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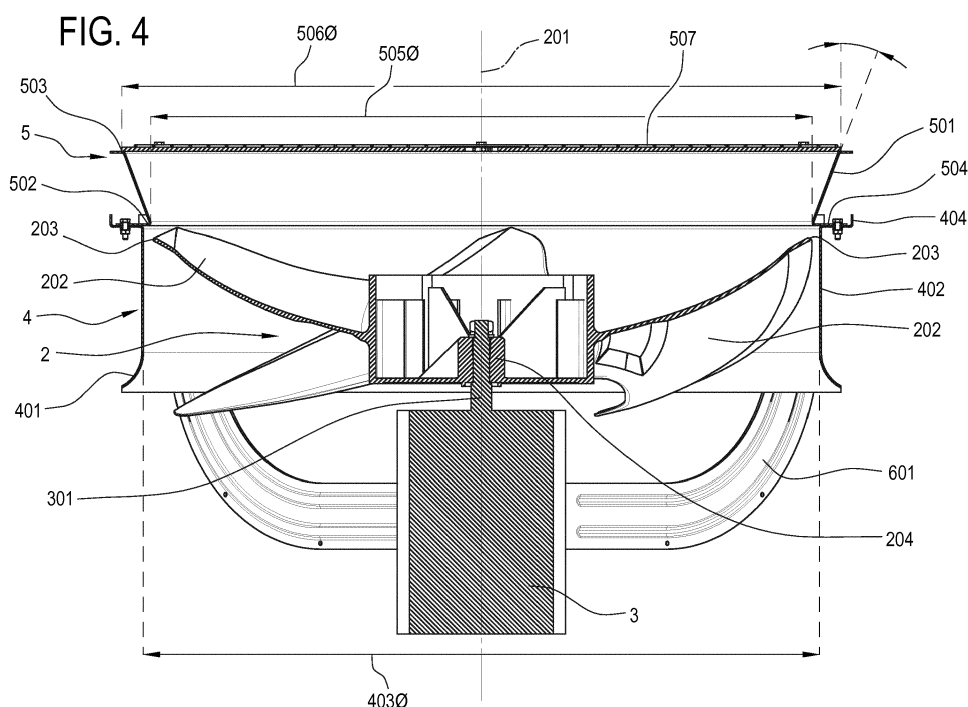
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(54) FAN FOR TEMPERATURE CONDITIONING SYSTEM

(57) A fan (1) for generating an air flow in a temperature conditioning system comprises: a blade assembly (2), rotatable about a longitudinal axis (201) to generate said air flow; a mouth (4), surrounding the blade assembly (2) coaxially to the longitudinal axis (201), wherein the mouth (4) has a minimum diameter (403) defining an annular gap with respect to the blade assembly (2); a dif-

fuser (501) having a first edge (502), facing the mouth (4), and a second edge (503), axially displaced downstream the blade assembly (2), to guide the air flowing away from the blade assembly (2). The diffuser (501) has a first diameter (505) at its first edge (502), which is smaller than the minimum diameter (403) of the mouth (4).



Description

[0001] This invention relates to a fan, for use in a temperature conditioning system.

[0002] Temperature conditioning systems, such as chillers or heat pumps, use a circulation of refrigerant fluid.

[0003] The refrigerant fluid is circulated by a compressor in a refrigerant circuit, through a condenser and an then through an evaporator.

[0004] Also, the temperature conditioning systems may include heat exchange between the refrigerant fluid and a flow of air. This air flow is typically generated through a fan.

[0005] For example, in the condenser an air flow may be provided, in order to cool down the refrigerant fluid.

[0006] Typically, the fans which are to be used in the temperature conditioning systems are subject to size constraints, to ease their coupling or to improve their interaction with other components of the refrigerant circuit.

[0007] From patent document EP0922911A2, an outdoor unit of an air-conditioning system is described, which has a reduced physical size.

[0008] However, these fans have a relatively poor efficiency.

[0009] Scope of the present invention is to overcome at least one of the aforementioned drawbacks.

[0010] This scope is achieved by the fan according to the appended claims.

[0011] This disclosure also covers a temperature conditioning system. The temperature conditioning system may for example be a chiller or a heat pump.

[0012] The temperature conditioning system has a refrigerant circuit, where a refrigerant fluid is circulated.

[0013] The (refrigerant circuit of the) temperature conditioning system comprises a compressor, for compressing the refrigerant fluid.

[0014] The (refrigerant circuit of the) conditioning system further comprises a condenser, for condensing the refrigerant fluid.

[0015] The (refrigerant circuit of the) conditioning system further comprises an expansion valve, for expanding the refrigerant fluid.

[0016] The (refrigerant circuit of the) conditioning system further comprises an evaporator, for evaporating the refrigerant fluid.

[0017] The compressor, the condenser, the expansion valve and the evaporator are connected in this order.

[0018] The (refrigerant circuit of the) conditioning system further comprises at least a fan, for generating an air flow. With the term "fan", in this document, it is meant a fan system, or fan assembly.

[0019] The (refrigerant circuit of the) conditioning system may include a plurality of fans.

[0020] In one embodiment, one or more fans are coupled to (or included in) the condenser. In this case, heat is extracted from the cooling fluid circulating in the condenser, through an air flow generated by said one or more

fans coupled to (or included in) the condenser.

[0021] In one embodiment, one or more fans are coupled to (or included in) the evaporator. In this case, heat is extracted from the flow generated by said one or more fans coupled to (or included in) the evaporator, through the cooling fluid circulating in the evaporator.

[0022] The present disclosure regards both the fan (per se) and the temperature conditioning system including one or more fans.

[0023] The fan according to the present disclosure comprises a blade assembly, rotatable about a longitudinal axis. Said longitudinal axis may have any orientation.

[0024] The blade assembly may include a hub, rotatable about the longitudinal axis, and a plurality of blades connected to the hub. Each blade has a tip, which is the portion of the blade most far from the longitudinal axis (e.g. positioned at the maximum distance from the longitudinal axis).

[0025] The blade assembly is configured to generate an air flow.

[0026] The fan also includes a mouth, which surrounds the blade assembly.

[0027] In one embodiment, the mouth is coaxial to the longitudinal axis.

[0028] The mouth has a minimum diameter defining an annular gap with respect to the blade assembly. In particular, said minimum gap is defined between the minimum diameter of the mouth and a tip of the blades.

[0029] This minimum gap has the function to permit a safe rotation of the blade assembly inside the mouth, without mechanical interference between the mouth and the blade assembly.

[0030] The mouth has an annular shape. The mouth defines internally a passage. The blade assembly (at least partly) occupies said passage defined by the mouth.

[0031] The fan also includes a diffuser. The diffuser is positioned downstream, with respect to the mouth, along the direction for the air flow.

[0032] The diffuser has the function to guide the air flowing away from the blade assembly.

[0033] In one embodiment, the mouth is a bell mouth.

[0034] The bell mouth may include a curved wall, divergent in a direction opposite the air flow direction.

[0035] The mouth may include a cylindrical wall. The cylindrical wall of the mouth faces at least a portion of the blade assembly. The cylindrical wall faces the tip of the blades, during their rotation around the longitudinal axis.

[0036] The cylindrical wall of the mouth can be interposed between the curved wall of the mouth and the diffuser.

[0037] Preferably, the cylindrical wall of the mouth has a uniform diameter equal to said minimum diameter.

[0038] The diffuser has a first edge, facing the mouth, and a second edge, axially displaced downstream the blade assembly (downstream in the direction for the air flow).

[0039] The diffuser has a first diameter at its first edge, which is smaller than the minimum diameter of the mouth.

[0040] Therefore, the diffuser defines a narrowing of the passage defined by the mouth.

[0041] In one embodiment, the first diameter of the diffuser is smaller than 1.25 times a diameter of a cylindrical volume occupied by the blade assembly in its rotation. In other words, the first radius (i.e. half of the first diameter) of the diffuser is smaller than 1.25 times the minimum distance between the tip of the blades and the rotational axis of the fan.

[0042] In one embodiment, the first diameter of the diffuser is equal to the diameter of said cylindrical volume. In other words, the first radius of the diffuser is equal to the radius of the tip of the (blades of the) blades assembly.

[0043] In one embodiment, the first diameter of the diffuser is smaller than the minimum diameter of the mouth. In other words, the first radius of the diffuser can be smaller than the minimum radius of the mouth.

[0044] According to an embodiment, the diffuser is a diverging diffuser; the diffuser may have a tapered shape. The size of the opening defined by the diffuser increases in the direction of the airflow, from the first edge to the second edge.

[0045] In an embodiment, said first diameter is the minimum diameter of the diffuser.

[0046] In an embodiment, the diffuser has a second diameter at its second edge, which is larger than the first diameter.

[0047] In a possible embodiment, the diffuser is connected to the mouth. The mouth is connected to the diffuser at its first edge.

[0048] In one embodiment, the fan has a symmetry of rotation with respect to the longitudinal axis.

[0049] The fan has a maximum transversal size, that is, a maximum size transversally to the longitudinal axis. This maximum transversal size may correspond to a maximum diameter; wherein said maximum diameter defines the maximum radial (or transversal) size of the fan.

[0050] In one embodiment, the second diameter of the diffuser is (substantially) equal to said maximum diameter of the fan.

[0051] The present disclosure also regards a method for generating an air flow. Particularly, the present disclosure regards a method for generating an air flow in a temperature conditioning system.

[0052] The method comprises a step of rotating a blade assembly about a longitudinal axis to generate the air flow.

[0053] The method also comprises a step of providing an annular empty volume surrounding the blade assembly. In one possible embodiment, said empty volume is provided between the blade assembly and a mouth which is radially spaced from the blade assembly at a distance which is at least a gap defined between a tip of the blade assembly and a corresponding section of the mouth.

[0054] The method further comprises a step of conveying the air flowing downstream the blade assembly

through an annular restriction of said empty volume.

[0055] In a possible embodiment, said annular restriction of the empty volume is provided downstream the mouth.

5 **[0056]** In a possible embodiment, said annular restriction of the empty volume is provided by a diffuser connected to the mouth.

10 **[0057]** In one embodiment, the method further comprises a step of conveying the air flowing downstream the annular restriction through a diverging diffuser.

15 **[0058]** In one embodiment, the air flow is directed to a condenser of a refrigerating system. In one embodiment, the air flow is directed top down through the condenser of the refrigerating system. The condenser may be "V" shaped condenser; that is, to a condenser with "V" shaped coils.

[0059] The narrowing of the passage through which the air flows in the fan allows to generate a particularly high air flow intensity.

20 **[0060]** In this context, the fact that the first diameter of the diffuser is smaller than diameter of mouth (which determines said narrowing) has the advantage of increasing the fan efficiency, by improving the air flow intensity.

25 **[0061]** The fact that the first diameter of the diffuser equal to diameter of blade tip is advantageous because it provides benefit to the fan efficiency also in the situations where a (relatively large) gap is needed between the blades and the mouth.

30 **[0062]** The diverging shape of the diffuser influences the direction of the exit flow and contributes to a reduction of recirculation in the air flow.

35 **[0063]** In this context, the fact that the diffuser is tapered has the advantage of increasing the fan efficiency, by improving the direction of the air flow downstream the fan.

40 **[0064]** The fact that the second diameter diffuser (substantially) defines the maximum diameter of the fan has the advantage of keep the size of the fan relatively small, i.e. it allows to optimize the size of the fan with respect to its efficiency.

45 **[0065]** This and other features of the invention will become more apparent from the following detailed description of a preferred, non-limiting example embodiment of it, with reference to the accompanying drawings, in which:

- Figure 1 illustrates (schematically) a refrigerant circuit of a temperature conditioning system, according to the present disclosure;
- 50 - Figure 2 shows a perspective view of a fan according to the present disclosure;
- Figure 3 shows the fan of figure 2, in lateral view;
- Figure 4 shows the fan of figure 2, in section view according to section IV of figure 3;
- 55 - Figure 5 shows an enlarged detail of figure 4.

[0066] With reference to the accompanying drawings, the numeral 100 denotes a refrigerant circuit of a tem-

perature conditioning system, according to the present disclosure. The temperature conditioning system may be a chiller (for example with size 80 KW - 2 MW) or a heat pump.

[0067] The refrigerant circuit 100 comprises a compressor 101, for compressing a refrigerant fluid.

[0068] The refrigerant circuit 100 comprises a condenser 102, for condensing the refrigerant fluid, from gas to liquid phase. The condenser 102 receives the refrigerant fluid (gas) from the compressor 101. In order to achieve this result, heat is extracted from the refrigerant fluid circulated in the condenser 102, thus cooling the refrigerant fluid. In one embodiment, said extraction of heat from the condenser 102 is carried out through an air flow.

[0069] The refrigerant circuit 100 comprises an expansion valve 103, for expanding the refrigerant fluid. The expansion valve 103 receives the refrigerant fluid from the condenser 102.

[0070] The refrigerant circuit 100 comprises an evaporator 104 for evaporating the refrigerant fluid. The evaporator 104 receives the refrigerant fluid from the expansion valve 103.

[0071] The compressor 101 receives at input the refrigerant fluid from the evaporator 104. Therefore, the refrigerant fluid is circulated in closed loop in the refrigerant circuit 100.

[0072] The refrigerant circuit 100 comprises at least a fan 1 (that is, a fan assembly, or a fan system). The fan 1 is configured to generate an air flow.

[0073] In one embodiment, the fan 1 is coupled to the condenser 102 to generate said air flow to cool down the refrigerant fluid.

[0074] The condenser 102 may be coupled to two or more fans 1.

[0075] Said one or more fans 1 may be external to the condenser 102 or they may be part of the condenser 102 itself (they could be incorporated in the condenser 102).

[0076] In a possible embodiment, one or more fans 1 may be coupled to (or incorporated in) the evaporator 104 (or other components of the refrigerant circuit 100), in addition or in alternative to the at least one fan 1 coupled to the condenser 102.

[0077] Regarding the compressor 101, in one embodiment it is configured to generate an output flow (of said mixture of oil and refrigerant fluid) at at least a first speed and a second speed different from the first speed. In order to generate an output mixture flow at different speeds, the compressor 101 may for example include an inverter connected to an electric motor of the compressor 101; in an alternative example, the compressor 101 may vary the mass flow of the output mixture by mechanical means (e.g. with a slide vanes technology).

[0078] Regarding the refrigerant fluid, in one embodiment it includes (preferably it is) hydrofluoroolefin (HFO). For example, HFO-1234yf, HFO-1234ze(E), HFO-1336mzz, HFO-1123, or HFO-1243zf may be used as HFO refrigerant fluid.

[0079] However, the refrigerant fluid may be of any other type, as for example a hydro fluoro carbon HFC (refrigerant). In this case, for example, HFC-134a and the like may be used as HFC refrigerant fluid.

[0080] Regarding the fluid used as refrigerant gas, it is further observed that a capacity (cooling capacity) per volume (capacity/unit of volume, [kW/m³/h]) of HFO is smaller (e.g. in [%]) than the capacity per volume (capacity/unit of volume, [kW/m³/h]) of HFC. For example, a capacity per volume of HF01234ze is 74% of the capacity per volume of HFC-134a.

[0081] The fan 1 comprises a blade assembly 2.

[0082] The blade assembly 2 is rotatable around a longitudinal axis 201.

[0083] The blade assembly 2 includes one or more blades 202. Preferably, the blade assembly 2 includes a plurality of blades 202 (for example, two or three blades).

[0084] Each blade 202 has a tip 203, which define the radial maximum size of the blade assembly.

[0085] In one embodiment, the blades 202 are made in plastic material; in one embodiment, the blades 202 are injection molded.

[0086] In one embodiment, the blades 202 are made in metallic material; in one embodiment, the blades 202 are die casted.

[0087] The blade assembly 2 may include a hub 204, connected to the blades 202.

[0088] The fan comprises a motor 3, connected to the blade assembly 2 to rotate it. In one embodiment, the motor 3 is an electric motor (such as a brushless, direct current motor, asynchronous motor or the like).

[0089] The motor 3 has a shaft 301, fixed to the hub 204.

[0090] In one embodiment, the fan may include a mouth 4.

[0091] The mouth 4 has an annular shape; the mouth 4 surrounds at least part of the blade assembly 2.

[0092] In one embodiment, the mouth 4 is coaxial to the longitudinal axis 201.

[0093] The mouth 4 defines a passage for the air flow generated by the blade assembly 2; said passage has an inlet and an outlet. The inlet of the passage defined by the mouth 4 is proximal to the motor 3 (low pressure side of the fan 1); the outlet is distal from the motor 3 (high pressure side of the fan 1).

[0094] In one embodiment, the mouth 4 has a tapered wall 401; the tapered wall 401 may be a curved wall 401.

[0095] In one embodiment, the mouth 4 has a cylindrical wall 402. The cylindrical wall 402 is positioned downstream the tapered wall 401 and may be connected thereto or may be provided in one piece with the tapered wall 401.

[0096] The tapered wall 401 is divergent towards the direction from the outlet to the inlet.

[0097] The cylindrical wall 402 of the mouth 4 faces at least a portion of the blade assembly 2.

[0098] The mouth 4 has a minimum diameter 403 (or minimum radius) defining an annular gap with respect to

the blade assembly 2.

[0099] In one embodiment, the cylindrical wall 402 has a uniform, constant section, which has a diameter equal to said minimum diameter 403.

[0100] The fan 1 defines a narrowing (that is, a restriction) of the passage formed by the mouth 4.

[0101] In one (preferred) embodiment, said narrowing of the passage is provided (defined) downstream the mouth 4 (at the outlet of the mouth 4).

[0102] Indeed, in a (preferred) embodiment, the gap between blades and relative housing (mouth 4) is set to the minimum possible; the gap is preferably uniform and the narrowing is provided downstream the housing, so as to not interfere with the blades 202 movement.

[0103] In one embodiment, the fan 1 includes a cover 5, arranged downstream the mouth 4.

[0104] The cover 5 comprises a diffuser 501; the diffuser 501 has an annular wall surrounding the longitudinal axis 201; preferably, the diffuser 501 is coaxial to the longitudinal axis 201.

[0105] The diffuser 501 has a first edge 502 and a second edge 503.

[0106] The first edge 502 of the diffuser 501 is proximal to the mouth 4 (faces the mouth 4); the second edge 503 of the diffuser 501 is distal to the mouth 4 (is axially displaced downstream along the longitudinal axis 201 in the direction of the air flow from the inlet to the outlet).

[0107] The function of the diffuser 501 is to guide the air flowing away from the blade assembly 2 (and from the mouth 4).

[0108] In one embodiment, said narrowing of the passage (the passage defined by the mouth 4) is provided by the diffuser 501. In an alternative embodiment, the said narrowing of the passage could be provided by a septum or another element positioned at the mouth 4 outlet.

[0109] In one embodiment, the diffuser 501, at its edge 502, forms a flange 504, connected to a corresponding flange member 404 of the mouth 4 provided at the outlet of the mouth.

[0110] In the (preferred) embodiment wherein said narrowing of the passage is provided by the diffuser 501, the diffuser 501 has a first diameter 505 at its first edge 502, which is smaller than the minimum diameter 403 of the mouth 4.

[0111] In one embodiment, the first diameter 505 of the diffuser 501 is smaller than the minimum diameter 403 of the mouth.

[0112] In one embodiment, the first diameter 505 of the diffuser 501 is smaller than 1.25 times or, preferably, is equal to the (largest) diameter of the circular path of the tip(s) 203 of the blade assembly 2.

[0113] In one embodiment, the diffuser is tapered and has a second diameter 506 at its second edge 503, which is larger than the first diameter 505.

[0114] In one embodiment, the cover 5 includes a grid 507 connected to the diffuser 501 at its second edge 503. In one embodiment, the grid 507 is spaced at 90 mm (or

more) from the blade assembly 2.

[0115] The function of the grid is that of protecting the blade assembly 2 and to protect the fingers of users from the blade assembly 2.

[0116] In one embodiment, the lateral, or radial size of the diffuser 501 substantially corresponds to the overall lateral, or radial size of the fan 1. In other words, the fan 1 has a maximum diameter defining the maximum radial size of the fan, and said second diameter 506 is equal to the maximum diameter of the fan 1.

[0117] In one embodiment, the diffuser 501 is divergent in the direction of the air flow. In one embodiment, the diffuser 501 is tapered (e.g. conical).

[0118] In one embodiment, the fan 1 comprises a frame 6.

[0119] The frame 6 is connected to the motor 3. The frame 6 is connected to the mouth 4; the frame 6 may, in addition or in alternative, be connected to the cover 5 (diffuser 501).

[0120] In one embodiment, the frame 6 includes at least one arm 601. Preferably, the frame 6 includes a plurality of arms 601; the arms 601 of said plurality may be equally spaced angularly around the longitudinal axis 201.

[0121] In one embodiment, the frame 6 is connected to said flange 504 of the cover, and/or to said flange member 404 of the mouth 4.

[0122] In one embodiment, each of said arms 601 of the frame 6 has a first end connected to the motor 3 and a second end connected to (the flange 504 of) the cover 5, and/or to (the flange member 404 of) the mouth 4.

[0123] The paragraphs listed below, labelled with alphanumeric references, are non-limiting example modes of describing this invention.

A. A fan (1) for generating an air flow in a temperature conditioning system, comprising:

- a blade assembly (2), rotatable about a longitudinal axis (201) to generate said air flow;
- a mouth (4), surrounding the blade assembly (2) coaxially to the longitudinal axis (201), wherein the mouth (4) has a minimum diameter (403) defining an annular gap with respect to the blade assembly (2);
- a diffuser (501) having a first edge (502), facing the mouth (4), and a second edge (503), axially displaced downstream the blade assembly (2), to guide the air flowing away from the blade assembly (2), wherein the diffuser (501) has a first diameter (505) at its first edge (502), which is smaller than the minimum diameter (403) of the mouth (4).

A1. The fan (1) of paragraph A, wherein said first diameter (505) is the minimum diameter of the diffuser.

A2. The fan (1) of paragraph A or A1, wherein the

mouth (4) is connected to the diffuser (501) at its first edge (502).

A3. The fan (1) of any of the preceding paragraphs A to A2, wherein the first diameter (505) of the diffuser (501) is smaller than 1.25 times a diameter of a cylindrical volume occupied by the blade assembly (2) in its rotation.

A4. The fan (1) of paragraph A3, wherein the first diameter (505) of the diffuser (501) is equal to the diameter of said cylindrical volume.

A5. The fan (1) of any of the preceding paragraphs A to A4, wherein the diffuser (501) is tapered and has a second diameter (506) at its second edge (503), which is larger than the first diameter (505).

A6. The fan (1) of paragraph A5, having a maximum diameter defining the maximum radial size of the fan, wherein said second diameter (506) is equal to the maximum diameter.

A7. The fan (1) of any of the preceding paragraphs A to A6, wherein the mouth (4) includes:

- a curved, tapered wall 401, divergent in a direction opposite the air flow direction;
- a cylindrical wall 402, interposed between the tapered wall 401 of the mouth (4) and the diffuser (501), wherein the cylindrical wall (402) faces the blade assembly (2) and has a uniform diameter equal to said minimum diameter (403).

A8. The fan (1) of any of the preceding paragraphs A to A7, wherein the mouth defines internally a passage and the blade assembly occupies said passage defined by the mouth.

A9. The fan (1) of any of the preceding paragraphs A to A8, wherein the diffuser is positioned downstream, with respect to the mouth, along the direction for the air flow.

A10. The fan (1) of any of the preceding paragraphs A to A9, wherein the diffuser is positioned downstream the mouth and downstream the blade assembly.

A11. The fan (1) of any of the preceding paragraphs A to A10, wherein the second diameter of the diffuser is larger than the diameter of the mouth. A12. The fan (1) of any of the preceding paragraphs A to A11, wherein the diffuser is a separate, distinct element, with respect to the mouth.

A13. The fan (1) of any paragraph A12, wherein the diffuser is fixed (mechanically connected) to the mouth.

A14. The fan (1) of any of the preceding paragraphs A to A13, wherein the mouth is a bell mouth.

B. A temperature conditioning system, having a refrigerant circuit (100) which comprises:

- a compressor (101), for compressing a refrigerant fluid;
- a condenser (102) for condensing the refrigerant

fluid;

- a fan (1) cooperating with the condenser (102) to generate an air flow for cooling the refrigerant fluid in the condenser (102);
- an expansion valve (103) for expanding the refrigerant fluid;
- an evaporator (104) for evaporating the refrigerant fluid, wherein the compressor (101), the condenser (102), the expansion valve (103) and the evaporator (104) are connected in this order, and wherein the fan (1) is according to any of the preceding paragraphs A to A14.

C. A method for generating an air flow in a temperature conditioning system, comprising the following steps:

- rotating a blade assembly (2) about a longitudinal axis (201) to generate said air flow;
- providing an annular empty volume surrounding the blade assembly (2);
- conveying the air flowing downstream the blade assembly (2) through an annular restriction of said empty volume.

Claims

1. A fan (1) for generating an air flow in a temperature conditioning system, comprising:

- a blade assembly (2), rotatable about a longitudinal axis (201) to generate said air flow;
- a bell mouth (4), surrounding the blade assembly (2) coaxially to the longitudinal axis (201), wherein the bell mouth (4) has a minimum diameter (403) defining an annular gap with respect to the blade assembly (2);
- a diffuser (501) having a first edge (502), facing the bell mouth (4), and a second edge (503), axially displaced downstream the blade assembly (2), to guide the air flowing away from the blade assembly (2),

characterized in that the diffuser (501) has a first diameter (505) at its first edge (502), which is smaller than the minimum diameter (403) of the bell mouth (4).

2. The fan (1) of claim 1, wherein said first diameter (505) is the minimum diameter of the diffuser.

3. The fan (1) of any of the preceding claims, wherein the bell mouth (4) is connected to the diffuser (501) at its first edge (502).

4. The fan (1) of any of the preceding claims, wherein

the first diameter (505) of the diffuser (501) is smaller than 1.25 times a length defined by twice a radius of a tip of the blade of the blades assembly (2), with respect to the a longitudinal axis (201).

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5. The fan (1) of claim 4, wherein the first diameter (505) of the diffuser (501) is equal to the diameter of said cylindrical volume.

6. The fan (1) of any of the preceding claims, wherein the diffuser (501) is tapered and has a second diameter (506) at its second edge (503), which is larger than the first diameter (505).

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7. The fan (1) of claim 6, having a maximum diameter defining the maximum radial size of the fan, wherein said second diameter (506) is equal to the maximum diameter.

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8. The fan (1) of any of the preceding claims, wherein the bell mouth (4) includes:

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- a curved, tapered wall (401), divergent in a direction opposite the air flow direction;
- a cylindrical wall (402), interposed between the tapered wall (401) of the bell mouth (4) and the diffuser (501), wherein the cylindrical wall (402) faces the blade assembly (2) and has a uniform diameter equal to said minimum diameter (403).

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9. A temperature conditioning system, having a refrigerant circuit (100) which comprises:

- a compressor (101), for compressing a refrigerant fluid;
- a condenser (102) for condensing the refrigerant fluid;
- a fan (1) cooperating with the condenser (102) to generate an air flow for cooling the refrigerant fluid in the condenser (102);
- an expansion valve (103) for expanding the refrigerant fluid;
- an evaporator (104) for evaporating the refrigerant fluid,

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wherein the compressor (101), the condenser (102), the expansion valve (103) and the evaporator (104) are connected in this order, and wherein the fan (1) is according to any of the preceding claims.

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10. A method for generating an air flow in a temperature conditioning system, comprising the following steps:

- rotating a blade assembly (2) about a longitudinal axis (201) to generate said air flow;
- providing an annular empty volume surrounding the blade assembly (1);

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- conveying the air flowing downstream the blade assembly (1) through an annular restriction of said empty volume.

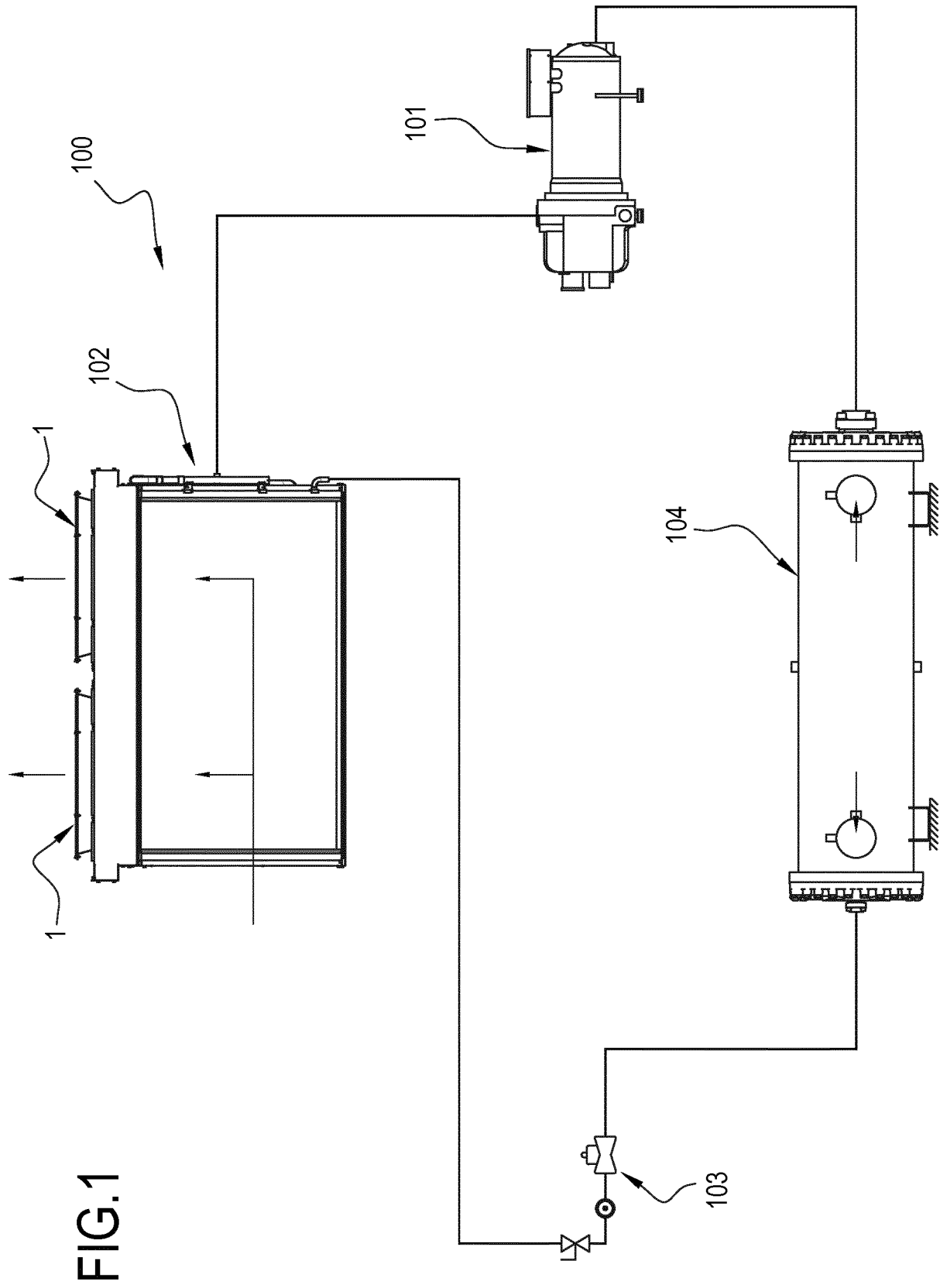
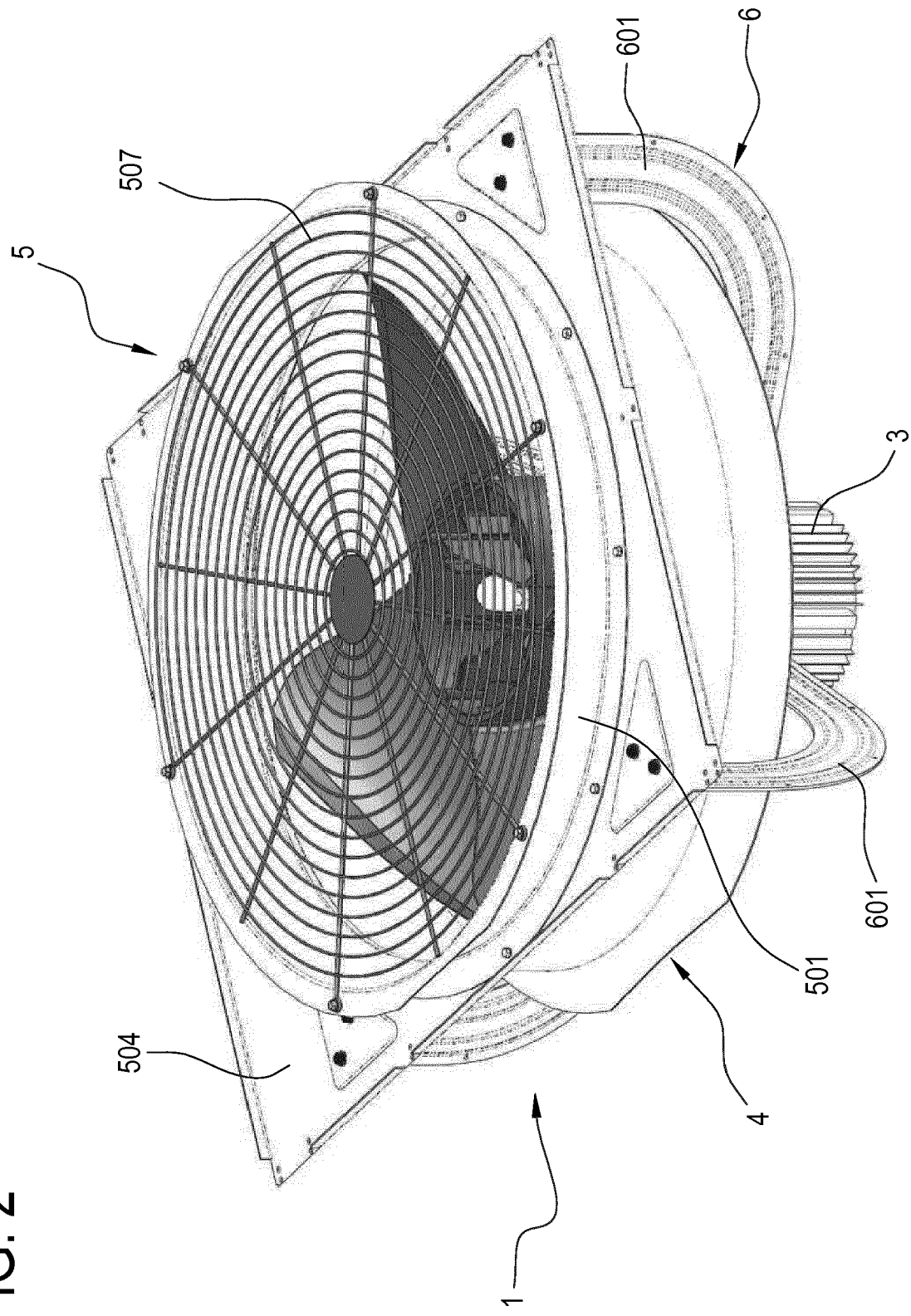


FIG. 2



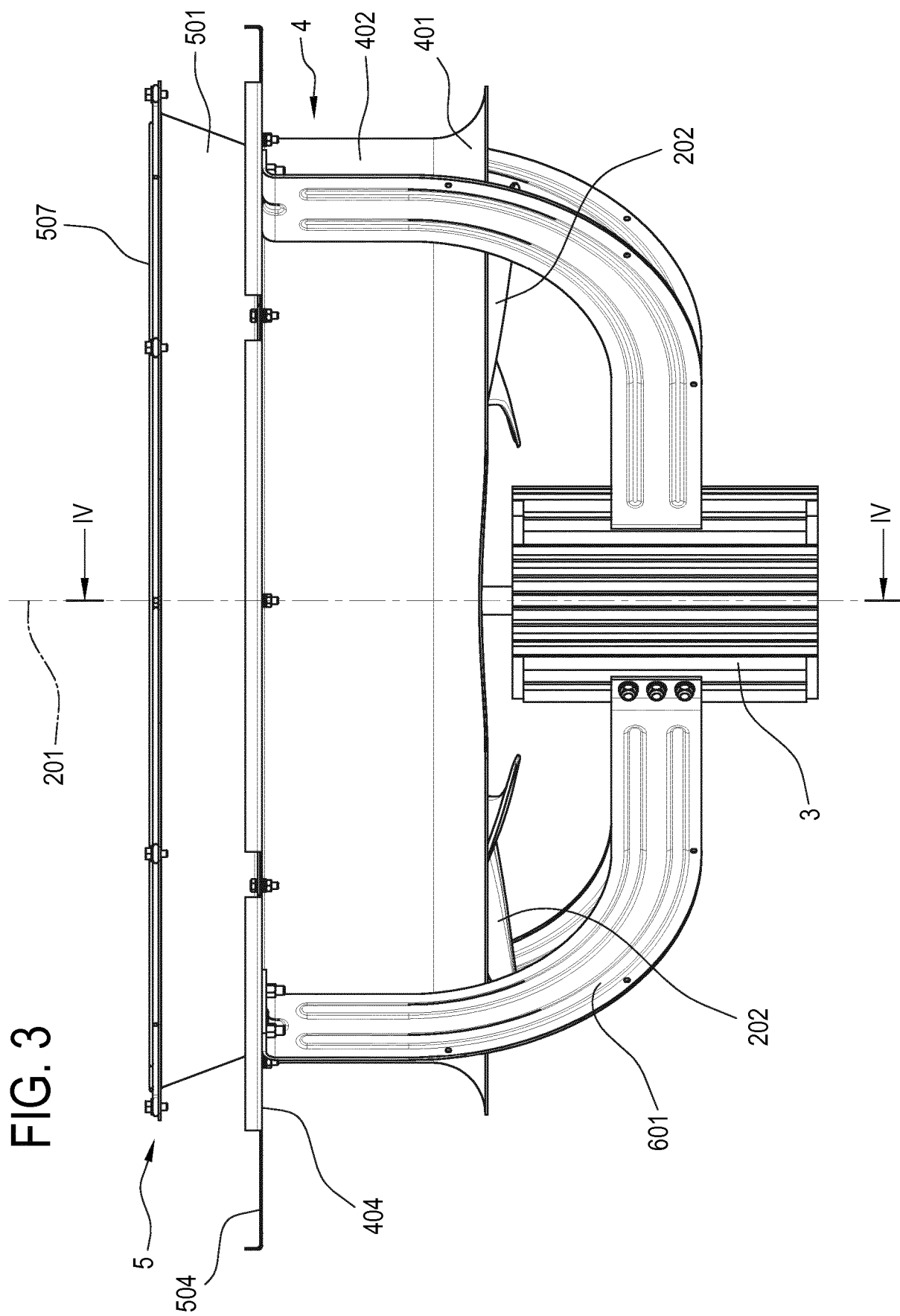


FIG. 4

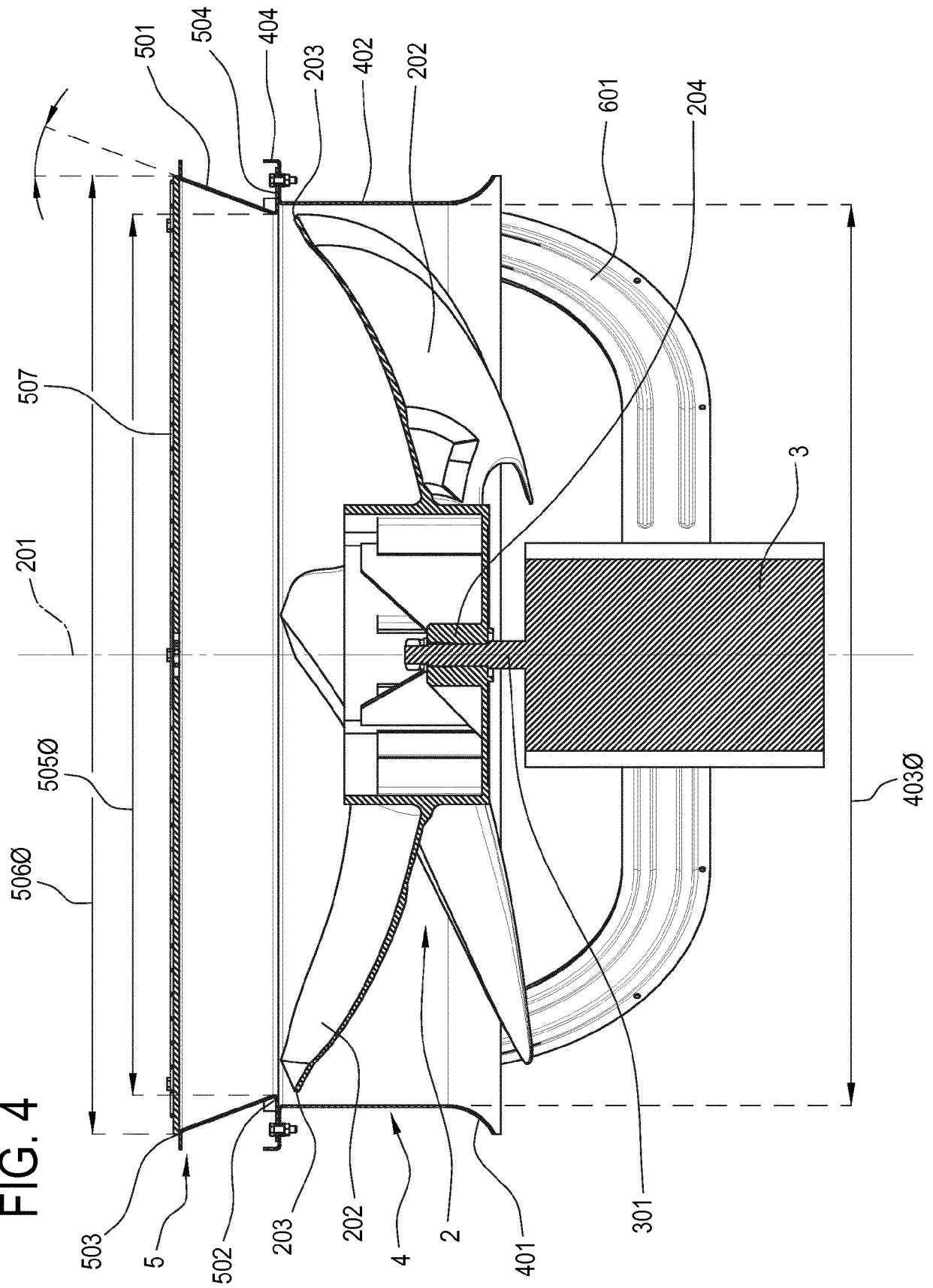
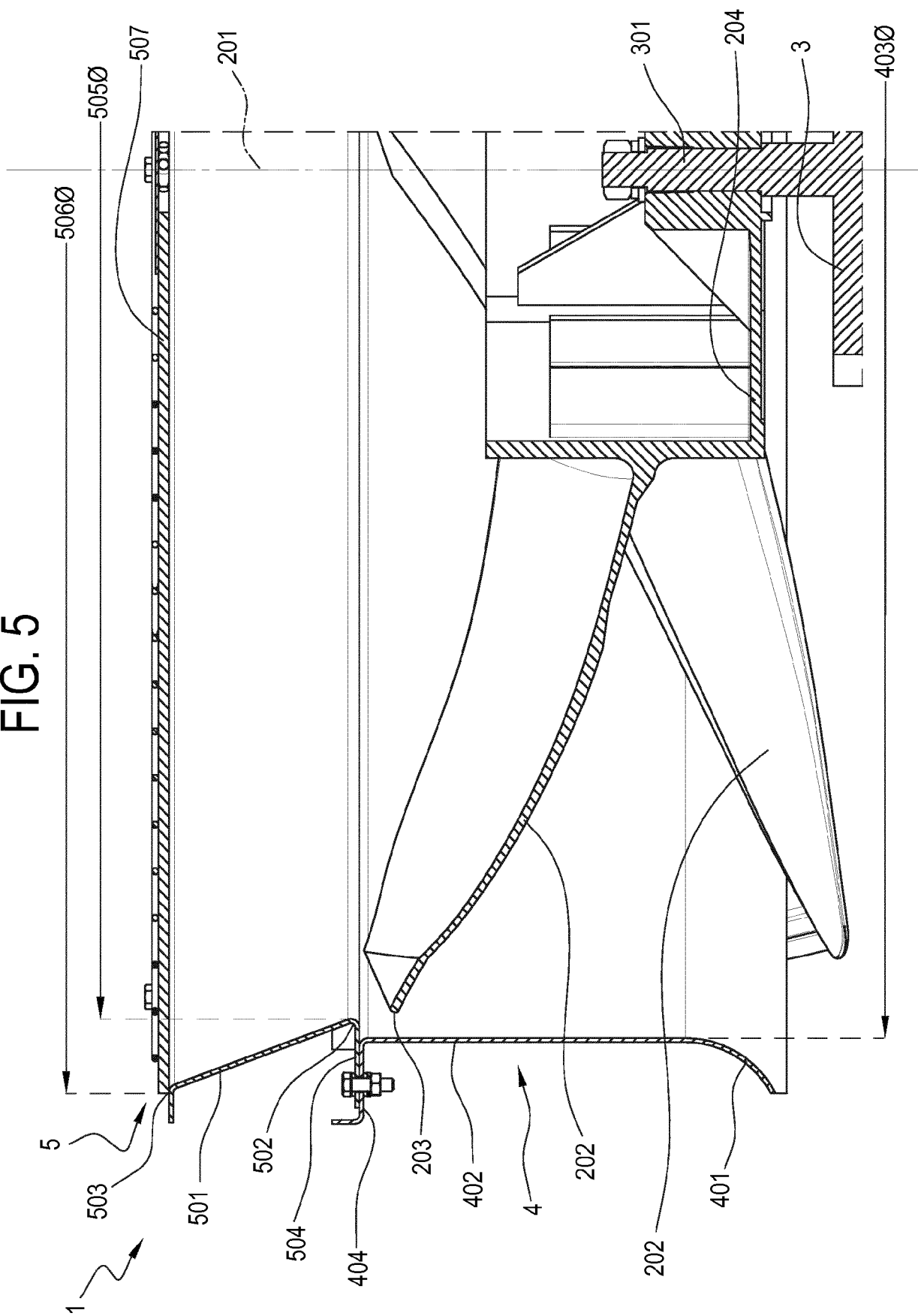


FIG. 5





EUROPEAN SEARCH REPORT

Application Number
EP 18 15 3853

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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