(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
14 June 2007 (14.06.2007)

PCT

(10) International Publication Number
WO 2007/066207 A2

(51) International Patent Classification: Not classified

(21) International Application Number:
PCT/IB2006/003491

(22) International Filing Date:
6 December 2006 (06.12.2006)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
BO2005A000745 6 December 2005 (06.12.2005) IT

(71) Applicant *(for all designated States except US)*: **IMPERA S.R.L.** [IT/IT]; Via Gasperina 196, I-00100 Roma (IT).

(71) Applicant and
(72) Inventor: **MELCHIORRI, Filippo** [IT/IT]; Viale dei Consoli n.94, I-00175 Roma (IT).

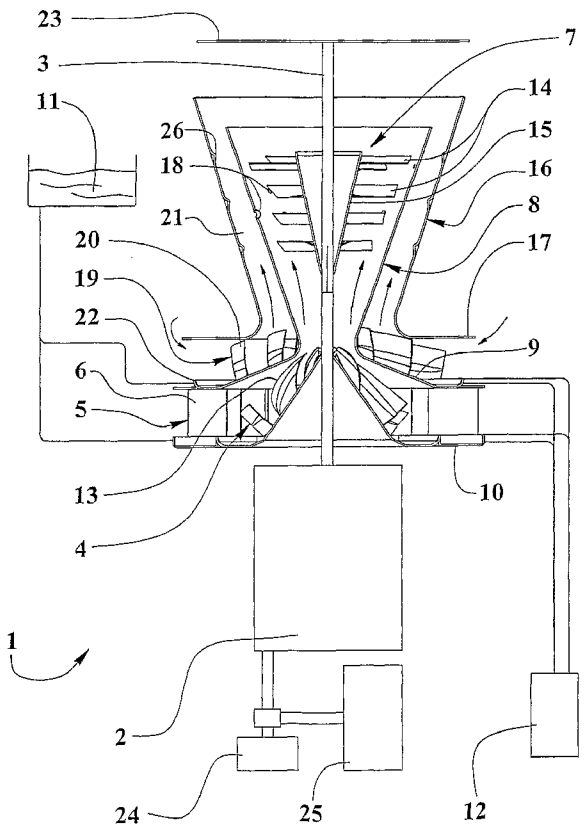
(74) Agent: **AGAZZANI, Giampaolo**; Agazzani & Associati S.R.L., Via dell'Angelo Custode 11/6, I-40141 Bologna (IT).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

[Continued on next page]

(54) Title: MACHINE FOR THE PRODUCTION OF ELECTRIC POWER FROM COMPLEMENTARY RENEWABLE SOURCES



(57) Abstract: A machine for production of electric power from complementary renewable sources is provided with an electrical generator (2) connected to a motion driving shaft (3). The shaft (3) is vertical and has at least one lower turbine (4) powered by an Aeolian flow by means of a respective toroidal shaped lower stator (5) coaxial to the shaft (3). Said lower stator has fixed blades (6) fit to convey the Aeolian flow to at least one lower turbine (4).

WO 2007/066207 A2

Declaration under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

Published:

— *without international search report and to be republished upon receipt of that report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

MACHINE FOR THE PRODUCTION OF ELECTRIC POWER FROM COMPLEMENTARY RENEWABLE SOURCES

TECHNICAL FIEDL

The present invention relates to the technical field to maximize the use of energy of renewable sources and it refers to the electric power generation from complementary renewable sources in particular the Aeolian and solar energy.

BACKGROUND OF THE INVENTION

Actually, for the electric power production from the Aeolian renewable source, they mostly use horizontal axis wind turbine generators, providing power typically ranging from 800 KW to 3,5 MW. These generators have a significant environment impact, in fact the towers which support the propellers are about from 90 to 120 m high.

In the technical literature there are researches regarding the vertical axis generators, but which are not used very often.

A drawback of both said known types of generators consists in that in case of lack of wind, the energy production is null and such situation occurs very often in the Summer time.

DISCLOSURE OF THE INVENTION

An object of the present invention is to provide a machine to obtain a significant electric power production from complementary renewable sources, such as Aeolian and solar sources, at least one of which is available almost during the whole year.

Other object is to provide a machine with moderate environment impact.

BRIEF DESCRIPTION OF THE DRAWINGS

The characteristics of the invention are evidenced in the following with particular reference to the attached drawings, in which:

- figure 1 illustrates a schematic front view, partially sectioned, of the machine for the electric power production from complementary renewable sources object of the present invention;
- figure 2 illustrates a side view of a lower stator associated to a lower evaporator and of a shaft connected to a generator of the machine of figure 1;
- figure 3 illustrates a plain view of the lower stator of figure 2;
- figure 4 illustrates side view of a lower turbine fixed to the shaft connected to the generator of the machine of figure 1;
- figure 5 illustrates a plain view of the lower turbine of figure 4;
- figure 6 illustrates a side view of an upper stator associated to a first conveyor of figure 1;
- figure 7 illustrates a side and sectioned view of a second conveyor and of a covering mean of figure 1;
- figure 8 illustrates a side view of an upper turbine of figure 1;
- figure 9 illustrates a plain view of the turbine of figure 8.

BEST MODE OF CARRYING OUT THE INVENTION

With reference to the figures 1 - 8, numeral 1 indicates the machine for electric power production from complementary renewable sources, object of the present invention, provided with an electrical generator 2, equipped with wirings and control circuits and, for example, incorporated or integrated in a basic building structure. The electric generator 2 receives the rotary motion from a vertical motion driving shaft 3. The machine 1 has a lower turbine 4 and an upon laying upper turbine 7, both rigidly fixed to the shaft 3 and powered, with the Aeolian flow, that is wind flow, by means of a toroidal shaped lower stator 5 coaxial to the shaft 3 and positioned around the base portion of the lower turbine.

The fixed blades 6 of lower stator 5 are accordingly inclined in respect to passing planes for the shaft 3.

The machine comprises a first conveyor 8, having one portion in the form of approximately inverted truncate cone and coaxial to the shaft 3, containing the upper turbine 7. The smaller and lower base of the inverted truncate cone shaped portion is provided with an enlargement 9 containing at least one portion of the lower turbine 4. The first conveyor 8 is fit to direct the Aeolian flow flowing out from the lower turbine 4 towards the blades 14 of the upper turbine. The truncate cone shaped portion of the first conveyor 8 comprises a plurality of passing openings 18. The movable blades 13 of the lower turbine 4 are helical shaped and the movable blades 14 of the upper turbine 7 are wing shaped or propeller blade shaped fixed to the shaft 3 by means of a hub 15.

The movable blades 14 of the upper turbine 7 are approximately disposed on several horizontal planes, for example four planes, and each of said planes comprises a set of blades, for example eight blades, disposed to form a respective disc of the blades. The diameter of said discs of the blades increases from the lower plane towards the higher plane and the hub 15 has an approximately inverted cone shape.

The machine comprises a second conveyor 16, of approximately inverted truncated cone shape, coaxial to the shaft 3, containing the first conveyor 8 and with the smaller lower base provided with a respective annulus enlargement 17. The base and the barycentre of the second conveyor are placed above the base and on the barycentre of the first conveyor.

The inner wall of the second conveyor is equipped with a plurality of relieves 26, consisting for example of deflector of the air flow carried out by folded sheets , fixed internally to the second conveyor and oriented towards the inside of the interspaces 21 between the conveyers 8, 16. Said relieves 26 are fit to direct part of the flow through the passing openings 18 of the first conveyor 8 towards the blades 14 of the upper turbine 7.

The machine comprises furthermore an upper stator 19, interposed between the enlargement 9 of the first conveyor 8 and the annulus enlargement 17 of the second conveyor 16. The blades of the upper stator 19 are helical shaped 20 and they are fit to convey the Aeolian flow into the interspaces 21 between the conveyors 8, 16.

The machine comprises a lower evaporator 10 and a upper evaporator 22. The lower evaporator 10 is disk shaped and is placed immediately below the turbine 4 in order to supply at least to this latter also water vapour. The upper evaporator 22 is approximately annulus shaped and it is associated with the enlargement 9 of the first conveyor 8 in order to supply the interspaces 21 also with water vapour.

The water is supplied by water feeding means 11, for example comprising a water reservoir or a connection to the public network, and is heated by solar collection means 12 connected to said evaporators 10.

The transversal sectioned area of the interspaces 21 between the conveyors 8, 16 increases from the lower part to the upper part thereof.

The machine comprises a horizontal covering mean 23 and fixed above and spaced apart from the second conveyor 16.

The covering mean 23, the interspaces, and the plurality of the openings 18 of the first conveyor, provide an advantageous depression downstream of the turbine and an advantageous rise of the flow through the upper turbine.

It is also provided that the machine is equipped with electrical means 24, for example comprising regulators and electrical batteries, powered by the electrical generator 2 and, in order to make maximum use of the solar energy in more direct manner, from photovoltaic means 25, for example consisting of amorphous silicon panels also positioned on the covering mean.

The operation of the machine, by means of the turbines, provides to maximize the use of

the air kinetic energy driven by the wind and by the convective motion produced by the air heating and by the air humidification carried out by the evaporator means which makes the maximum use of the thermal energy collected by the solar collection means.

The machine is therefore able to supplying electric energy also in case of lack of one of the two Aeolian and solar sources.

In particular the lower stator, in cooperation with the first conveyor and independently from the horizontal direction of the wind, conveys the Aeolian flow, heated and humidified by lower evaporator means, through the turbines. The stator and the upper evaporator means carry out a similar effect heating and humidifying a second Aeolian flow conveyed into the interspaces comprised between the first and the second conveyor. Said second flow generates, in virtue of Venturi effect, the depression below the covering mean and generates, through the openings of the first conveyor, the increase of the flow through the upper turbine.

An advantage of the present invention is to provide a machine to obtain a significant electric power production from renewable sources also in lack of wind.

Other advantage is to provide a machine with moderate environment impact.

CLAIMS

1) Machine for the production of electric power from complementary renewable sources provided with an electrical generator (2) connected to a motion driving shaft (3), said machine (1) being characterized in that the shaft (3) is vertical and has at least lower turbine (4) powered by an Aeolian flow by means of a respective toroidal shaped lower stator (5) coaxial to the shaft (3), and having fixed blades (6) fit to convey the Aeolian flow to the respective at least one lower turbine (4).

2) Machine according to claim 1 characterized in that it comprises an upper turbine (7), fixed to the shaft (3) above the first turbine (4).

3) Machine according to claim 2 characterized in that it comprises at least a first conveyor (8) of approximately inverted truncate cone shape, coaxial to the shaft (3), containing the upper turbine (7), and with the smaller lower base provided with an enlargement (9) eventually containing at least a portion of the lower turbine (4).

4) Machine according to claim 1 characterized in that it comprises at least a lower evaporator (10) positioned immediately under the at least a lower turbine (4) in order to provide at least to this latter also water vapour, the water being supplied by water feeding means (11) and heated by solar collection means (12) connected to the at least one lower evaporator (10).

5) Machine according to claim 2 characterized in that the movable blades (13) of the lower turbine (4) have helical shape and the movable blades (14) of the upper turbine (7) are wing shaped or propeller blade shaped, approximately arranged on one or more planes, and fixed to the shaft (3) by means of a hub (15).

6) Machine according to claim 3 characterized in that it comprises a second conveyor (16) having approximately inverted truncate conic shape, coaxial in respect to the shaft (3), containing the first conveyor (8) and with the smaller lower base

provided with a respective annulus enlargement (17).

7) Machine according to claim 6 characterized in that the truncate conic shaped portions of the first (8) and second (16) conveyors have respectively a plurality of openings (18) and a plurality of relieves (26).

8) Machine according to claim 6 characterized in that it comprises an upper stator (19), interposed between the enlargement (9) of the first conveyor (8) and the annulus enlargement (17) of the second conveyor (16), with respective helical blades (20) fit to convey the Aeolian flow into the interspaces (21) between the conveyors (8, 16).

9) Machine according to claims 4, 6 and 8 characterized in that it comprises an upper evaporator (22) having approximately annulus shape and associated to the enlargement (9) of the first conveyor (8) in order to provide the interspaces (21) also with water vapour, said water being provided by water feeding means (11) and heated by the solar collection means (12) connected to the upper evaporator (22).

10) Machine according to claim 6 characterized in that it comprises a horizontal covering mean (23) fixed above and spaced apart from the second conveyor (16).

11) Machine according to claim 7 characterized in that the relieves (26) of the second conveyor (16) are obtained from folded sheets oriented towards the inside of the interspaces (21) between the conveyors (8, 16).

12) Machine according to claim 8 characterized in that the transversal sectioned area of the interspaces (21) between conveyors (8, 16) increases from the lower part to the upper part thereof.

13) Machine according to any one of the preceding claims characterized in that it comprises electrical means (24) powered by photovoltaic means (25) and by

electrical generator (2).

14) Machine according to claim 5 characterized in that the movable blades (14) of the upper turbine (7) are disposed on four horizontal planes and each of said planes comprises eight blades disposed to form a respective disc of the blades, the diameter of said discs increasing from the lower part to the upper part of the upper turbine (7).

15) Machine according to claim 14 characterized in that the hub (15) has a approximately inverted truncate cone shape.

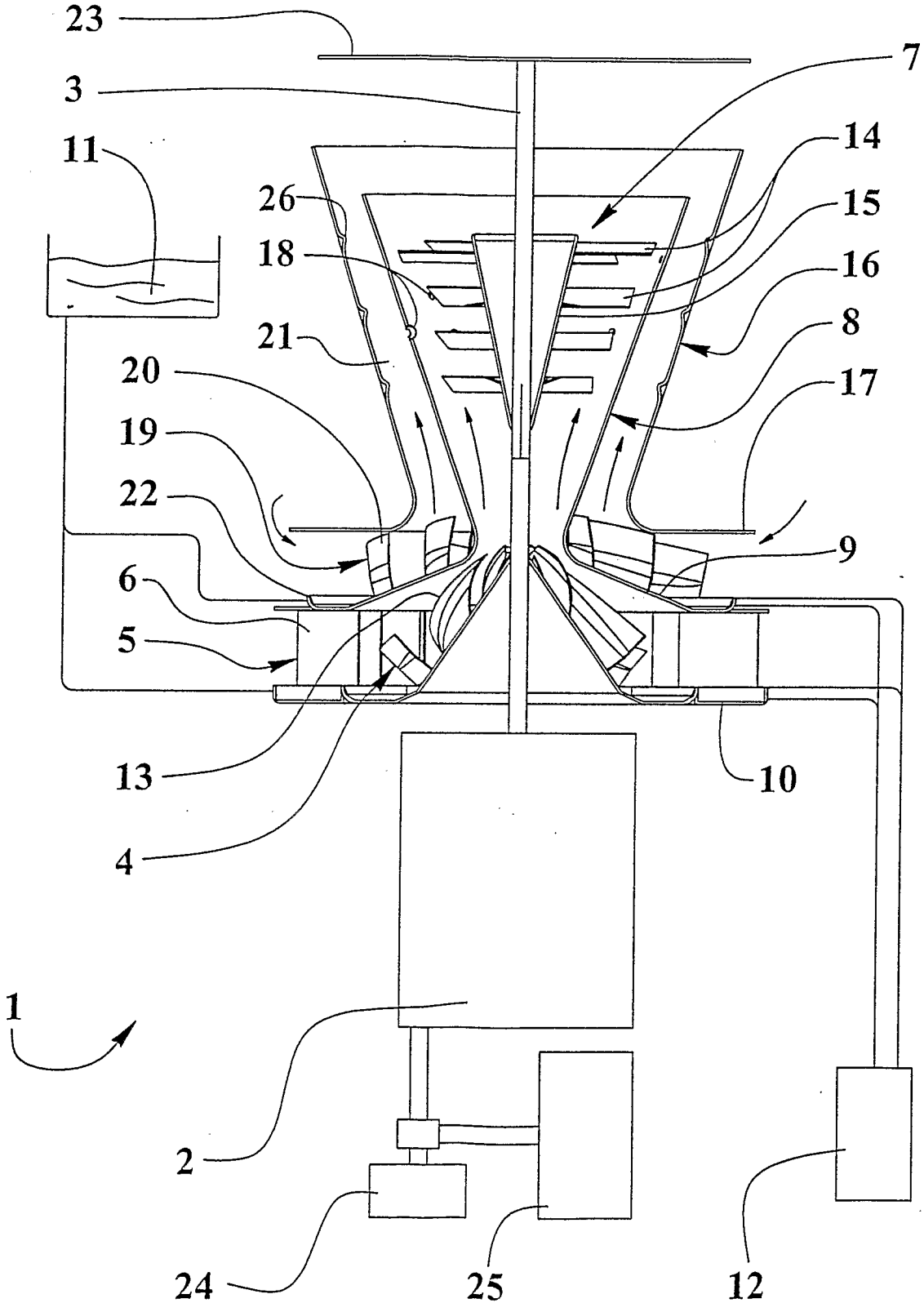


FIG.1

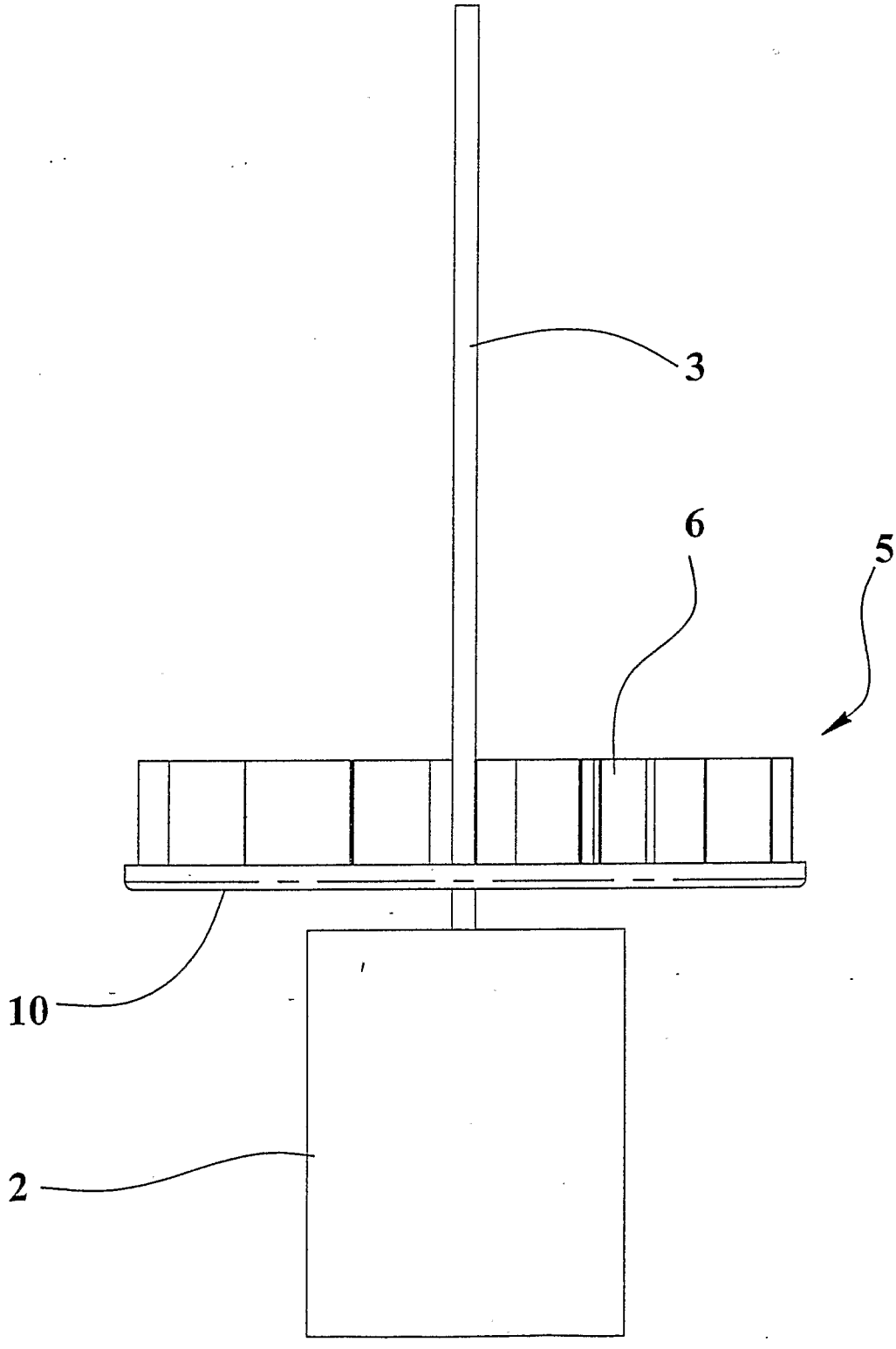


FIG.2

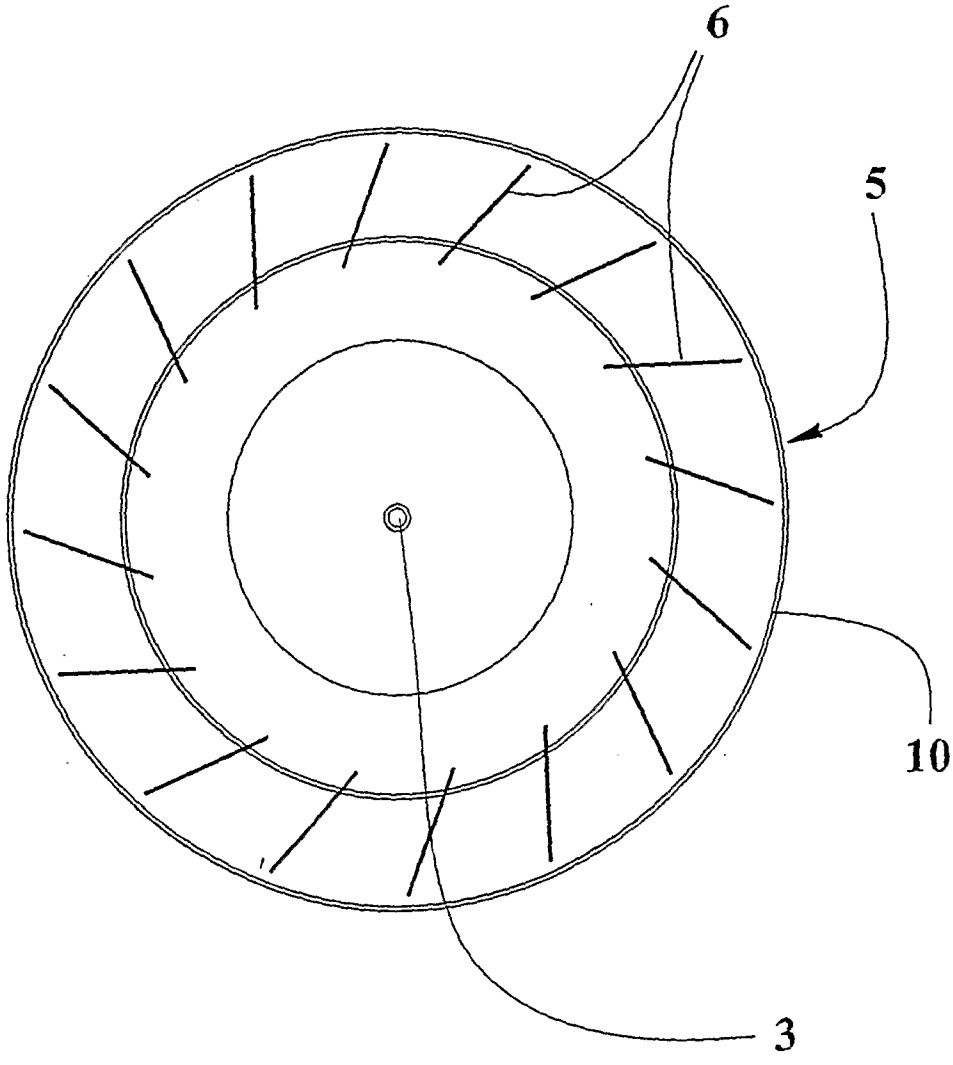


FIG.3

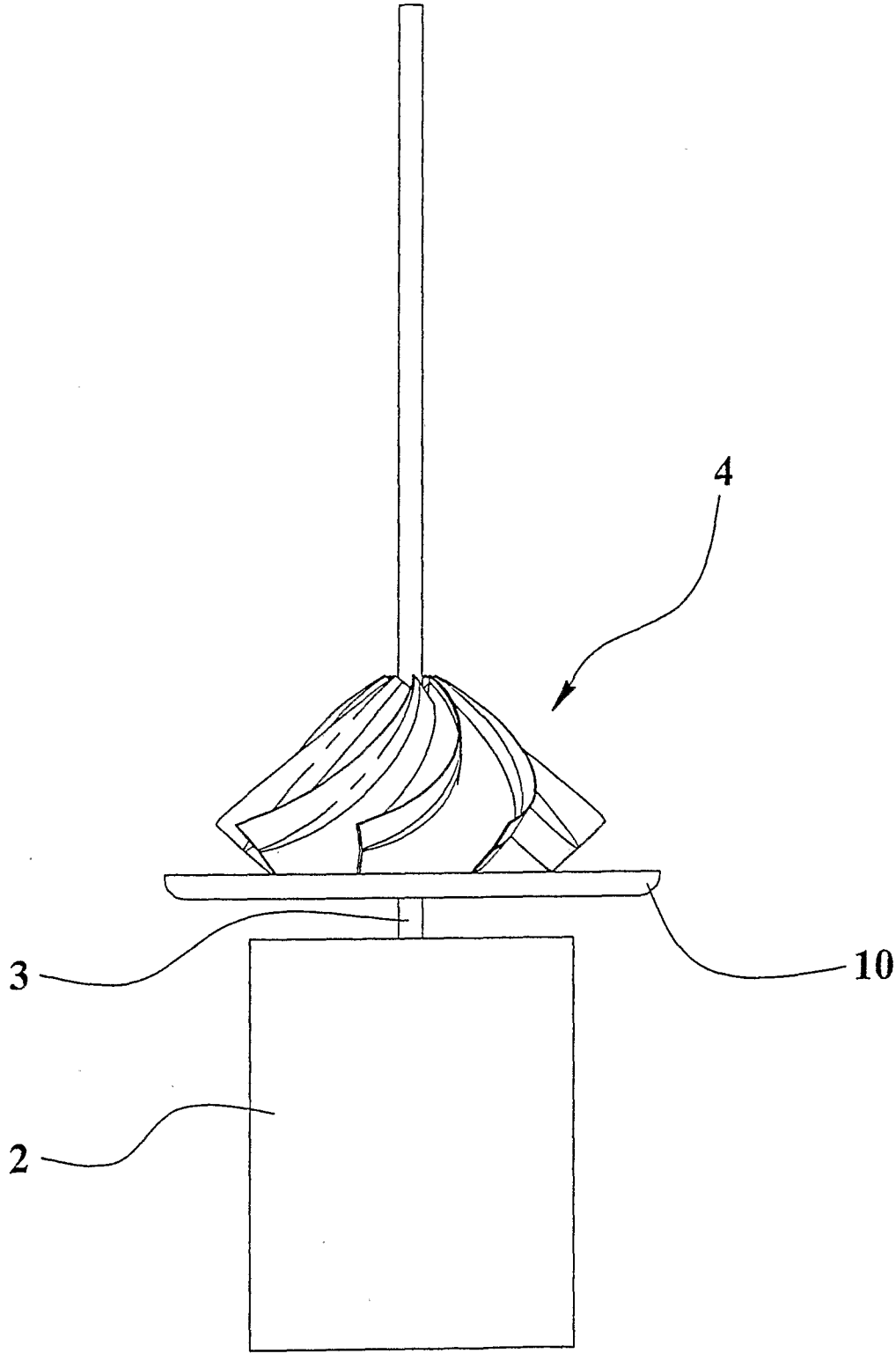
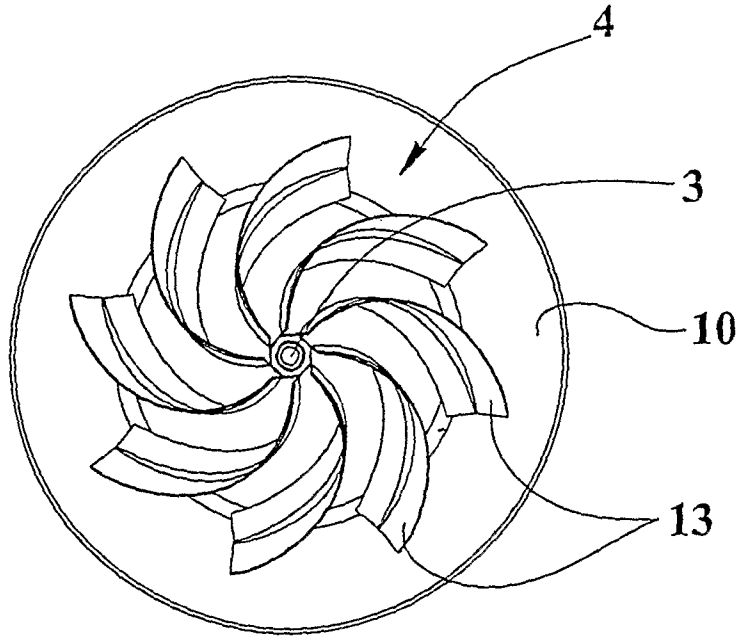


FIG.4

FIG.5



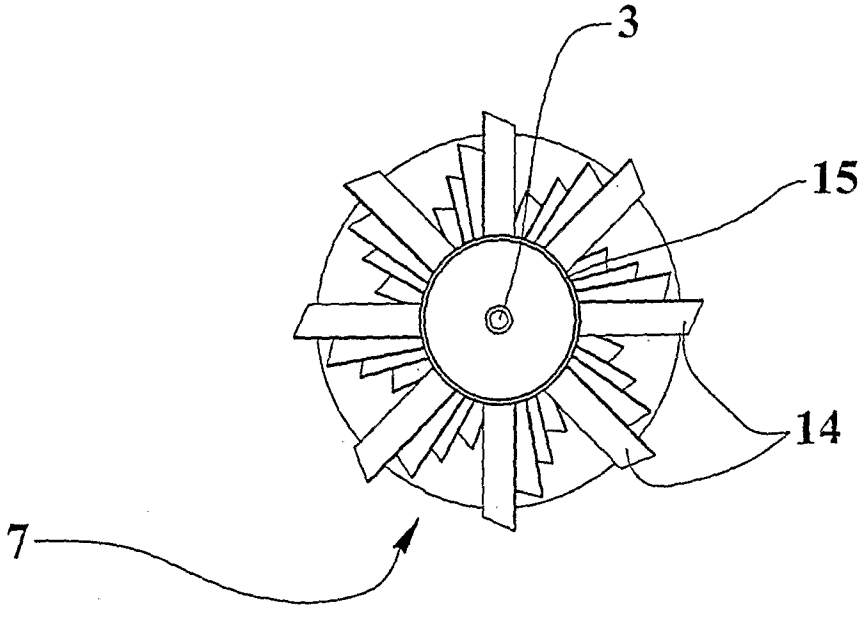


FIG.9

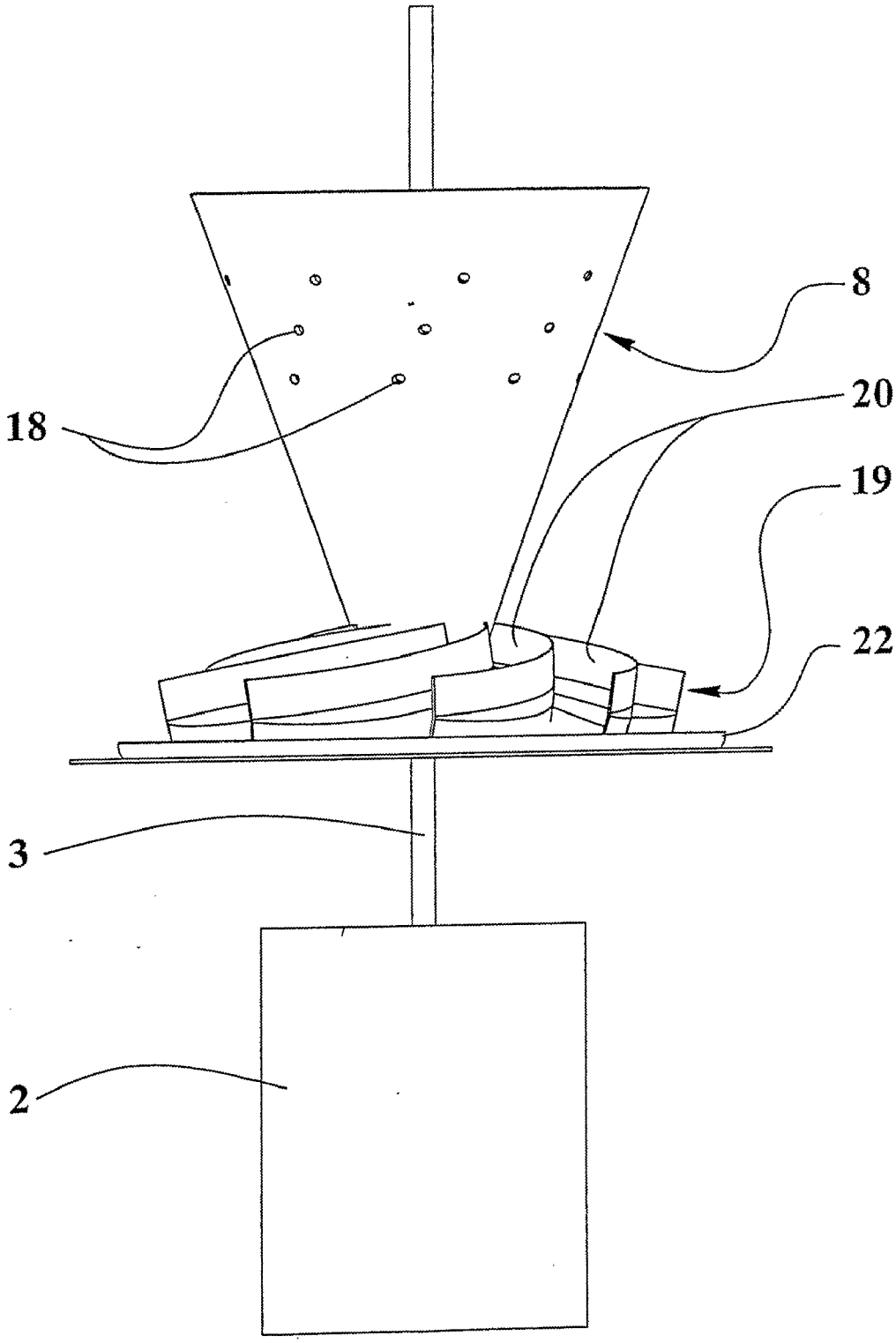


FIG.6

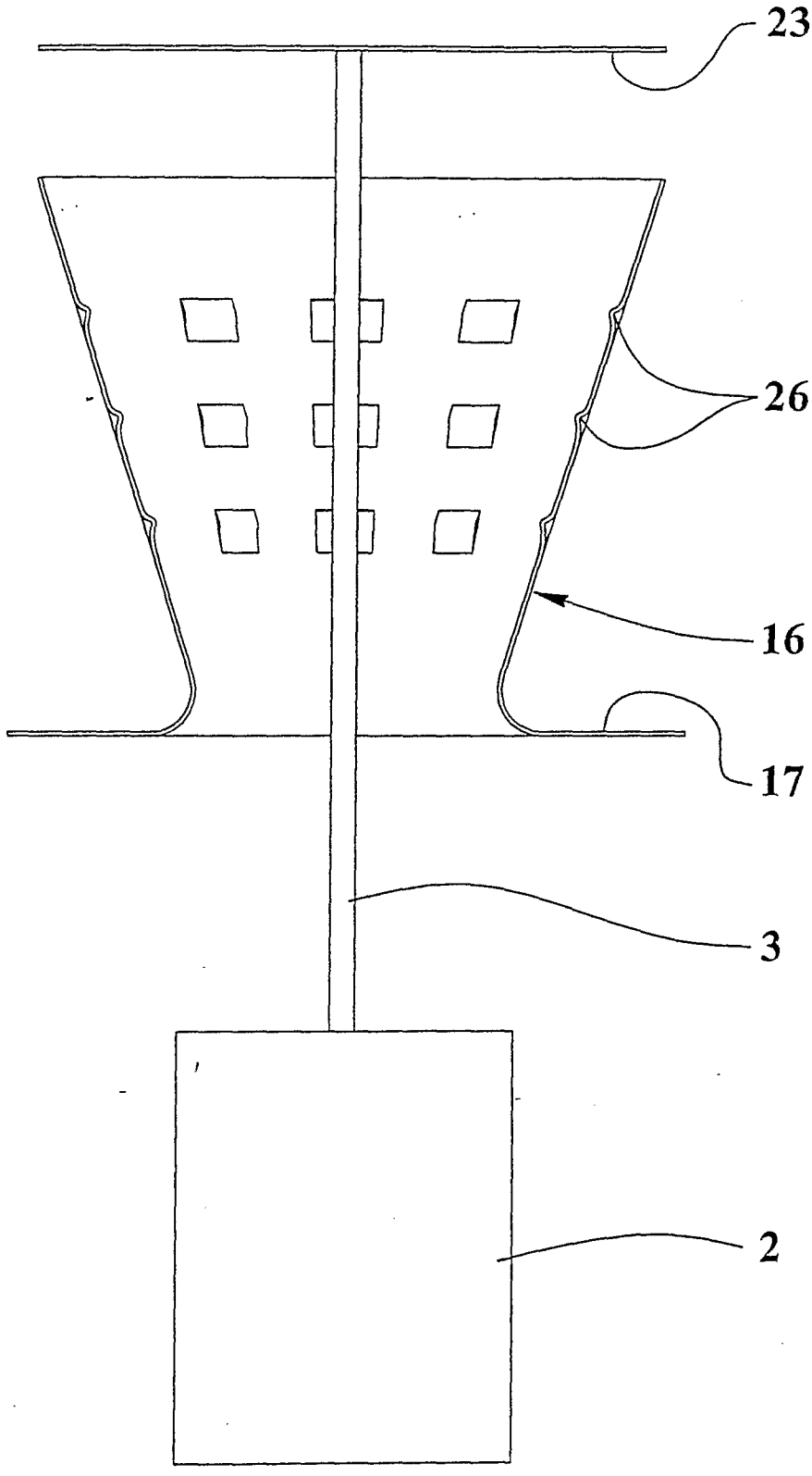


FIG.7

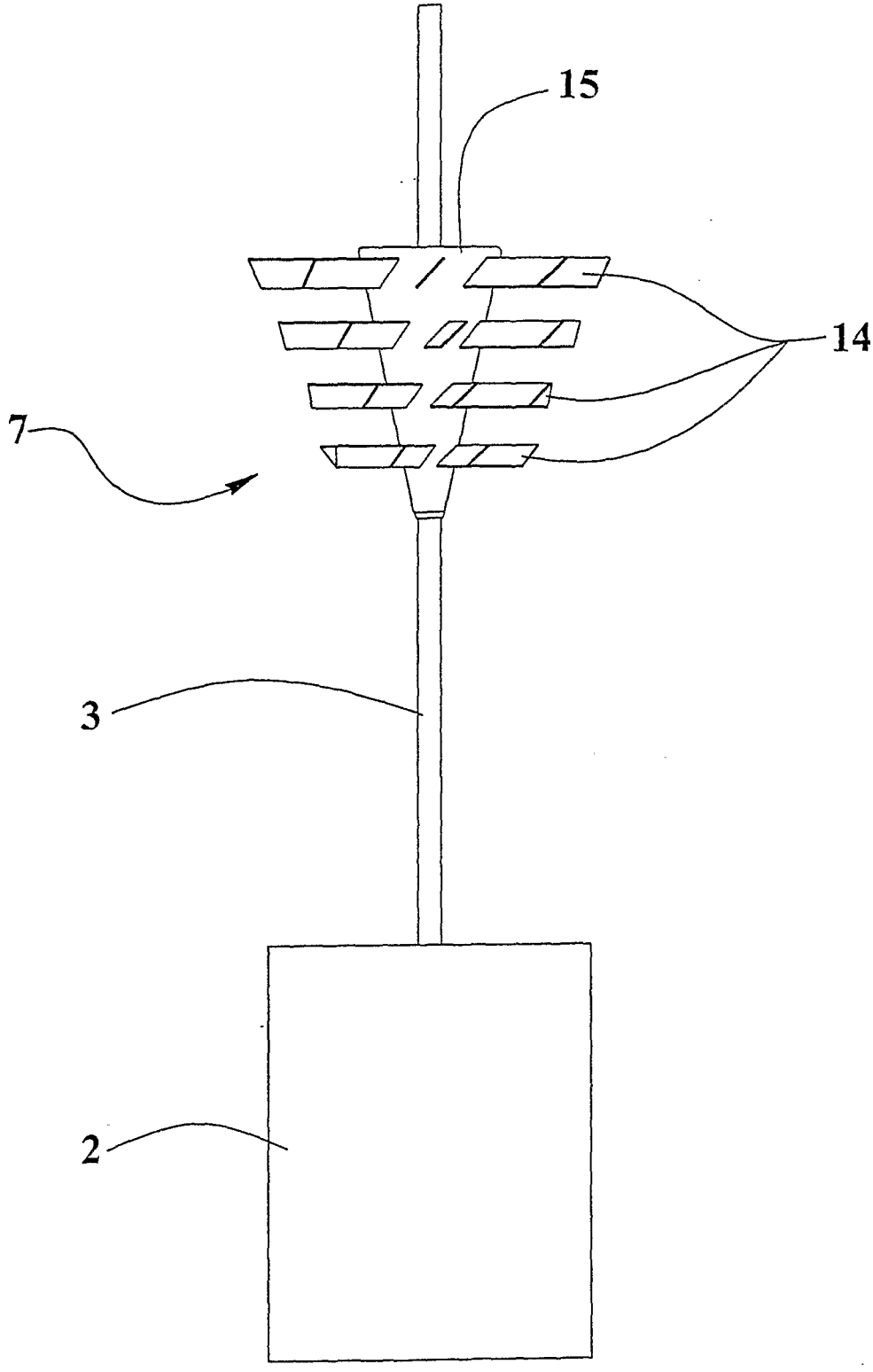


FIG.8