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(54) Title: FITTING FOR A WIND TURBINE, WIND TURBINE WITH SUCH A FITTING AND METHOD FOR IMPROVING THE EFFICIENCY OF SUCH A WIND TURBINE

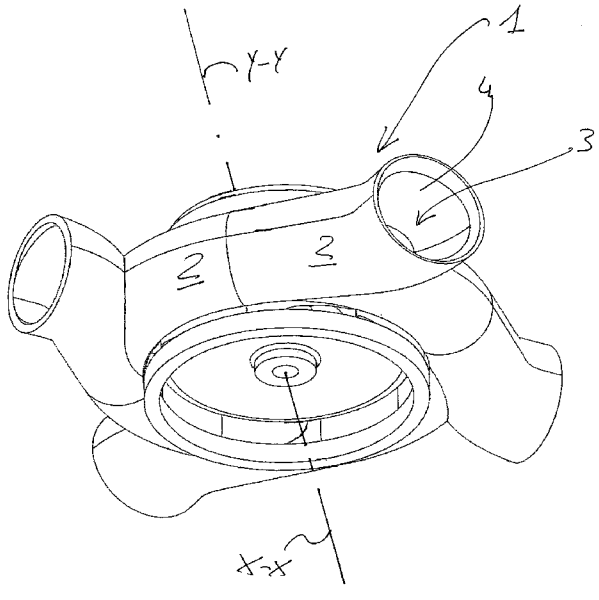

Fig. 1

(57) Abstract: The present invention relates to a fitting for a wind turbine, comprising a deflecting wall (2) and an open portion (3) shaped as a Venturi tube (4), which can be mounted onto a vertical-axis wind turbine comprising such a fitting, and to a method for improving the efficiency of such a wind turbine.

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Title: "FITTING FOR A WIND TURBINE, WIND TURBINE WITH SUCH A FITTING AND METHOD FOR IMPROVING THE EFFICIENCY OF SUCH A WIND TURBINE"

TECHNICAL FIELD

The present invention relates to a fitting for a wind turbine, to a wind turbine comprising such a fitting and to a method for improving the efficiency of such a wind turbine.

BACKGROUND OF THE INVENTION

Wind generators can be divided into two large classes, depending on the arrangement of the rotor: horizontal-axis design and vertical-axis design.

Horizontal-axis wind generators are e.g. windmills, in which the axis of rotation of the blades is arranged substantially aligned with the direction of the air flow; normally, the axis of rotation can rotate as well(usually around a vertical axis) so as to adapt blade orientation to wind direction. In these generators all the blades (there are usually three to five of them, even though configurations with a larger or a smaller number are possible) are normally struck by the wind flow so that wind can positively affect rotor rotation.

These generators, however, have the drawback of requiring large installation spaces, which results in high costs and a strong landscape impact.

Vertical-axis wind generators, conversely, are characterized in that their axis of rotation is arranged substantially orthogonal to the direction of wind flow. In this case, blade rotation will comprise an active portion, in which blade rotation is actually accelerated by wind, and an opposite passive portion, in which blade rotation is slowed down by wind.

In the known art, vertical-axis wind turbines are divided into two large classes, referred to as "SAVONIUS" and "DARRIEUS", shown in Figures 3 and 4, respectively. Other types are possible but are substantially a combination of the two types mentioned above.

To the purposes of the present invention, a vertical-axis wind generator will be one comprising blades as defined above. Despite the large variety of possible embodiments, installations and conditions of use, the skilled man in the field will always be able to indicate whether the wind generator is actually of vertical-axis design as defined above or not.

Several solutions have been developed in order to solve this problem, all of which are focused on optimizing the wing profile of the blades, so as to maximize thrust and minimize wind resistance.

Thanks to their small size, interest for vertcal-axis wind generators is growing, since they can be easily installed also in domestic environments (e.g. on house roofs).

In the light of the state of the art as described, the present invention aims at providing a fitting which can improve the efficiency of vertical-axis wind generators (or turbines).

Moreover, the present invention enables to obtain advantages in terms of easy manufacturing, higher resistance, higher compactness and/or higher versatility.

SUMMARY OF THE INVENTION

According to the present invention, this aim is achieved by a fitting according to claim 1, by a combination of a fitting and a vertical-axis wind generator according to claim 5, or by a method according to claim 8.

BRIEF DESCRIPTION OF THE DRAWINGS

The characteristics and advantages of the

present invention will be evident from the following detailed description of a practical embodiment, provided as a non-limiting example with reference to the accompanying drawings, in which:

- Figure 1 shows an embodiment of a fitting according to the present invention;

- Figure 2 shows a second embodiment of a fitting according to the present invention;

- Figure 3 shows a "SAVONIUS"-type vertical-axis turbine;

- Figures 4a and 4b show a "DARRIEUS"-type vertical-axis wind turbine, in a top view and a side view, respectively;

- Figure 5 shows a schematic view of a fitting according to the present invention coupled with a "SAVONIUS"-type turbine;

- Figure 6 shows a schematic view of the fitting according to Figure 5 coupled with a "DARRIEUS"-type turbine;

- Figure 7 shows a schematic view of a fitting similar to those of Figure 5 and 6, though closed on top, coupled with a turbine.

DETAILED DESCRIPTION

With reference to the figures, the numeral 1 globally refers to the fitting, which comprises a deflecting wall 2 and an open portion 3.

The deflecting wall 2 is advantageously carried out as a deflecting wall, whereas the open portion 3 - optional in some embodiments - is advantageously carried out by means of an air conveyor.

The turbine (or wind generator) 100, which can be seen in Figures 3, 4a or 4b, normally comprises a rotor 101 with one or more blades 102, apt to convert an air flow (wind) into a rotation around an axis X-X, and means for converting the rotation of the blades around axis X-X into electric energy produced by the turbine.

The blades 102 of the vertical-axis turbines 100, as said, have a different profile depending on the direction they are looked at, so that the absolute values of work performed by an air flow striking the blades 102 when these move in the same direction or in an opposite direction with respect to the air flow are different in the two cases, and that their sum can therefore give a positive net value.

Looking at the turbine (or wind generator) 100

from a direction orthogonal to axis X-X, i.e. from a direction from which the turbine 100 can receive an air flow so as to convert it into electric energy, it is possible to define (with respect to axis X-X, of substantial symmetry for the rotor 101) an active side and a passive side, defined precisely by the profile of the blades.

The active side will therefore be the one for which it is envisaged that the incident air flow can perform a higher work, whereas the passive side will be the one for which the work of the air flow is lower. Normally, the passive side is the one from which the blades move against the air flow, but the skilled technician will anyhow be able to assess for every single turbine the active and the passive side based on the planned direction of rotation, so that it can actually produce energy.

In Figures 3 and 4a arrows 103 indicate the direction of rotation of each turbine 100. It is therefore clear which is in the two examples shown the "active" side and which the "passive", side with respect to axis X-X, for each turbine 100. It should be noted that the "active" and "passive" sides are independent from the direction (transversal to axis

X-X) from which the turbine 100 is looked at.

According to the invention, the deflecting wall 2 is arranged near the passive side between the turbine 100 and the direction which the air flow comes from, so as to enable a reduction of the work performed by the air flow against the rotation of the rotor 101, thus increasing the efficiency of the turbine 100, i.e. enabling the increase of energy produced by the latter with the same wind speed.

Advantageously, beside the deflecting wall 2 is arranged the open portion 3, which enables the passage of the air flow towards the active side. The open portion 3 can both be simply an opening (with or without a frame defining it) or be carried out as a conveyor 4, apt to collect incident air and direct it into a specific portion of the turbine 100.

Advantageously, the conveyor 4 is carried out in a substantially conical shape, e.g. as a Venturi tube, so as to increase the speed of the air flow against the blades 102 of the turbine 100.

The fitting shown in the figures comprises four walls 2 and four open portions 4, arranged with radial symmetry, i.e. at the same circumferential distance of 90°.

However, it is evident that a different number of pairs walls/open portions is possible, from one pair only (in the case of an installation designed for winds whose direction of origin is always constant) upwards.

Advantageously, the conveyor 4 extends radially beyond the deflecting wall 2: with a conical conveyor 4 this enables to increase the amount of air flow which can be caught and conveyed against the blades 102, thus further increasing the efficiency of the turbine 100.

Advantageously, moreover, if there is a plurality of pairs of side walls 2 and conveyors 4, the side wall 2 can be made directly by the wall of the conveyor 4 directly adjacent thereto, as can be seen in Figures 1, 2, 5, 6 and 7.

Another advantage of the fitting 1 described consists in that it is possible to apply a net (not shown) in front of the open portion 3, so as to protect animals which might come into contact with the rotor of the turbine 100. Apart from this, it is also possible to carry out the fitting 1 as a container closed on top and laterally (except for the open portions 3 mentioned above), so that once it is

installed air turbulences disturbing electricity production are minimized.

Example of fittings 1 open above are shown in Figure 4 or 5, whereas the fittings of Figure 1, 2 and 7 are closed above by a wall 5 (indicated in Figure 7 only).

Obviously, a skilled technician aiming at meeting contingent and specific needs can make several changes and variants to the configurations described above.

All of these variants and changes, however, fall within the scope of protection of the invention as defined by the following claims.

It should further be pointed out that what might prove to be already known or obvious to the skilled technician before the priority date is not claimed (and is thus specifically disclamed).

CLAIMS

1. A fitting (1) for a vertical-axis wind turbine (100),

- said turbine (100) comprising a rotor (101) equipped with blades (102) and means for converting the rotation of said rotor (101) into electric energy, said blades (102) being arranged rotating around an axis of rotation X-X and being such as to define with respect to said axis X-X, when seen in a direction substantially orthogonal to said axis X-X, an active side in which an incident air flow can perform on the blades (102) a first work L1, and a passive side in which an incident air flow can perform on the blades (102) a second work L2<L1,

- said fitting (1) comprising an envelope apt to contain said rotor (101) and having substantially radial symmetry around an axis Y-Y, said axis Y-Y being designed in use to coincide with the axis X-X of said turbine (100);

- said envelope comprising a deflecting wall (2) and a flow conveyor (4), adjacent one to the other and arranged so that, when said fitting (1) is mounted with said turbine (100), said deflecting wall (2) is

able to screen at least partially said passive side from an incident air flow and said conveyor (4) is able to convey at least partially said incident air flow on said active side.

2. The fitting according to claim 1, wherein said conveyor (4) is a Venturi tube.

3. The fitting according to any one of the claims 1 or 2, comprising two, three or four pairs of deflecting wall (2)/conveyor (4), preferably at the same circumferential distance.

4. The fitting according to any one of the claims 1 to 3, wherein said deflecting wall (2) and said conveyor (4) are able together to substantially concentrate the air of the incident flow in the active side of the turbine (100) only.

5. The fitting according to any one of the claims 1 to 4, wherein the passage of objects or elements conveyed through said open portion (3) by the incident air flow is made more difficult by a protection net or grid arranged at the inlet of said open portion (3).

6. A combination of a vertical-axis wind turbine and a deflecting wall (2), wherein

- said turbine (100) comprises a rotor (101) equipped

with blades (102) and further comprises means for converting the rotation of said rotor (101) into electric energy, said blades (102) being arranged rotating around an axis of rotation X-X and being such as to define with respect to said axis X-X, when seen in a direction substantially orthogonal to said axis X-X, an active side in which an incident air flow can perform on the blades (102) a first work L1, and a passive side in which an incident air flow can perform on the blades (102) a second work L2<L1,

- said deflecting wall (2) is positioned so that, for at least one direction striking said turbine (100), said deflecting wall (2) substantially screens the whole passive side defined with respect to said incident direction.

7. The combination according to claim 6, wherein said deflecting wall (2) is arranged adjacent to an open portion (3), so as not to substantially screen the active side of said turbine (100), when seen from said at least one incident direction.

8. A combination of a turbine (100) and a fitting (1) according to any one of the claims 1 to 5, wherein said deflecting wall (2) of said fitting (1) further comprises all the characteristics defined

in claims 6 or 7.

9. A method for increasing the efficiency of a vertical-axis turbine (100), comprising the following steps:

(a) providing a vertical-axis turbine (100) comprising a rotor (101) equipped with blades (102) and further comprising means for converting the rotation of said rotor (101) into electric energy, said blades (102) being arranged rotating around an axis of rotation X-X and being such as to define with respect to said axis X-X, when seen in a direction substantially orthogonal to said axis X-X, an active side in which an incident air flow can perform on the blades a first work L1, and a passive side in which an incident air flow can perform on the blades a second work L2<L1;

(b1) providing a fitting (1) according to one of the claims 1 to 5, said fitting (1) comprising a deflecting wall (2), or as an alternative,

(b2) providing a deflecting wall (2) according to any one of the claims 6 to 8;

(c) mounting said deflecting wall (2) and said turbine (100) so that said deflecting wall (2) substantially screens said passive side from an

incident air flow for said at least one direction;

wherein steps (a), (b1) and (c) or steps (a), (b2) and (c) are envisaged.

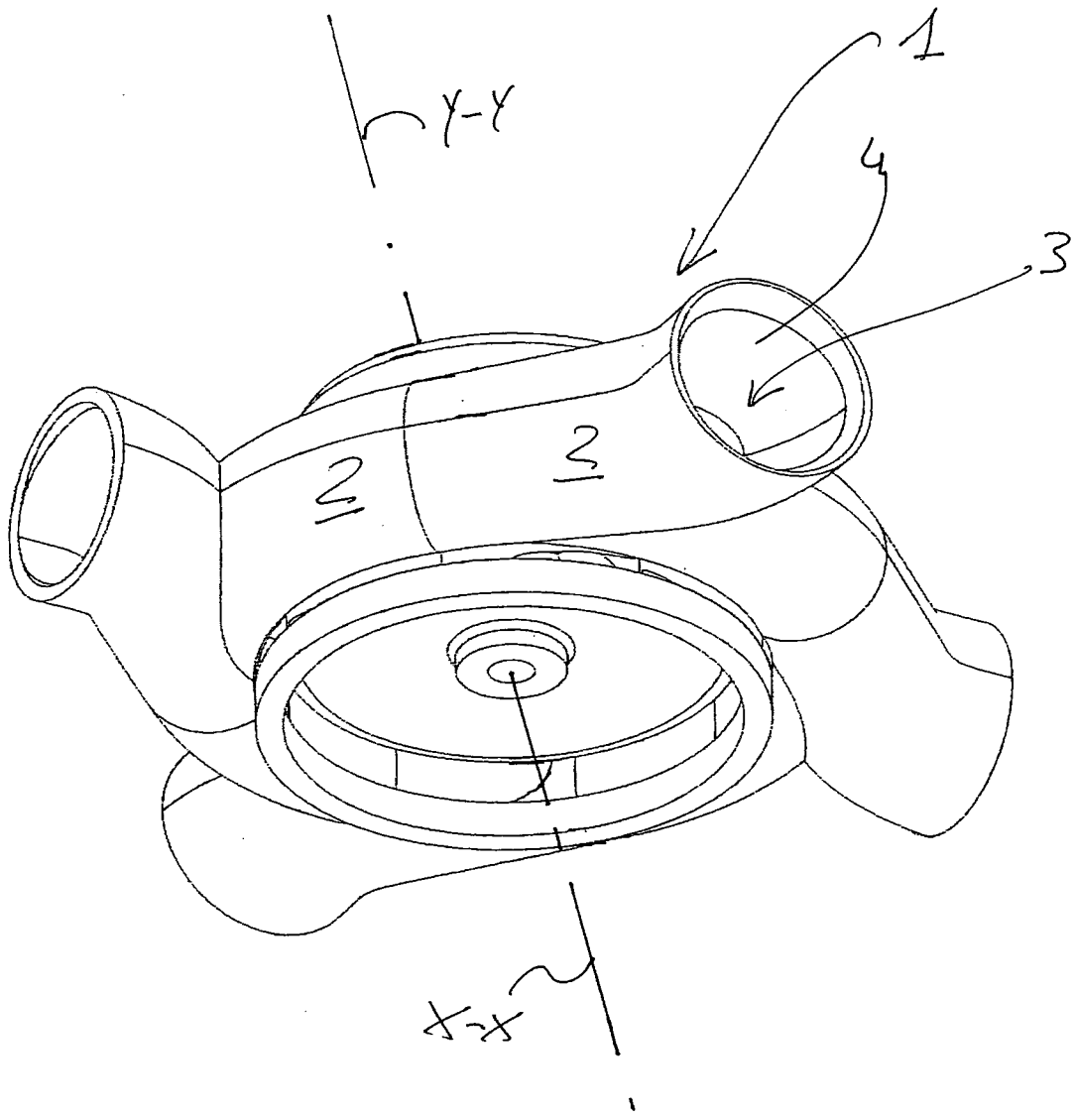

Fig. 1

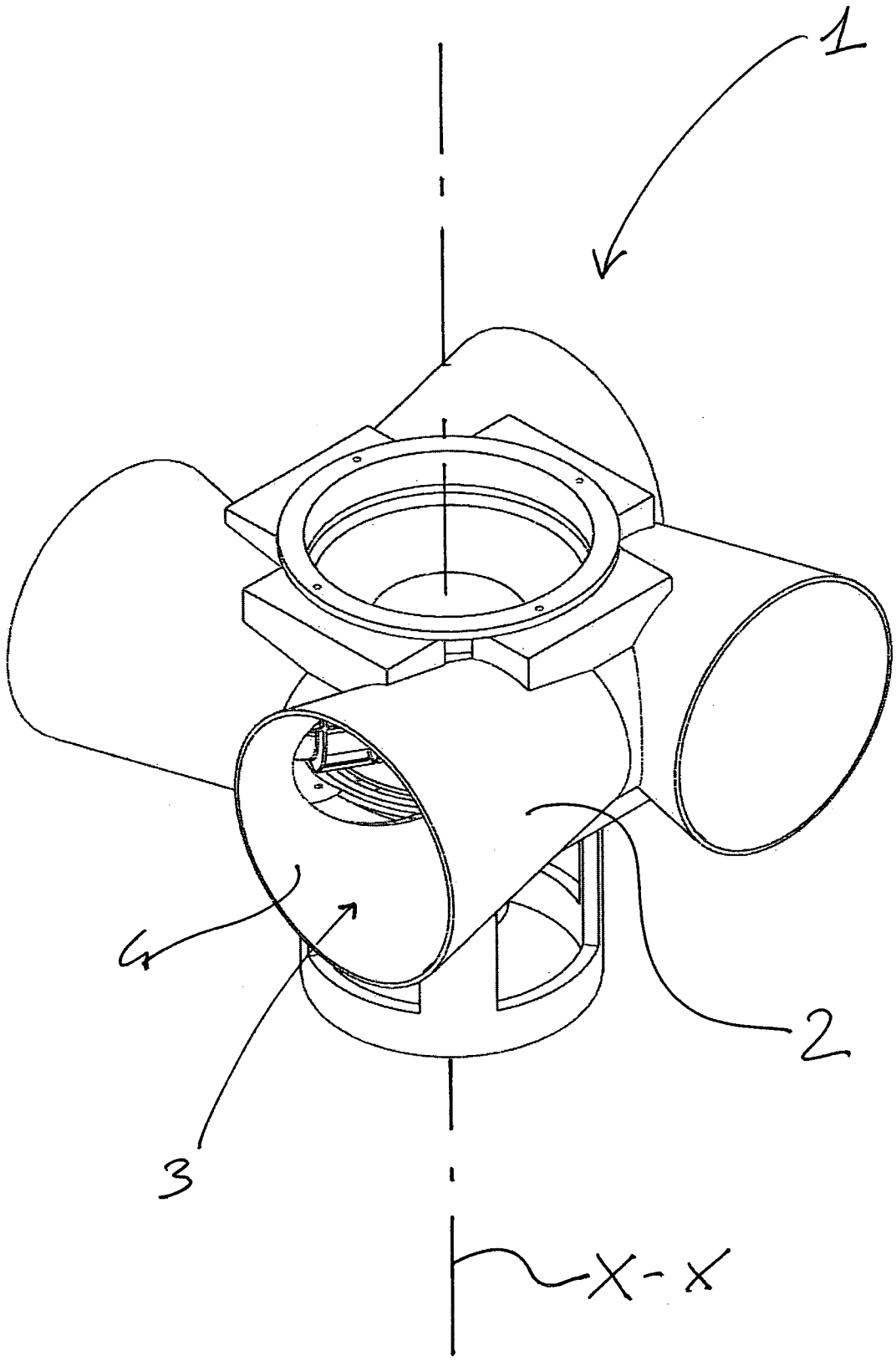

Fig. 2

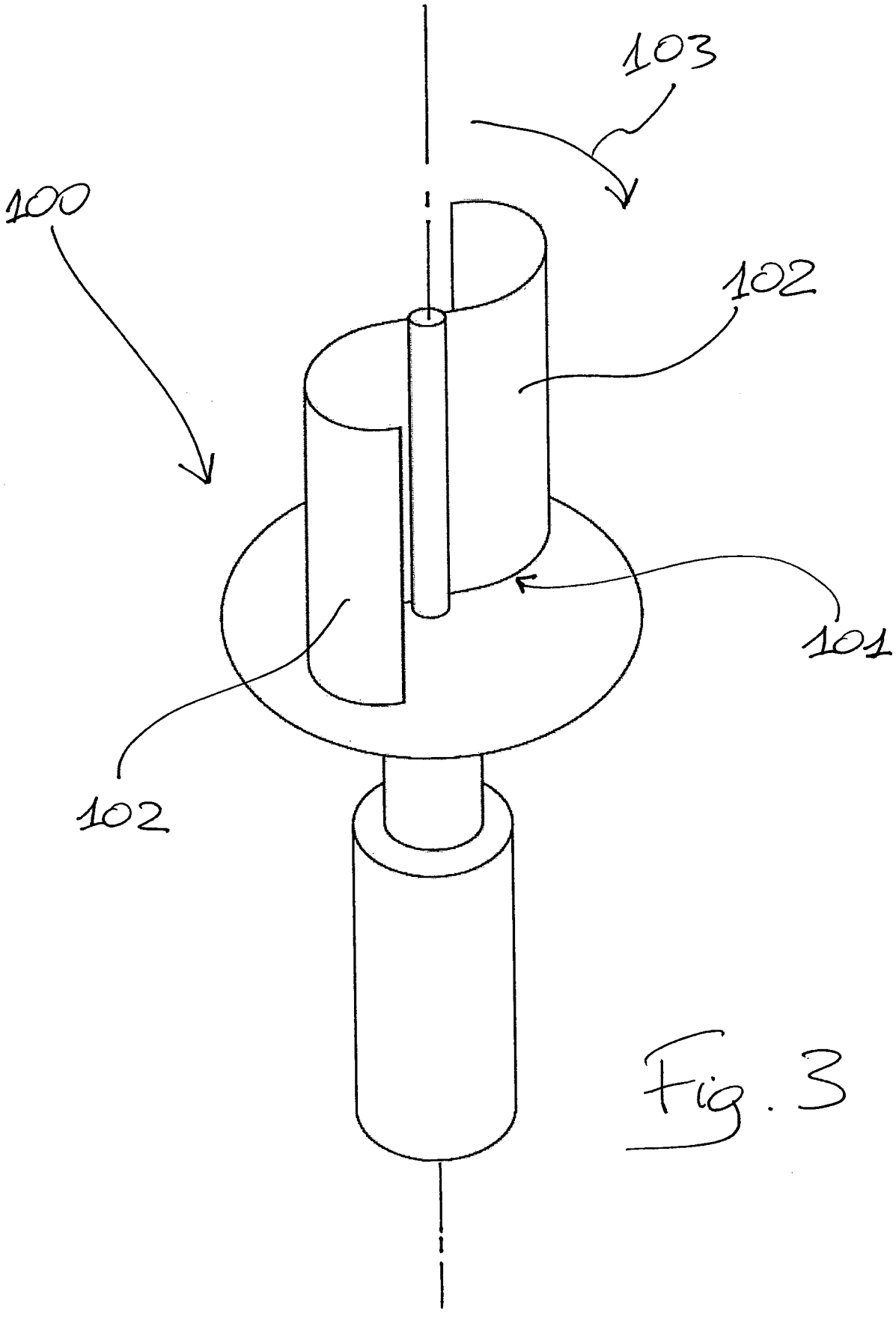

Fig. 3

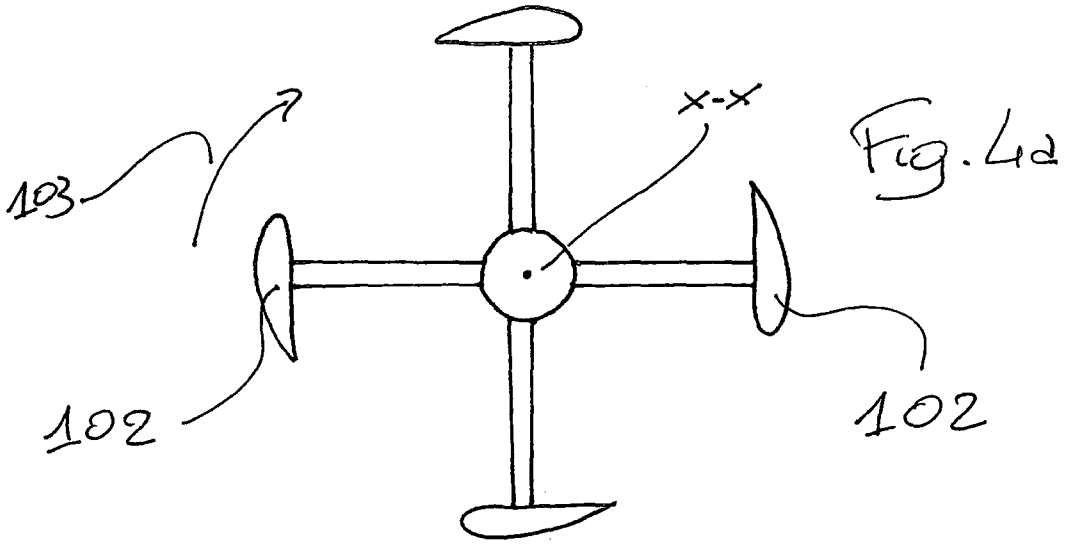

Fig. 4a

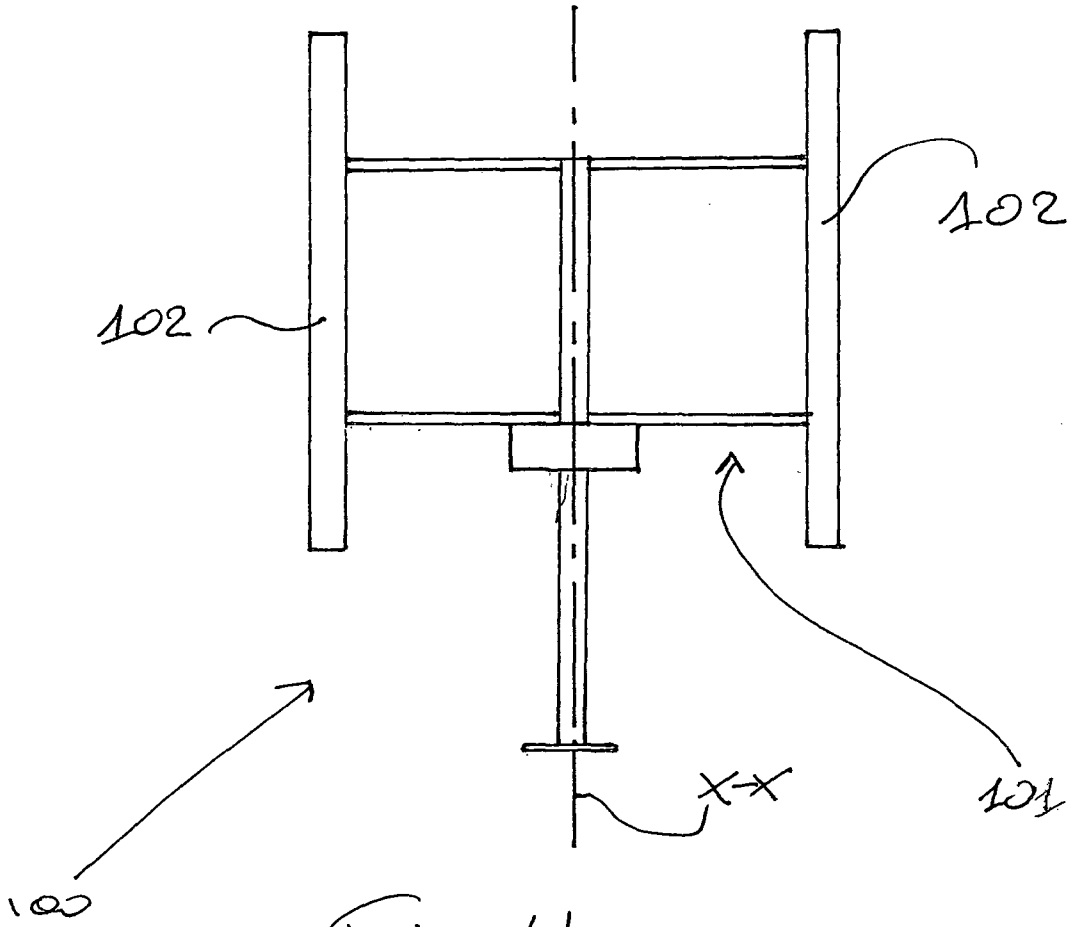

Fig. 4b

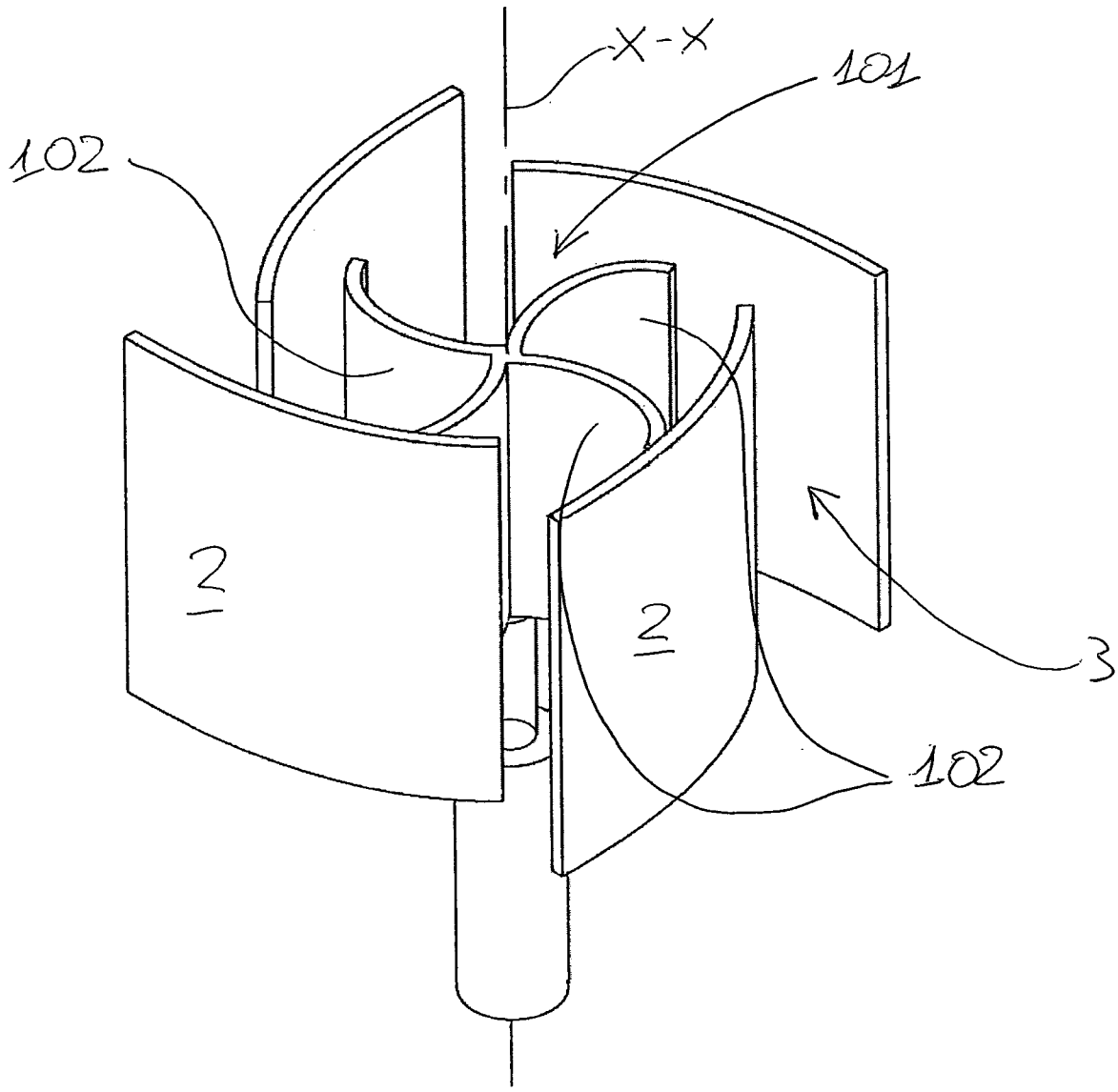

Fig. 5

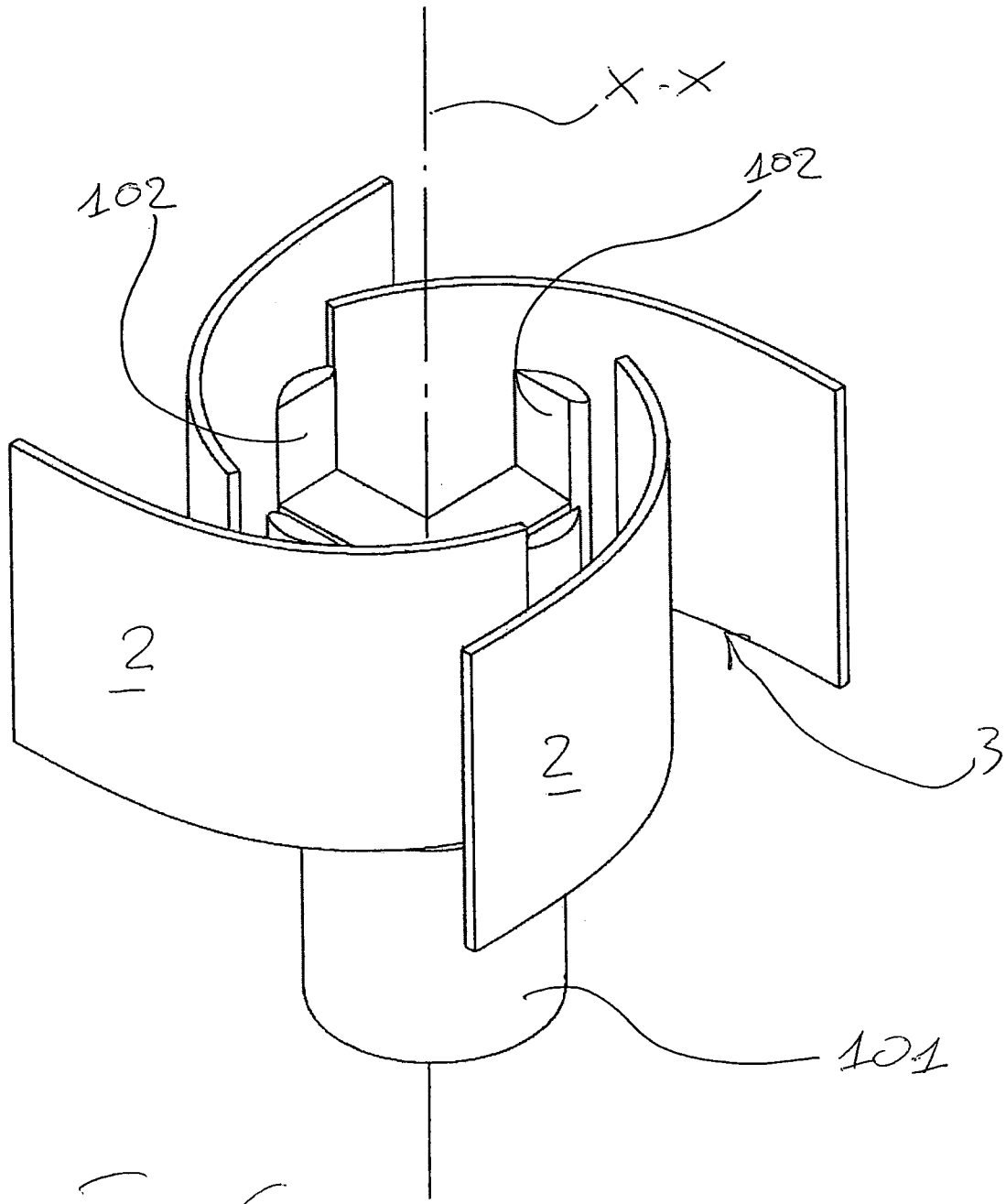

Fig.6

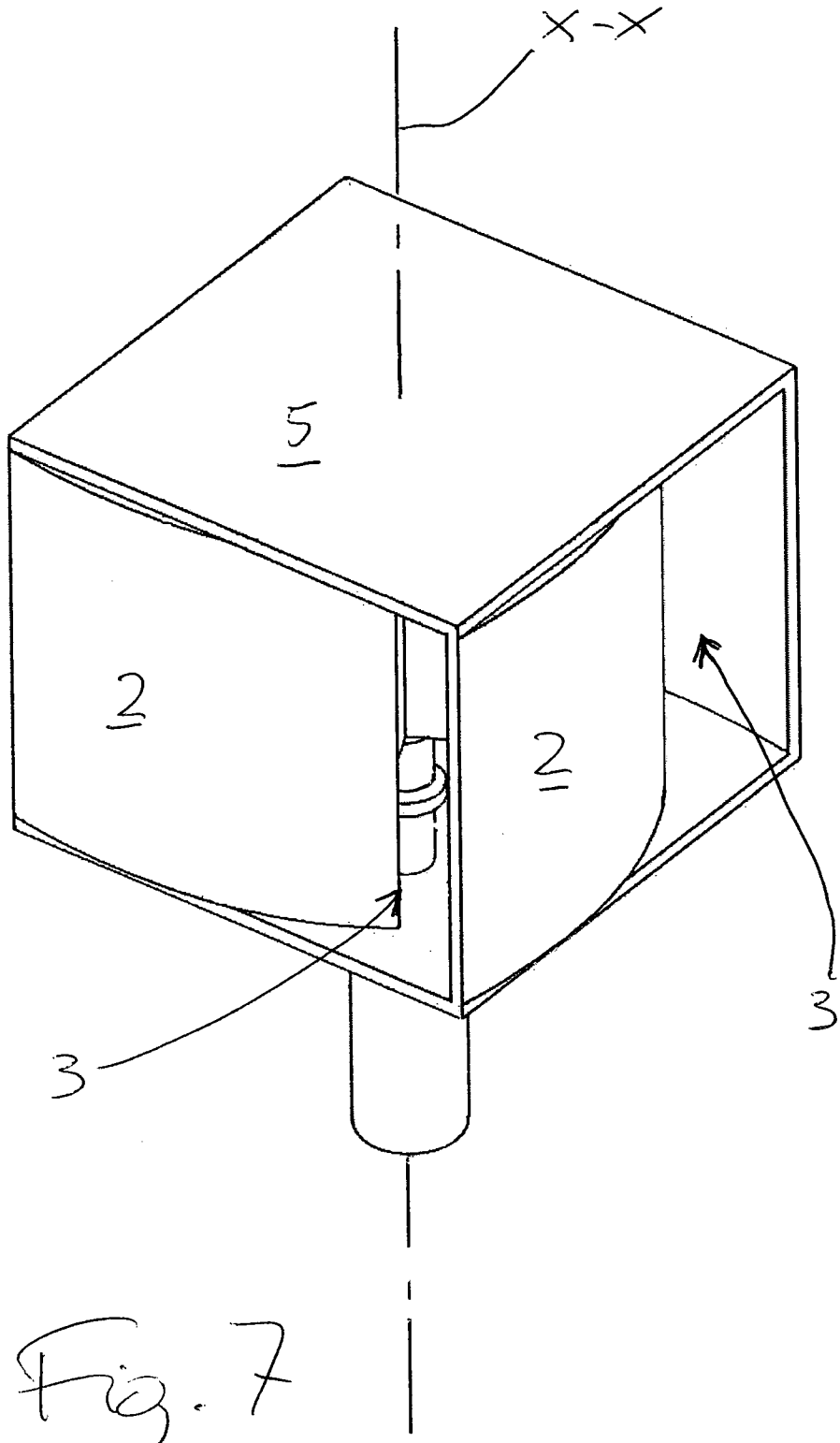

Fig. 7