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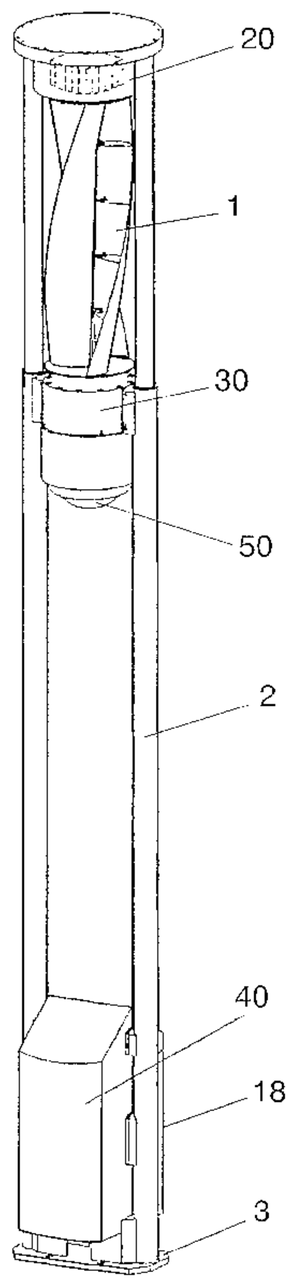
(54) Title: WIND TURBINE GENERATOR



(57) Abrégé/Abstract:
A wind turbine device where over speeding of a wind wheel with the increase in natural wind is prevented by a load produced by a fan based on a rotational force of the wind wheel. The wind turbine device has a wind wheel rotating while catching natural wind and a storage battery converting rotational energy into electrical energy to store it. The wind turbine device further has a centrifugal blade wheel provided coaxial with the rotation shaft of the wind wheel, and the centrifugal blade wheel has a casing, not catching natural wind, to form a fan.

ABSTRACT

Such a wind turbine generator is provided, which avoids a vane from over-rotation accompanied with increasing of a natural wind by load generated by a fan. This wind turbine generator is equipped with the vane rotating by receiving the natural wind and a storage battery storing an electric energy converted from a rotational energy of the vane, wherein there are furnished a radial impeller provided coaxially with a rotational axis of the vane and a fan having a casing in which the radial impeller does not receive the natural wind.

Description

WIND TURBINE GENERATOR

TECHNICAL FIELD

The present invention relates to a wind turbine generator making use of natural energy. More particular, the invention relates to a protective device for a vane at a strong wind.

BACKGROUND ART

Conventionally, concerning this kind of the protective device of the vane when a strong wind blows, such a wind turbine generator of variable pitch system has been well known, where pitches of rotor blades change in response to wind pressure received by the vane. There is also such a side-displacing wind turbine generator of a suspended type-fixed pitch system where the vane or a generator suspended from a pivot turns or changes in response to wind pressure received by the vane. One of them uses a directional plate and an output adjusting spring provided thereto, and varies rotation number of the vane in response to wind pressure such that only almost fixed wind pressure is effected to the vane, irrespective of wind speeds, and displaces, at a wild wind, the vane transversely to the direction of the wind so that the vane receives the smallest resistance for its protection. Such a system is disclosed in, for example, Patent Laid Open No. 128471/1983. On the other

hand, a brake disc system having a brake disc in front of a propeller of a propeller shaft generates, at the strong wind, friction by urging pressure of the brake disc so as to brake. Such a system is disclosed in, for example, Patent Laid Open No. 77573/1981.

DISCLOSURE OF THE INVENTION

A wind turbine generator, equipped with a vane rotating by receiving a natural wind and a storage battery storing an electric energy converted from a rotational energy of the vane, comprising:

a radial impeller provided coaxially with a rotational axis of the vane,

wherein the radial impeller comprises a casing in which the radial impeller does not receive the natural wind.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view of the whole summary of the wind turbine generator based on one embodiment of the invention.

Fig. 2 is a perspective view of a fan composing part of the wind turbine generator based on one embodiment of the invention.

Fig. 3A is a front view of the wind turbine generator based on one embodiment of the invention.

Fig. 3B is a partially cross sectional view of the

multi-bladed impeller seen from the front face of the wind turbine generator based on one embodiment of the invention.

Fig. 3C is a partially cross sectional view of the vane seen from the front face of the wind turbine generator based on one embodiment of the invention.

Fig. 4 is a table of characteristics showing the speed of the natural wind and the number of revolutions of the vane and the fan of the wind turbine generator based on one embodiment of the invention.

Fig. 5 is a perspective view of the whole summary of the vane, the propeller and fan of the wind turbine generator of one embodiment of the invention.

Fig. 6 is a cooling part of the bearing device of the wind turbine generator of one embodiment of the invention.

Fig. 7 is a composing part of the tongue portion of the wind turbine generator of one embodiment of the invention.

Fig. 8 is a whole front view of the air duct for discharging heat from the wind turbine generator of one embodiment of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

In the conventional wind turbine generator as above mentioned, when the speed of the natural wind is high, for example, as 60 m/s at a typhoon, the vane rotates at high speed by the strong wind. Therefore, a mechanical vibration and pulsation

repeat at high speed owing to strength of the blades of the vane, and cause deterioration or cracks in the blades, and finally invite breakage in the blades when an internal stress in the material exceeds a breaking point. Many countermeasures have been taken, and a variable pitch system is known where pitches of the rotational blades are varied when the strong wind blows, but this system requires many incidental facilities such as a rotation transmitting mechanism. The suspended type-fixed pitch system also is known, which has the rotation transmitting mechanism or a spring mechanism, necessitating many incidental facilities. The brake disc system requires the spring mechanism, and has a new problem as breakage around frictional parts, since this system brakes with the frictional force. There is another system of braking by exerting an electromagnetic brake not to rotate the blades.

These conventional systems have the problems that the structure is complicated at the high cost of equipment, taking many processes requiring regular maintenances for securing functions because of the complicated structure. Another problem is concerned with certainty that in case of braking by the electromagnetic brake, if the battery is out of order, stopping of the vane cannot be continued.

The invention is to solve the existing problems, and it is an object of the invention to provide a protective device of the vane which is simple, secure, and low at cost, and has

a long cycle of maintenance.

Explanation will be made to the embodiments of the invention, referring to the attached drawings.

In the following description, explanation will be made, on the basis of the drawings, to one embodiment of a street lamp using the wind turbine generator of the invention.

Fig. 1 is a perspective view of the whole summary of the wind turbine generator based on one embodiment of the invention. Fig. 2 is a perspective view of a fan composing part of the wind turbine generator based on one embodiment of the invention. Fig. 3A is a front view of the wind turbine generator based on one embodiment of the invention. Fig. 3B is a partially cross sectional view of the multi-bladed impeller seen from the front face of the wind turbine generator based on one embodiment of the invention. Fig. 3C is a partially cross sectional view of the vane seen from the front face of the wind turbine generator based on one embodiment of the invention. Fig. 4 is a table of characteristics showing the speed of the natural wind and the number of revolutions of the vane and the fan of the wind turbine generator based on one embodiment of the invention. Fig. 5 is a perspective view of the whole summary of the vane, the propeller and fan of the wind turbine generator of one embodiment of the invention. Fig. 6 is a cooling part of the bearing device of the wind turbine generator of one embodiment of the invention. Fig. 7 is a composing part of

the tongue portion of the wind turbine generator of one embodiment of the invention. Fig. 8 is a whole front view of the air duct for discharging the heat of the wind turbine generator of one embodiment of the invention.

(Embodiment 1)

The whole structure of the wind turbine generator according to the present embodiment is equipped with vane 1, fan 20 for avoiding over-revolution of vane 1, generating set 30 of converting revolution energy of vane 1 into electric energy, capacitor 40 for storing electric power generated by generating set 30, and lighting device 50 for lighting by electric power stored in capacitor 40. Vane 1, fan 20, generating set 30, capacitor 40, and lighting device 50 are supported between two poles 2 at determined heights from the ground. Poles 2 are installed on the ground by mounting bed 3 installed by fixture such as anchor bolts.

Fan casing 21 is composed of top board 22, side board 23, and bottom board 24. Fan 20 has inlet ports 10 disposed at ends of hollow poles 2, and is composed of inlet chamber 11 and orifice 12 provided between inlet ports 10 and top board 22, multi-bladed impeller 4, tongue portion 13 and fan outlet port 14. Multi-bladed impeller 4 is connected coaxially to the upper end of rotational axis 7 of vane 1. Multi-bladed impeller 4 is one example of a radial impeller, and the radial impeller is not limited to multi-bladed impeller 4.

Multi-bladed impeller 4 as the radial impeller is formed with a fan, having a casing not to receive the natural wind. A direction receiving the wind of the blades of multi-bladed impeller 4 is the same direction as the rotating direction of vane 1 rotating by receiving the wind, and vane 1 is connected at its lower end coaxially to the rotational axis of electric generator 5 equipped within generating set 30. Vane 1 is composed of rotational axis 7 connected, via coupling 6, to electric generator 5 and a plurality of blades 8 of the vane disposed around rotational axis 7. Rotational axis 7 is respectively provided at the upper and lower parts with bearings 9 for holding rotational axis 7, where bearings 9 are provided at the interior of fan 20 and at the interior of generating set 30, respectively.

Generating set 30 is furnished on the lower part with lighting device 50 to provide a structure having inside illumination 15.

Capacitor 40 has inside control box 16 and lead storage battery 17 for automatically turning ON and OFF by an illumination sensor. Capacitor 40 has inspection door 18 for maintenance.

Generating set 30 and lighting device 50 are electrically connected to capacitor 40 via control box 16. Electric power generated by rotational energy of vane 1 is stored in capacitor 40, and supplied to lighting device 50 for turning ON

illumination 15.

Fig. 4 shows in the present embodiment respective characteristics in a case of driving a simplex of vane 1, another case of driving a simplex of fan 20, and a further case of driving vane 1 and fan 20 together. Fig. 4 shows in the table the characteristics of the natural wind speed and the number of revolutions of the vane and the fan. A curve 101 is the characteristics of driving the simplex of vane 1, and the number of revolution of vane 1 increases in proportion to increasing of the natural wind speed. Another curve 102 is the load characteristics of the simplex of fan 20, and the number of revolution of fan 20 increases in proportion to square of the natural wind speed. Herein, a further curve 103 in a case of attaching fan 20 to vane 1 is the driving characteristics of deducting the curve 102 from the curve 101, showing the actual driving conditions. In regard to the case of the wind speed of 15 m/s being an upper value of an ordinary wind speed and the case of the wind speed of 60 m/s at the typhoon, prevention of over-rotation of vane 1 will be explained under.

A reason why the upper limit of the ordinary wind speed is determined to be 15 m/s, is because a rated wind speed of the wind turbine generator is set to be 15 m/s and power at a wind speed exceeding it is not stored in capacitor 40. When the upper limit of the ordinary wind speed is 15 m/s as shown in the curve 103, the driving of the simplex of vane 1 is around

1000 r/min, and in case of attaching fan 20, it is around 800 r/min, and a restraining rate of the number of revolution decreasing the number of revolution of vane 1 by attaching fan 20 is 20%. On the other hand, to the wind speed of 60 m/s at the typhoon, the driving of the simplex of vane 1 is around 4400 r/min, and in case of attaching fan 20, it is around 2150 r/min, and the restraining rate of the number of revolution is 51% and the restraining rate of the number of revolution largely decreases. This is why the characteristic of vane 1 increases the number of revolution in proportion to the wind speed, but the characteristic of fan 20 increases the number of revolution by square with respect to increasing of the wind speed. As a result, in case vane 1 and fan 20 are coaxially connected, since the revolution of vane 1 is less restrained in the range of the low wind speed of fan 20, while in the high range the revolution of vane 1 is restrained, the over-revolution is prevented in that the stronger is made the natural wind speed, the larger is made the number of revolution of vane 1.

In the following description, explanation will be made to another embodiment of the wind turbine generator according to the invention. Structures having the same functions as those of the above mentioned embodiment will be give the same numerals for omitting explanation. Other structures not shown have the same structures as those of the above embodiment.

For capacitor 40, a condenser may be used other than the

lead storage battery.

(Embodiment 2)

Fig. 5 is the perspective view of the whole summary of the vane of a propeller fan of the wind turbine generator of the second embodiment of the invention.

As shown in Fig. 5, the wind turbine generator according to the present embodiment uses the vane of a horizontal axis, and multi-bladed impeller 4 is furnished coaxially with rotational axis 7 of vane 1, and the rotational axis 7 is connected to electric generator 5 via coupling 6. Multi-bladed impeller 4 is furnished in the interior of fan 20, and is structured to rake out the air absorbed from inlet port 10 by multi-bladed impeller 4 and discharge it to fan outlet port 14.

Similarly to the embodiment shown in Fig. 1, also in this embodiment, when vane 1 receives the strong wind, multi-bladed impeller 4 coaxially rotating serves as resistance to avoid over-rotation.

(Embodiment 3)

Fig. 6 is the cooling part of the bearing device of the wind turbine generator of the third embodiment of the invention

As shown in Fig. 6, a structure is provided with bearings 9 in the air duct within fan 20 furnished on the upper part of the wind turbine generator.

In the this structure, air stored in inlet chamber 11 as the air ducts being the interiors of two poles 2 is discharged

outside by multi-bladed impeller 4 via orifice 12.

It is possible thereby to make the outlet flow collide against bearing 9 and avoid the temperature from rising.

(Embodiment 4)

Fig. 7 is a composing part of the tongue portion of the wind turbine generator of the fourth embodiment of the invention

As shown in Fig. 7, tongue portion 13 provided within fan 20 furnished on the upper part of the above mentioned wind turbine generator has a variable structure in is a condition of a position 13B not functioning as the tongue portion at the ordinary wind speed of lower than 15 m/s, and in a condition of a position 13A at the strong wind exceeding 15 m/s.

In this structure, the air within fan 20 is raked out in a centrifugal direction by multi-bladed impeller 4 rotating, and is discharged outside of the device from fan outlet port 14 through tongue portion 13.

By making tongue portion 13 variable, the characteristic of fan 20 can be adjusted, and it is possible to decrease load until a range of an arbitrary wind speed, and reduce loss of power generation caused by fan 20.

In the above manners, the space between multi-bladed impeller 4 as the radial impeller and tongue portion 13 does not form the tongue shape until the wind speed range of power generation, and when going into the wind speed range of power generation, tongue portion forming means shaped in the tongue

is formed within the casing.

(Embodiment 5)

Fig. 8 is a whole front view of a the air duct for discharging the heat of the wind turbine generator of the fifth embodiment.

As shown in Fig. 8, the structure is similar to that of the embodiment shown in Fig. 1 of the embodiment 1.

Heat generated in electric generator 5, illumination 15, control box 16, and lead storage battery 17 is discharged outside of the device through the air duct of the interiors of two poles 2 by fan 20 installed on the upper part of the wind turbine generator.

It is possible thereby to discharge the quantity of heat generated inside of the wind turbine generator and prevent the temperature from rising inside of the device.

As explained above, the invention is the wind turbine generator which is equipped with the vane rotating by receiving the natural wind and the storage battery storing electric energy converted from rotational energy of the vane, wherein there are furnished the radial impeller provided coaxially with the rotational axis of the vane, and the fan having the casing in which the radial impeller does not receive the natural wind. Thereby, based on the rotational force of the vane, load created by the fan avoids over-rotation of the vane accompanied with increase of the natural wind.

As explained above, in the invention, the fan has the

radial impeller, the tongue portion and the casing, wherein the tongue portion varies its shape, thereby to change the fan characteristic so that it is possible to adjust the load effected on the vane.

As explained above, the invention shows, in the wind turbine generator, that the structure has the space between the radial impeller and the tongue portion does not form the tongue shape until the range of the wind speed causing the electrical generation, and when entering into the range of the wind speed causing the electrical generation, the space forms the tongue portion. In such a manner, it is possible to adjust the fan characteristics by the tongue portion such that the load of the fan is made light during the natural wind while enabling to use the power generated by the vane, and the load is made heavy in case of the natural wind being higher than that natural wind.

As explained above, the invention shows, in the wind turbine generator, that the bearing of the vane is disposed in the air duct in the vicinity of the outlet port of the radial impeller in the interior of the casing for cooling heat of the bearing by discharging flow of the fan. In such a manner, since when the rotation number of the fan goes up, the temperature of the bearing also goes up, the bearing is provided with the air duct of the fan for serving as cooling the heat of the bearing.

As explained above, the invention shows, in the wind

turbine generator, that the rotating direction of the radial impeller is forward in the direction of the blade with respect to the vane rotating by receiving the natural wind, so that the vane and the blades of the fan are controlled not to cause counter-load.

The invention in the wind turbine generator allows the material of the radial impeller to be composed with aluminum.

In the wind turbine generator of the invention, the radial impeller may be composed of the multi-bladed impeller

The wind turbine generator of the invention is provided with the heating unit of the storage battery, the inverter, the electric generator and the controller, and with the connecting poles for supporting the vane and the heating unit, the connecting poles being hollow in construction, defining the air ducts communicating with the heating unit. The air ducts are connected to inlet ports of the fan for discharging heat of the heating unit from the fan. In such a manner, the heat generated from the heating unit is discharged from the fan not catching the natural wind in order not to receiving outdoor influences as rain invading.

The blades of vane 1 of the invention are enough with other than savonius or propeller, and if rotating by the natural wind, the shape of the blade is not limited.

The invention enables to compose the material of the radial impeller with aluminum.

The invention is concerned with the protection of the blades of the vane when receiving the natural wind, but may be applied to currents of water or other fluids.

As apparently from the above mentioned explanation, according to the invention, at times as when the strong wind blows as typhoon, since braking is automatically effected by braking force of the fan, the structure is simplified, a complicated auxiliary facility is no longer necessary for the protection of the vane. According to the invention, it is possible to provide the protective device for the vane of a long maintenance, since the cost of equipment is cheap and the braking function is secured by the simple structure, frequency of scheduled maintenance is lesser.

The invention has an effect of exhausting heat generated from the storage battery, generator, inverter or controller by connecting the hollow structure of the support pipe.

INDUSTRIAL APPLICABILITY

The invention is to provide a wind turbine generator having a protective device of a vane being simple, secure, cheap and long in a maintenance cycle. The invention may be applied to protection of the blades of the vane when receiving the natural wind or protection of currents of water or other fluids.

CLAIMS

1. A wind turbine generator, equipped with a vane rotating by receiving a natural wind and a storage battery storing an electric energy converted from a rotational energy of the vane, comprising:

a radial impeller provided coaxially with a rotational axis of the vane,

wherein the radial impeller comprises a casing in which the radial impeller does not receive the natural wind.

2. The wind turbine generator of claim 1,

wherein the fan comprises:

the radial impeller;

a tongue portion; and

the casing,

wherein the tongue portion varies its shape.

3. The wind turbine generator of claim 2,

wherein a measure of forming the tongue portion is provided, which does not develop the portion to be a tongue shape in a space between the radial impeller and the tongue portion until the vane comes to a range of a wind speed causing an electrical generation, and which reveals the portion to be the tongue shape within the casing when entering into the range

of wind speed of the electrical generation.

4. The wind turbine generator of claim 1, further comprising a bearing of the vane disposed in an air duct in the vicinity of a discharge opening of the radial impeller in an interior of the casing,

wherein the bearing is cooled by discharging flow of the fan.

5. The wind turbine generator of claim 1, wherein the rotating direction of the radial impeller is forward in the direction of the blade with respect to the vane rotating by receiving the natural wind.

6. The wind turbine generator of claim 1, wherein material of the radial impeller is aluminum.

7. The wind turbine generator in any of claims 1 to 6, wherein the radial impeller is a multi-bladed impeller.

8. The wind turbine generator of claim 1, further comprising:

a heating unit of the storage battery, the inverter, the electric generator and the controller; and

a connecting pole for supporting the vane and the heating unit,

wherein the connecting pole has hollow construction, defining air ducts communicating with the heating unit, and connecting the air ducts to inlet ports of the fan for discharging heat of the heating unit.

FIG. 1

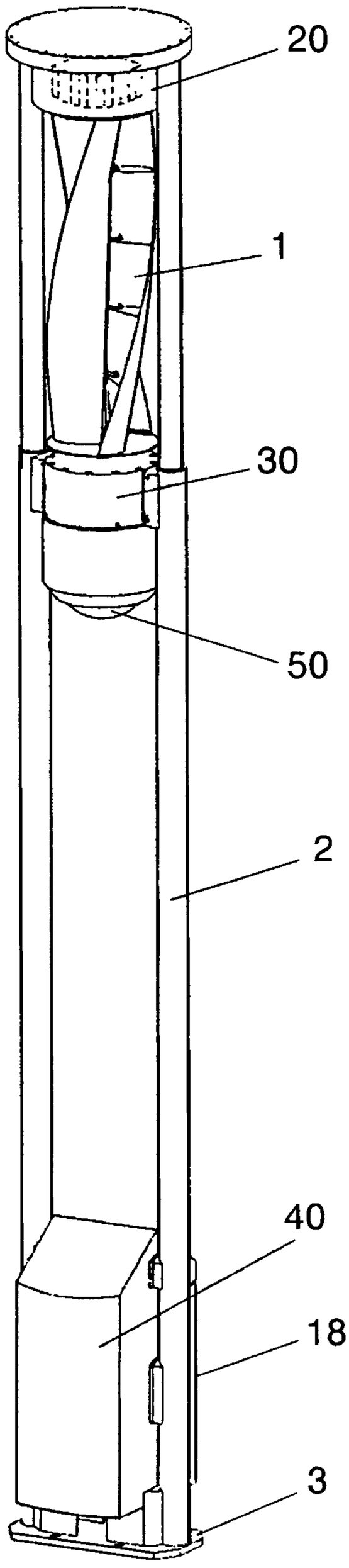


FIG. 2

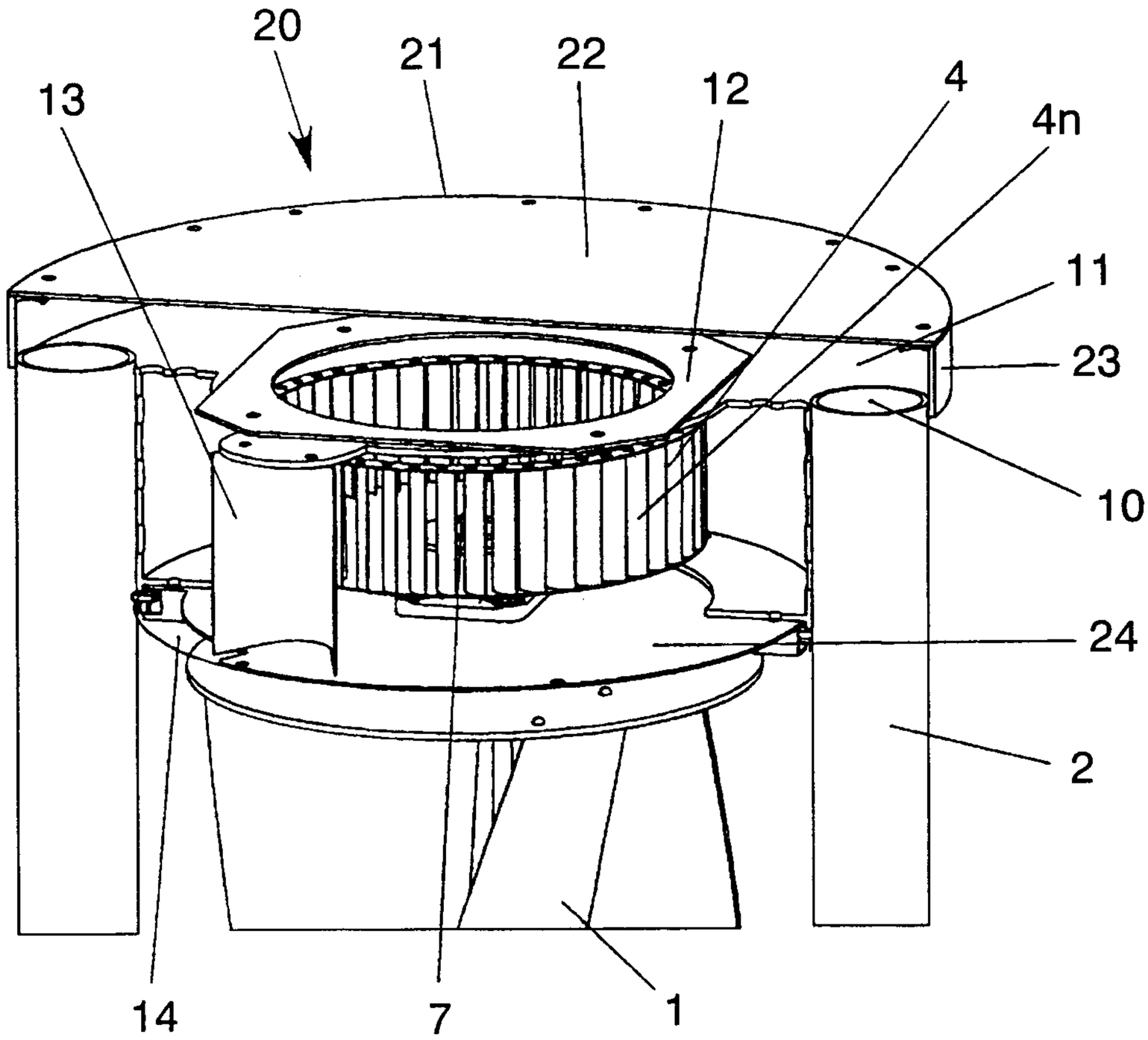


FIG. 3A

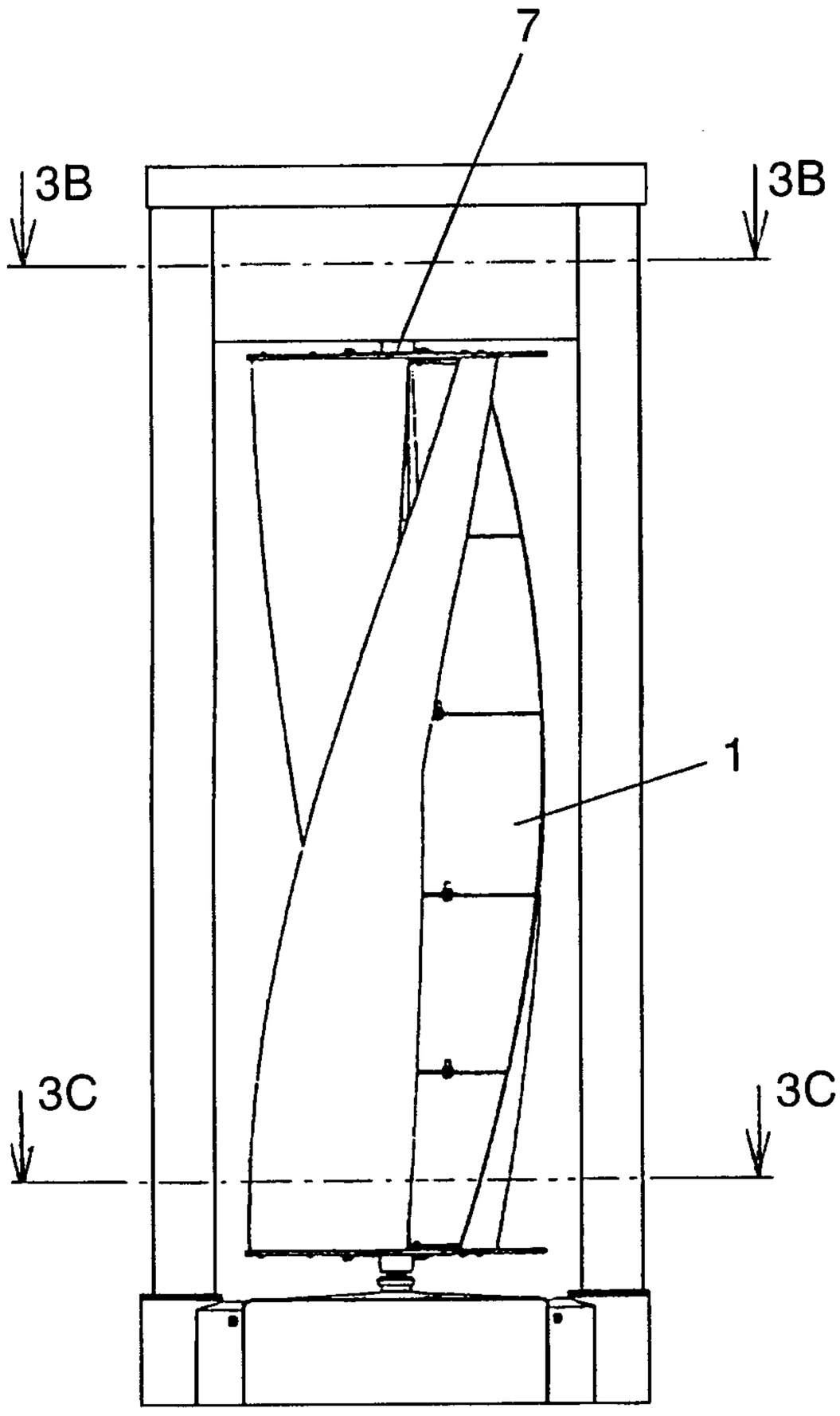


FIG. 3B

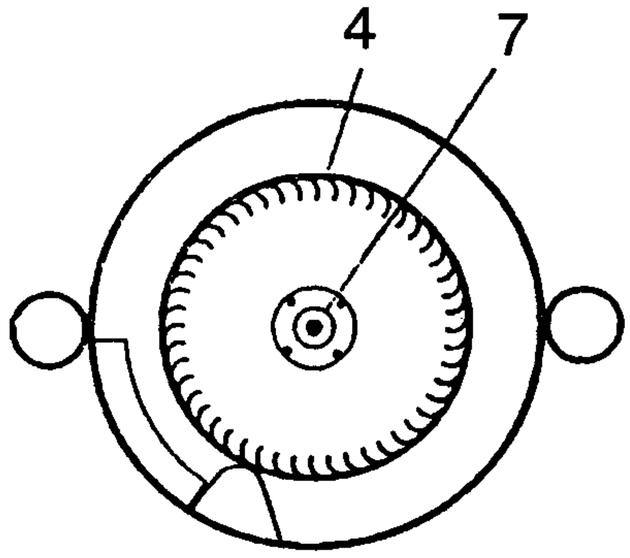


FIG. 3C

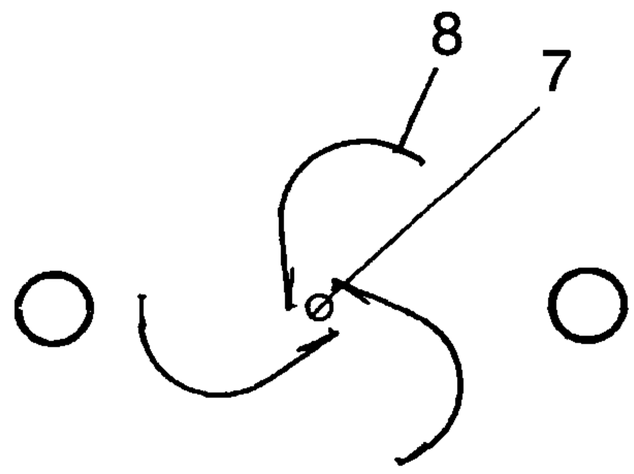


FIG. 4

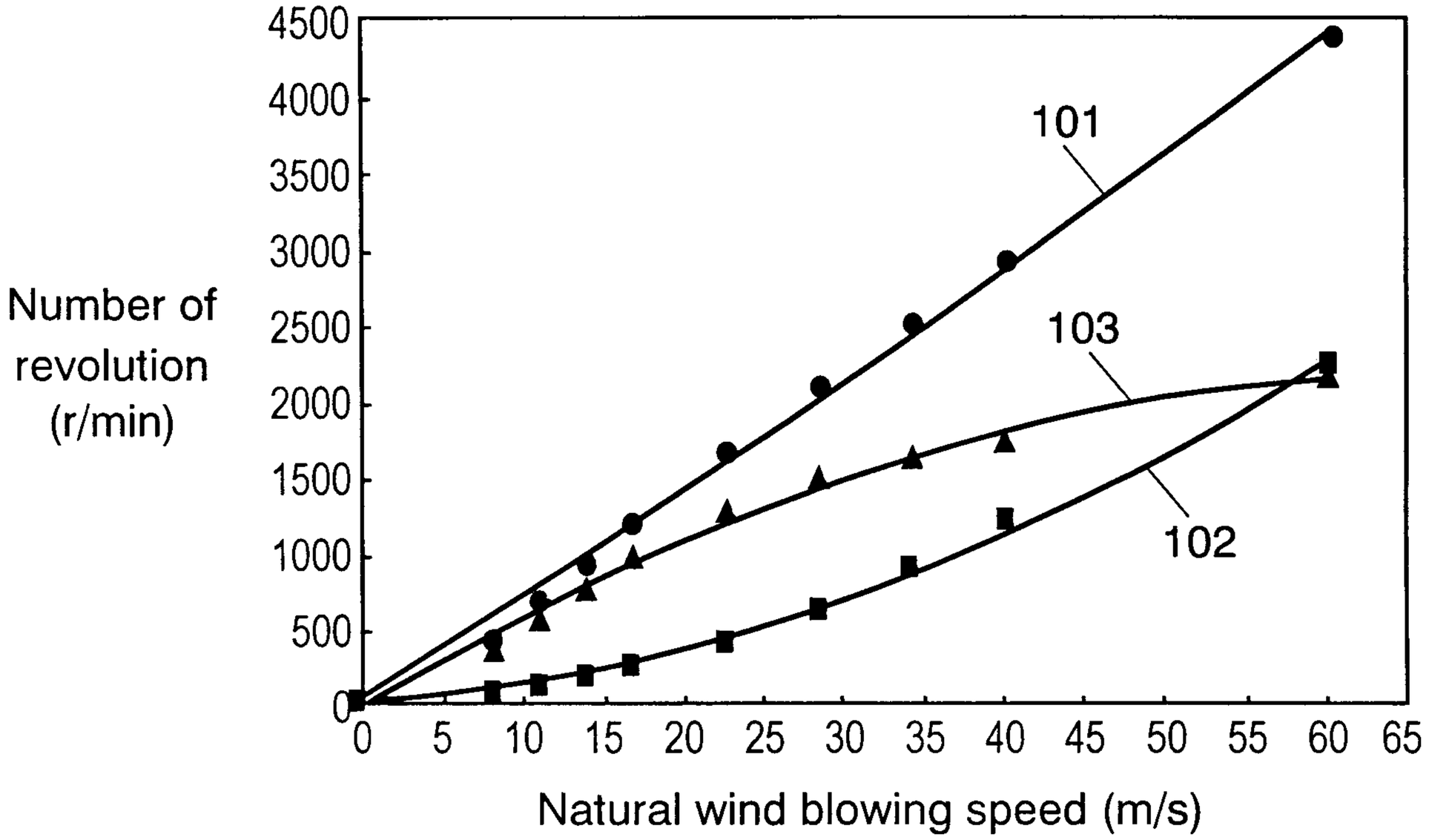

Number of revolution (r/min)
4500
4000
3500
3000
2500
2000
1500
1000
500
0
0
5
10
15
20
25
30
35
40
45
50
55
60
65
101
103
102
Natural wind blowing speed (m/s)

FIG. 5

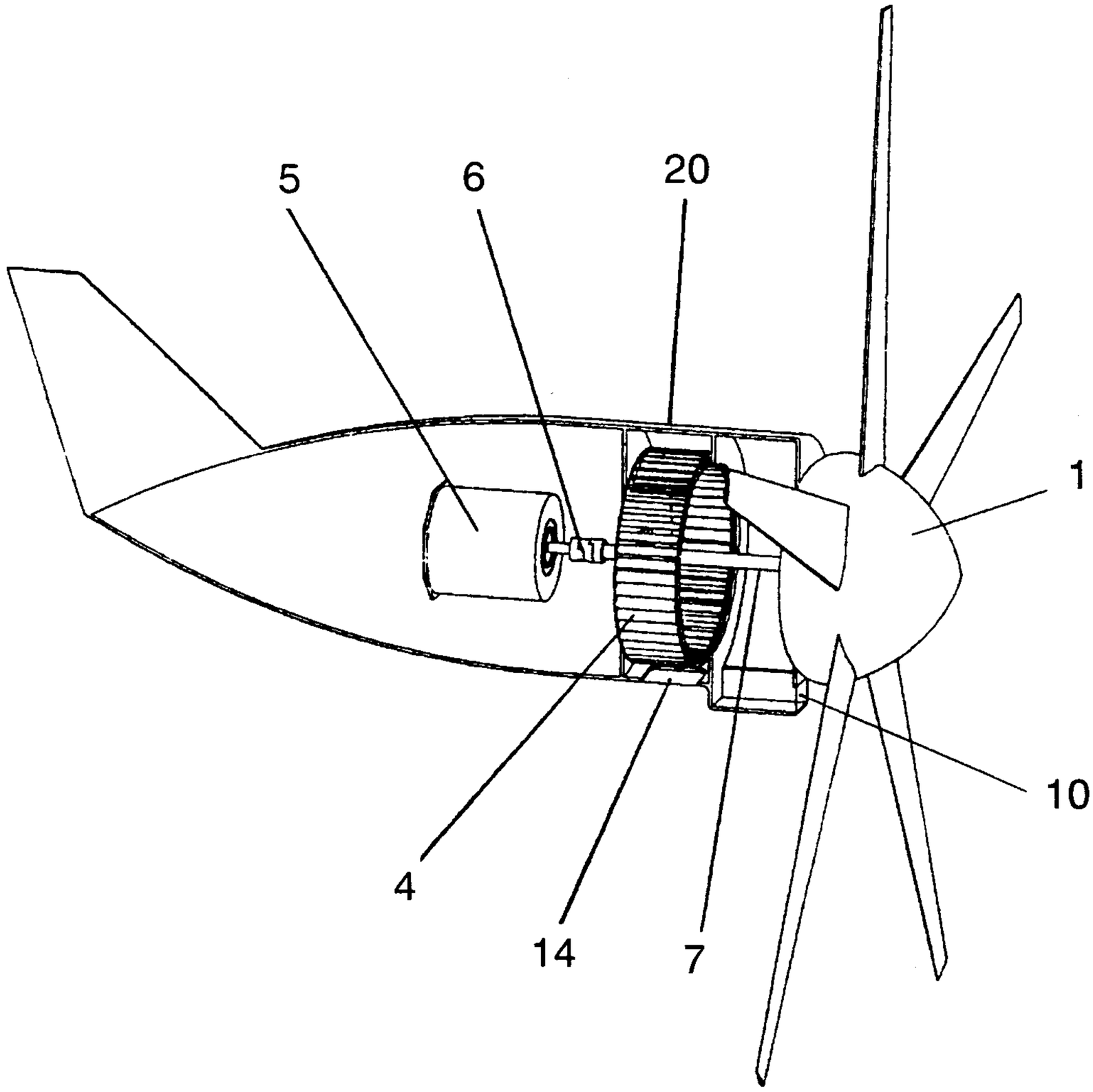


FIG. 6

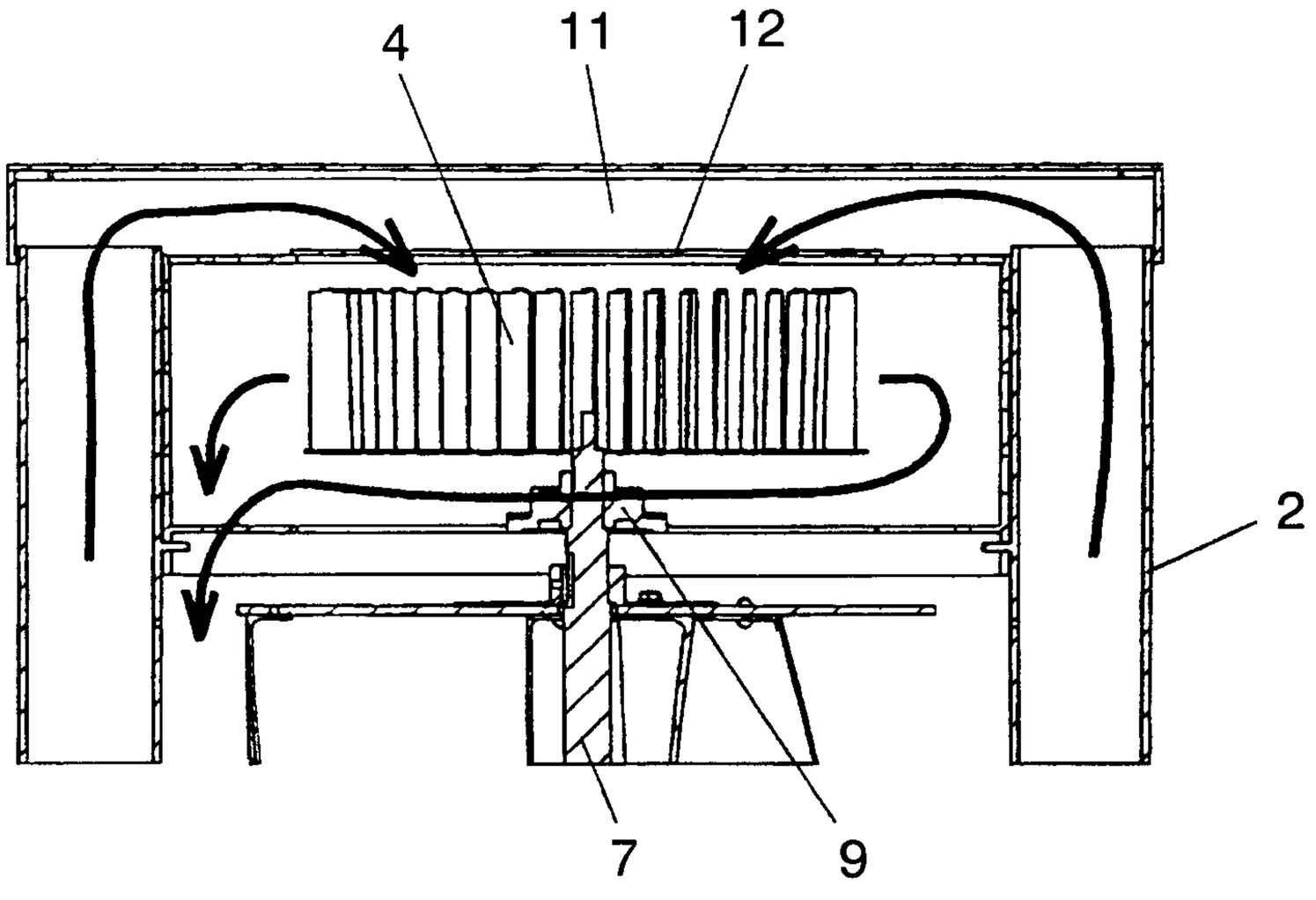


FIG. 7

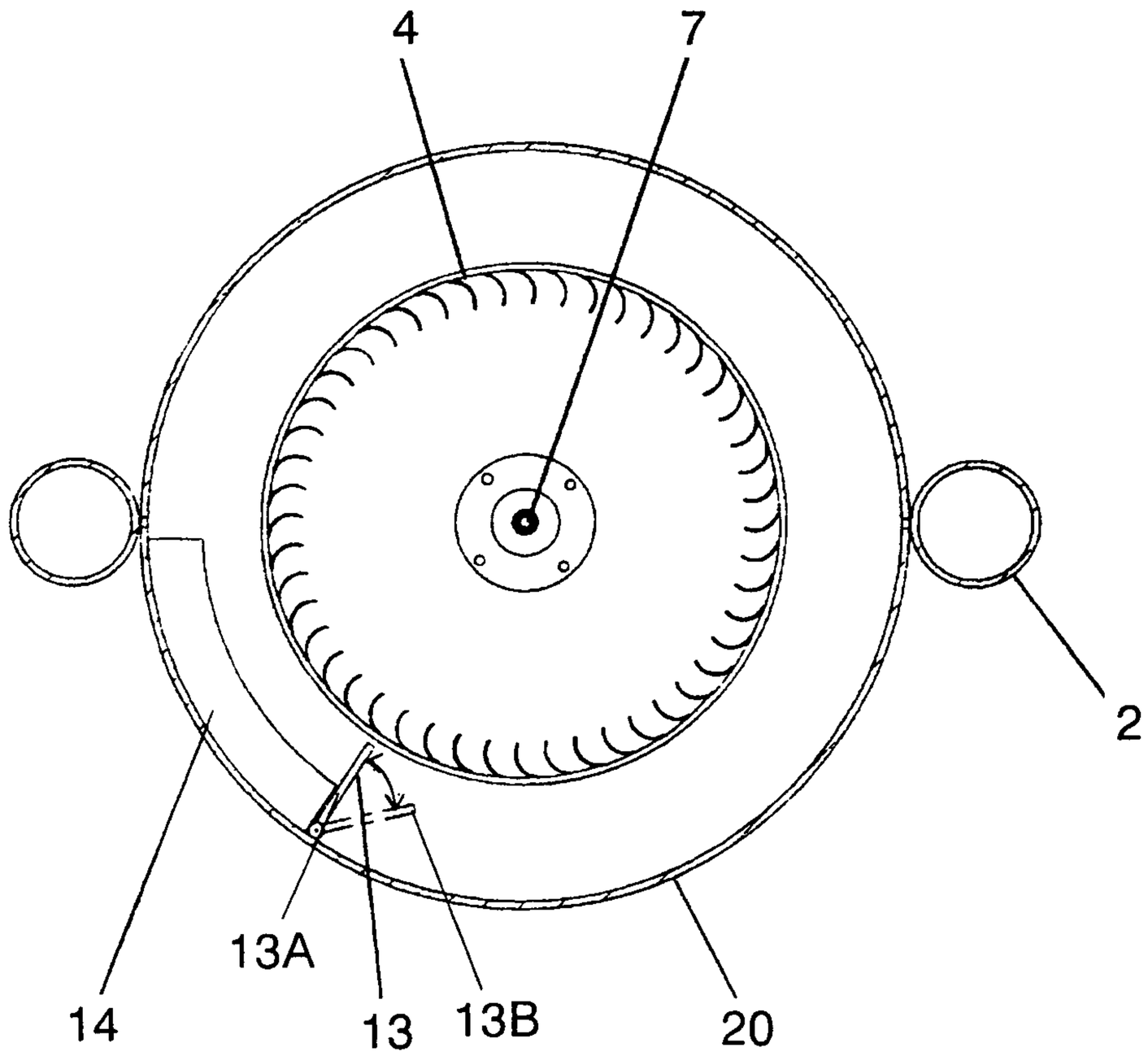
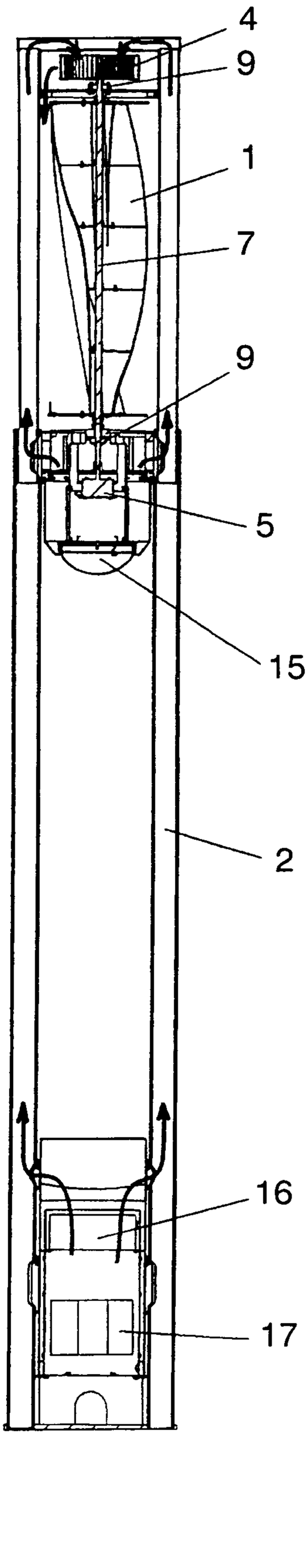
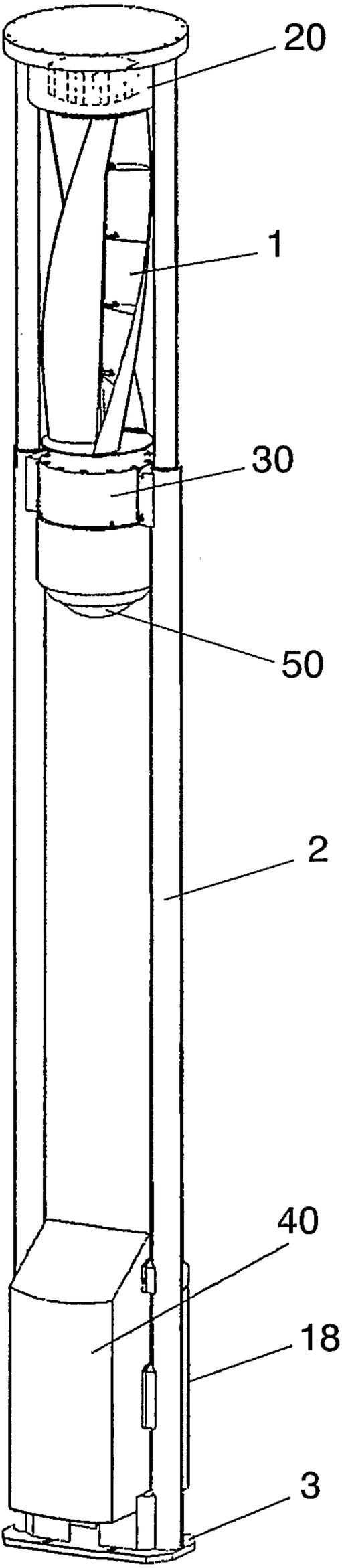


FIG. 8



Reference numerals in the drawings

1 Vane
2 Poles
3 Mounting bed
4 Multi-bladed impeller
5 Electric generator
6 Coupling
7 Rotational axis
8 Blades
9 Bearing
10 Inlet port
11 Inlet chamber
12 Orifice
13 Tongue portion
14 Fan outlet port
15 Illumination
16 Control box
17 Lead storage battery
18 Inspection door
20 Fan
21 Fan casing
22 Top board
23 Side board
24 Bottom board
30 Generating set
40 Capacitor
50 Lighting device


20
1
30
50
2
40
18
3