

ROTARY 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 rotary 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 exchange
10 rotating disk, or to modulate the composition ratio of the gaseous or liquid state pumping fluid, wherein the heat exchange rotating disk inside the rotary type heat exchange apparatus being insertingly installed or coated with penetrating type or absorbing type moisture absorbing material, or the heat exchange rotating disk itself having the concurrent
15 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
20 fluid include:

- (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.

25 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 speeds and the temperature difference
30 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 rotary type double flow circuit heat exchange apparatus is made to have the operating function of the rotary type heat exchange apparatus having automatic exchange fluid flow rate modulation, and through the modulation of the rotary type heat exchange rotating disk or rotary type total heat exchange rotating disk driven by the rotating disk driving device 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 rotary type total heat exchange apparatus.

Fig. 2 is a schematic view of the conventional rotary type total heat exchange apparatus having two fluid streams in different flow directions to pass through different positions of the rotary type total heat exchange rotating disk.

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

Fig. 4 is a block schematic view of the embodiment showing that the present invention is further installed with the temperature detecting device to operatively control the flow rates of the heat exchange fluids.

Fig. 5 is a block schematic view of the embodiment showing that the present invention is further installed with the temperature detecting device and humidity detecting device to operatively control the flow rates of the total heat exchange fluids.

5 Fig. 6 is a schematic view of the structural principle of the embodiment showing that the present invention is further installed with temperature detecting device and gaseous or liquid state composition detecting device to operatively control the flow rates of the heat exchange fluids.

10 Fig. 7 is a schematic view of the structural principle of the embodiment showing that the present invention is further installed with temperature detecting device, humidity detecting device and gaseous or liquid state composition detecting device to operatively control the flow rates of the total heat exchange fluids.

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DESCRIPTION OF MAIN COMPONENT SYMBOLS

11: Temperature detecting device

21: Humidity detecting device

31: Gaseous or liquid state fluid composition detecting device

20 100: Rotary type heat exchange rotating disk

110: Rotating disk rotationally driving device

111: Variable speed transmission device

120a, 120b: Unidirectional fluid pump

123: Double flow circuit fluid pumping device

25 130: Heater

200: Rotary type total heat exchange rotating disk

300: Power source

250: Operative control device

1000: Rotary type heat exchange apparatus

30 a, b, c, d: Fluid port

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The warming energy reclaim effectiveness of the conventional rotary type heat exchange apparatus or rotary type total heat exchange apparatus has very wide range of applications, and the more representative rotary type total heat exchange apparatus is taken as the example herein, such as that Fig. 1 is a schematic view showing the operating principles of the conventional rotary type total heat exchange apparatus; as shown in Fig. 1, the conventional rotary type total heat exchange apparatus usually installed with two fluid 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 rotary type total heat exchange rotating disk (200) inside the conventional total heat exchange apparatus, wherein the two fluid streams are respectively pumped in through the two fluid ports at different sides and are respectively discharged through the fluid port at the other side, so as the two fluid circuits are segregated to pass through the rotationally driven rotary type total heat exchange rotating disk (200) at different positions, such as that Fig. 2 is a schematic view of the conventional rotary type total heat exchange apparatus having two fluid streams in different flow directions to pass through different positions of the rotary type total heat exchange rotating disk (200); 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 conventional rotary type total heat exchange apparatus via the fluid port (a), and passes through the fluid circuit of the rotary type total heat exchange rotating disk (200) on one side, and then is discharged to the outside via the fluid port (b), and the lower temperature outdoor fresh air is pumped into the conventional rotary type total heat exchange apparatus via the fluid port (c) from the outside, passes through the fluid circuit of

the rotary type total heat exchange rotating disk (200) on the other side, and then is discharged into indoors via the fluid port (d), wherein the fluid port (a) and the fluid port (d) are disposed at the side passing to the inside, while the fluid port (c) and the fluid port (b) are disposed at the side
5 passing to the outside; in stable operation, one side of the rotary type total heat exchange rotating disk (200) in the conventional rotary type total heat exchange apparatus between the fluid port (a) and the fluid port (b) forms the temperature distribution from the higher temperature at the fluid port (a) to gradually reduce to the lower temperature at the fluid port (b) and
10 the other side of the rotary type total heat exchange rotating disk (200) between the fluid port (c) and the fluid port (d) forms the temperature distribution from the lower temperature at the fluid port (c) to gradually increased to the higher temperature at the fluid port (d), while the heat exchange efficiency is decided by the fluid property, flow speed and
15 characteristics of the heat exchange rotating disk in the heat exchange apparatus as well as the temperature difference of the two side fluids; if the heat exchange rotating disk being insertingly installed or coated with penetrating type, or absorbing type moisture absorbing material or the heat exchange rotating disk itself having the concurrent dehumidification
20 function are applied to constitute the total heat exchange rotating disk, then the above said two fluid streams in different flow directions are formed with the stable status of temperature difference and humidity saturation difference at the two inlet/outlet ends and the two sides for passing by the fluids in different flow directions of the rotary type total
25 heat exchange rotating disk (200) inside the conventional rotary type total heat exchange apparatus.

The present invention discloses that the conventional rotary type double flow circuit heat exchange apparatus is further made to have the operating function of the rotary type heat exchange apparatus having
30 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. 3 is a block schematic view of the embodiment showing the present invention is capable of automatically operatively controlling the
5 flow rate of heat exchange fluid;

As shown in Fig. 3, 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 rotary type heat exchange apparatus (1000) are respectively installed with the
10 unidirectional fluid pumps (120a)(120b) 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) and operative control of the operative control device (250) to drive the unidirectional fluid pumps (120a)(120b) of the double flow circuit fluid
15 pumping device (123) being capable of producing negative pressure or positive pressure for pumping the two fluids to pass through the rotary type heat exchange rotating disk (100) in different areas and different flow directions, and the flow circuits of the two fluid streams are mutually isolated, wherein:

20 -- The rotary type heat exchange apparatus (1000) and the unidirectional fluid pumps (120a)(120b) capable of producing negative pressure or positive pressure can be integrally combined or separately installed to constitute the double flow circuit fluid pumping device (123) function, and the two unidirectional fluid pumps (120a)(120b) capable of producing
25 negative pressure or positive pressure are respectively installed to the fluid port (b) and the fluid port (d) so as to pump the fluid in different pumping flow directions; said two unidirectional fluid pumps (120a)(120b) capable of producing negative pressure or positive pressure are respectively driven by the electric motor individually or are commonly
30 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, including: 1) the two unidirectional fluid pumps (120a)(120b) are pumped in negative pressure for pumping the two fluid streams in different pumping flow directions; 2) the two unidirectional fluid pumps (120a)(120b) are pumped in positive pressure for pumping the two fluid streams in different pumping flow directions; in said two functional mode operations of said 1) & 2), the two fluid streams are pumped to pass through different areas of the rotary type heat exchange rotating disk (100), the flow circuits of the two fluid streams are mutually isolated, and the flow directions of the two fluid streams are contrary to each other;

-- The double flow circuit fluid pumping device (123): It is constituted by at least two unidirectional fluid pumps (120a)(120b), wherein 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 installed within the rotary type heat exchange apparatus (1000) are respectively installed with the unidirectional fluid pumps (120a)(120b) being capable of producing negative 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 fluid circuit fluid pumping device (123) driven by the power source (300), as well as to operative control the rotating speed of the rotary type heat exchange rotating disk (100) driven by the rotating disk rotationally driving device (110);

-- 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 rotary 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) 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 rotary type heat exchange rotating disk (100); or 4) operatively controlling the rotating speed of the rotary type heat exchange rotating disk (100) driven by the rotating disk rotationally driving device (110); or 5) integrally operatively controlling at least two of said items 1)2)3)4) in combination;

-- The rotating disk rotationally driving device (110): It is constituted by electric motor or other rotational power source with variable speed transmission device (111) for driving the rotary type heat exchange rotating disk (100) to rotate and modulating its rotating speed to change its heat exchange characteristics;

-- The rotary type heat exchange rotating disk (100): It is rotationally driven by the rotating disk rotationally driving device (110), wherein its disk is internally provided with two porous fluid circuit areas for passing through different directional fluid flows and has the heat absorbing or dissipating function, the two fluid circuits of the rotary type heat exchange rotating disk are respectively provided with two fluid ports for respectively pumping two fluid streams, wherein the passage of the two fluid streams are mutually isolated, thereby allowing the fluids in different flowing directions to pass through the rotary type heat exchange rotating disk (100) rotationally driven by the rotating disk rotationally driving device (110) for heat exchange function operations;

-- The timings to operatively control the flow rate of heat exchange fluid and/or the rotating speed of rotary type heat exchange rotating disk (100) driven by rotating disk rotationally driving device (110) are 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;

The unidirectional fluid pump (120a) and unidirectional fluid pump (120b) can also be installed to the fluid ports (a)(d) or installed to the fluid ports (b)(c) in said embodiment of Fig. 3, wherein one unidirectional fluid pump is pumped in positive pressure while the other unidirectional fluid pump is pumped in negative pressure so as to allow the two fluid streams to pass through the rotary type heat exchange rotating disk (100) in different pumping flow directions.

Fig. 4 is a block schematic view of the embodiment showing that the present invention is further installed with the temperature detecting device to operatively control the flow rates of the heat exchange fluids;

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 rotary type heat exchange apparatus (1000) are respectively installed with the unidirectional fluid pumps (120a)(120b) 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) and operative control of the operative control device (250) to drive the unidirectional fluid pumps (120a)(120b) of the double flow circuit fluid pumping device (123) being capable of producing negative pressure or positive pressure for pumping the two fluids to pass through the rotary type heat exchange rotating disk (100) in different areas and different flow directions, and the flow circuits of the two fluid streams are mutually isolated, wherein:

-- The rotary type heat exchange apparatus (1000) and the unidirectional fluid pumps (120a)(120b) capable of producing negative pressure or positive pressure can be integrally combined or separately installed to constitute the double flow circuit fluid pumping device (123) function, and the two unidirectional fluid pumps (120a)(120b) capable of producing

negative pressure or positive pressure are respectively installed to the fluid port (b) and the fluid port (d) so as to pump the fluid in different pumping flow directions; said two unidirectional fluid pumps (120a)(120b) capable of producing negative pressure or positive pressure are
5 respectively driven by the electric motor individually 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, including: 1) the two unidirectional fluid pumps (120a)(120b) are pumped in negative pressure for pumping
10 the two fluid streams in different pumping flow directions; 2) the two unidirectional fluid pumps (120a)(120b) are pumped in positive pressure for pumping the two fluid streams in different pumping flow directions; in said two functional mode operations of said 1) & 2), the two fluid streams are pumped to pass through different areas of the rotary type heat
15 exchange rotating disk (100), the flow circuits of the two fluid streams are mutually isolated, and the flow directions of the two fluid streams are contrary to each other;

-- At least one temperature detecting device (11) is installed at the position capable of directly or indirectly detecting the temperature
20 variation of the pumping exchange fluid, wherein the detected signal is referred as the operative control timing for the operative control device (250); including: 1) operatively controlling the flow rate of the exchange fluid pumped by the double flow circuit fluid pumping device (123); or 2) operatively controlling the rotating speed of the rotary type heat exchange
25 rotating disk (100) driven by the rotating disk rotationally driving device (110); or 3) operatively controlling said items 1) & 2) simultaneously;

-- The double flow circuit fluid pumping device (123) : It is constituted by at least two unidirectional fluid pumps (120a)(120b), wherein the fluid
30 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 installed within the rotary

type heat exchange apparatus (1000) are respectively installed with the unidirectional fluid pumps (120a)(120b) being capable of producing negative or positive pressure to constitute the double flow circuit fluid pumping device (123), thereby by the operative control device (250) to

5 operative control the flow rate of the heat exchange fluid pumped by the double fluid circuit fluid pumping device (123) driven by the power source (300), as well as to operative control the rotating speed of the rotary type heat exchange rotating disk (100) driven by the rotating disk rotationally driving device (110);

10 -- 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 rotary type heat exchange apparatus with automatic exchange flow rate modulation;

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

15 electromechanical components, solid state electronic components, or microprocessors and related software and operative control interfaces to operatively control the unidirectional fluid pumps (120a)(120b) of the double flow circuit fluid pumping device (123) by: 1) operatively controlling the switching functional operation; or 2) operatively

20 controlling the flow rate of pumping heat exchange fluid; or 3) operatively controlling the temperature distribution status between the fluid and the rotary type heat exchange rotating disk (100); or 4) operatively controlling the rotating speed of the rotary type heat exchange rotating disk (100) driven by the rotating disk rotationally driving device (110); or 5)

25 integrally operatively controlling at least two of said items 1)2)3)4) in combination;

-- The rotating disk rotationally driving device (110): It is constituted by electric motor or other rotational power source with variable speed transmission device (111) for driving the rotary type heat exchange

30 rotating disk (100) to rotate and modulating its rotating speed to change

its heat exchange characteristics;

-- The rotary type heat exchange rotating disk (100): It is rotationally driven by the rotating disk rotationally driving device (110), wherein its disk is internally provided with two porous fluid circuit areas for passing through different directional fluid flows and has the heat absorbing or dissipating function, the two fluid circuits of the rotary type heat exchange rotating disk are respectively provided with two fluid ports for respectively pumping two fluid streams, wherein the two fluid flow circuits are mutually isolated, thereby allowing the fluids in different flowing directions to pass through the rotary type heat exchange rotating disk (100) rotationally driven by the rotating disk rotationally driving device (110) for heat exchange function operations;

-- The timings to operatively control the flow rate of heat exchange fluid and/or the rotating speed of rotary type heat exchange rotating disk (100) driven by rotating disk rotationally driving device (110) are 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) to install at least one temperature detecting device (11) at the position capable of directly or indirectly detecting the temperature variation, wherein the signals detected by the temperature detecting device (11) is referred to determine the operating timing for operatively controlling the flow rate of pumping exchange fluid and/or the rotating speed of the rotary type heat exchange rotating disk (100) driven by the rotating disk rotationally driving device (110);

The unidirectional fluid pump (120a) and unidirectional fluid pump (120b) can also be installed to the fluid ports (a)(d) or installed to the fluid ports (b)(c) in said embodiment of Fig. 4, wherein one unidirectional fluid pump is pumped in positive pressure while the other unidirectional fluid pump is pumped in negative pressure so as to allow the two fluid streams to pass through the rotary type heat exchange rotating disk (100) in

different pumping flow directions.

Fig. 5 is a block schematic view of the embodiment showing that the present invention is further installed with the temperature detecting device and humidity detecting device to operatively control the flow rates of the
5 total heat exchange fluid;

As shown in Fig. 5, 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 rotary type heat exchange apparatus (1000) are respectively installed with the
10 unidirectional fluid pumps (120a)(120b) 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 unidirectional fluid pumps (120a)(120b) capable of producing negative pressure or positive pressure of the double flow circuit
15 fluid pumping device (123) being driven by the power source (300), wherein the pumping two fluid streams pass through the rotary type total heat exchange rotating disk (200) in different areas, and the flow directions of the two fluid streams are different and mutually isolated, wherein:

20 -- The rotary type heat exchange apparatus (1000) and the unidirectional fluid pumps (120a)(120b) capable of producing negative pressure or positive pressure can be integrally combined or separately installed to constitute the double flow circuit fluid pumping device (123) function, and the two unidirectional fluid pumps (120a)(120b) capable of producing
25 negative pressure or positive pressure are respectively installed to the fluid port (b) and the fluid port (d) so as to pump the fluid in different pumping flow directions; said two unidirectional fluid pumps (120a)(120b) capable of producing negative pressure or positive pressure are respectively driven by the electric motor individually or are commonly
30 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, including: 1) the two unidirectional fluid pumps (120a)(120b) are pumped in negative pressure for pumping the two fluid streams in different pumping flow directions; 2) the two unidirectional fluid pumps (120a)(120b) are pumped in positive pressure for pumping the two fluid streams in different pumping flow directions; in said two functional mode operations of said 1) & 2), the two fluid streams are pumped to pass through different areas of the rotary type total heat exchange rotating disk (200), the flow circuits of the two fluid streams are mutually isolated, and the flow directions of the two fluid streams are contrary to each other;

-- 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 detecting the temperature and humidity variations of the pumping exchange fluid, including installing both or at least one detecting device, wherein the detected signals are referred as the operating timing for the operative control device (250); including: 1) operatively controlling the flow rate of the exchange fluid pumped by the double flow circuit fluid pumping device (123); or 2) operatively controlling the rotating speed of the rotary type total heat exchange rotating disk (200) driven by rotating disk rotationally driving device (110); or 3) operatively controlling said items 1) & 2) simultaneously;

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

-- The double flow circuit fluid pumping device (123): It is constituted by at least two unidirectional fluid pumps (120a)(120b), wherein the fluid port (b) and fluid port (d) of the double flow circuit installed within the rotary type heat exchange apparatus (1000) are respectively installed with the unidirectional fluid pumps (120a)(120b) being capable of producing negative 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 fluid circuit fluid pumping device (123) driven by the power source (300), as well as to operative control the rotating speed of the rotary type total heat exchange rotating disk (200) driven by the rotating disk rotationally driving device (110);

-- 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 rotary 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) 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 rotary type total heat exchange rotating disk (200); or 4) operatively controlling the humidity distribution status of the rotary type total heat exchange rotating disk (200); or 5) operatively controlling the rotating speed of the rotary type total heat exchange rotating disk (200) driven by the rotating disk rotationally driving device (110); or 6) integrally operatively controlling at least two of said items 1), 2), 3), 4) & 5) in combination;

-- The rotating disk rotationally driving device (110): It is constituted by electric motor or other rotational power source with variable speed transmission device (111) for driving the rotary type total heat exchange rotating disk (200) to rotate and modulating its rotating speed to change its heat exchange characteristics;

-- The rotary type total heat exchange rotating disk (200): It is rotationally driven by the rotating disk rotationally driving device (110), wherein its disk is internally provided with two porous fluid circuit areas for passing through different directional fluid flows and has the heat absorbing or dissipating as well as humidity absorbing or dissipating function, the two fluid circuits of the rotary type total heat exchange rotating disk (200) are respectively individually made with two fluid ports for respectively pumping two fluid streams, wherein the two fluid flow circuits are mutually isolated, thereby allowing the fluids in different flow directions to pass through the rotary type total heat exchange rotating disk (200) driven by the rotating disk rotationally driving device (110) for total heat exchange function operations;

-- The timings to operatively control the flow rate of heat exchange fluid and/or the rotating speed of rotary type total heat exchange rotating disk (200) driven by rotating disk rotationally driving device (110) are 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) to install both or at least one of the temperature detecting device (11), and humidity detecting device (21) at the position capable of directly or indirectly detecting the temperature variation, or humidity variation of the pumping exchange fluid, wherein the detected signals are referred to determine the operating timing for operatively controlling the flow rate of pumping exchange fluid and/or the rotating speed of the rotary type total heat exchange rotating disk (200) driven by the rotating disk rotationally driving device (110);

The unidirectional fluid pump (120a) and unidirectional fluid pump (120b) can also be installed to the fluid ports (a)(d) or installed to the fluid ports (b)(c) in said embodiment of Fig. 5, wherein one unidirectional fluid pump is pumped in positive pressure while the other unidirectional fluid pump is pumped in negative pressure so as to allow the two fluid streams

to pass through the rotary type total heat exchange rotating disk (200) in different pumping flow directions;

The aforesaid embodiment of Fig. 5 is further installed a heater (130) in the fluid exchange flow circuit of the rotary type total heat exchange rotating disk (200) to enhance the dehumidification performance, wherein
5 the heater is actuated by electric energy or other temperature controllable heat generating sources;

In addition, it is further through the operative control device (250) to refer to detected values of the temperature detecting device (11), humidity
10 detecting device (21) to operatively control the heating timing and heating thermal energy value of the heater (130);

Fig. 6 is a schematic view of the structural principle of the embodiment showing that the present invention is further installed with the temperature detecting device and the gaseous or liquid state
15 composition detecting device to operatively control the flow rates of the heat exchange fluids;

As shown in Fig. 6, 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 rotary
20 type heat exchange apparatus (1000) are respectively installed with the unidirectional fluid pumps (120a)(120b) 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) and operative control of the operative control device (250) to drive the
25 unidirectional fluid pumps (120a)(120b) of the double flow circuit fluid pumping device (123) being capable of producing negative pressure or positive pressure for pumping the two fluids to pass through the rotary type heat exchange rotating disk (100) in different flow directions, and the flow circuits of the two fluid streams in different flow directions are
30 mutually isolated, wherein:

-- The rotary type heat exchange apparatus (1000) and the unidirectional fluid pumps (120a)(120b) capable of producing negative pressure or positive pressure can be integrally combined or separately installed to constitute the double flow circuit fluid pumping device (123) function, and the two unidirectional fluid pumps (120a)(120b) capable of producing negative pressure or positive pressure are respectively installed to the fluid port (b) and the fluid port (d) so as to pump the fluid in different pumping flow directions; said two unidirectional fluid pumps (120a)(120b) capable of producing negative pressure or positive pressure are respectively driven by the electric motor individually 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, including: 1) the two unidirectional fluid pumps (120a)(120b) are pumped in negative pressure for pumping the two fluid streams in different pumping flow directions; 2) the two unidirectional fluid pumps (120a)(120b) are pumped in positive pressure for pumping the two fluid streams in different pumping flow directions; in said two functional mode operations of said 1) & 2), the two fluid streams are pumped to pass through different areas of the rotary type heat exchange rotating disk (100), the flow circuits of the two fluid streams are mutually isolated, and the flow directions of the two fluid streams are contrary to each other;

-- 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 of the pumping exchange fluid and the composition variation of the pumping gaseous or liquid state fluid, including installing both or at least one detecting device, wherein the detected signals are referred as the operating timing for the operative control device (250); including 1) operatively controlling the flow rate of the exchange fluid pumped by the

double flow circuit fluid pumping device (123); or 2) operatively controlling the rotating speed of the rotating speed of the rotary type heat exchange rotating disk (100) driven by the rotating disk rotationally driving device (110); or 3) operatively controlling said items 1) & 2) simultaneously;

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

-- The double flow circuit fluid pumping device (123): It is constituted by at least two unidirectional fluid pumps (120a)(120b), wherein 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 installed within the rotary type heat exchange apparatus (1000) are respectively installed with the unidirectional fluid pumps (120a)(120b) being capable of producing negative 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 fluid circuit fluid pumping device (123) driven by the power source (300), as well as to operative control the rotating speed of the rotary type heat exchange rotating disk (100) driven by the rotating disk rotationally driving device (110);

-- 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 rotary 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) 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
rotary type heat exchange rotating disk (100); or 4) operatively controlling
5 the composition interaction status of between the gaseous or liquid state
fluids for heat exchange at the two sides of the rotary type heat exchange
apparatus (1000); or 5) operatively controlling the rotating speed of the
rotary type heat exchange rotating disk (100) driven by the rotating disk
rotationally driving device (110); or 6) integrally operatively controlling
10 at least two of said items 1), 2), 3), 4) & 5) in combination;

-- The rotating disk rotationally driving device (110): It is constituted by
electric motor or other rotational power source with variable speed
transmission device (111) for driving the rotary type heat exchange
rotating disk (100) to rotate and modulating its rotating speed to change
15 its heat exchange characteristics;

-- The rotary type heat exchange rotating disk (100): It is rotationally
driven by the rotating disk rotationally driving device (110), wherein its
disk is internally provided with two porous fluid circuit areas for passing
through different directional fluid flows and has the heat absorbing or
20 dissipating function, the two fluid circuits of the rotary type heat exchange
rotating disk are respectively individually made with two fluid ports for
respectively pumping two fluid streams, wherein the two fluid flow
circuits are mutually isolated, thereby allowing the fluids in different flow
directions to pass through the rotary type heat exchange rotating disk (100)
25 driven by the rotating disk rotationally driving device (110) for heat
exchange function operations;

-- The timings to operatively control the flow rate of heat exchange fluid
and/or the rotating speed of rotary type heat exchange rotating disk (100)
driven by rotating disk rotationally driving device (110) are that: 1) the
30 fluid flow rate and change timing are preset in the open loop operative

control; or 2) It is randomly manually operatively controlled; or 3) to
install at least one temperature detecting device (11) or at least one
gaseous or liquid state fluid composition detecting device (31) at the
position capable of directly or indirectly detecting the temperature or
5 composition of the pumping gaseous or liquid state fluid, including
installing both or at least one detecting device, wherein the detected
signals are used as the reference to determine the operating timing for
operatively controlling the flow rate of the pumping exchange fluid or the
rotating speed of the rotary type heat exchange rotating disk (100) driven
10 by the rotating disk rotationally driving device (110);

The unidirectional fluid pump (120a) and unidirectional fluid pump
(120b) can also be installed to the fluid ports (a)(d) or installed to the fluid
ports (b)(c) in said embodiment of Fig. 6, wherein one unidirectional fluid
pump is pumped in positive pressure while the other unidirectional fluid
15 pump is pumped in negative pressure so as to allow the two fluid streams
to pass through the rotary type heat exchange rotating disk (100) in
different pumping flow directions.

Fig. 7 is a schematic view of the structural principle of the
embodiment showing that the present invention is further installed with
20 the temperature detecting device, the humidity detecting device and the
gaseous or liquid state composition detecting device to operatively control
the flow rates of the total heat exchange fluids;

As shown in Fig. 7, the present invention is mainly constituted by that
the fluid port (b) and fluid port (d) among the fluid port (a), fluid port (b),
25 fluid port (c), and fluid port (d) of the double flow circuit of the rotary
type heat exchange apparatus (1000) are respectively installed with the
unidirectional fluid pumps (120a)(120b) 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
30 operative control the unidirectional fluid pumps (120a)(120b) capable of

producing negative pressure or positive pressure of the double flow circuit fluid pumping device (123) being driven by the power source (300), wherein the pumping two fluid streams pass through the rotary type total heat exchange rotating disk (200) in different areas, and the flow
5 directions of the two fluid streams are different and mutually isolated, wherein:

-- The rotary type heat exchange apparatus (1000) and the unidirectional fluid pumps (120a)(120b) capable of producing negative pressure or positive pressure can be integrally combined or separately installed to
10 constitute the double flow circuit fluid pumping device (123) function, and the two unidirectional fluid pumps (120a)(120b) capable of producing negative pressure or positive pressure are respectively installed to the fluid port (b) and the fluid port (d) so as to pump the fluid in different pumping flow directions; said two unidirectional fluid pumps (120a)(120b)
15 capable of producing negative pressure or positive pressure are respectively driven by the electric motor individually 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, including: 1) the two unidirectional
20 fluid pumps (120a)(120b) are pumped in negative pressure for pumping the two fluid streams in different pumping flow directions; 2) the two unidirectional fluid pumps (120a)(120b) are pumped in positive pressure for pumping the two fluid streams in different pumping flow directions; in said two functional mode operations of said 1) & 2), the two fluid streams
25 are pumped to pass through different areas of the rotary type total heat exchange rotating disk (200), the flow circuits of the two fluid streams are mutually isolated, and the flow directions of the two fluid streams are contrary to each other;

-- At least one temperature detecting device (11), at least one humidity
30 detecting device (21), or 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, humidity variation, or gaseous or liquid state fluid composition variation of the pumping exchange fluid, including installing three or at least one
5 detecting device, wherein the detected signals are used as the references to determine the operating timing of the exchange fluid flow rate pumped by the double flow circuit fluid pumping device (123) being operatively controlled by the operative control device (250); including 1) operatively controlling the flow rate of the exchange fluid pumped by the double flow
10 circuit fluid pumping device (123); or 2) operatively controlling the rotating speed of the rotary type total heat exchange rotating disk (200) driven by the rotating disk rotationally driving device (110); or 3) operatively controlling said items 1) & 2) simultaneously;

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

-- The double flow circuit fluid pumping device (123): It is constituted by at least two unidirectional fluid pumps (120a)(120b), wherein the fluid port (b) and fluid port (d) of the double flow circuit installed within the
20 rotary type heat exchange apparatus (1000) are respectively installed with the unidirectional fluid pumps (120a)(120b) being capable of producing negative 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
25 double fluid circuit fluid pumping device (123) driven by the power source (300), as well as to operative control the rotating speed of the rotary type total heat exchange rotating disk (200) driven by the rotating disk rotationally driving device (110);

-- 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 rotary 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) 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 rotary type total heat exchange rotating disk (200); or 4) operatively controlling the humidity distribution status of the rotary type total heat exchange rotating disk (200); or 5) operatively controlling the composition interaction status between the gaseous or liquid state fluids for heat exchange at the two sides of the rotary type heat exchange apparatus (1000); or 6) operatively controlling the rotating speed of the rotary type total heat exchange rotating disk (200) driven by the rotating disk rotationally driving device (110); or 7) integrally operatively controlling at least two of said items 1), 2), 3), 4), 5) & 6) in combination;
- The rotating disk rotationally driving device (110): It is constituted by electric motor or other rotational power source with variable speed transmission device (111) for driving the rotary type total heat exchange rotating disk (200) to rotate and modulating its rotating speed to change its heat exchange characteristics;
- The rotary type total heat exchange rotating disk (200): It is rotationally driven by the rotating disk rotationally driving device (110), wherein its disk is internally provided with two porous fluid circuit areas for passing through different directional fluid flows and has the heat absorbing or dissipating as well as humidity absorbing or dissipating function, the two fluid circuits of the rotary type total heat exchange rotating disk (200) are

respectively individually made with two fluid ports for respectively
pumping two fluid streams, wherein the two fluid flow circuits are
mutually isolated, thereby allowing the fluids in different flow directions
to pass through the rotary type total heat exchange rotating disk (200)
5 driven by the rotating disk rotationally driving device (110) for total heat
exchange function operations;

-- The timings to operatively control the flow rate of heat exchange fluid
and/or the rotating speed of rotary type total heat exchange rotating disk
(200) driven by rotating disk rotationally driving device (110) are that: 1)
10 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) to
install three or at least one kind of detecting devices of at least one
temperature detecting device (11), at least one humidity detecting device
(21), or at least one gaseous or liquid state fluid composition detecting
15 device (31) at the position capable of directly or indirectly detecting the
temperature variation, humidity variation, or gaseous or liquid state fluid
composition variation of the pumping exchange fluid, wherein the
detected signals are used as the reference to determine the operating
timing for operatively controlling the flow rate of the pumping fluid or the
20 rotating speed of the rotary type total heat exchange rotating disk (200)
driven by the rotating disk rotationally driving device (110);

The unidirectional fluid pump (120a) and unidirectional fluid pump
(120b) can also be installed to the fluid ports (a)(d) or installed to the fluid
ports (b)(c) in said embodiment of Fig. 7, wherein one unidirectional fluid
25 pump is pumped in positive pressure while the other unidirectional fluid
pump is pumped in negative pressure so as to allow the two fluid streams
to pass through the rotary type total heat exchange rotating disk (200) in
different pumping flow directions;

The aforesaid embodiment of Fig. 7 is further installed a heater (130)
30 in the fluid exchange flow circuit of the rotary type heat exchange rotating

disk (200) to enhance the dehumidification performance, wherein the heater is actuated by electric energy or other temperature controllable heat generating sources;

In addition, it is further through the operative control device (250) to
5 refer to detected values of the temperature detecting device (11), humidity detecting device (21), gaseous or liquid state composition detecting device (31) to operatively control the heating timing and heating thermal energy value of the heater (130);

For the rotary type heat exchange apparatus with automatic flow rate
10 exchange modulation of present invention, the structural types of the rotary type heat exchange rotating disk or the rotary type total heat exchange rotating disk 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 constituted by the gaseous or liquid state liquid
15 fluid circuits; or 3) one or more than one fluid circuit in series connection, parallel connection, or series and parallel connection;

The rotary type heat exchange apparatus with automatic flow rate exchange modulation of present invention is further installed with the three or at least one or more than one detecting devices of the temperature
20 detecting device (11), 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 rotary type heat exchange apparatus (1000), rotary
25 type heat exchange rotating disk (100), or rotary type total heat exchange rotating disk (200), 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 could be one or more than one to provide detected signals for reference by one or more than
30 functional operations of the following: 1) for reference to operatively

control the double flow circuit fluid pumping device (123) for modulating the flow speed or flow rate of the pumping fluid; or 2) for reference to operatively control the opening percentage of the fluid valve for modulating the flow speed or flow rate of the pumping fluid;

5 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 detecting devices are integrally combined, or they are individually separately installed;

10 Said double flow circuit fluid pumping device (123) of the present invention constituted by two unidirectional fluid pumps (120a)(120b) is configured for pumping gaseous or liquid state fluids, wherein the two unidirectional fluid pumps (120a)(120b) constituting the double flow circuit fluid pumping device (123) except for being driven by individually
15 installed electric motors or by a common electric motor, they can also be driven by engine power, or the mechanical or electric power converted from other wind power, thermal energy, temperature-difference energy, or solar energy.

The operative control device (250) of the present invention is
20 equipped with the electric motor, engine power, or mechanical or electric power generated or converted from other wind power, thermal energy, temperature-difference energy, or solar energy for driving various unidirectional fluid pumps (120a)(120b), or the rotating disk rotationally driving device (110), or capable of operatively controlling the operating
25 timing of the fluid pumps or fluid valves thereby changing the flow directions of the two fluid streams passing through the rotary type heat exchange rotating disk (100), or capable of operatively controlling the rotating speed of the rotary type heat exchange rotating disk (100) or the rotary type total heat exchange rotating disk (200) driven by the rotating
30 disk rotationally driving device (110) to further operatively control partial

or all modulating functions of the rotating speed, flow rate, fluid pressure of the fluid pumps.

For said rotary type heat exchange apparatus with automatic flow rate exchange modulation of present invention, it is further through the operative control device (250) to operatively control the flow rate of the pumping fluid pumped by the double flow circuit fluid pumping device (123) and/or to operatively control the rotating speed of the rotary type heat exchange rotating disk (100) or the rotary type total heat exchange rotating disk (200) driven by the rotating disk rotationally driving device (110), wherein the operating modes include one or more than one of the following:

- 1) The adjustment or setting is manually operatively controlled;
- 2) The operative control is referring to the signal detected by at least one installed temperature detecting device;
- 15 3) The operative control is referring to the signal detected by at least one installed humidity detecting device;
- 4) The operative control is referring to the signal detected by at least one installed gaseous or liquid state fluid composition detecting device;
- 5) The operative control is performed by combining the two or more than two methods of items 1) ~ 4).
- 20

In setting up the flow rate operative control function of the rotary 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 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:

- 1) It is through operatively controlling the pumping rotating speed of the double flow circuit fluid pumping device (123) comprising two unidirectional fluid pumps (120a)(120b) within the range from cease
- 30

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 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.

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

- 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;
- 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 rotary 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 constituted by two fluid pumps capable of bidirectional pumping 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;

- 2) Operatively controlling the fluids in two flow circuits to be reversely pumped in the same flow directions for discharging fluids;
- 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 system with automatic flow rate exchange modulation, comprising:

a heat exchange apparatus (1000) including a heat exchange rotating disk (100, 200) and two mutually isolated internal flow paths through which at least a first heat exchange fluid is respectively pumped in a first direction and at least a second heat exchange fluid is respectively pumped in a second direction, so that the heat exchange apparatus has four fluid ports (a,b,c,d) through which the first and second heat exchange fluids are pumped into and out of the heat exchange apparatus,

wherein said rotating disk (100, 200) is driven by a rotating disk driving device (110),

said rotating disk (100, 200) includes two porous fluid areas through which said first and second heat exchange fluids in the internal flow paths flow respectively in said first and second directions, and

said rotating disk (100, 200) is made of a heat absorbing or dissipating material that absorbs or dissipates heat carried by said first and second heat exchange fluids as they pass through the rotating disk (100, 200), said rotating disk thereby causing heat exchange between said first and second heat exchange fluids;

at least two fluid pumps (120a,120b) for respectively pumping the first and second heat exchange fluids in said first direction through the heat exchange apparatus and in said second direction through the heat exchange apparatus (1000);

a power source (300) for supplying power to the at least two fluid pumps (120a,120b);

an operative control device (250) for controlling said heat exchange between the first and second heat exchange fluids by operatively controlling at least one of (a) a flow rate of at least one of the first and second heat exchange fluids, and (b) a rotating speed of the rotating disk (100, 200); and

at least one gaseous or liquid state fluid composition detecting device (31) installed at a position to detect a fluid composition variation within the heat exchange apparatus, wherein the gaseous or liquid state fluid composition detecting device (31) provides fluid composition detecting signals to said operative control device (250) for use as a reference to operatively control an inflow status of one of said first and second heat exchange fluids.

2. The heat exchange system according to claim 1, further comprising at least one temperature detecting device (11) installed at a position to detect a temperature variation of a respective one of said first and second heat exchange fluids, wherein the at least one temperature detecting device provides temperature detecting signals to said operative control device (250) to control said at least one of said flow rate and rotating speed by using said temperature detecting signals as a reference.

3. The heat exchange system according to claim 2, further comprising at least one humidity detecting device (21) installed at a position to detect a humidity variation of a respective one of said first and second heat exchange fluids when a state of said respective one of said first and second heat exchange fluids at said position is gaseous, wherein the at least one humidity detecting device provides humidity detecting signals to said operative control device (250) to control said at least one of said flow rate and rotating speed by using said humidity detecting signals as a reference.

4. The heat exchange system according to claim 3, wherein said operative control device (250) controls said at least one of said flow rate and rotating speed by operatively controlling said at least two fluid pumps.

5. The heat exchange system according to claim 3, wherein said at least two fluid pumps are unidirectional pumps and are operated in one of three modes: a mode in which said unidirectional pumps are operated to generate positive pressure, a mode in which said unidirectional pumps are operated to generate negative pressure, and a mode in which at least one of said unidirectional pumps is operated to generate positive pressure and at least one of said unidirectional pumps is operated to generate negative pressure.

6. The heat exchange system according to claim 3, wherein the at least two fluid pumps (111,112 or 120a,120b,120c,120d) are operatively controlled by the operative control device (250) according to at least one of the following operative control modes:

- (a) a mode in which adjustment or setting of the flow rate is manually controlled;
- (b) a mode in which the flow rate is operatively controlled by referring to a signal detected by said at least one temperature detecting device;

- (c) a mode in which the flow rate is operatively controlled by referring to a signal detected by said at least one humidity detecting device;
- (d) a mode in which the flow rate is operatively controlled by referring to a signal detected by said at least one gaseous or liquid state fluid composition detecting device; and
- (e) a mode which is a combination of at least two of said modes (a) to (d).

7. The heat exchange system according to claim 3, wherein said rotating disk driving device (110) supplies power to said rotating disk (100, 200) under control of said operative control device (250).

8. The heat exchange system according to claim 3, wherein said two porous fluid areas of said rotating disk (100, 200) include respective apertures for passage of said first and second heat exchange fluids.

9. The heat exchange system according to claim 3, wherein said rotating disk (100, 200) has one of a humidity absorbing property for absorbing humidity and a humidity dissipating property for dissipating humidity when a respective one of said first and second heat exchange fluids is in a gaseous state.

10. The heat exchange system according to claim 1, further comprising at least one humidity detecting device (21) installed at a position to detect a humidity variation of a respective one of said first and second heat exchange fluids when a state of said respective one of said first and second heat exchange fluids at said position is gaseous, wherein the at least one humidity detecting device provides humidity detecting signals to said operative control device (250) to control said at least one of said flow rate and rotating speed by using said humidity detecting signals as a reference.

11. The heat exchange system according to claim 1, wherein said operative control device (250) controls said at least one of said flow rate and rotating speed by operatively controlling at least one of said at least two fluid pumps.

12. The heat exchange system according to claim 1, wherein said rotating disk (100, 200) has one of a humidity absorbing property for absorbing humidity and a humidity dissipating property for dissipating humidity when a respective one of said first and second heat exchange fluids is in a gaseous state.

13. The heat exchange system according to claim 1, wherein said rotating disk driving device (110) supplies power to said rotating disk (100, 200) under control of said operative control device (250).

14. The heat exchange system according to claim 1, wherein said two porous fluid areas of said rotating disk (100, 200) include respective apertures for passage of said first and second heat exchange fluids.

15. The heat exchange system according to claim 1, wherein the flow rate of a respective one of said first and second heat exchange fluids in one of said fluid flow paths is controlled to be greater than the flow rate of the other one of said first and second heat exchange fluids in the other of said fluid flow paths in a first mode; and the flow rate of the respective one of said heat exchange fluids is controlled to be the same as the flow rate of the other one of said heat exchange fluids in a second mode.

16. The heat exchange system according to claim 1, wherein said at least two fluid pumps are arranged to operate in at least one of the following modes: a mode in which said first and second fluids are pumped into said heat exchange apparatus, a mode in which said first and second fluids are reversely pumped out of said heat exchange apparatus, and a mode in which said first and second fluids are periodically pumped into and out of said heat exchange apparatus in respectively reversed flow directions.