US010385737B2

(12) **United States Patent**
Park et al.

(10) **Patent No.: US 10,385,737 B2**
(45) **Date of Patent: Aug. 20, 2019**

(54) **DEVICE FOR CONTROLLING SUPPLY OF WORKING FLUID**

(71) Applicant: **DOOSAN HEAVY INDUSTRIES & CONSTRUCTION CO., LTD.**, Changwon-si, Gyeongsangnam-do (KR)

(72) Inventors: **Sang Sin Park**, Chungcheongbuk-do (KR); **Seung Gyu Kang**, Yongin-si (KR); **Jeong Ho Hwang**, Yongin-si (KR); **Hyo Seong Lee**, Ulsan (KR)

(73) Assignee: **Doosan Heavy Industries Construction Co., Ltd**, Gyeongsangnam-do (KR)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **15/927,097**

(22) Filed: **Mar. 21, 2018**

(65) **Prior Publication Data**

US 2018/0283222 A1 Oct. 4, 2018

(30) **Foreign Application Priority Data**

Mar. 28, 2017 (KR) 10-2017-0039383

(51) **Int. Cl.**
F01K 25/10 (2006.01)
F01K 7/16 (2006.01)
(Continued)

(52) **U.S. Cl.**
CPC ***F01K 25/103*** (2013.01); ***F01K 3/16*** (2013.01); ***F01K 7/165*** (2013.01); ***F01K 13/006*** (2013.01); ***F22D 3/00*** (2013.01); ***F22D 5/06*** (2013.01)

(58) **Field of Classification Search**
CPC F01K 25/103; F01K 25/08; F01K 25/10; F01K 13/006; F01K 3/14; F01K 3/16;
(Continued)

(56) **References Cited**

U.S. PATENT DOCUMENTS

8,281,593 B2 * 10/2012 Held F01K 3/185 60/659
2012/0047892 A1 * 3/2012 Held F01K 3/185 60/652

(Continued)

FOREIGN PATENT DOCUMENTS

JP 2014-134175 A 7/2014

OTHER PUBLICATIONS

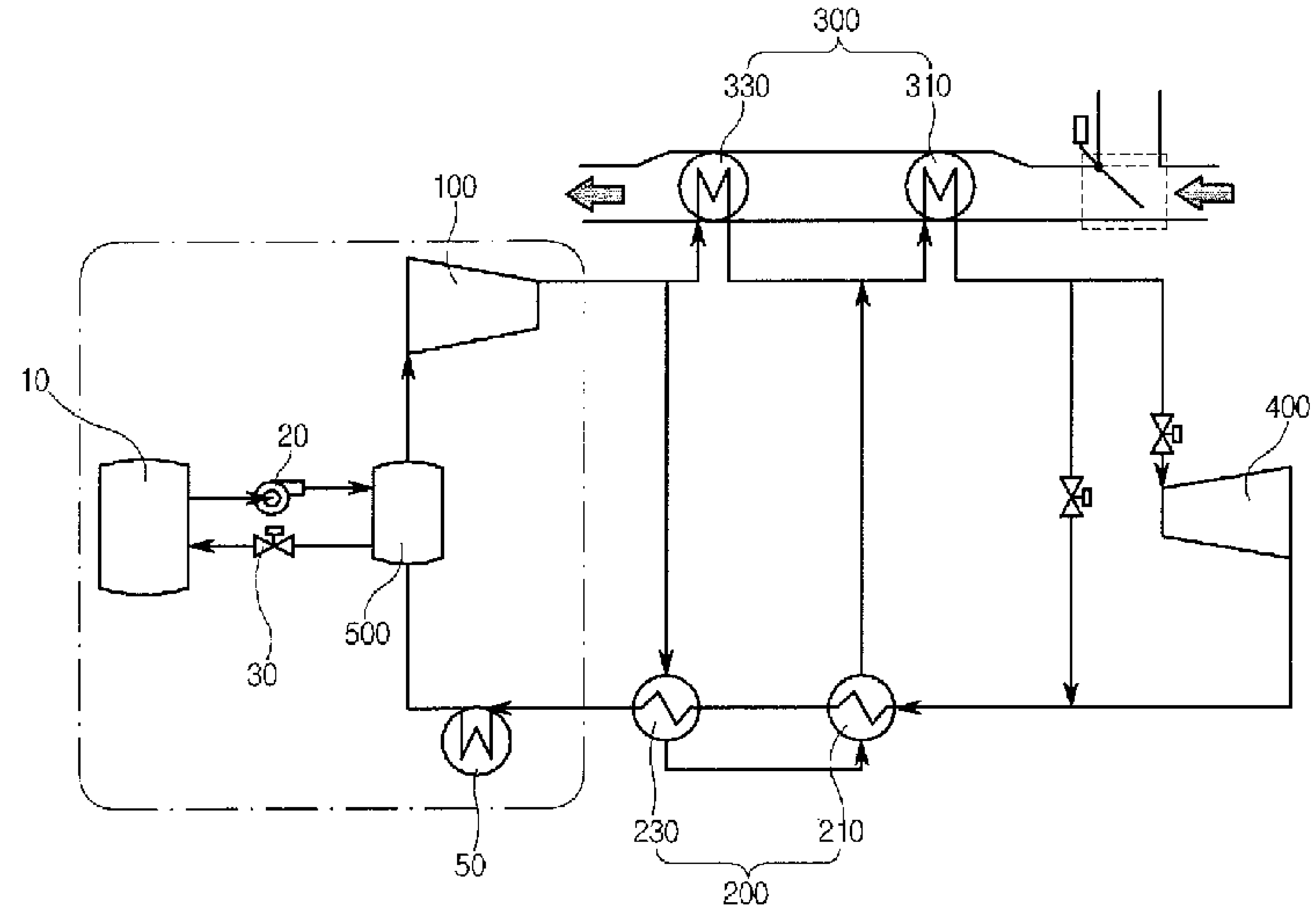
A Japanese Office Action dated Mar. 27, 2019 in connection with Japanese Patent Application No. 2018-057234 which corresponds to the above-referenced U.S. application.

Primary Examiner — Mark A Laurenzi
Assistant Examiner — Xiaoting Hu
(74) *Attorney, Agent, or Firm* — Invenstone Patent, LLC

(57) **ABSTRACT**

A device for controlling a supply of a working fluid to a power generation cycle with a compressor compressing the working fluid and a precooler cooling the working fluid supplied to the compressor comprises a storage tank storing the working fluid supplied to the power generation cycle and a flotation tank disposed between the precooler and the compressor to flow or temporarily store the working fluid, wherein a pressure within the flotation tank and a flow rate of the working fluid are controlled based on pressures at an inlet of the compressor and an outlet of the precooler.

19 Claims, 4 Drawing Sheets



(51) **Int. Cl.**

F01K 13/00	(2006.01)
F01K 3/16	(2006.01)
F22D 3/00	(2006.01)
F22D 5/06	(2006.01)

(58) **Field of Classification Search**

CPC ... F01K 7/16; F01K 7/165; F01K 7/32; F22D 3/00; F22D 3/04; F22D 5/00; F22D 5/06; F22D 5/18; F22D 5/28; F22D 5/30; F22D 5/32

See application file for complete search history.

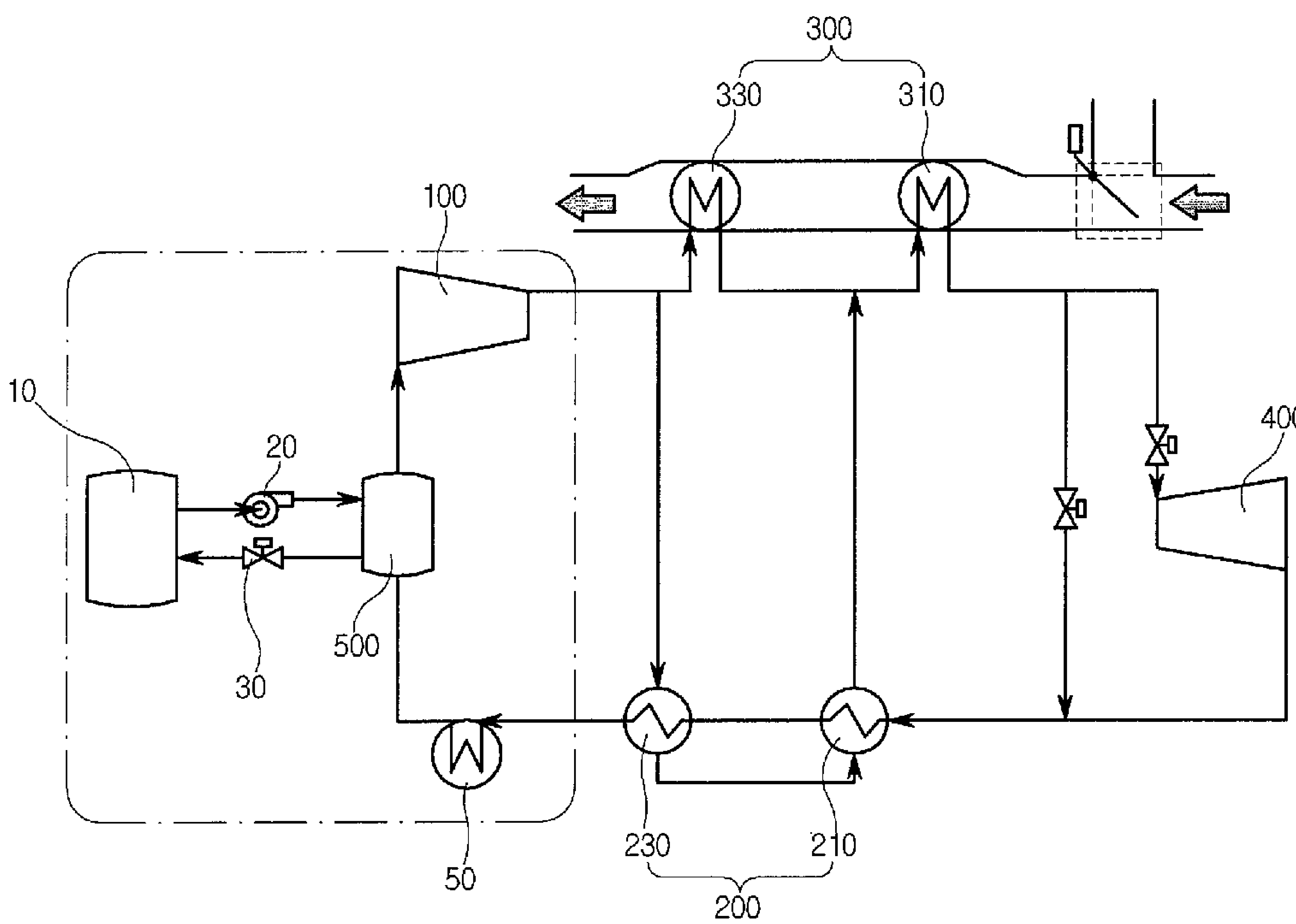
(56) **References Cited**

U.S. PATENT DOCUMENTS

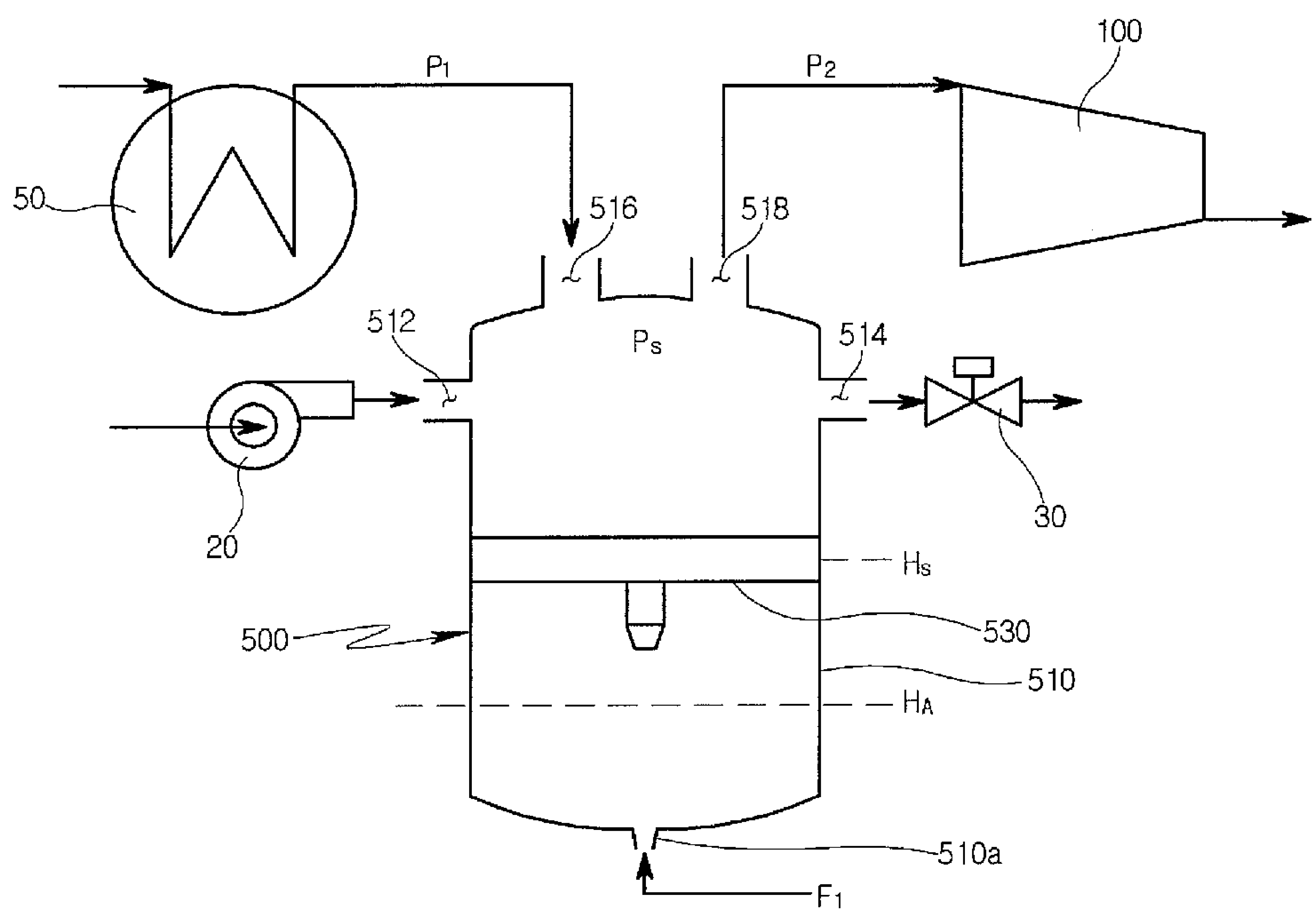
2014/0102098 A1* 4/2014 Bowan F01K 7/32 60/645
2016/0010512 A1* 1/2016 Close F01K 11/04 60/651
2017/0362963 A1* 12/2017 Hostler F01K 13/00

* cited by examiner

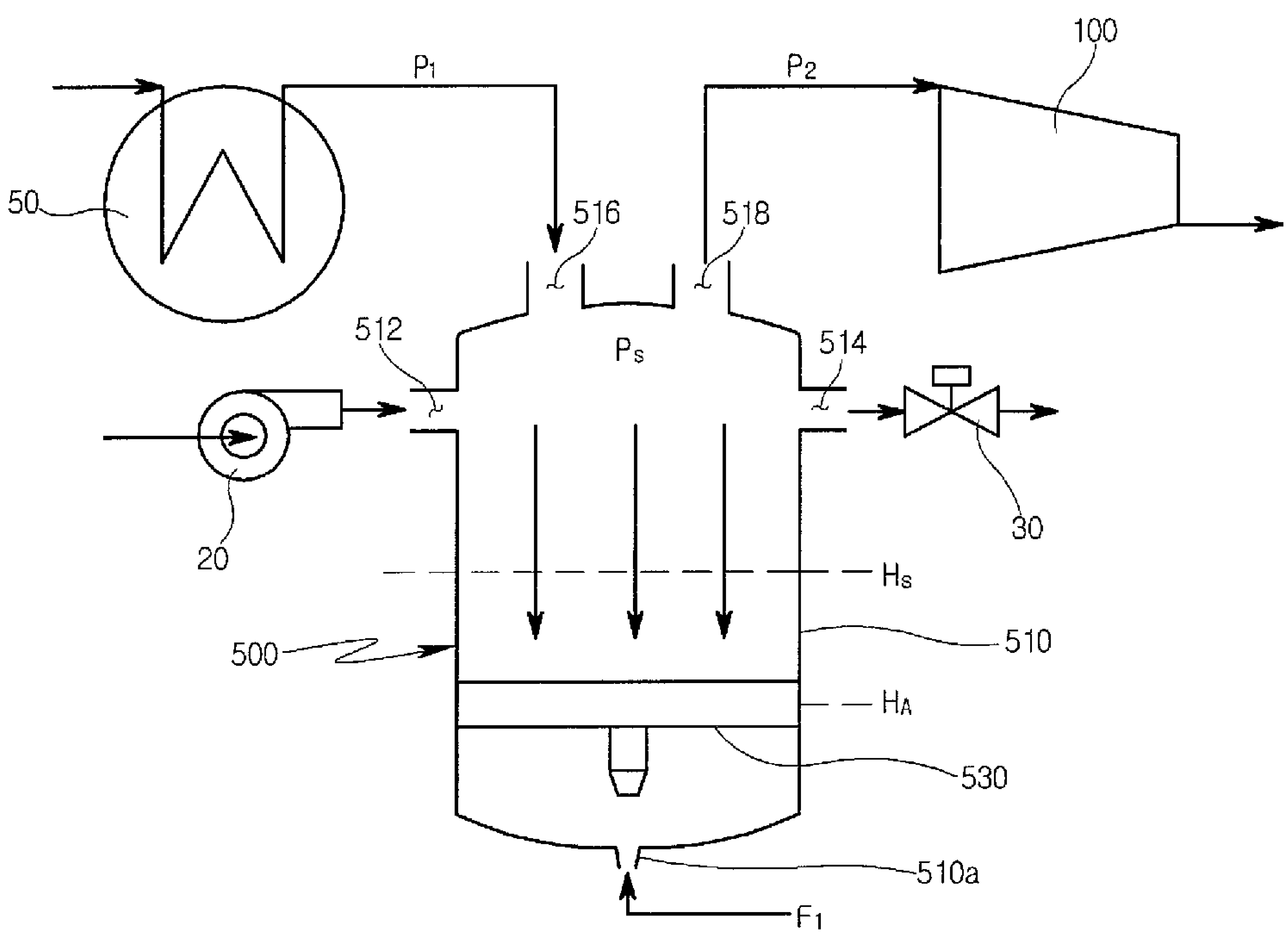
[FIG. 1]



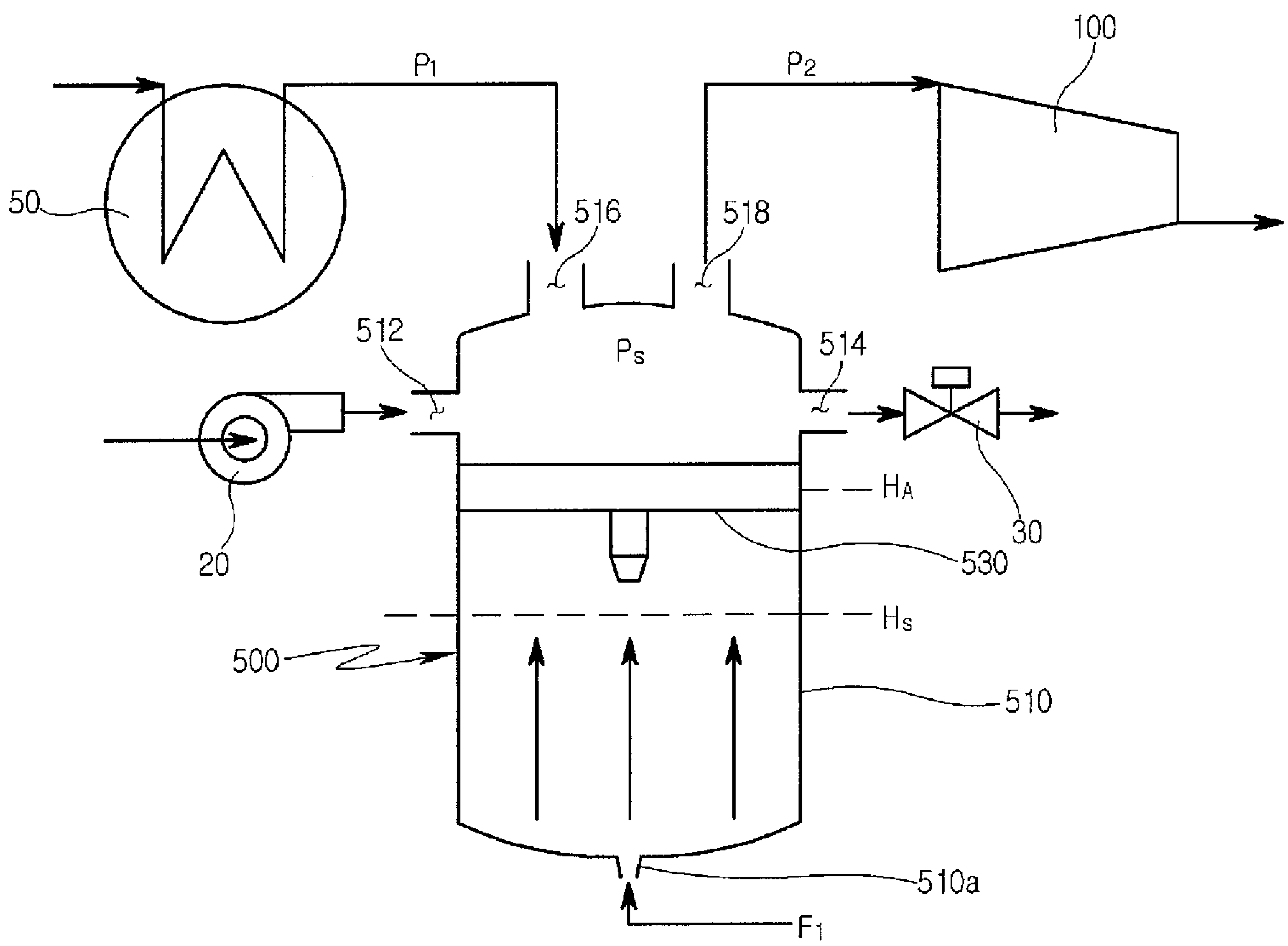
[FIG. 2]



[FIG. 3]



[FIG. 4]



DEVICE FOR CONTROLLING SUPPLY OF WORKING FLUID

CROSS-REFERENCE(S) TO RELATED APPLICATIONS

This application claims priority to Korean Patent Application No. 10-2017-0039383, filed on Mar. 28, 2017 the disclosure of which is incorporated herein by reference in its entirety.

BACKGROUND OF THE DISCLOSURE

Field of the Disclosure

Exemplary embodiments of the present disclosure relate to a device for controlling a supply of a working fluid, and more particularly, to a device for controlling a supply of a working fluid capable of efficiently and economically controlling a flow rate and a pressure of the working fluid to supply the working fluid into a power generation cycle.

Description of the Related Art

Various efforts for increasing a power output while decreasing the emission of pollutants have been made. As one of such efforts, research and development of a power generation system using supercritical CO_2 as a working fluid have been actively conducted.

Because supercritical CO_2 has a density similar to the liquid state and viscosity similar to the gas state, an equipment utilizing the property may be miniaturized and power consumption required to compress and circulate the fluid may be minimized. At the same time, supercritical CO_2, with its critical points of 31.4° C. and 72.8 atm much lower than the critical points of water at 373.95° C. and 217.7 atm, may be handled very easily.

In addition, the power generation system using supercritical CO_2 is mostly operated as a closed cycle in which carbon dioxide used for power generation is not emitted to outside, thus greatly reducing the emission of pollutants.

The working fluid is supplied into the cycle for two purposes: power generation and a turbo machine. For the purpose of power generation, the working fluid is injected into a power generation cycle to drive the turbo machine. For the purpose of the turbo machine, the working fluid is for bearing lubrication and sealing of the turbo machine.

U.S. Pat. No. 8,281,593 discloses a method for supplying a working fluid stored in a storage tank into a cycle and a turbo machine using a high-pressure piston pump. Further, a mass control tank is provided for controlling a flow rate of the working fluid and controlling a pressure at an inlet and an outlet of a compressor. The mass control tank is also referred to as an inventory tank. In general, the mass control tank is connected to a high pressure line of the outlet of the compressor and a low pressure line of an inlet of a precooler. As the pressure at the outlet of the compressor increases, a high pressure valve may be open to send some of the flow rate to the mass control tank, thereby reducing the pressure. As the pressure at the inlet of the compressor decreases, the low pressure valve may be open to send some of the flow rate of the mass control tank to the inlet line of the compressor, thereby increasing the pressure.

Therefore, since the mass control tank is connected to the high pressure line of the outlet of the compressor, it is essential that the mass control tank is made of expensive materials and components capable of withstanding the high pressure, which leads to an increase in cost and a decrease in economical efficiency.

SUMMARY OF THE DISCLOSURE

An object of the present disclosure is to provide a device for controlling a supply of a working fluid capable of efficiently and economically controlling a flow rate and a pressure of a working fluid to supply the working fluid into a power generation cycle.

Other objects and advantages of the present disclosure can be understood by the following description, and become apparent with reference to the embodiments of the present disclosure. Also, it is obvious to those skilled in the art to which the present disclosure pertains that the objects and advantages of the present disclosure can be realized by the means as claimed and combinations thereof.

In accordance with one aspect of the present disclosure, a device for controlling a supply of a working fluid for supplying the working fluid to a power generation cycle comprising a compressor compressing the working fluid and a precooler cooling the working fluid supplied to the compressor comprises: a storage tank storing the working fluid supplied to the power generation cycle; and a flotation tank disposed between the precooler and the compressor to flow or temporarily store the working fluid, wherein a pressure within the flotation tank and a flow rate of the working fluid are controlled depending on pressures at an inlet of the compressor and an outlet of the precooler.

The device may further comprise: a supply pump disposed between the storage tank and the flotation tank to supply the working fluid from the storage tank to the flotation tank; and a control valve disposed between the storage tank and the flotation tank to discharge the working fluid from the flotation tank to the storage tank.

The flotation tank may be a piston accumulator type tank.

The flotation tank may comprise: a tank body into which the working fluid is introduced; and a piston installed inside the tank body to be elevated by a control fluid supplied from the outside.

The flotation tank may further comprise: a control fluid inflowing portion provided at a lower end of the tank body and having the control fluid inflowing and outflowing therethrough; a first inlet provided at one side of the tank body and having the working fluid inflowing from the supply pump thereinto; and a first outlet provided at the other side of the tank body and having the working fluid discharged to the control valve therethrough.

The flotation tank may further comprise: a second inlet provided at an upper part of the tank body and having the working fluid inflowing from the precooler thereinto; and a second outlet provided at the upper part of the tank body and having the working fluid discharged to the compressor therethrough.

When **P1** which is a pressure at a rear end of the precooler or **P2** which is a pressure at a front end of the compressor rises, the control fluid may be supplied to the control fluid inflowing portion and the control valve may be open to discharge the working fluid within the flotation tank to the storage tank through the first outlet.

The supply of the control fluid and the discharge of the working fluid to the storage tank may be made until a height of the piston reaches a height corresponding to a set value.

When **P1** which is a pressure at a rear end of the precooler or **P2** which is a pressure at a front end of the compressor falls, the supply pump may be operated to supply the working fluid into the flotation tank through the first inlet.

The supply of the working fluid into the flotation tank may be made until a height of the piston reaches a height corresponding to a set value.

In accordance with another aspect of the present disclosure, a device for controlling a supply of a working fluid for supplying the working fluid to a power generation cycle comprising a compressor compressing the working fluid and a precooler cooling the working fluid supplied to the compressor comprises: a storage tank storing the working fluid supplied to the power generation cycle; a flotation tank disposed on a low pressure line of an inlet of the compressor to flow or temporarily store the working fluid; a supply pump disposed between the storage tank and the flotation tank to supply the working fluid from the storage tank to the flotation tank; and a control valve disposed between the storage tank and the flotation tank to discharge the working fluid from the flotation tank to the storage tank.

If a pressure at an outlet of the precooler or an inlet of the compressor rises, the working fluid is discharged from the flotation tank to the storage tank, and if the pressure at the outlet of the precooler or the inlet of the compressor falls, the working fluid may be supplied from the storage tank to the flotation tank.

The flotation tank may be a piston accumulator type tank.

The flotation tank may comprise: a tank body into which the working fluid is introduced; and a piston installed inside the tank body to be elevated by a control fluid supplied from the outside.

The flotation tank may further comprise: a control fluid inflowing portion provided at a lower end of the tank body and having the control fluid inflowing and outflowing therethrough; a first inlet provided at one side of the tank body and having the working fluid inflowing from the supply pump thereinto; and a first outlet provided at the other side of the tank body and having the working fluid discharged to the control valve therethrough.

The flotation tank may further comprise: a second inlet provided at an upper part of the tank body and having the working fluid inflowing from the precooler thereinto; and a second outlet provided at the upper part of the tank body and having the working fluid discharged to the compressor therethrough.

When P**1** which is a pressure at a rear end of the precooler or P**2** which is a pressure at a front end of the compressor rises, the control fluid may be supplied to the control fluid inflowing portion and the control valve may be open to discharge the working fluid within the flotation tank to the storage tank through the first outlet.

The supply of the control fluid and the discharge of the working fluid to the storage tank may be made until a height of the piston reaches a height corresponding to a set value.

When P**1** which is a pressure at a rear end of the precooler or P**2** which is a pressure at a front end of the compressor falls, the supply pump may be operated to supply the working fluid into the flotation tank through the first inlet.

The supply of the working fluid into the flotation tank may be made until a height of the piston reaches a height corresponding to a set value.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects, features and other advantages of the present disclosure will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

FIG. **1** is a schematic diagram showing an example of a power generation cycle to which a device for controlling a supply of a working fluid according to an embodiment of the present disclosure is applied;

FIG. **2** is a schematic diagram showing an example of the device for controlling the supply of the working fluid shown in FIG. **1**; and

FIGS. **3** and **4** are schematic diagrams showing an operating state of the device for controlling the supply of the working fluid shown in FIG. **2**.

DESCRIPTION OF SPECIFIC EMBODIMENTS

Hereinafter, a device for controlling a supply of a working fluid according to an exemplary embodiment of the present disclosure will be described in detail with reference to the accompanying drawings.

Generally, the power generation system using supercritical CO_2 configures a close cycle in which CO_2 used for power generation is not emitted to outside, but uses supercritical CO_2 as a working fluid.

The power generation system using supercritical CO_2 can use exhaust gas emitted from a thermal power plant or the like since a working fluid is the supercritical CO_2. Accordingly, the power generation system using supercritical CO_2 may not only be used as a single power generation system, but also be used for a hybrid power generation system with the thermal power generation system. The working fluid of the power generation system using supercritical CO_2 may also supply CO_2 separated from the exhaust gas and may also supply CO_2 separately.

Supercritical CO_2 (hereinafter, referred to as working fluid) within the cycle passes through a compressor, and it is then heated while passing through a heat source such as a heater to become a high-temperature high-pressure working fluid, thereby driving a turbine. A generator or a pump is connected to the turbine, the turbine connected to the generator produces power, and the turbine connected to the pump operates the pump. The working fluid passing through the turbine is cooled while passing through a heat exchanger, and the cooled working fluid is again supplied to the compressor to be circulated within the cycle. The turbine or the heat exchanger may be provided in multiple.

The power generation system using supercritical CO_2 according to various embodiments of the present disclosure includes a system where all the working fluids flowing within the cycle are in the supercritical state as well as a system where most of the working fluids are in the supercritical state and the rest of the working fluids are in a subcritical state.

Further, in various embodiments of the present disclosure, CO_2 is used as the working fluid. Here, CO_2 may include pure carbon dioxide, carbon dioxide including slight impurities, and even a fluid where carbon dioxide is mixed with one or more fluids as additives.

FIG. **1** is a schematic diagram showing an example of a power generation cycle to which a device for controlling a supply of a working fluid according to an embodiment of the present disclosure is applied.

As shown in FIG. **1**, the power generation cycle may be a power generation cycle using supercritical CO_2, which comprises one turbine, a plurality of recuperators **200**, and a plurality of external heat exchangers **300**.

The components of the present disclosure are connected to each other by a transfer pipe in which the working fluid flows. However, when a plurality of components is integrated, the components and areas actually serving as the transfer pipe may be present in the integrated components. Therefore, even in this case, it is to be understood that the working fluid flows along the transfer pipe, where in the present disclosure, the transfer pipe is indicated by numbers in parentheses.

The working fluid supplied into the cycle through the device for controlling the supply of the working fluid is compressed to a high pressure by a compressor **100**. Some of the working fluid is branched to the recuperator **200**, and a part thereof is branched to the external heat exchanger **300**.

The recuperator **200** is configured to comprise a first recuperator **210** and a second recuperator **230** which are arranged in series, such that the working fluid passing through the first recuperator **210** is sequentially introduced into the second recuperator **230**. The working fluid passing through the turbine **400** is first introduced into the first recuperator **210**, such that the first recuperator **210** exchanges heat with a relatively higher-temperature working fluid than the second recuperator **230**.

The external heat exchanger **300** is configured to comprise a first heat exchanger **310** and a second heat exchanger **330**. The first heat exchanger **310** and the second heat exchanger **330** use a gas (hereinafter, a waste heat gas) having waste heat like exhaust gas emitted from a boiler of a power plant as a heat source, and serve to exchange heat between the waste heat gas and a working fluid circulating within a cycle to heat the working fluid.

When the plurality of heat exchangers **300** are provided, they may be classified into relatively low temperature, medium temperature, high temperature or the like depending on the temperature of the waste heat gas. That is, the heat exchanger can perform heat exchange at the high temperature as the waste heat gas is introduced into an inlet end, and the heat exchanger performs heat exchange at the lower temperature as the waste heat gas is discharged through an outlet end.

In the present embodiment, the first heat exchanger **310** may be a heat exchanger using relatively a high or medium-temperature waste heat gas compared to the second heat exchanger **330**, and the second heat exchanger **330** may be a heat exchanger using a relatively medium or low-temperature waste heat gas. That is, an example in which the first heat exchanger **310** and the second heat exchanger **330** are sequentially disposed from the inlet end into which the waste heat gas is introduced toward the outlet end will be described.

As described above, some of the working fluid passing through the compressor **100** is sent to the second recuperator **230** and exchanges heat with the working fluid passing through the first recuperator **210** to be heated primarily, and is then sent to the first recuperator **210** and exchanges heat with the working fluid passing through the turbine **400** to be heated. Thereafter, the working fluid is transferred to a front end of the first heat exchanger **310**.

Some of the working fluid passing through the compressor **100** is sent to the second heat exchanger **330** and exchanges heat with the waste heat gas to be heated primarily, and is then mixed with the working fluid heated by the first recuperator **210** and is supplied to the first heat exchanger **310**. The working fluid heated by the first heat exchanger **310** is supplied to the turbine **400**.

The turbine **400** is driven by the working fluid, and the turbine **400** may be connected to a generator (not shown) to produce power. The working fluid is expanded while passing through the turbine **400**, and therefore the turbine **400** also serves as an expander. The working fluid passing through the turbine **400** is transferred to the first recuperator **210**.

The working fluid cooled by exchanging heat with the working fluid passing through the compressor **100** in the first recuperator **210** and the second recuperator **230** is transferred to a precooler **50**.

The precooler **50** uses air or cooling water as a refrigerant and secondarily cools the working fluid which passes through the recuperator **200** and is primarily cooled. The working fluid cooled by passing through the precooler **50** is supplied to the compressor **100** via a flotation tank **500**.

The device for controlling the supply of the working fluid to the compressor **100** comprises the flotation tank **500** disposed between the above-mentioned precooler **50** and the compressor **100**, a storage tank **10** storing the working fluid, a supply pump **20** supplying the working fluid from the storage tank **10** to the flotation tank **500**, and a control valve **30** discharging the working fluid of the flotation tank **500** to the storage tank **10**.

The storage tank **10** which is a large-capacity reservoir capable of storing and supplying the flow rate of the working fluid which is required over the whole cycle has a size enough to store the amount of working fluid required at the time of the initial driving of the cycle. Since the storage tank **10** is also used to discharge some of the flow rate of the working fluid within the cycle, it is preferable to store a flow rate larger than that of the total of working fluid within the cycle. The pressure of the working fluid supplied from the storage tank **10** to the flotation tank **500** may be primarily boosted by the supply pump **20** and secondarily controlled within the flotation tank **500** to supply the working fluid to the compressor **100**.

The flotation tank **500** is installed at the inlet end of the compressor **100**, and therefore serves as a buffer against the change in the pressure at the inlet of the compressor **100**. Therefore, the control of the pressure at the inlet of the compressor **100** may be automatically controlled by the flotation tank **500**.

The buffer action against the change in the pressure at the inlet of the compressor **100** is made by the buffer action against the change in the pressure within the flotation tank **500**. To this end, the flotation tank **500** is preferably provided as piston accumulator type tank. The maximum allowable flow rate of the flotation tank **500** may be, for example, 215 L/sec. The piston accumulator type tank has the advantage that a response speed and a reaction time of the control reaction are very fast.

Since the flotation tank **500** is installed at the inlet end of the compressor **100**, the working fluid is temporarily stored or flows before it gets compressed. Accordingly, since the flotation tank **500** is positioned in the low-pressure line within the cycle, the flotation tank **500** has an advantage in that the cycle can be economically configured without expensive materials and components to withstand the high pressure like the conventional inventory tank.

While the storage tank **10** should have a minimum size enough to store the flow rate of the working fluid which is required over the whole cycle, the flotation tank **500** is of a size enough to store the working fluid corresponding to about ⅓ of the flow rate of the whole cycle for the pressure buffer function. Accordingly, since the size of the flotation tank **500** may be reduced to ⅓ of that of the conventional inventory tank, the construction cost for the cycle may be reduced.

The pressure buffer function of the flotation tank **500** will be described in detail as follows.

FIG. **2** is a schematic diagram showing an example of the device for controlling the supply of the working fluid shown in FIG. **1**, and FIGS. **3** and **4** are schematic diagrams showing an operating state of the device for controlling the supply of the working fluid shown in FIG. **2**.

As shown in FIG. **2**, the flotation tank **500** comprises a tank body **510**, a piston **530** installed inside the tank body **510**, a control fluid inflowing portion **510***a* formed at a lower end of the tank body **510** to elevate the piston **530** and having a fluid for controlling a position of the piston inflowing and outflowing therethrough, a first inlet **512** provided at one side of the tank body **510** and having the working fluid inflowing from the supply pump **20** thereinto, and a first outlet **514** provided at the other side of the tank body **510** and having the working fluid discharged to the control valve **30** therethrough. In addition, an upper part of the tank body **510** spaced apart from the first inlet **512** and the first outlet **514** is provided with a second inlet **516** into which the working fluid is introduced from the precooler **50** and a second outlet **518** spaced apart from the second inlet **516** and having the working fluid discharged to the compressor **100** therethrough.

In FIG. **2**, P**1** is a pressure at a rear end of the precooler **50**, P**2** is a pressure at a front end of the compressor **100**, and Ps is a pressure inside the flotation tank **500**. Further, F**1** means the flow rate of the control fluid for controlling the position of the piston **530**, where other working fluids which are fluids different from the working fluid supplied into the cycle or fluids other than supercritical CO_2 may be used as the control fluid. Hs means a height of the piston **530** depending on a set point in the flotation tank **500**, and H_A means the height of the piston **530** depending on the change in the pressure in the flotation tank **500**. Ps and Hs are set to a predetermined set value at the time of designing the cycle and are controlled so that these set values in the flotation tank **500** are maintained depending on the change in the pressure. The method for controlling the flotation tank **500** based on the change in the pressure will be described in detail with reference to the above description.

As illustrated in FIG. **3**, P**1** may rise.

If P**1** rises, the height of the piston **530** within the flotation tank **500** falls from Hs to H_A. At this time, the piston **530** rises to the set height Hs in the flotation tank **500**, and at the same time the flow rate of the control fluid is injected into F**1** to maintain the reference pressure Ps. At the same time, the control valve **30** is open to discharge the flow rate of some of the working fluid in the flotation tank **500** and to send the working fluid to the storage tank **10**. According to this process, when Ps and Hs are maintained at the set value, the control valve **30** is closed to stop the injection of the flow rate of the control fluid into F**1** and to stop the discharge of the working fluid from the flotation tank **500** simultaneously. At this time, the supply pump **20** is not driven.

On the other hand, even if P**2** rises, the piston **530** may fall to the height of H_A as shown in FIG. **3**. Even in this case, the height of the piston **530** falls from Hs to H_A within the flotation tank **500**. Therefore, the control fluid is injected into F**1** to keep the reference pressure Ps, and the control valve **30** is open to raise the piston **530** to Hs, thereby discharging some of the working fluid within the flotation tank **500** to the storage tank **10**. When Ps and Hs are maintained at the set value, the control valve **30** is closed to stop the injection of the flow rate of the control fluid into F**1** and to stop the discharge of the working fluid from the flotation tank **500** simultaneously.

Conversely, as illustrated in FIG. **4**, P**1** may fall.

If P**1** falls, the height of the piston **530** within the flotation tank **500** is increased from Hs to H_A. At this time, the piston **530** falls to the set height Hs within the flotation tank **500**, and at the same time the supply pump **20** is operated to maintain the reference pressure Ps, thereby supplementing the flow rate of the working fluid into the flotation tank **500**. According to this process, if Ps and Hs reach the set values, the supply pump **20** stops the supply of the working fluid to the flotation tank **500**, thereby maintaining Ps and Hs. At this time, the control valve **30** is not driven, and the control fluid for positioning the piston **530** is also not supplied.

In addition, even when P**2** falls, the piston **530** may rise to the height of H_A as shown in FIG. **4**. Therefore, the piston **530** falls to the set height Hs within the flotation tank **500**, and at the same time the supply pump **20** is operated to maintain the reference pressure Ps, thereby supplementing the flow rate of the working fluid into the flotation tank **500**. According to this process, if Ps and Hs reach the set values, the supply pump **20** stops to stop the supply of the working fluid to the flotation tank **500**, thereby maintaining Ps and Hs.

As described above, since the pressure within the flotation tank and the flow rate of the working fluid are changed depending on the change in the pressure at the inlet of the compressor and the outlet of the precooler, the pressure within the flotation tank and the height of the piston may be maintained at a predetermined set value. As described above, since the flotation tank serves as the buffer depending on the change in the pressure at the inlet of the compressor, the flotation tank does not require the separate pressure control and therefore needs not use the expensive materials and components like the conventional inventory tank, such that the construction cost of the cycle may be saved. Further, the flow rate of the working fluid may be efficiently controlled by only the flotation tank, and the pressure at the inlet and outlet of the compressor may be controlled, such that the construction cost of the cycle can be reduced and the economical efficiency can be improved.

According to an embodiment of the present disclosure, the device for controlling the supply of the working fluid can control the pressure at the inlet and outlet of the compressor without using the expensive inventory tank and can efficiently control the flow rate of the working fluid to save the cost of the cycle construction, thereby improving the economical efficiency.

The various exemplary embodiments of the present disclosure, which is described as above and shown in the drawings, should not be interpreted as limiting the technical spirit of the present disclosure. The scope of the present disclosure is limited only by matters set forth in the claims and those skilled in the art can modify and change the technical subjects of the present disclosure in various forms. Therefore, as long as these improvements and changes are apparent to those skilled in the art, they are comprised in the protective scope of the present disclosure.

What is claimed is:

1. A device for controlling a supply of a working fluid to a power generation cycle with a compressor compressing the working fluid and a precooler cooling the working fluid supplied to the compressor, the device comprising:

a storage tank storing the working fluid supplied to the power generation cycle;

a flotation tank disposed between the precooler and the compressor to flow or temporarily store the working fluid;

a supply pump disposed between the storage tank and the flotation tank to supply the working fluid from the storage tank to the flotation tank; and

a control valve disposed between the storage tank and the flotation tank to discharge the working fluid from the flotation tank to the storage tank, wherein a pressure within the flotation tank and a flow rate of the working fluid are controlled based on pressures at an inlet of the compressor and an outlet of the precooler.

2. The device of claim **1**, wherein the flotation tank is a piston accumulator tank.

3. The device of claim **2**, wherein the flotation tank comprises:

a tank body into which the working fluid is introduced; and

a piston installed inside the tank body to be elevated by a control fluid supplied from the outside.

4. The device of claim **3**, wherein the flotation tank further comprises:

a control fluid inflowing portion provided at a lower end of the tank body and having the control fluid inflowing and outflowing therethrough;

a first inlet provided at one side of the tank body and having the working fluid inflowing from the supply pump thereinto; and

a first outlet provided at the other side of the tank body and having the working fluid discharged to the control valve therethrough.

5. The device of claim **4**, wherein the flotation tank further comprises:

a second inlet provided at an upper part of the tank body and having the working fluid inflowing from the precooler thereinto; and

a second outlet provided at the upper part of the tank body and having the working fluid discharged to the compressor therethrough.

6. The device of claim **5**, wherein when the pressure at the outlet of the precooler or the pressure at the inlet of the compressor rises, the control fluid is supplied to the control fluid inflowing portion and the control valve is open to discharge the working fluid within the flotation tank to the storage tank through the first outlet.

7. The device of claim **6**, wherein the supply of the control fluid and the discharge of the working fluid to the storage tank are made until a height of the piston reaches a height corresponding to a set value.

8. The device of claim **5**, wherein when the pressure at the outlet of the precooler or the pressure at the inlet of the compressor falls, the supply pump is operated to supply the working fluid into the flotation tank through the first inlet.

9. The device of claim **8**, wherein the supply of the working fluid into the flotation tank is made until a height of the piston reaches a height corresponding to a set value.

10. A device for controlling a supply of a working fluid to a power generation cycle with a compressor compressing the working fluid and a precooler cooling the working fluid supplied to the compressor, the device comprising:

a storage tank storing the working fluid supplied to the power generation cycle;

a flotation tank disposed on a low pressure line of an inlet of the compressor to flow or temporarily store the working fluid;

a supply pump disposed between the storage tank and the flotation tank to supply the working fluid from the storage tank to the flotation tank; and

a control valve disposed between the storage tank and the flotation tank to discharge the working fluid from the flotation tank to the storage tank.

11. The device of claim **10**, wherein if a pressure at an outlet of the precooler or the inlet of the compressor rises, the working fluid is discharged from the flotation tank to the storage tank, and if the pressure at the outlet of the precooler or the inlet of the compressor falls, the working fluid is supplied from the storage tank to the flotation tank.

12. The device of claim **11**, wherein the flotation tank is a piston accumulator tank.

13. The device of claim **12**, wherein the flotation tank comprises:

a tank body into which the working fluid is introduced; and

a piston installed inside the tank body to be elevated by a control fluid supplied from the outside.

14. The device of claim **13**, wherein the flotation tank further comprises:

a control fluid inflowing portion provided at a lower end of the tank body and having the control fluid inflowing and outflowing therethrough;

a first inlet provided at one side of the tank body and having the working fluid inflowing from the supply pump thereinto; and

a first outlet provided at the other side of the tank body and having the working fluid discharged to the control valve therethrough.

15. The device of claim **14**, wherein the flotation tank further comprises:

a second inlet provided at an upper part of the tank body and having the working fluid inflowing from the precooler thereinto; and

a second outlet provided at the upper part of the tank body and having the working fluid discharged to the compressor therethrough.

16. The device of claim **15**, wherein when the pressure at the outlet of the precooler or the pressure at the inlet of the compressor rises, the control fluid is supplied to the control fluid inflowing portion and the control valve is open to discharge the working fluid within the flotation tank to the storage tank through the first outlet.

17. The device of claim **16**, wherein the supply of the control fluid and the discharge of the working fluid to the storage tank are made until a height of the piston reaches a height corresponding to a set value.

18. The device of claim **15**, wherein when the pressure at the outlet of the precooler or the pressure at the inlet of the compressor falls, the supply pump is operated to supply the working fluid into the flotation tank through the first inlet.

19. The device of claim **18**, wherein the supply of the working fluid into the flotation tank is made until a height of the piston reaches a height corresponding to a set value.

* * * * *