

VERTICAL FLUID HEAT EXCHANGER INSTALLED WITHIN NATURAL THERMAL ENERGY BODY

BACKGROUND OF THE INVENTION

5 (a) Field of the Invention

The present invention relates to a fluid heat exchanger with the form of vertical relay fluid storage barrel installed with at least one fluid inlet and at least one fluid outlet for being close installed, or whole or in part placement into natural thermal energy body in vertical or downward
10 oblique manner, wherein a thermal energy exchanger is installed inside the structure of the relay fluid storage barrel temporarily storing thermal conductive fluid for external flow, such as tap-water, or water from rivers, lakes or sea, for performing the function of auxiliary water storage barrel installed at shallow thermal energy body, the thermal energy exchanger is
15 installed with at least one fluid piping for the thermal conductive fluid passing through, to perform heat exchange with the fluid in the relay fluid storage barrel, and the fluid in the relay fluid storage barrel performs heat exchange with the thermal energy of the natural thermal energy body, such as soil of shallow surface of the earth, or lakes, rivers, or sea, or
20 artificial fluid storage facilities of ponds, reservoirs, or fluid pools.

(b) Description of the Prior Art

The conventional embedded vertical relay fluid storage barrel installed at natural thermal energy body, such as soil of shallow surface of the earth, or lakes, rivers, or sea, or artificial fluid storage facilities of
25 ponds, reservoirs, or fluid pools, is usually constituted by rod structure in solid, and only the rod structural body performs heat exchange through transmitting thermal energy of the natural thermal energy body to fluid piping installed inside the rod structural body with the shortages of small value and slow speed of heat exchange.

SUMMARY OF THE INVENTION

The present invention relates to a fluid heat exchanger with the form of vertical relay fluid storage barrel for being close installed, or whole or in part placement into natural thermal energy body installed in soil of shallow surface of the earth, or lakes, rivers, or sea, or artificial fluid storage facilities of ponds, reservoirs, or fluid pools, in vertical or downward oblique manner, wherein the relay fluid storage barrel is installed with at least one fluid inlet and at least one fluid outlet, a thermal energy exchanger is installed inside the structure of the relay fluid storage barrel temporarily storing thermal conductive fluid for external flow, such as tap-water, or water from rivers, lakes or sea, for performing the function of auxiliary water storage barrel installed at shallow thermal energy body, the thermal energy exchanger is installed with at least one fluid piping for the thermal conductive fluid passing through, to perform heat exchange with the fluid in the relay fluid storage barrel, and the fluid in the relay fluid storage barrel performs heat exchange with the thermal energy of the natural thermal energy body, such as soil of shallow surface of the earth, or lakes, rivers, or sea, or artificial fluid storage facilities of ponds, reservoirs, or fluid pools; the thermal conductive fluid in the relay fluid storage barrel, such as tap-water, or water from rivers, lakes or sea, can be randomly pumped to form an open flow path system, or the system can be kept random pumping facilities and be additionally installed with pumps (including a common pump and making choice of pumped fluid flow by a switch valve), to pump the thermal conductive fluid in the relay fluid storage barrel to the source of the thermal conductive fluid to form a semi-open flow path system, or the system can be only installed with pumps, but without random pumping facilities, to pump the thermal conductive fluid in the relay fluid storage barrel to the upstream source of the thermal conductive fluid to form a closed flow path system.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a three-dimensional schematic view showing the basic structure of the present invention;

Fig. 2 is a sectional view of Fig. 1;

5 Fig. 3 is a structural schematic view of an embodiment, showing a thermal energy exchanger (705) constituted by U-type piping, according to the present invention;

Fig. 4 is a structural schematic view of an embodiment, showing the thermal energy exchanger (705) constituted by spiral piping, according to
10 the present invention;

Fig. 5 is a structural schematic view of an embodiment, showing the thermal energy exchanger (705) constituted by wavy piping, according to the present invention;

Fig. 6 is a structural schematic view of an embodiment, showing the
15 thermal energy exchanger (705) constituted by U-type piping additionally installed with thermal conductive fins, according to the present invention;

Fig. 7 is a structural schematic view of an embodiment, showing the thermal energy exchanger (705) constituted by a thermal conductive structural body inside installed with flow paths, according to the present
20 invention;

Fig. 8 is a structural schematic view of an embodiment, showing that a fluid inlet (701) and a fluid outlet (702) are placed at upper part in a relay fluid storage barrel (700), wherein flow guiding structure (730) for guiding the flow of internal fluid to flow from top to bottom is placed
25 inside the relay fluid storage barrel (700) to connect the fluid inlet (701) and/or the fluid outlet (702), according to the present invention;

Fig. 9 is a sectional view of Fig. 8;

Fig. 10 is a structural schematic view of an embodiment, showing that a combined thermal energy exchanger (7050) is constituted by two
30 crossed U-type piping with 90 degrees difference, according to the present

invention;

Fig. 11 is a structural schematic view of an embodiment, showing that the same combined thermal energy exchanger (7050) within the relay fluid storage barrel (700) is installed with two fluid pathways, according to the present invention;

Fig. 12 is a sectional view of Fig. 11;

Fig. 13 is a structural schematic view of an embodiment, showing that two or more thermal energy exchangers (705) are installed within the same relay fluid storage barrel (700), according to the present invention;

Fig. 14 is a sectional view of Fig. 13;

Fig. 15 is a structural schematic view of an embodiment, showing that a fluid inlet (708) and/or a fluid outlet (709) of the fluid pathway in the thermal energy exchanger (705) are installed with a switch valve (710), according to the present invention;

Fig. 16 is a sectional view of Fig. 15;

Fig. 17 is a structural schematic view of an embodiment, showing that the fluid inlet (701) and/or the fluid outlet (702) of the relay fluid storage barrel (700) are installed with a switch valve (703), according to the present invention;

Fig. 18 is a sectional view of Fig. 17;

Fig. 19 is a structural schematic view of an embodiment, showing that a controllable valve (801) is installed at the fluid inlet (701) and/or a controllable valve (802) is installed at the fluid outlet (702), and with-flow piping (800) is installed between the controllable valve (801) and the controllable valve (802), within the relay fluid storage barrel (700), according to the present invention;

Fig. 20 is a sectional view of Fig. 19;

Fig. 21 is a structural schematic view of an embodiment, showing that the relay fluid storage barrel (700) is further installed with ventilation piping (720), according to the present invention;

Fig. 22 is a structural schematic view of an embodiment, showing that the relay fluid storage barrel (700) is further installed with a backflow fluid outlet (702'), besides the thermal energy exchanger (705), the fluid outlet (702), and a pump (704), and backflow piping (750) connected with a pump (714) in series is installed between the backflow fluid outlet (702') and upstream fluid piping or fluid source (900), for pumping partial fluid in the relay fluid storage barrel (700) to upstream through the backflow piping (750) to form a semi-closed circuit system with thermal energy adjustment function, according to the present invention;

Fig. 23 is a structural schematic view of an embodiment, showing that the relay fluid storage barrel (700) is only kept the thermal energy exchanger (705), and the backflow piping (750) connected with the pump (714) in series is installed between the backflow fluid outlet (702') and upstream fluid piping or the fluid source (900), for pumping the fluid in the relay fluid storage barrel (700) to upstream through the backflow piping (750) to form a closed circuit system with thermal energy adjustment function, according to the present invention;

Fig. 24 is a structural schematic view of an embodiment, showing that secondary segment fluid storage facilities (850) is installed at the position higher than that of the relay fluid storage barrel (700), for storing the fluid pumped by the pump (704) through fluid piping (810), according to the present invention;

Fig. 25 is a structural schematic view of an embodiment, showing that the secondary segment fluid storage facilities (850) is installed at the position higher than that of the relay fluid storage barrel (700), for storing the fluid pumped by the pump (704) through the fluid piping (810), the secondary segment fluid storage facilities (850) is the fluid terminal storage facilities, or which is installed with a fluid port (723) for fluid external flow, and auxiliary fluid piping (820) is installed between the relay fluid storage barrel (700) and the secondary segment fluid storage

facilities (850), according to the present invention;

Fig. 26 is a system schematic view of the first embodiment, showing the operation of air conditioning cooling towers connected in series, according to the present invention;

5 Fig. 27 is a system schematic view of the second embodiment, showing the operation of air conditioning cooling towers connected in series, according to the present invention; and

Fig. 28 is a structural schematic view of an embodiment, showing that an external conduit (3000) is installed around the relay fluid storage
10 barrel (700), according to the present invention.

Fig. 29 is a structural schematic view of an embodiment, showing the relay fluid storage barrel (700) is formed to a longer two-step structure having a larger top portion and a smaller bottom portion, and the top portion thereof is placed on the surface of the natural thermal energy body,
15 the bottom portion is placed into the natural thermal energy body;

Fig. 30 is a structural schematic view of an embodiment, showing the relay fluid storage barrel (700) is formed to a longer two-step structure having a larger top portion and a smaller bottom portion, a part of the larger top portion and the whole smaller bottom portion connected
20 therewith are placed into the natural thermal energy body;

Fig. 31 is a structural schematic view of an embodiment, showing the relay fluid storage barrel (700) is formed to a longer two-step structure having a larger top portion and a smaller bottom portion, the larger top portion of the relay fluid storage barrel (700) is supported by a gantry
25 structure (1100), and the smaller bottom portion downwardly extends into the natural thermal energy body;

Fig. 32 is a structural schematic view of an embodiment, showing the relay fluid storage barrel (700) is formed to a cone shape;

Fig. 33 is a structural schematic view of an embodiment, showing the
30 relay fluid storage barrel (700) is formed to a reverse taper shape

three-dimension polyhedron;

Fig. 34 is a structural schematic view of an embodiment, showing the relay fluid storage barrel (700) is formed to a reverse trapezoid cone shape structure;

- 5 Fig. 35 is a structural schematic view of an embodiment, showing the relay fluid storage barrel (700) is formed to a reverse trapezoid taper shape three-dimension polyhedron.

DESCRIPTION OF MAIN COMPONENT SYMBOLS

- 10 (700): Relay fluid storage barrel
 (701), (708), (708'): Fluid inlet
 (702), (709), (709'): Fluid outlet
 (702'): Backflow fluid outlet
 (703): Switch valve
15 (704), (714), (724): Pump
 (705): Thermal energy exchanger
 (710), (801), (802): Controllable valve
 (720): Ventilation piping
 (723): Fluid port
20 (725): Ventilation switch valve
 (730), (730'): Flow guiding structure for guiding the flow of internal fluid
 to flow from top to bottom
 (750): Backflow piping
 (760): Heat insulation member
25 (800): With-flow piping
 (810): Fluid piping
 (820), (830): Auxiliary fluid piping
 (850): Secondary segment fluid storage facilities
 (900): Fluid source
30 (1000): Natural thermal energy body

(1100): Gantry structure
(1200): Cooling tower
(1201): High temperature water inlet
(1202): Cooling water outlet
5 (1500): Air-conditioning device
(2000): Control device
(3000): External conduit
(7001): Bottom portion of relay fluid storage barrel
(7050): Combined thermal energy exchanger

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DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The conventional embedded vertical relay fluid storage barrel installed at natural thermal energy body, such as soil of shallow surface of the earth, or lakes, rivers, or sea, or artificial fluid storage facilities of ponds, reservoirs, or fluid pools, is usually constituted by rod structure in solid, and only the rod structural body performs heat exchange through transmitting thermal energy of the natural thermal energy body to fluid piping installed inside the rod structural body with the shortages of small value and slow speed of heat exchange.

20 The present invention relates to a vertical fluid heat exchanger installed within natural thermal energy body, mainly to a fluid heat exchanger with the form of vertical relay fluid storage barrel for being close installed, or whole or in part placement into natural thermal energy body installed in soil of shallow surface of the earth, or lakes, rivers, or sea, or artificial fluid storage facilities of ponds, reservoirs, or fluid pools, in vertical or downward oblique manner, wherein the relay fluid storage barrel is installed with at least one fluid inlet and at least one fluid outlet, a thermal energy exchanger is installed inside the structure of the relay fluid storage barrel temporarily storing thermal conductive fluid for external flow, such as tap-water, or water from rivers, lakes or sea, for

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performing the function of auxiliary water storage barrel installed at shallow thermal energy body, the thermal energy exchanger is installed with at least one fluid piping for the thermal conductive fluid passing through, to perform heat exchange with the fluid in the relay fluid storage barrel, and the fluid in the relay fluid storage barrel performs heat exchange with the thermal energy of the natural thermal energy body, such as soil of shallow surface of the earth, or lakes, rivers, or sea, or artificial fluid storage facilities of ponds, reservoirs, or fluid pools; the thermal conductive fluid in the relay fluid storage barrel, such as tap-water, or water from rivers, lakes or sea, can be randomly pumped to form an open flow path system, or the system can be kept random pumping facilities and be additionally installed with pumps (including a common pump and making choice of pumped fluid flow by a switch valve), to pump the thermal conductive fluid in the relay fluid storage barrel to the source of the thermal conductive fluid to form a semi-open flow path system, or the system can be only installed with pumps, but without random pumping facilities, to pump the thermal conductive fluid in the relay fluid storage barrel to the upstream source of the thermal conductive fluid to form a closed flow path system.

For the vertical fluid heat exchanger installed within natural thermal energy body, the basic structure and operation are explained as following:

Fig. 1 is a three-dimensional schematic view showing the basic structure of the present invention, and Fig. 2 is a sectional view of Fig. 1. As shown in Fig. 1 and Fig. 2, the main components include:

---Relay fluid storage barrel (700): made of thermal conductive material to be integrated or combined, wherein the relay fluid storage barrel (700) is a fluid heat exchanger with the form of vertical relay fluid storage barrel for being close installed, or whole or in part placement into natural thermal energy body (1000) in vertical or downward oblique manner, and the relay fluid storage barrel (700) is installed with at least

one fluid inlet (701) and at least one fluid outlet (702) for fluid entering and leaving to perform fluid exchange function; in which the fluid inlet (701) is installed at the position lower than that of the relay fluid storage barrel (700), and the fluid outlet (702) is installed at the position higher than that of the relay fluid storage barrel (700), or vice versa, to prevent the fluid at lower part within the relay fluid storage barrel (700) from stagnation; and wherein

---the fluid passing through the relay fluid storage barrel (700) is controlled by human or by control device (2000) for pumping or pump-priming, by way of external pressure, or gravity with potential difference, or a pump (704) being installed at the fluid inlet (701) and/or the fluid outlet (702), to drive the fluid in liquid state, or gaseous state, or liquid to gaseous state, or gaseous to liquid state for pumping, or stop, or adjustment of pumping flow rate;

---one or more thermal energy exchangers (705) related to fluid by fluid are installed inside the relay fluid storage barrel (700);

---the thermal energy exchanger (705) has independent flow paths for fluid passing through, to perform heat exchange with the fluid in the relay fluid storage barrel (700); the thermal energy exchanger (705) is directly constituted by the structure of tubular flow paths in a variety of geometric shapes, including U-type fluid piping (such as Fig. 3 is a structural schematic view of an embodiment, showing the thermal energy exchanger (705) constituted by U-type piping, according to the present invention;), or spiral fluid piping (such as Fig. 4 is a structural schematic view of an embodiment, showing the thermal energy exchanger (705) constituted by spiral piping, according to the present invention;), or wavy fluid piping (such as Fig. 5 is a structural schematic view of an embodiment, showing the thermal energy exchanger (705) constituted by wavy piping, according to the present invention;), and/or the thermal energy exchanger (705) is constituted by U-type piping additionally installed with thermal

conductive fins (such as Fig. 6 is a structural schematic view of an embodiment, showing the thermal energy exchanger (705) constituted by U-type piping additionally installed with thermal conductive fins, according to the present invention;), and the above thermal energy exchangers (705) in various shapes are installed with fluid inlet (708) and fluid outlet (709);

---the thermal energy exchanger (705) is directly constituted by a thermal conductive structural body inside installed with flow paths and installed with the fluid inlet (708) and the fluid outlet (709), and/or thermal conductive fins extended from the thermal conductive structural body (such as Fig. 7 is a structural schematic view of an embodiment, showing the thermal energy exchanger (705) constituted by a thermal conductive structural body inside installed with flow paths, according to the present invention;);

---the individual fluid pathway of the thermal energy exchanger (705) is installed with fluid inlet and fluid outlet; and

---the fluid passing through the fluid pathway of the thermal energy exchanger (705) is controlled for pumping or pump-priming, by way of external pressure, or gravity with potential difference, or a pump being installed, to individually drive the same or different fluid in liquid state, or gaseous state, or liquid to gaseous state, or gaseous to liquid state ; and

---Control device (2000): related to control device activated by electrical force, mechanical force, current force, or magnetic force, for controlling the pump (704), wherein the control device (2000) and the pump (704) are installed simultaneously.

For the vertical fluid heat exchanger installed within natural thermal energy body, there are one or more cylindrical relay fluid storage barrels (700) inside installed with the thermal energy exchanger (705), and if two or more relay fluid storage barrels (700) exist, the fluid pathways in the individual relay fluid storage barrel (700) are series connection, parallel

connection, or series-parallel connection; wherein

---the different relay fluid storage barrels (700) individually operate for same or different types fluids passing through;

5 ---there are one or divided into more than one fluid pathways within the relay fluid storage barrel (700), and if divided into two or more fluid pathways exist, individual flow path is installed with fluid inlet and fluid outlet;

10 ---if there are two or more fluid pathways within the relay fluid storage barrel (700), individual fluid pathway individually operates for same or different types fluids passing through; and

---if there are two or more fluid pathways within the relay fluid storage barrel (700), the fluid pathways are series connection, parallel connection, or series-parallel connection.

15 For the vertical fluid heat exchanger installed within natural thermal energy body, the thermal energy exchanger (705) is directly constituted by at least two crossed U-type fluid piping, in which one fluid pathway is installed with the fluid inlet (708) and the fluid outlet (709), and another fluid pathway is installed with fluid inlet (708') and fluid outlet (709').

20 For the vertical fluid heat exchanger installed within natural thermal energy body, the fluid inlet (701) and the fluid outlet (702) are further installed at upper part within the relay fluid storage barrel (700) to facilitate maintenance, and flow guiding structure (730) for guiding the flow of internal fluid to flow from top to bottom is placed inside the relay fluid storage barrel (700) to connect the fluid inlet (701) and/or the fluid outlet (702), for ensuring the flow path between the fluid inlet (701) and
25 the fluid outlet (702) passing through the bottom of the relay fluid storage barrel (700) to prevent the fluid at lower part within the relay fluid storage barrel (700) from stagnation; (such as Fig. 8 is a structural schematic view of an embodiment, showing that a fluid inlet (701) and a fluid outlet (702)
30 are placed at upper part in a relay fluid storage barrel (700), wherein the

flow guiding structure (730) for guiding the flow of internal fluid to flow from top to bottom is placed inside the relay fluid storage barrel (700) to connect the fluid inlet (701) and/or the fluid outlet (702), according to the present invention; and Fig. 9 is a sectional view of Fig. 8;); wherein

5 ---the fluid pathways of the same combined thermal energy exchanger (7050) in the same relay fluid storage barrel (700) include two or more U-type piping, which are parallel and side by side, parallel and stacked, or crossed with angle difference, (such as Fig. 10 is a structural schematic view of an embodiment, showing that the combined thermal
10 energy exchanger (7050) is constituted by two crossed U-type piping with 90 degrees difference, according to the present invention;) and if two or more fluid pathways exist, individual fluid pathway is installed with fluid inlet and fluid outlet, and individually operates for same or different types fluids passing through; (such as Fig. 11 is a structural schematic view of
15 an embodiment, showing that the same combined thermal energy exchanger (7050) within the relay fluid storage barrel (700) is installed with two fluid pathways, according to the present invention; and Fig. 12 is a sectional view of Fig. 11;) and

 ---if there are two or more fluid pathways of the same combined
20 thermal energy exchanger (7050) in the same relay fluid storage barrel (700), the fluid pathways are series connection, parallel connection, or series-parallel connection;

 ---if two or more thermal energy exchangers (705) are installed within the same relay fluid storage barrel (700), the individual thermal
25 energy exchanger (705) includes one or more fluid pathways respectively installed with fluid inlet and fluid outlet, and individual fluid pathway individually operates for same or different types fluids passing through; (such as Fig. 13 is a structural schematic view of an embodiment, showing that two or more thermal energy exchangers (705) are installed within the
30 same relay fluid storage barrel (700), according to the present invention;

and Fig. 14 is a sectional view of Fig. 13);

---if there are two or more thermal energy exchangers (705) installed inside the same relay fluid storage barrel (700), the fluid pathways of the individual thermal energy exchanger (705) are series connection, parallel
5 connection, or series-parallel connection;

---the fluid pathways of the thermal energy exchangers (705) installed within the different relay fluid storage barrels (700) individually operate;

---same or different types fluids pass through the individual fluid
10 pathway of the thermal energy exchangers (705) within the different relay fluid storage barrels (700);

---the fluid pathways of the thermal energy exchangers (705) within the different relay fluid storage barrels (700) are series connection, parallel connection, or series-parallel connection; and

15 ---the fluids passing through the piping of the thermal energy exchangers (705) within the different relay fluid storage barrels (700) are controlled by human or by the control device (2000) for pumping or pump-priming, by way of external pressure, or gravity with potential difference, or the pump (714) being installed, to drive the fluids in liquid
20 state, or gaseous state, or liquid to gaseous state, or gaseous to liquid state.

For the above thermal energy exchanger (705), the fluid inlet (708) and/or the fluid outlet (709) of the fluid pathway are installed with a switch valve (710) (such as Fig. 15 is a structural schematic view of an embodiment, showing that the fluid inlet (708) and/or the fluid outlet (709)
25 of the fluid pathway in the thermal energy exchanger (705) are installed with the switch valve (710), according to the present invention; and Fig. 16 is a sectional view of Fig. 15;).

As shown in Fig. 15 and Fig. 16, the fluid inlet (708) and/or the fluid outlet (709) of the fluid pathway in the thermal energy exchanger (705)
30 are installed with the controllable valve (710) for control regulation of the

fluid entering the fluid pathway in the thermal energy exchanger (705).

For the vertical fluid heat exchanger installed within natural thermal energy body, the barrel cross-section shapes of the relay fluid storage barrels (700) include circular, oval, star, or other shapes.

5 The shapes of the relay fluid storage barrels (700) include parallel rods or non-parallel rods.

For the relay fluid storage barrels (700), the fluid inlet (701) and/or the fluid outlet (702) are installed with a switch valve (703) to control the switch valve (703) by human or by the control device (2000) for opening,
10 or closing, or adjustment of flow rate, and to control the pump (704) for pumping, or stop, or adjustment of pumping flow rate; the control device (2000) is control device activated by electrical force, mechanical force, current force, or magnetic force (such as Fig. 17 is a structural schematic view of an embodiment, showing that the fluid inlet (701) and/or the fluid
15 outlet (702) of the relay fluid storage barrel (700) are installed with the switch valve (703), according to the present invention; and Fig. 18 is a sectional view of Fig. 17;).

For the relay fluid storage barrels (700), a controllable valve (801) is installed at the fluid inlet (701) and/or a controllable valve (802) is
20 installed at the fluid outlet (702), and with-flow piping (800) is installed between the controllable valve (801) and the controllable valve (802) to regulate the fluid flow rate entering inside the relay fluid storage barrels (700), by way of adjustment of the fluid flow rate passing through the with-flow piping, to control the controllable valve (801) and/or the
25 controllable valve (802) by human or by the control device (2000) for opening, or closing, or adjustment of flow rate, and to control the pump (704) for pumping, or stop, or adjustment of pumping flow rate; the control device (2000) is control device activated by electrical force, mechanical force, current force, or magnetic force (such as Fig. 19 is a
30 structural schematic view of an embodiment, showing that the

controllable valve (801) is installed at the fluid inlet (701) and/or the controllable valve (802) is installed at the fluid outlet (702), and the with-flow piping (800) is installed between the controllable valve (801) and the controllable valve (802), within the relay fluid storage barrel (700),
5 according to the present invention; and Fig. 20 is a sectional view of Fig. 19;).

As shown in Fig. 19 and Fig. 20, the controllable valves (801) and (802) and the with-flow piping (800) are controlled for one or more flow modes as following, including:

- 10 1) blocking the fluid passing through the with-flow piping (800), and then the fluid completely passing through the relay fluid storage barrel (700) for entering or leaving;
- 2) blocking the fluid entering into the relay fluid storage barrel (700), and then the fluid completely passing through the with-flow piping (800);
- 15 3) partial fluid entering into the relay fluid storage barrel (700), and partial fluid passing through the with-flow piping (800); and
- 4) adjusting the fluid flow rate entering into the relay fluid storage barrel (700), for performing the functions of opening and closing.

For the vertical fluid heat exchanger installed within natural thermal
20 energy body, the relay fluid storage barrel (700) and/or the thermal energy exchanger (705) are constituted by integrated or combined structure to facilitate the dismantling and maintenance.

The structural cross-section shapes of the thermal energy exchanger (705) include circular, oval, star, square, or other shapes.

25 The shapes of the thermal energy exchanger (705) include parallel rods or non-parallel rods.

For the vertical fluid heat exchanger installed within natural thermal energy body, the relay fluid storage barrel (700) is further installed with ventilation piping (720), the position of the ventilation piping (720) is
30 higher than that of the fluid source to prevent fluid from overflow, and/or

is further installed with a ventilation switch valve (725), if fluid does not enter the inlet, the fluid within the relay fluid storage barrel (700) will be pumped-out by the pump (704), and the ventilation switch valve (725) is controlled by human or by the control device (2000) for eliminating the negative pressure when the pump (704) is pumping-out the fluid within the relay fluid storage barrel (700), such as Fig. 21 is a structural schematic view of an embodiment, showing that the relay fluid storage barrel (700) is further installed with the ventilation piping (720), according to the present invention.

For the vertical fluid heat exchanger installed within natural thermal energy body, the relay fluid storage barrel (700) is further installed with a backflow fluid outlet (702'), besides the thermal energy exchanger (705), the fluid outlet (702), the pump (704), and the control device (2000), and backflow piping (750) connected with a pump (714) in series is installed between the backflow fluid outlet (702') and upstream fluid piping or fluid source (900), to control the pump (714) by human or by the control device (2000) for pumping partial fluid in the relay fluid storage barrel (700) to upstream through the backflow piping (750) to form a semi-closed circuit system with thermal energy adjustment function; if the position of the backflow fluid outlet (702') is at upper part of the relay fluid storage barrel (700), flow guiding structure (730') for guiding the flow of internal fluid to flow from top to bottom is additional placed inside the relay fluid storage barrel (700), and if the position of the backflow fluid outlet (702') is at lower part of the relay fluid storage barrel (700), the flow guiding structure (730') for guiding the flow of internal fluid to flow from top to bottom is unnecessarily placed inside the relay fluid storage barrel (700), such as Fig. 22 is a structural schematic view of an embodiment, showing that the relay fluid storage barrel (700) is further installed with the backflow fluid outlet (702'), besides the thermal energy exchanger (705), the fluid outlet (702), and the pump

(704), and backflow piping (750) connected with a pump (714) in series is installed between the backflow fluid outlet (702') and upstream fluid piping or fluid source (900), for pumping partial fluid in the relay fluid storage barrel (700) to upstream through the backflow piping (750) to form a semi-closed circuit system with thermal energy adjustment function, according to the present invention.

The relay fluid storage barrel (700) is not installed with the pump (704) and the fluid outlet (702), and is only kept the thermal energy exchanger (705), and the backflow piping (750) connected with the pump (714) in series is installed between the backflow fluid outlet (702') and upstream fluid piping or the fluid source (900), to control the pump (714) by human or by the control device (2000) for pumping the fluid in the relay fluid storage barrel (700) to upstream through the backflow piping (750) to form a closed circuit system with thermal energy adjustment function; if the position of the backflow fluid outlet (702') is at upper part of the relay fluid storage barrel (700), the flow guiding structure (730') for guiding the flow of internal fluid to flow from top to bottom is additional placed inside the relay fluid storage barrel (700), and if the position of the backflow fluid outlet (702') is at lower part of the relay fluid storage barrel (700), the flow guiding structure (730') for guiding the flow of internal fluid to flow from top to bottom is unnecessarily placed inside the relay fluid storage barrel (700), such as Fig. 23 is a structural schematic view of an embodiment, showing that the relay fluid storage barrel (700) is only kept the thermal energy exchanger (705), and the backflow piping (750) connected with the pump (714) in series is installed between the backflow fluid outlet (702') and upstream fluid piping or the fluid source (900), for pumping the fluid in the relay fluid storage barrel (700) to upstream through the backflow piping (750) to form a closed circuit system with thermal energy adjustment function, according to the present invention.

For the vertical fluid heat exchanger installed within natural thermal energy body, secondary segment fluid storage facilities (850) is further installed at the position higher than that of the relay fluid storage barrel (700), for storing the fluid pumped by the pump (704) through fluid piping (810), in which the secondary segment fluid storage facilities (850) is the semi-closed or full-closed type fluid terminal storage facilities (850), and/or which is installed with a fluid port (723) for fluid external flow, and/or the ventilation piping (720) and/or the ventilation switch valve (725) are installed at the top of the fluid terminal storage facilities (850), such as Fig. 24 is a structural schematic view of an embodiment, showing that the secondary segment fluid storage facilities (850) is installed at the position higher than that of the relay fluid storage barrel (700), for storing the fluid pumped by the pump (704) through fluid piping (810), according to the present invention.

For the vertical fluid heat exchanger installed within natural thermal energy body, the secondary segment fluid storage facilities (850) is further installed at the position higher than that of the relay fluid storage barrel (700), for storing the fluid pumped by the pump (704), which is controlled by human or by the control device (2000), and pumped into the secondary segment fluid storage facilities (850) through the fluid piping (810), in which the secondary segment fluid storage facilities (850) is the semi-closed or full-closed type fluid terminal storage facilities, and/or which is installed with the fluid port (723) for fluid external flow; the secondary segment fluid storage facilities (850) is enclosed or non-closed structure, and/or which is installed with the ventilation piping (720) or the ventilation switch valve (725), and auxiliary fluid piping (820) is installed between the relay fluid storage barrel (700) and the secondary segment fluid storage facilities (850), in place of the ventilation piping (720) of the relay fluid storage barrel (700), and/or the ventilation piping (720) and/or the ventilation switch valve (725) are installed at the top of the fluid

terminal storage facilities (850) (such as Fig. 25 is a structural schematic view of an embodiment, showing that the secondary segment fluid storage facilities (850) is further installed at the position higher than that of the relay fluid storage barrel (700), for storing the fluid pumped by the pump (704) through the fluid piping (810), the secondary segment fluid storage facilities (850) is the fluid terminal storage facilities, or which is installed with a fluid port (723) for fluid external flow, and the auxiliary fluid piping (820) is installed between the relay fluid storage barrel (700) and the secondary segment fluid storage facilities (850), according to the present invention).

If the secondary segment fluid storage facilities (850) is enclosed structure, the fluid within the relay fluid storage barrel (700) is pumped by the pump (704), which is controlled by human or by the control device (2000), and enters into the secondary segment fluid storage facilities (850) through the fluid piping (810), and the air within the secondary segment fluid storage facilities (850) enters into the space of the relay fluid storage barrel (700) via the auxiliary fluid piping (820), which is produced by pumping fluid.

For the vertical fluid heat exchanger installed within natural thermal energy body, which is further applied for the operation of air conditioning cooling towers connected in series, the water cooled by cooling towers is pumped back to air conditioning device through the connected in series flow paths of the thermal energy exchanger (705) installed within the relay fluid storage barrel (700), such as Fig. 26 is a system schematic view of the first embodiment, showing the operation of air conditioning cooling towers connected in series, according to the present invention; as shown in Fig. 26, the main components include:

---Relay fluid storage barrel (700): made of thermal conductive material to be integrated or combined, wherein the relay fluid storage barrel (700) is a fluid heat exchanger with the form of vertical relay fluid

storage barrel for being close installed, or whole or in part placement into natural thermal energy body (1000) in vertical or downward oblique manner, and the relay fluid storage barrel (700) is installed with at least one fluid inlet (701) and at least one fluid outlet (702) for fluid entering and leaving to perform fluid exchange function; in which the fluid inlet (701) is installed at the position lower than that of the relay fluid storage barrel (700), and the fluid outlet (702) is installed at the position higher than that of the relay fluid storage barrel (700), or vice versa, to prevent the fluid at lower part within the relay fluid storage barrel (700) from stagnation; or as shown in Fig. 26, the fluid inlet (701) and the fluid outlet (702) are installed at upper part within the relay fluid storage barrel (700) to facilitate maintenance, and the flow guiding structure (730) for guiding the flow of internal fluid to flow from top to bottom is placed inside the relay fluid storage barrel (700) to connect the fluid inlet (701) and/or the fluid outlet (702), for ensuring the flow path between the fluid inlet (701) and the fluid outlet (702) passing through the bottom of the relay fluid storage barrel (700) to prevent the fluid at lower part within the relay fluid storage barrel (700) from stagnation; and wherein

---the fluid passing through the relay fluid storage barrel (700) is controlled by human or by control device (2000) for pumping or pump-priming, by way of external pressure, or gravity with potential difference, or the pump (704) being installed at the fluid inlet (701) and/or the fluid outlet (702), to drive the fluid in liquid state, or gaseous state, or liquid to gaseous state, or gaseous to liquid state for pumping, or stop, or adjustment of pumping flow rate;

---there are one or more cylindrical relay fluid storage barrels (700) inside installed with the thermal energy exchanger (705), and if two or more relay fluid storage barrels (700) exist, the fluid pathways in the individual relay fluid storage barrel (700) are series connection, parallel connection, or series-parallel connection;

---the thermal energy exchanger (705) has independent flow paths for fluid passing through, to perform heat exchange with the fluid in the relay fluid storage barrel (700); and the fluid piping of the thermal energy exchangers (705) are installed with the fluid inlet (708) and the fluid outlet (709);

---the individual fluid pathway of the thermal energy exchanger (705) is installed with fluid inlet and fluid outlet; and

---the fluid passing through the fluid pathway of the thermal energy exchanger (705) is controlled for pumping or pump-priming, by way of external pressure, or gravity with potential difference, or the pump (714) being installed, to individually drive the same or different fluid in liquid state, or gaseous state, or liquid to gaseous state, or gaseous to liquid state ; and

---Cooling tower (1200): related to a conventional air conditioning cooling tower, wherein the cooling tower installed with a high temperature water inlet (1201) and a cooling water outlet (1202) is a heat exchanger for passing through the auxiliary fluid piping (820) and leading to the fluid inlet (708) of the thermal energy exchanger (705), and then leaving the fluid outlet (709) and leading to air-conditioning device (1500), and high temperature water pumped by the pump (724) connected in series for passing through auxiliary fluid piping (830) to the high temperature water inlet (1201) and entering into the cooling tower (1200).

Fig. 27 is a system schematic view of the second embodiment, showing the operation of air conditioning cooling towers connected in series, according to the present invention, which shows the states of the relay fluid storage barrel (700), as shown in the embodiment of Fig. 26, directly storing fluids and the fluid inlet (701) and the fluid outlet (702), wherein the fluid within the heat exchanger of air-conditioning device (1500) is pumped by a pump (724) and/or the ventilation switch valve (725), which are controlled by the control device (2000), for passing

through the auxiliary fluid piping (830), and entering into the cooling tower (1200) from the high temperature water inlet (1201), and then the fluid leaves the cooling water outlet (1202), passes through the fluid inlet (701) via the auxiliary fluid piping (820), enters into the relay fluid storage barrel (700), and is transmitted to the fluid inlet of the air-conditioning device (1500) via the fluid outlet (702); the relay fluid storage barrel (700) without the thermal energy exchanger (705) performs heat exchange with the natural thermal storage body through the shell thereof.

10 For the vertical fluid heat exchanger installed within natural thermal energy body, if whole or in part of which is placed into natural thermal energy body installed in water or strata, an external conduit (3000), whose internal diameter is bigger than or equal to the external diameter of the relay fluid storage barrel (700), is further installed around the relay fluid storage barrel (700), such as Fig. 28 is a structural schematic view of an embodiment, showing that the external conduit (3000) is installed around the relay fluid storage barrel (700), according to the present invention; wherein:

20 ---External conduit (3000): made of conductive materials, wherein the internal diameter of which is bigger than or equal to the external diameter of the relay fluid storage barrel (700), and the length of which is equal to or longer than that of the relay fluid storage barrel (700); and wherein

25 ---the external conduit (3000) directly contacts with the relay fluid storage barrel (700), and there is an interval for placement or removal of the relay fluid storage barrel (700), or for filling conductive materials in colloidal state, and/or liquid state, and/or solid state.

In the vertical fluid heat exchanger installed within natural thermal energy body, the relay fluid storage barrel (700) can be further formed to a longer two-step and more than two-step structure, in which the top portion

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is larger and the bottom portion is smaller, and is a cylindrical or step-like column member having at least three faces, for increasing the heat conduction area with the natural thermal energy body.

Fig. 29 is a structural schematic view of an embodiment, showing the relay fluid storage barrel (700) is formed to a longer two-step structure having a larger top portion and a smaller bottom portion, and the top portion thereof is placed on the surface of the natural thermal energy body, the bottom portion is placed into the natural thermal energy body;

As shown in Fig. 29, wherein the main components and installation manner of the relay fluid storage barrel (700) are as followings:

-- relay fluid storage barrel (700) made of a heat conductive material and formed to a two-step or more than two-step structure in which the top end being larger than the bottom end, including a top portion structure having a larger cross section area and a bottom portion structure having a smaller cross section area, the cross section shape of the bottom portion of relay fluid storage barrel (7001) perpendicular to the axle direction includes round, oval or polyhedron shapes having three or more than three faces;

-- heat insulation member (760): includes a heat insulation member formed through fabricating the part of the relay fluid storage barrel (700) exposed outside the housing of the natural thermal energy body with a heat insulation material, or a heat insulation member made of a heat insulation material for covering the part of the relay fluid storage barrel (700) exposed outside the housing of the natural thermal energy body;

-- installation manner is that the top portion is placed on the surface of the natural thermal energy body, the bottom portion is placed into the natural thermal energy body.

Fig. 30 is a structural schematic view of an embodiment, showing the relay fluid storage barrel (700) is formed to a longer two-step structure having a larger top portion and a smaller bottom portion, a part of the

larger top portion and the whole smaller bottom portion connected therewith are placed into the natural thermal energy body;

As shown in Fig. 30, wherein the main components and installation manner of the relay fluid storage barrel (700) are as followings:

5 -- relay fluid storage barrel (700) made of a heat conductive material and formed to a two-step or more than two-step structure in which the top end being larger than the bottom end, including a top portion structure having a larger cross section area and a bottom portion having a smaller cross section area, the cross section shape of the bottom portion of relay
10 fluid storage barrel (7001) perpendicular to the axle direction includes round, oval or polyhedron shapes having three or more than three faces;

 -- heat insulation member (760): includes a heat insulation member formed through fabricating the part of the relay fluid storage barrel (700) exposed outside the housing of the natural thermal energy body with a
15 heat insulation material, or a heat insulation member made of a heat insulation material for covering the part of the relay fluid storage barrel (700) exposed outside the housing of the natural thermal energy body;

 -- installation manner is that the topmost section of the larger top portion is placed on the natural thermal energy body, a part of the larger
20 top portion and the whole smaller bottom portion connected therewith are placed into the natural thermal energy body.

Fig. 31 is a structural schematic view of an embodiment, showing the relay fluid storage barrel (700) is formed to a longer two-step structure having a larger top portion and a smaller bottom portion, the larger top
25 portion of the relay fluid storage barrel (700) is supported by a gantry structure (1100), and the smaller bottom portion downwardly extends into the natural thermal energy body;

As shown in Fig. 31, wherein the main components and installation manner of the relay fluid storage barrel (700) are as followings:

30 -- relay fluid storage barrel (700) made of a heat conductive material

and formed to a two-step or more than two-step structure in which the top end being larger than the bottom end, including a top portion structure having a larger cross section area and a bottom portion having a smaller cross section area, the cross section shape of the relay fluid storage barrel (700) perpendicular to the axle direction includes round, oval or polyhedron shapes having three or more than three faces;

-- heat insulation member (760): includes a heat insulation member formed through fabricating the part of the relay fluid storage barrel (700) exposed outside the housing of the natural thermal energy body with a heat insulation material, or a heat insulation member made of a heat insulation material for covering the part of the relay fluid storage barrel (700) exposed outside the housing of the natural thermal energy body;

-- installation manner is that the larger top portion of the relay fluid storage barrel (700) is supported by a gantry structure (1100), and the smaller bottom portion is downwardly placed into the natural thermal energy body.

In the vertical fluid heat exchanger placed within natural thermal energy body, the relay fluid storage barrel (700) is formed to a structure with a cone shape in which the top portion being larger than the bottom portion, or a structure with a taper or trapezoid shape having at least three faces.

Fig. 32 is a structural schematic view of an embodiment, showing the relay fluid storage barrel (700) is formed to a cone shape;

As shown in Fig. 32, wherein the main components and installation manner of the relay fluid storage barrel (700) are as followings:

-- relay fluid storage barrel (700) made of a heat conductive material and formed to a cone shape structure in which the top end being larger than the bottom end, including a top portion structure having a larger cross section area and a bottom portion having a smaller cross section area, the cross section shape of the relay fluid storage barrel (700)

perpendicular to the axle direction includes round or oval shapes;

-- heat insulation member (760): includes a heat insulation member formed through fabricating the part of the relay fluid storage barrel (700) exposed outside the housing of the natural thermal energy body with a
5 heat insulation material, or a heat insulation member made of a heat insulation material for covering the part of the relay fluid storage barrel (700) exposed outside the housing of the natural thermal energy body;

-- installation manner is that a part of the top portion structure, having larger cross section area, of the cone shape structure is placed on
10 the surface of the natural thermal energy body, and the bottom portion, having smaller cross section area, is placed into the natural thermal energy body.

Fig. 33 is a structural schematic view of an embodiment, showing the relay fluid storage barrel (700) is formed to a reverse taper shape
15 three-dimension polyhedron;

As shown in Fig. 33, wherein the main components and installation manner of the relay fluid storage barrel (700) are as followings:

-- relay fluid storage barrel (700) made of a heat conductive material and formed to a taper shape three-dimension polyhedron structure,
20 including a top portion structure having a larger cross section area and a bottom portion having a smaller cross section area, the cross section shape of the relay fluid storage barrel (700) perpendicular to the axle direction includes polyhedron shapes having three or more than three faces;

-- heat insulation member (760): includes a heat insulation member
25 formed through fabricating the part of the relay fluid storage barrel (700) exposed outside the housing of the natural thermal energy body with a heat insulation material, or a heat insulation member made of a heat insulation material for covering the part of the relay fluid storage barrel (700) exposed outside the housing of the natural thermal energy body;

30 -- installation manner is that the top portion structure, having larger

cross section area, of the taper shape three-dimension polyhedron structure is placed on the surface of the natural thermal energy body, the bottom portion having smaller cross section is placed into the natural thermal energy body.

5 Fig. 34 is a structural schematic view of an embodiment, showing the relay fluid storage barrel (700) is formed to a reverse trapezoid cone shape structure;

As shown in Fig. 34, wherein the main components and installation manner of the relay fluid storage barrel (700) are as followings:

10 -- relay fluid storage barrel (700) made of a heat conductive material and formed to a trapezoid cone shape structure in which the top end being larger than the bottom end, including a top portion structure having a larger cross section area and a bottom portion having a smaller cross section area, the cross section shape of the relay fluid storage barrel (700)
15 perpendicular to the axle direction includes round or oval shapes;

 -- heat insulation member (760): includes a heat insulation member formed through fabricating the part of the relay fluid storage barrel (700) exposed outside the housing of the natural thermal energy body with a heat insulation material, or a heat insulation member made of a heat
20 insulation material for covering the part of the relay fluid storage barrel (700) exposed outside the housing of the natural thermal energy body;

 -- installation manner is that a part of the top portion structure, having larger cross section area, of the trapezoid cone shape structure is placed on the surface of the natural thermal energy body, the bottom
25 portion having smaller cross section area is placed into the natural thermal energy body.

Fig. 35 is a structural schematic view of an embodiment, showing the relay fluid storage barrel (700) is formed to a reverse trapezoid taper shape three-dimension polyhedron;

30 As shown in Fig. 35, wherein the main components and installation

manner of the relay fluid storage barrel (700) are as followings:

-- relay fluid storage barrel 700 made of a heat conductive material and formed to a trapezoid taper shape three-dimension polyhedron structure in which the top end being larger than the bottom end, including
5 a top portion structure having a larger cross section area and a bottom portion having a smaller cross section area, the cross section shape of the relay fluid storage barrel (700) perpendicular to the axle direction includes polyhedron shapes having three or more than three faces;

-- heat insulation member (760): includes a heat insulation member
10 formed through fabricating the part of the relay fluid storage barrel (700) exposed outside the housing of the natural thermal energy body with a heat insulation material, or a heat insulation member made of a heat insulation material for covering the part of the relay fluid storage barrel (700) exposed outside the housing of the natural thermal energy body;

-- installation manner is that a part of the top portion structure, having larger cross section structure, of the trapezoid taper shape three-dimension polyhedron structure is placed on the surface of the natural thermal energy body, the bottom portion having smaller cross section area is placed into the natural thermal energy body.

CLAIMS

1. A vertical fluid heat exchanger installed within natural thermal energy body, wherein mainly by way of a fluid heat exchanger with the form of vertical relay fluid storage barrel for being close installed,
5 or whole or in part placement into natural thermal energy body installed in soil of shallow surface of the earth, or lakes, rivers, or sea, or artificial fluid storage facilities of ponds, reservoirs, or fluid pools, in vertical or downward oblique manner, the relay fluid storage barrel is installed with at least one fluid inlet and at least one fluid
10 outlet, a thermal energy exchanger is installed inside the structure of the relay fluid storage barrel temporarily storing thermal conductive fluid for external flow, such as tap-water, or water from rivers, lakes or sea, for performing the function of auxiliary water storage barrel installed at shallow thermal energy body, the thermal energy
15 exchanger is installed with at least one fluid piping for the thermal conductive fluid passing through, to perform heat exchange with the fluid in the relay fluid storage barrel, and the fluid in the relay fluid storage barrel performs heat exchange with the thermal energy of the natural thermal energy body, such as soil of shallow surface of the
20 earth, or lakes, rivers, or sea, or artificial fluid storage facilities of ponds, reservoirs, or fluid pools; the main components include:
---Relay fluid storage barrel (700): made of thermal conductive material to be integrated or combined, wherein the relay fluid storage barrel (700) is a fluid heat exchanger with the form of
25 vertical relay fluid storage barrel for being close installed, or whole or in part placement into natural thermal energy body (1000) in vertical or downward oblique manner, and the relay fluid storage barrel (700) is installed with at least one fluid inlet (701) and at least one fluid outlet (702) for fluid entering and leaving to
30 perform fluid exchange function; in which the fluid inlet (701) is

installed at the position lower than that of the relay fluid storage barrel (700), and the fluid outlet (702) is installed at the position higher than that of the relay fluid storage barrel (700), or vice versa, to prevent the fluid at lower part within the relay fluid storage barrel (700) from stagnation; and wherein

5 ---the fluid passing through the relay fluid storage barrel (700) is controlled by human or by control device (2000) for pumping or pump-priming, by way of external pressure, or gravity with potential difference, or a pump (704) being installed at the fluid inlet (701) and/or the fluid outlet (702), to drive the fluid in liquid state, or gaseous state, or liquid to gaseous state, or gaseous to liquid state for pumping, or stop, or adjustment of pumping flow rate;

10 ---one or more thermal energy exchangers (705) related to fluid by fluid are installed inside the relay fluid storage barrel (700);

15 ---the thermal energy exchanger (705) has independent flow paths for fluid passing through, to perform heat exchange with the fluid in the relay fluid storage barrel (700); the thermal energy exchanger (705) is directly constituted by the structure of tubular flow paths in a variety of geometric shapes, including U-type fluid piping, or spiral fluid piping, or wavy fluid piping, and/or the thermal energy exchanger (705) is constituted by U-type piping additionally installed with thermal conductive fins, and the above thermal energy exchangers (705) in various shapes are installed with fluid inlet (708) and fluid outlet (709);

20 ---the thermal energy exchanger (705) is directly constituted by a thermal conductive structural body inside installed with flow paths and installed with the fluid inlet (708) and the fluid outlet (709), and/or thermal conductive fins extended from the thermal conductive structural body;

25 30

---the individual fluid pathway of the thermal energy exchanger (705)
is installed with fluid inlet and fluid outlet; and

---the fluid passing through the fluid pathway of the thermal energy
exchanger (705) is controlled for pumping or pump-priming, by
5 way of external pressure, or gravity with potential difference, or a
pump being installed, to individually drive the same or different
fluid in liquid state, or gaseous state, or liquid to gaseous state, or
gaseous to liquid state ; and

---Control device (2000): related to control device activated by
10 electrical force, mechanical force, current force, or magnetic force,
for controlling the pump (704), wherein the control device (2000)
and the pump (704) are installed simultaneously; wherein

---the number of the cylindrical relay fluid storage barrels (700) for
15 internally installed with the thermal energy exchanger (705)
includes one or more than one, and if two or more relay fluid
storage barrels (700) exist, the fluid pathways in the individual
relay fluid storage barrel (700) are series connection, parallel
connection, or series-parallel connection;

20 ---the different relay fluid storage barrels (700) individually operate
for same or different types fluids passing through;

---there are one or divided into more than one fluid pathways
within the relay fluid storage barrel (700), and if divided into two
or more fluid pathways exist, individual flow path is installed with
25 fluid inlet and fluid outlet; if there are two or more fluid pathways
within the relay fluid storage barrel (700), individual fluid
pathway individually operates for same or different types fluids
passing through;

---if there are two or more fluid pathways within the relay fluid
30 storage barrel (700), the fluid pathways are series connection,

parallel connection, or series-parallel connection.

2. The vertical fluid heat exchanger installed within natural thermal energy body as claimed in Claim 1, wherein the fluid inlet (701) and the fluid outlet (702) are further installed at upper part within the relay fluid storage barrel (700) to facilitate maintenance, and flow guiding structure (730) for guiding the flow of internal fluid to flow from top to bottom is placed inside the relay fluid storage barrel (700) to connect the fluid inlet (701) and/or the fluid outlet (702), for ensuring the flow path between the fluid inlet (701) and the fluid outlet (702) passing through the bottom of the relay fluid storage barrel (700) to prevent the fluid at lower part within the relay fluid storage barrel (700) from stagnation.
3. The vertical fluid heat exchanger installed within natural thermal energy body as claimed in Claim 1, wherein the individual fluid pathways of the thermal energy exchangers (705) installed within the same or different relay fluid storage barrels (700) individually operate for same or different types fluids passing through.
4. The vertical fluid heat exchanger installed within natural thermal energy body as claimed in Claim 1, wherein the fluid pathways of the thermal energy exchangers (705) within the different relay fluid storage barrels (700) are series connection, parallel connection, or series-parallel connection.
5. The vertical fluid heat exchanger installed within natural thermal energy body as claimed in Claim 1, wherein the fluid inlet (701) and/or the fluid outlet (702) of the relay fluid storage barrels (700) are installed with a switch valve (703) to control the switch valve (703) by human or by the control device (2000) for opening, or closing, or adjustment of flow rate, and to control the pump (704) for

pumping, or stop, or adjustment of pumping flow rate; the control device (2000) is control device activated by electrical force, mechanical force, current force, or magnetic force.

6. The vertical fluid heat exchanger installed within natural thermal energy body as claimed in Claim 1, wherein for the relay fluid storage barrels (700), a controllable valve (801) is installed at the fluid inlet (701) and/or a controllable valve (802) is installed at the fluid outlet (702), and with-flow piping (800) is installed between the controllable valve (801) and the controllable valve (802) to regulate the fluid flow rate entering inside the relay fluid storage barrels (700), by way of adjustment of the fluid flow rate passing through the with-flow piping, to control the controllable valve (801) and/or the controllable valve (802) by human or by the control device (2000) for opening, or closing, or adjustment of flow rate, and to control the pump (704) for pumping, or stop, or adjustment of pumping flow rate; the control device (2000) is control device activated by electrical force, mechanical force, current force, or magnetic force; and the controllable valves (801) and (802) and the with-flow piping (800) are controlled for one or more flow modes as following, including:
- 1) blocking the fluid passing through the with-flow piping (800), and then the fluid completely passing through the relay fluid storage barrel (700) for entering or leaving;
 - 2) blocking the fluid entering into the relay fluid storage barrel (700), and then the fluid completely passing through the with-flow piping (800);
 - 3) partial fluid entering into the relay fluid storage barrel (700), and partial fluid passing through the with-flow piping (800); and
 - 4) adjusting the fluid flow rate entering into the relay fluid storage barrel (700), for performing the functions of opening and closing.

7. The vertical fluid heat exchanger installed within natural thermal energy body as claimed in Claim 1, wherein the relay fluid storage barrel (700) is further installed with ventilation piping (720), the position of the ventilation piping (720) is higher than that of the fluid source to prevent fluid from overflow, and/or is further installed with a ventilation switch valve (725), if fluid does not enter the inlet, the fluid within the relay fluid storage barrel (700) will be pumped-out by the pump (704), and the ventilation switch valve (725) is controlled by human or by the control device (2000) for eliminating the negative pressure when the pump (704) is pumping-out the fluid within the relay fluid storage barrel (700).
8. The vertical fluid heat exchanger installed within natural thermal energy body as claimed in Claim 1, wherein the relay fluid storage barrel (700) is further installed with a backflow fluid outlet (702'), besides the thermal energy exchanger (705), the fluid outlet (702), the pump (704), and the control device (2000), and backflow piping (750) connected with a pump (714) in series is installed between the backflow fluid outlet (702') and upstream fluid piping or fluid source (900), to control the pump (714) by human or by the control device (2000) for pumping partial fluid in the relay fluid storage barrel (700) to upstream through the backflow piping (750) to form a semi-closed circuit system with thermal energy adjustment function; if the position of the backflow fluid outlet (702') is at upper part of the relay fluid storage barrel (700), flow guiding structure (730') for guiding the flow of internal fluid to flow from top to bottom is additionally placed inside the relay fluid storage barrel (700), and if the position of the backflow fluid outlet (702') is at lower part of the relay fluid storage barrel (700), the flow guiding structure (730') for guiding the flow of internal fluid to flow from top to bottom is unnecessarily placed inside the relay fluid storage barrel (700).

9. The vertical fluid heat exchanger installed within natural thermal energy body as claimed in Claim 1, wherein the relay fluid storage barrel (700) is not installed with the pump (704) and the fluid outlet (702), and is only kept the thermal energy exchanger (705), and the backflow piping (750) connected with the pump (714) in series is installed between the backflow fluid outlet (702') and upstream fluid piping or the fluid source (900), to control the pump (714) by human or by the control device (2000) for pumping the fluid in the relay fluid storage barrel (700) to upstream through the backflow piping (750) to form a closed circuit system with thermal energy adjustment function; if the position of the backflow fluid outlet (702') is at upper part of the relay fluid storage barrel (700), the flow guiding structure (730') for guiding the flow of internal fluid to flow from top to bottom is additional placed inside the relay fluid storage barrel (700), and if the position of the backflow fluid outlet (702') is at lower part of the relay fluid storage barrel (700), the flow guiding structure (730') for guiding the flow of internal fluid to flow from top to bottom is unnecessarily placed inside the relay fluid storage barrel (700).
10. The vertical fluid heat exchanger installed within natural thermal energy body as claimed in Claim 1, wherein secondary segment fluid storage facilities (850) is further installed at the position higher than that of the relay fluid storage barrel (700), for storing the fluid pumped by the pump (704) through fluid piping (810), in which the secondary segment fluid storage facilities (850) is the semi-closed or full-closed type fluid terminal storage facilities (850), and/or which is installed with a fluid port (723) for fluid external flow, and/or the ventilation piping (720) and/or the ventilation switch valve (725) are installed at the top of the fluid terminal storage facilities (850).
11. The vertical fluid heat exchanger installed within natural thermal

energy body as claimed in Claim 1, wherein the secondary segment fluid storage facilities (850) is further installed at the position higher than that of the relay fluid storage barrel (700), for storing the fluid pumped by the pump (704), which is controlled by human or by the control device (2000), and pumped into the secondary segment fluid storage facilities (850) through the fluid piping (810), in which the secondary segment fluid storage facilities (850) is the semi-closed or full-closed type fluid terminal storage facilities, and/or which is installed with the fluid port (723) for fluid external flow; the secondary segment fluid storage facilities (850) is enclosed or non-closed structure, and/or which is installed with the ventilation piping (720) or the ventilation switch valve (725), and auxiliary fluid piping (820) is installed between the relay fluid storage barrel (700) and the secondary segment fluid storage facilities (850), in place of the ventilation piping (720) of the relay fluid storage barrel (700), and/or the ventilation piping (720) and/or the ventilation switch valve (725) are installed at the top of the fluid terminal storage facilities (850).

12. The vertical fluid heat exchanger installed within natural thermal energy body as claimed in Claim 1, wherein which is further applied for the operation of air conditioning cooling towers connected in series, the water cooled by cooling towers is pumped back to air conditioning device through the connected in series flow paths of the thermal energy exchanger (705) installed within the relay fluid storage barrel (700), the main components include:

---Relay fluid storage barrel (700): made of thermal conductive material to be integrated or combined, wherein the relay fluid storage barrel (700) is a fluid heat exchanger with the form of vertical relay fluid storage barrel for being close installed, or whole or in part placement into natural thermal energy body (1000) in vertical or

downward oblique manner, and the relay fluid storage barrel (700) is installed with at least one fluid inlet (701) and at least one fluid outlet (702) for fluid entering and leaving to perform fluid exchange function; in which the fluid inlet (701) is installed at the position lower than that of the relay fluid storage barrel (700), and the fluid outlet (702) is installed at the position higher than that of the relay fluid storage barrel (700), or vice versa, to prevent the fluid at lower part within the relay fluid storage barrel (700) from stagnation; or the fluid inlet (701) and the fluid outlet (702) are installed at upper part within the relay fluid storage barrel (700) to facilitate maintenance, and the flow guiding structure (730) for guiding the flow of internal fluid to flow from top to bottom is placed inside the relay fluid storage barrel (700) to connect the fluid inlet (701) and/or the fluid outlet (702), for ensuring the flow path between the fluid inlet (701) and the fluid outlet (702) passing through the bottom of the relay fluid storage barrel (700) to prevent the fluid at lower part within the relay fluid storage barrel (700) from stagnation; and wherein

---the fluid passing through the relay fluid storage barrel (700) is controlled by human or by control device (2000) for pumping or pump-priming, by way of external pressure, or gravity with potential difference, or the pump (704) being installed at the fluid inlet (701) and/or the fluid outlet (702), to drive the fluid in liquid state, or gaseous state, or liquid to gaseous state, or gaseous to liquid state for pumping, or stop, or adjustment of pumping flow rate;

---there are one or more cylindrical relay fluid storage barrels (700) inside installed with the thermal energy exchanger (705), and if two or more relay fluid storage barrels (700) exist, the fluid pathways in the individual relay fluid storage barrel (700) are series connection, parallel connection, or series-parallel

connection;

---the thermal energy exchanger (705) has independent flow paths for fluid passing through, to perform heat exchange with the fluid in the relay fluid storage barrel (700); and the fluid piping of the thermal energy exchangers (705) are installed with the fluid inlet (708) and the fluid outlet (709);

---the individual fluid pathway of the thermal energy exchanger (705) is installed with fluid inlet and fluid outlet; and

---the fluid passing through the fluid pathway of the thermal energy exchanger (705) is controlled for pumping or pump-priming, by way of external pressure, or gravity with potential difference, or the pump (714) being installed, to individually drive the same or different fluid in liquid state, or gaseous state, or liquid to gaseous state, or gaseous to liquid state ; and

---Cooling tower (1200): related to a conventional air conditioning cooling tower, wherein the cooling tower installed with a high temperature water inlet (1201) and a cooling water outlet (1202) is a heat exchanger for passing through the auxiliary fluid piping (820) and leading to the fluid inlet (708) of the thermal energy exchanger (705), and then leaving the fluid outlet (709) and leading to air-conditioning device (1500), and high temperature water pumped by the pump (724) connected in series for passing through auxiliary fluid piping (830) to the high temperature water inlet (1201) and entering into the cooling tower (1200).

13. The vertical fluid heat exchanger installed within natural thermal energy body as claimed in Claim 1, wherein which is applied for the operation of air conditioning cooling towers connected in series, the relay fluid storage barrel (700) installed with the fluid inlet (701) and the fluid outlet (702) directly stores fluids, and the fluid within the heat exchanger of air-conditioning device (1500) is pumped by a

pump (724) and/or the ventilation switch valve (725), which are controlled by the control device (2000), for passing through the auxiliary fluid piping (830), and entering into the cooling tower (1200) from the high temperature water inlet (1201), and then the fluid leaves the cooling water outlet (1202), passes through the fluid inlet (701) via the auxiliary fluid piping (820), enters into the relay fluid storage barrel (700), and is transmitted to the fluid inlet of the air-conditioning device (1500) via the fluid outlet (702); the relay fluid storage barrel (700) without the thermal energy exchanger (705) performs heat exchange with the natural thermal storage body through the shell thereof.

14. The vertical fluid heat exchanger installed within natural thermal energy body as claimed in Claim 1, wherein an external conduit (3000), whose internal diameter is bigger than or equal to the external diameter of the relay fluid storage barrel (700), is further installed around the relay fluid storage barrel (700); wherein:

---External conduit (3000): made of conductive materials, wherein the internal diameter of which is bigger than or equal to the external diameter of the relay fluid storage barrel (700), and the length of which is equal to or longer than that of the relay fluid storage barrel (700); and wherein

---the external conduit (3000) directly contacts with the relay fluid storage barrel (700), and there is an interval for placement or removal of the relay fluid storage barrel (700), or for filling conductive materials in colloidal state, and/or liquid state, and/or solid state.

15. The vertical fluid heat exchanger installed within natural thermal energy body as claimed in Claim 1, wherein the barrel cross-section shapes of the relay fluid storage barrels (700) include circular, oval, star, or other shapes, and the shapes of the relay fluid storage barrels

(700) include parallel rods or non-parallel rods.

16. The vertical fluid heat exchanger installed within natural thermal energy body as claimed in Claim 1, wherein it is further formed to a longer two-step and more than two-step structure, in which the top portion is larger and the bottom portion is smaller, and is a cylindrical or step-like column member having at least three faces, for increasing the heat conduction area with the natural thermal energy body, and the main components and installation manner of the relay fluid storage barrel (700) are as followings:

-- relay fluid storage barrel (700) made of a heat conductive material and formed to a two-step or more than two-step structure in which the top end being larger than the bottom end, including a top portion structure having a larger cross section area and a bottom portion structure having a smaller cross section area, the cross section shape of the bottom portion of relay fluid storage barrel (7001) perpendicular to the axle direction includes round, oval or polyhedron shapes having three or more than three faces;

-- heat insulation member (760): includes a heat insulation member formed through fabricating the part of the relay fluid storage barrel (700) exposed outside the housing of the natural thermal energy body with a heat insulation material, or a heat insulation member made of a heat insulation material for covering the part of the relay fluid storage barrel (700) exposed outside the housing of the natural thermal energy body.

-- installation manner is that 1) the top portion is placed on the surface of the natural thermal energy body, the bottom portion is placed into the natural thermal energy body; or 2) the topmost section of the larger top portion is placed on the natural thermal energy body, a part of the larger top portion and the whole smaller bottom portion connected therewith are placed into the natural thermal energy body;

or 3) the larger top portion of the relay fluid storage barrel (700) is supported by a gantry structure (1100), and the smaller bottom portion is downwardly placed into the natural thermal energy body.

17. The vertical fluid heat exchanger installed within natural thermal energy body as claimed in Claim 1, wherein the relay fluid storage barrel (700) is formed to a structure with a cone shape in which the top portion being larger than the bottom portion, or a structure with a taper or trapezoid shape having at least three faces; including 1) the relay fluid storage barrel (700) is formed to a cone shape; or 2) the relay fluid storage barrel (700) is formed to a reverse taper shape three-dimension polyhedron; or 3) the relay fluid storage barrel (700) is formed to a reverse trapezoid cone shape structure; or 4) the relay fluid storage barrel (700) is formed to a reverse trapezoid taper shape three-dimension polyhedron;
- heat insulation member (760): includes a heat insulation member formed through fabricating the part of the relay fluid storage barrel (700) exposed outside the housing of the natural thermal energy body with a heat insulation material, or a heat insulation member made of a heat insulation material for covering the part of the relay fluid storage barrel (700) exposed outside the housing of the natural thermal energy body;
- installation manner is that a part of the top portion structure, having larger cross section area, of the taper shape structure, including the cone or the polygonal pyramid, is placed on the surface of the natural thermal energy body, and the bottom portion, having smaller cross section area, is placed into the natural thermal energy body.