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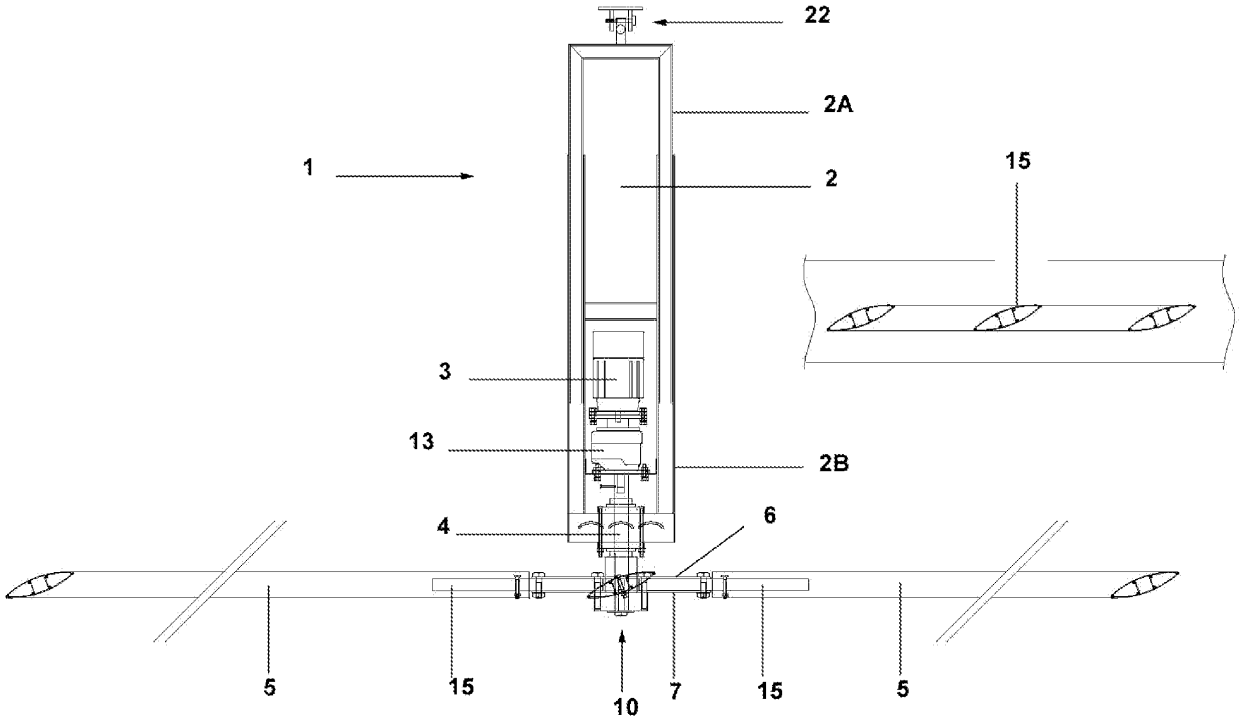
(54) **Fan system**

(57) The invention relates to a fan system (1) comprising a frame (2) for mounting of the fan system, for instance on a ceiling of a building. A motor (3) is arranged in the frame. The motor drives a rotatable shaft (4). A number of fan blades (5) are attached at an angle of tilt to the rotatable shaft (4). The angle of tilt lies substantially between 15 and 25 degrees, and is preferably substantially 20 degrees.

Fig. 1



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Description

[0001] The invention relates to a fan system, comprising a frame for mounting of the fan system, for instance on a ceiling of a building, a motor mounted on the frame, a rotatable shaft coupled to the motor, and a number of fan blades which are attached at an angle of tilt to the rotatable shaft.

[0002] Such a fan system is known in practice. The known fan system is described in the European patent EP 1173359.

[0003] The known fan system is intended for the purpose of cooling an industrial building and comprises ten fan blades which are attached to the rotatable shaft at an □ angle of attac eight degrees to the plane of rotation.

[0004] Described in EP 1173359 are measurement results which show that at a rotation speed of 50 rotations per minute the fan blades produce a column of moving air which is about 6 to 7.3 metres in diameter at a position in the immediate vicinity of the fan blades, wherein air has a speed of about 1.3 to 2.2 metres per second at a distance of about 3 metres from the blade. A moving volume of air is thus entrained in advantageous manner in a flow in a circulating pattern through the industrial building to thereby disrupt the boundary layer of air close to the individuals present so as to facilitate evaporation of sweat from the individual.

[0005] The present invention has for its object to provide an improved embodiment of the known fan system.

[0006] The fan system according to the invention has for this purpose the feature that the angle of tilt amounts to between substantially 15 and 25 degrees, preferably substantially 20 degrees.

[0007] The choice of these different values achieves the surprising effect of a much higher air speed, whereby the cooling effect of the fan system is much greater.

[0008] In a first preferred embodiment of the fan system according to the invention the fan blades, at a rotation speed of the fan blades of approximately 51 rotations per minute, produce a column of moving air such that air has a speed of approximately 34 metres per second at a distance of approximately three metres from the outer end of a fan blade.

[0009] According to a further preferred embodiment, the ratio of the air speed measured in metres per second to the rotation speed of the fan blades in rotations per minute has a value < 1, irrespective of the distance to the tip.

[0010] In an elegant preferred embodiment of the fan system according to the invention there is arranged on the rotatable shaft a rotor element provided with a number of radially extending rotor arms for attaching of the fan blades.

[0011] According to a practical preferred embodiment, the fan blades take an at least partially hollow form for the purpose of receiving the rotor arms. In a further development each rotor arm is chamfered on one side at two diagonally opposite corners. After assembly each fan blade automatically lies at the desired angle of tilt.

[0012] In another preferred embodiment the length of the fan blades amounts to a maximum of two metres.

[0013] High values for the air speed are achieved in a preferred embodiment in which each fan blade has a propeller blade section.

[0014] The optimum number of fan blades amounts to six.

[0015] According to an advantageous, more elaborate preferred embodiment, the motor is provided with a control adapted to cause rotation of the shaft both to the left and the right. Depending on the direction of rotation, the generated airflow can run upward from below, or vice versa, as a result which respectively cooling or heating occurs.

[0016] The invention will now be discussed in more detail with reference to the drawings, in which

Figure 1 shows a schematic, partly cut-away and partly sectional view of a preferred embodiment of a fan system according to the invention;
Figure 2 shows the fan system of figure 1 with exploded parts; and
Figure 3 shows a bottom view of the fan system of figure 1.

[0017] The same reference numerals refer in the figures to the same components.

[0018] Figures 1 and 2 show a preferred embodiment of a fan system 1 according to the invention.

[0019] Fan system 1 comprises a frame 2 in which a motor 3 is accommodated. Motor 3 drives a rotatable shaft 4 to which a number of fan blades 5 are attached.

[0020] In the shown preferred embodiment frame 2 of fan system 1 is provided with means 22 for mounting on a ceiling of a building. Frame 2 further comprises two parts 2A and 2B which engage slidably in each other in lengthwise direction. The distance of fan blades 5 from the means 22 for mounting on the ceiling is hereby adjustable in continuously variable manner.

[0021] Situated in frame 2 is motor 3, which is coupled to rotatable shaft 4 by means of a transmission 13. Motor 3 is supported by a fixing plate 11. Two bearings 16 and locking rings 12 are arranged on the shaft.

[0022] Fan system 1 further comprises a rotor element 10 arranged on rotatable shaft 4. Rotor element 10 comprises two discs 6, 7 with a central opening 14 for passage of shaft 4. Situated between the two discs 6, 7 are a number of radially extending rotor arms 15 for attachment of fan blades 5.

[0023] Fan blades 5 take a hollow form at an outer end for the purpose of receiving rotor arms 15. Fan blades 5 lie at an angle of tilt , also referred to as □ angle of attack□ , relati own plane of rotation R. Angle of tilt amounts substantially

to between 15 and 25 degrees, preferably substantially 20 degrees.

[0024] Rotor arms 15 are preformed such that fan blades 5 are automatically in the desired oblique position after mounting, i.e. at the predetermined angle of tilt. For this purpose each rotor arm 15 is chamfered over the angle of tilt on one side at two opposite corners. This is shown in the inset in figure 2.

[0025] The length of fan blades 5 amounts to a maximum of two metres. Each fan blade has a propeller blade section. The number of fan blades can vary and preferably amounts to six.

[0026] The components of the fan system can be manufactured from diverse materials. The rotor arms and the fan blades are preferably of aluminium.

[0027] An example of a suitable motor has the following specifications: 0.55 kW, 220/380 V, 1480 revolutions. The motor is preferably provided with a control adapted to cause rotation of the shaft both to the left and the right. An example of a suitable motor is provided with a double motor protection connected in parallel, wherein the choice of the motor protection determines the rotation direction. An example of a suitable motor is provided with a speed regulation. This can be hand-operated as well as automatic, for instance temperature-controlled. Such motors are commercially available.

[0028] An example of a suitable transmission has the following specifications: 535/1480 - 2158 revolutions (20/50 Hz). Such a transmission is commercially available.

[0029] Table 1 shows measurement results from a prototype of a fan system according to the invention. The measurement results show the air speed (AS) in metres per second at different values of the rotation speed (RS) of the fan blades given in rotations per minute (T). The air speed is measured at different distances (respectively 1, 2, 3, 4 and 5 metres) from the outer end of each of the fan blades at one meter from the plane of rotation of the fan blades in the direction of the air movement.

Table 1

RS	AS at 1m	AS at 2m	AS at 3m	AS at 4m	AS at 5m
21T	6	6	5	4	3
26T	11	11	10	8	6
31T	14	14	13	12	10
36T	29	20	19	17	14
41T	23	23	22	20	17
46T	30	30	29	27	24
51T	35	35	34	31	28
58T	45	45	44	40	37

[0030] In addition, table 2 shows the measured values for the air speed in metres per second below the centre of the same prototype of the fan system according to the invention at different values of the rotation speed of the fan blades given in rotations per minute (T).

Table 2

RS	AS below
21T	4 m/s
26T	10 m/s
31T	13 m/s
36T	17 m/s
41T	20 m/s
46T	27 m/s
51T	31 m/s
58T	40 m/s

[0031] Compared to the prior art, there are surprisingly great differences in the measurement results. Table 1 shows that the fan blades of the fan system according to the invention, at a rotation speed of the fan blades of approximately

51 rotations per minute, produce a column of moving air such that air has a speed of approximately 34 metres per second at a distance of approximately three metres from the outer end of a fan blade. Compared to this, the air speed in the known fan assembly is between 1.3 and 2.2 metres per second at a rotation speed of 50 rotations per minute.

[0032] The table further shows that the ratio of the air speed measured in metres per second to the rotation speed of the fan blades in rotations per minute has a value < 1. This is the case irrespective of the distance to the outer end of a fan blade.

[0033] The present invention generally provides a technically reliable fan system which can realize a surprisingly large air displacement. At high outside temperatures this can be employed to cool large spaces by generating an airflow upward from below. At low outside temperatures this can be employed to heat large spaces by generating an airflow downward from above. The fan system according to the invention is moreover simple to assemble. The components can also be produced at low cost. The fan system can be produced in diverse embodiments.

[0034] The invention is of course not limited to the described and shown preferred embodiment, but extends to any embodiment falling within the scope of protection as defined in the claims and as seen in the light of the foregoing description and accompanying drawings.

Claims

1. Fan system, comprising:

a frame for mounting of the fan system, for instance on a ceiling of a building,
a motor mounted on the frame;
a rotatable shaft coupled to the motor; and
a number of fan blades which are attached at an angle of tilt to the rotatable shaft,

characterized in that the angle of tilt amounts to between substantially 15 and 25 degrees, preferably substantially 20 degrees.

2. Fan system as claimed in claim 1, wherein the fan blades, at a rotation speed of the fan blades of approximately 51 rotations per minute, produce a column of moving air such that air has a speed of approximately 34 metres per second at a distance of approximately three metres from the outer end of a fan blade.

3. Fan system as claimed in claim 1 or 2, wherein the ratio of the air speed measured in metres per second to the rotation speed of the fan blades in rotations per minute has a value < 1.

4. Fan system as claimed in claim 1, 2 or 3, wherein a rotor element provided with a number of radially extending rotor arms for attaching of the fan blades is arranged on the rotatable shaft.

5. Fan system as claimed in claim 4, wherein the fan blades take an at least partially hollow form for the purpose of receiving the rotor arms.

6. Fan system as claimed in claim 5, wherein each rotor arm is chamfered on one side at two diagonally opposite corners.

7. Fan system as claimed in any of the foregoing claims, wherein the length of the fan blades amounts to a maximum of two metres.

8. Fan system as claimed in any of the foregoing claims, wherein each fan blade has a propeller blade section.

9. Fan system as claimed in any of the foregoing claims, wherein the number of fan blades amounts to six.

10. Fan system as claimed in any of the foregoing claims, wherein the motor is provided with a control adapted to cause rotation of the shaft both to the left and the right.

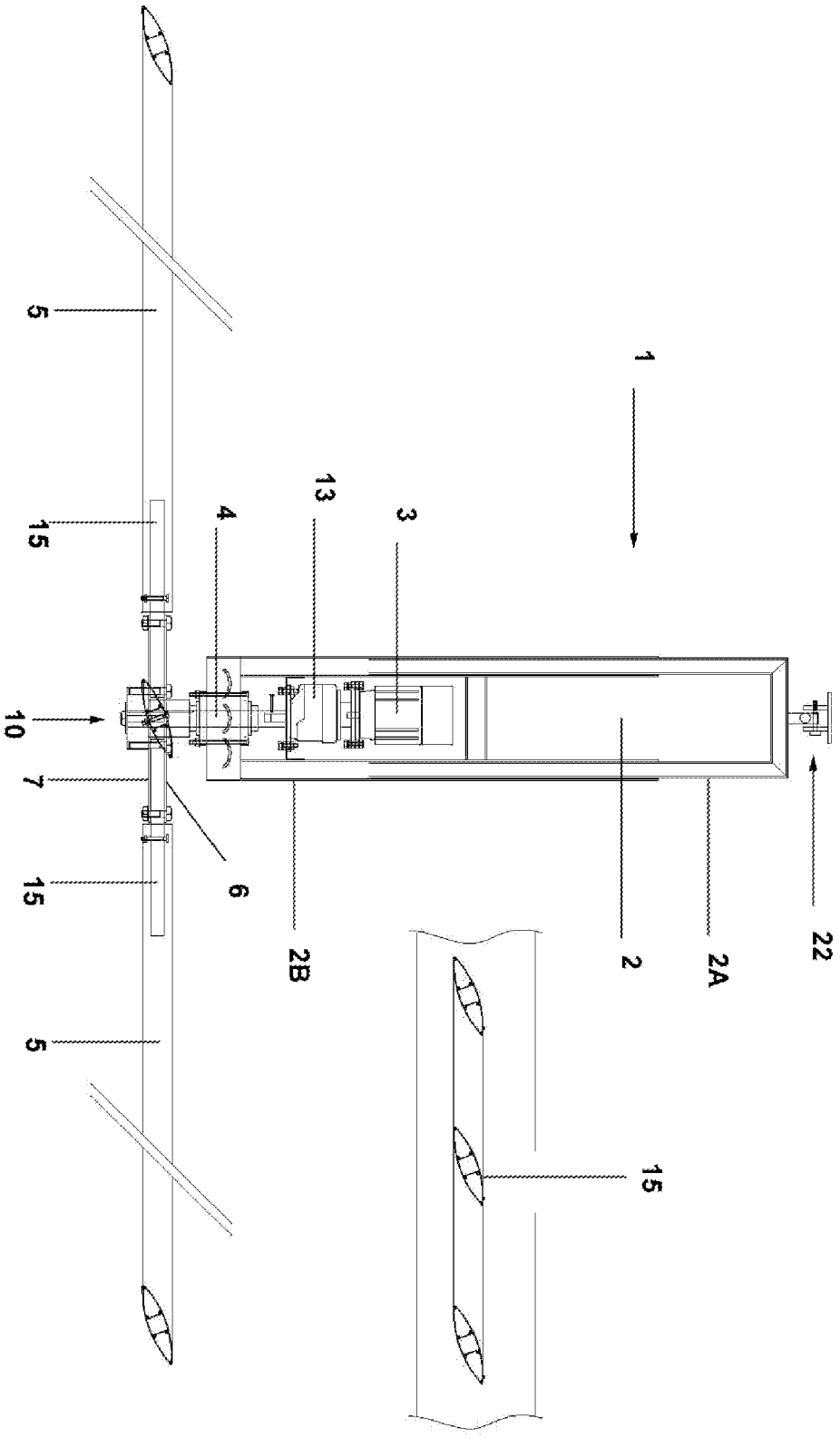

Fig. 1

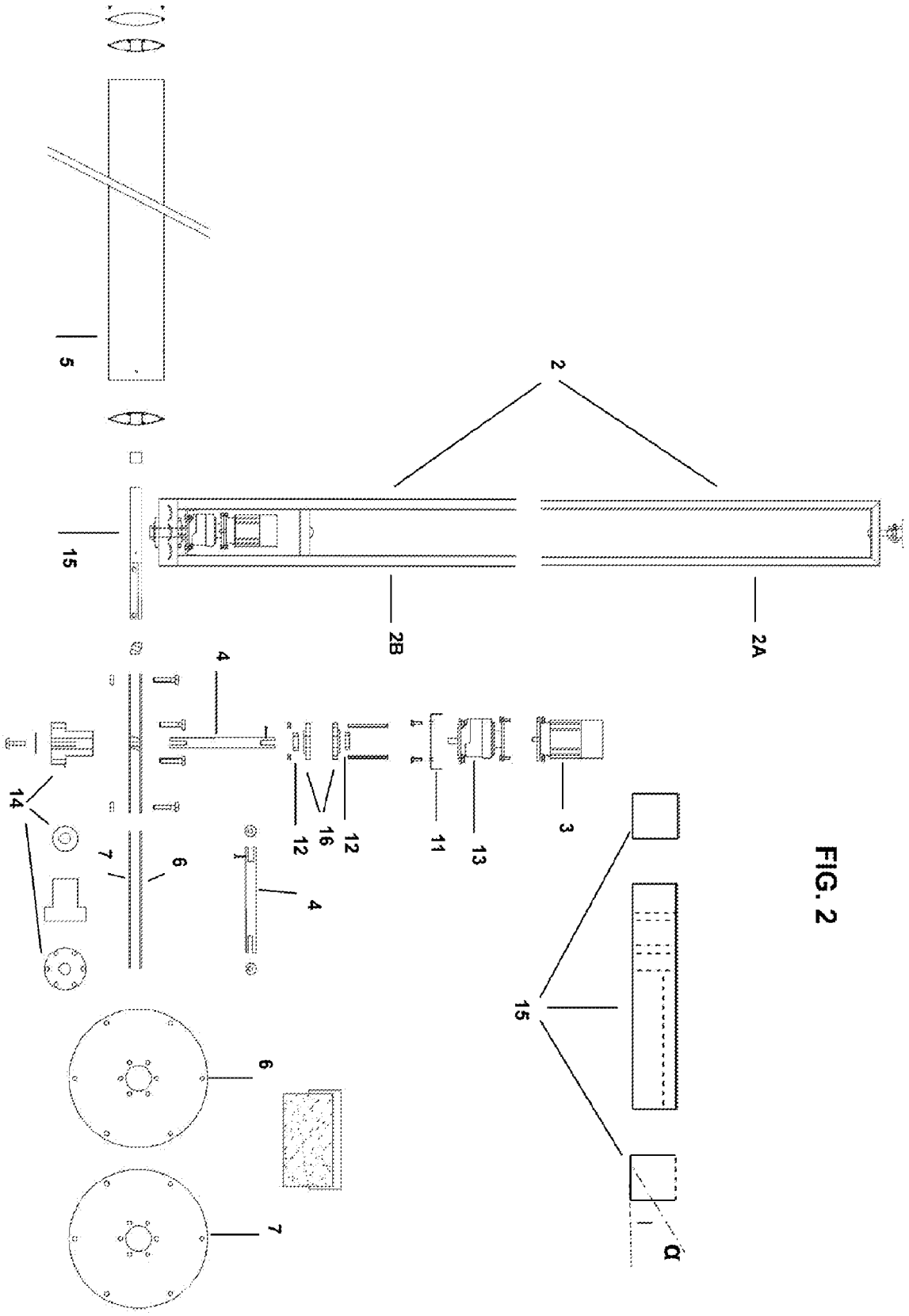

FIG. 2

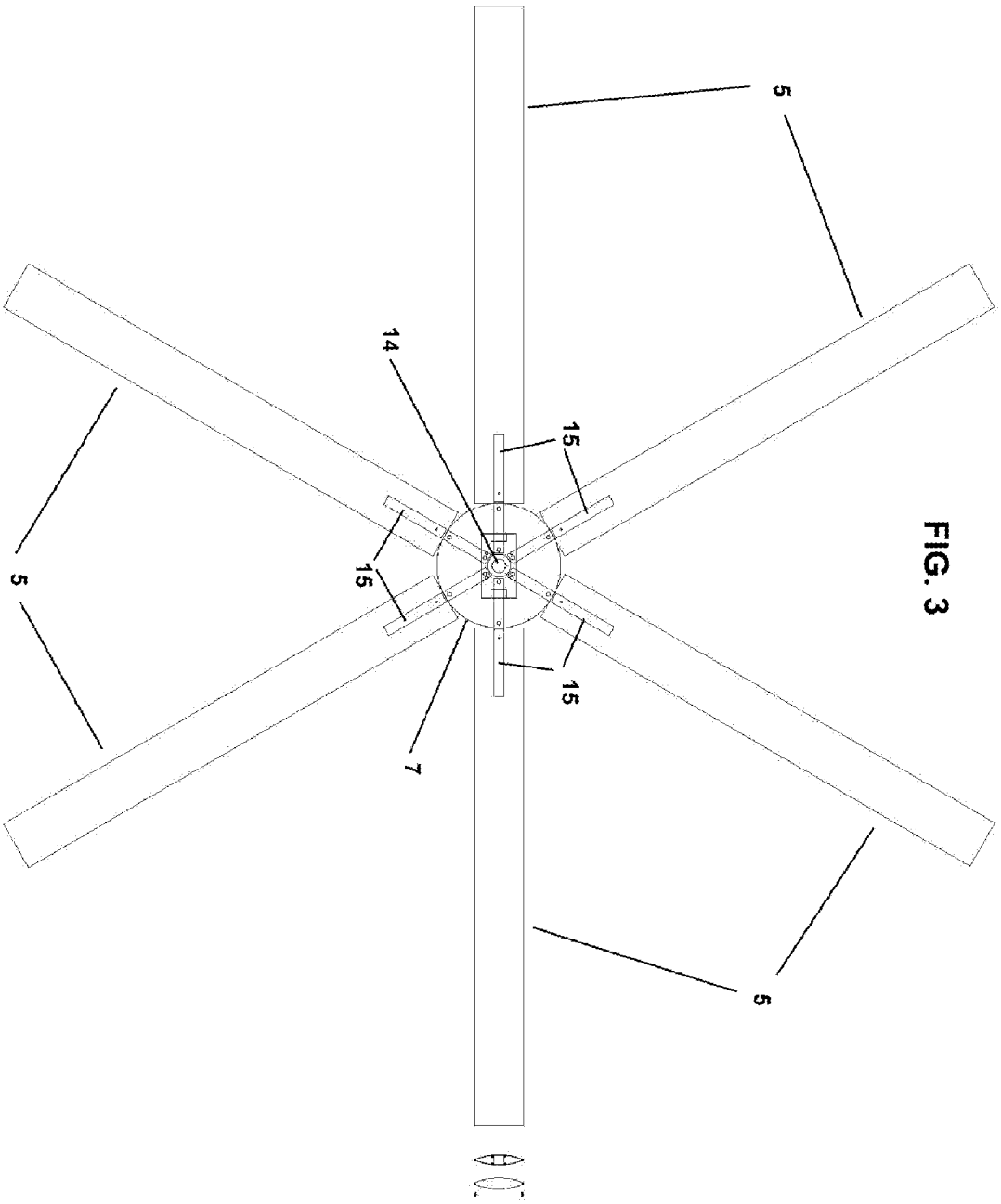

FIG. 3

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 1173359 A **[0002] [0004]**