(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 3 147 589 A1

(12) EUROPEAN PATENT APPLICATION

published in accordance with Art. 153(4) EPC

(43) Date of publication:
29.03.2017 Bulletin 2017/13

(21) Application number: **15812225.9**

(22) Date of filing: **22.05.2015**

(51) Int Cl.:
F25B 15/00 *(2006.01)* ***F25B 17/00*** *(2006.01)*

(86) International application number:
PCT/CN2015/079574

(87) International publication number:
WO 2015/196884 (30.12.2015 Gazette 2015/52)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
MA

(30) Priority: **23.06.2014 CN 201410280179**

(71) Applicant: **Zhou, Yongkui**
Yibin, Sichuan 644007 (CN)

(72) Inventor: **LI, Hong**
Yibin
Sichuan 644007 (CN)

(74) Representative: **Sun, Yiming**
HUASUN Patent- und Rechtsanwälte
Friedrichstraße 33
80801 München (DE)

(54) SELF-DRIVEN THERMAL COMPRESSION HEAT PUMP REFRIGERATION METHOD

(57) The present invention relates to a self-driving heat compression-type heat pump refrigerating method. According to the method, high-temperature steam is prepared, with condensed heat generated by a heat compression-type heat pump refrigerating circulation system, as a driving heat source for heat compression-type heat pump refrigerating circulation system to drive the heat compression-type heat pump refrigerating circulation system. By consuming only a very small amount of electricity, the present invention can prepare the driving steam by using condensing heat generated by refrigerating media steam. The heat generated during the circulation of a system itself is used as a driving heat source, realizing refrigerating and heating. The present invention is highly efficient and energy-saving.

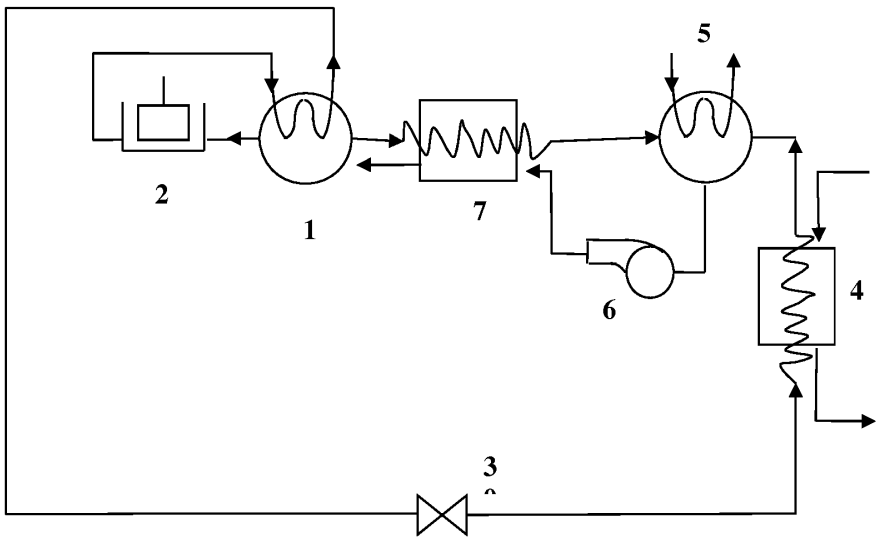

FIG. 1

EP 3 147 589 A1

Description

Technical Field

[0001] The present invention relates to a self-driving heat compression-type heat pump refrigerating method, belonging to the technical field of heat pump refrigeration.

Description of the Related Art

[0002] Common heat pump refrigerating methods include steam compression-type heat pump refrigeration, absorption-type heat pump refrigeration, adsorption-type heat pump refrigeration, etc., wherein the steam compression-type heat pump refrigerating and absorption-type heat pump refrigerating are most generally applied.

[0003] The steam compression-type heat pump refrigerating features a high heat ratio, but must consume a lot of electricity as the driving energy source. The heat compression-type heat pump refrigeration (absorption-type refrigeration or adsorption-type refrigeration) can employ a low-grade heat energy driving source, consumes a small amount of the electricity, but has a low heat ratio. When no waste heat is available for use, heat compression-type heat pump refrigeration does not create a lot of economic advantages in comparison with the steam compression-type refrigeration. Practically, it is impossible that the waste heat is found everywhere..

Detailed Contents of The Invention

[0004] The objective of the present invention is to provide an efficient and economical heat compression-type heat pump refrigerating method. The problem to be solved is to find a more economical and convenient heat compressor driving method to enlarge the applicable scope of the heat compression-type heat pump refrigerating method.

[0005] The technical solution employed by the present invention: The present invention relates to a self-driving heat compression-type heat pump refrigerating method. According to the method, a high-temperature heat source is prepared, with condensed heat generated by a heat compression-type heat pump refrigerating circulation system, as a driving heat source for heat compression-type heat pump refrigerating circulation system to drive the heat compression-type heat pump refrigerating circulation system to work, outputting heat energy while refrigerating.

[0006] The present invention has the following benefits: the present invention uses the latent condensing heat of the refrigerating media steam as the driving heat source, does not need an external high-temperature driving heat source, reduces the consumption of the cooled water during the condensing process, and can consume a small amount of electricity to prepare the driving heat source by using the latent condensing heat of the refrigerating media steam. The energy-saving effect is good.

[0007] Further, the heat compression-type heat pump refrigerating circulation system is an absorption-type heat pump refrigerating circulation system.

[0008] Further, the absorption-type heat pump refrigerating circulation system consists of a working media circulation system and a solution circulation system; the working media circulation system is a circuit formed by connecting a refrigerating working media terminal of a generator, a steam compressor, a thermal source terminal of the generator, a first throttle reducing valve, an evaporator, an absorber, a solution pump, a solution heat exchanger and the refrigerating working media terminal of the generator in turn through pipes; the solution circulation system is a circuit formed by connecting the absorber, the solution pump, the solution heat exchanger, the generator, the solution heat exchanger and the absorber in turn through pipes; the heat pump refrigerating circulation system is internally provided with refrigerating working media and a working pair solution consisting of substances which have high solubility in the refrigerating working media.

[0009] Further, the absorption-type heat pump refrigerating circulation system consists of a working media circulation system and a solution circulation system; the working media circulation system is a circuit formed by connecting a refrigerating working media terminal of a generating rectifier, a steam compressor, a thermal source terminal of the generating rectifier, a first throttle reducing valve, an evaporator, an absorber, a solution pump, a solution heat exchanger and the refrigerating working media terminal of the generating rectifier in turn through pipes; the solution circulation system is a circuit formed by connecting the absorber, the solution pump, the solution heat exchanger, the generating rectifier, the solution heat exchanger and the absorber in turn through pipes; the heat pump refrigerating circulation system is internally provided with refrigerating working media and a working pair solution consisting of substances which have high solubility in the refrigerating working media.

[0010] Further, the absorption-type heat pump refrigerating circulation system consists of a working media circulation system and a solution circulation system; the working media circulation system is a circuit formed by connecting a refrigerating working media terminal of a generator, a steam compressor, a thermal source terminal of the generator, a first throttle reducing valve, an evaporator, a low-pressure compressor, an absorber, a solution pump, a solution heat exchanger and the refrigerating working media terminal of the generator in turn through pipes; the solution circulation system is a circuit formed by connecting the absorber, the solution pump, the solution heat exchanger, the generator, the solution heat exchanger and the absorber in turn through pipes; the heat pump refrigerating circulation system is internally provided with refrigerating working media and a working pair solution consisting of substances which have high solubility in the refrigerating working media.

[0011] Further, the heat compression-type heat pump

refrigerating circulation system is an adsorption-type heat pump refrigerating circulation system.

[0012] Further, the heat pump refrigerating circulation system is a circuit formed by connecting a refrigerating working media terminal of an adsorption bed, the steam compressor, a heat source terminal of the adsorption bed, a first valve, a first liquid storage, a second valve, the first throttle reducing valve, the evaporator, and a refrigerating working media terminal of the adsorption bed in turn through pipes; and the heat pump refrigerating circulation system is provided with working media and working pairs consisting of absorbents which are capable of adsorbing the working media.

[0013] Further, the heat compression-type heat pump refrigerating circulation system consists of a driving circulation system and a heat pump refrigerating circulation system.

[0014] Further, the driving circulation system is a circuit formed by connecting an evaporator, a condenser and the evaporator in turn through pipes; the heat pump refrigerating circulation system consists of the working media circulation system and the solution circulation system; the working media circulation system is a circuit formed by connecting the generator, the condenser, a working media lifting pump, the evaporator, the absorber, the solution heat exchanger and the generator through pipes in turn; the solution circulation system is a circuit formed by connecting the generator, the solution heat exchanger, the solution pump, the absorber, the solution heat exchanger and the generator through pipes in turn; and the heat pump refrigerating circulation system is internally provided with the refrigerating working media and the working pair solution consisting of substances which have high solubility in the refrigerating working media.

[0015] Further, the driving circulation system is a circuit formed by connecting a first adsorption bed, a second adsorption bed and the first adsorption bed in turn through pipes; the heat pump refrigerating circulation system has two paths, one path being formed by connecting the first adsorption bed, a valve, the condenser, the working media lifting pump, the evaporator, a valve and the second adsorption bed in turn through pipes, and the other path being formed by connecting the second adsorption bed, a valve, the condenser, the working media lifting pump, the evaporator, a valve and the first adsorption bed in turn through pipes; the heat pump refrigerating circulation system is provided with the working media and the working pairs consisting of substances which are capable of adsorbing the working media; the first adsorption bed is filled in with an absorbent which is absorbed with a certain amount of the working media; and the second adsorption bed is filled with an absorbent which is absorbed with a small amount of the working media.

[0016] Further, the driving circulation system is a circuit formed by connecting an evaporator, a condenser and the evaporator in turn through pipes; the heat pump refrigerating circulation system consists of the working media circulation system and the solution circulation system; the working media circulation system is a circuit formed by connecting the generator, the condenser, a throttle reducing valve, the evaporator, the absorber, the solution pump, the solution heat exchanger and the generator in turn through pipes; the solution circulation system is a circuit formed by connecting the generator, the solution heat exchanger, the absorber, the solution pump, the solution heat exchanger and the generator in turn through pipes; and the heat pump refrigerating circulation system is internally provided with the refrigerating working media and the solution consisting of substances which have high solubility in the refrigerating working media.

[0017] Further, the driving circulation system is a circuit formed by connecting a first compressor, the generator, a second throttle reducing valve, the condenser and the first compressor in turn though pipes; the heat pump refrigerating circulation system consists of the working media circulation system and the solution circulation system; the working media circulation system is a circuit formed by connecting the generator, the condenser, the first throttle reducing valve, the evaporator, the absorber, the solution pump, the solution heat exchanger and the generator in turn through pipes; the solution circulation system is a circuit formed by connecting the absorber, the solution pump, the solution heat exchanger, the generator, the solution heat exchanger and the absorber in turn through pipes; and the heat pump refrigerating circulation system is internally provided with refrigerating working media and the working pair solution consisting of substances which have high solubility in the refrigerating working media.

[0018] Further, the driving circulation system is a circuit formed by connecting a first compressor, a generating rectifier, a second throttle reducing valve, the condenser and the first compressor in turn though pipes; the heat pump refrigerating circulation system consists of the working media circulation system and the solution circulation system; the working media circulation system is a circuit formed by connecting the generating rectifier, the condenser, the first throttle reducing valve, the evaporator, the absorber, the solution pump, the solution heat exchanger and the generating rectifier in turn through pipes; the solution circulation system is a circuit formed by connecting the absorber, the solution pump, the solution heat exchanger, the generator, the solution heat exchanger and the absorber in turn through pipes; and the heat pump refrigerating circulation system is internally provided with refrigerating working media and the working pair solution consisting of substances which have high solubility in the refrigerating working media.

[0019] Further, the driving circulation system is a circuit formed by connecting the first compressor, the generator, the second throttle reducing valve, the condenser and the first compressor in turn through pipes; the heat pump refrigerating circulation system consists of the working media circulation system and the solution circulation system; and the working media circulation system is a circuit

formed by connecting the generator, the condenser, the first throttle reducing valve, the evaporator, the low-pressure compressor, the absorber, the solution pump, the solution heat exchanger and the generator in turn through pipes. The solution circulation system is a circuit formed by connecting the absorber, the solution pump, the solution heat exchanger, the generator, the solution heat exchanger and the absorber in turn through pipes; and the heat pump refrigerating circulation system is internally provided with refrigerating working media and a working pair solution consisting of substances which have high solubility in the refrigerating working media.

[0020] Further, the driving circulation system is a circuit formed by connecting the first compressor, the adsorption bed serving as the condenser, the second throttle reducing valve, the condenser serving as the evaporator and the first compressor in turn through pipes; the heat pump refrigerating circulation system is a circuit formed by connecting the adsorption bed, the condenser, the first valve, the first liquid storage, the second valve, the first throttle reducing valve, the evaporator and the adsorption bed in turn through pipes; and the heat pump refrigerating circulation system is provided with the working media and the working pairs consisting of substances which are capable of adsorbing the working media.

[0021] Further, the driving circulation system is a circuit formed by connecting a second compressor, the generator serving as a condenser, a third throttle reducing valve, a absorber serving as an evaporator and the second compressor in turn though pipes; the heat pump refrigerating circulation system consists of the working media circulation system and the solution circulation system; the working media circulation system is a circuit formed by connecting the generator, the condenser, the first throttle reducing valve, the evaporator, the absorber, the solution pump, the solution heat exchanger and the generator in turn through pipes; the solution circulation system is a circuit formed by connecting the absorber, the solution pump, the solution heat exchanger, the generator, the solution heat exchanger and the absorber in turn through pipes; and the heat pump refrigerating circulation system is internally provided with refrigerating working media and the working pair solution consisting of substances which have high solubility in the refrigerating working media.

[0022] Further, the driving circulation system is a circuit formed by connecting a second compressor, a generating rectifier serving as a condenser, a third throttle reducing valve, a absorber serving as an evaporator and the second compressor in turn though pipes; the heat pump refrigerating circulation system consists of the working media circulation system and the solution circulation system; the working media circulation system is a circuit formed by connecting the generating rectifier, the condenser, the first throttle reducing valve, the evaporator, the absorber, the solution pump, the solution heat exchanger and the generating rectifier in turn through pipes; the solution circulation system is a circuit formed by connecting the absorber, the solution pump, the solution heat exchanger, the generator, the solution heat exchanger and the absorber in turn through pipes; and the heat pump refrigerating circulation system is internally provided with refrigerating working media and the working pair solution consisting of substances which have high solubility in the refrigerating working media.

[0023] Further, the driving circulation system is a circuit formed by connecting a second compressor, a steam accumulator, a third valve, an adsorption bed serving as the condenser, a fourth valve, a second liquid storage, a fifth valve, a third throttle reducing valve, an adsorption bed serving as an evaporator, a sixth valve and the second compressor in turn through pipes; the heat pump refrigerating circulation system is a circuit formed by connecting the adsorption bed, the condenser, the first valve, the first liquid storage, the second valve, the first throttle reducing valve, the evaporator and the adsorption bed in turn through pipes; and the heat pump refrigerating circulation system is provided with the working media and the working pairs consisting of the absorbent which is capable of adsorbing the working media.

Description of Several Views of the Attached Drawings

[0024]

Fig. 1 is a schematic view of a self-driving absorption-type heat pump refrigerating system.

Fig. 2 is a schematic view of a self-driving absorption-type heat pump refrigerating system equipped with a rectifying tower.

Fig. 3 is a schematic view of a self-driving absorption-type heat pump refrigerating system equipped with a low-pressure steam compressor.

Fig. 4 is a schematic view of a self-driving adsorption-type heat pump refrigerating system.

Fig. 5 is a schematic view of a self-driving absorption-type heat pump refrigerating system without a compressor.

Fig. 6 is a schematic view of a self-driving continuous adsorption-type heat pump refrigerating system without a compressor.

Fig. 7 is a schematic view of a self-driving absorption-type heat pump refrigerating system which performs evaporation in a pressuring rising way.

Fig. 8 is a schematic view of a compound self-driving absorption-type heat pump refrigerating system.

Fig. 9 is a schematic view of a compound self-driving

adsorption-type heat pump refrigerating system equipped with a rectifying tower.

Fig. 10 is a schematic view of a compound self-driving absorption-type heat pump refrigerating system equipped with a low-pressure steam compressor.

Fig. 11 is a schematic view of a compound self-driving adsorption-type heat pump refrigerating system.

Fig. 12 is a schematic view of an absorbed-heat-driving compound absorption-type heat pump refrigerating system.

Fig. 13 is a schematic view of an absorbed-heat-driving compound absorption-type heat pump refrigerating system equipped with a rectifying tower.

Fig. 14 is a schematic view of an adsorbed-heat-driving compound adsorption-type heat pump refrigerating system.

Below is a list of parts marked with numbers in the drawings:

[0025] 1 Generator, 2 steam compressor, 3 throttle reducing valve, 4 evaporator, 5 absorber, 6 solution pump, 7 solution heat exchanger, 8 generating rectifier, 9 low-pressure compressor, 10 adsorption bed, 11 liquid storage, 12 valve, 13 valve, 14 compressor, 15 condenser, 16 throttle reducing valve, 17 throttle reducing valve, 18 compressor, 19 valve, 20 valve, 22 steam accumulator, 23 valve, 24 valve, 25 liquid storage, 26 working media lifting pump, 27 second adsorption bed, 28 valve, 29 valve, 30 valve, 31 valve.

Detailed Description of the Present Invention

[0026] The principle and characteristics of the present invention are described with reference to the attached drawings. Embodiments here are used for explaining the present invention, not limiting the scope of the present invention.

[0027] A self-driving absorption-type heat pump refrigerating system, as shown in Figure 1, consists of a working media circulation system and a solution circulation system. The working media circulation system is formed by connecting a refrigerating working media terminal of a generator 1, a steam compressor 2, a heat source terminal of the generator 1, a throttle reducing valve 3, an evaporator 4, an absorber 5, a solution pump 6, a solution heat exchanger 7 and the generator 1 in turn through pipes. The solution circulation system is a circuit formed by connecting the absorber 5, the solution pump 6, the solution heat exchanger 7, the generator 1, the solution heat exchanger 7 and the absorber 5 in turn through pipes. The heat pump refrigerating circulation system is internally provided with refrigerating working media and a working pair solution consisting of substances which have high solubility in the refrigerating working media. The diluted working pair solution is heated by high-pressure refrigerating working media in the generator 1 and generates medium-pressure refrigerating media steam. The medium-pressure refrigerating media steam is pressurized and heated by the steam compressor 2 to become high-temperature-high-pressure refrigerating media steam. The high-pressure refrigerating media steam is inputted to the heat source terminal of the generator 1 as a driving heat source to heat the diluted solution and self-condense into the medium-pressure refrigerating media liquid. The medium-pressure refrigerating media liquid is decompressed by the throttle reducing valve 3, absorbs heat and evaporates at a low pressure in the evaporator 4 to supply low heat to the environment. The low-pressure refrigerating media steam enters the absorber 5 to be absorbed by the concentrated solution to supply heat to the environment. The diluted solution is pumped into the solution heat exchanger 7 by the solution pump 6 to exchange heat with the concentrated solution in the generator 1 and then enters the generator 1 to start the next cycle.

[0028] The absorption-type heat pump refrigerating system equipped with a rectifying tower, as shown in Figure 2, consists of a working media circulation system and a solution circulation system. The working media circulation system is formed by connecting a refrigerating working media terminal of a generating rectifier 8, a steam compressor 2, a heat source terminal of the generating rectifier 8, a throttle reducing valve 3, an evaporator 4, an absorber 5, a solution pump 6, a solution heat exchanger 7 and the generating rectifier 8 in turn through pipes. The solution circulation system is a circuit formed by connecting the absorber 5, the solution pump 6, the solution heat exchanger 7, the generating rectifier 8, the solution heat exchanger 7 and the absorber 5 in turn through pipes. The heat pump refrigerating circulation system is internally provided with working media and a working pair solution consisting of substances which have high solubility in the working media. The diluted working pair solution is heated by high-pressure refrigerating working media in the generating rectifier 8 and generates working pair mixed steam. The working pair mixed steam is rectified in a rectifying tower at the upper part of the generating rectifier 8 to generate medium-pressure refrigerating media steam. The medium-pressure refrigerating media steam is pressurized and heated by the steam compressor 2 to become high-temperature refrigerating media steam. The high-temperature refrigerating media steam is inputted to the heat source terminal of the generating rectifier 8 as a driving heat source to heat the diluted solution and self-condense into the medium-pressure refrigerating media liquid. The medium-pressure refrigerating media liquid is decompressed by the throttle reducing valve 3, absorbs heat and evaporates at a low pressure in the evaporator 4 to supply low heat to the environment. The low-pressure refriger-

ating media steam enters the absorber 5 to be absorbed by the concentrated solution therein to supply heat to the environment. The diluted solution is pumped by the solution pump 6 to exchange heat with the concentrated solution in the generating rectifier 8 and then enters the generating rectifier 8 to start the next cycle.

[0029] The absorption heat pump refrigerating system equipped with the low-pressure compressor, as shown in Figure 3, which consists of a working media circulation system and a solution circulation system. The working media circulation system is formed by connecting a refrigerating working media terminal of a generator 1, a steam compressor 2, a heat source terminal of the generator 1, a throttle reducing valve 3, an evaporator 4, a low-pressure compressor 9, an absorber 5, a solution pump 6, a solution heat exchanger 7 and the generator 1 in turn through pipes. The solution circulation system is a circuit formed by connecting the absorber 5, the solution pump 6, the solution heat exchanger 7, the generator 1, the solution heat exchanger 7 and the absorber 5 in turn through pipes. The heat pump refrigerating circulation system is internally provided with refrigerating working media and a working pair solution consisting of substances which have high solubility in the refrigerating working media. The diluted working pair solution is heated by high-pressure refrigerating working media in the generator 1 and generates medium-pressure refrigerating media steam. The medium-pressure refrigerating media steam is pressurized and heated by the steam compressor 2 to become high-temperature refrigerating media steam. The high-temperature refrigerating media steam is inputted to the heat source terminal of the generator 1 to heat the diluted solution and self-condense into the medium-pressure refrigerating media liquid. The medium-pressure refrigerating media liquid is decompressed by the throttle reducing valve 3, absorbs heat and evaporates at a low pressure in the evaporator 4 to supply low heat to the environment. The low-pressure refrigerating media steam is pressurized by the low-pressure compressor 9 and then enters the absorber 5 to be absorbed by the concentrated solution in the absorber 5 to supply heat to the environment. The diluted solution is pumped into the solution heat exchanger 7 by the solution pump 6 to exchange heat with the concentrated solution coming from the generator 1 and then enters the generator 1 to start the next cycle.

[0030] A self-driving intermittent adsorption-type heat pump refrigerating system, as shown in the Figure 4, is formed by connecting a refrigerating working media terminal of an adsorption bed 10, a steam compressor 2, a heat source terminal of the adsorption bed 10, a valve 12, a liquid storage 11, a valve 13, a throttle reducing valve 3, an evaporator 4 and a refrigerating working media terminal of the adsorption bed 10 in turn through pipes. and the heat pump refrigerating circulation system is provided with the working media and the working pairs consisting of substances which are capable of adsorbing the working media. In the desorbing stage, a valve 12 opens, and a valve 13 closes. The working media is heated and desorbed by the high-pressure refrigerating working media in the adsorption bed 10 and generates medium-pressure refrigerating media steam. The medium-pressure refrigerating media steam is pressurized and heated by the steam compressor 2 to become high-temperature refrigerating media steam. The high-temperature refrigerating media steam is inputted into the heat source terminal of the adsorption bed 10 as the driving heat source to heat the adsorption bed 10 and be self-condensed into the medium-pressure refrigerating media liquid. The medium-pressure refrigerating media liquid is stored in a liquid storage 11. In the refrigerating and adsorbing stage, the valve 12 closes and the valve 13 opens. The medium-pressure refrigerating media liquid in the liquid storage 11 is decompressed by the throttle reducing valve 3, adsorbs heat and evaporates at a low pressure in the evaporator 4 to supply heat to the environment. The low-pressure refrigerating media steam enters the adsorption bed 10 to be adsorbed. Then, the next cycle begins.

[0031] A compound self-driving absorption-type heat pump refrigerating system, as shown in Figure 5, consists of a driving circulation system and a heat pump refrigerating circulation system. The driving circulation system is a circuit formed by connecting an evaporator 4, a condenser 15 and the evaporator 4 in turn through pipes. A heat media absorbs heat in the condenser 15 to cool refrigerating media steam in the condenser, increases in enthalpy and enters the evaporator 4 to transmit heat to the refrigerating media in the evaporator. When the refrigerating media evaporates, the enthalpy of the heat media declines. The heat pump refrigerating circulation system consists of the working media circulation system and the solution circulation system. The working media circulation system is a circuit formed by connecting the generator 1, the condenser 15, a working media lifting pump 26, the evaporator 4, the absorber 5, the solution pump 6, the solution heat exchanger 7 and the generator 1 through pipes in turn. The solution circulation system is a circuit formed by connecting the generator 1, the solution heat exchanger 7, the solution pump 6, the absorber 5, the solution heat exchanger 7 and the generator 1 through pipes in turn. The heat pump refrigerating circulation system is internally provided with the refrigerating working media and the working pair solution consisting of substances which have high solubility in the refrigerating working media. The diluted working pair solution is heated in the generator 1 and generates refrigerating media steam which enters the condenser 15. The refrigerating media steam is condensed into the refrigerating media liquid. The refrigerating media liquid is pressurized by the working media lifting pump 26, absorbs heat and evaporates in the evaporator 4 to supply low heat to the environment. The refrigerating media steam enters the absorber 5 to be absorbed by the concentrated solution to supply heat to the environment. The diluted solution is pumped into the solution heat exchanger 7 by the so-

lution pump 6 to exchange heat with the concentrated solution coming from the generator 1 and then enters the generator 1 to start the next cycle.

[0032] A compound self-driving adsorption-type heat pump refrigerating system, as shown in Figure 6, consists of a driving circulation system and a heat pump refrigerating circulation system. The driving circulation system is a circuit formed by connecting a first adsorption bed 10, a second adsorption bed 27 and the first adsorption bed 10 in turn through pipes. In the desorbing stage of the first adsorption bed 10 and the adsorbing stage of the second adsorption bed 27, the heat media adsorbs heat in the second adsorption bed 27, increases in enthalpy and enters the first adsorption bed 10 to heat the adsorption bed, and then declines in the enthalpy. The heat pump refrigerating circulation system has two paths, one path being formed by connecting the first adsorption bed 10, a valve 28, the condenser 15, the working media lifting pump 26, the evaporator 4, a valve 30 and the second adsorption bed 27 in turn through pipes, and the other path being formed by connecting the second adsorption bed 27, a valve 29, the condenser 15, the working media lifting pump 26, the evaporator 4, a valve 31 and the first adsorption bed 10 in turn through pipes; the heat pump refrigerating circulation system is provided with the working media and the working pairs consisting of substances which are capable of adsorbing the working media; the first adsorption bed is filled in with an absorbent which is absorbed with a certain amount of the working media; and the second adsorption bed is filled with an absorbent which is absorbed with a small amount of the working media. In the desorbing stage of the first adsorption bed 10 and the adsorbing stage of the second adsorption bed 27, a valve 28 and a valve 30 open, and a valve 27 and a valve 31 close. The working media is heated and desorbed in the first adsorption bed 10 and generates refrigerating media steam. The refrigerating media steam enters the condenser 15 and condenses into the refrigerating media liquid. The refrigerating media liquid is pressurized by the working media lifting pump 26, enters the evaporator 4 to absorb heat and evaporate, and then generates the refrigerating media steam. The refrigerating media steam enters the second adsorption bed 27 to be adsorbed to supply heat to the environment. In the adsorbing stage of the first adsorption bed 10 and the desorbing stage of the second adsorption bed 27, the valve 29 and the valve 31 open, and the valve 28 and the valve 30 close. The working media is heated and desorbed in the second adsorption bed 27 and generates refrigerating media steam. The refrigerating media steam enters the condenser 15 and condenses into the refrigerating media liquid. The refrigerating media liquid is pressurized by the working media lifting pump 26, enters the evaporator 4 to absorb heat and evaporate, and then generates the refrigerating media steam. The refrigerating media steam enters the first adsorption bed 10 to be adsorbed to supply heat to the environment. Then, the next cycle begins.

[0033] A compound self-driving absorption-type heat pump refrigerating system, as shown in Figure 7, consists of a driving circulation system and a heat pump refrigerating circulation system. The driving circulation system is a circuit formed by connecting the generator 1, the absorber 5 and the generator 1 in turn through pipes. The heat media absorbs heat in the absorber 5, increases in enthalpy, enters the generator 1 to heat the generator 1, declines in the enthalpy, and then enters the absorber 5 to start the next cycle. The heat pump refrigerating circulation system consists of the working media circulation system and the solution circulation system. The working media circulation system is a circuit formed by connecting the generator 1, the condenser 15, a throttle reducing valve 3, the evaporator 4, the absorber 5, the solution pump 6, the solution heat exchanger 7 and the generator 1 through pipes in turn. The solution circulation system is a circuit formed by connecting the generator 1, the solution heat exchanger 7, the absorber 5, the solution pump 6, the solution heat exchanger 7 and the generator 1 through pipes in turn. The heat pump refrigerating circulation system is internally provided with the refrigerating working media and the solution consisting of substances which have high solubility in the refrigerating working media. The diluted working pair solution is heated in the generator 1 and generates refrigerating media steam which enters the condenser 15. The refrigerating media steam is condensed into the refrigerating media liquid. The refrigerating media liquid is decompressed by the throttle reducing valve 3, absorbs heat and evaporates in the evaporator 4 to supply low heat to the environment. The refrigerating media steam enters the absorber 5 to be absorbed by the concentrated solution to supply heat to the environment. The diluted solution is pumped into the solution heat exchanger 7 by the solution pump 6 to exchange heat with the concentrated solution coming from the generator 1 and then enters the generator 1 to start the next cycle.

[0034] A compound self-driving absorption-type heat pump refrigerating system, as shown in Figure 8, consists of a driving circulation system and an adsorption-type heat pump refrigerating circulation system. The driving circulation system is formed by connecting a compressor 14, a generator 1 serving as a condenser, a throttle reducing valve 16, a condenser 15 serving as an evaporator and the compressor 14 in turn through pipes. The driving media steam is compressed and pressurized by the compressor 14 and generates high-pressure driving media steam. The high-pressure driving media steam serving as a driving heat source heats the generator 1 serving as the condenser, and self-condenses into the driving media liquid. The driving media liquid is throttled and decompressed by the throttle reducing valve 16, enters the condenser 15 serving as the evaporator, absorbs heat and evaporates. The driving media steam enters the compressor 14 to start the next cycle. The absorption-type heat pump refrigerating system consists of a working media circulation system and a solution circulation sys-

tem. The working media circulation system is formed by connecting a generator 1, a condenser 15, a throttle reducing valve 3, an evaporator 4, an absorber 5, a solution pump 6, a solution heat exchanger 7 and the generator 1 in turn through pipes. The solution circulation system is a circuit formed by connecting the absorber 5, the solution pump 6, the solution heat exchanger 7, the generator 1, the solution heat exchanger 7 and the absorber 5 in turn through pipes; and the heat pump refrigerating circulation system is internally provided with refrigerating working media and a working pair solution consisting of substances which have high solubility in the refrigerating working media. The diluted working pair solution is heated by driving steam in the generator 1 and generates refrigerating media steam. The refrigerating media steam is condensed into the refrigerating media liquid in the condenser 15. The refrigerating media liquid is decompressed by the throttle reducing valve 3, absorbs heat and evaporates at a low pressure in the evaporator 4 to supply low heat to the environment. The low-pressure refrigerating media steam enters the absorber 5 to be absorbed by the concentrated solution to supply heat to the environment. The diluted solution is pumped into the solution heat exchanger 7 by the solution pump 6 to exchange heat with the concentrated solution coming from the generator 1 and then enters the generator 1 to start the next cycle.

[0035] A compound self-driving absorption-type heat pump refrigerating system equipped with a rectifying tower, as shown in Figure 9, consists of a driving circulation system and an adsorption-type heat pump refrigerating circulation system. The driving circulation system is formed by connecting a compressor 14, a generating rectifier 8 serving as a condenser, a throttle reducing valve 16, a condenser 15 serving as an evaporator and the compressor 14 in turn through pipes. The driving media steam is compressed and pressurized by the compressor 14 and generates high-temperature driving media steam. The driving media steam serving as a driving heat source heats the generating rectifier 8 serving as the condenser, and self-condenses into the driving media liquid. The driving media liquid is throttled and decompressed by the throttle reducing valve 16, enters the condenser 15 serving as the evaporator, absorbs heat and evaporates. The driving media steam enters the compressor 14 to start the next cycle. An absorption-type heat pump refrigerating system consists of a working media circulation system and a solution circulation system. The working media circulation system is formed by connecting a generating rectifier 8, a condenser 15, a throttle reducing valve 3, an evaporator 4, an absorber 5, a solution pump 6, a solution heat exchanger 7 and the generating rectifier 8 in turn through pipes. The solution circulation system is a circuit formed by connecting the absorber 5, the solution pump 6, the solution heat exchanger 7, the generating rectifier 8, the solution heat exchanger 7 and the absorber 5 in turn through pipes; and the heat pump refrigerating circulation system is internally provided with refrigerating working media and a working pair solution consisting of substances which have high solubility in the refrigerating working media. The diluted working pair solution is heated by driving steam in the generating rectifier 8 and generates refrigerating media steam. The refrigerating media steam is condensed into the refrigerating media liquid in the condenser 15. The refrigerating media liquid is throttled and decompressed by the throttle reducing valve 3, absorbs heat and evaporates at a low pressure in the evaporator 4 to supply low heat to the environment. The low-pressure refrigerating media steam enters the absorber 5 to be absorbed by the concentrated solution to supply heat to the environment. The diluted solution is pumped into the solution heat exchanger 7 by the solution pump 6 to exchange heat with the concentrated solution coming from the generating rectifier 8 and then enters the generating rectifier 8 to start the next cycle.

[0036] A compound self-driving absorption-type heat pump refrigerating system equipped with a low-pressure steam compressor, as shown in Figure 10, consists of a driving circulation system and an adsorption-type heat pump refrigerating circulation system. The driving circulation system is formed by connecting a compressor 14, a generator 1 serving as a condenser, a throttle reducing valve 16, a condenser 15 serving as an evaporator and the compressor 14 in turn through pipes. The driving media steam is compressed and pressurized by the compressor 14 and generates high-pressure driving media steam. The driving media steam serving as a driving heat source heats the generator 1 serving as the condenser, and self-condenses into the driving media liquid. The driving media liquid is throttled and decompressed by the throttle reducing valve 16, enters the condenser 15 serving as the evaporator, absorbs heat and evaporates. The driving media steam enters the compressor 14 to start the next cycle. An absorption-type heat pump refrigerating system consists of a working media circulation system and a solution circulation system. The working media circulation system is formed by connecting a generator 1, a condenser 15, a throttle reducing valve 3, an evaporator 4, a low-pressure compressor 9, an absorber 5, a solution pump 6, a solution heat exchanger 7 and the generator 1 in turn through pipes. The solution circulation system is a circuit formed by connecting the absorber 5, the solution pump 6, the solution heat exchanger 7, the generator 1, the solution heat exchanger 7 and the absorber 5 in turn through pipes; and the heat pump refrigerating circulation system is internally provided with refrigerating working media and a working pair solution consisting of substances which have high solubility in the refrigerating working media. The diluted working pair solution is heated by driving steam in the generator 1 and generates refrigerating media steam. The refrigerating media steam dissipates heat and is condensed into the refrigerating media liquid in the condenser 15. The refrigerating media liquid is throttled and decompressed by the throttle reducing valve 3, absorbs heat and evaporates at a low pressure in the evaporator 4 to supply low

heat to the environment. The low-pressure refrigerating media steam is pressured and compressed by the compressor 9 and then enters the absorber 5 to be absorbed by the concentrated solution to supply heat to the environment. The diluted solution is pumped into the solution heat exchanger 7 by the solution pump 6 to exchange heat with the concentrated solution coming from the generator 1 and then enters the generator 1 to start the next cycle.

[0037] A compound self-driving adsorption-type heat pump refrigerating system, as shown in Figure 11, consists of a driving circulation system and an adsorption-type heat pump refrigerating circulation system. The driving circulation system is formed by connecting a compressor 14, an adsorption bed 10 serving as a condenser, a throttle reducing valve 16, a condenser 15 serving as an evaporator and the compressor 14 in turn through pipes. The driving media steam is compressed and pressurized by the compressor 14 and generates high-pressure driving media steam. The driving media steam serving as a driving heat source heats the adsorption bed 10 serving as the condenser, and self-condenses into the driving media liquid. The driving media liquid is throttled and decompressed by the throttle reducing valve 16, enters the condenser 15 serving as the evaporator, absorbs heat and evaporates. The driving media steam enters the compressor 14 to start the next cycle. The adsorption-type heat pump refrigerating circulation system is formed by connecting the adsorption bed 10, the condenser 15, a valve 12, a liquid storage 11, a valve 13, a throttle reducing valve 3, an evaporator 4 and adsorption bed 10 in turn through pipes. The heat pump refrigerating circulation system is provided with the working media and the working pairs consisting of substances which are capable of adsorbing the working media. In the desorbing stage, a valve 12 opens, and a valve 13 closes. The working media is heated and adsorbed by the driving stream in the adsorption bed 10 and generates refrigerating media steam. The refrigerating media steam is condensed into the refrigerating media liquid in the condenser 15. The refrigerating media liquid is stored in the liquid storage 11. In the refrigerating media adsorbing stage, the valve 12 closes and the valve 13 opens. The refrigerating media liquid in the liquid storage 11 is decompressed by the throttle reducing valve 3, adsorbs heat and evaporates at a low pressure in the evaporator 4 to supply low heat to the environment. The low-pressure refrigerating media steam enters the adsorption bed 10 to be adsorbed to supply heat to the environment. Then, the next cycle begins.

[0038] An absorbed-heat-driving type compound absorption-type heat pump refrigerating system, as shown in Figure 12, consists of a driving circulation system and an adsorption-type heat pump refrigerating circulation system. The driving circulation system is formed by connecting a compressor 18, a generator 1 serving as a condenser, a throttle reducing valve 17, an absorber 5 serving as an evaporator and the compressor 18 in turn through pipes. The driving media steam is compressed and pressurized by the compressor 18 and generates high-pressure driving media steam. The driving media steam serving as a driving heat source heats the generator 1 serving as the condenser, and self-condenses into the driving media liquid. The driving media liquid is throttled and decompressed by the throttle reducing valve 17, enters the absorber 5 serving as the evaporator, absorbs heat and evaporates. The driving media steam enters the compressor 18 to start the next cycle. The absorption-type heat pump refrigerating system consists of a working media circulation system and a solution circulation system. The working media circulation system is formed by connecting a generator 1, a condenser 15, a throttle reducing valve 3, an evaporator 4, an absorber 5, a solution pump 6, a solution heat exchanger 7 and the generator 1 in turn through pipes. The solution circulation system is a circuit formed by connecting the absorber 5, the solution pump 6, the solution heat exchanger 7, the generator 1, the solution heat exchanger 7 and the absorber 5 in turn through pipes; and the heat pump refrigerating circulation system is internally provided with refrigerating working media and a working pair solution consisting of substances which have high solubility in the refrigerating working media. The diluted working pair solution is heated by driving steam in the generator 1 and generates refrigerating media steam. The refrigerating media steam is condensed into the refrigerating media liquid in the condenser 15. The refrigerating media liquid is decompressed by the throttle reducing valve 3, absorbs heat and evaporates at a low pressure in the evaporator 4 to supply low heat to the environment. The low-pressure refrigerating media steam enters the absorber 5 to be absorbed by the concentrated solution to supply heat to the environment. The diluted solution is pumped into the solution heat exchanger 7 by the solution pump 6 to exchange heat with the concentrated solution coming from the generator 1 and then enters the generator 1 to start the next cycle.

[0039] A compound self-driving absorption-type heat pump refrigerating system equipped with a rectifying tower, as shown in Figure 13, consists of a driving circulation system and an adsorption-type heat pump refrigerating circulation system. The driving circulation system is formed by connecting a compressor 18, a generating rectifier 8 serving as a condenser, a throttle reducing valve 17, an absorber 5 serving as an evaporator and the compressor 18 in turn through pipes. The driving media steam is compressed and pressurized by the compressor 18 and generates high-pressure driving media steam. The driving media steam serving as a driving heat source heats the generating rectifier 8 serving as the condenser, and self-condenses into the driving media liquid. The driving media liquid is throttled and decompressed by the throttle reducing valve 17, enters the absorber 5 serving as the evaporator, absorbs heat and evaporates. The driving media steam enters the compressor 18 to start the next cycle. The absorption-type heat pump refriger-

ating system consists of a working media circulation system and a solution circulation system. The working media circulation system is formed by connecting a generating rectifier 8, a condenser 15, a throttle reducing valve 3, an evaporator 4, an absorber 5, a solution pump 6, a solution heat exchanger 7 and the generating rectifier 8 in turn through pipes. The solution circulation system is a circuit formed by connecting the absorber 5, the solution pump 6, the solution heat exchanger 7, the generator 1, the solution heat exchanger 7 and the absorber 5 in turn through pipes; and the heat pump refrigerating circulation system is internally provided with refrigerating working media and a working pair solution consisting of substances which have high solubility in the refrigerating working media. The diluted working pair solution is heated by driving steam in the generating rectifier 8 and generates refrigerating media steam. The refrigerating media steam is condensed into the refrigerating media liquid in the condenser 15. The refrigerating media liquid is decompressed by the throttle reducing valve 3, absorbs heat and evaporates at a low pressure in the evaporator 4 to supply low heat to the environment. The low-pressure refrigerating media steam enters the absorber 5 to be absorbed by the concentrated solution to supply heat to the environment. The diluted solution is pumped into the solution heat exchanger 7 by the solution pump 6 to exchange heat with the concentrated solution coming from the generating rectifier 8 and then enters the generating rectifier 8 to start the next cycle.

[0040] An adsorbed-head-driving type compound adsorption-type heat pump refrigerating system, as shown in Figure 14, consists of a driving circulation system and an adsorption-type heat pump refrigerating circulation system. The driving circulation system is formed by connecting a compressor 18, a steam accumulator 22, a valve 23, an adsorption bed 10 serving as a condenser, a valve 19, liquid storage 25, a valve 24, a throttle reducing valve 17, an absorption bed 10 serving as an evaporator, a valve 20 and the compressor 18 in turn through pipes. In the desorbing stage, the valve 23 and the valve 19 open, the valve 24 and the valve 20 close. The high-pressuring driving media steam in the steam accumulator 22 enters the adsorption bed 10 to serve as the driving heat source, and self-condenses into the driving media liquid which enters and is stored in the liquid storage 25. In the adsorbing stage, the valve 24 and the valve 20 open, and the valve 23 and the valve 19 close. The driving media liquid in the liquid storage 25 is throttled and decompressed by the throttle reducing valve 17, then enters the adsorption bed 10 serving as the evaporator to absorb the adsorbed heat, and then evaporate. The driving media steam is compressed and pressurized by the compressor 18 and generates high-pressure driving media steam. The high-pressure driving media steam enters and is stored in the steam accumulator 22. The adsorption-type heat pump refrigerating circulation system is formed by connecting the adsorption bed 10, the condenser 15, a valve 12, a liquid storage 11, a valve 13, a throttle reducing valve 3, an evaporator 4 and adsorption bed 10 in turn through pipes. The heat pump refrigerating circulation system is provided with the working media and the working pairs consisting of substances which are capable of adsorbing the working media. In the desorbing stage, a valve 12 opens, and a valve 13 closes. The working media is heated and adsorbed by the driving stream in the adsorption bed 10 and generates refrigerating media steam. The refrigerating media steam is condensed into the refrigerating media liquid in the condenser 15. The refrigerating media liquid is stored in the liquid storage 11. In the refrigerating media adsorbing stage, the valve 12 closes and the valve 13 opens. The medium-pressure refrigerating media liquid in the liquid storage 11 is decompressed by the throttle reducing valve 3, adsorbs heat and evaporates at a low pressure in the evaporator 4 to supply low heat to the environment. The low-pressure refrigerating media steam enters the adsorption bed 10 to be adsorbed. Then, the next cycle begins.

[0041] The present invention has the following benefits: the present invention recycles the latent condensing heat of the refrigerating media steam as the driving heat source, does not need a high-temperature driving heat source, reduces the consumption of the cooled water during the condensing process, and can consume a small amount of electricity to prepare the driving heat source by using the latent condensing heat of the refrigerating media steam. Generally, to supply a 1,000KW refrigerating output, the electricity consumed by the compressor is about 30-70KW. Besides, the steam compressor is added in the compression process, but the generating and condensing processes are completed in the generator at the same time, so the special condenser is reduced. Compared with the traditional steam compression-type heat pump refrigerating method, the present invention can save about 80% of the power consumption. Compared with common absorption-type heat pump refrigerating devices, and medium-temperature, low-grade heat sources and fuel consumption is also not needed, realizing self-driving; and even at places without waste heat, the present invention can be used with only a very small amount of electricity. The energy-saving effect is obvious.

[0042] The above embodiments are only preferable embodiments of the present invention and shall not be regarded as limits of the present invention. Any modifications, equivalent changes and improvement made within the concept and principle of the present invention shall fall within the protective scope of the present invention.

Claims

1. A self-driving heat compression-type heat pump refrigerating method, **characterized in that**, according to said method high-temperature steam is prepared with condensed heat generated by a heat compres-

sion-type heat pump refrigerating circulation system, as a driving heat source for heat compression-type heat pump refrigerating circulation system to drive the heat compression-type heat pump refrigerating circulation system.

2. The self-driving heat compression-type heat pump refrigerating method according to claim 1, **characterized in that**, the heat compression-type heat pump refrigerating circulation system is an absorption-type heat pump refrigerating circulation system.

3. The self-driving heat compression-type heat pump refrigerating method according to claim 2, **characterized in that**, the absorption-type heat pump refrigerating circulation system consists of a working media circulation system and a solution circulation system; the working media circulation system is a circuit formed by connecting a refrigerating working media terminal of a generator (1), a steam compressor (2), a thermal source terminal of the generator (1), a first throttle reducing valve (3), an evaporator (4), an absorber (5), a solution pump (6), a solution heat exchanger (7) and the refrigerating working media terminal of the generator (1) in turn through pipes; the solution circulation system is a circuit formed by connecting the absorber (5), the solution pump (6), the solution heat exchanger (7), the generator (1), the solution heat exchanger (7) and the absorber (5) in turn through pipes; the heat pump refrigerating circulation system is internally provided with refrigerating working media and a working pair solution consisting of substances which have high solubility in the refrigerating working media.

4. The self-driving heat compression-type heat pump refrigerating method according to claim 2, **characterized in that**, the absorption-type heat pump refrigerating circulation system consists of a working media circulation system and a solution circulation system; the working media circulation system is a circuit formed by connecting a refrigerating working media terminal of a generating rectifier (8), a steam compressor (2), a thermal source terminal of the generating rectifier (8), a first throttle reducing valve (3, an evaporator (4), an absorber (5), a solution pump (6), a solution heat exchanger (7) and the refrigerating working media terminal of the generating rectifier (8) in turn through pipes; the solution circulation system is a circuit formed by connecting the absorber (5), the solution pump (6), the solution heat exchanger (7), the generating rectifier (8), the solution heat exchanger (7) and the absorber (5) in turn through pipes; the heat pump refrigerating circulation system is internally provided with refrigerating working media and a working pair solution consisting of substances which have high solubility in the refrigerating working media.

5. The self-driving heat compression-type heat pump refrigerating method according to claim 2, **characterized in that**, the absorption-type heat pump refrigerating circulation system consists of a working media circulation system and a solution circulation system; the working media circulation system is a circuit formed by connecting a refrigerating working media terminal of a generator (1), a steam compressor (2), a thermal source terminal of the generator (1), a first throttle reducing valve (3), an evaporator (4), the low-pressure compressor (9), the absorber (5), the solution pump (6), the solution heat exchanger (7) and the generator (1) in turn through pipes; the solution circulation system is a circuit formed by connecting the absorber (5), the solution pump (6), the solution heat exchanger (7), the generator (1), the solution heat exchanger (7) and the absorber (5) in turn through pipes; and the heat pump refrigerating circulation system is internally provided with refrigerating working media and working pair solution consisting of substances which have high solubility in the refrigerating working media.

6. The heat compression-type heat pump refrigerating method according to claim 1, **characterized in that**, the heat compression-type heat pump refrigerating circulation system is an adsorption-type heat pump refrigerating circulation system .

7. The self-driving heat compression-type heat pump refrigerating method according to claim 6, **characterized in that**, the heat pump refrigerating circulation system is a circuit formed by connecting a refrigerating working media terminal of an adsorption bed (10), the steam compressor (2), a heat source terminal of the adsorption bed (10), a first valve (12), a first liquid storage (11), a second valve (13), the first throttle reducing valve (3), the evaporator (4), and a refrigerating working media terminal of the adsorption bed (10) in turn through pipes; and the heat pump refrigerating circulation system is provided with working media and working pairs consisting of absorbents which are capable of adsorbing the working media.

8. The self-driving heat compression-type heat pump refrigerating method according to claim 1, **characterized in that**, the heat compression-type heat pump refrigerating circulation system comprises a driving circulation system and a heat pump refrigerating circulation system.

9. The self-driving heat compression-type heat pump refrigerating method according to claim 8, **characterized in that**, the driving circulation system is a circuit formed by connecting the evaporator (4), a condenser (15) and the evaporator (4) through pipes in turn; the driving circulation system is internally pro-

vided with working media; the heat pump refrigerating circulation system consists of the working media circulation system and the solution circulation system; the working media circulation system is a circuit formed by connecting the generator (1), the condenser (15), a working media lifting pump (27), the evaporator (4), the absorber (5), the solution pump (6), the solution heat exchanger (7) and the generator (1) through pipes in turn; the solution circulation system is a circuit formed by connecting the generator (1), the solution heat exchanger (7), the solution pump (6), the absorber (5), the solution heat exchanger (7) and the generator (1) through pipes in turn; the heat pump refrigerating circulation system is internally provided with the refrigerating working media and the working pair solution consisting of substances which have high solubility in the refrigerating working media.

10. The self-driving heat compression-type heat pump refrigerating method according to claim 8, **characterized in that**, the driving circulation system is a circuit formed by connecting a first adsorption bed (10), a second adsorption bed (27) and the first adsorption bed (10) in turn through pipes; the driving circulation system is internally provided with the working media; the heat pump refrigerating circulation system has two paths, one path being formed by connecting the first adsorption bed (10), a valve (28), the condenser (15), the working media lifting pump (26), the evaporator (4), a valve (30) and the second adsorption bed (27) in turn through pipes, and the other path being formed by connecting the second adsorption bed (27), a valve (29), the condenser (15), the working media lifting pump (26), the evaporator (4), a valve (31) and the first adsorption bed (10) in turn through pipes; the heat pump refrigerating circulation system is provided with the working media and the working pairs consisting of substances which are capable of adsorbing the working media; the first adsorption bed is filled in with an absorbent which is absorbed with a certain amount of the working media; and the second adsorption bed is filled with an absorbent which is absorbed with a small amount of the working media.

11. The self-driving heat compression-type heat pump refrigerating method according to claim 8, **characterized in that**, the driving circulation system is a circuit formed by connecting the generator (1), the absorber (5) and the evaporator (1) through pipes in turn; the driving circulation system is internally provided with working media; the heat pump refrigerating circulation system consists of the working media circulation system and the solution circulation system; the working media circulation system is a circuit formed by connecting the generator (1), the condenser (15), a throttle reducing valve (3), the evaporator (4), the absorber (5), the solution pump (6), the solution heat exchanger (7) and the generator (1) through pipes in turn; the solution circulation system is a circuit formed by connecting the generator (1), the solution heat exchanger (7), the absorber (5), the solution pump (6), the solution heat exchanger (7) and the generator (1) through pipes in turn; the heat pump refrigerating circulation system is internally provided with the refrigerating working media and a solution consisting of substances which have high solubility in the refrigerating working media.

12. The self-driving heat compression-type heat pump refrigerating method according to claim 8, **characterized in that**, the driving circulation system is a circuit formed by connecting a first compressor (14), the generator (1), a second throttle reducing valve (16), the condenser (15) and the first compressor (14) in turn though pipes; the heat pump refrigerating circulation system consists of the working media circulation system and the solution circulation system; the driving circulation system is internally provided with the working media; the working media circulation system is a circuit formed by connecting the generator (1), the condenser (15), the first throttle reducing valve (3), the evaporator (4), the absorber (5), the solution pump (6), the solution heat exchanger (7) and the generator (1) in turn through pipes; the solution circulation system is a circuit formed by connecting the absorber (5), the solution pump (6), the solution heat exchanger (7), the generator (1), the solution heat exchanger (7) and the absorber (5) in turn through pipes; the heat pump refrigerating circulation system is internally provided with refrigerating working media and the working pair solution consisting of substances which have high solubility in the refrigerating working media.

13. The self-driving heat compression-type heat pump refrigerating method according to claim 8, **characterized in that**, the driving circulation system is a circuit formed by connecting a first compressor (14), the generating rectifier (8), a second throttle reducing valve (16), the condenser (15) and the first compressor (14) in turn though pipes; the driving circulation system is internally provided with working media; the heat pump refrigerating circulation system consists of the working media circulation system and the solution circulation system; the working media circulation system is a circuit formed by connecting the generating rectifier (8), the condenser (15), the first throttle reducing valve (3), the evaporator (4), the absorber (5), the solution pump (6), the solution heat exchanger (7) and the generator (8) in turn through pipes; the solution circulation system is a circuit formed by connecting the absorber (5), the solution pump (6), the solution heat exchanger (7), the gen-

erating rectifier (1), the solution heat exchanger (7) and the absorber (5) in turn through pipes; the heat pump refrigerating circulation system is internally provided with refrigerating working media and the working pair solution consisting of substances which have high solubility in the refrigerating working media.

14. The self-driving heat compression-type heat pump refrigerating method according to claim 8, **characterized in that**, the driving circulation system is a circuit formed by connecting the first compressor (14), the generator (1), the second throttle reducing valve (16), the condenser (15) and the first compressor (14) in turn through pipes; the driving circulation system is internally provided with the working media; the heat pump refrigerating circulation system consists of the working media circulation system and the solution circulation system; the working media circulation system is a circuit formed by connecting the generator (1), the condenser (15), the firs throttle reducing valve (3), the evaporator (4), the low-pressure compressor (9), the absorber (5), the solution pump (6), the solution heat exchanger (7) and the generator (1) in turn through pipes; the solution circulation system is a circuit formed by connecting the absorber (5), the solution pump (6), the solution heat exchanger (7), the generator (1), the solution heat exchanger (7) and the absorber (5) in turn through pipes; and the heat pump refrigerating circulation system is internally provided with refrigerating working media and working pair solution consisting of substances which have high solubility in the refrigerating working media.

15. The self-driving heat compression-type heat pump refrigerating method according to claim 8, **characterized in that**, the driving circulation system is a circuit formed by connecting the first compressor (14), the absorber (10) serving as the condenser, the second throttle reducing valve (16), the condenser (15) serving as the evaporator and the first compressor (14) in turn through pipes; the driving circulation system is internally provided with the working media; the heat pump refrigerating circulation system is a circuit formed by connecting the absorber (10), the condenser (15), the firs valve (12), the first liquid storage (11), the second valve (13), the first throttle reducing valve (3), the evaporator (4) and the adsorption bed (10) in turn through pipes; and the heat pump refrigerating circulation system is provided with the working media and the working pairs consisting of substances which are capable of adsorbing the working media.

16. The self-driving heat compression-type heat pump refrigerating method according to claim 8, **characterized in that**, the driving circulation system is a circuit formed by connecting a second compressor (18), the generator (1) serving as the condenser, a third throttle reducing valve (17), the absorber (5) serving as the evaporator and the second compressor (18) in turn though pipes; the driving circulation system is internally provided with working media; the heat pump refrigerating circulation system consists of the working media circulation system and the solution circulation system; the working media circulation system is a circuit formed by connecting the generator (1), the condenser (15), the first throttle reducing valve (3), the evaporator (4), the absorber (5), the solution pump (6), the solution heat exchanger (7) and the generator (1) in turn through pipes; the solution circulation system is a circuit formed by connecting the absorber (5), the solution pump (6), the solution heat exchanger (7), the generator (1), the solution heat exchanger (7) and the absorber (5) in turn through pipes; the heat pump refrigerating circulation system is internally provided with refrigerating working media and the working pair solution consisting of substances which have high solubility in the refrigerating working media.

17. The self-driving heat compression-type heat pump refrigerating method according to claim 8, **characterized in that**, the driving circulation system is a circuit formed by connecting a second compressor (18), the generating rectifier (8) serving as the condenser, a third throttle reducing valve (17), the absorber (5) serving as the evaporator and the second compressor (18) in turn though pipes; the driving circulation system is internally provided with working media; the heat pump refrigerating circulation system consists of the working media circulation system and the solution circulation system; the working media circulation system is a circuit formed by connecting the generating rectifier (8), the condenser (15), the first throttle reducing valve (3), the evaporator (4), the absorber (5), the solution pump (6), the solution heat exchanger (7) and the generating rectifier (8) in turn through pipes; the solution circulation system is a circuit formed by connecting the absorber (5), the solution pump (6), the solution heat exchanger (7), the generator (1), the solution heat exchanger (7) and the absorber (5) in turn through pipes; the heat pump refrigerating circulation system is internally provided with refrigerating working media and the working pair solution consisting of substances which have high solubility in the refrigerating working media.

18. The self-driving heat compression-type heat pump refrigerating method according to claim 8, **characterized in that**, the driving circulation system is a circuit formed by connecting a second compressor (18), a steam accumulator (22), a third valve (23),an adsorption bed (10) serving as the condenser, a

fourth valve (19), a second liquid storage (25), a fifth valve (24), a third throttle reducing valve (17), an adsorption bed (10) serving as the evaporator, a sixth valve (20) and the second compressor (18) in turn through pipes; the driving circulation system is internally provided with the working media; the heat pump refrigerating circulation system is a circuit formed by connecting the adsorption bed (10), the condenser (15), the first valve (12), the first liquid storage (11), the second valve (13), the first throttle reducing valve (3), the evaporator (4) and the adsorption bed (10) in turn through pipes; and the heat pump refrigerating circulation system is provided with the working media and the working pairs consisting of the absorbent which is capable of adsorbing the working media.

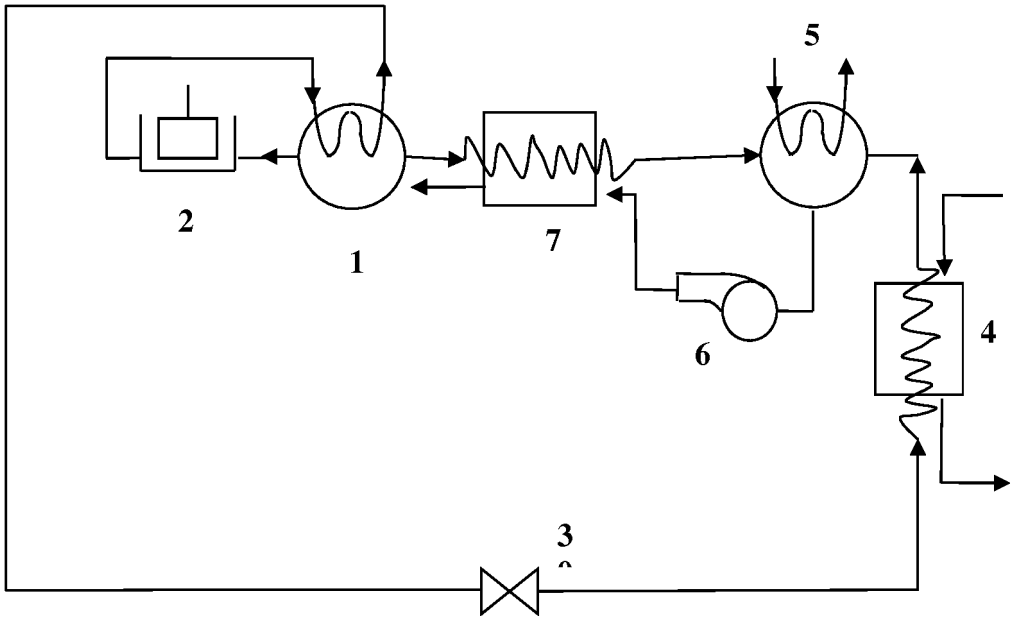

FIG. 1

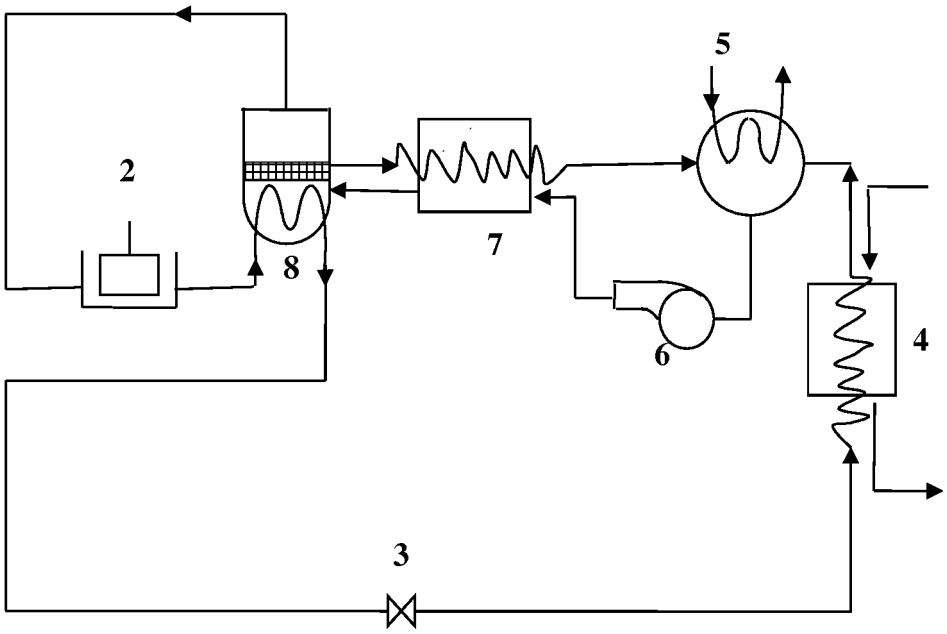

FIG. 2

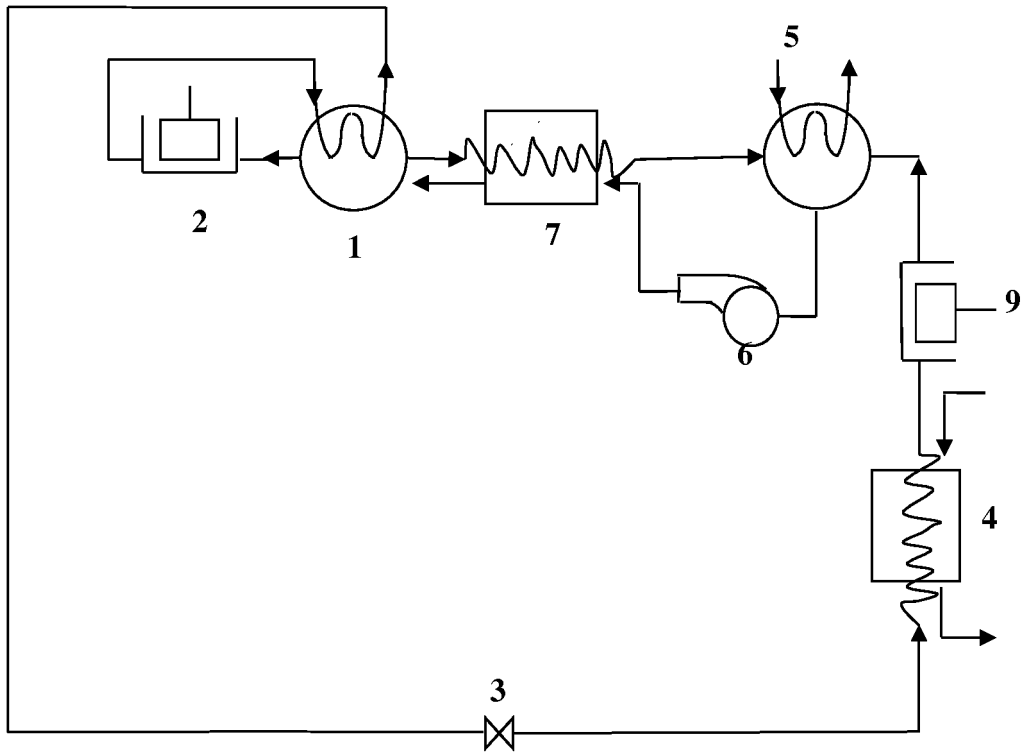

FIG. 3

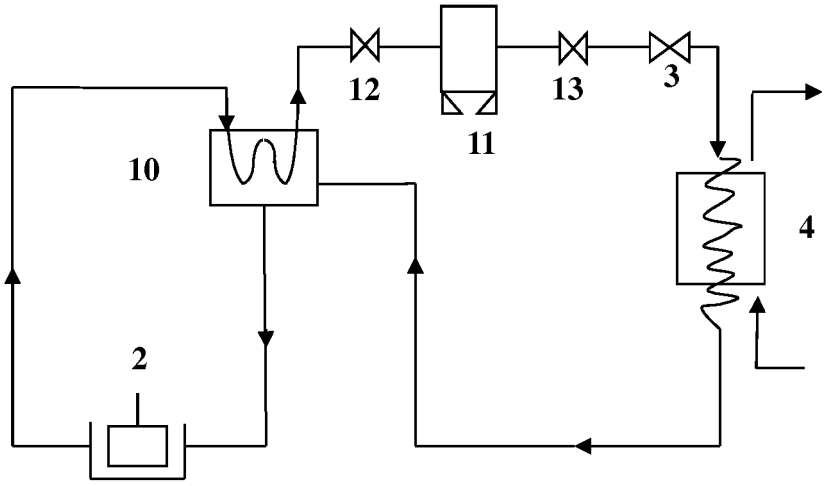

FIG. 4

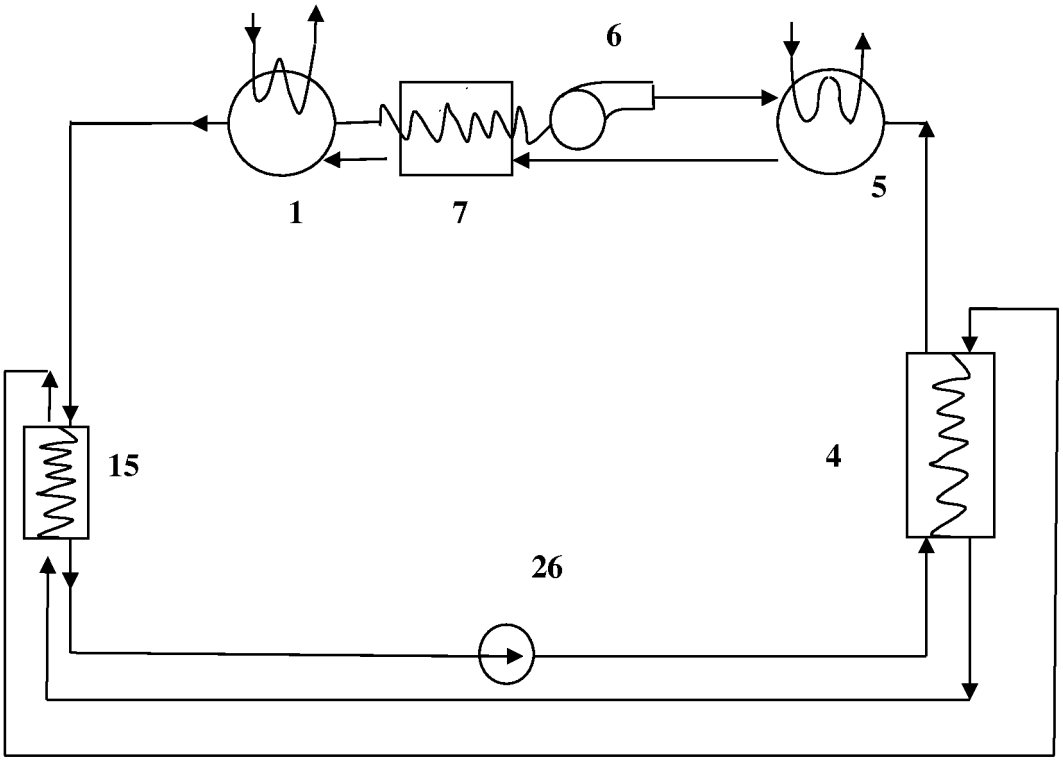

FIG. 5

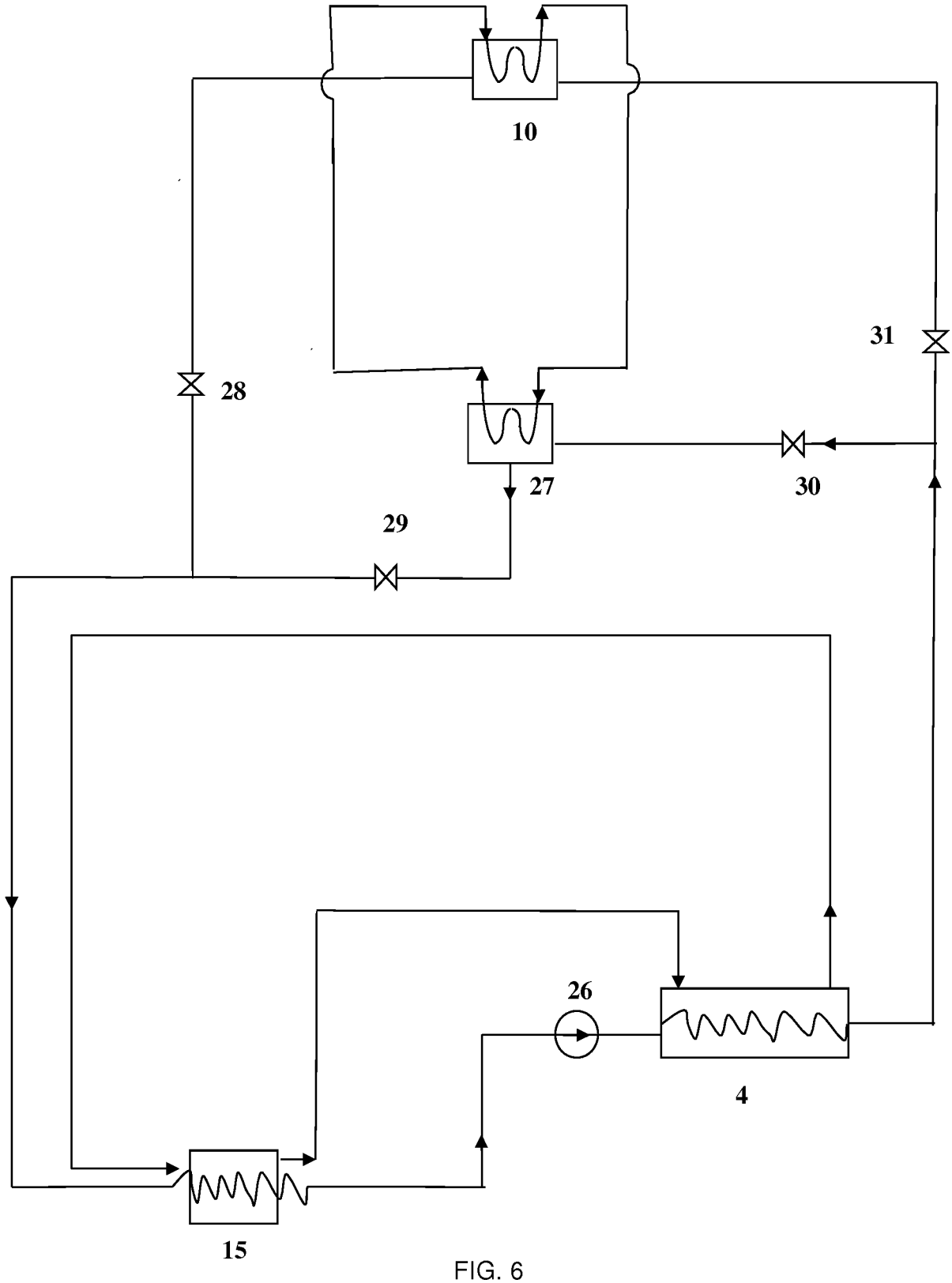

FIG. 6

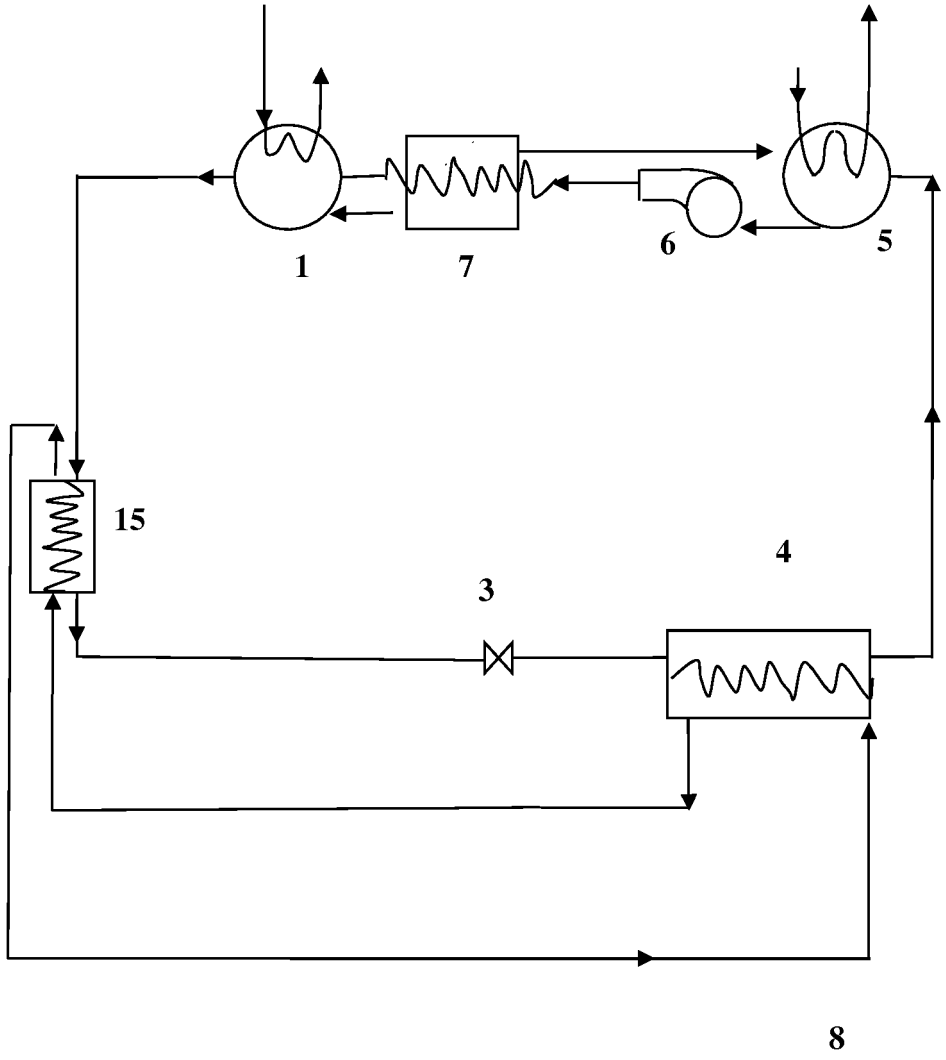

FIG. 7

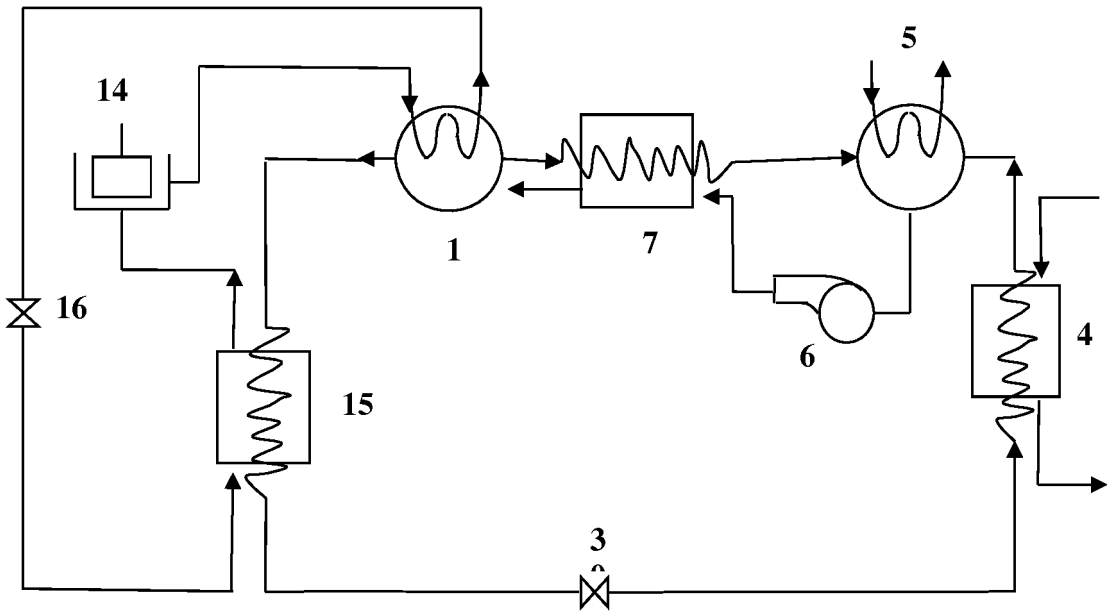

FIG. 8

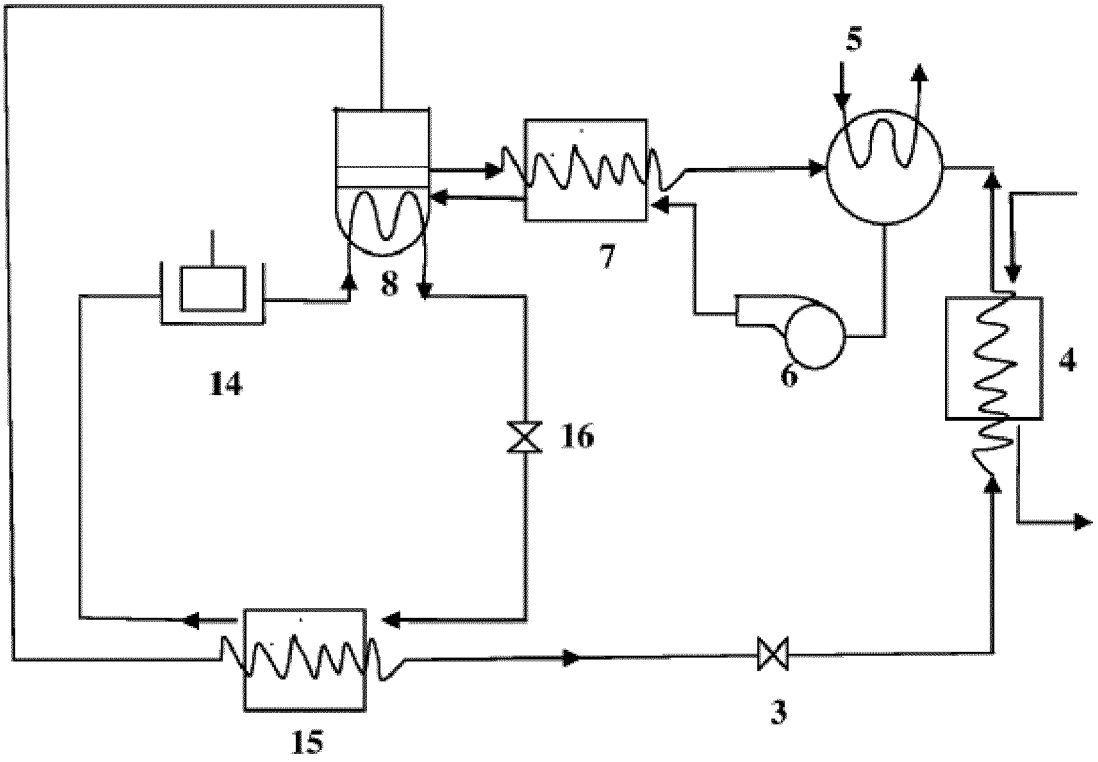

FIG. 9

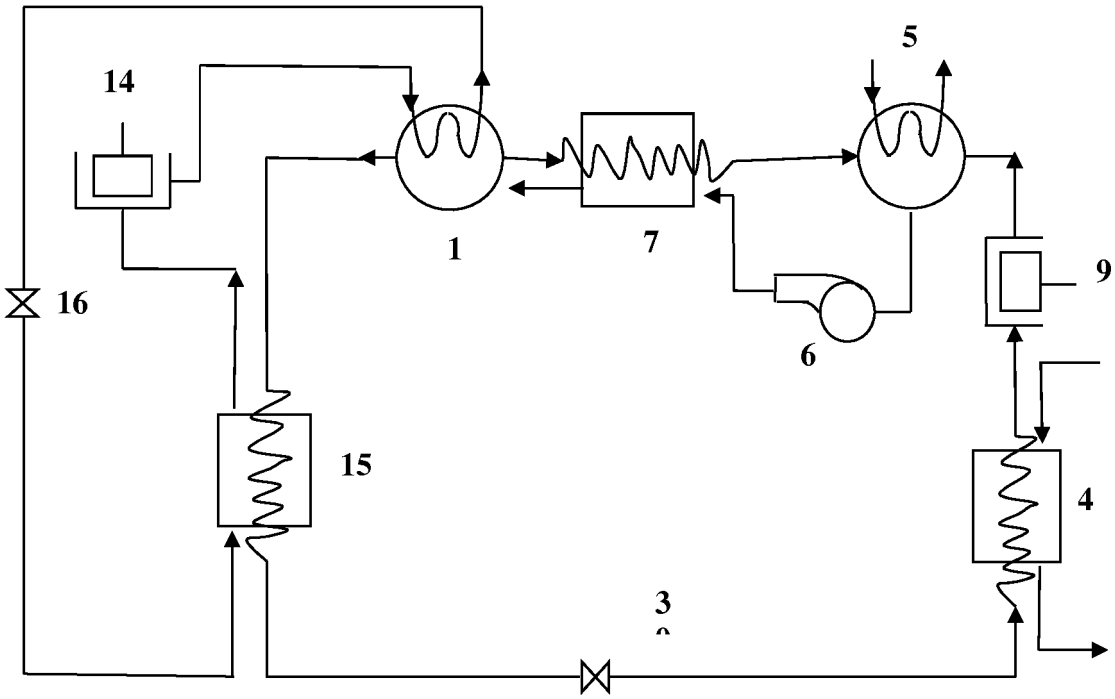

FIG. 10

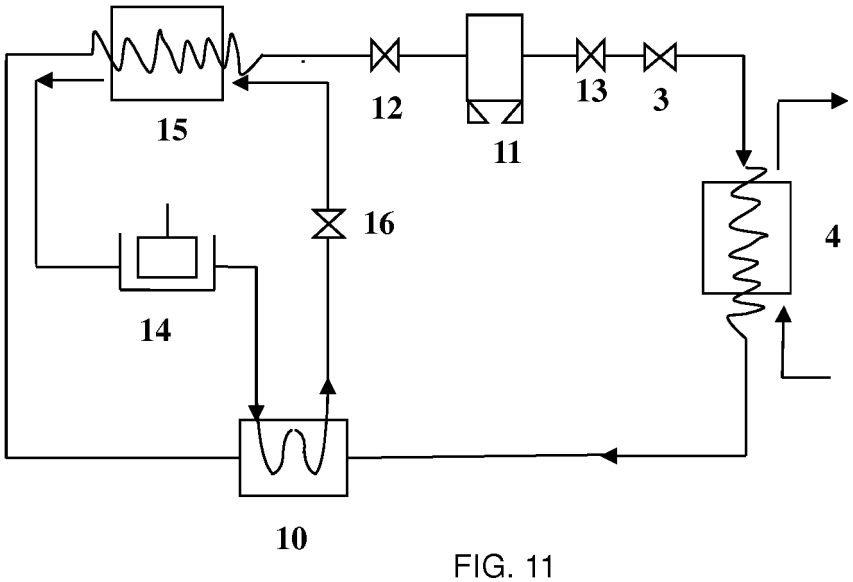

FIG. 11

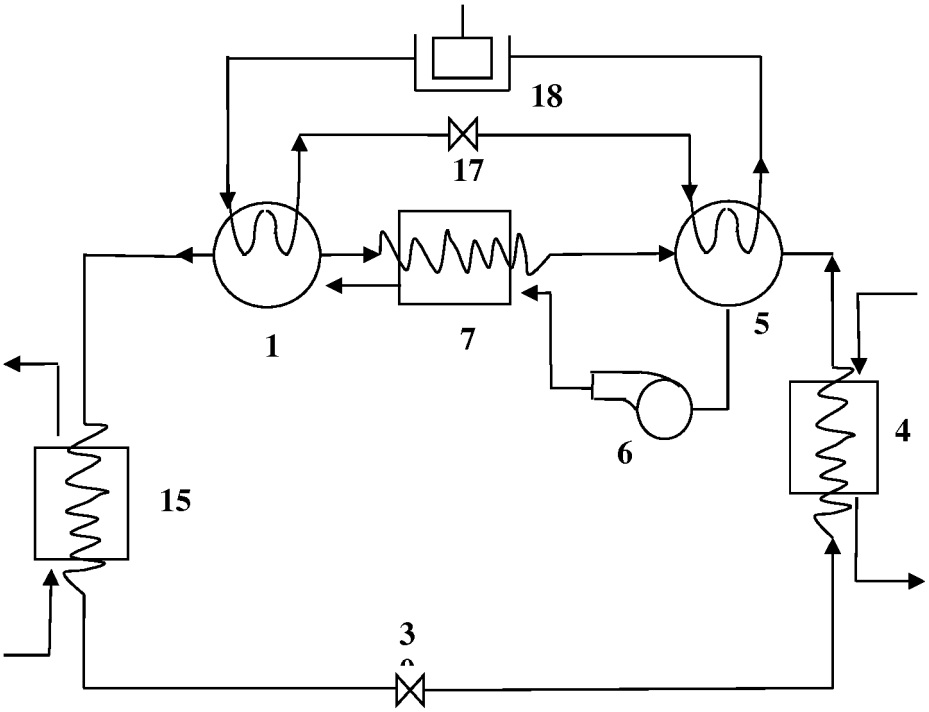

FIG. 12

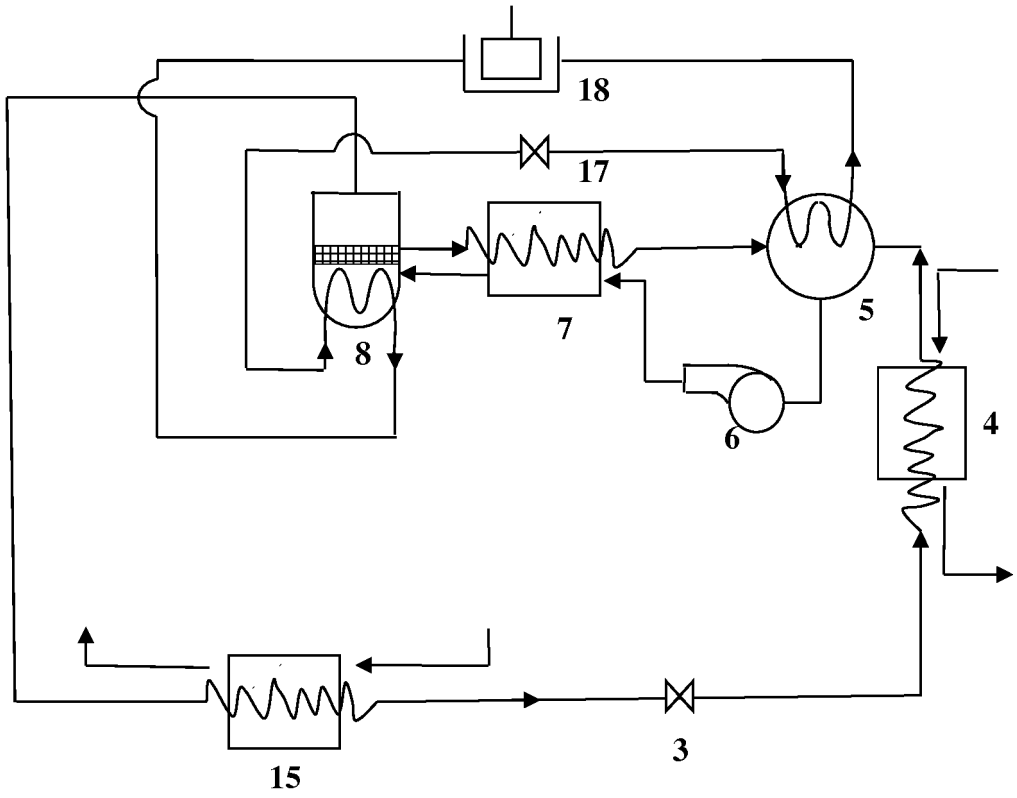

FIG. 13

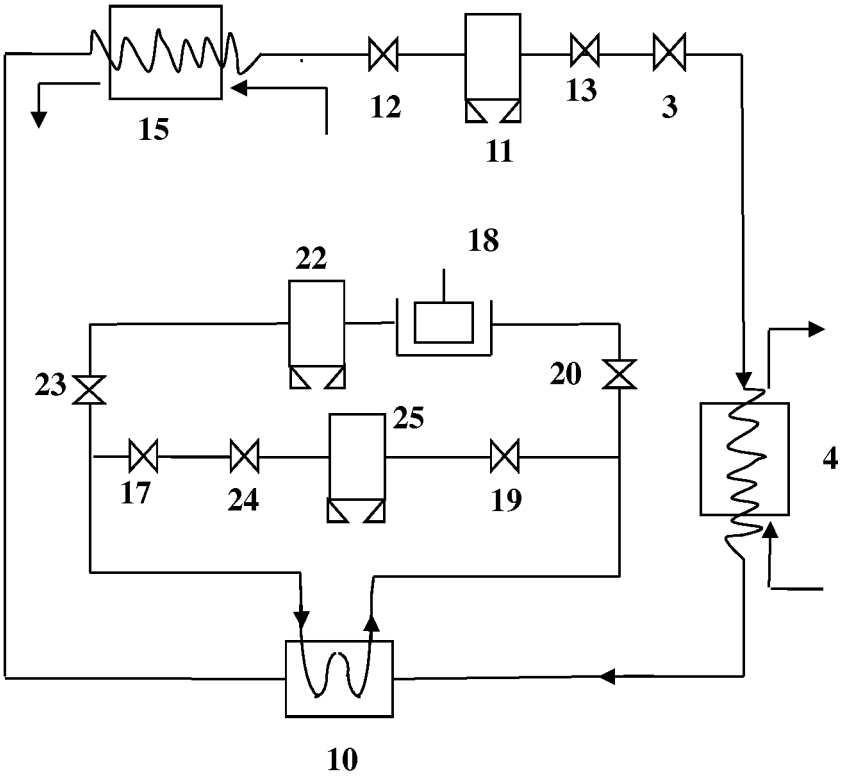

FIG. 14

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2015/079574

A. CLASSIFICATION OF SUBJECT MATTER

F25B 15/00 (2006.01) i; F25B 17/00 (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)

F25B 15, F25B 17, F25B 25, F25B 30, F25B 33

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

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

CNABS, CNTXT, CNKI, SIPOABS, DWPI: ZHOU, Yongkui; condensation heat, absorb+, absorption, adsorb, adsorption, compress+, condensation, heat, generator

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 104034083 A (ZHOU, Yongkui et al.), 10 September 2014 (10.09.2014), description, paragraphs [0023]-[0033], claims 1-21, and figures 1-11	1-8, 12-18
PX	CN 104061710 A (ZHOU, Yongkui), 24 September 2014 (24.09.2014), description, paragraphs [0018]-[0042], claims 1-9, and figures 1-6	1, 2, 6, 8
X	CN 1179529 A (WEN, Sheng), 22 April 1998 (22.04.1998), description, pages 1-3, and figures 1-3	1-3
Y	CN 1179529 A (WEN, Sheng), 22 April 1998 (22.04.1998), description, pages 1-3, and figures 1-3	4
Y	CN 101644506 A (LIU, Hui), 10 February 2010 (10.02.2010), description, page 2, lines 13-28, and page 3, lines 10-11, and figures 1 and 3	4
A	CN 102155813 A (SHANGHAI JIAO TONG UNIVERSITY), 17 August 2011 (17.08.2011), the whole document	1-18
A	US 6536229 B1 (KAWASAKI THERMAL ENG.), 25 March 2003 (25.03.2003), the whole document	1-18

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

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"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
17 July 2015 (17.07.2015)	**10 August 2015 (10.08.2015)**
Name and mailing address of the ISA/CN: State Intellectual Property Office of the P. R. China No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088, China Facsimile No.: (86-10) 62019451	Authorized officer **ZHANG, Linying** Telephone No.: (86-10) **62084194**

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2015/079574

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2003114066 A (EBARA CORP.), 18 April 2003 (18.04.2003), the whole document	1-18

Form PCT/ISA/210 (continuation of second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2015/079574

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN 104034083 A	10 September 2014	None	
CN 104061710 A	24 September 2014	None	
CN 1179529 A	22 April 1998	None	
CN 101644506 A	10 February 2010	None	
CN 102155813 A	17 August 2011	CN 102155813 B	03 October 2012
US 6536229 B1	25 March 2003	EP 1348919 A1	01 October 2003
		WO 0218849 A1	07 March 2002
		EP 1348919 A4	23 April 2008
JP 2003114066 A	18 April 2003	WO 03031882 A1	17 April 2003

Form PCT/ISA/210 (patent family annex) (July 2009)