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(54) **IN-LINE HELICOCENTRIFUGAL FAN**

(57) The invention relates to an in-line helicocentrifugal fan, comprising a central body with a cylindrical casing (2) inside which the corresponding electric motor (3) with an impeller (5) and a diffuser (6) and nozzles referred to as cones (11) is installed, where the two cones (11) are arranged inside the cylindrical casing (2), forming a removable subassembly (1) together with the cylindrical casing (2) and the elements mounted inside the latter.

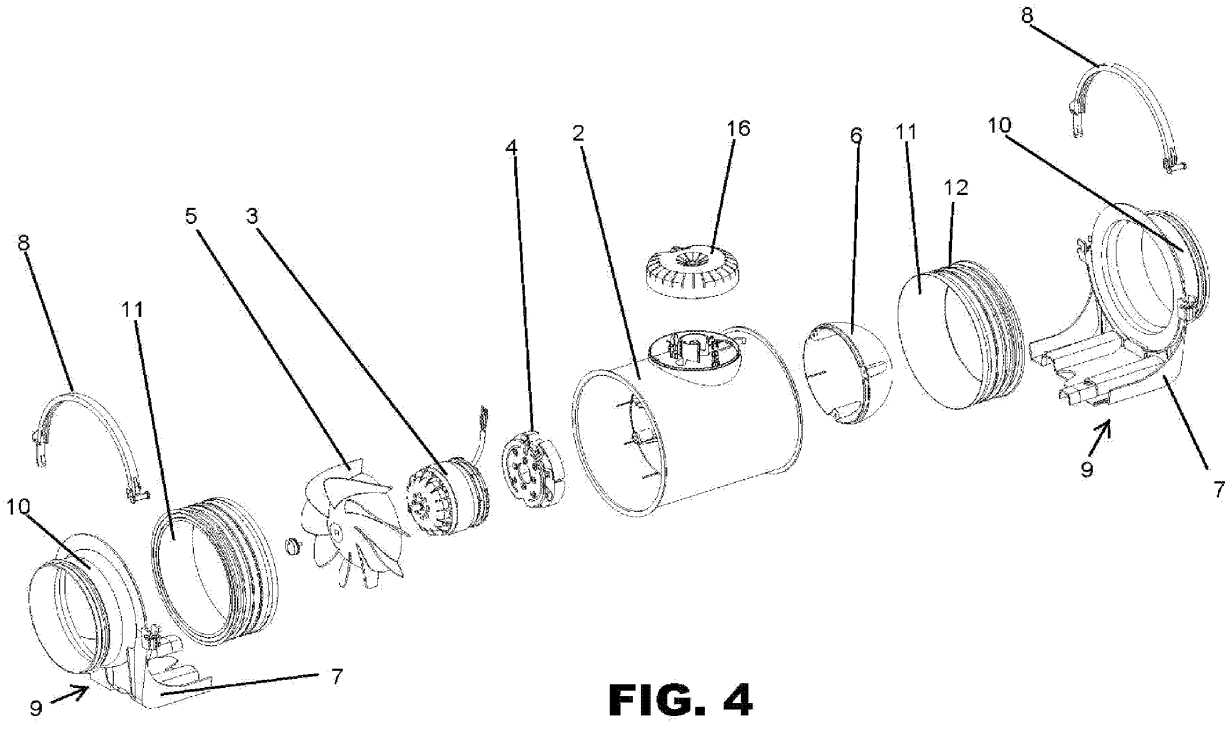

FIG. 4

EP 4 067 666 A1

Description

Technical field

[0001] The present invention relates to the field of ventilation with air driving means arranged in a support structure, with a view to being inserted in a ventilation pipe with a circular cross-section, proposing a helicocentrifugal fan that provides a low noise level and can be easily disassembled for maintenance or replacement.

State of the art

[0002] In-line helicocentrifugal fans, which form an assembly unit that can be inserted into ventilation pipes with a circular cross-section, are widely known today.

[0003] The state of the art involves the embodiment of these fans by means of a central body that is made up of a cylindrical casing, wherein the corresponding drive motor and a rotating propeller in contact with the air that takes the form of an impeller with blades are housed. Also known is the existence, inside the cylindrical casing made in a tubular sheath of the motor body and fixed to said tubular sheath, of a series of fixed blades called guides that guide the air to increase the pressure and performance of the apparatus. The existence of respective nozzles usually identified as cones, due to the frustoconical configuration thereof, is also known, these cones being arranged in such a way that one is located at the inlet located on the suction side and the other, at an outlet, is located on the discharge side, at one and the other end of the central cylindrical body.

[0004] It is also known that these cones are identical and therefore the central body is reversible. Moreover, the fact that the central cylindrical body can be disassembled to be removed from the housing thereof without having to touch the ducts is also part of the state of the art.

[0005] Likewise, the state of the art involves the arrangement of rubber gaskets in the inlet and outlet cones to improve sealing by preventing air leaks.

[0006] Among the embodiments of this type of apparatus known to date, there is a design where on the suction side a cone is arranged inside the cylindrical casing that houses the motor and covers the impeller of the fan, while on the discharge side the cone is arranged outside the cylindrical casing that houses the motor, being integrated in the portion of the fan through which it joins the corresponding ventilation pipe. In this way, when the cylindrical casing is removed with the motor, one of the cones is removed together with the cylindrical casing while the other remains joined to the rest of the fixed structure of the apparatus to which the ends of the corresponding pipe in which the fan is mounted are coupled. In other words, only the cone on the suction side would be part of the removable subassembly.

[0007] With this solution, by removing only one of the cones with the cylindrical casing of the central body that includes the motor and the impeller, the other cone remains fixed with the coupling to the ventilation pipe. Therefore, the maintenance or replacement of the fixed cone is considerably complicated, making it difficult to maintain in places with limited space. Moreover, since the cones do not achieve mutual symmetry, the air flow cannot be reversed by simply removing and rotating the removable subassembly; instead, it would be necessary to disassemble the couplings of the ventilation tubes.

[0008] Another alternative embodiment is also known according to which both cones are not inside the cylindrical casing of the central body, although in this case the cones do form part of the removable subassembly.

[0009] In this case, during maintenance or replacement operations, the cones are removed together with the cylindrical casing that surrounds the motor, thus facilitating maintenance or replacement of the cones.

[0010] That being said, these cones are joined to the cylindrical casing on the outside. In this way, the maintenance of the internal components of the casing is more complicated. Moreover, the dimensions of the assembly increase. Thus, this type of solution is not feasible in places where space is limited.

[0011] In view of the described disadvantages of the currently existing solutions, a solution is needed that allows for a more compact installation, while at the same time facilitating the maintenance and/or repair of the components of the fan. These objectives are fulfilled by the object of the present invention, which also provides an embodiment that allows for quieter operation and greater protection of the most sensitive parts or elements, as will be seen later.

Object of the invention

[0012] In order to fulfil this objective and solve the technical problems discussed so far, in addition to providing additional advantages that can be derived later, the present invention proposes an embodiment of the fan according to which cones are inside the cylindrical casing of the central body that surrounds the motor, being located inside said cylindrical casing, and they also form part of a removable subassembly. In this way, this removable subassembly is formed by the cylindrical casing and the two cones, in addition to the rest of the components of the central body such as an electric motor, an impeller and a diffuser.

[0013] With this configuration, maintenance tasks are facilitated, since it is not necessary to loosen the joint couplings joining the ventilation tubes of the installation. It is only necessary to remove the removable subassembly that houses practically all the components therein that may require maintenance or replacement.

[0014] In fact, with this solution, fan maintenance or replacement operations are simplified since the removable subassembly incorporates practically all the parts and elements that are able to be repaired and/or replaced.

[0015] An additional advantage derived from the cones

being tightly housed inside the removable cylindrical casing is that the dimensions of the helicocentrifugal fan are smaller for quiet fans. In fans of this type, as in the present invention, a silent block is included for the motor and a diffuser is included to reduce the noise generated. However, in existing solutions of this type, they are removed together with the removable cylindrical body, but remain outside the same, increasing the longitudinal dimensions of the fan assembly.

[0016] Moreover, this double condition of incorporating the cones inside the cylindrical casing of the central body and the fact that they form part of the removable subassembly is achieved by maintaining the concept that the two cones are identical to each other and that the helicocentrifugal fan provides a condition of symmetry. In this way, the central body of the fan formed by the removable subassembly is reversible and can be assembled on the corresponding support and anchor stand both in one direction and in the other.

[0017] With this arrangement in which the cones form part of the removable subassembly, the maintenance of cones which can accumulate dirt or have a crack that causes the fan to malfunction is facilitated, avoiding the complete replacement of the coupling to the ventilation tubes.

[0018] Moreover, since the cones are located inside the cylindrical casing of the central body, they protect the internal components of the fan and a quieter operation is achieved.

[0019] According to another feature of the invention, the cones comprise peripheral annular ribs that form an ideal cylinder with an outer diameter corresponding to the inner diameter of the removable cylindrical casing. Therefore, they fit correctly in the removable cylindrical casing to reduce noise and ensure greater internal tightness. Moreover, said cones comprise an over-injected gasket at the outer end thereof, which further ensures internal sealing at the joint thereof with the couplings of the support, the over-injected gasket and the body of each cone forming a single piece.

[0020] Optionally, the removable cylindrical casing comprises therein a tubular sheath surrounding the electric motor, said tubular sheath comprising fixed blades on the outer surface thereof oriented in the opposite direction to the impeller and separated from said impeller, the function of which is to act as guides.

[0021] This configuration, along with the diffuser that surrounds the electric motor, helps make the fan assembly quieter.

[0022] In particular, it is provided that the joint couplings with the ventilation tubes comprise a sealing gasket on the outer cylindrical surface thereof. This sealing gasket that surrounds the coupling helps to achieve an external tightness when the tube is installed on it.

[0023] Therefore, a tubular fan assembly with great internal and external tightness is achieved and, due to the embodiment thereof, it significantly simplifies maintenance and replacement tasks, maintaining an identical embodiment of both cones and the reversibility of the central body and, moreover, all this is achieved with an embodiment that reduces the noise generated by the fan in the operating phase thereof.

[0024] Finally, it is provided that the electric motor has coupled thereto a silent block comprised inside the tubular sheath of the cylindrical casing and attached to the diffuser. Therefore, noise is reduced, providing a compact and sealed block that results in a silent and versatile helicocentrifugal fan.

Description of the figures

[0025]

Figure 1 shows a diagram of one of the already known embodiment solutions of helicocentrifugal fans, according to which the cone (11) located at the air inlet is arranged inside the cylindrical casing (2) of the central body of the fan while the other cone (11) remains outside the cylindrical casing (2). In that way, when the cylindrical casing (2) is removed with the motor, the cone (11) located at the air outlet remains joined to the rest of the fixed structure of the apparatus to which the end of the corresponding pipe in which the fan is mounted is coupled. The removable cylindrical casing (2) is shown with dashed lines and the cones (11) are shown with thick lines, one of them being fixed to the coupling (10).

Figure 2 shows a diagram of another already known embodiment according to which the cones (11) are not inside the cylindrical casing (2) of the central body of the fan, although in this case the cones (11) do form part of the removable subassembly. The cylindrical casing (2), which is removable together with the cones (11) represented with thick lines and which remain fixed to the cylindrical casing (2) on the outside, is shown with dashed lines.

Figure 3 shows a diagram of the solution object of the present invention. The removable subassembly (1) being represented with dashed lines, and the cones (11) comprised therein being represented with thick lines.

Figure 4 is a schematic exploded perspective view of a helicocentrifugal fan assembly object of the invention.

Figure 5 is a schematic perspective view of the mounted helicocentrifugal fan assembly and with open flanges (8) prior to being fixed.

Figure 6 is a schematic perspective view of the extractable subassembly (1) of the helicocentrifugal fan once it has been removed from the support structure thereof.

Figure 7 corresponds to a view of the longitudinal section of the helicocentrifugal fan assembly.

Figure 8 shows a schematic view of a sectional detail of the joint between the helicocentrifugal fan assembly and the support (9).

Detailed description of the invention

[0026] The present invention relates to a helicocentrifugal fan assembly of those installed in ventilation tubes that comprises a central body formed by a cylindrical casing (2) that in the example shown in the embodiment includes therein an electric motor (3) with a silent block (4); an impeller (5) with the blades thereof facing outwards; a diffuser (6) that surrounds the electric motor (3); and a support (9) for assembling and supporting the helicocentrifugal fan assembly (1). This support (9), as is already known in fans of this type, is made up of two equal pieces arranged opposite to each other, each one defining a stand (7) that allows the apparatus to be installed both vertically and horizontally and joint couplings (10) joining the ventilation tubes not shown. The joint between the cylindrical casing (2) and the couplings (10) is made through flanges (8), articulated at one end.

[0027] Helicocentrifugal fans of this type incorporate two nozzles with a frustoconical configuration called cones and identified with the numerical reference (11). These two cones (11) are usually identical to each other and are arranged symmetrically with respect to the cylindrical casing (2), one at the inlet that surrounds the impeller (5) in its entirety and the other at the outlet, surrounding the diffuser (6). The aim of these cones (11) is to reduce the cross-section of the cylindrical casing (2) for the joining thereof with the ventilation tubes, through the corresponding couplings (10).

[0028] According to an embodiment already comprised in the state of the art and schematically represented in Figure 1, the cone (11) located at the air inlet is arranged inside the cylindrical casing (2) of the central body of the fan, while the other cone (11) is outside the cylindrical casing (2). In that way, when the cylindrical casing (2) is removed with the motor, the cone (11) located at the air outlet remains joined to the rest of the fixed structure of the apparatus to which the end of the corresponding pipe in which the fan is mounted is coupled.

[0029] Another embodiment of fans of this type is also known, schematically represented in Figure 2, according to which the cones (11) are not inside the cylindrical casing (2) of the central body of the fan, although in this case the cones (11) do form part of the removable subassembly.

[0030] Figure 3 schematically shows the main object of this invention and it involves determining the central body of the fan by means of the cylindrical casing (2), but with the feature that the cones (11) are inside the cylindrical casing (2), being located inside this cylindrical casing (2), forming part of a removable subassembly (1) according to Figure 6. In this way, this removable subassembly (1) is formed by the cylindrical casing (2), the motor (3) and the two cones (11), as well as, logically, the rest of the elements inherent to this central body, such as the impeller (5), the silent block of the motor and the diffuser (6).

[0031] With this configuration, maintenance tasks are facilitated, since it is not necessary to loosen the joint couplings (10) joining the ventilation tubes of the installation. It is only necessary to remove the removable subassembly (1) that houses practically all the components therein that may require maintenance or replacement.

[0032] In fact, with this solution, fan maintenance or replacement operations are simplified since the removable subassembly (1) incorporates practically all the parts and elements that are able to be repaired and/or replaced.

[0033] An additional advantage derived from the cones (11) being tightly housed inside the cylindrical casing (2) is that the dimensions of the fan assembly are smaller. Unlike other solutions in which the cones (11) are removed together with the cylindrical casing (2), but remain outside the same, as is the case with the embodiment shown in Figure 2.

[0034] Moreover, this double condition of incorporating the cones (11) inside the cylindrical casing (2) of the central body and the fact that they form part of the removable subassembly (1) is achieved by maintaining the concept that the two cones (11) are identical to each other and that the helicocentrifugal fan provides a condition of symmetry. In this way, the central body of the fan is reversible and can be assembled on the corresponding support and anchor stand (9) both in one direction and in the other, unlike solutions like the one represented in Figure 1.

[0035] Figure 4 shows how the cones (11) are symmetrical and separate from the cylindrical casing (2) and that there are peripheral annular ribs (12) on the same which form an ideal cylinder with an outer diameter corresponding to the inner diameter of the cylindrical casing (2), so that a greater fit is achieved between the outside of the cones (11) and the inside of the cylindrical casing (2), contributing to the tightness between both in that area and reducing the noise level. According to a practical embodiment variant, it is envisaged that some or all of these peripheral annular ribs (12) may have an over-injected gasket (13) made of flexible synthetic material that allows obtaining a tight fit between the outside of the cones (11) and the inside of the cylindrical casing (12).

[0036] To assemble the fan, it will first be necessary to install the support stand (9) by coupling the ventilation tubes to the same through the couplings (10). To ensure external tightness with the helicocentrifugal fan, there is a sealing gasket (17) in each coupling (10), as can be seen in Figure 7.

[0037] Next, the joint is ensured with the articulated flanges (8). As can be seen in Figure 5, each flange (8) has at the articulation end thereof a formation in the shape of a small transverse pin (8.1) formed by the flange (8) itself. This pin (8.1) has respective stop widenings at the ends thereof. This pin is housed, by means of elastic clipping, inside a reciprocal support (9.1) configured on the supporting stand (9), which allows the flanges (8) to rotate.

[0038] Each flange (8), at the end thereof opposite to

the articulation end, determines a protruding tab (8.3) intended to be inserted into a housing that defines each support (9.1). This insertion is carried out on the side of the stand (9) opposite that of the articulation of the flange (8). On each tab (8.3) there is a tongue (8.2) that clips elastically inside the respective housing of the support (9.1), which allows the flanges (8) to be pre-fixed. Definitive fixing is established by means of screwing via a screw that is assembled on a formation (8.4) of the flange (8) itself, as can be seen in Figure 5. This screw, not shown, incorporates a washer made of elastic material to prevent it from inadvertently coming out of the housing thereof in the formation (8.4); in a solution like that of the screw of a junction box (16) coupled in the cylindrical casing (2).

[0039] Once the support (9) is fixed, the removable subassembly (1) is assembled with all its components such as the cylindrical casing (2), the motor (3) with the silent block (4) and the impeller (5) and the diffuser (6) located at the outlet.

[0040] To contribute to the efficiency and reduction of the noise level, the cylindrical casing (2) comprises therein a tubular sheath (14) that surrounds the motor (3) and has fixed blades (15) on the outer surface thereof. Said fixed blades (15) have an elongated configuration, the longitudinal dimension thereof being slightly smaller than the length of the tubular sheath (14) and separated a small distance from the impeller (5), and they fulfil a function of guiding the air flow. Thus, in conjunction with the diffuser (6), the air is guided to increase the pressure and performance of the apparatus with a low noise level.

[0041] Once the removable subassembly (1) is assembled, the corresponding electrical connection is made through the junction box (16) that rotates 360° to allow the corresponding wiring to exit in the most convenient direction. This junction box (16) has a low profile and is fixed by a single screw, provided with a washer made of elastic material that prevents the screw from inadvertently coming out, which means that it cannot be lost.

[0042] The complete assembly would be assembled as shown in the cross-section of Figure 7. This figure shows the cones (11) housed inside the cylindrical casing (2), and the symmetry thereof which allows for the reversibility of the fan.

[0043] At this time, the helicocentrifugal fan assembly is assembled, resulting in a more compact assembly that can be installed in installations where the available space is minimal. And ensuring a fan with a low noise level thanks to the different components inside the removable subassembly (1) that reduce noise, such as the silent block (4) coupled to the electric motor (3), the diffuser (6), and the fixed blades (15), all surrounded by the cones (11) and ensuring the sealing thereof by the over-injected gasket (13). This thereby minimises the noise generated without losing efficiency.

[0044] Finally, as shown in the detail of Figure 8, to ensure internal sealing and avoid noise produced in the joint of the removable subassembly (1) with the fixed structure of the fan, each cone (11) has at the outer end thereof an over-injected gasket (13) made of synthetic material of a certain flexibility that remains supported against a turned tab (10.1) existing in the entire contour of the rear mouth of each coupling (10). Thus, closing the flanges (8) ensures the internal tightness of the removable subassembly (1) and noise is avoided, resulting in a more compact fan with a low noise level.

[0045] The fact that the gasket (13) is determined in an over-injected material on each cone (11) means that said gasket (13) and the cone (11) are a single piece, which facilitates the handling and assembly thereof.

[0046] If subsequently, it is necessary to act on the internal components for maintenance or it is necessary to reverse the direction of action of the fan, the swivelling flanges (8) are simply opened to remove the removable subassembly (1) shown in Figure 6. Once this removable subassembly (1) is removed, the cones (11) can be disassembled and the corresponding maintenance and/or repair tasks can be carried out.

Claims

1. An in-line helicocentrifugal fan, comprising a central body with a cylindrical casing (2) inside which the corresponding electric motor (3) with an impeller (5) and a diffuser (6) and nozzles referred to as cones (11) is installed, **characterised in that** the two cones (11) are arranged inside the cylindrical casing (2), forming a removable subassembly (1) together with the cylindrical casing (2) and the elements mounted inside the latter.

2. The in-line helicocentrifugal fan according to claim 1, wherein each cone (11) comprises, at the end thereof with a smaller diameter facing outwards, a single-piece over-injected gasket (13) with the general body of the cone (11), this over-injected gasket (13) being arranged between the cone (11) and a corresponding coupling (10) of the fan with the ventilation tubes.

3. The in-line helicocentrifugal fan according to claims 1 and 2, wherein the cones (11) comprise peripheral annular ribs (12) that form an ideal cylinder with an outer diameter corresponding to the inner diameter of the cylindrical casing (2).

4. The in-line helicocentrifugal fan according to any one of claims 1 to 3, wherein the cylindrical casing (2) incorporates therein a tubular sheath (14) surrounding the electric motor (3), said tubular sheath comprising fixed blades (15) on the outer surface thereof oriented in the opposite direction to the impeller (5) and separated from said impeller (5), acting as guides.

5. The in-line helicocentrifugal fan according to any one of claims 1 to 4, wherein the couplings (10) comprise a sealing gasket (17) on the outer cylindrical surface thereof.

6. The in-line helicocentrifugal fan according to any one of claims 1 to 5, wherein the electric motor (3) has coupled thereto a silent block (4) comprised inside the tubular sheath (14) of the cylindrical casing (2) and attached to the diffuser (6).

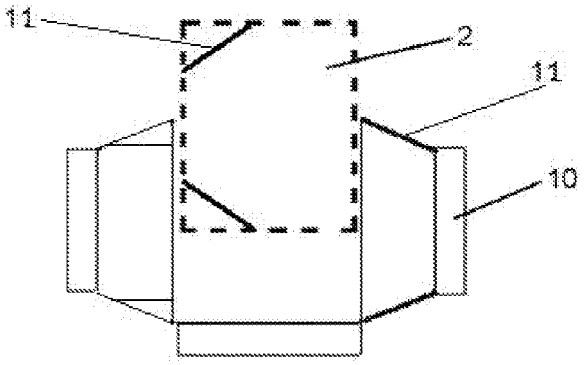

FIG. 1

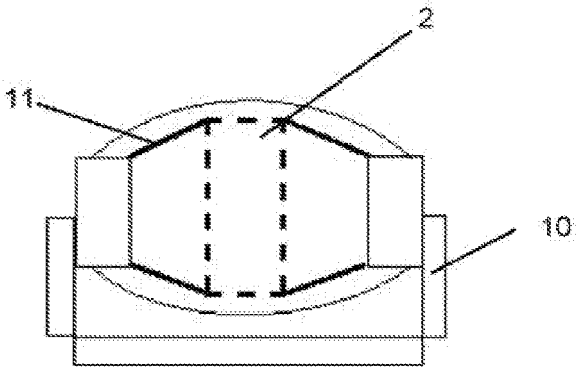

FIG. 2

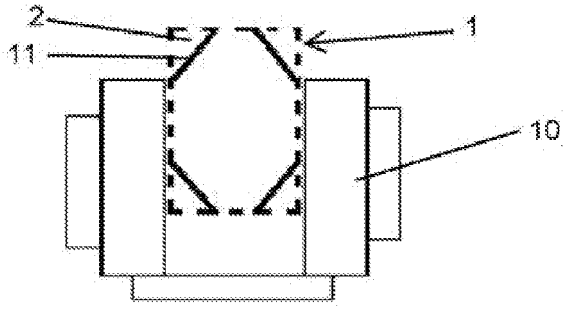

FIG. 3

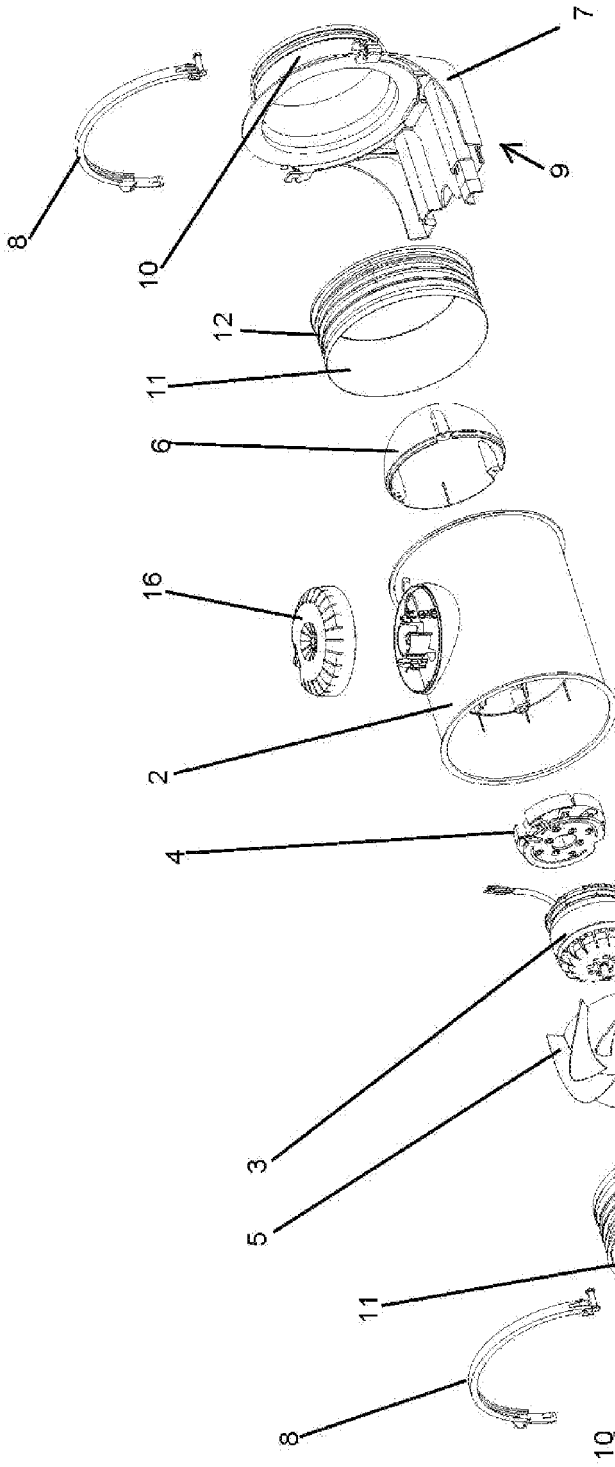

FIG. 4

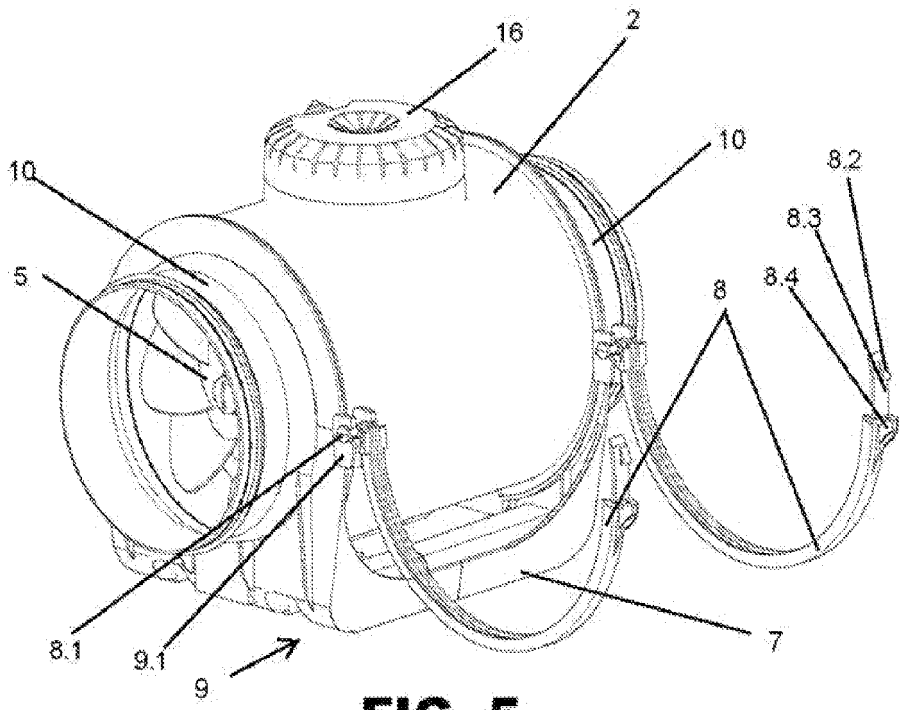

FIG. 5

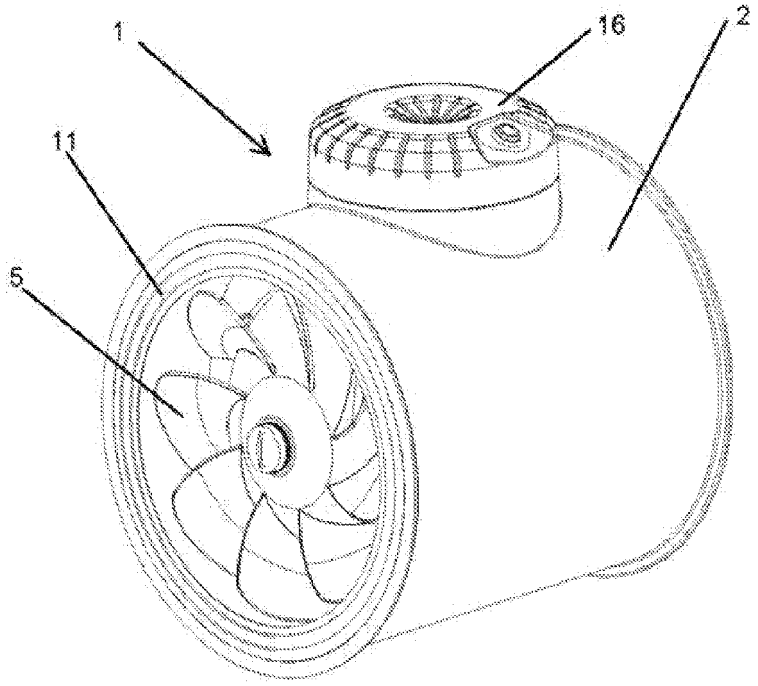

FIG. 6

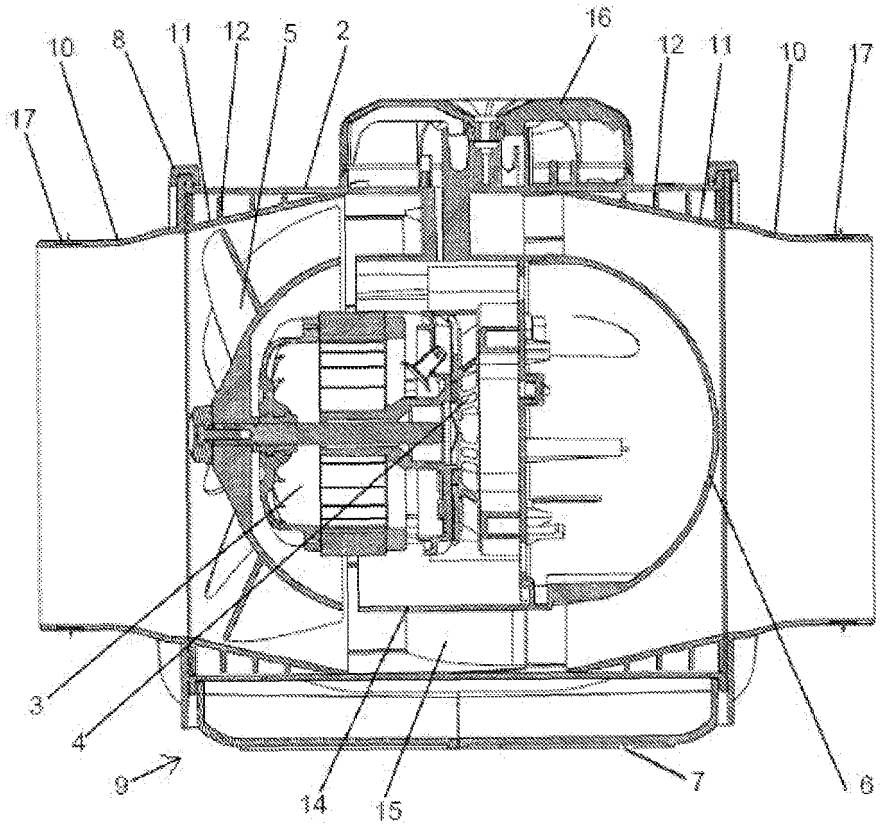

FIG. 7

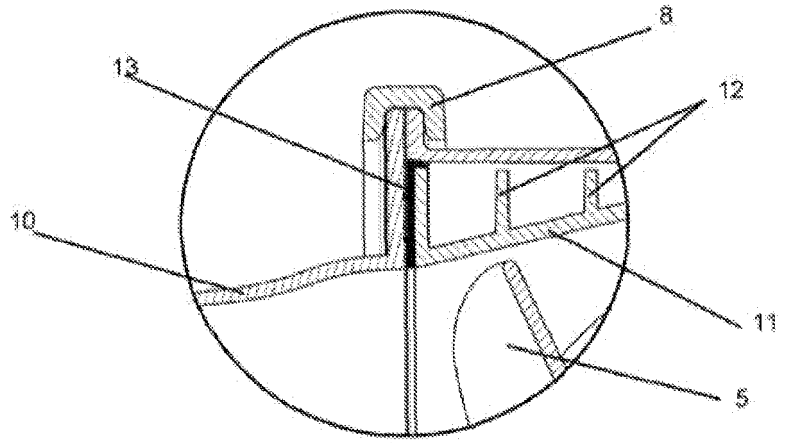

FIG. 8

INTERNATIONAL SEARCH REPORT

International application No.
PCT/ES2020/070676

A. CLASSIFICATION OF SUBJECT MATTER

See extra sheet

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

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)

EPODOC, INVENES

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Y	ES 2020637 A6 (SOLER & PALAU) 16/08/1991, paragraphs [16 - 18]; figures.	1-6
Y	US 2012051889 A1 (GAMISSANS BOU MARIUS) 01/03/2012, the whole document.	1-6
A	US 2014241894 A1 (BROWNELL KYLE ANDREW ET AL.) 28/08/2014, paragraphs [74 - 86]; figures 1 - 6, 26-41.	1-4
A	WO 2012031295 A1 (TWIN CITY FAN COMPANIES LTD ET AL.) 08/03/2012, the whole document.	1, 3, 4
A	US 3312386 A (HULL RICHARD L ET AL.) 04/04/1967, the whole document.	1

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
01/02/2021	**(16/02/2021)**
Name and mailing address of the ISA/ OFICINA ESPAÑOLA DE PATENTES Y MARCAS Paseo de la Castellana, 75 - 28071 Madrid (España) Facsimile No.: 91 349 53 04	Authorized officer C. Piñero Aguirre Telephone No. 91 3493405

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
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