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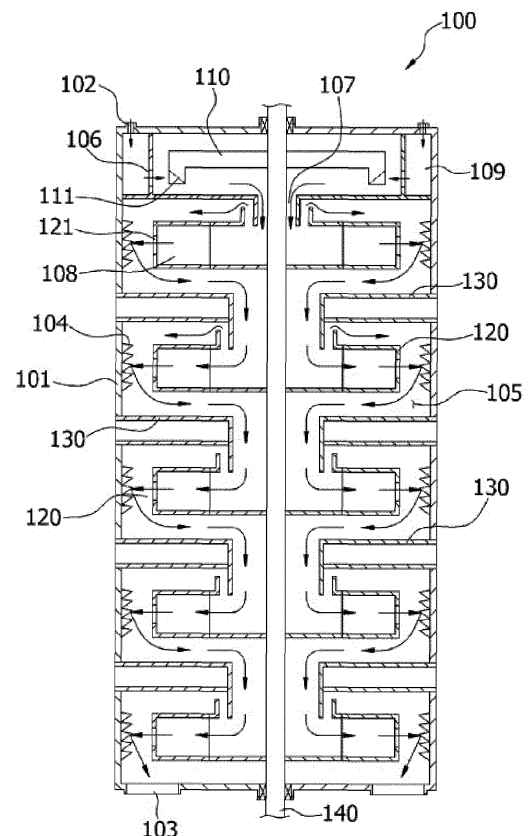
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(54) **STRUCTURE OF AXIAL-TYPE MULTISTAGE TURBINE**

(57) The present invention relates to a structure of an axial-type multistage turbine. To this end, the present invention provides the structure of the axial-type multistage turbine including a mixed-type turbine (100) having an inner part filled with a fluid, and the mixed type turbine comprises: a body (101) having a space part (105) in which a fluid is filled, and an inlet (102) and an outlet (103) respectively formed at an upper end and a lower end thereof; a rotary shaft (140) provided in a center of the body (101) to be rotated at a high speed and having a discharging hole (107); at least one first rotational blade (110) provided to be integrated with the rotary shaft (140); a plurality of second rotational blades (120) provided to be integrated with the rotary shaft (140) at a predetermined interval; and the body (101) comprising a reception hole (106) formed inside the upper end thereof and a plurality of fixing blades (130) provided to be fixed at a lower end of the body. The present invention having the above-mentioned configuration enables a user to selectively use a turbine structure among an immersion type, a collision type, and a recoil-operated type in accordance with circumstances on site, and particularly, can maximize efficiency by superlatively forming angles of a blade and a nozzle of the turbine, thereby providing a good image of a product by satisfying various consumer needs of users by remarkably improving quality and reliability of the product.

Fig.1



Description

[Technical Field]

[0001] The present invention relates to a structure of an axial-type multistage turbine which may be arbitrarily formed in one stage or multiple stages in accordance with a type and a flow rate of a fluid and a velocity or a head of the fluid, and more particularly, to a structure of an axial-type multistage turbine which may enable a user to selectively use a turbine structure from a collision type turbine and a recoil-operated type turbine in accordance with circumstances on site, and particularly, may maximize efficiency by superlatively forming angles of a blade and a nozzle of the turbine, thereby providing a good image of a product by satisfying various consumer desires (needs) of users by remarkably improving quality and reliability of the product.

[Background Art]

[0002] It should be noted that the present invention is an invention improving on Patent No. 1184877 (Title: Improved structure of axial-type turbine) which has been registered through earlier application by the present applicant.

[0003] As is generally known, a turbine is a machine that converts energy that fluid, such as wind, water, gas, steam, and the like, has into useful mechanical energy, and is characterized by performing rotational motion. In general, a turbo-type machine in which multiple blades or wings are provided at a circumference of a rotor and rotated at a high speed by jetting a fluid having a constant speed to the blades or wings is called a turbine. A turbine which drops water from high places and enables the dropped water to pass through a runner that is a rotor to convert the energy of the running water into mechanical energy is a hydraulic turbine, and a turbine which uses steam energy for enabling the turbine to rotate by jetting steam from nozzles to the blades is a steam turbine. In addition, as the steam turbine, there are a collision type turbine and a recoil-operated type turbine, and there is also a mixed-type turbine combining advantages of both turbines. In addition, a gas turbine uses energy which high-temperature and high-pressure gas has, and an air turbine uses energy which high-pressure compressed air has. Any turbine is important as power for industries. The steam turbine is used to drive a generator in a thermoelectric power plant and a nuclear power plant, and the hydraulic turbine is used to move a generator in a hydroelectric power plant.

[0004] Meanwhile, a multistage turbine refers to a turbine that expands gas or steam in several stages, and is achieved by combining several stages, each of which is constituted of a nozzle or a fixed blade and a rotational blade.

[0005] However, the above-described gas turbine has low thermal efficiency and large fuel consumption, and

a large space is required in an axial direction due to a complex structure and the enlargement of the rotor of the gas turbine, all of which does not facilitate installation.

[0006] In addition, the above-described conventional technology fails to superlatively form angles of the blade and the nozzle of the turbine, resulting in decreased efficiency.

[Prior Art Documents]

[0007]

[Patent Document 1] Korean Patent Publication No. 2010-0105103 (Title: Axial-type multistage turbine) has been published.

[Patent Document 2] Korean Patent Registration No. 1184877 (Title: Improved structure of Axial-type multistage turbine) has been registered.

[Disclosure]

[Technical Problem]

[0008] The present invention is directed to providing a structure of an axial-type multistage turbine which may include first and second rotational blades, a fixed blade, a collision wing inclined surface, and a resistance projection provided in a body thereof, be arbitrarily formed in one stage or multiple stages in accordance with a type and a flow rate of a fluid and a velocity or a head of the fluid, enable a user to selectively use a turbine structure from a collision type turbine and a recoil operated type turbine in accordance with circumstances on site, and maximize efficiency by superlatively forming angles of a blade and a nozzle of the turbine, thereby providing a good image of a product by satisfying various consumer desires (needs) of users by remarkably improving quality and reliability of the product.

[Technical Solution]

[0009] One aspect of the present invention provides a structure of an axial-type multistage turbine in which a mixed-type turbine 100 with a fluid filled therein is provided, wherein the mixed-type turbine includes: a body 101 that has a space portion 105 in which the fluid is filled and an inlet 102 and an outlet 103 respectively formed at an upper end and a lower end thereof; a rotary shaft 140 that is pivotally arranged at a center of the body 101, is rotated at a high speed, and has a fluid passage 107 in which the fluid flows; one or more first rotational blades 110 that are pivotally arranged to be integrated with the rotary shaft 140; a plurality of second rotational blades that are pivotally arranged to be integrated with the rotary shaft 140 at a predetermined interval; and a plurality of fixed blades 130 that are fixedly installed at the lower end of the body 101 while a nozzle portion 106 is formed inside the upper end of the body 101.

[0010] Another aspect of the present invention provides a structure of an axial-type multistage turbine in which a recoil-operated type turbine 200 with a fluid filled therein is provided, wherein the recoil-operated type turbine 200 includes: a body 201 that has a space portion 203 in which the fluid is filled and an inlet 202 and an outlet respectively formed at an upper end and a lower end thereof; a rotary shaft 220 that is pivotally arranged at a center of the body 201, is rotated at a high speed, and has a reception space 204 formed therein; a plurality of rotational blades 230 that are pivotally arranged to be integrated with the rotary shaft 220 at a predetermined interval, and in which a fixed space 205 is formed; and a plurality of fixed blades 210 that are fixedly installed at a predetermined interval inside the body 201.

[Advantageous Effects]

[0011] According to embodiments of the present invention, first and second rotational blades, a fixed blade, a collision wing inclined surface, and a resistance projection may be provided in a body in a structure of an axial-type multistage turbine.

[0012] Also, according to embodiments of the present invention, a structure of an axial-type multistage turbine may be arbitrarily formed in one stage or multiple stages in accordance with a type and a flow rate of a fluid and a velocity or a head of the fluid.

[0013] Also, according to embodiments of the present invention, a structure of an axial-type multistage turbine may enable a user to selectively use a turbine structure from a collision type turbine and a recoil-operated type turbine in accordance with circumstances on site.

[0014] In particular, according to embodiments of the present invention, a structure of an axial-type multistage turbine may maximize efficiency by superlatively forming angles of a blade and a nozzle of the turbine.

[0015] Therefore, according to embodiments of the present invention, a good image of a product can be provided by satisfying various consumer desires (needs) of users by remarkably improving quality and reliability of the product.

[Description of Drawings]

[0016]

FIG. 1 is a cross-sectional view showing a structure of an axial-type multistage turbine according to a first embodiment of the present invention.

FIG. 2 is a cross-sectional view showing a structure of an axial-type multistage turbine according to a second embodiment of the present invention.

FIG. 3 is a cross-sectional view showing a structure of an axial-type multistage turbine according to a third embodiment of the present invention.

FIG. 4 is a cross-sectional view showing a structure of an axial-type multistage turbine according to a

fourth embodiment of the present invention.

FIG. 5 is a top cross-sectional view of an axial-type multistage turbine according to the present invention.

FIG. 6 is a cross-sectional view showing a nozzle according to the first embodiment of the present invention.

FIG. 7a is a cross-sectional view showing a nozzle according to the second embodiment of the present invention, and FIG. 7b is a cross-sectional view showing a nozzle according to the third embodiment of the present invention.

FIG. 8a is a cross-sectional view showing a nozzle according to the fourth embodiment of the present invention, and FIG. 8b is a cross-sectional view showing a nozzle according to a fifth embodiment of the present invention.

FIG. 9 is a cross-sectional view showing a nozzle according to a sixth embodiment of the present invention.

FIG. 10 is a configuration view showing a rotational blade according to another embodiment of the present invention.

[Description of major parts of drawings]

[0017]

100: Mixed-type turbine
110: First rotational blade
120: Second rotational blade
130: Fixed blade
140: Rotary shaft
300: Cover

[Modes of the Invention]

[0018] A structure of an axial-type multistage turbine according to the present invention will be described with reference to FIGS. 1 to 10.

[0019] In the following descriptions of possible embodiments operable from the invention, when some of the components and features of the present invention are known and description thereof obscures the subject matter of the present invention, the corresponding detailed description will be omitted, and a specific embodiment illustrated in the drawings will be mainly described.

[0020] The following terms are defined in consideration of the functions of the present invention, and may be differently defined according to the intention of an operator or custom. Therefore, the terms should be defined based on the overall contents of the specification.

[0021] First, in a structure of an axial-type multistage turbine according to a first embodiment of the present invention, a mixed-type turbine 100 having an inner portion filled with a fluid is provided as shown in FIG. 1, and the mixed-type turbine includes a body 101 having a space portion 105 in which the fluid is filled and an inlet

102 and an outlet 103 respectively formed at an upper end and a lower end thereof.

[0022] In addition, the mixed-type turbine includes a rotary shaft 140 which is pivotally arranged at the center of the body 101, is rotated at a high speed, and has a fluid passage 107 inside of which the fluid flows.

[0023] In addition, the mixed-type turbine includes one or more first rotational blades 110 which are coaxially arranged to be integrated with the rotary shaft 140.

[0024] In addition, the mixed-type turbine includes a plurality of second rotational blades 120 which are coaxially arranged to be integrated with the rotary shaft 140 at a predetermined interval.

[0025] In addition, an ejection hole 121, through which a fluid flowing into the space portion 109 formed inside the upper end of the body 101 is ejected from a nozzle portion 106 and collides with the first rotational blade 110 so as to flow through the fluid passage 107, is formed in the body 101, and a plurality of fixed blades 130 are fixedly installed in the body 101.

[0026] In particular, inside the body 101 according to the present invention, a resistance projection 104 is formed to protrude at a predetermined interval so that the fluid collides with the resistance projection 104 to cause a recoil motion.

[0027] In addition, the collision wing inclined surface 111 which the fluid collides with to enhance a rotational force is further formed at the first rotational blade 110.

[0028] The ejection hole 121 through which the fluid flowing into the inside is discharged to a side of the resistance projection is further formed at the second rotational blade 120.

[0029] Meanwhile, in a structure of an axial-type multi-stage turbine according to a second embodiment of the present invention, a recoil-operated type turbine having an inner portion filled with a fluid is provided as shown in FIG. 1, and the recoil-operated type turbine includes a body 201 having a space portion 203 in which the fluid is filled and an inlet 202 and an outlet respectively formed at an upper end and a lower end thereof.

[0030] In addition, the recoil-operated type turbine includes a rotary shaft 220 which is coaxially arranged at the center of the body 201, is rotated at a high speed, and has a reception space 204 formed therein.

[0031] In addition, the recoil-operated type turbine includes a plurality of rotational blades 230 which are coaxially arranged at a predetermined interval to be integrated with the rotary shaft 220 and having a fixed space 205 formed therein.

[0032] In addition, a plurality of fixed blades 210 are fixedly installed at a predetermined interval inside the body 201.

[0033] In particular, the rotational blade 230 and the fixed blade 210 according to the present invention are assembled and installed to vertically cross each other in the form of "⊥" or "⊃".

[0034] In an end portion 207, in which a path in a fluid ejection direction is formed in an inner space portion from

an outer periphery of the rotational blade 230, a fluid passage is formed as shown in FIG. 5.

[0035] In addition, a second end portion 208 that protrudes upward is formed at the outer periphery of the rotational blade 230, and a bent portion 230a is formed in such a manner that the fluid flows from the inside of a wing to the outside of the blade through a pipe passage groove 200 shown in FIG. 5 and collides with a resistance projection 206 formed at an inner side of a housing to cause a recoil force.

[0036] In addition, in the collision type turbine structure, an end surface 231 of the nozzle portion is formed in parallel with an end surface 232 of the rotational blade in order to prevent a flow rate loss of the fluid, and at least one or a plurality of multinozzle structures is achieved.

[0037] In addition, a cover 300 is formed at the end surface 231 of the nozzle portion according to the present invention so that the fluid does not spread out.

[0038] On the other hand, according to the present invention, it is preferable that a wing blade of the rotational blade 230 be formed at an end side surface of the rotational blade 230 like a gear, and front (a rotational direction) and rear (an opposite direction to the rotational direction) angles be formed to be inclined in the range of 5 to 45 degrees with respect to a center axis 701 in the rotational direction, while upper and lower angles are perpendicular to each other.

[0039] In addition, it is preferable that left and right angles be inclined in the range of 90 to 60 degrees in the rotational direction and the front and rear angles be formed to be inclined in the range of 5 to 45 degrees in the rotational direction while the rotational blade 230 are formed like ribs of a fan (see FIG. 8a).

[0040] In addition, according to the present invention, the angle of a nozzle is in a straight line with or orthogonal to a wing surface which the fluid collides with, and upper and lower angles of the nozzle in a disk shape of ribs of a fan is in the range of 1 to 30 degrees and left and right angles thereof are orthogonal to the wing surface that is inclined in the rotational direction.

[0041] In addition, according to the present invention, as shown in FIGS. 2 to 5, a fluid flows into the inlet 202, further flows into the fixed space 205 formed inside the rotational blade through the reception space 204, collides with a resistance wall 221 formed at a front surface of a pipe passage groove 230b via the pipe passage groove 230b formed at a rotor end portion to thereby cause a propulsion action, and the fluid collides with the resistance projection 206 formed inside the housing while the fluid is ejected in the opposite direction to a direction in which the blade is rotated, and thereby obtains a recoil force.

[0042] In addition, according to the present invention, as shown in FIGS. 7a and 7b, an end surface of a nozzle is formed in parallel with a wing end surface 232 of the rotational blade which the fluid collides with, a plurality of nozzles are provided, and an outer periphery of the

end surface is covered with the cover in order to prevent dispersion of the fluid.

[0043] In addition, according to the present invention, the end surface 231 of the nozzle from which the fluid is ejected is formed in parallel with the wing end surface 232 of the rotational blade.

[0044] Meanwhile, when the above-described components are applied, the present invention may be modified variously and employ various forms.

[0045] In addition, it should be understood that the present invention is not limited to the above-mentioned particular form. On the contrary, the invention covers all alternatives, modifications, and equivalents within the spirit and scope of the present invention which are defined by the appended claims, and in particular, a wing shape in the collision type turbine structure may be modified in various forms.

[0046] Hereinafter, the effect of the structure of the axial-type multistage turbine according to the present invention which is configured as described above will be described.

[0047] First, according to the present invention, a user may selectively use a turbine structure from a collision type turbine structure and a recoil-operated type turbine structure in accordance with circumstances on site, and in particular, efficiency may be maximized by superlatively forming angles of a blade and a nozzle of the turbine,

[0048] For this, according to the first embodiment of the present invention, the inner space portion 105 is fully filled with a fluid or a gas through the inlet 102 in a state in which the outlet 103 of the body 101 is closed.

[0049] Accordingly, a propagation passage of the fluid or the gas is formed in inner space portions of the first rotational blade 110 and the second rotational blade 120 as well as the space portion 105 of the body 101, and the size of the propagation passage is adjusted and installed in accordance with the type or pressure condition of the fluid or the gas.

[0050] When the fluid or the gas is injected at a high pressure through the inlet 102 and a nozzle portion 106 in the above-described state, the fluid or the gas rotates the first rotational blade 110 and the second rotational blade 120 with respect to the rotary shaft 140 at a high speed while the fluid or the gas flows into the fluid passage 107.

[0051] In particular, the fluid flowing in through the nozzle portion 106 collides with the first rotational blade 110 so that the first rotational blade 110 may be rotated at a high speed. In addition, the collision wing inclined surface 111 is formed at an end surface of the first rotational blade and a plurality of collision wing inclined surfaces 111 are provided to have an angle in the range of 60 to 90 degrees. That is, an angle at which the fluid is ejected is in the range of 1 to 30 degrees, the collision wing inclined surface 111 is formed to have an inclination angle (an inclination) in the range of 60 to 90 degrees, and the angle at which the fluid is ejected and an angle of a sur-

face (the collision wing inclined surface) which the fluid collides with are orthogonal to each other.

[0052] Next, the fluid or the gas passes through the fluid passage 107, is ejected through the ejection hole 121 formed in an outer circumferential surface of the second rotational blade 120, and is then discharged to the next stage.

[0053] In this instance, the fluid or the gas ejected through the ejection hole 121 collides with the resistance projection 104 and then enters in an inward direction again, and this process is repeatedly performed so that the mixed-type turbine 100 is operated.

[0054] In addition, the fluid leaks to the spaces of the fixed blade 130 and the second rotational blade 120 and propagates even through the fluid passage 107, so that a flow rate loss of the fluid may be minimized without a leakage of the fluid between an end surface of a wing of the turbine and an inner wall of the housing in the prior art, thereby rotating the second rotational blade 120 at a high speed.

[0055] When the second rotational blade 120 is rotated, the fixed blade 120 adjacent to the second rotational blade 120 is positioned in a fixed state without being rotated.

[0056] Hereinafter, a second embodiment of the present invention will be described.

[0057] The second embodiment of the present invention is substantially similar to the above-described first embodiment, and a difference therebetween will be described below.

[0058] A fluid flowing in through the inlet 202 rotates the rotational blade 230 which is coaxially arranged on the rotary shaft 220 at a high speed while it is discharged out of the reception space 204 between the rotational blade 230 and the fixed blade 210.

[0059] In the above-described process, a first end portion 207 having an inner space portion formed therein is formed at the outer periphery of the rotational blade 230, thereby increasing a rotational force.

[0060] In addition, in the above-described process, the second end portion 208 that protrudes upward is formed at the periphery of the rotational blade 230, and the fluid also collides with the second end portion 203, thereby further increasing the rotational force of the rotational blade 230.

[0061] Meanwhile, the present invention may obviously be configured and used in the form of the collision type turbine and the recoil-operated type turbine as shown in FIG. 4.

[0062] In addition, according to the present invention, the end surface of the nozzle may be formed as shown in FIGS. 6, 7a, 7b, and 7c, thereby increasing the rotational force of the rotational blade.

[0063] In addition, according to the present invention, the nozzle may be formed in one or a plurality of multi-structures as shown in FIGS. 7a and 7b. The nozzle is formed in parallel along a circumferential surface of the blade in order to reduce a flow rate loss of the fluid, and

the rotational blade is formed to have the same angle as that of the ejected fluid or less so that a loss of the fluid is prevented.

[0064] In addition, according to the present invention, the nozzle may be formed in one or a plurality of multi-structures as shown in FIGS. 8a and 8b, so that the end surface of the nozzle and the wing end surface of the rotational blade are formed in parallel with each other, thereby increasing the rotational force of the rotational blade.

[0065] In addition, according to the present invention, the cover 300 may be formed at the end surface of the nozzle as shown in FIG. 9, so that the fluid or the gas may be directly discharged without being spread out, thereby increasing the rotational force of the rotational blade.

[Industrial Applicability]

[0066] The technical idea of the structure of the axial-type multistage turbine according to the present invention may repeatedly perform the same result in reality, and in particular, technological development may be promoted by performing the present invention to contribute to industrial development, and therefore the present invention may be sufficiently worthy of protection.

Claims

1. A structure of an axial-type multistage turbine in which a mixed-type turbine 100 with a fluid filled therein is provided, wherein the mixed-type turbine comprises:

a body 101 that has a space portion 105 in which the fluid is filled and an inlet 102 and an outlet 103 respectively formed at an upper end and a lower end thereof;

a rotary shaft 140 that is arranged at the center of the body 101, is rotated at a high speed, and has a fluid passage 107 in which the fluid flows; one or more first rotational blades 110 that are coaxially arranged to be integrated with the rotary shaft 140;

a plurality of second rotational blades that are coaxially arranged to be integrated with the rotary shaft 140 at a predetermined interval; and a plurality of fixed blades 130 that are fixedly installed at the lower end of the body 101 while a nozzle portion 106 is formed inside the upper end of the body 101.

2. The structure of the axial-type multistage turbine according to claim 1, wherein a resistance projection 104 is formed inside the body 101 so as to protrude at a predetermined interval so that the fluid collides with the resistance projection 104 to cause a recoil

motion.

3. The structure of the axial-type multistage turbine according to claim 1, wherein an ejection hole 121, through which the fluid flowing into the inside is discharged to a side of the resistance projection, is further formed at the second rotational blade 120.

4. A structure of an axial-type multistage turbine in which a recoil-operated type turbine 200 with a fluid filled therein is provided, wherein the recoil-operated type turbine 200 comprises:

a body 201 that has a space portion 203 in which the fluid is filled and an inlet 202 and an outlet respectively formed at an upper end and a lower end thereof;

a rotary shaft 220 that is coaxially arranged at a center of the body 201, is rotated at a high speed, and has a reception space 204 formed therein; a plurality of rotational blades 230 that are coaxially arranged to be integrated with the rotary shaft 220 at a predetermined interval, and in which a fixed space 205 is formed; and a plurality of fixed blades 210 that are fixedly installed at a predetermined interval inside the body 201.

5. The structure of the axial-type multistage turbine according to claim 4, wherein, at an outer periphery of the rotational blade 230, a first end portion 207 is further formed in a direction in which the fluid is ejected to an inner space.

6. The structure of the axial-type multistage turbine according to claim 5, wherein a second end portion 208 that protrudes upward is formed in the outer periphery of the rotational blade 230, and, while the fluid is flowing from an inside of a wing to the outside through a pipe passage groove 230b formed in a bent portion 230a, the fluid collides with a wall formed in front of the pipe passage groove and, while the fluid is being ejected in an opposite direction to a direction in which the blade is rotated, collides with a resistance projection 206 formed in the direction in which the fluid is ejected and a recoil force is obtained.

7. The structure of the axial-type multistage turbine according to claim 1 or claim 4, wherein an end surface 231 of a nozzle is formed in parallel along the rotational blade in order to reduce a flow rate loss, the structure is formed in one or a plurality of multi-structures, and an end surface 232 of the rotational blade which the fluid collides with is formed to have the same angle as that of an ejected fluid or less in order to reduce a loss of the fluid.

8. The structure of the axial-type multistage turbine according to claim 7, wherein a cover 300 is further formed in the end surface of the nozzle so that the fluid is not dispersed to the outside.
9. The structure of the axial-type multistage turbine according to claim 1 or claim 4, wherein a blade is formed at an end side surface of the rotational blade, and upper and lower angles are formed in the range of 60 to 90 degrees and front (a rotational direction) and rear (an opposite direction to the rotational direction) angles are formed to be inclined in the range of 5 to 45 degrees in the rotational direction with respect to a straight line of a center axis 701.
10. The structure of the axial-type multistage turbine according to claim 1 or claim 4, wherein the rotational blade 230 is formed in a shape of ribs of a fan, and upper and lower angles are formed in the range of 90 to 60 degrees and front and rear angles are formed to be inclined in the range of 5 to 45 degrees in a rotational direction with respect to a straight line of a center axis 801.
11. The structure of the axial-type multistage turbine according to claim 1 or claim 4, wherein an angle of a nozzle is in the range of 5 to 45 degrees so that the angle of the nozzle is an angle being in a straight line with a wing surface which the fluid collides with, and left and right angles of the nozzle in a disk shape of ribs of a fan is formed in the range of 1 to 30 degrees and front and rear angles thereof are formed to be inclined in the range of 5 to 45 degrees in a rotational direction.
12. The structure of the axial-type multistage turbine according to claim 1 or claim 4, wherein the fluid flows into the inlet 202, further flows into the fixed space 205 formed inside the rotational blade through the reception space 204, and collides with a resistance wall 221 formed at a front surface of a pipe passage groove 230b via the pipe passage groove 230b formed at an end portion of a rotor to cause a propulsion action, and the fluid collides with a resistance projection 206 formed inside a housing while being ejected in an opposite direction to a direction in which the blade is rotated, and thereby obtains a recoil force.
13. The structure of the axial-type multistage turbine according to claim 1 or claim 4, wherein an angle of a nozzle is formed to be orthogonal to a surface of a wing which the fluid collides with in horizontal and vertical directions, one or a plurality of nozzles are formed in multiple layers and extend along an end surface to form a multi-layer structure so that the nozzles are in parallel with each other, and an outer periphery of the end surface is covered with a cover
- in order to prevent dispersal of the fluid.
14. The structure of the axial-type multistage turbine according to claim 1 or claim 4, wherein an end surface 231 of a nozzle through which the fluid is ejected is formed to be parallel with an end surface 232 of the rotational blade.

Fig.1

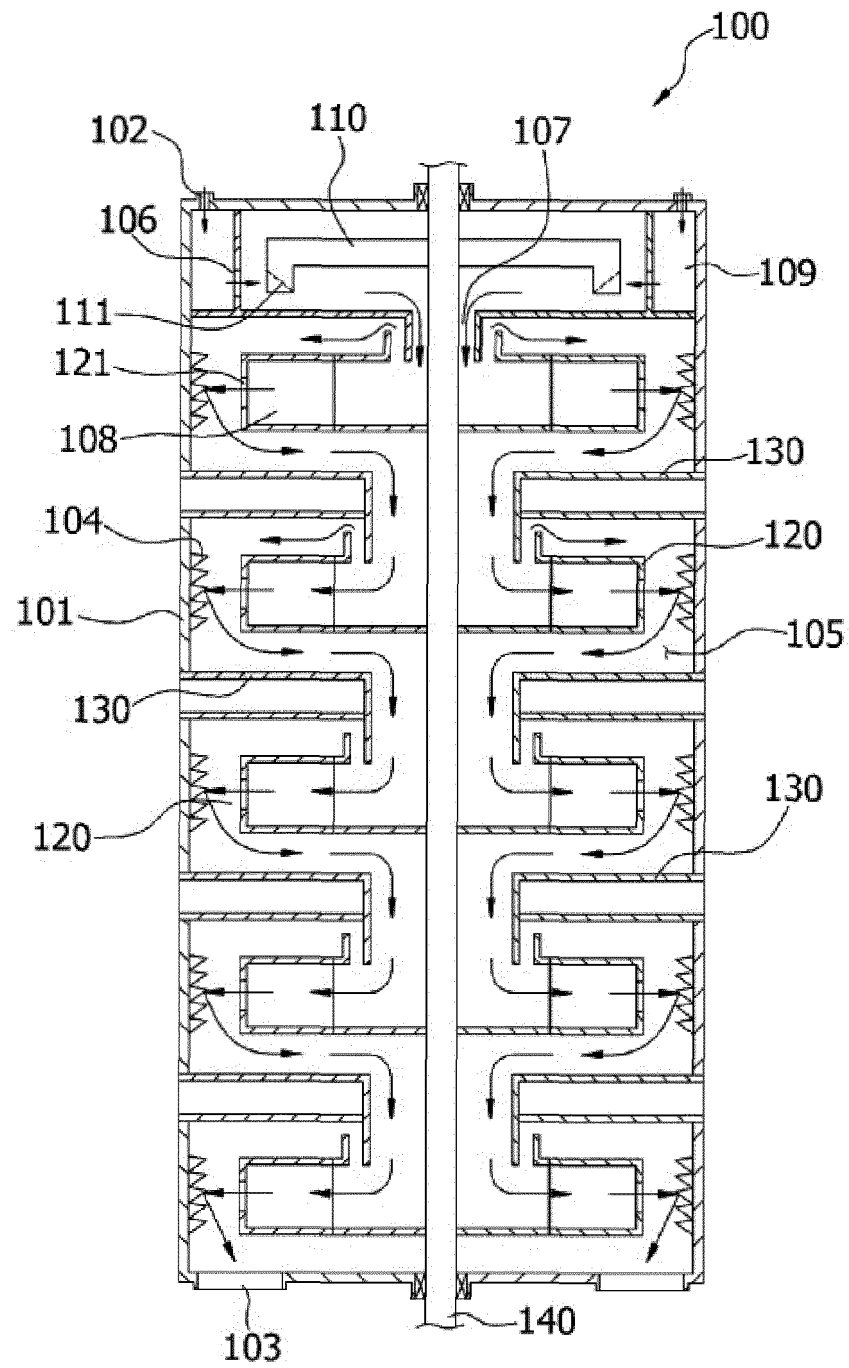


Fig.2

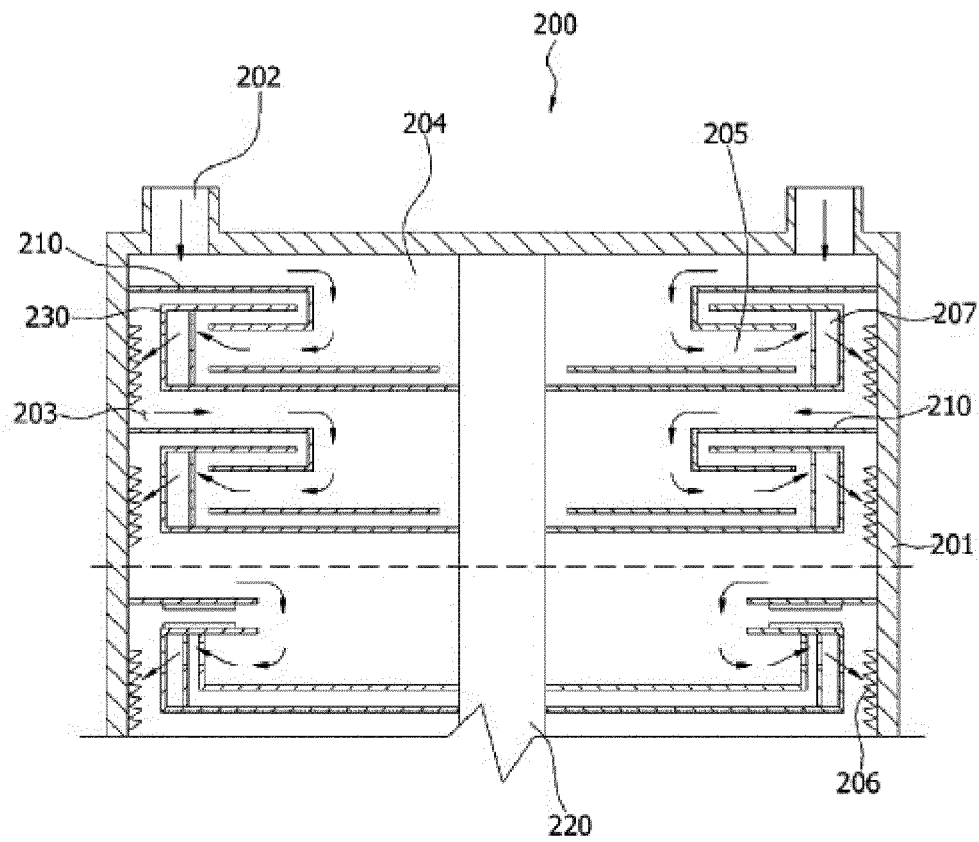


Fig.3

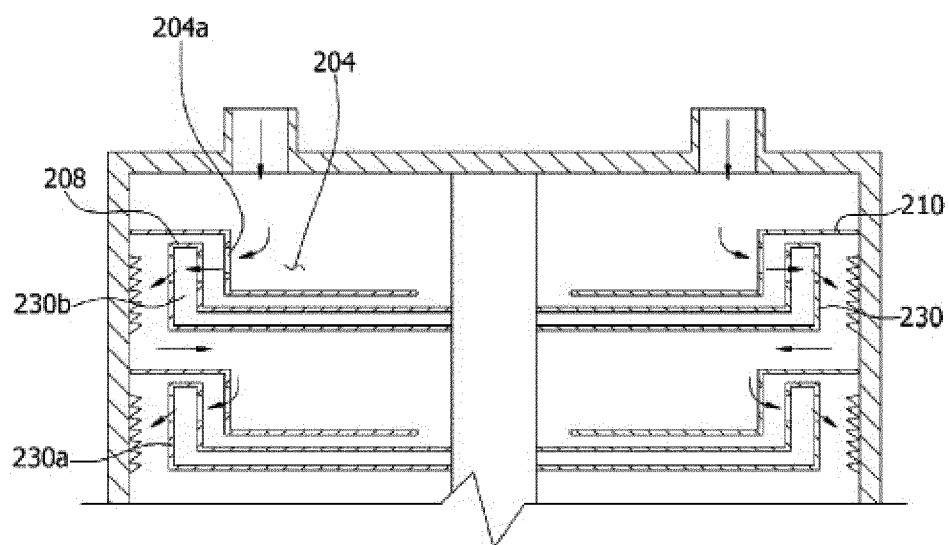


Fig.4

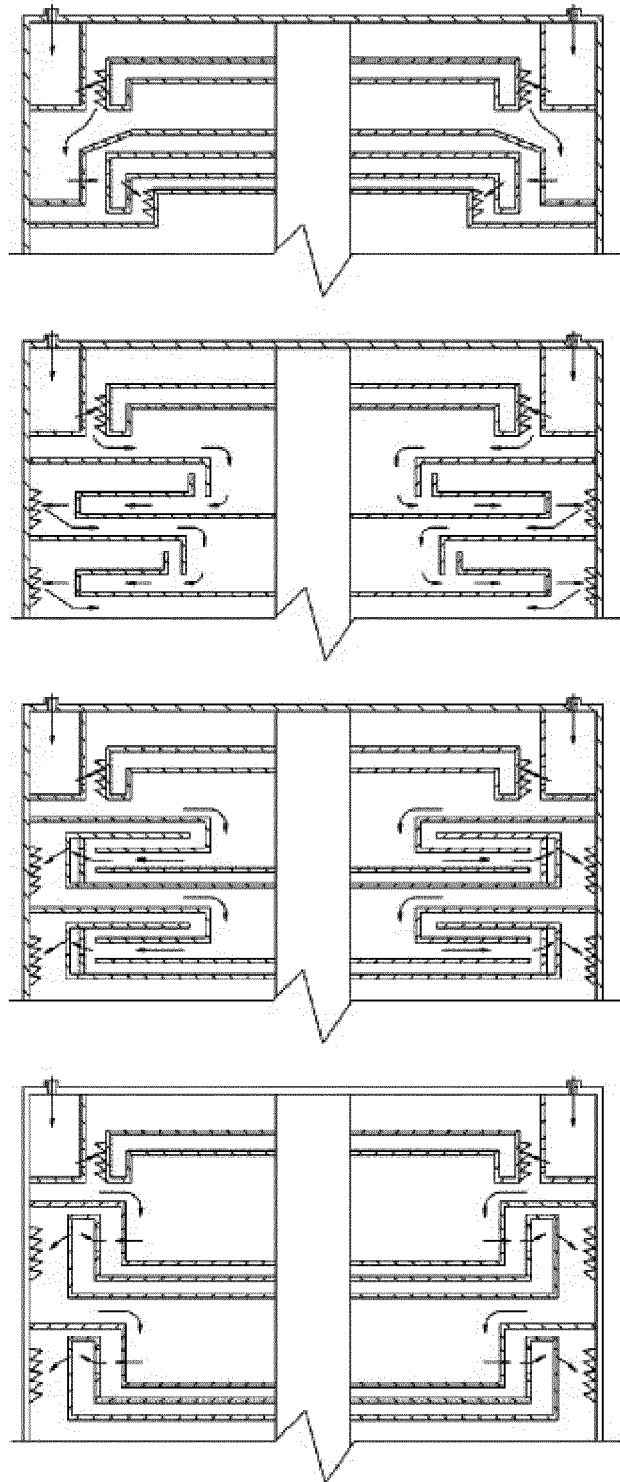


Fig.5

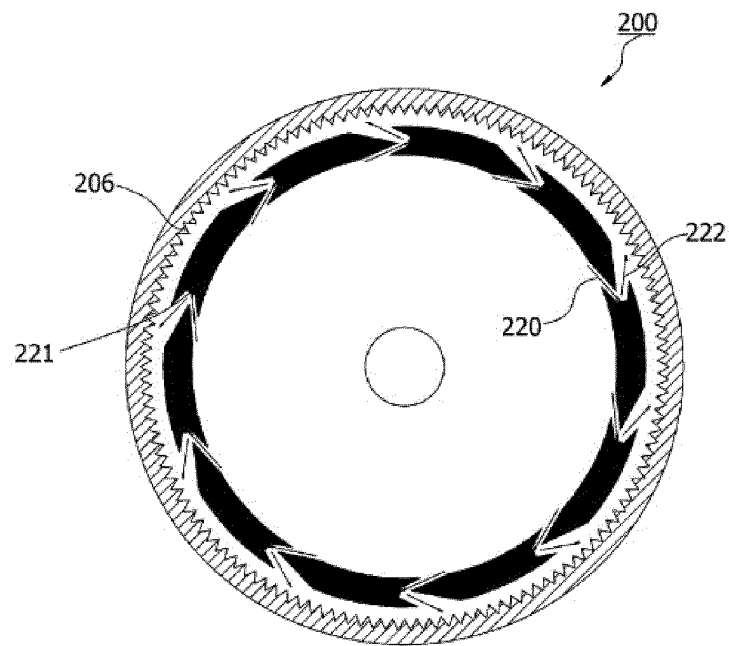


Fig.6

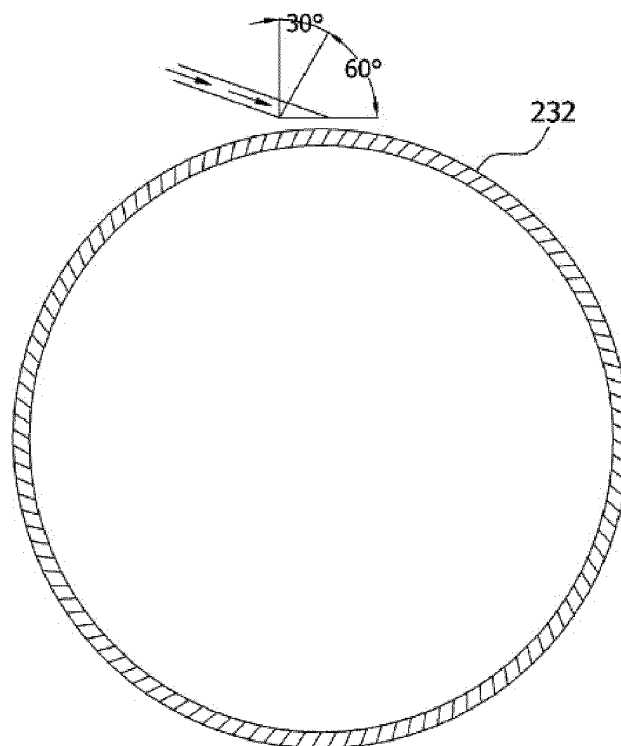


Fig.7a

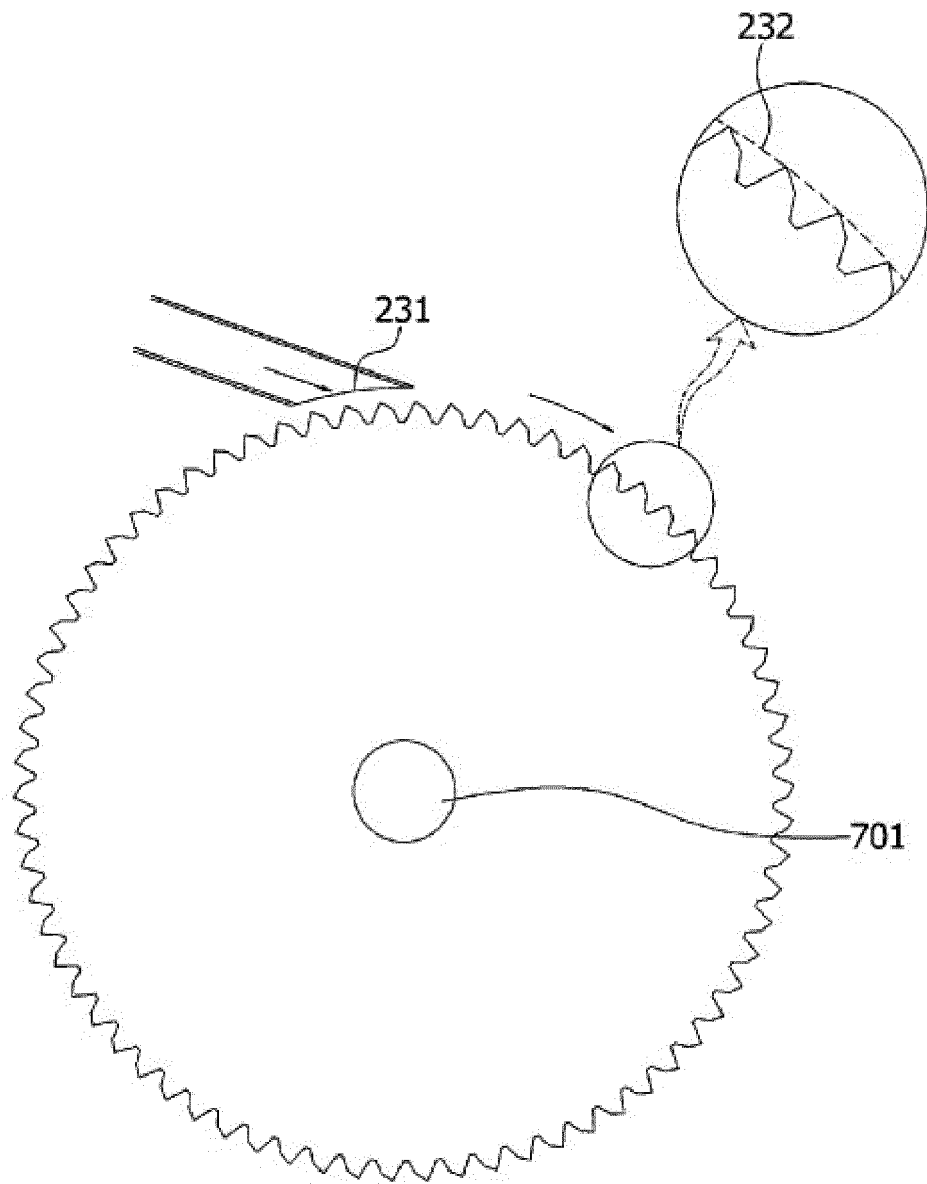


Fig.7b

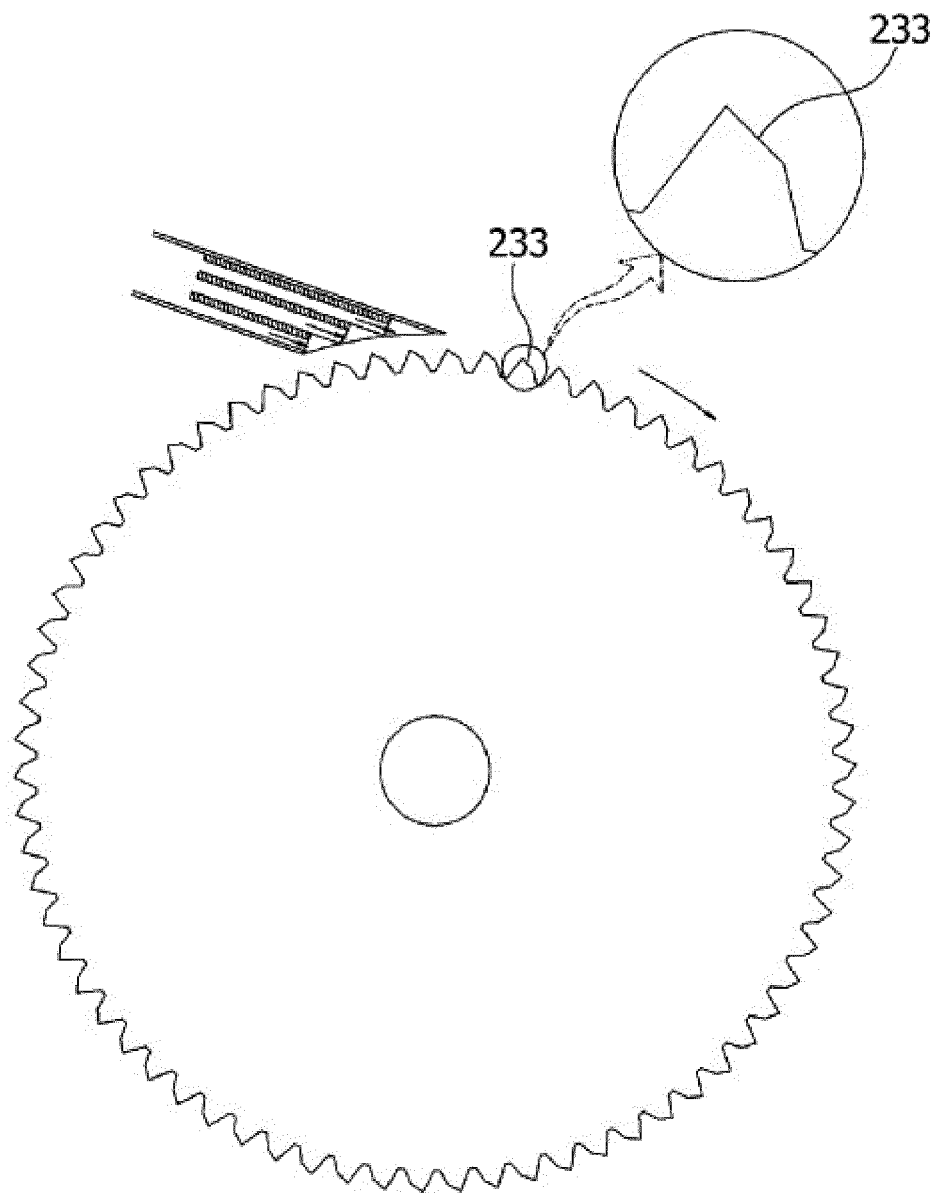


Fig.8a

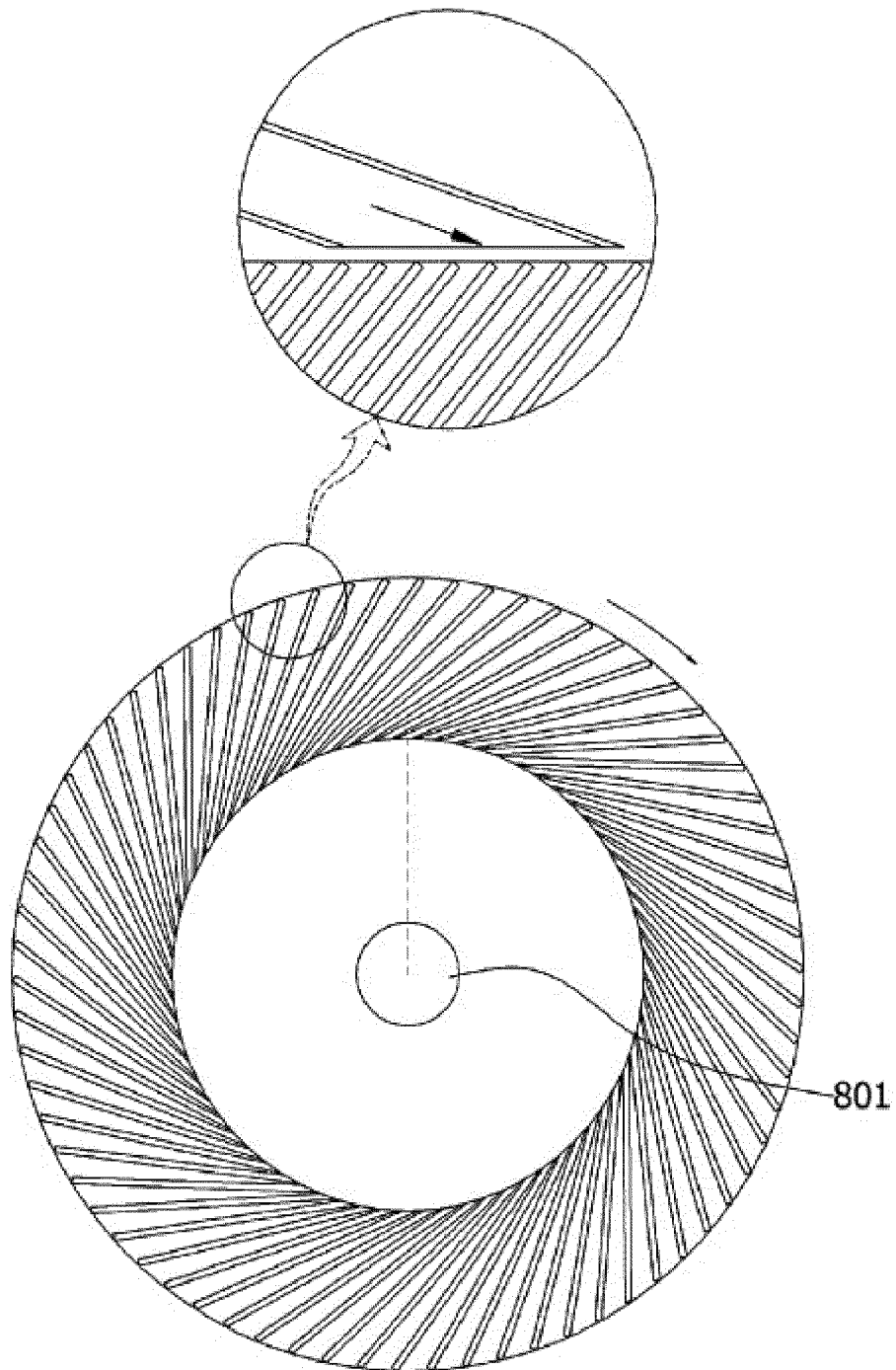


Fig.8b

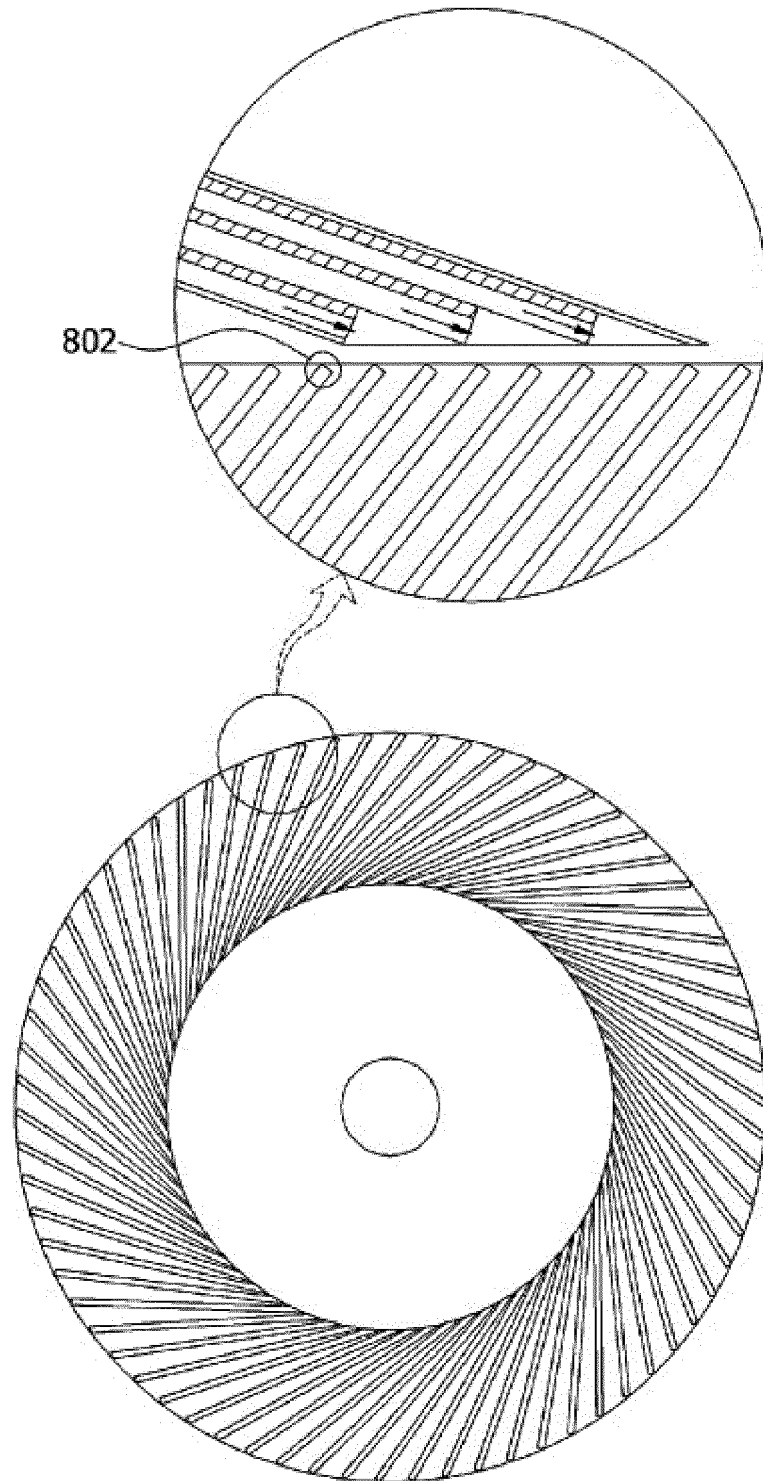


Fig.9

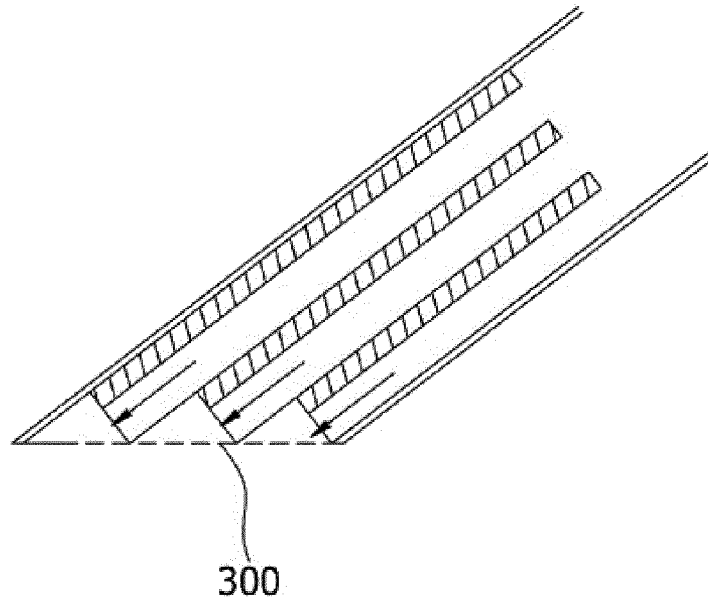
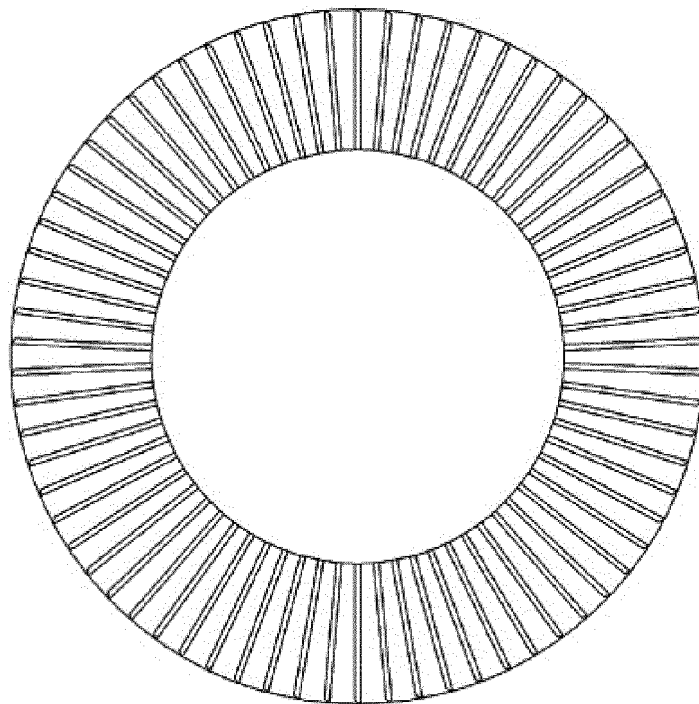


Fig.10



INTERNATIONAL SEARCH REPORT

International application No.

PCT/KR2014/009054

A. CLASSIFICATION OF SUBJECT MATTER

F01D 1/10(2006.01)i, F01D 1/02(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F01D 1/10; F02C 6/02; F01D 5/06; F01D 5/12; F01D 5/26; F01D 5/14; F01D 1/04; F04D 29/00; F04D 17/12; F01D 1/02

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean Utility models and applications for Utility models: IPC as above

Japanese Utility models and applications for Utility models: IPC as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS (KIPO internal) & Keywords: multi, stage, turbine

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	KR 10-1184877 B1 (CHOI, Hyuk Sun) 26 September 2012 See page 11 and figure 7.	1-4,7
A		5,6,8-14
A	JP 2009-019516 A (HITACHI LTD.) 29 January 2009 See figures 1, 2.	1-14
A	JP 2006-063811 A (NIDEC SHIBAURA CORP.) 09 March 2006 See pages 4, 5 and figures 1, 3.	1-14
A	KR 10-2007-0092841 A (PTL HEAVY INDUSTRY, LTD. et al.) 14 September 2007 See page 4 and figures 2-4.	1-14
A	KR 10-2010-0105103 A (CHOI, Hyuk Sun) 29 September 2010 See page 5 and figures 1, 2.	1-14

☐ Further documents are listed in the continuation of Box C.
 ☒ See patent family annex.

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Date of the actual completion of the international search

26 DECEMBER 2014 (26.12.2014)

Date of mailing of the international search report

29 DECEMBER 2014 (29.12.2014)

Name and mailing address of the ISA/KR


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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/KR2014/009054

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REFERENCES CITED IN THE DESCRIPTION

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- WO 1184877 A [0002]
- KR 20100105103 [0007]
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