

FIXED TYPE HEAT EXCHANGE APPARATUS WITH AUTOMATIC FLOW RATE EXCHANGE MODULATION

BACKGROUND OF THE INVENTION

5 (a) Field of the invention

The present invention improves the conventional fixed type double flow circuit heat exchange apparatus to have the operating function of automatic exchange fluid flow rate modulation so as to timely change the temperature distribution status between the fluid and the heat exchanger, or to modulate the composition ratio of the gaseous or liquid state pumping fluid, wherein the heat exchanger inside the fixed type heat exchange apparatus being insertingly installed or coated with penetrating type or absorbing type moisture absorbing material, or the heat exchanger itself having the concurrent dehumidification function constitute the dehumidification effect of the total heat exchange function.

(b) Description of the Prior Art

The conventional double flow circuit heat reclaim device or total heat reclaim device for passing through by the gaseous or liquid state pumping fluid include:

- 20 1) The fixed type fluid heat reclaim device;
- 2) The fixed type fluid total heat reclaim device;
- 3) The rotary type fluid heat reclaim device;
- 4) The rotary type fluid total heat reclaim device.

Said heat reclaim devices are usually selected to operate at a set flow speed, hence its heat exchange efficiency is affected by the temperature difference between input and output sides, or the fluid composition difference between the spaces of the exchange gaseous or liquid state fluids, or the difference of fluid flow speeds and the temperature difference between the spaces of the exchange gaseous or liquid state fluids; further, the conventional heat exchangers are unable to modulate

the heat exchange flow rate so as to modulate the fluid composition difference between the spaces of the exchange gaseous or liquid state fluids, as well as have the automatic modulation function to proactively modulate the heat exchange flow rate thereby achieving energy saving effect by matching with the temperature difference or humidity difference.

SUMMARY OF THE INVENTION

The present invention discloses that the conventional fixed type double flow circuit heat exchange apparatus is made to have the operating function having automatic exchange fluid flow rate modulation, thereby modulating the flow rate, temperature distribution, humidity distribution, and gaseous or liquid state compositions of the exchange fluid.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a schematic view showing the operating principles of the conventional double flow circuit heat exchange apparatus or total heat exchange apparatus.

Fig. 2 is the first structural block schematic view of the embodiment of the present invention capable of automatically operatively controlling the flow rate of heat exchange fluid.

Fig. 3 is the second structural block schematic view of the embodiment of the present invention capable of automatically operatively controlling the flow rate of heat exchange fluid.

Fig. 4 is the first structural block schematic view of the embodiment showing that the present invention is further installed with the temperature detecting device in the heat exchanger application.

Fig. 5 is the second structural block schematic view of the embodiment showing that the present invention is further installed with the temperature detecting device in the heat exchanger application.

Fig. 6 is the first schematic view of the structural block operating

principle of the embodiment showing that the present invention is further installed with the temperature detecting device and the humidity detecting device in the total heat exchanger application.

Fig. 7 is the second schematic view of the structural block operating principle of the embodiment showing that the present invention is further installed with the temperature detecting device and the humidity detecting device in the total heat exchanger application.

Fig. 8 is the schematic view of the structural block operating principle showing that the present invention is further installed with the temperature detecting device and the gaseous or liquid state fluid composition detecting device.

Fig. 9 is the schematic view of the structural block operating principle showing that the present invention is further installed with the temperature detecting device and the gaseous or liquid state fluid composition detecting device.

Fig. 10 is the schematic view of the structural block operating principle showing that the present invention is further installed with the temperature detecting device, the humidity detecting device, and the gaseous or liquid state fluid composition detecting device.

Fig. 11 is the schematic view of the structural block operating principle showing that the present invention is further installed with the temperature detecting device, the humidity detecting device, and the gaseous or liquid state fluid composition detecting device.

DESCRIPTION OF MAIN COMPONENT SYMBOLS

11: Temperature detecting device

21: Humidity detecting device

31: Gaseous or liquid state fluid composition detecting device

100: Heat exchanger

111, 112: Bidirectional fluid pump capable of producing negative pressure

or positive pressure

120a, 120b, 120c, 120d: Unidirectional fluid pump

123: Double flow circuit fluid pumping device

200: Total heat exchanger

5 300: power source

250: Operative control device

1000: Heat exchange apparatus

a, b, c, d: Fluid port

10 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Fig. 1 is a schematic view showing the operating principles of the conventional double flow circuit heat exchange apparatus or total heat exchange apparatus; as shown in Fig. 1, the conventional double flow circuit heat exchange apparatus is usually installed with two fluid
15 pumping devices in different flow directions and four fluid ports for pumping the two fluid streams of temperature difference in different flow directions through the two sides of the heat exchanger (100) inside the heat exchange apparatus (1000), wherein the two fluid streams are respectively pumped into the heat exchanger (100) inside the heat
20 exchange apparatus (1000) via the two fluid ports at the two different ends and are discharged via the fluid ports on the other side; such as that by taking the example of the heat exchange apparatus for indoor to outdoor air exchange in winter times, the indoor higher temperature air flow is pumped into the heat exchange apparatus (1000) via fluid port (a), and
25 passes through the flow circuit on one side of the heat exchanger (100), then is discharged to the outside via fluid port (b), and the lower temperature outdoor fresh air is pumped into the heat exchange apparatus (1000) via fluid port (c) from the outside, passes through the flow circuit on the other side of the heat exchanger (100), and then is discharged to the
30 indoor via fluid port (d), wherein fluid port (a) and fluid port (d) are

disposed at the side passing to the indoor, while the fluid port (c) and fluid port (b) are disposed at the side passing to the outdoor; in stable operation, one side of the heat exchanger (100) inside the heat exchange apparatus (1000) between fluid port (a) and fluid port (b) forms the temperature distribution from higher high temperature at fluid port (a) to gradually reduce to the lower temperature at fluid port (b), and the other side of the heat exchanger (100) between fluid port (c) and fluid port (d) forms the temperature distribution from the lower temperature at fluid port (c) to gradually increased to the higher temperature at fluid port (d), while the heat exchange efficiency is decided by the fluid property, flow speed and characteristics of the heat exchanger in the heat exchange apparatus as well as the temperature difference of the two side fluids; if the heat exchanger being insertingly installed or coated with penetrating type, or absorbing type moisture absorbing material or the heat exchanger itself having the concurrent dehumidification function are applied to constitute the total heat exchanger, then the above said fluids in two different flow directions are formed a stable status of temperature difference and humidity saturation difference at the two inlet/outlet ends and the two sides for passing by the fluid in different flow directions of the total heat exchanger (200) inside the heat exchange apparatus (1000).

The present invention discloses that the conventional fixed type double flow circuit heat exchange apparatus is made to have the operating function of the fixed type double flow circuit heat exchange apparatus having automatic exchange fluid flow rate modulation thereby modulating the flow rate, temperature distribution, humidity distribution, and gaseous or liquid state compositions of the exchange fluid.

Fig. 2 is the first structural block schematic view of the embodiment of the present invention capable of automatically operatively controlling the flow rate of heat exchange fluid;

As shown in Fig. 2, the present invention is mainly constituted by that

the fluid port (b) and the fluid port (d) among the fluid port (a), fluid port (b), fluid port (c), and fluid port (d) of the double flow circuit of the heat exchange apparatus (1000) are respectively installed with the bidirectional fluid pumps (111, 112) capable of producing negative pressure or positive pressure to constitute the double flow circuit fluid pumping device (123), and it is through the power of power source (300) to drive the bidirectional fluid pumps (111, 112) being capable of producing negative pressure or positive pressure of the double flow circuit fluid pumping device (123) by the operative control of the operative control device (250) to pump the two fluids passing through the heat exchanger (100) in different flow directions, wherein:

The heat exchange apparatus (1000) and the bidirectional fluid pumps (111, 112) capable of producing negative pressure or positive pressure are integrally combined or separately installed, and the two bidirectional fluid pumps (111, 112) capable of producing negative pressure or positive pressure constituting the double flow circuit fluid pumping device (123) function are respectively installed to fluid port (b) and fluid port (d) so as to pump the fluid in different pumping flow directions; said bidirectional fluid pumps (111, 112) capable of producing negative pressure or positive pressure are respectively driven by individual electric motors or are commonly driven by the same motor, wherein they are operatively controlled by the operative control device (250) to operate in one or more than one functional modes of the following: **1)** the two bidirectional fluid pumps (111, 112) are pumped in negative pressure to allow the two fluid streams passing through the heat exchanger (100) in different pumping flow directions; **2)** the two bidirectional fluid pumps (111, 112) are pumped in positive pressure to allow the two fluid streams passing through the heat exchanger (100) in different pumping flow directions;

-- The double flow circuit fluid pumping device (123): The fluid port (b) and fluid port (d) among the fluid port (a), fluid port (b), fluid port (c),

and fluid port (d) of the double flow circuit are respectively installed with the bidirectional fluid pumps (111, 112) capable of producing positive or negative pressure to constitute the double flow circuit fluid pumping device (123), thereby by the operative control device (250) to operatively
5 control the flow rate of the heat exchange fluids pumped by the double flow circuit fluid pumping device (123) driven by the power source (300);
-- The power source (300): It is the device including AC or DC city power system or independent power supply device to provide power source for the operation of the fixed type heat exchange apparatus with automatic
10 exchange flow rate modulation;
-- The operative control device (250): It is constituted by electromechanical components, solid state electronic components, or microprocessors and related software and operative control interfaces to operatively control the bidirectional fluid pumps (111, 112) of the double
15 flow circuit fluid pumping device (123) by: **1)** operatively controlling the switching functional operation; or **2)** operatively controlling the flow rate of the pumping heat exchange fluid; or **3)** operatively controlling the temperature distribution status between the fluid and the heat exchanger (100) inside the heat exchange apparatus (1000); or **4)** integrally
20 operatively controlling at least two of said items 1), 2) & 3) in combination;
-- The heat exchanger (100): It is the heat exchanger in conventional heat exchange structure having two internal flow circuits and the heat absorbing or dissipating function, wherein the two flow circuits
25 respectively individually have two fluid ports to respectively pump the fluid, so that to enable heat exchange between the two fluids;

The timing to operatively control the flow rate of heat exchange fluid is that: **1)** the fluid flow rate and change timing are preset in the open loop operative control; or **2)** It is randomly manually operatively controlled;

30 In addition, the bidirectional fluid pump (111) and the bidirectional

fluid pump (112) can also be installed to fluid ports (a, d) or installed to fluid ports (b, c) in said embodiment of Fig. 2, wherein one bidirectional fluid pump is pumped in positive pressure while the other bidirectional fluid pump is pumped in negative pressure so as to allow the two fluid streams to pass through the heat exchanger (100) in different pumping flow directions.

Fig. 3 is the second structural block schematic view of the embodiment of the present invention capable of automatically operatively controlling the flow rate of heat exchange fluid;

As shown in Fig. 3, the present invention is mainly constituted by that the unidirectional fluid pumps (120a, 120b, 120c, 120d) capable of pumping in unidirectional flow directions are respectively installed to the fluid port (a), fluid port (b), fluid port (c), and fluid port (d) of the two flow circuits for passing the two flow circuit fluid in the heat exchange apparatus (1000) to constitute the double flow circuit fluid pumping device (123); whereby by the power from the power source via the operative control device (250) to operatively control the two fluid streams being pumped by the double flow circuit fluid pumping device (123) to pass through the heat exchanger (100) in different flow directions, wherein:

The heat exchange apparatus (1000) and unidirectional fluid pumps (120a, 120b, 120c, 120d) are integrally combined or separately installed to constitute the functions of the double flow circuit fluid pumping device (123); the four unidirectional fluid pumps (120a, 120b, 120c, 120d) are respectively installed to fluid port (a), fluid port (b), fluid port (c), and fluid port (d) for pumping the fluid, wherein the unidirectional fluid pumps (120a, 120c) being installed to fluid port (a) and fluid port (c) are one group to be driven by the individual electric motors or driven by a common motor, while the unidirectional fluid pumps (120b, 120d) being installed to fluid port (b) and fluid port (d) are another group to be driven

by the individual electric motors or driven by a common motor, wherein they are operatively controlled by the operative control device (250) to have one or more than one functional modes of the structural types and operating methods of the following: **1)** the unidirectional fluid pumps are

5 structurally distributed to pump the fluid in negative pressure thereby allowing the two fluid streams to appear in different flow directions; or **2)** the unidirectional fluid pumps are structurally distributed to pump the fluid in positive pressure thereby allowing the two fluid streams to appear in different flow directions; or **3)** The different fluid pumps among part or

10 all of the unidirectional fluid pumps (120a, 120b, 120c, 120d) are pumped in positive pressure and negative pressure to form auxiliary pumping in the same flow circuit and allow the two fluid streams to be pumped in different flow directions; in the functional mode operations of said items 1), 2) & 3), the flow directions of the two fluid streams passing through

15 the two sides of the heat exchanger (100) inside the heat exchange apparatus (1000) are kept opposite to each other;

-- The double flow circuit fluid pumping device (123): The fluid port (a), fluid port (b), fluid port (c), and fluid port (d) of the double flow circuit are respectively installed with the unidirectional fluid pumps (120a, 120b,

20 120c, 120d) in unidirectional flow pumping to constitute the double flow circuit fluid pumping device (123), thereby by the operative control device (250) to operatively control the flow rate of the heat exchange fluids pumped by the double flow circuit fluid pumping device (123) driven by the power source (300);

25 -- The power source (300): It is the device including AC or DC city power system or independent power supply device to provide power source for the operation of the fixed type heat exchange apparatus with automatic exchange flow rate modulation;

-- The operative control device (250): It is constituted by

30 electromechanical components, solid state electronic components, or

microprocessors and related software and operative control interfaces to operatively control the unidirectional fluid pumps (120a, 120b, 120c, 120d) of the double flow circuit fluid pumping device (123) by: **1)** operatively controlling the switching functional operation; or **2)**
5 operatively controlling the flow rate of the pumping heat exchange fluid; or **3)** operatively controlling the temperature distribution status between the fluid and the heat exchanger (100) in the heat exchange apparatus (1000); or **4)** integrally operatively controlling at least two of said items 1), 2) & 3) in combination;

10 -- The heat exchanger (100): It is the heat exchanger in conventional heat exchange structure having two internal flow circuits and the heat absorbing or dissipating function, wherein the two flow circuits respectively individually have two fluid ports to respectively pump the fluid, so that to enable heat exchange between the two fluids;

15 The timing to operatively control the flow rate of heat exchange fluid is that: **1)** the fluid flow rate and change timing are preset in the open loop operative control; or **2)** It is randomly manually operatively controlled.

Fig. 4 is the first structural block schematic view of the embodiment showing that the present invention is further installed with the temperature
20 detecting device in the heat exchanger application;

As shown in Fig. 4, the present invention is mainly constituted by that the fluid port (b) and fluid port (d) among the fluid port (a), fluid port (b), fluid port (c), and fluid port (d) of the double flow circuit of the heat exchange apparatus (1000) are respectively installed with the bidirectional
25 fluid pumps (111, 112) capable of producing negative pressure or positive pressure to constitute the double flow circuit fluid pumping device (123), and the two fluid streams are pumped by the bidirectional fluid pumps (111, 112) capable of producing negative pressure or positive pressure of the double flow circuit fluid pumping device (123) being driven by the
30 power source (300) and operatively controlled by the operative control

device (250) to pass through the heat exchanger (100) in different flow directions, wherein:

- The heat exchange apparatus (1000) and the bidirectional fluid pumps (111, 112) capable of producing negative pressure or positive pressure are integrally combined or separately installed; the two bidirectional fluid pumps (111, 112) capable of producing negative pressure or positive pressure constituting the functions of double flow circuit fluid pumping device (123) are respectively installed to fluid port (b) and fluid port (d) for pumping the fluid in different pumping flow directions, wherein said bidirectional fluid pumps (111, 112) capable of producing negative pressure or positive pressure being driven by the individual electric motors or driven by a common motor are operatively controlled by the operative control device (250) to have one or more than one functional mode operations of the following as needed: **1)** the two bidirectional fluid pumps (111, 112) are pumped in negative pressure to allow the two fluid streams passing through the heat exchanger (100) in different pumping flow directions; **2)** the two bidirectional fluid pumps (111, 112) are pumped in positive pressure to allow the two fluid streams passing through the heat exchanger (100) in different pumping flow directions;
- At least one temperature detecting device (11) is installed at the position capable of directly or indirectly detecting the temperature variation of the exchange fluid, wherein the detected signals are referred by the operative control device (250) to operatively control the double flow circuit fluid pumping device (123) for determining the flow rate operative control timing of the pumping exchange fluid;
- The double flow circuit fluid pumping device (123): The fluid port (b) and fluid port (d) among the fluid port (a), fluid port (b), fluid port (c), and fluid port (d) of the double flow circuit are respectively installed with the bidirectional fluid pumps (111, 112) capable of producing negative pressure or positive pressure to constitute the double flow circuit fluid

pumping device (123), thereby by the operative control device (250) to operatively control the flow rate of the heat exchange fluids pumped by the double flow circuit fluid pumping device (123) driven by the power source (300);

5 -- The power source (300): It is the device including AC or DC city power system or independent power supply device to provide power source for the operation of the fixed type heat exchange apparatus with automatic exchange flow rate modulation;

-- The operative control device (250): It is constituted by
10 electromechanical components, solid state electronic components, or microprocessors and related software and operative control interfaces to operatively control the bidirectional fluid pumps (111, 112) of the double flow circuit fluid pumping device (123) by: 1) operatively controlling the switching functional operation; or 2) operatively controlling the flow rate
15 of the pumping heat exchange fluid; or 3) operatively controlling the temperature distribution status between the fluid and the heat exchanger (100) inside the heat exchange apparatus (1000); or 4) integrally operatively controlling at least two of said items 1), 2) & 3) in combination;

20 -- The heat exchanger (100): It is the heat exchanger in conventional heat exchange structure having two internal flow circuits and the heat absorbing or dissipating function, wherein the two flow circuits respectively individually have two fluid ports to respectively pump the fluid, so that to enable heat exchange between the two fluids;

25 The timing to operatively control the flow rate of heat exchange fluid is that: 1) the fluid flow rate and change timing are preset in the open loop operative control; or 2) It is randomly manually operatively controlled; or 3) at least one temperature detecting device (11) is installed at the position capable of directly or indirectly detecting the temperature variation of the
30 exchange fluid, wherein the detected signal is used as the reference to

operatively control the flow rate operating timing of the pumping exchange fluid;

Further, the bidirectional fluid pump (111) and the bidirectional fluid pump (112) can also be installed to fluid ports (a, d), or installed to fluid ports (b, c) in the embodiment of Fig. 4, wherein one bidirectional fluid pump is pumped in positive pressure while the other bidirectional fluid pump is pumped in negative pressure so as to allow the two fluid streams to pass through the heat exchanger (100) in different pumping flow directions.

Fig. 5 is the second structural block schematic view of the embodiment showing that the present invention is further installed with the temperature detecting device in the heat exchanger application;

As shown in Fig. 5, the present invention is mainly constituted by that unidirectional fluid pumps (120a, 120b, 120c, 120d) capable of pumping in unidirectional flow directions are respectively installed to the fluid port (a), fluid port (b), fluid port (c), and fluid port (d) of the two flow circuit for passing the two double flow circuit fluids in the heat exchange apparatus (1000) to constitute the double flow circuit fluid pumping device (123); whereby by the power from the power source via the operative control device (250) to operatively control the two fluid streams being pumped by the double flow circuit fluid pumping device (123) to pass through the heat exchanger (100) in different flow directions, wherein:

The heat exchange apparatus (1000) and unidirectional fluid pumps (120a, 120b, 120c, 120d) are integrally combined or separately installed to constitute the functions of the double flow circuit fluid pumping device (123); the four unidirectional fluid pumps (120a, 120b, 120c, 120d) are respectively installed to fluid port (a), fluid port (b), fluid port (c), and fluid port (d) for pumping the fluid, wherein the unidirectional fluid pumps (120a, 120c) being installed to fluid port (a) and fluid port (c) are

one group to be driven by the individual electric motors or driven by a common motor, while the unidirectional fluid pumps (120b, 120d) being installed to fluid port (b) and fluid port (d) are another group to be driven by the individual electric motors or driven by a common motor, wherein

5 they are operatively controlled by the operative control device (250) to have one or more than one functional modes of the structural types and operating methods of the following: 1) the unidirectional fluid pumps are structurally distributed to pump the fluid in negative pressure thereby allowing the two fluid streams to appear in different flow directions; or 2)

10 the unidirectional fluid pumps are structurally distributed to pump the fluid in positive pressure thereby allowing the two fluid streams to appear in different flow directions; 3) The different fluid pumps among part or all of the unidirectional fluid pumps (120a, 120b, 120c, 120d) are pumped in positive pressure and negative pressures to form auxiliary pumping in the

15 same flow circuit and allow the two fluid streams to be pumped in different flow directions; in the functional mode operations of said items 1), 2) & 3), the flow directions of the two fluid streams passing through the two sides of the heat exchanger (100) inside the heat exchange apparatus (1000) are kept opposite to each other;

20 -- At least one temperature detecting device (11) is installed at the position capable of directly or indirectly detecting the temperature variation of the exchange fluid, wherein the detected signals are referred by the operative control device (250) to operatively control the double flow circuit fluid pumping device (123) for determining the flow rate

25 operating timing of the pumping exchange fluid;

-- The double flow circuit fluid pumping device (123): The fluid port (a), fluid port (b), fluid port (c), fluid port (d) of the double flow circuit are respectively installed with the unidirectional fluid pumps (120a, 120b, 120c, 120d) in unidirectional flow pumping to constitute the double flow

30 circuit fluid pumping device (123), thereby by the operative control

device (250) to operatively control the flow rate of the heat exchange fluids pumped by the double flow circuit fluid pumping device (123) driven by the power source (300);

-- The power source (300): It is the device including AC or DC city power system or independent power supply device to provide power source for the operation of the fixed type heat exchange apparatus with automatic exchange flow rate modulation;

-- The operative control device (250): It is constituted by electromechanical components, solid state electronic components, or microprocessors and related software and operative control interfaces to operatively control unidirectional fluid pumps (120a, 120b, 120c, 120d) of the double flow circuit fluid pumping device (123) by: 1) operatively controlling the switching functional operation; or 2) operatively controlling the flow rate of the pumping heat exchange fluid; or 3) operatively controlling the temperature distribution status between the fluid and the heat exchanger (100) inside the heat exchange apparatus (1000); or 4) integrally operatively controlling at least two of said items 1), 2) & 3) in combination;

-- The heat exchanger (100): It is the heat exchanger in conventional heat exchange structure having two internal flow circuits and the heat absorbing or dissipating function, wherein the two flow circuits respectively individually have two fluid ports to respectively pump the fluid, so that to enable heat exchange between the two fluids;

The timing to operatively control the flow rate of heat exchange fluid is that: 1) the fluid flow rate and change timing are preset in the open loop operative control; or 2) it is randomly manually operatively controlled; or 3) at least one temperature detecting device (11) is installed at the position capable of directly or indirectly detecting the temperature variation of the exchange fluid, wherein the detected signal is used as the reference to operatively control the flow rate operating timing of the pumping

exchange fluid.

Fig. 6 is the first schematic view of the structural block operating principle of the embodiment showing that the present invention is further installed with the temperature detecting device and the humidity detecting
5 device in the total heat exchanger application;

As shown in Fig. 6, the present invention is mainly constituted by that the bidirectional fluid pumps (111, 112) capable of producing negative pressure or positive pressure are respectively installed to the fluid port (b) and fluid port (d) among the fluid port (a), fluid port (b), fluid port (c),
10 and fluid port (d) of the double flow circuit of the heat exchange apparatus (1000) to constitute the double flow circuit fluid pumping device (123); the two fluid streams are pumped by the bidirectional fluid pumps (111, 112) capable of producing negative pressure or positive pressure of the double flow circuit fluid pumping device (123) being driven by the power
15 source (300) and operatively controlled by the operative control device (250) in different flow directions; wherein:

The heat exchange apparatus (1000) and the bidirectional fluid pumps (111, 112) capable of producing negative pressure or positive pressure are integrally combined or separately installed; the two bidirectional fluid
20 pumps (111, 112) capable of producing negative pressure or positive pressure constituting the functions of double flow circuit fluid pumping device (123) are respectively installed to fluid port (b) and fluid port (d) for pumping the fluid in different pumping flow directions, wherein said bidirectional fluid pumps (111, 112) capable of producing negative
25 pressure or positive pressure being driven by the individual electric motors or driven by a common motor are operatively controlled by the operative control device (250) to have one or more than one functional mode operations of the following as needed: 1) the two bidirectional fluid pumps (111, 112) are pumped in negative pressure to allow the two fluid
30 streams passing through the total heat exchanger (200) in different

pumping flow directions; 2) the two bidirectional fluid pumps (111, 112) are pumped in positive pressure to allow the two fluid streams passing through the total heat exchanger (200) in different pumping flow directions; in the functional mode operations of said items 1) & 2), the
5 flow directions of the two fluid streams passing through the two sides of the total heat exchanger (200) inside the heat exchange apparatus (1000) are kept opposite to each other;

-- At least one temperature detecting device (11) or at least one humidity detecting device (21) is installed at the position capable of directly or
10 indirectly detecting the temperature variation or humidity variation, including installing both or at least one type of said detecting devices, wherein the detected signals are referred by the operative control device (250) to operatively control the double flow circuit fluid pumping device (123) for determining the flow rate operating timing of the pumping
15 exchange fluid;

Said temperature detecting device (11) and humidity detecting device (21) are integrally commonly combined or individually separately installed;

-- The double flow circuit fluid pumping device (123): The fluid port (b) and fluid port (d) of the double flow circuit are respectively installed with
20 the bidirectional fluid pumps (111, 112) capable of producing negative pressure or positive pressure to constitute the double flow circuit fluid pumping device (123), thereby by the operative control device (250) to operatively control the flow rate of the heat exchange fluids pumped by
25 the double flow circuit fluid pumping device (123) driven by the power source (300);

-- The power source (300): It is the device including AC or DC city power system or independent power supply device to provide power source for the operation of the fixed type heat exchange apparatus with automatic
30 exchange flow rate modulation;

-- The operative control device (250): It is constituted by electromechanical components, solid state electronic components, or microprocessors and related software and operative control interfaces to operatively control the bidirectional fluid pumps (111, 112) of the double flow circuit fluid pumping device (123) by: 1) operatively controlling the switching functional operation; or 2) operatively controlling the flow rate of the pumping heat exchange fluid; or 3) operatively controlling the temperature distribution status between the fluid and the total heat exchanger (200) inside the heat exchange apparatus; or 4) operatively controlling the humidity distribution status in the total heat exchanger (200); or 5) integrally operatively controlling at least two of said items 1), 2), 3) & 4) in combination;

-- The total heat exchanger (200): It is the total heat exchanger in conventional total heat exchange structure having two internal flow circuits and the heat absorbing or dissipating function as well as the dehumidifying or humidifying functions, wherein the two flow circuits respectively individually have two fluid ports to respectively pump the fluid, so that to enable heat exchange and dehumidification functions between the two fluids;

The timing to operatively control the flow rate of heat exchange fluid is that: 1) the fluid flow rate and change timing are preset in the open loop operative control; or 2) it is randomly manually operatively controlled; or 3) both or either one of at least one temperature detecting device (11) and at least one humidity detecting device (21) are installed at the positions capable of directly or indirectly detect the temperature variation or humidity variation, wherein the detected signals are referred for operatively controlling the flow rate operating timing of the pumping exchange fluid;

Further, the bidirectional fluid pump (111) and the bidirectional fluid pump (112) can also be installed to fluid ports (a, d), or installed to fluid

ports (b, c) in the embodiment of Fig. 6, wherein one bidirectional fluid pump is pumped in positive pressure while the other bidirectional fluid pump is pumped in negative pressure so as to allow the two fluid streams to pass through the total heat exchanger (200) in different pumping flow
5 directions.

Fig. 7 is the second schematic view of the structural block operating principle of the embodiment showing that the present invention is further installed with the temperature detecting device and the humidity detecting device in the total heat exchanger application;

10 As shown in Fig. 7, the present invention is mainly constituted by that unidirectional fluid pumps (120a, 120b, 120c, 120d) capable of pumping in unidirectional flow directions are respectively installed to the fluid port (a), fluid port (b), fluid port (c), and fluid port (d) of the two flow circuit for passing the two double flow circuit fluids in the heat exchange
15 apparatus (1000) to constitute the double flow circuit fluid pumping device (123); whereby by the power from the power source via the operative control device (250) to operatively control the two fluid streams being pumped by the double flow circuit fluid pumping device (123) to pass through the heat exchanger (100) in different flow directions,
20 wherein:

The heat exchange apparatus (1000) and unidirectional fluid pumps (120a, 120b, 120c, 120d) are integrally combined or separately installed to constitute the functions of the double flow circuit fluid pumping device (123); the four unidirectional fluid pumps (120a, 120b, 120c, 120d) are
25 respectively installed to fluid port (a), fluid port (b), fluid port (c), and fluid port (d) for pumping the fluid, wherein the unidirectional fluid pumps (120a, 120c) being installed to fluid port (a) and fluid port (c) are one group to be driven by the individual electric motors or driven by a common motor, while the unidirectional fluid pumps (120b, 120d) being
30 installed to fluid port (b) and fluid port (d) are another group to be driven

by the individual electric motors or driven by a common motor, wherein they are operatively controlled by the operative control device (250) to have one or more than one functional modes of the structural types and operating methods of the following: 1) the unidirectional fluid pumps are
5 structurally distributed to pump the fluid in negative pressure thereby allowing the two fluid streams to appear in different flow directions; or 2) the unidirectional fluid pumps are structurally distributed to pump the fluid in positive pressure thereby allowing the two fluid streams to appear in different flow directions; or 3) The different fluid pumps among part or
10 all of the unidirectional fluid pumps (120a, 120b, 120c, 120d) are pumped in positive pressure and negative pressures to form auxiliary pumping in the same flow circuit and allow the two fluid streams to be pumped in different flow directions;

-- At least one temperature detecting device (11) or at least one humidity
15 detecting device (21) is installed at the position capable of directly or indirectly detecting the temperature variation or humidity variation, including installing both or at least one type of said detecting devices, wherein the detected signals are referred by the operative control device (250) to operatively control the double flow circuit fluid pumping device
20 (123) for determining the flow rate operating timing of the pumping exchange fluid;

Said temperature detecting device (11) and humidity detecting device (21) are integrally commonly combined or individually separately installed;

25 -- The double flow circuit fluid pumping device (123): The fluid port (a), fluid port (b), fluid port (c), and fluid port (d) of the double flow circuit are respectively installed with the unidirectional fluid pumps (120a, 120b, 120c, 120d) in unidirectional flow pumping to constitute the double flow circuit fluid pumping device (123), thereby by the operative control
30 device (250) to operatively control the flow rate of the heat exchange

fluids pumped by the double flow circuit fluid pumping device (123) driven by the power source (300);

-- The power source (300): It is the device including AC or DC city power system or independent power supply device to provide power source for the operation of the fixed type heat exchange apparatus with automatic exchange flow rate modulation;

-- The operative control device (250): It is constituted by electromechanical components, solid state electronic components, or microprocessors and related software and operative control interfaces to operatively control the unidirectional fluid pumps (120a, 120b, 120c, 120d) of the double flow circuit fluid pumping device (123) by: 1) operatively controlling the switching functional operation; or 2) operatively controlling the flow rate of pumping heat exchange fluid; or 3) operatively controlling the temperature distribution status between the fluid and the total heat exchanger (200) inside the heat exchange apparatus; or 4) operatively controlling the humidity distribution status in the total heat exchanger (200); or 5) integrally operatively controlling at least two of said items 1), 2), 3) & 4) in combination;

-- The total heat exchanger (200): It is the total heat exchanger in conventional total heat exchange structure having two internal flow circuits and the heat absorbing or dissipating function as well as the dehumidifying or humidifying functions, wherein the two flow circuits respectively individually have two fluid ports to respectively pump the fluid, so that to enable heat exchange and dehumidification functions between the two fluids;

The timing to operatively control the flow rate of heat exchange fluid is that: 1) the fluid flow rate and change timing are preset in the open loop operative control; or 2) it is randomly manually operatively controlled; or 3) both of either one of at least one temperature detecting device (11) and at least one humidity detecting device (21) are installed at the position

capable of directly or indirectly detecting the temperature variation or humidity variation, wherein the detected signals are referred for operatively controlling the flow rate operating timing of the pumping exchange fluid;

5 The fixed type heat exchange apparatus with automatic flow rate exchange modulation is further installed with the three or at least one or more than one detecting devices of the temperature detecting device (11), humidity detecting device (21), and gaseous or liquid state fluid composition detecting device (31), wherein the installation positions
10 include both or one of the positions near to fluid port (a) and fluid port (b), or both or one of the positions near to fluid port (c) and fluid port (d) of the heat exchanger (100), total heat exchanger (200), or the heat exchange apparatus (1000), or other positions capable of detecting the temperature, humidity or composition of the exchange fluid during heat exchange
15 operation, and the number of them can be one or more than one to provide detected signals for reference to execute one or more than one functional operations as the following: 1) as the reference for operatively controlling the double flow circuit fluid pumping device (123) to modulate the flow speed or flow rate of the pumping fluid; or 2) as the reference for
20 operatively controlling the opening percentage of the fluid valve to modulate the flow speed or flow rate of the pumping fluid;

For said temperature detecting device (11), humidity detecting device (21), and gaseous or liquid state fluid composition detecting device (31), all of the detecting devices are integrally combined, or part of the
25 detecting devices are integrally combined, or they are individually separately installed;

Fig. 8 is the schematic view of the structural block operating principle showing that the present invention is further installed with the temperature detecting device and the gaseous or liquid state fluid composition
30 detecting device;

As shown in Fig. 8, the present invention is mainly constituted by that the fluid port (b) and fluid port (d) among the fluid port (a), fluid port (b), fluid port (c), and fluid port (d) of the double flow circuit of the heat exchange apparatus (1000) are respectively installed with the bidirectional
5 fluid pumps (111, 112) capable of producing negative pressure or positive pressure to constitute the double flow circuit fluid pumping device (123), and the two fluid streams are pumped by the bidirectional fluid pumps (111, 112) capable of producing negative pressure or positive pressure of the double flow circuit fluid pumping device (123) being driven by the
10 power source (300) and operatively controlled by the operative control device (250) to pass through the heat exchanger (100) in different flow directions, wherein:

The heat exchange apparatus (1000) and the bidirectional fluid pumps (111, 112) capable of producing negative pressure or positive pressure are
15 integrally combined or separately installed; the two bidirectional fluid pumps (111, 112) capable of producing negative pressure or positive pressure constituting the functions of double flow circuit fluid pumping device (123) are respectively installed to fluid port (b) and fluid port (d) for pumping the fluid in different pumping flow directions, wherein said
20 bidirectional fluid pumps (111, 112) capable of producing negative pressure or positive pressure being driven by the individual electric motors or driven by a common motor are operatively controlled by the operative control device (250) to have one or more than one functional mode operations of the following as needed: 1) the two bidirectional fluid
25 pumps (111, 112) are pumped in negative pressure to allow the two fluid streams passing through the heat exchanger (100) in different pumping flow directions; 2) the two bidirectional fluid pumps (111, 112) are pumped in positive pressure to allow the two fluid streams passing through the heat exchanger (100) in different pumping flow directions;
30 -- At least one temperature detecting device (11) is installed at the

position capable of directly or indirectly detecting the temperature variation of the exchange fluid, and at least one gaseous or liquid state fluid composition detecting device (31) is installed at the position capable of detecting the composition variation of the pumping gaseous or liquid state fluid, including installing both or at least one type of said detecting devices, wherein the detected signals are referred by the operative control device (250) to operatively control the double flow circuit fluid pumping device (123) for determining the flow rate operating timing of the pumping exchange fluid;

10 Said temperature detecting device (11) and gaseous or liquid state fluid composition detecting device (31) are integrally commonly combined or individually separately installed;

-- The double flow circuit fluid pumping device (123): The fluid port (b) and fluid port (d) among the fluid port (a), fluid port (b), fluid port (c), and fluid port (d) of the double flow circuit are respectively installed with the bidirectional fluid pumps (111, 112) capable of producing negative pressure or positive pressure to constitute the double flow circuit fluid pumping device (123), thereby by the operative control device (250) to operative control the flow rate of the heat exchange fluid pumped by the double flow circuit fluid pumping device (123) driven by the power source (300);

-- The power source (300): It is the device including AC or DC city power system or independent power supply device to provide power source for the operation of the fixed type heat exchange apparatus with automatic exchange flow rate modulation;

-- The operative control device (250): It is constituted by electromechanical components, solid state electronic components, or microprocessors and related software and operative control interfaces to operatively control the bidirectional fluid pumps (111, 112) constituting the double flow circuit fluid pumping device (123) by: 1) operatively

controlling the switching functional operation; or 2) operatively
controlling the flow rate of the pumping heat exchange fluid; or 3)
operatively controlling the temperature distribution status between the
fluid and the heat exchanger (100) inside the heat exchange apparatus
5 (1000); or 4) operatively controlling the interflow status of the gaseous or
liquid state fluid compositions for heat exchange between the two sides of
the heat exchange apparatus (1000); or 5) integrally operatively
controlling at least two of said items 1), 2), 3) & 4) in combination;

-- The heat exchanger (100): It is the heat exchanger in conventional heat
10 exchange structure having two internal flow circuits and the heat
absorbing or dissipating function, wherein the two flow circuits
respectively individually have two fluid ports to respectively pump the
fluid, so that to enable heat exchange between the two fluids;

The timing to operatively control the flow rate of heat exchange fluid
15 is that: 1) the fluid flow rate and change timing are preset in the open loop
operative control; or 2) it is randomly manually operatively controlled; or
3) both or either one of at least one temperature detecting device (11) and
at least one gaseous or liquid state fluid composition detecting device (31)
are installed at the positions capable of directly or indirectly detecting the
20 temperature variation or gaseous or liquid state fluid composition
variation, wherein the detected signals are referred for operatively
controlling the flow rate operating timing of the pumping exchange fluid;

Further, the embodiment of Fig. 8 can be that the bidirectional fluid
pump (111) and bidirectional fluid pump (112) are installed to fluid ports
25 (a, d) or installed to fluid ports (b, c), wherein one bidirectional fluid
pump is pumped in positive pressure, while the other bidirectional fluid
pump is pumped in negative pressure so as to allow the two fluid streams
to pass through the heat exchanger (100) in different pumping flow
directions.

30 Fig. 9 is the schematic view of the structural block operating principle

showing that the present invention is further installed with the temperature detecting device and the gaseous or liquid state fluid composition detecting device;

As shown in Fig. 9, the present invention is mainly constituted by that
5 the fluid port (a), fluid port (b), fluid port (c), and fluid port (d) of the double flow circuit of the heat exchange apparatus (1000) are respectively installed with the unidirectional fluid pumps (120a, 120b, 120c, 120d) able to be pumped in unidirectional flow directions to constitute the double flow circuit fluid pumping device (123), and the two fluid streams
10 pumped by the double flow circuit fluid pumping device (123) being driven by the power source (300) and operatively controlled by the operative control device (250) to pass through the heat exchanger (100) in different flow directions, wherein:

The heat exchange apparatus (1000) and unidirectional fluid pumps
15 (120a, 120b, 120c, 120d) are integrally combined or separately installed to constitute the functions of the double flow circuit fluid pumping device (123); the four unidirectional fluid pumps (120a, 120b, 120c, 120d) are respectively installed to fluid port (a), fluid port (b), fluid port (c), and fluid port (d) for pumping the fluid, wherein the unidirectional fluid
20 pumps (120a, 120c) being installed to fluid port (a) and fluid port (c) are one group to be driven by the individual electric motors or driven by a common motor, while the unidirectional fluid pumps (120b, 120d) being installed to fluid port (b) and fluid port (d) are another group to be driven by the individual electric motors or driven by a common motor, wherein
25 they are operatively controlled by the operative control device (250) to have one or more than one functional modes of the structural types and operating methods of the following: 1) the unidirectional fluid pumps are structurally distributed to pump the fluid in negative pressure thereby allowing the two fluid streams to appear in different flow directions; or 2)
30 the unidirectional fluid pumps are structurally distributed to pump the

fluid in positive pressure thereby allowing the two fluid streams to appear in different flow directions; or 3) the different fluid pumps among part or all of the unidirectional fluid pumps (120a, 120b, 120c, 120d) are pumped in positive pressure and negative pressures to form auxiliary pumping in the same flow circuit and allow the two fluid streams to be pumped in different flow directions; in the functional mode operations of said items 1), 2) & 3), the flow directions of the two fluid streams passing through the two sides of the heat exchanger (100) inside the heat exchange apparatus (1000) are kept opposite to each other;

10 -- At least one temperature detecting device (11) is installed at the position capable of directly or indirectly detecting the temperature variation of the exchange fluid, and at least one gaseous or liquid state fluid composition detecting device (31) is installed at the position capable of detecting the composition variation of the pumping gaseous or liquid state fluid, including installing both or at least one type of said detecting devices, wherein the detected signals are referred by the operative control device (250) to operatively control the double flow circuit fluid pumping device (123) for determining the flow rate operating timing of the pumping exchange fluid;

15 Said temperature detecting device (11) and gaseous or liquid state fluid composition detecting device (31) are integrally commonly combined or individually separately installed;

-- The double flow circuit fluid pumping device (123): The fluid port (a), fluid port (b), fluid port (c), and fluid port (d) of the double flow circuit are respectively installed with the unidirectional fluid pumps (120a, 120b, 120c, 120d) in unidirectional flow pumping to constitute the double flow circuit fluid pumping device (123), thereby by the operative control device (250) to operative control the flow rate of the heat exchange fluid pumped by the double flow circuit fluid pumping device (123) driven by the power source (300);

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-- The power source (300): It is the device including AC or DC city power system or independent power supply device to provide power source for the operation of the fixed type heat exchange apparatus with automatic exchange flow rate modulation;

- 5 -- The operative control device (250): It is constituted by electromechanical components, solid state electronic components, or microprocessors and related software and operative control interfaces to operatively control the unidirectional fluid pumps (120a, 120b, 120c, 120d) of the double flow circuit fluid pumping device (123) by: 1)
10 operatively controlling the switching functional operation; or 2) operatively controlling the flow rate of the pumping heat exchange fluid; or 3) operatively controlling the temperature distribution status of the fluid and the heat exchanger (100) inside the heat exchange apparatus (1000); or 4) operatively controlling the interflow status of the gaseous or
15 liquid state fluid compositions for heat exchange between the two sides of heat exchange apparatus (1000); or 5) integrally operatively controlling at least two of said items 1), 2), 3) & 4) in combination;
- The heat exchanger (100): It is the heat exchanger in conventional heat exchange structure having two internal flow circuits and the heat
20 absorbing or dissipating function, wherein the two flow circuits respectively individually have two fluid ports to respectively pump the fluid, so that to enable heat exchange between the two fluids;

The timing to operatively control the flow rate of heat exchange fluid is that: 1) the fluid flow rate and change timing are preset in the open loop
25 operative control; or 2) it is randomly manually operatively controlled; or 3) both or either one of at least one temperature detecting device (11) and at least one gaseous or liquid state fluid composition detecting device (31) are installed at the positions capable of directly or indirectly detecting the temperature variation or gaseous or liquid state fluid composition
30 variation, wherein the detected signals are referred for operatively

controlling the flow rate operating timing of the pumping exchange fluid.

Fig. 10 is the schematic view of the structural block operating principle showing that the present invention is further installed with the temperature detecting device, the humidity detecting device, and the
5 gaseous or liquid state fluid composition detecting device;

As shown in Fig. 10, the present invention is mainly constituted by that the fluid port (b) and fluid port (d) among the fluid port (a), fluid port (b), fluid port (c), and fluid port (d) of the double flow circuit of the heat exchange apparatus (1000) are respectively installed with the bidirectional
10 fluid pumps (111, 112) capable of producing negative pressure or positive pressure to constitute the double flow circuit fluid pumping device (123), and the two fluid streams are pumped by the bidirectional fluid pumps (111, 112) capable of producing negative pressure or positive pressure of the double flow circuit fluid pumping device (123) being driven by the
15 power source (300) and operatively controlled by the operative control device (250) in different flow directions, wherein:

The heat exchange apparatus (1000) and the bidirectional fluid pumps (111, 112) capable of producing negative pressure or positive pressure are integrally combined or separately installed; the two bidirectional fluid
20 pumps (111, 112) capable of producing negative pressure or positive pressure constituting the functions of double flow circuit fluid pumping device (123) are respectively installed to fluid port (b) and fluid port (d) for pumping the fluid in different pumping flow directions, wherein said bidirectional fluid pumps (111, 112) capable of producing negative
25 pressure or positive pressure being driven by the individual electric motors or driven by a common motor are operatively controlled by the operative control device (250) to have one or more than one functional mode operations of the following as needed: 1) the two bidirectional fluid pumps (111, 112) are pumped in negative pressure to allow the two fluid
30 streams passing through the total heat exchanger (200) in different

pumping flow directions; 2) the two bidirectional fluid pumps (111, 112) are pumped in positive pressure to allow the two fluid streams passing through the total heat exchanger (200) in different pumping flow directions; in the functional mode operations of said items 1) & 2), the
5 flow directions of the two fluid streams passing through the two sides of the total heat exchanger (200) inside the heat exchange apparatus (1000) are kept opposite to each other;

-- At least one temperature detecting device (11), at least one humidity detecting device (21), and at least one gaseous or liquid state fluid
10 composition detecting device (31) are installed at the positions capable of directly or indirectly detecting the temperature variation, or humidity variation, or gaseous or liquid state fluid composition variation, including installing all three or at least one type of said detecting devices, wherein the detected signals are referred by the operative control device (250) to
15 operatively control the double flow circuit fluid pumping device (123) for determining the flow rate operating timing of the pumping exchange fluid;

Said temperature detecting device (11) and humidity detecting device (21) as well as said gaseous or liquid state fluid composition detecting device (31) are integrally commonly combined or individually separately
20 installed;

-- The double flow circuit fluid pumping device (123): The fluid port (b) and fluid port (d) of the double flow circuit are respectively installed with the bidirectional fluid pumps (111, 112) capable of producing negative pressure or positive pressure to constitute the double flow circuit fluid
25 pumping device (123), thereby by the operative control device (250) to operative control the flow rate of the heat exchange fluid pumped by the double flow circuit fluid pumping device (123) driven by the power source (300);

-- The power source (300): It is the device including AC or DC city power
30 system or independent power supply device to provide power source for

the operation of the fixed type heat exchange apparatus with automatic exchange flow rate modulation;

- The operative control device (250): It is constituted by electromechanical components, solid state electronic components, or microprocessors and related software and operative control interfaces to operatively control the bidirectional fluid pumps (111, 112) of the double flow circuit fluid pumping device (123) by: 1) operatively controlling the switching functional operation; or 2) operatively controlling the flow rate of the pumping heat exchange fluid; or 3) operatively controlling the temperature distribution status between the fluid and the total heat exchanger (200) inside the heat exchange apparatus; or 4) operatively controlling the humidity distribution status in the total heat exchanger (200); or 5) operatively controlling the interflow status of gaseous or liquid state fluid compositions for heat exchange between the two sides of the heat exchange apparatus (1000); or 6) integrally operatively controlling at least two of said items 1), 2), 3), 4) & 5) in combination;
- The total heat exchanger (200): It is the total heat exchanger in conventional total heat exchange structure having two internal flow circuits and the heat absorbing or dissipating function as well as the dehumidifying or humidifying functions, wherein the two flow circuits respectively individually have two fluid ports to respectively pump the fluid, so that to enable heat exchange and dehumidification functions between the two fluids;

The timing to operatively control the flow rate of heat exchange fluid is that: 1) the fluid flow rate and change timing are preset in the open loop operative control; or 2) It is randomly manually operatively controlled; or 3) at least one temperature detecting device (11), at least one humidity detecting device (21), and at least one gaseous or liquid state fluid composition detecting device (31) are installed at the position capable of directly or indirectly detecting the temperature variation, or humidity

variation, or gaseous or liquid state fluid composition variation, including installing all three or at least one type of detecting devices, wherein the detected signals are referred for operatively controlling the flow rate operating timing of the pumping exchange fluid;

5 Further, the bidirectional fluid pump (111) and the bidirectional fluid pump (112) can also be installed to fluid ports (a, d), or installed to fluid ports (b, c) in the embodiment of Fig. 10, wherein one bidirectional fluid pump is pumped in positive pressure, while the other bidirectional fluid pump is pumped in negative pressure so as to allow the two fluid streams
10 to pass through the total heat exchanger (200) in different pumping flow directions.

Fig. 11 is the schematic view of the structural block operating principle showing that the present invention is further installed with the temperature detecting device, the humidity detecting device, and the
15 gaseous or liquid state fluid composition detecting device;

As shown in Fig. 11, the present invention is mainly constituted by that unidirectional fluid pumps (120a, 120b, 120c, 120d) able to be pumped in unidirectional flow directions are respectively installed to fluid port (a), fluid port (b), fluid port (c), and fluid port (d) of the double flow
20 circuit of the heat exchange apparatus (1000) for passing through by the two double circuit fluids thereby to constitute the double flow circuit fluid pumping device (123); the two fluid streams are pumped by the double flow circuit fluid pumping device (123) being driven by the power source (300) and operatively controlled by the operative control device (250) in
25 different flow directions, wherein:

The heat exchange apparatus (1000) and unidirectional fluid pumps (120a, 120b, 120c, 120d) are integrally combined or separately installed to constitute the functions of the double flow circuit fluid pumping device (123); the four unidirectional fluid pumps (120a, 120b, 120c, 120d) are
30 respectively installed to fluid port (a), fluid port (b), fluid port (c), and

fluid port (d) for pumping the fluid, wherein the unidirectional fluid pumps (120a, 120c) being installed to fluid port (a) and fluid port (c) are one group to be driven by the individual electric motors or driven by a common motor, while the unidirectional fluid pumps (120b, 120d) being
5 installed to fluid port (b) and fluid port (d) are another group to be driven by the individual electric motors or driven by a common motor, wherein they are operatively controlled by the operative control device (250) to have one or more than one functional modes of the structural types and operating methods of the following: 1) the unidirectional fluid pumps are
10 structurally distributed to pump the fluid in negative pressure thereby allowing the two fluid streams to appear in different flow directions; or 2) the unidirectional fluid pumps are structurally distributed to pump the fluid in positive pressure thereby allowing the two fluid streams to appear in different flow directions; or 3) the different fluid pumps among part or
15 all of the unidirectional fluid pumps (120a, 120b, 120c, 120d) are pumped in positive pressure and negative pressures to form auxiliary pumping in the same flow circuit and allow the two fluid streams to be pumped in different flow directions;

-- At least one temperature detecting device (11), at least one humidity
20 detecting device (21), and at least one gaseous or liquid state fluid composition detecting device (31) are installed at the position capable of directly or indirectly detecting the temperature variation, or humidity variation, or gaseous or liquid state fluid composition variation, including installing all three or at least one type of detecting devices, wherein the
25 detected signals are referred by the operative control device (250) to operatively control the double flow circuit fluid pumping device (123) for determining the flow rate operating timing of the pumping exchange fluid;

Said temperature detecting device (11), humidity detecting device (21) and gaseous or liquid state fluid composition detecting device (31) are
30 integrally commonly combined or individually separately installed;

- The double flow circuit fluid pumping device (123): The fluid port (a), fluid port (b), fluid port (c), and fluid port (d) of the double flow circuit are respectively installed with unidirectional fluid pumps (120a, 120b, 120c, 120d) in unidirectional flow pumping to constitute the double flow circuit fluid pumping device (123), thereby by the operative control device (250) to operative control the flow rate of the heat exchange fluid pumped by the double flow circuit fluid pumping device (123) driven by the power source (300);
- The power source (300): It is the device including AC or DC city power system or independent power supply device to provide power source for the operation of the fixed type heat exchange apparatus with automatic exchange flow rate modulation;
- The operative control device (250): It is constituted by electromechanical components, solid state electronic components, or microprocessors and related software and operative control interfaces to operatively control the unidirectional fluid pumps (120a, 120b, 120c, 120d) of the double flow circuit fluid pumping device (123) by: 1) operatively controlling the switching functional operation; or 2) operatively controlling the flow rate of the pumping heat exchange fluid; or 3) operatively controlling the temperature distribution status between the fluid and the total heat exchanger (200) inside the heat exchange apparatus; or 4) operatively controlling the humidity distribution status in the total heat exchanger (200); or 5) operatively controlling the interflow status of gaseous or liquid state fluid compositions for heat exchange between the two sides of the heat exchange apparatus (1000); or 6) integrally operatively controlling at least two of said items 1), 2), 3), 4) & 5) in combination;
- The total heat exchanger (200): It is the total heat exchanger in conventional total heat exchange structure having two internal flow circuits and the heat absorbing or dissipating function as well as the

dehumidifying or humidifying functions, wherein the two flow circuits respectively individually have two fluid ports to respectively pump the fluid, so that to enable heat exchange and dehumidification functions between the two fluids;

5 The timing to operatively control the flow rate of heat exchange fluid is that: 1) the fluid flow rate and change timing are preset in the open loop operative control; or 2) it is randomly manually operatively controlled; or 3) three or at least one of at least one temperature detecting device (11), at least one humidity detecting device (21), and at least one gaseous or liquid
10 state fluid composition detecting device (31) are installed at the positions capable of directly or indirectly detecting the temperature variation, or humidity variation, or gaseous or liquid state fluid composition variation, wherein the detected signals are referred for operatively controlling the flow rate operating timing of the pumping exchange fluid;

15 The structural types of the heat exchanger or total heat exchanger in the fixed type heat exchange apparatus with automatic flow rate exchange modulation include one or more than one characteristic of the following: 1) the tubular structure in linear or other geometric shape; or 2) the multi-layer structure with fluid circuits for passing the gaseous or liquid
20 state liquid fluid; or 3) one or more than one fluid circuit in series connection, parallel connection, or series and parallel connection.

 The fixed type heat exchange apparatus with automatic flow rate exchange modulation is further installed with the three or at least one or more than one detecting devices of the temperature detecting device (11),
25 humidity detecting device (21), and gaseous or liquid state fluid composition detecting device (31), wherein the installation positions include both or one of the positions near to fluid port (a) and fluid port (b), or both or one of the positions near to fluid port (c) and fluid port (d) of the heat exchanger (100), or the total heat exchanger (200), or the heat
30 exchange apparatus (1000), or the other positions capable of detecting the

temperature, humidity or composition of the exchange fluid during heat exchange operation, and the number of them can be one or more than one to provide detected signals for reference to execute one or more than one functional operations as the following: 1) as the reference for operatively
5 controlling the double flow circuit fluid pumping device (123) to modulate the flow speed or flow rate of the pumping fluid; or 2) as the reference for operatively controlling the opening percentage of the fluid valve to modulate the flow speed or flow rate of the pumping fluid;

For said temperature detecting device (11), humidity detecting device
10 (21), and gaseous or liquid state fluid composition detecting device (31), all of the detecting devices are integrally combined, or part of the detecting devices are integrally combined, or they are individually separately installed;

The said double flow circuit fluid pumping device (123) of the present
15 invention is configured for pumping gaseous or liquid state fluids, wherein the double flow circuit fluid pumping device (123) except for being driven by the individual electric motors or at least two of the fluid pumps are driven by a common electric motor, it can be also driven by engine power, or mechanical or electric power converted from other wind
20 power, thermal energy, temperature-difference energy, or solar energy.

The operative control device (250) of the present invention is equipped with electric motor, or controllable engine power, or mechanical or electric power generated or converted from other wind energy, thermal energy, temperature-difference energy, or solar energy for controlling
25 various fluid pumps for driven, or controlling the operation timing of the fluid pumps or fluid valves, thereby changing the direction of the two fluid streams passing through the heat exchanger (100) and further to operatively control partial or all regulations of rotational speed, flow rate, fluid pressure of various fluid pumps thereof.

30 For said fixed type heat exchange apparatus with automatic flow rate

exchange modulation of present invention, the flow rate of the fluids pumped by the double flow circuit fluid pumping device (123) can further be operatively controlled by the operative control device (250) to include one or more than one of the following operative control modes:

- 5 1) The adjustment or setting of the pumping fluid flow rate is manually operatively controlled;
- 2) The fluid flow rate is operatively controlled by referring to the signal detected by at least one installed temperature detecting device;
- 3) The fluid flow rate is operatively controlled by referring to the
10 signal detected by at least one installed humidity detecting device;
- 4) The fluid flow rate is operatively controlled by referring to the signal detected by at least one installed gaseous or liquid state fluid composition detecting device;
- 5) The fluid flow rate is operatively controlled by combining the
15 two or more than two methods of items 1) ~ 4).

In setting up the flow rate operative control function of the fixed type heat exchange apparatus with automatic flow rate exchange modulation of present invention, the fluid flow rate operative control range including the stepped or stepless fluid flow rate modulations from cease of
20 transportation to maximum transportation rate is relied on one or more than one of the following devices to change the fluid flow rate, wherein it includes:

- 25 1) It is through operatively controlling the rotational speed of the double flow circuit fluid pumping device (123) within the range from cease of transportation to maximum transportation rate to further operatively control the fluid flow rate;
- 2) It is through adopting the double flow circuit fluid pumping device (123) being installed with operatively controllable fluid inlet/outlet valves to operatively control the opening of the fluid inlet/outlet valves of
30 the double flow circuit fluid pumping device (123) to further operatively

control the fluid flow rate;

3) It is through operatively controlling any one device of items 1)~2) to pump the fluid intermittently so as to modulate the average flow rate by the time ratio of pumping on/off.

5 The flow rate ratio between the two fluid streams of the said fixed type heat exchange apparatus with automatic flow rate exchange modulation of present invention for passing through the heat exchange apparatus (1000) during operation include one or more than one ratio mode of the following:

10 1) The flow rate of fluid in one flow circuit is greater than the one in the other flow circuit;

2) The flow rates of the fluids in both flow circuits are the same;

15 3) Two fluid pumps in different pumping flow directions are alternatively operated to alternatively pump the two fluid streams in opposite flow directions;

For said fixed type heat exchange apparatus with automatic flow rate exchange modulation of present invention, beside of the operating function of pumping fluids of the double flow circuit in different flow directions, the double flow circuit fluid pumping device (123) being
20 constituted by two bidirectional fluid pumps is through operatively controlling the pumping flow directions of the two fluid streams to further have one or more than one special operating modes of the following:

1) Operatively controlling the fluids in two flow circuits to be pumped in the same flow directions for pumping in fluids;

25 2) Operatively controlling the fluids in two flow circuits to be reversely pumped in the same flow directions for discharging fluids;

30 3) Operatively controlling the fluids in two flow circuits to be periodically pumped in positive and reverse flow directions for pumping in fluids in the same flow directions and discharging fluids in reverse flow directions.

The same directional pumping function of said two fluid streams can be applied to meet the needs for emergency additional fluid flow rate pumping in or out.

CLAIMS

1. A heat exchange apparatus with automatic flow rate exchange modulation, comprising:

a heat exchange apparatus four fluid ports (a,b,c,d) through which the at least one heat exchange fluid is pumped into and out of the heat exchange apparatus, wherein first and fourth ones of the fluid ports (a,d) are on a first side of the heat exchange apparatus and second and third ones of the fluid ports (b,c) are on a second side of the heat exchange apparatus;

at least two fluid pumps (111,112 or 120a,120b,120c,120d) that form a double flow circuit fluid pumping device (123) for pumping at least one heat exchange fluid through the heat exchange apparatus in the first direction via a first fluid flow port from the first fluid port (a) on the first side of the heat exchange apparatus to the second fluid port (b) on the second side of the heat exchange apparatus and in the second direction via a second fluid flow path from the third fluid port (c) on the second side of the heat exchange apparatus to the fourth fluid port (d) on the first side of the heat exchange apparatus, said first fluid flow path being different from the second fluid flow path;

a power source (300) for supplying power to the at least two pumps; and

an operative control device (250) for operatively controlling said at least two fluid pumps to perform at least one of the following operations in order to operatively control a temperature distribution with the heat exchange apparatus: (a) switching a pumping direction; (b) operatively controlling a flow rate of the fluid; (c) operatively controlling both the pumping direction and the flow rate, wherein a timing of said operations is preset in an open loop operative control or manually controlled.

2. The heat exchange apparatus claimed in claim 1, wherein said at least two fluid pumps are bidirectional fluid pumps installed at two said fluid ports.

3. The heat exchange apparatus claimed in claim 2, wherein said bidirectional fluid pumps are installed at two said four ports (a,b,c,d), said two ports being selected according to whether both of said bidirectional pumps are operated to generate positive pressure or negative pressure, or whether one of said bidirectional pumps is operated to generate

positive pressure while the other of said two bidirectional pumps is operated to generate negative pressure.

4. The heat exchange apparatus claimed in claim 2, further comprising at least one temperature detecting device (11) installed at a position to directly or indirectly detect a temperature variation of a respective said heat exchange fluid, wherein the at least one temperature detecting device provides temperature detecting signals to said operative control device (250), and said operation of operatively controlling a temperature distribution status within the heat exchange apparatus including an operation of controlling a timing of said switching or said flow rate control to control said temperature distribution by using said temperature detecting signals as a reference.

5. The heat exchange apparatus claimed in claim 2, further comprising at least one temperature detecting device (11) or at least one humidity detecting device (21), said temperature detecting device (11) or humidity detecting device (21) installed at a position to directly or indirectly detect a temperature variation or a humidity variation within the heat exchange apparatus, wherein the at least one temperature detecting device (11) or humidity detecting device (21) respectively provide temperature or humidity detecting signals to said operative control device (250), said operation of operatively controlling a temperature distribution status within the heat exchange apparatus including an operation of controlling a timing of said switching or said flow rate control to control said temperature distribution by using said temperature detecting signals as a reference, and said humidity detecting device being arranged to provide humidity detecting signals to said operative control device (250) to operatively control a humidity distribution within said heat exchange apparatus by using said humidity detection signals as a reference to control said switching or flow rate timing.

6. The heat exchange apparatus claimed in claim 5, wherein said heat exchange apparatus includes both said at least one temperature detecting device (11) and said at least one humidity detecting device (12).

7. The heat exchange apparatus claimed in claim 2, further comprising at least one of the following: at least one temperature detecting device (11), at least one humidity detecting device (21), and at least one gaseous or liquid state fluid composition detecting device (31), said at least one temperature detecting device (11), humidity detecting device (21), or gaseous or liquid state fluid composition detecting device being installed at a position to directly or indirectly detect a temperature variation, a humidity variation, or a fluid composition variation within the heat exchange apparatus, wherein the at least one temperature detecting device (11), humidity detecting device (21), or gaseous or liquid state fluid composition detecting device (31) respectively provide temperature, humidity, or fluid composition detecting signals to said operative control device (250), said operation of operatively controlling a temperature distribution status within the heat exchange apparatus including an operation of controlling a timing of said switching or said flow rate control to control said temperature distribution by using said temperature detecting signals as a reference, said humidity detecting device being arranged to provide humidity detecting signals to said operative control device (250) to operatively control a humidity distribution within said heat exchange apparatus by using said humidity detection signals as a reference to control said switching or flow rate timing, and said gaseous or liquid state fluid composition detecting device being arranged to provide fluid composition detecting signals to said operative control device (250) as a reference to operatively control an inflow status of a respective said at least one heat exchange fluid.

8. The heat exchange apparatus claimed in claim 7, wherein said heat exchange apparatus includes two different ones of said at least one temperature detecting device (11), said at least one humidity detecting device (12), and said at least one temperature detecting device (31).

9. The heat exchange apparatus claimed in claim 7, wherein said operative control device (250) controls said switching or flow rate timing by operatively controlling said pumps.

10. The heat exchange apparatus claimed in claim 1, wherein said at least two fluid pumps include a first unidirectional pump (120a) installed at the first fluid port (a), a

second unidirectional pump (120b) installed at the second fluid port (b), a third unidirectional pump (120c) installed at the third fluid port (c), and a fourth unidirectional pump (120d) installed at the fourth fluid port (d), wherein said first and second unidirectional fluid pumps (120a,120b) operate to pump fluid in the first direction and the third and fourth unidirectional pumps (120c,120d) operate to pump said fluid in the second direction, and wherein switching between operation of the first and second unidirectional pumps (120a,120b) and operation of the third and fourth unidirectional pumps (120c,120d) switches a fluid flow direction within the heat exchange apparatus.

11. The heat exchange apparatus as claimed in claim 10, wherein at least one of said first and third unidirectional pumps (120a,120c) is operated to generate positive pressure and at least one of said second and fourth unidirectional pumps (120b,120d) is operated to generate negative pressure.

12. The heat exchange apparatus as claimed in claim 10, further comprising at least one temperature detecting device (11) installed at a position to directly or indirectly detect a temperature variation of a respective said heat exchange fluid, wherein the at least one temperature detecting device provides temperature detecting signals to said operative control device (250), and said operation of operatively controlling a temperature distribution status within the heat exchange apparatus including an operation of controlling a timing of said switching or said flow rate control to control said temperature distribution by using said temperature detecting signals as a reference.

13. The heat exchange apparatus as claimed in claim 10, further comprising at least one temperature detecting device (11) or at least one humidity detecting device (21), said temperature detecting device (11) or humidity detecting device (21) installed at a position to directly or indirectly detect a temperature variation or a humidity variation within the heat exchange apparatus, wherein the at least one temperature detecting device (11) or humidity detecting device (21) respectively provide temperature or humidity detecting signals to said operative control device (250), said operation of operatively controlling a temperature distribution status within the heat exchange apparatus including an operation of controlling a timing of said switching or said flow rate control to control said

temperature distribution by using said temperature detecting signals as a reference, and said humidity detecting device being arranged to provide humidity detecting signals to said operative control device (250) to operatively control a humidity distribution within said heat exchange apparatus by using said humidity detection signals as a reference to control said switching or flow rate timing.

14. The heat exchange apparatus as claimed in claim 13, wherein said heat exchange apparatus includes both said at least one temperature detecting device (11) and said at least one humidity detecting device (12).

15. The heat exchange apparatus as claimed in claim 10, further comprising at least one of the following: at least one temperature detecting device (11), at least one humidity detecting device (21), and at least one gaseous or liquid state fluid composition detecting device (31), said at least one temperature detecting device (11), humidity detecting device (21), or gaseous or liquid state fluid composition detecting device (31) being installed at a position to directly or indirectly detect a temperature variation, a humidity variation, or a gaseous or liquid state fluid composition variation within the heat exchange apparatus, wherein the at least one temperature detecting device (11), humidity detecting device (21), or gaseous or liquid state fluid composition detecting device (31) respectively provide temperature, humidity, or fluid composition detecting signals to said operative control device (250), said operation of operatively controlling a temperature distribution status within the heat exchange apparatus including an operation of controlling a timing of said switching or said flow rate control to control said temperature distribution by using said temperature detecting signals as a reference, said humidity detecting device being arranged to provide humidity detecting signals to said operative control device (250) to operatively control a humidity distribution within said heat exchange apparatus by using said humidity detection signals as a reference to control said switching or flow rate timing, and said gaseous or liquid state fluid composition detecting device being arranged to provide fluid composition detecting signals to said operative control device (250) as a reference to operatively control an inflow status of a respective said at least one heat exchange fluid.

16. The heat exchange apparatus as claimed in claim 15, wherein said heat exchange apparatus includes two different ones of said at least one temperature detecting device (11), said at least one humidity detecting device (12), and said at least one temperature detecting device (31).

17. The heat exchange apparatus as claimed in claim 15, wherein said operative control device (250) controls said switching or flow rate timing by operatively controlling said unidirectional pumps.

18. The heat exchange apparatus as claimed in claim 1, wherein the control device (250) is arranged to operatively control a timing of said at least two fluid pumps (111,112 or 120a,120b,120c,120d) that form a double flow circuit fluid pumping device (123) to change a direction of the fluid passing through the heat exchange apparatus and further to provide at least partial regulation of pump rotational speed, flow rate, and fluid pressure of individual said at least two fluid pumps (111,112 or 120a,120b,120c,120d) that form a double flow circuit fluid pumping device (123).

19. The heat exchange apparatus as claimed in claim 1, further comprising at least one of a temperature detecting device, a humidity detecting device, and a gaseous or liquid state fluid composition detecting device, wherein the at least two fluid pumps (111,112 or 120a,120b,120c,120d) that form a double flow circuit fluid pumping device (123) are operatively controlled by the operative control device (250) according to at least one of the following operative control modes:

- (a) adjustment or setting of a pumping fluid flow rate is manually controlled;
- (b) the flow rate is operatively controlled by referring to a signal detected by at least one temperature detecting device;
- (c) the flow rate is operatively controlled by referring to a signal detected by at least one humidity detecting device;
- (d) the flow rate is operatively controlled by referring to a signal detected by at least one gaseous or liquid state gaseous or liquid state fluid composition detecting device; and
- (e) the flow rate is operatively controlled by two or more of said modes (a) to (d).

20. The heat exchange apparatus as claimed in claim 1, wherein operative control of flow rate of the at least one heat exchange fluid is achieved by:

- (a) operatively controlling a rotational speed of said at least two fluid pumps (111,112 or 120a,120b,120c,120d) that form a double flow circuit fluid pumping device (123);
- (b) operatively controlling said at least two fluid pumps (111,112 or 120a,120b,120c,120d) that form a double flow circuit fluid pumping device (123) to pump the fluid intermittently in order to modulate an average flow rate according to pumping on/off time ratio.

21. The heat exchange apparatus as claimed in claim 1, wherein a ratio of flow rates in said first and second fluid flow directions is one of the following:

- (a) the flow rate in one said direction is greater than a flow rate in the other said direction;
- (b) the flow rate in said directions is equal; and
- (c) said pumps operating in different directions alternately pump the fluid streams in said first and second directions.

22. The heat exchange apparatus as claimed in claim 1, wherein said at least two fluid pumps (111,112 or 120a,120b,120c,120d) that form a double flow circuit fluid pumping device (123) are further arranged to pump said fluid into said heat exchange apparatus in same flow directions, to reversely pump said fluid out of said heat exchange apparatus, or to periodically pump said fluid into the heat exchange apparatus in same flow directions and out of said heat exchange apparatus in reverse flow directions.