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(54) **Ventilation device with spiral air channelling**

(57) Ventilation device that channels air into a spiral, thereby facilitating its extraction, for which it is provided with a spherical base (3), a spherical deflector (2), and a cylindrical body (3). The deflector (2) and the base (3) are spherical and are made from galvanised or stainless steel plate in a single piece, and do not have any orifices. In addition the cylindrical body (1) is provided internally

with the motorised fan (7), beneath which is placed the motor case (12), and is also provided with the motorised window (5) that has a wavelike shape. The supports (8) for the motorised fan (7) and the supports (6) of the deflector (2) have a special design.

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Description

OBJECT OF THE INVENTION

[0001] The present invention relates to a ventilation device with spiral air channelling, from among industrial ventilation devices, preferably mounted on a roof.

[0002] The present invention is characterised, among other factors, by enabling a spiral air extraction that facilitates extraction in a mixed manner, performed either dynamically with a blade driven by a motorised fan or by natural physical convection using thermal gradients of the air.

[0003] Also the object of the invention are the physical and structural characteristics of the ventilation device, which in combination and when assembled together facilitate air extraction in a spiral, as well as providing a greater structural stiffness to withstand wind forces, resulting in an improved performance in general and a substantial noise reduction, reducing the transmitted vibrations.

[0004] The present invention thus lies in the field of ventilators or air extraction equipment.

BACKGROUND OF THE INVENTION

[0005] Ventilation devices currently available in the market carry out the extraction either by Venturi systems or mixed systems, by convection with specific designs. In all prior solutions the ventilation devices are made from cut, folded and drilled plates, sewn by tubular rivets or surface screws on the top cone and on the base.

[0006] In other cases the ventilation devices are made from a single piece with polyester resins, although this presents certain drawbacks as diameters above 500 mm are difficult to obtain due to the structural problems encountered when affected by the external temperatures that they may be subjected to.

[0007] In addition, in order to avoid rainfall convection or motorised devices have cones with large diameters in relation to the chimney body, which hinders a correct suction in the case of convection.

[0008] We also find that ventilation devices with envelopes significantly reduce performance, as they force the flow to turn 180°.

[0009] As regards Venturi-based ventilation systems, these suffer from a serious drawback such as loss of pressure through their side openings, as these are used with a motor, while those devices that do not use a motor only reach an efficiency of 30% of the flow.

[0010] A further difficulty encountered in currently available ventilation devices is the form of attachment to the roof, as this is normally performed in a bespoke fashion depending on the inclination of said roof, where the base used for attachment to the deck is comprised of several parts welded and riveted to each other. This solution does not ensure water tightness.

[0011] It is also often the case that the means current-

ly employed for securing the motor consist of metal plates attached as tie rods, the entire surface of which offer resistance to air passage, and in which the connection box is placed on the side, further increasing air resistance. Finally, it should be mentioned that devices as currently installed have the wiring outside the device, exposed to environmental hazards.

[0012] Thus, the object of the present invention is to overcome the aforementioned drawbacks of ventilation devices, providing one that allows an improved adaptation and attachment of the structure of the ventilation device to the roof, prevents entry of rainwater, has a structure that is not made from cut, folded and drilled plate joined by riveting, has no pressure losses whatsoever and in which the entire unit is designed so that it offers a minimal air resistance and favours a spiral air channelling.

DESCRIPTION OF THE INVENTION

[0013] The invention disclosed of a ventilation device with spiral air channelling consists of a device that performs a spiral air extraction in a gradual manner, suctioning air from the interior through a spherical shape, in which are involved the opening and closing window, the motor support fins, the blades of the motorised fan, the spherical deflector and its supports. With all of this a hurricane effect is achieved for the air motion that reduces load losses from residual turbulence and improves flow rates, as the air at all times operates with spherical, cylindrical or conical surface envelopes.

[0014] The ventilation device object of the invention basically comprises a hinged spherical base, a spherical deflector, its tangential supports and a cylinder that is the body of the chimney.

[0015] Both the hinged spherical base and the spherical deflector are curved surfaces, and thus provide the assembly with a greater structural stiffness that allows withstanding the wind force in any direction, as its air resistance is minimised. Both are made with galvanised metal or stainless steel plate and in a single piece, with no orifices, cuts or unions so that moisture or rain will not affect it in any manner and torsions, wear and oxidation are prevented.

[0016] The spherical base is hinged so that it may adapt to the inclination of the deck. It has the shape of a spherical cap and is attached to the chimney body, a cylinder, at any point. The intersection between the two is circular and in the case of inclined roofs part of the surface of the spherical base may be uncovered. In order to cover this part of the spherical base a flap is provided on the base of the chimney to cover or overlap the exposed gap, so that no rain will enter the hinged spherical base. It is also possible to make an orifice at the exact point of union of the two parts and later weld them together.

[0017] The cylindrical body or chimney is where the air is drawn, either directly from the inside of the precinct

from which air must be extracted or through a telescoping and flexible tube.

[0018] Inside the cylinder the motorised fan connection case and the window lid are installed, designed to channelling spiral air.

[0019] The motorised window is in charge of opening and closing the air passage. It has a circular shape crossed by a shaft that makes it turn 90° when opening or closing. The window has a wavelike shape to aid the spiral air formation when air passes through it. This shape of the window provides it with a greater stiffness and increases its inertia in the rotation sense of the cover.

[0020] The motorised fan is secured to the cylindrical body by a number of support points in the form of "Z" or "U"-shaped fins that are perpendicular to the motor and that are turned a certain angle from the centre of the motor, thus forcing the air to turn in a spiral. The design of these supports is such that the system has nearly no inertia in the torsion sense of the motor, allowing the motor to absorb torsional vibrations by its own motion and further preventing load losses as said attachments are positioned perpendicular to the rest of the cylindrical body.

[0021] In addition, in order to favour air passage through the interior of the cylindrical body the motorised fan connection case instead of being placed lateral to said fan is placed below it. The wiring is also arranged so that it runs inside the cylinder at all times, with no wires exposed in order to prevent their wear due to environmental or accidental conditions.

[0022] Furthermore, the upper neck of the chimney is provided with two parallel circular flanges at the height of the blade, in order to obtain a higher efficiency during extraction and impulsion, while minimising the ovalisation of the cylinder, as well as providing a constant flow rate by adjusting the aspiration opening to the blade.

[0023] As regards the supports of the spherical deflector, these are crucial for redirecting the air into a spiral and are made from a plate folded into a "Z" or similar shape. The number of attachments provided will depend on the size of the device, the wind pressure to withstand and the higher-order harmonics of the ventilator. In order to prevent orifices in the deflector the attachments are welded to said deflector to form a single piece. They are screwed onto the cylindrical neck for purposes of cleaning and maintenance at a point protected from the rain.

[0024] The spherical deflector is made from a shaping die or mould from a single piece of galvanised or stainless steel metal plate. As its shape is spherical it has a greater structural stiffness and as it has no cuts or unions it is not affected by humidity and environmental factors. Its shape gives it a reduced resistance to external air while aiding natural convection and preventing undesired turbulences for extraction of the internal air, while helping the distribution of the extracted air into equal parts. In addition, as its radius is progressive the air trajectory ends tangentially. This deflector does not

require the use of a backflow preventor, thereby avoiding load losses and reducing vibrations.

[0025] As an option it is possible to install a backflow preventor or an internal cone with absorbent materials to compensate the shadow of the blade core.

DESCRIPTION OF THE DRAWINGS

[0026] As a complement of the description provided below and in order to aid a better understanding of the characteristics of the invention the present descriptive memory is accompanied by a set of drawings with figures where for purposes of illustration and in a non-limiting sense the most relevant details of the invention are shown.

[0027] Figure 1 shows a sectional view along the entire length of the assembled unit.

[0028] Figure 2 shows a plan view of the unit.

[0029] Figure 3 shows a representation of the ventilator unit with the window vertical.

[0030] Figure 4 shows the same as the previous figure, with the window placed horizontally.

[0031] Figure 5 shows the window in a perspective view.

[0032] Figure 6 shows an example of an embodiment for the motor supports.

[0033] Figure 7 shows another example of embodiment for the motor supports.

[0034] Figure 8 shows the arrangement of the motor supports between the cylinder and the motor itself.

[0035] Figures 9, 10 and 11 shows various examples of embodiments for the backflow preventor.

[0036] Figure 12 shows the union between the cylinder and the hinged spherical base.

[0037] Figure 13 shows the same as the previous figure for the case with a slightly inclined roof.

[0038] Figure 14 shows the form of connection of the motor.

[0039] Figure 15 shows the flanges at the top end of the cylinder.

[0040] Figure 16 shows the form of the supports for the spherical deflector.

[0041] Figure 17 shows the effect of the spherical deflector supports with the air exhaust and the wind.

PREFERRED EMBODIMENT OF THE INVENTION

[0042] In view of the figures a description of a preferred embodiment of the invention is provided below, as well as a description of the figures.

[0043] Figure 1 shows the ventilation device, basically comprised of a cylindrical body (1) or ventilator neck, a spherical deflector (2) placed on the top and a hinged spherical base (3) on which is set the entire assembly and that is used for attachment to the roof. Also shown are the supports (6) to which is welded the spherical deflector (2). The cylindrical body (1) is the chimney in which the device draws the flow, which may be directly

connected to the inside of the precinct or connected by means of a telescoping flexible duct (4) as shown in the figure.

[0044] Inside the cylindrical body (1) is the motorised fan (7) with its corresponding blades and the motorised window in charge of opening and closing the ventilator.

[0045] Figure 2 in general shows the same parts described above, and reveals the supports (8) of the motorised fan (7) to the cylindrical body (1) and the tangential air exhaust with the aid of the supports (6) of the spherical deflector (2). Later on and in successive figures the constructive details of the assembly will be shown in greater detail.

[0046] Figures 3, 4 and 5 show the most remarkable characteristics of the motorised window (5), meant to open and close the air flue. Basically, the window (5) is shaped as a circle with a shaft across one of its diameters. Figure 4 shows the profile of the window (5) that is basically in the form of a wave so that when it is vertical it aids the formation of a spiral in the air. This shape provides advantages by stiffening the cover without requiring reinforcements to be welded on it, increasing the inertia in the rotation sense of the cover.

[0047] Figures 6 and 7 show two possible embodiments for the supports (8) of the motorised fan (7) to the cylindrical body (1). As shown in figure 6 these have a Z-shape, while as shown in figure 7 they have a U-shape. In any case their ends have folds that define trapezoidal ends (8.1), (8.2), (8.3) and (8.4). Said supports (8) are placed turned with respect to the centre, forcing the air to move in a spiral towards the blade (9) of the fan, providing an increased performance and less noise.

[0048] Figure 8 shows in a broken line the tensions applied to the supports (8); said system of supports (8) reinforces the structure of the unit by improving the load distribution, and in addition has an almost zero inertia in the torsion sense of the motor, allowing a torsional motion of the support that favours the absorption by the motor of its own torsional vibrations in its motion. As the support system absorbs the vibrations it prevents them from being transmitted to the unit. In addition, and as it is placed perpendicular to the cylindrical body (1), it prevents load losses.

[0049] Figures 9 to 11 shows various types of deflectors, all of them in the form of a spherical cap in a single piece, made of galvanised or stainless steel plate. Said deflector (2) has a minimised air resistance because of the shape of its surface, aids natural convection and prevents undesired turbulence.

[0050] Figure 10 shows the deflector (2) with a back-flow preventor (2.1) while figure 11 shows the backflow preventor (2.2) with a water-drop shape. These back-flow preventors are meant to compensate the shadow of the blade core chosen.

[0051] Figures 12 and 13 show the union of the cylindrical body (1) and the spherical base (3). Said spherical base has a flat area (3.1) for union to the roof and a central bulge in the form of a spherical cap, where an

orifice is provided. SO that this orifice is valid regardless of the inclination of the roof, an endless circular cut is made from the centre of the cap to the greatest possible diameter. As the union between the cylindrical body (1) and the spherical base (3) leaves an uncovered part (11) (as shown in figure 13), on the bottom of the cylindrical body (1) is welded a plate or part (10) that overlaps said sphere in the required surface.

[0052] Figure 14 shows the arrangement of the case (12) of the motorised fan (7), as set beneath the motor in order to reduce air resistance. In addition the wiring (13) runs inside the cylindrical body (1) at all times, preventing its wear due to contact with the environment.

[0053] Figure 15 shows, on the top edge of the cylindrical body (1), two parallel circular flanges (15) at the height of the blade (9), which provide an improved efficiency in extraction and impulsion while minimising the ovalisation of the cylinder and improving its performance by adjusting the window to the blade and reducing noise.

[0054] Finally, figure 16 shows the supports (6) of the spherical deflector (2). Said supports (6) are made from folded plate and have a "Z" shape or the like, and are joined to the deflector (2) by welding.

[0055] Figure 17 shows the air exhaust in a spiral inside the cylindrical body (1), ending tangentially with the aid of the supports (6) of the spherical deflector (2) and of the wind.

[0056] It should be noted that the supports are regularly distributed and have an exit angle greater than 90°, allowing the spiral to end tangentially and protected from the wind pressure.

[0057] It is not considered necessary to extend this description in order for an expert in the field to understand the scope of the invention and the advantages derived thereof.

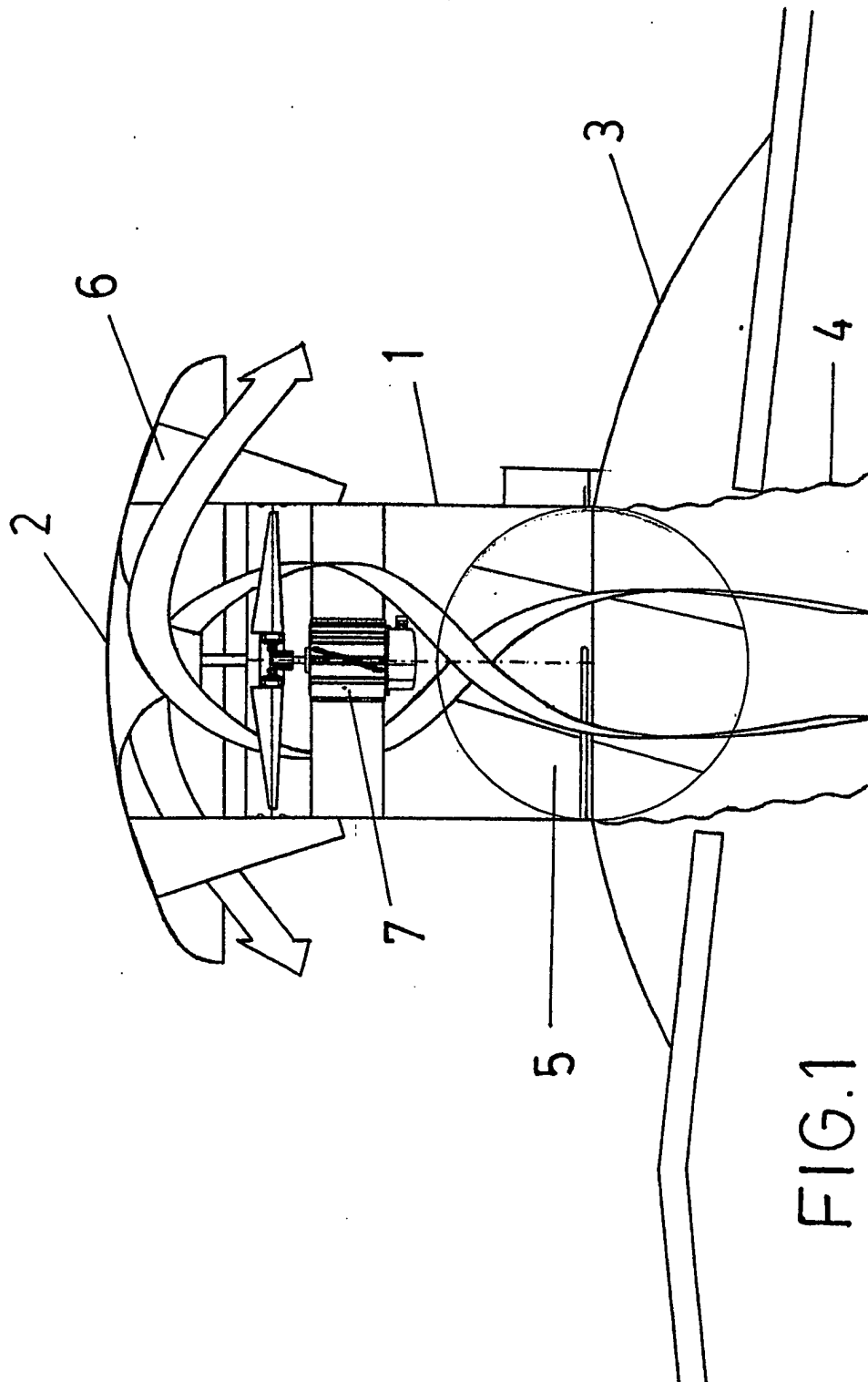
[0058] The materials, shape, size and arrangement of the components may vary as long as the essence of the invention is not affected.

[0059] The terms used in this memory should be understood in a wide and non-limiting sense.

Claims

1. Ventilation device with spiral air channelling **characterised in that** it facilitates air extraction in a spiral, whether in a mixed manner, dynamically with a motorised fan blade or by physical convection of a thermal origin, with the air forced to exit the ventilator device tangentially, for which purpose the device is provided with a base (3) and a deflector (2), both spherical, without orifices nor cuts, made of galvanised or stainless steel plate, and is further provided with a chimney defined by a cylindrical body (1) inside which are housed the motorised fan (7) and the motorised window (5).

2. Ventilation device with spiral air channelling according to claim 1, **characterised in that** the spherical base (3) is hinged to the inclination of the roof, for which it is provided with a flat peripheral flap (3.1) that allows attaching said base to the roof, while on the part in the form of a spherical cap an endless circular cut is provided so that it does not have to be shortened for each inclination of the roof. 5
3. Ventilation device with spiral air channelling according to claim 2, **characterised in that** in order to cover the uncovered part (11) between the cylindrical body (1) and the spherical base (3) a part or flap (11) is provided on the bottom end of the cylindrical body (1). 10 15
4. Ventilation device with spiral air channelling according to claim 1, **characterised in that** the motorised window (5) has a circular shape crossed by a diametric shaft, and a profile with a wavelike shape. 20
5. Ventilation device with spiral air channelling according to claim 1, **characterised in that** the attachment of the motorised fan (7) to the cylindrical body (1) Z-shaped supports (8) with their ends folded to define trapezoidal surfaces (8.1) and (8.2). 25
6. Ventilation device with spiral air channelling according to claim 1, **characterised in that** the attachment of the motorised fan (7) to the cylindrical body (1) is effected by U-shaped supports (8) with their ends folded to define trapezoidal surfaces (8.3) and (8.4). 30
7. Ventilation device with spiral air channelling according to claim 1, **characterised in that** the motorised fan (7) has its connection case (12) installed beneath it. 35
8. Ventilation device with spiral air channelling according to claim 1, **characterised in that** the wiring (13) that reaches the connection case (12) of the motorised fan (7) runs inside the device. 40
9. Ventilation device with spiral air channelling according to claim 1, **characterised in that** the top part of the cylindrical body (1) is provided with two circular, parallel flanges (14) at the height of the blade (9). 45
10. Ventilation device with spiral air channelling according to claim 1, **characterised in that** the supports of the spherical deflector (2) have a "Z" or similar shape that helps the spiral formation of the air and its tangential exhaust; these supports (6) are joined to the spherical deflector by welding and are distributed regularly with an exit angle greater than 90°, thereby allowing the spiral air formation to end tangentially. 50 55
11. Ventilation device with spiral air channelling according to claim 1, **characterised in that** the spherical deflector (2) is provided with a backflow preventor (2.1) to compensate the shadow of the core of the chosen blade.
12. Ventilation device with spiral air channelling according to claim 1, **characterised in that** the spherical deflector (2) is provided with a backflow preventor (2.2) to compensate the shadow of the core of the chosen blade.



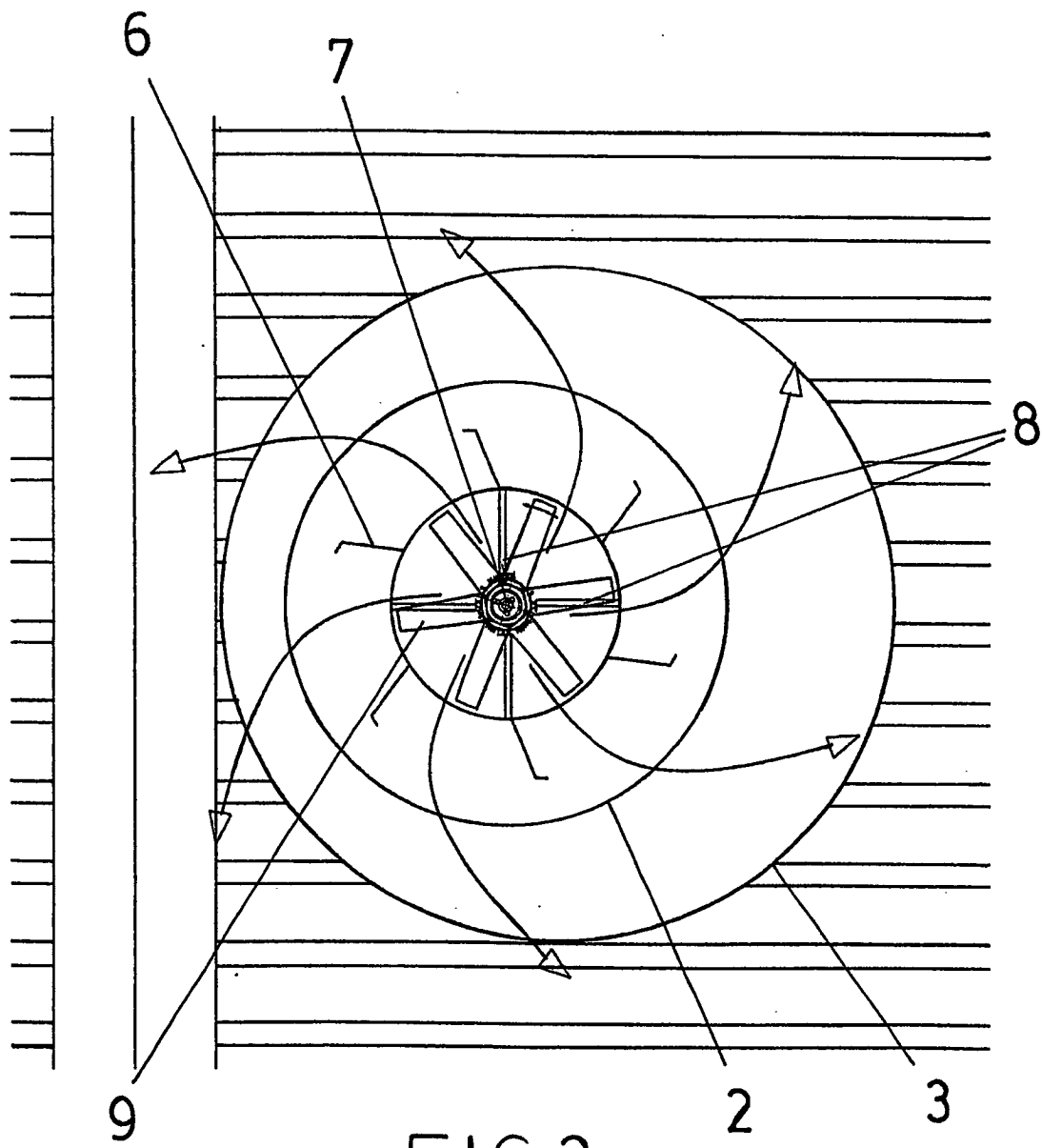
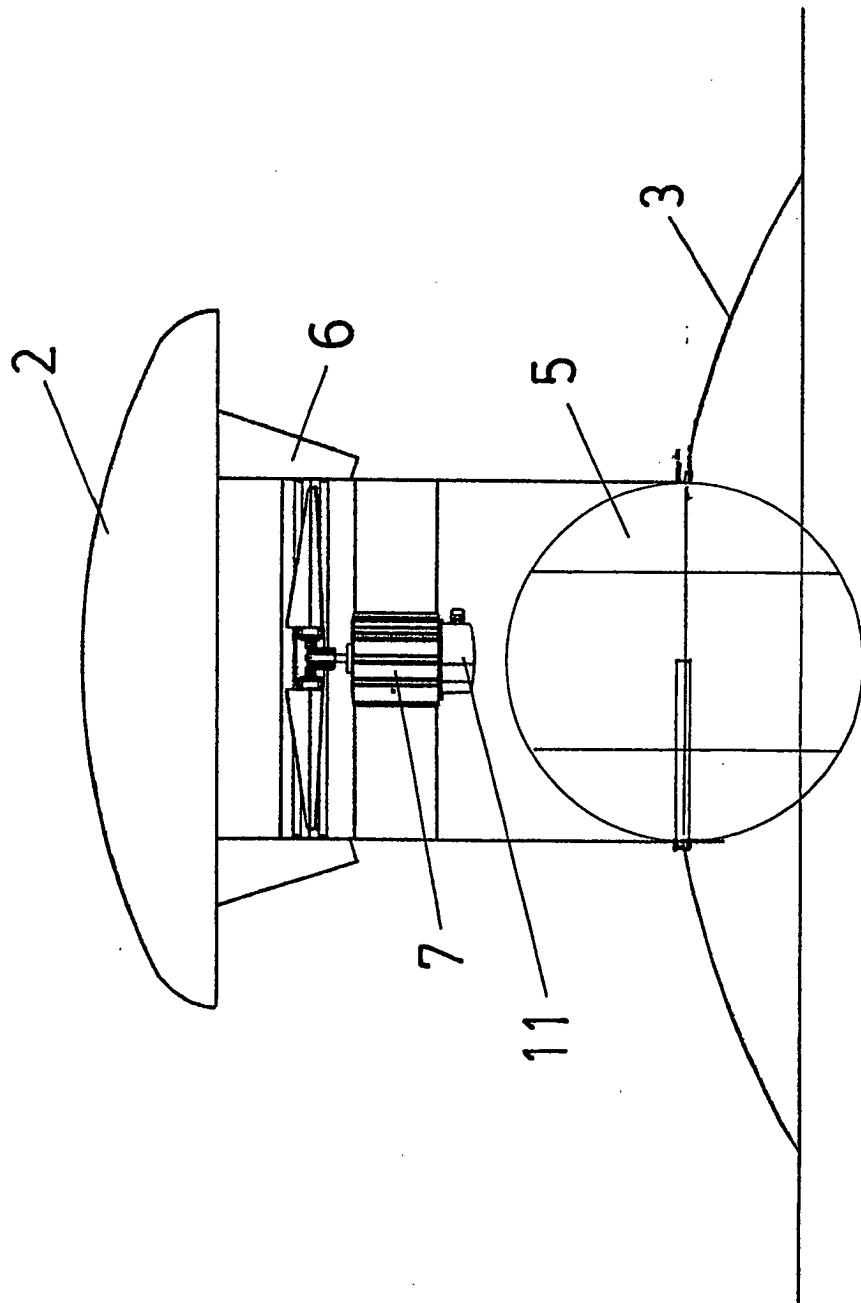


FIG. 2



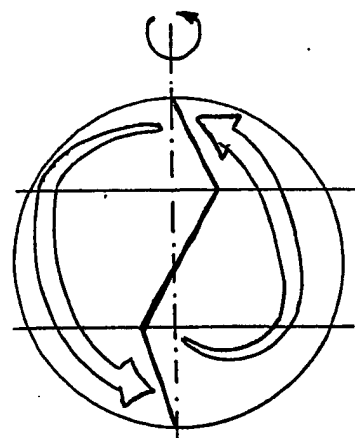
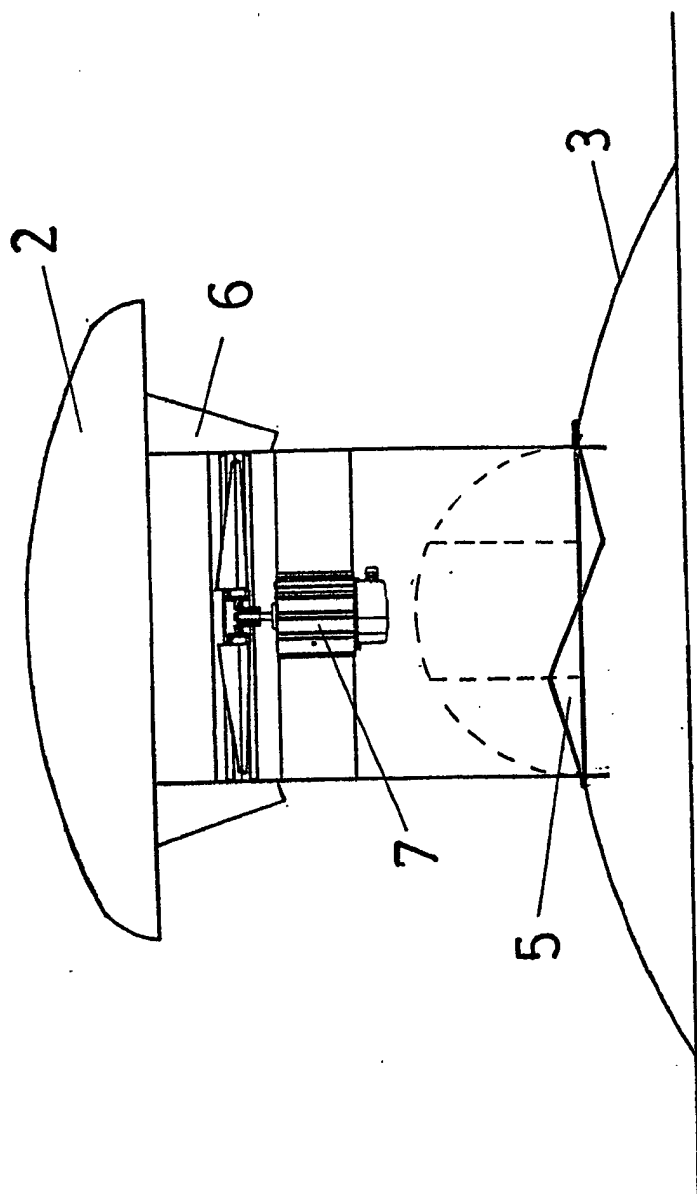


FIG. 4

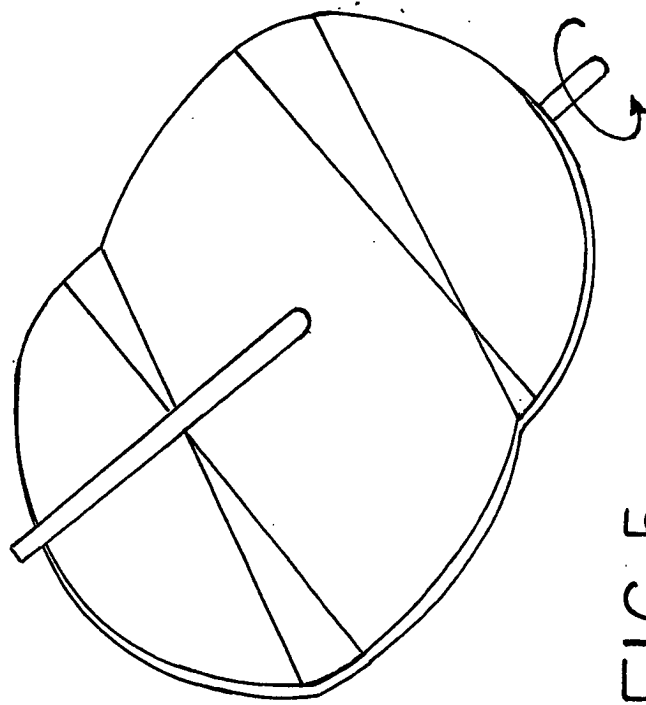
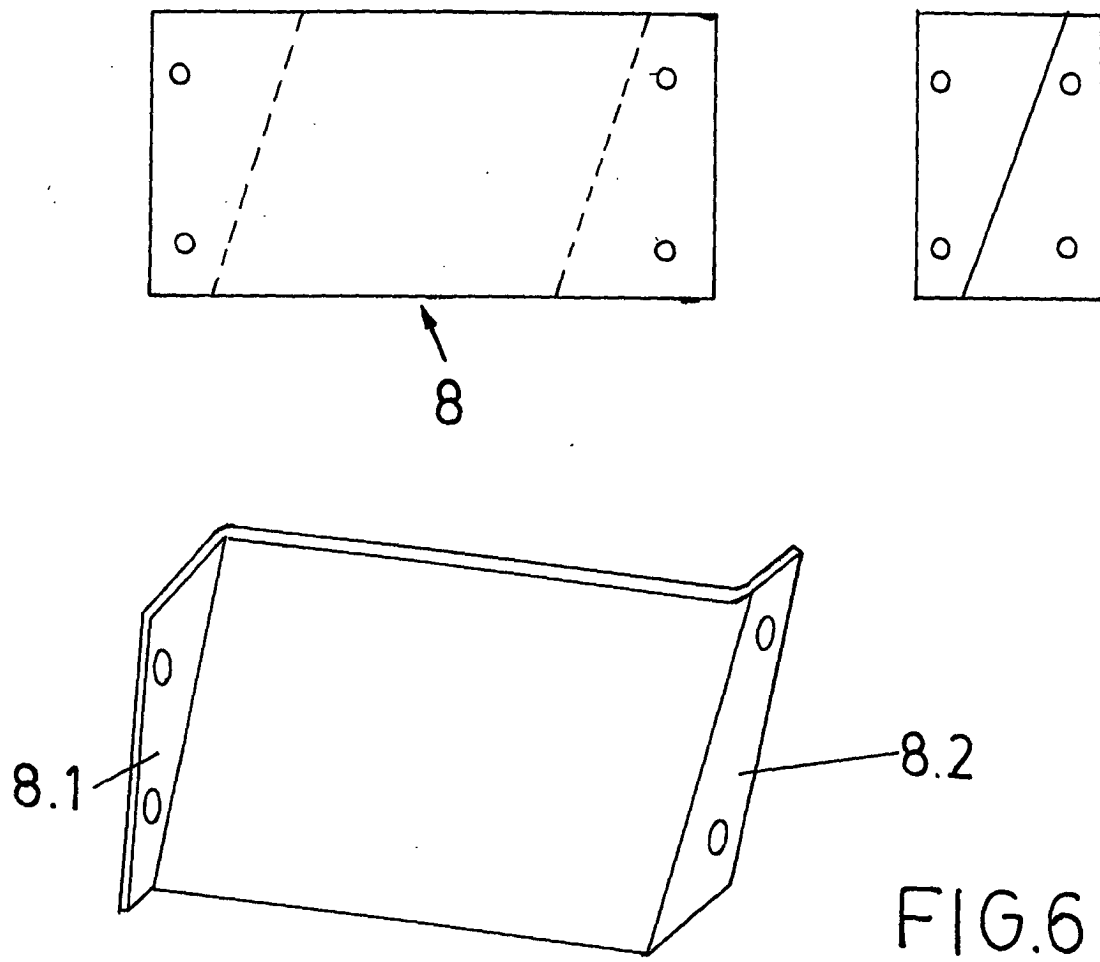


FIG. 5



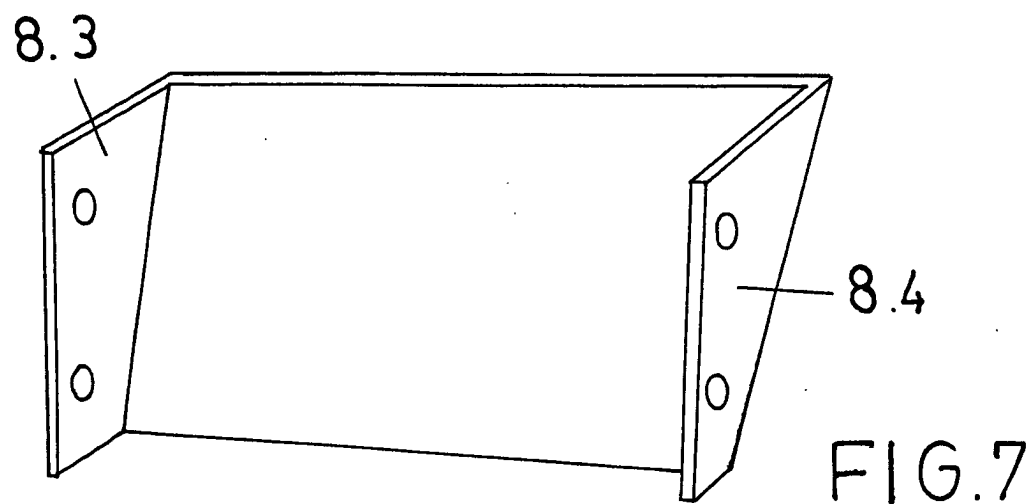
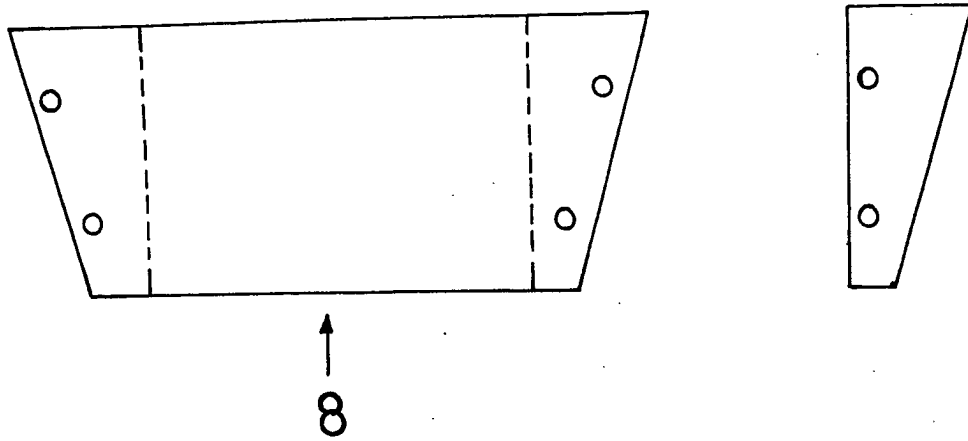


FIG.7

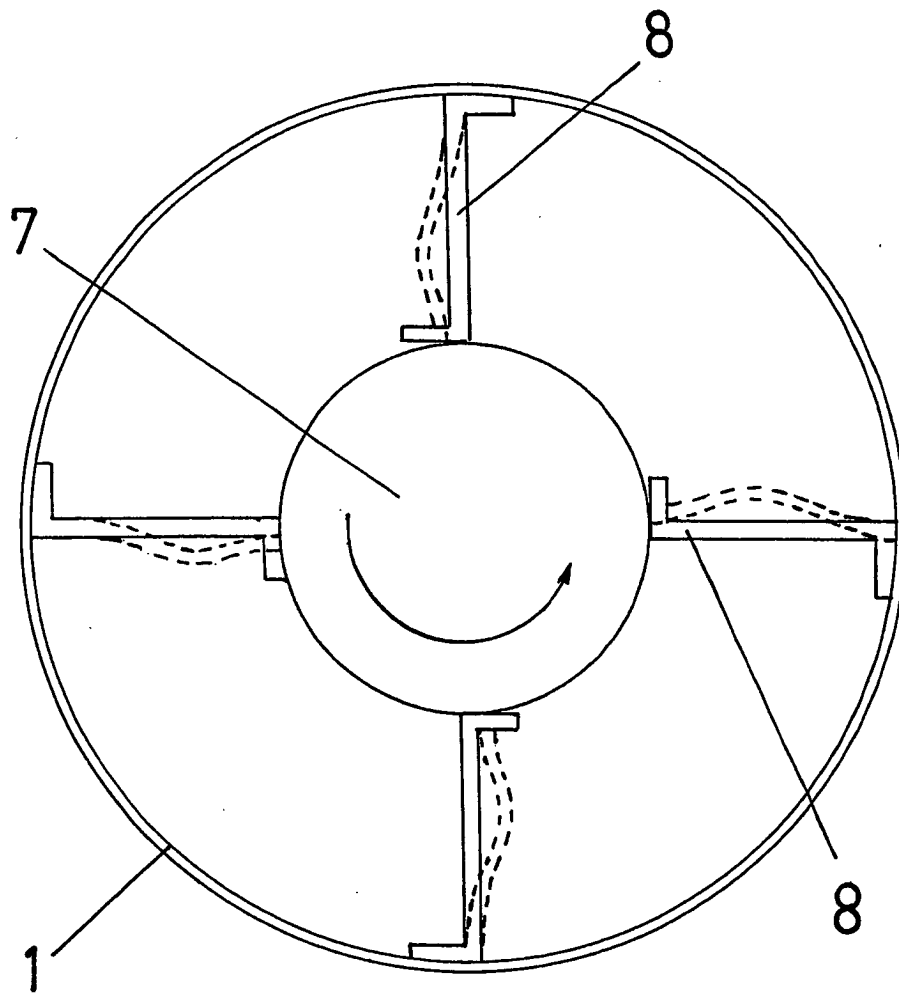


FIG. 8

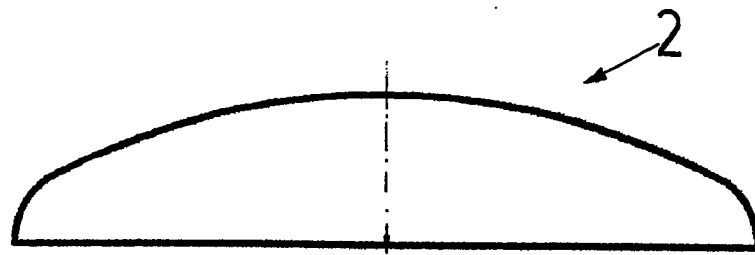


FIG. 9

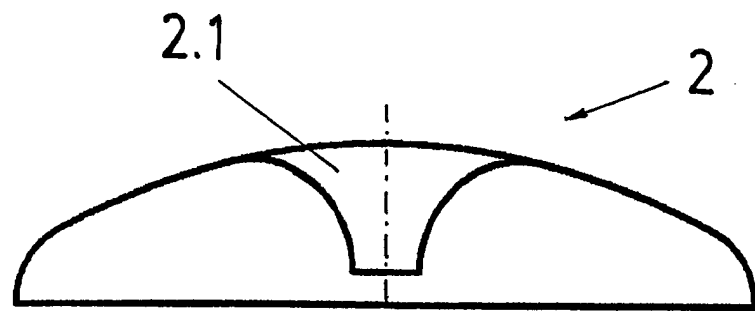


FIG. 10

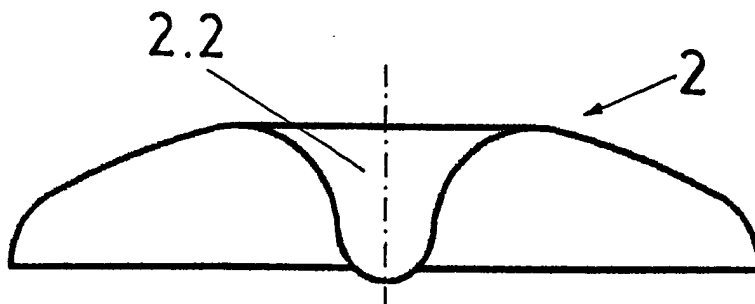
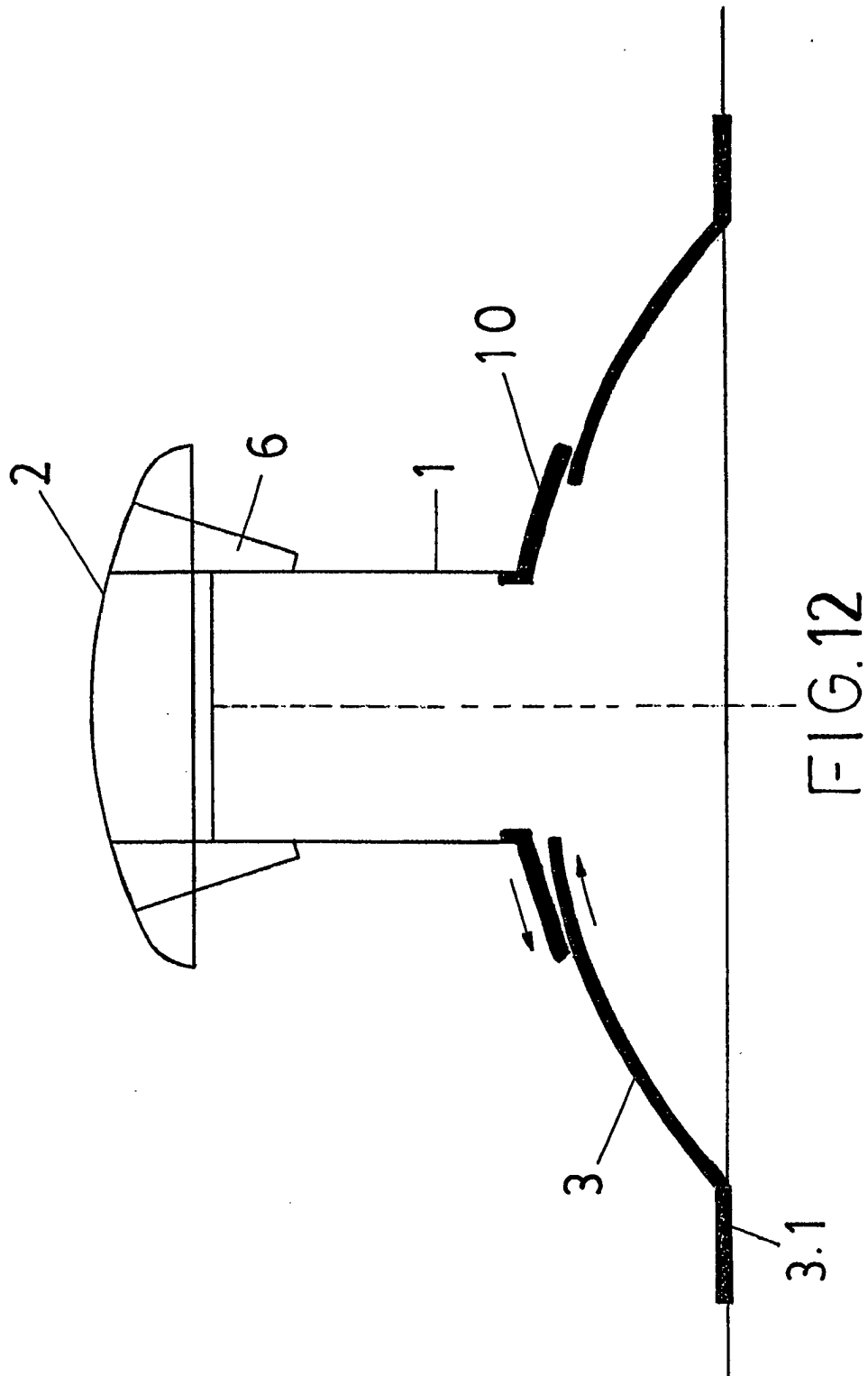
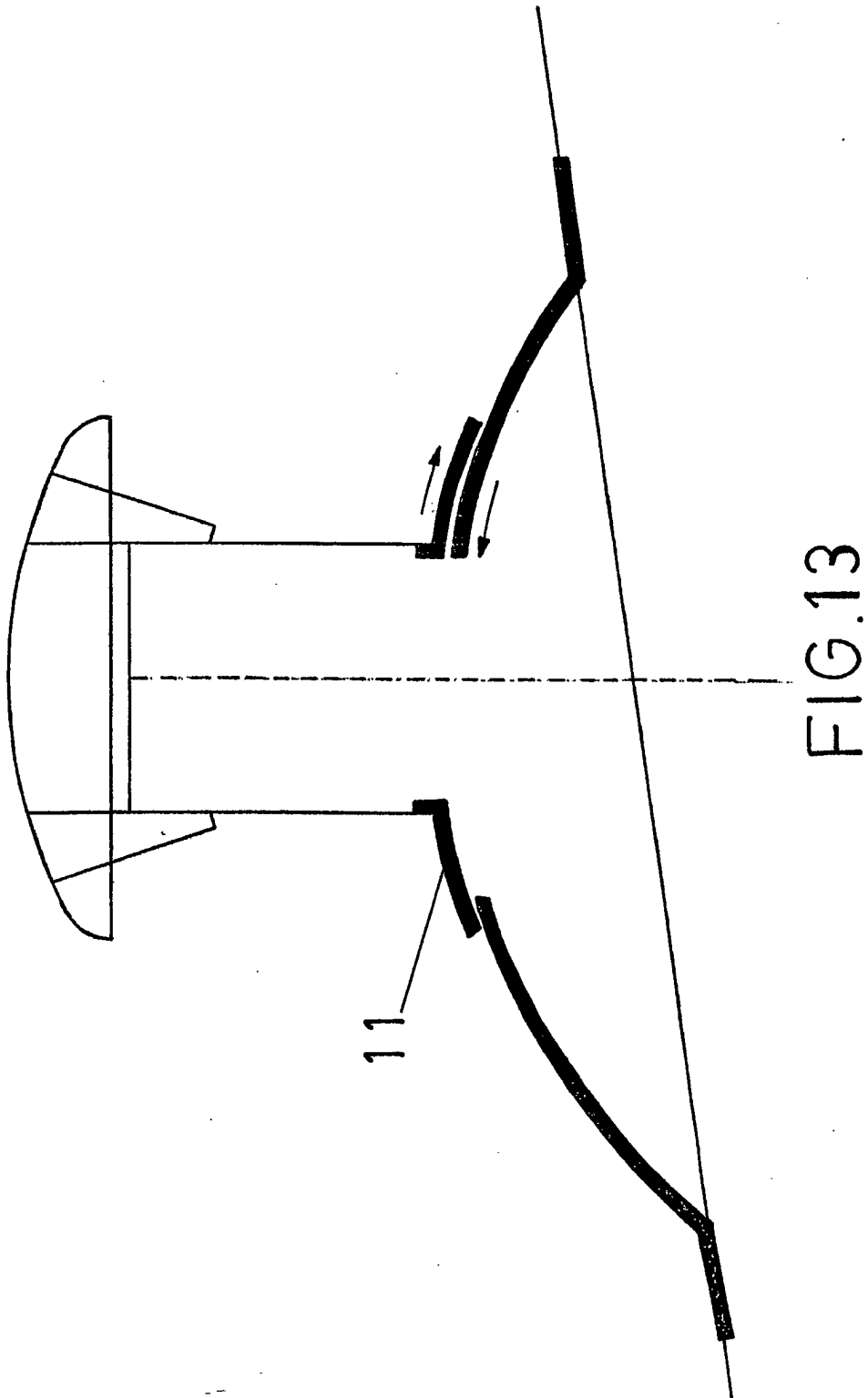


FIG. 11





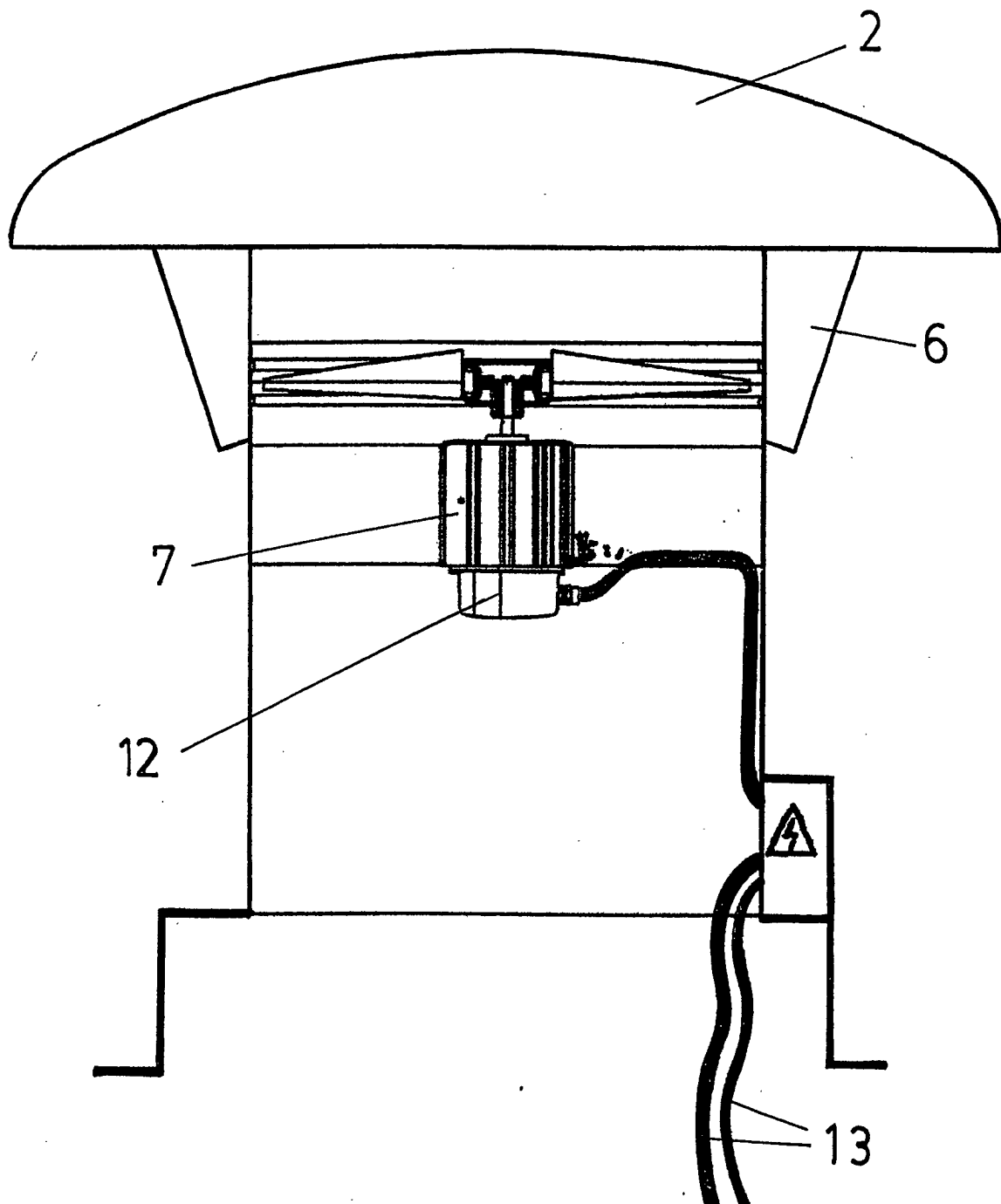


FIG.14

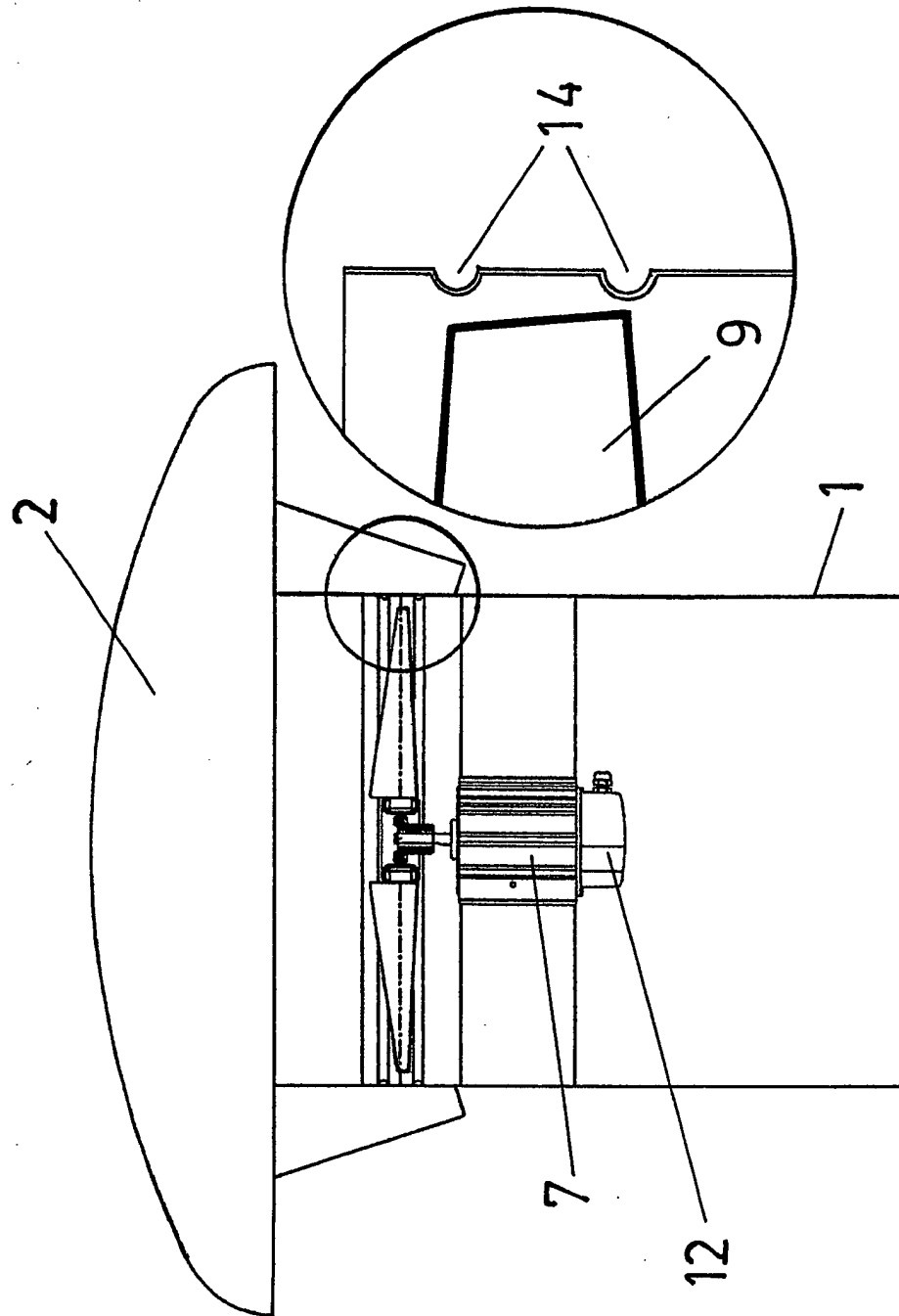
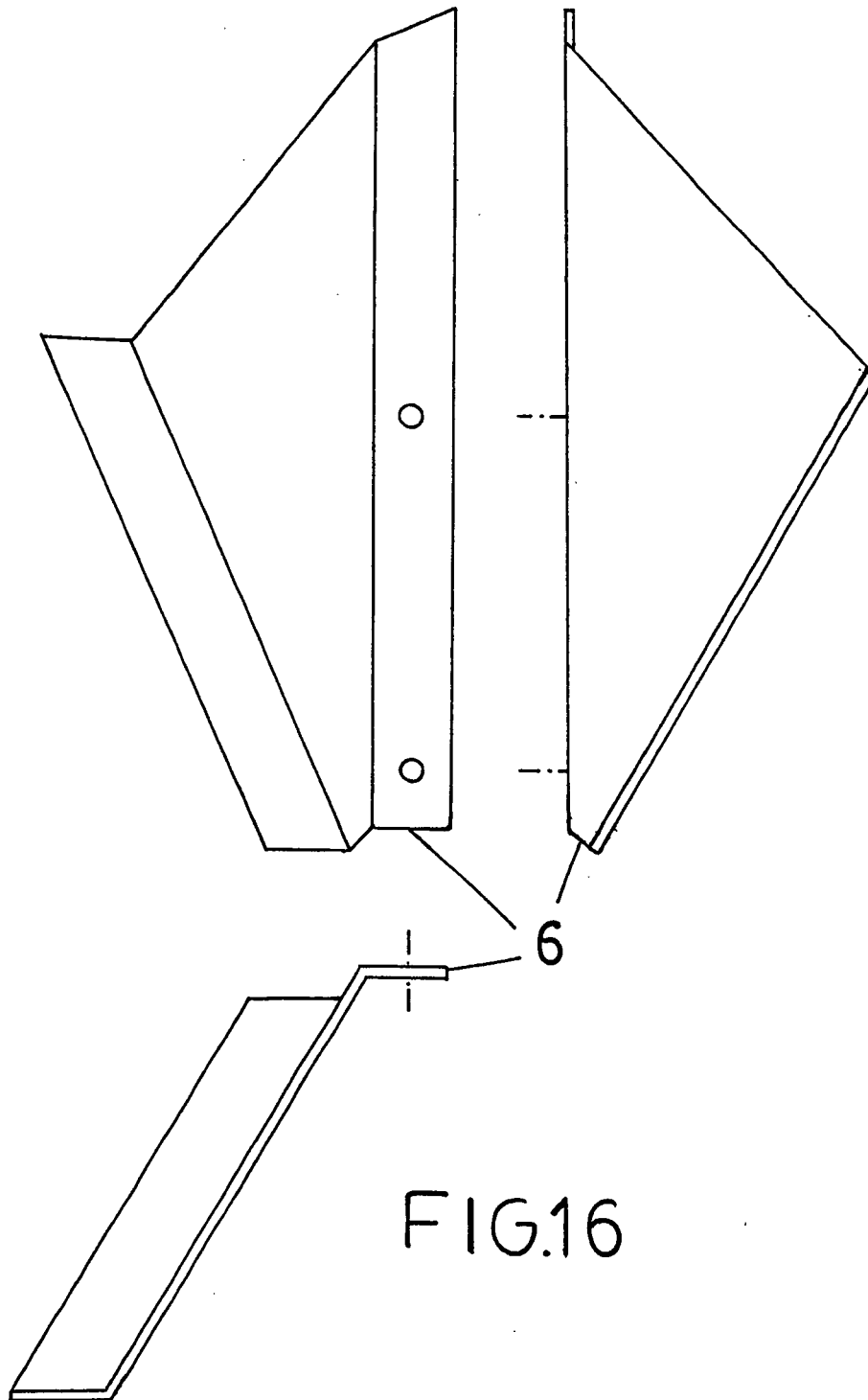
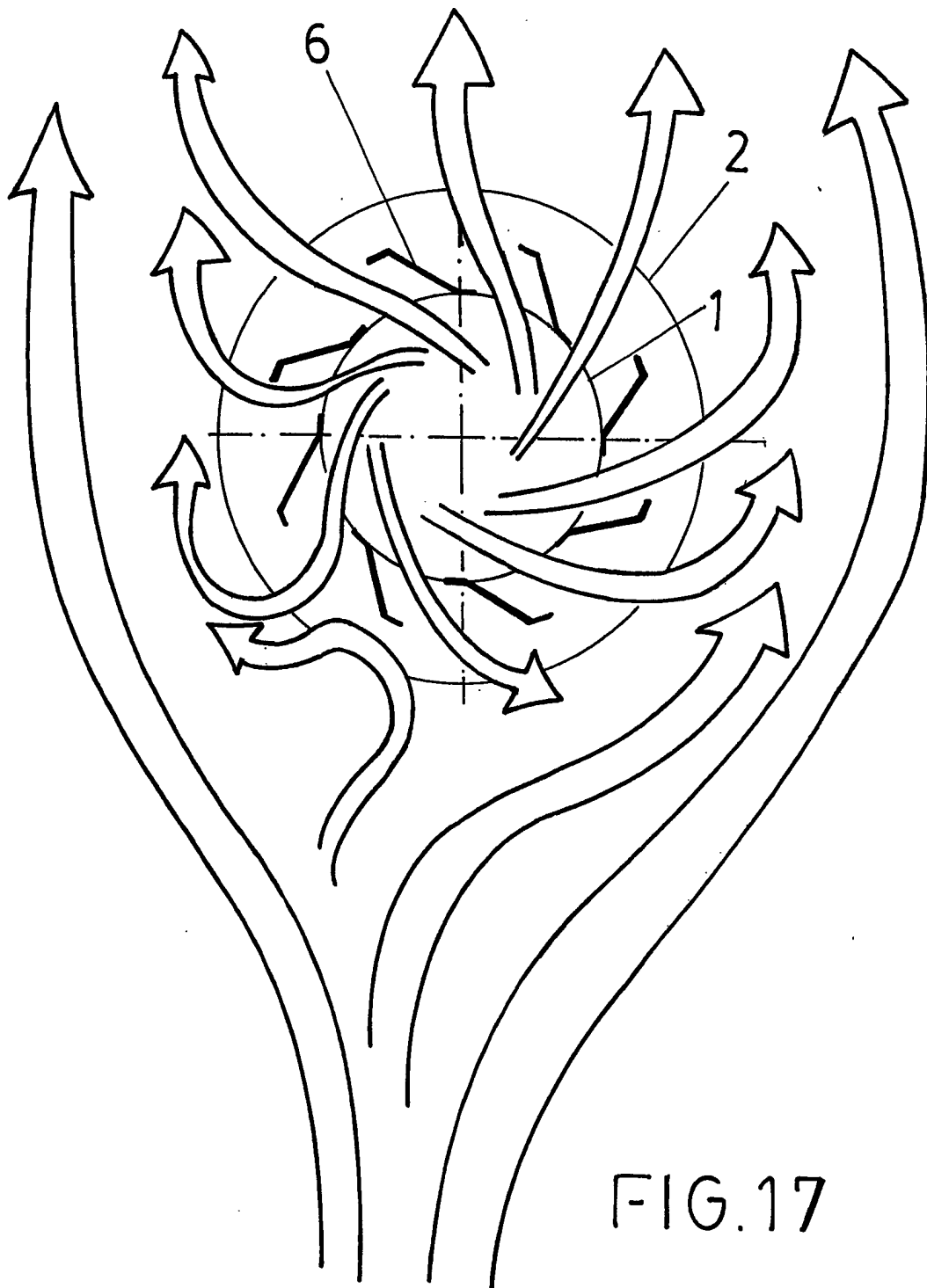


FIG. 15







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EUROPEAN SEARCH REPORT

Application Number
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Y	EP 0 802 378 A (KLOEBER JOHANNES) 22 October 1997 (1997-10-22) * column 4, line 36 - column 4, line 59; figures 1,6 * * column 8, line 18 - column 8, line 33 * ---	1-3	F24F7/02 E04D13/147
Y	US 2001/039776 A1 (O'HAGIN HARRY) 15 November 2001 (2001-11-15) * claim 2; figure 6 * ---	1-3	
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The present search report has been drawn up for all claims			
Place of search MUNICH		Date of completion of the search 11 October 2002	Examiner Lienhard, D
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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