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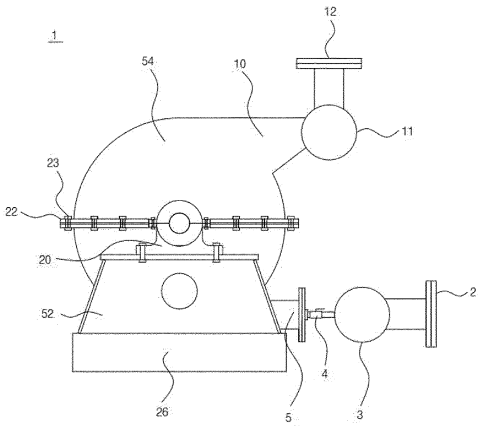
(54) STEAM TURBINE

(57) The present invention provides a steam turbine comprising: a steam inlet opening; a steam distribution container connected to the steam inlet opening and providing a single long shaped chamber formed along a front side of the steam turbine; a plurality of injection nozzles communicating with the steam distribution container, wherein the injection nozzles are diverged and extended into an inside of a housing, and injects steam into an impeller inside the housing; wherein an injection valves supplying or blocking steam to each injection nozzle is installed at a turbine entrance, wherein a steam outlet passage and a steam gathering container are installed at the housing, wherein a diameter of the steam outlet passage becomes narrow toward an end, and the steam gathering container is connected to the end of the steam outlet passage and provides a single long shaped chamber formed along the steam turbine.

【Fig. 1】



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Description

Technical Field

[0001] The invention relates to a steam turbine.

Background Art

[0002] Steam made from boiler is supplied into a steam turbine in a supercritical condition by superheating. A steam turbine provides a rotational force to outside by driving an impeller using steam as a power source.

[0003] In Korean Patent No. 10-1810186, the applicant of this application discloses a steam turbine that is configured that the inside of the steam turbine is divided into a plurality of spaces along a longitudinal direction; that includes an impeller equipped in each space; and that is operated to drive the plurality of impellers in turn by repeatedly circulating steam from the inside of the plurality of spaces formed in the steam turbine and to the outside

[0004] The Korean Publication No. 10-2011-45754 discloses a steam pump sealing device comprising: a pump seal body inserted into a sealing groove formed in a diaphragm; a pressure groove formed in on side of the body so that steam is flowed into between the diaphragm and the body; a plurality of tooth portions formed in the body and configured to block steam flowed into between a rotor and the body, wherein an air curtain is formed in the front end of the body by inducing steam into a direction of the rotor. The Korean Patent No. 10-988582 discloses a structure that comprises a nozzle plate and a rotation body and that is configured that multiple levels of the turbine lever are spaced apart inside a casing, wherein each volume of steam passages corresponding to each level gradually increases as it goes to a steam exhaust direction by enlarging a diameter of each level, to gain high power by converting heat energy of high pressure steam to energy of multiple levels.

[0005] However, steam turbines disclosed in prior arts require a plenty of components for sequential multi-stage compression of steam and occupy huge spaces. In addition, if a single level of multiple levels of the turbine breaks down, the entire device should be stopped.

[0006] The present invention is devised to solve the problems mentioned above by providing a steam turbine that can perform efficient inflow and exhaust of steam and have durability and convenient installment.

Detailed Description of Invention

Technical Problem

[0007] Accordingly, the object of the invention is to provide a steam turbine that is durable, compact, and easy to control the steam pressure.

Technical Solution

[0008] To accomplish the above-mentioned object, the present invention provides a steam turbine comprising: a steam inlet opening; a steam distribution container connected to the steam inlet opening and providing a single chamber formed along a front side of the steam turbine, with a long shape; a plurality of injection nozzles communicating with the steam distribution container, wherein the injection nozzles are diverged, and each injection nozzle is extended into an inside of a lower portion of a housing receiving an impeller and injects steam into the impeller; wherein each of injection valves supplying or blocking steam to the each injection nozzle is installed at each of turbine entrances, respectively, wherein a steam outlet passage and a steam gathering container are installed at an upper portion of the housing, wherein a diameter of the steam outlet passage becomes narrow toward an end, and the steam gathering container is connected to the end of the steam outlet passage and provides a single chamber formed along the steam turbine with a long shape.

[0009] The impeller comprises a moving body having a circle-shaped case, and a wing having hook-shaped blades formed along an outer circumference of the moving body with a same spacing to each other; wherein a shaft and a boss supporting the shaft from an outer side of the shaft are installed at a center of the moving body, and supporting plates are installed between the boss and an outer side of the moving body with a same spacing to each other to strengthen durability.

[0010] A stand supports both sides of the housing; wherein a steam pressure blocking device, a mechanical sealing device that is a part of the steam pressure blocking device, and a bearing case are installed in order of proximity to the housing.

[0011] The steam pressure blocking device is installed to surround circumference of the shaft to seal a lateral opening portion of the housing; wherein the mechanical sealing device pressurizes a case of the steam pressure blocking device toward the housing; wherein the bearing case includes a bearing that is installed inside the bearing case, and the bearing supports rotation of the shaft by receiving an end of the shaft.

Technical Effects

[0012] According to the present invention, since steam is uniformly supplied over the entire length of the housing, the impeller can be rotated efficiently and strongly without steam loss. In addition, since the housing is closed by the sealing devices, steam leakage can be prevented. Furthermore, since steam supply can be reduced when steam pressure is excessive, operations and maintenances of the turbine are convenient.

[0013] Additionally, a steam turbine of the present invention is strong, durable, and can be easily installed in a small space.

Description of Drawings

[0014]

Fig. 1 is a side view of a steam turbine of the present invention;

Fig. 2 is a side cross-sectional view of the steam turbine in FIG. 1, which is cut along an imaginary line parallel to the side to show the inside of the steam turbine;

Fig. 3 is a front cross-sectional view of a steam turbine of the present invention, which is cut along an imaginary line at the back of a steam gathering container.

Fig. 4 is a top cross-sectional view of a steam turbine of the present invention that is cut along an imaginary line parallel to the top thereof.

Mode for Invention

[0015] The purposes, technical effects, and technical elements of the present invention will be clarified by embodiments described in detail later in conjunction with the accompanying drawings. Detailed explanation regarding related elements or functions, which are well known to one of ordinary skill in the art, will be omitted in case it may obscure the gist of the present invention.

[0016] In this specification, when a portion "comprises" and/or "includes" an element, it does not mean to preclude the presence or addition of one or more other elements and/or components unless the context clearly indicates otherwise. Meanwhile, in embodiments of the present invention, each element, component, functional block, or mean may be composed of one or more of subordinate elements.

[0017] Fig. 1 is a side view of a steam turbine 1 of the present invention.

[0018] Steam is supplied through a steam inlet opening 2 and flows into a steam distribution container 3. The steam inlet opening 2 is single, and the steam distribution container 3 provides a single chamber formed along a front side of the steam turbine 1 and having a long shape. However, turbine entrances 5 are separated into multiple entrances, and steam flowed into the steam distribution container 3 divergely spreads out and supplied through each entrance. Each of inlet valves 4 is installed at a front of each of the turbine entrance 5 (the right side in FIG. 1), respectively, and steam supply is turned on or off according to control of the inlet valves 4.

[0019] A steam outlet passage 10 is formed in an upper portion of housing 54 receiving an impeller and has an approximate circle shape. A diameter of the steam outlet passage 10 becomes narrow toward an end. Steam is discharged to outside through a steam gathering container 11 located at the end of the steam outlet passage 10 and a steam outlet opening 12. The steam gathering container 11 is a single chamber having a long shape like the steam distribution container 3, and the single steam outlet opening 12 is installed at a middle of the team gathering container 11.

[0020] A housing 54 is separated into an upper housing and a lower housing, which are connected to each other by a separable flange 22 and a fixing bolt 23 engaged with the separable flange 22. In addition, a lower die 26 and a stand 52 are disposed in order from a floor, or ground, and a bearing case 20 is installed on the stand 52.

[0021] Fig. 2 is a side cross-sectional view of the steam turbine 1 in FIG. 1, which is cut along an imaginary line parallel to the side thereof to show the inside.

[0022] An impeller, which is a rotational object rotating by steam, comprises a moving body 9, which is a circle-shaped case, and a wing 7, which is hooked-shaped blades formed along outer circumference of the moving body 9 with the same spacing to each other. A shaft 15 and a boss 16 that supports the shaft 15 from an outer side of the shaft 15, are installed at a center of the moving body 9. A supporting plates 14 are installed between the boss 16 and an outer side of the moving body 9 with the same spacing to each other to strengthen durability.

[0023] As illustrated in FIG. 2, each of the injection nozzles 6, which injects steam to the impeller, is installed inside each of the turbine entrances 5, and the impeller rotates in a clockwise direction in FIG. 2 by steam supplied through the injection nozzles 6. According to some embodiments of the present invention, the impeller includes a single moving body, and a wing 7 is installed in multiple rows corresponding to the number of the turbine entrances 5, but the impeller can be modified to various structures. In other embodiments of the present invention, the moving body and the wing 7 may be manufactured as a single module, and this module may be disposed along the shaft 15. In other embodiments, a steam turbine of the present invention may consist of a single moving body and a single impeller.

[0024] Fig. 3 is a front cross-sectional view of a steam turbine 1 of the present invention which is cut along an imaginary line at the back of the steam gathering container 11. The wing 7 is not shown in FIG. 3 for convenience of explanation. As shown in FIG. 3, after passing the steam distribution container 3, steam is supplied through the plurality of turbine entrances 5. Each wing 7 is received in each space 7s, which is partitioned by a division plate 13. When the shaft 15 rotates by rotation of the moving part 9, a driven body, such as a pulley 21, which is connected to an end of the shaft 15, rotates, and this rotational force is supplied to outside.

[0025] Fig. 4 is a top cross-sectional view of a steam turbine 1 of the present invention which is cut along an imaginary line parallel to the top thereof. The wing 7 is not shown in FIG. 4 for convenience of explanation. Since an operation of each nozzle 6 installed inside the turbine entrance 5 can be turned on or off with each injection valve 4, some injection valves 4 may be closed when steam pressure is excessive. In this instance, the steam turbine 1 may comprises a pressure sensor (not shown), which senses pressure inside the housing 54.

[0026] On the stand 52 supporting both sides of the housing 54, a steam pressure blocking device 17, a mechanical sealing device 19, which is a part of the steam pressure blocking device 17, and a bearing case 20 are installed in order of proximity to the housing 54. The steam pressure blocking device 17 is a sealing member, which seals a lateral opening portion of the housing 54, and installed to surround circumference of the shaft 15 to seal the opening portions. The mechanical sealing device 19 pressurizes a case of the steam pressure blocking device 17 toward the housing 54. The mechanical sealing device 19 may be a circle-shaped plate, which is moved by bolt fastening, or a bearing. In addition, a bearing, which supports rotation of the shaft 15 by receiving an end of the shaft 15, is installed inside the bearing case 20.

[0027] According to the steam turbine 1 of the present invention, since steam is uniformly supplied over the entire length of a housing 54 by the injection nozzles 6, the impeller can be rotated efficiently and strongly without steam loss. In addition, since the housing 54 is closed by the steam pressure blocking device 17 and the mechanical sealing device 19, steam leakage can be prevented. Furthermore, since steam supply can be reduced when steam pressure is excessive, operations and maintenances of the turbine are convenient.

[0028] The above embodiments are provided to easily understand the inventive concept of the present invention, and are not intended to limit the invention. It is to be appreciated that those skilled in the art can change or modify the embodiments without departing from the spirit or scope of the present invention.

Claims

1. A steam turbine comprising:

a steam inlet opening;
a steam distribution container connected to the steam inlet opening and providing a single chamber formed along a front side of the steam turbine, with a long shape;
a plurality of injection nozzles communicating with the steam distribution container, wherein the injection nozzles are diverged, and each injection nozzle is extended into an inside of a lower portion of a housing receiving an impeller and injects steam into the impeller;
wherein each of injection valves supplying or blocking steam to the each injection nozzle is installed at each of turbine entrances, respectively,
wherein a steam outlet passage and a steam gathering container are installed at an upper portion of the housing, wherein a diameter of the steam outlet passage becomes narrow toward an end, and the steam gathering container is connected to the end of the steam outlet passage and provides a single chamber formed along the steam turbine with a long shape.

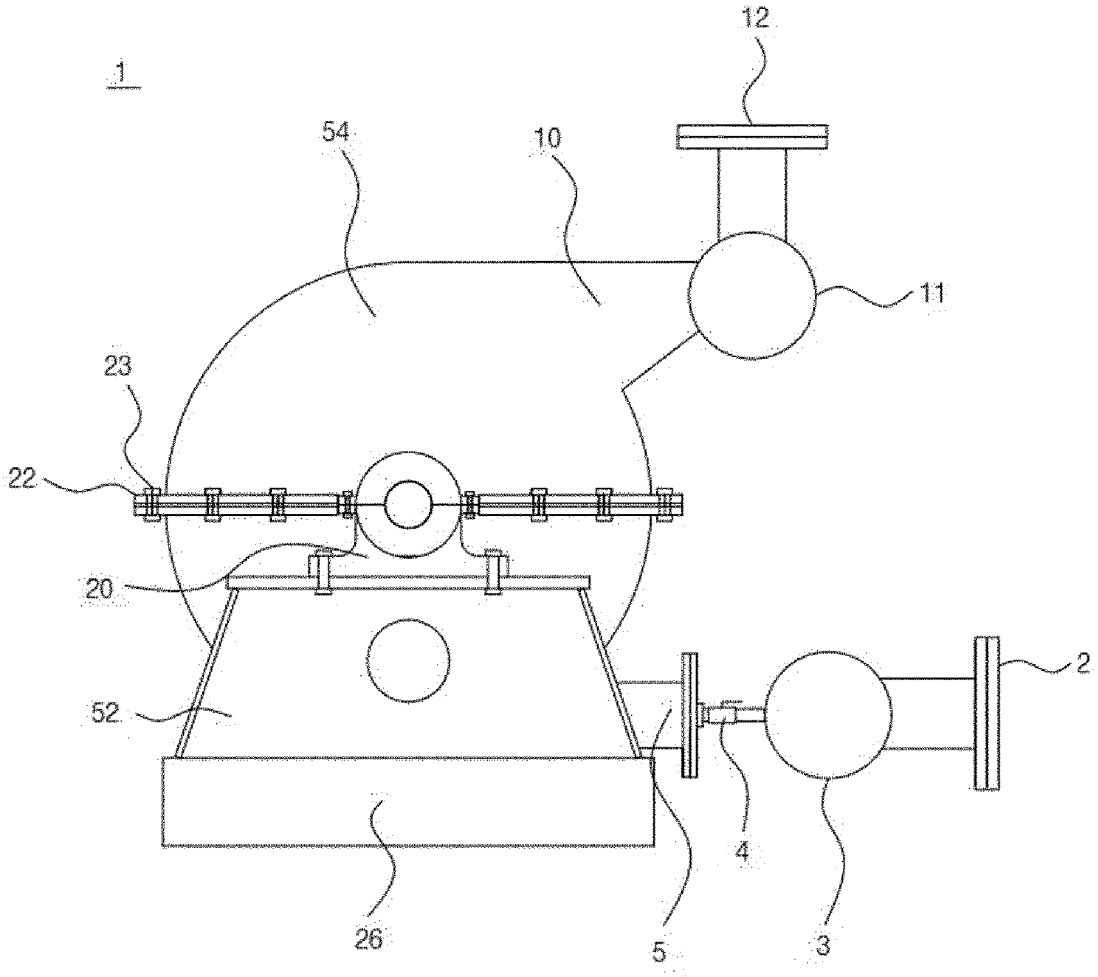
2. The steam turbine according to claim 1, wherein the impeller comprises a moving body having a circle-shaped case, and a wing having hook-shaped blades formed along an outer circumference of the moving body with a same spacing to each other;
wherein a shaft and a boss supporting the shaft from an outer side of the shaft are installed at a center of the moving body, and supporting plates are installed between the boss and an outer side of the moving body with a same spacing to each other to strengthen durability.

3. The steam turbine according to claim 1, wherein a stand supports both sides of the housing;
wherein a steam pressure blocking device, a mechanical sealing device that is a part of the steam pressure blocking device, and a bearing case are installed in order of proximity to the housing.

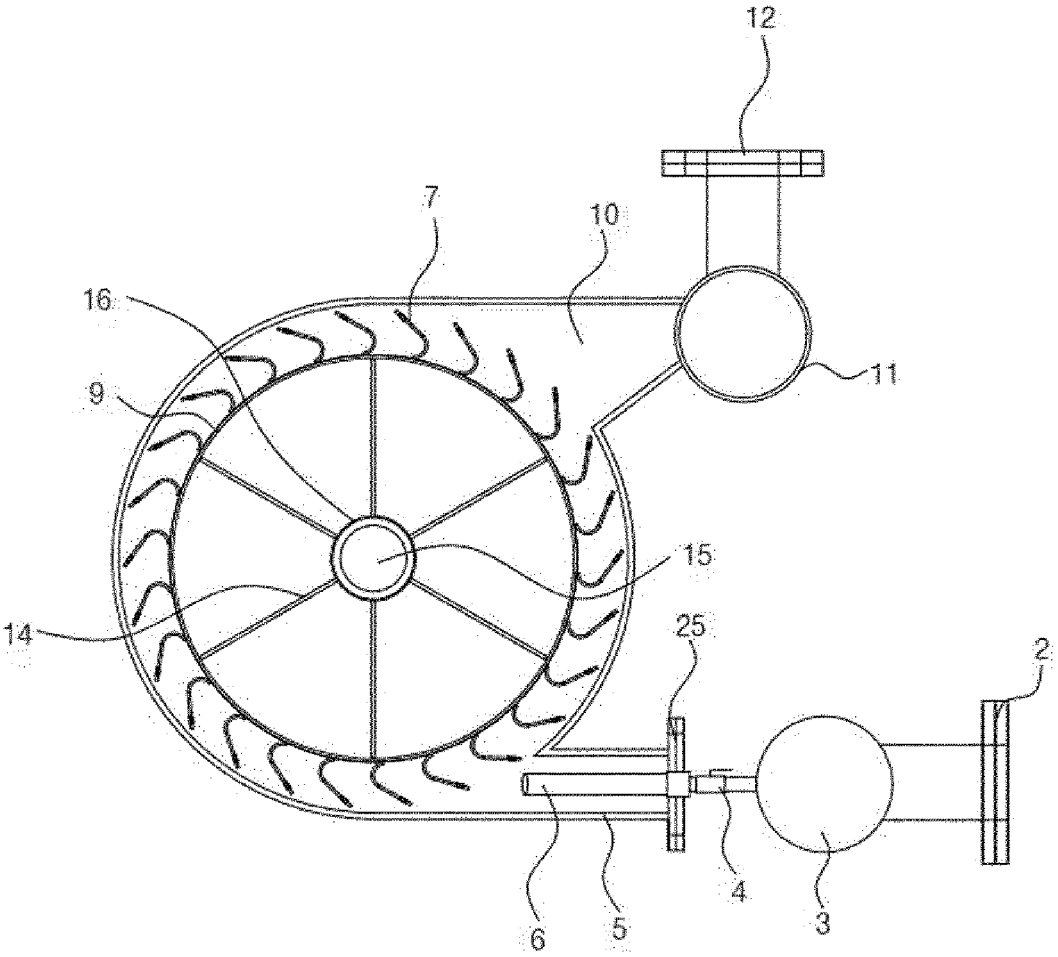
4. The steam turbine according to claim 3, wherein the steam pressure blocking device is installed to surround circumference of the shaft to seal a lateral opening portion of the housing;

wherein the mechanical sealing device pressurizes a case of the steam pressure blocking device toward the housing;
wherein the bearing case includes a bearing that is installed inside the bearing case, and the bearing supports rotation of the shaft by receiving an end of the shaft.

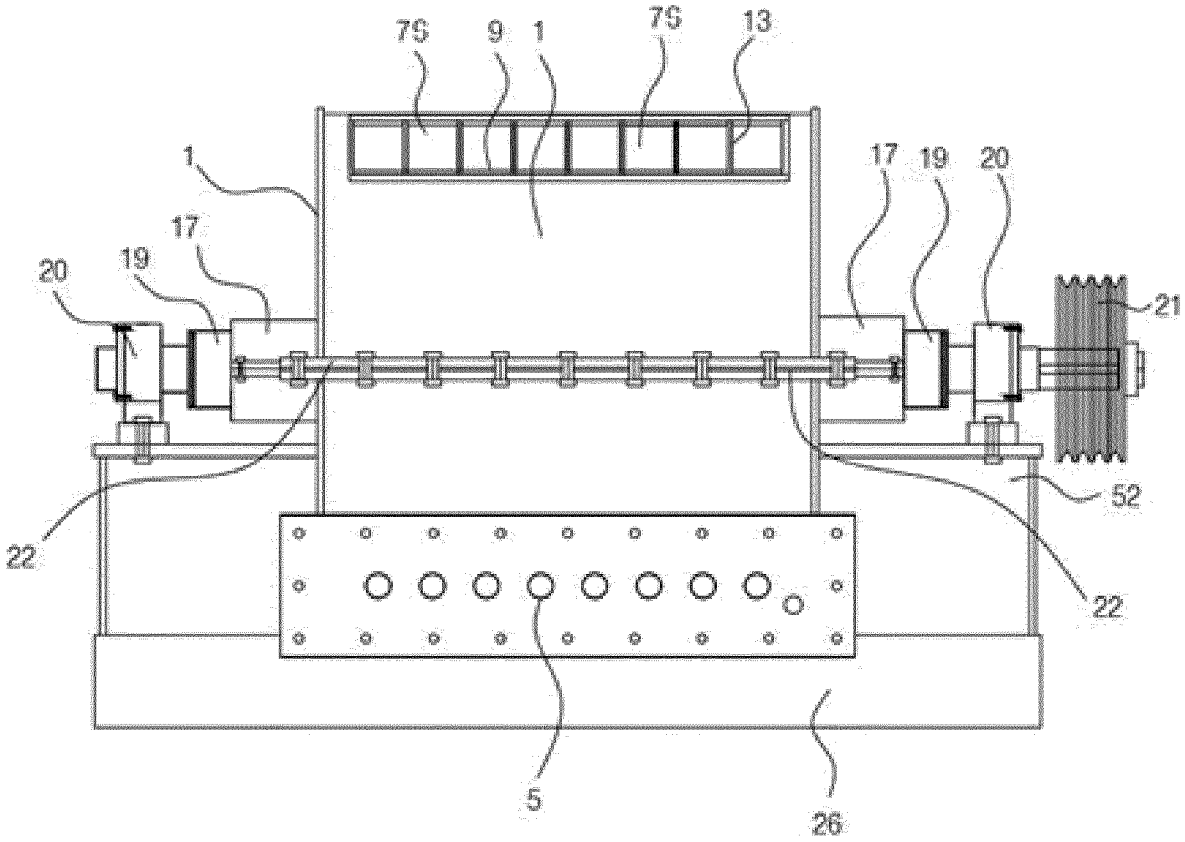
【Fig. 1】



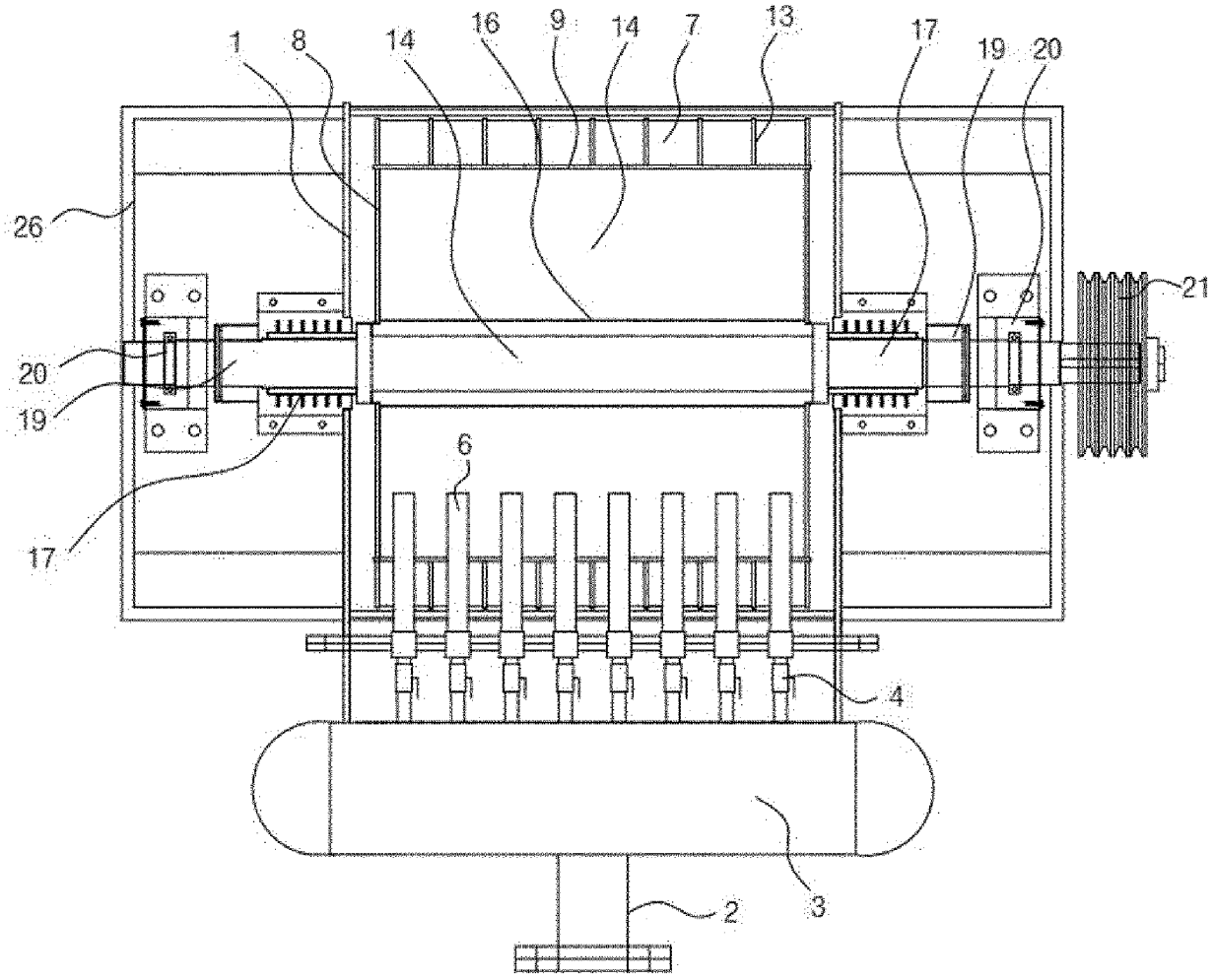
【Fig. 2】



【Fig. 3】



【Fig. 4】



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2020/015268

A. CLASSIFICATION OF SUBJECT MATTER

F01D 17/14(2006.01)i; **F01D 1/02**(2006.01)i; **F01D 25/24**(2006.01)i; **F01D 25/16**(2006.01)i; **F01D 11/00**(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 17/14(2006.01); F01D 1/06(2006.01); F01D 1/08(2006.01); F01D 1/16(2006.01); F01D 17/10(2006.01); F01D 25/00(2006.01); F01D 5/14(2006.01); F01K 7/16(2006.01)

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: 스팀터빈(steam turbine), 스팀주입구(steam inlet), 챔버(chamber), 스팀분배통(steam distibution box), 주입밸브(injection valve), 스팀 출구(steam outlet), 스팀 모음통(steam collection box)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	KR 10-2012-0064843 A (HWANG, Ki Ho et al.) 20 June 2012 (2012-06-20) See paragraphs [0024]-[0051] and figures 1-2.	1,3-4 2
Y	KR 10-2010-0131847 A (MORIGUCHI, Yaichiro) 16 December 2010 (2010-12-16) See paragraph [0024] and figure 3.	2
A	KR 10-2079787 B1 (CHEON, Byung Chul) 21 February 2020 (2020-02-21) See paragraph [0067] and figures 10-11.	1-4
A	JP 2010-048216 A (FUJI ELECTRIC SYSTEMS CO., LTD.) 04 March 2010 (2010-03-04) See paragraphs [0003]-[0014] and figures 5-6.	1-4
A	KR 10-2016-0134382 A (S.H.ENERGY CO., LTD.) 23 November 2016 (2016-11-23) See claim 1 and figure 1.	1-4

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

* Special categories of cited documents:
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"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
18 May 2021	**18 May 2021**
Name and mailing address of the ISA/KR **Korean Intellectual Property Office** **Government Complex-Daejeon Building 4, 189 Cheongsa-ro, Seo-gu, Daejeon 35208** Facsimile No. **+82-42-481-8578**	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (July 2019)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/KR2020/015268

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
KR 10-2012-0064843 A	20 June 2012	KR 10-1178322 B1	29 August 2012
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KR 10-2079787 B1	21 February 2020	WO 2021-025524 A1	11 February 2021
JP 2010-048216 A	04 March 2010	None	
KR 10-2016-0134382 A	23 November 2016	None	

Form PCT/ISA/210 (patent family annex) (July 2019)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- KR 101810186 **[0003]**
- KR 10201145754 **[0004]**
- KR 10988582 **[0004]**