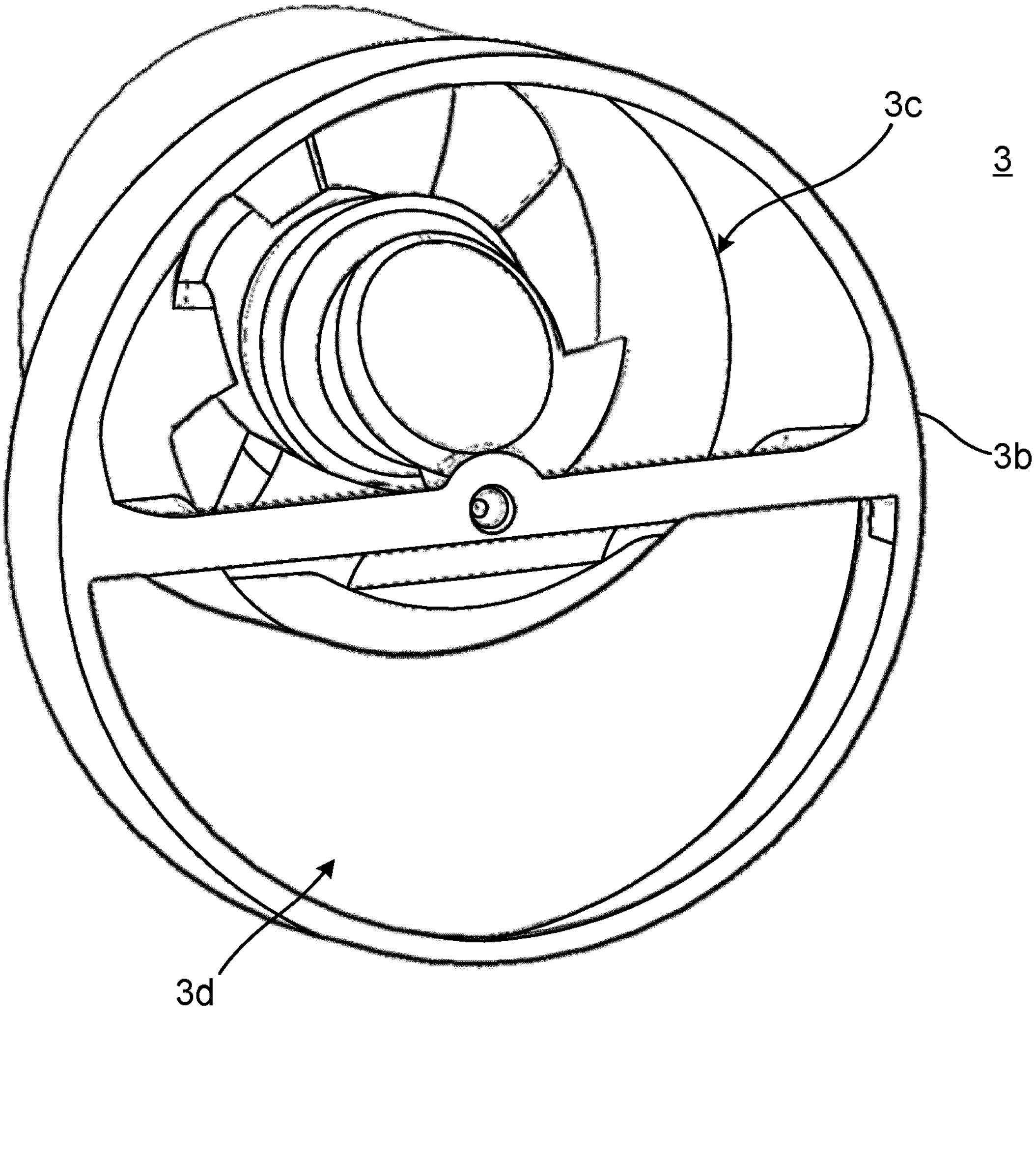

Fig. 4

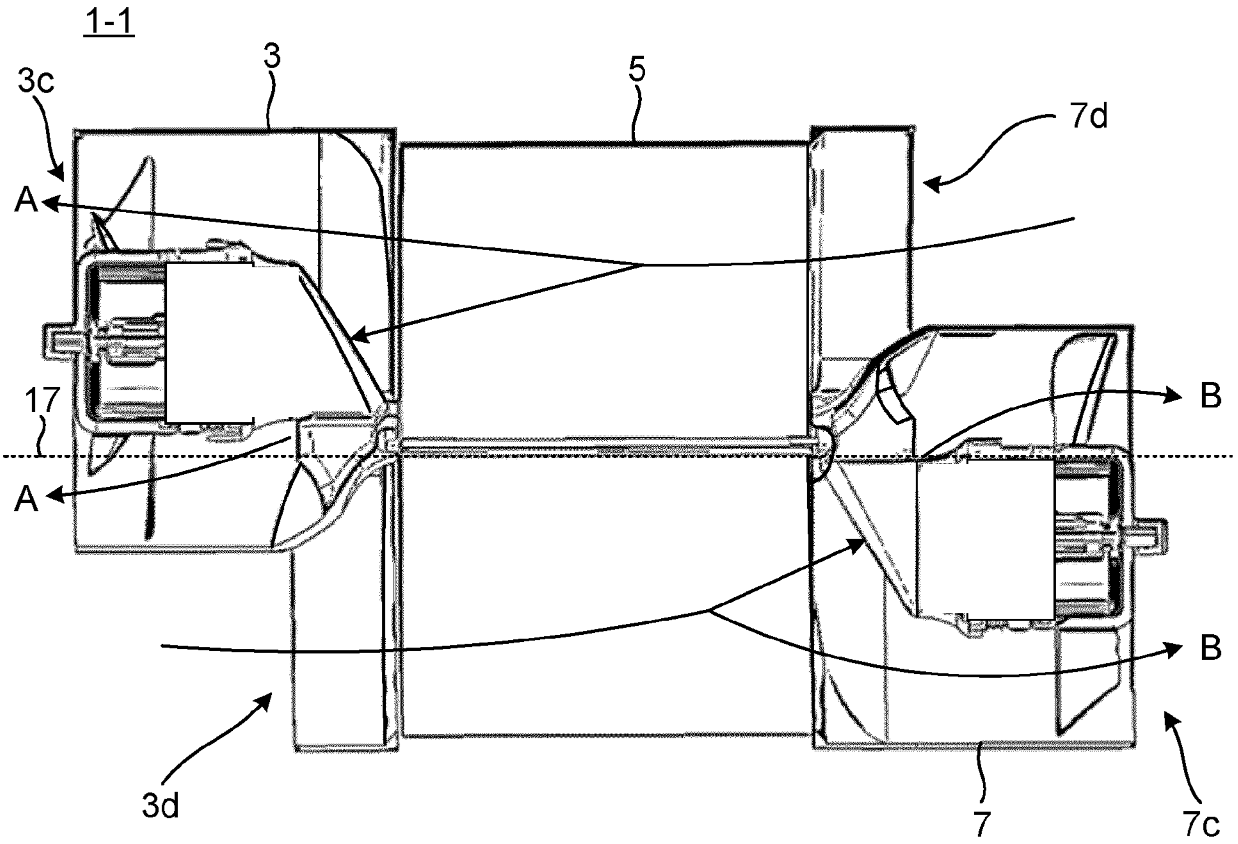

Fig. 5

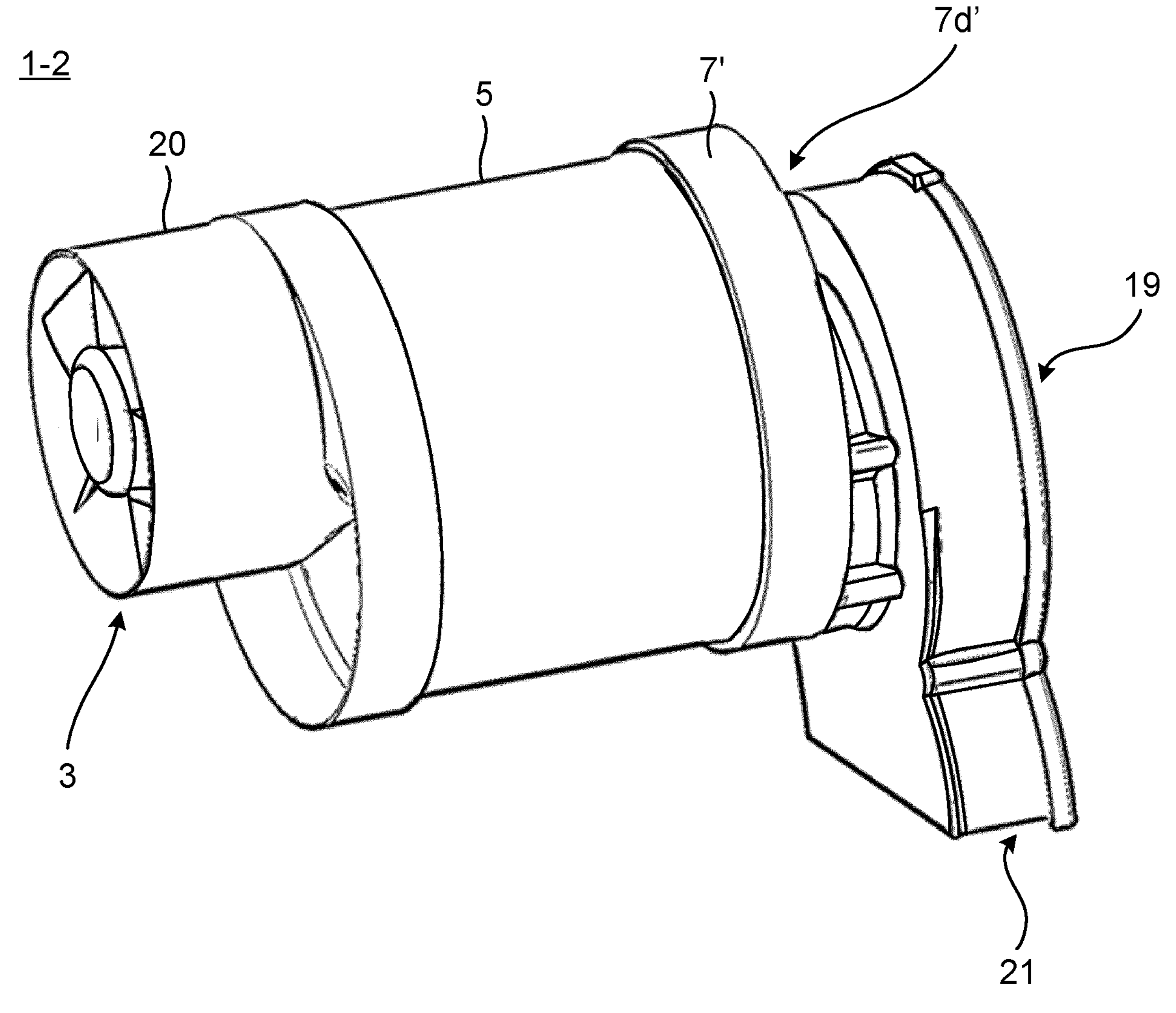

Fig. 6

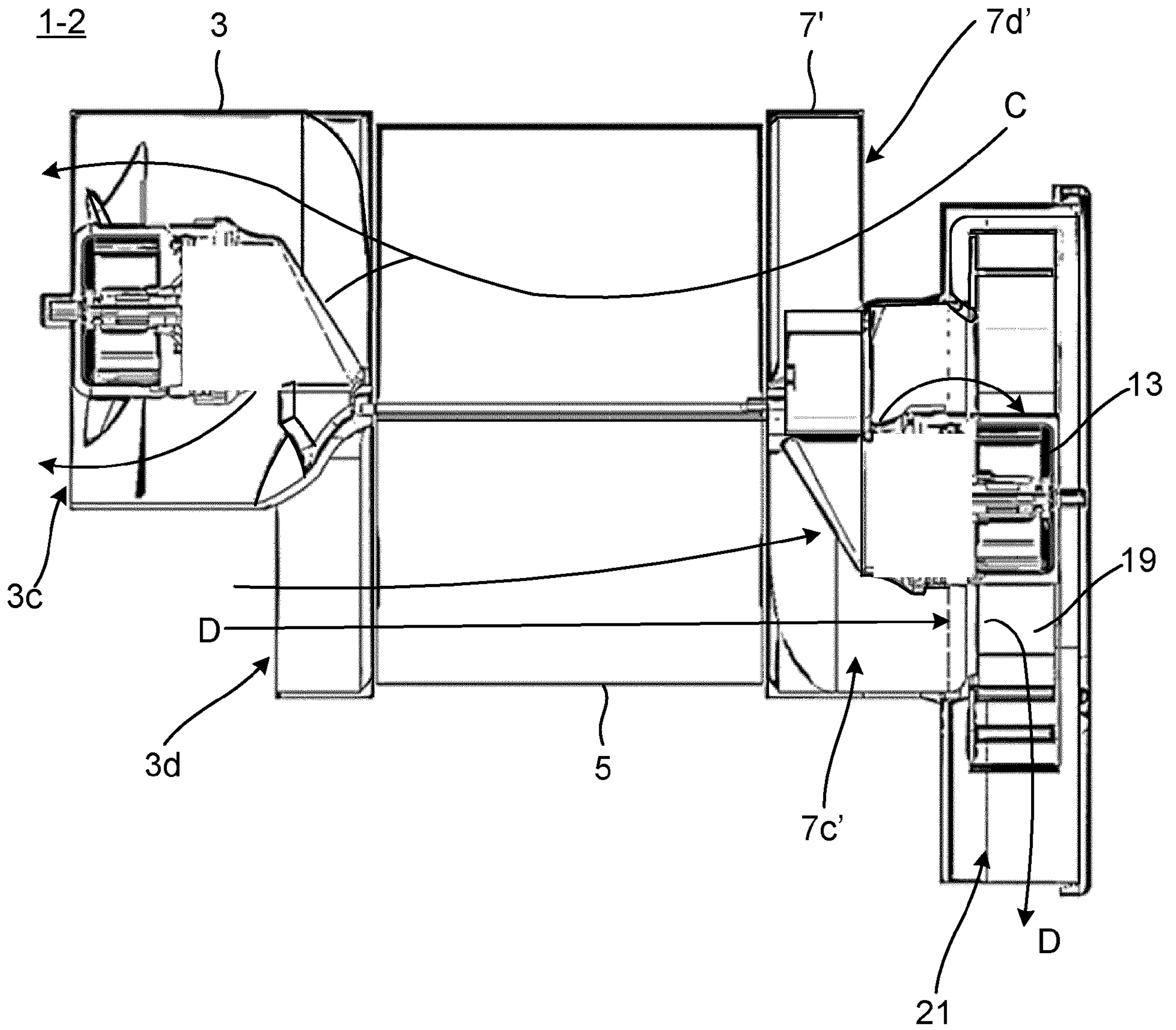

Fig. 7

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 21 16 5652

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,D A	CN 208 282 345 U (GUIZHOU DINGZHENG ENVIRONMENTAL PROT CO LTD) 25 December 2018 (2018-12-25) * the whole document * -----	1-3,5-12 4,13	INV. F24F13/08 F24F12/00 ADD. F24F13/20
A	JP S56 171317 U (-) 17 December 1981 (1981-12-17) * abstract; figure 1 * -----	1-13	
A	US 2010/155045 A1 (YANG TAI-HER [TW]) 24 June 2010 (2010-06-24) * paragraphs [0002], [0003]; figure 2 * -----	1-13	
A	NO 345 384 B1 (PEAKVENT AS [NO]) 11 January 2021 (2021-01-11) * the whole document * -----	1-13	

TECHNICAL FIELDS SEARCHED (IPC)

F24F

The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
Munich	7 September 2021	Arndt, Markus

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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