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(54) **Title**: SOLAR WORKSTATION

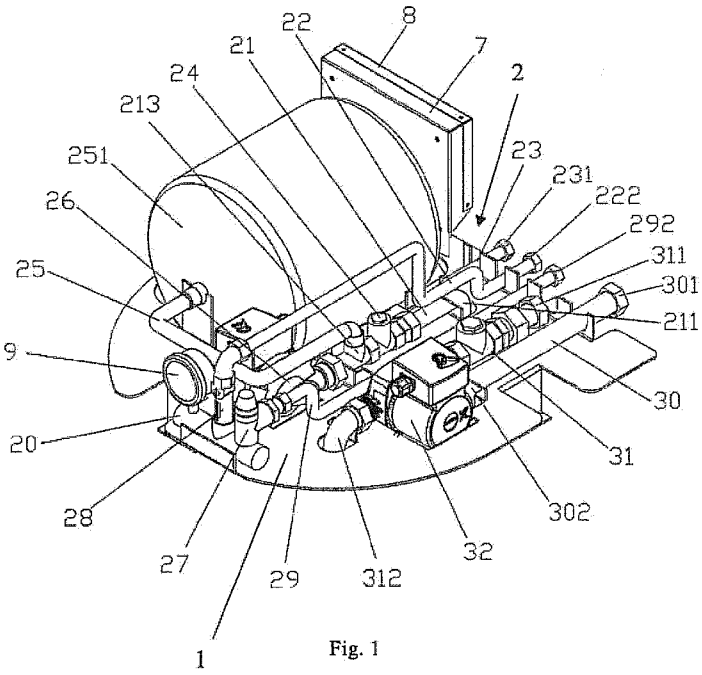

Fig. 1

(57) **Abstract**: The present invention provides a solar workstation for a solar energy heating system, comprising a controller and a medium circulating system. The medium circulating system comprises a medium circulating pipeline composed of a first medium pipeline and a second medium pipeline, a pressure-release pipeline and a buffer pipeline communicating with the medium circulating pipeline respectively, a one-way valve and a medium pump installed in the medium circulating pipeline, an expansion tank installed in the buffer pipeline, and a relief valve installed in the pressure-release pipeline. The solar workstation further comprises a base, and all components of the medium circulating system are provided on the base integrally. The invention has a compact structure and a small size, and the overall spatial arrangement is appropriate so that the occupied space is reduced, while avoiding failure of the expansion tank due to an external force. Therefore, the solar energy heating system using the solar workstation of the invention can operate reliably.

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Title: Solar Workstation

Description

TECHNICAL FIELD

[01] The present invention relates to a solar workstation for a solar energy heating system.

BACKGROUND

[02] A solar energy heating system comprises a thermal insulation water tank, a heat collector, a heat exchanger, and a solar energy work station wherein the thermal insulation water tank is used to contain water and can be placed indoors; the heat collector needs to be installed outdoors at a position which is exposed to the sunshine for absorbing solar heat energy; the heat exchanger is generally positioned within the water tank, and the solar workstation is connected between the heat exchanger and the heat collector.

[03] A conventional solar workstation comprises a casing, a controller, and a medium circulating system. The medium circulating system comprises a medium circulation pipeline, a pressure-release pipeline, and a buffer pipeline which communicate with the medium circulation pipeline respectively, an expansion tank installed in the buffer pipeline, a relief valve installed in the pressure-release pipeline, as well as a one-way valve, a medium pump, a pressure gauge and a flow meter and the like which are installed in the medium circulation pipeline. The medium circulation pipeline is connected with the heat exchanger and the heat collector, respectively, so as to form a medium circulation loop. A medium at a high temperature after absorbing solar energy in the heat collector flows to the heat exchanger to exchange heat with water at a low temperature in the water tank, such

that the water temperature is increased and the medium temperature is decreased. Then, the medium at the decreased temperature flows back to the heat collector under the action of the medium pump, so as to become the high temperature medium again by collecting solar energy and passes over to the next circulation. In this way, the circulation proceeds continuously. Therefore, the water within the water tank can reach a very high temperature.

[04] In a solar energy heating system which can be heated instantaneously upon being turned on, the solar workstation further comprises an instant hot water circulating system comprising a hot water return pipe, a hot water inlet pipe, and a water pump installed in the hot water inlet pipe. Both the hot water inlet pipe and the hot water return pipe communicate with the thermal insulation water tank at one end, and communicate with a customer terminal water pipe at the other end, thus, a circulating pipeline which maintains a constant temperature periodically is formed. When a temperature of the customer terminal water pipe is decreased to a temperature lower than a temperature set by a control system, and the water temperature inside the thermal insulation water tank is higher by a set value than that inside the pipeline, for example 5°C, the water pump will be enabled to pump the cold water in the pipeline into the thermal insulation water tank, and the water at a high temperature within the thermal insulation water tank will be mixed with the cold water within the pipeline, so as to produce hot water which meets setting conditions again. When the customer uses water, he is able to have hot water instantly flowing out by opening a water tap.

[05] In the above-described conventional solar workstation, the controller and the medium circulating system are generally provided within the casing, while the expansion tank is provided at the outside of the casing and connected to the medium circulating pipeline via the buffer pipeline. Therefore, the overall spatial arrangement of the solar workstation is in disarray, inappropriate, voluminous, and taking up

much space, while the solar workstation is subjected to external forces which results in failure of the expansion tank which in turn results in an unreliable operation of the entire solar energy heating system since the buffer pipeline is exposed to the outside.

SUMMARY OF THE INVENTION

[06] One object of the present invention is to overcome technical problems of the solar workstation in prior art such as the spatial arrangement being inappropriate and bulky.

[07] To achieve this object, the present invention provides the following technical solutions:

[08] According to the invention, a solar energy workstation for a solar energy heating system is provided. The solar energy heating system comprises a thermal insulation water tank, a heat collector, and a heat exchanger. The solar energy workstation comprises a controller and a medium circulating system. The medium circulating system comprises a medium circulating pipeline composed of a first medium pipeline and a second medium pipeline, a pressure-release pipeline, and a buffer pipeline which respectively communicate with the medium circulating pipeline, a one-way valve and a medium pump installed in the medium circulating pipeline, an expansion tank installed in the buffer pipeline, and a relief valve installed in the pressure-release pipeline, characterized in that the solar workstation further comprises a base on which all components of the medium circulating system are provided integrally.

[09] The solar workstation further comprises a hot water return pipe installed on the base.

[10] The solar workstation further comprises a hot water inlet pipe and a water pump installed on the hot water inlet pipe.

[11] The first medium pipeline, the second medium pipeline, the pressure-release pipeline and the expansion tank of the medium circulating system are all installed on the base and in parallel to the

base; each one of the first medium pipeline, the second medium pipeline and the pressure-release pipeline has one end protruding out of a rear end surface of the base, and each one of the first medium pipeline and the second medium pipeline has the other end corresponding to a through hole which is provided in the base.

[12] The solar workstation further comprises a hot water return pipe installed on the base in parallel to the base, wherein the hot water return pipe has one end protruding out of the rear end surface of the base, and has the other end corresponding to a through hole which is provided in the base.

[13] The solar workstation further comprises a hot water inlet pipe installed on the base in parallel to the base and a water pump installed on the hot water inlet pipe, wherein the hot water inlet pipe has one end protruding out of the rear end surface of the base, and has the other end corresponding to which a through hole is provided in the base.

[14] The first medium pipeline comprises a first medium inlet pipeline and a first medium return pipeline which are arranged parallel to each other and communicate with each other at one end.

[15] The one-way valve and the medium pump are installed in the first medium inlet pipeline in the medium flow direction sequentially, and the buffer pipeline communicates with the first medium inlet pipeline at a position between the one-way valve and the medium pump.

[16] In the solar workstation, the pipelines are arranged in at least two rows in such a way that one row vertically overlaps the other row.

[17] The base has a bottom shape matching a top shape of the thermal insulation water tank in the solar energy heating system.

[18] Several clamping portions for fixing the first medium pipeline and the second medium pipeline are provided on a top surface of the base; and an expansion tank fixing means and a medium pump accommodating and fixing means are provided on the base.

[19] The expansion tank fixing means comprises an expansion tank accommodation opening for allowing a part of the expansion tank to pass through, and an expansion tank support plate. The expansion tank accommodation opening is provided on the base at a position corresponding to the expansion tank, and the expansion tank support plate is provided on a bottom surface of the base provided at a position adjacent to the expansion tank accommodation opening. The medium pump accommodating and fixing means comprises a medium pump opening for allowing a part of the medium pump to pass through, and two medium pump support plates. The medium pump opening is provided in the base at a position corresponding to the medium pump, and the medium pump support plates are provided on the bottom surface of the base at positions near the opposite sides of the medium pump opening.

[20] The top surface of the base is provided with several auxiliary fixing elements for supporting the first medium pipeline, the second medium pipeline, the pressure-release pipeline, and the buffer pipeline.

[21] The base may be a metal plate with several legs attached to the bottom surface of the base. Furthermore, the clamping portions, the legs, the auxiliary fixing elements, the expansion tank support plate, and the medium pump support plates may all be combined with the base to form an integral structure.

[22] Several clamping portions for fixing the hot water return pipe are provided on the top surface of the base.

[23] Several clamping portions for fixing the hot water inlet pipe are provided on the top surface of the base. A water pump accommodating and fixing means is provided on the base.

[24] The water pump accommodating and fixing means comprises a water pump accommodation opening for allowing the water pump to partly pass through, and two water pump support plates provided on the bottom surface of the base at positions near the opposite sides of the water pump accommodation opening. The water pump

accommodation opening is provided in the base at a position corresponding to the water pump, and the water pump support plates are provided on the bottom surface of the base at positions near the opposite sides of the water pump accommodation opening.

[25] The solar workstation further comprises an outer cover connected to the base.

[26] A rear panel that is convenient to be opened and closed is provided on the outer cover at a position corresponding to the controller.

[27] Several recesses for fixing the first medium pipeline, the second medium pipeline and the pressure-release pipeline of the medium circulating system are provided on the top surface of the base. At least two expansion tank fixing ribbed plates parallel to each other or an expansion tank accommodation recesses capable of accommodating a part of the expansion tank are provided on the base at positions corresponding to the expansion tank. Furthermore, a medium pump accommodation recess for accommodating a part of the medium pump is provided on the base at a position corresponding to the medium pump.

[28] A recess for fixing the hot water return pipe is further provided on the top surface of the base.

[29] A recess for fixing the hot water inlet pipe and a water pump accommodation recess for accommodating a part of the water pump are further provided on the top surface of the base.

[30] Several bearing seats are further provided on the top surface of the base, and the recesses are respectively provided in the bearing seats.

[31] The solar workstation further comprises a clamping member installed on the base. The clamping member is used to assist in fixing various pipelines.

[32] Any two of the recesses are arranged in such a way that one recess vertically (in an upwards and downwards direction) over-

laps the other recess to form one combined recess for accommodating the pipelines arranged so as to overlap each other.

[33] Any two of the recesses are arranged in such a way that one recess vertically overlaps the other recess so as to form one combined recess for accommodating the pipelines arranged so as to overlap each other.

[34] The energy solar workstation further comprises a cover plate covering a part of the base and being positioned on one side of the expansion tank. Furthermore, the cover plate covers the accommodation recesses provided at positions corresponding to the first medium pipeline and the second medium pipeline, respectively, and a gap for allowing the medium pump to be exposed to the outside is provided at a position corresponding to the medium pump in the cover plate.

[35] The cover plate covers the recess provided at the position corresponding to the hot water return pipe.

[36] A gap for allowing the water pump to be exposed to the outside is provided in the cover plate at a position corresponding to the water pump.

[37] A controller recess for fixing the controller is provided at the top of the cover plate.

[38] Both the base and the cover plate may be made of a thermal insulation material.

[39] The solar workstation further comprises an outer cover connected to the base, and notches or slots are provided at the bottom of the outer cover at positions corresponding to protruding ends of the pipelines.

[40] It can be seen from the above-described technical solutions that the advantages and beneficial effects of the solar workstation according to the present invention lie in that: According to the present invention, the solar workstation comprises the base, and all components of the medium circulating system including the expansion

tank are fixed on the base integrally. Thus, the solar workstation of the present invention has a compact structure and a small size, the overall spatial arrangement is adequate, thereby, the occupied space is reduced. The circumstance that the expansion tank is subjected to the effect of the external force to result in a failure of the expansion tank is avoided since the expansion tank is also fixed on the base. Therefore, the solar energy heating system using the solar workstation according to the present invention operates reliably.

[41] The above and other objects, features and advantages of the present invention will become more apparent from the description of the preferred embodiment given below with reference to the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[42] Fig. 1 is a perspective structural schematic diagram of a solar workstation having a metal base according to the present invention viewed from the front;

[43] Fig. 2 is a perspective structural schematic diagram of the solar workstation having the metal base according to the present invention viewed from the rear;

[44] Fig. 3 is a perspective structural schematic diagram of the solar workstation having the metal base according to the present invention viewed from the bottom;

[45] Fig. 4 is a perspective structural schematic diagram of the metal base in the solar workstation according to the present invention;

[46] Fig. 5 is a perspective structural schematic diagram of a solar workstation having a thermal insulation base according to the present invention viewed from the front;

[47] Fig. 6 is a perspective structural schematic diagram of a clamping member in the solar workstation according to the present invention;

[48] Fig. 7 is a perspective structural schematic diagram of a

solar workstation having the thermal insulation base according to the present invention viewed from the rear;

[49] Fig. 8 is a perspective structural schematic diagram of the thermal insulation base having a bearing seat in the solar workstation according to the present invention;

[50] Fig. 9 is a perspective structural schematic diagram of the thermal insulation base used for accommodating pipelines arranged in an overlapping manner in the solar workstation according to the present invention;

[51] Fig. 10 is a perspective structural schematic diagram of the solar workstation having a cover plate according to the present invention;

[52] Fig. 11 is a perspective structural schematic diagram illustrating a bottom shape of the thermal insulation base in the solar workstation according to the present invention.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[53] Hereinafter some particular embodiments of the present invention will be described in detail. It should be understood that the embodiments described herein are provided by way of illustration only, and do not limit the present invention.

[54] A solar workstation according to the present invention is used for a solar heating system. The solar heating system comprises a thermal insulation water tank for storing hot water, a heat collector for collecting solar heat energy, and a heat exchanger for exchanging heat.

First Embodiment

[55] As shown in Figs. 1, 2, and 3, the first embodiment provides a solar workstation comprising a base 1, a controller 8, and a medium circulating system 2. All components of the medium circulating system 2 are installed on the base 1. The controller 8 can also be installed on the

base 1.

[56] The medium circulating system 2 comprises a four-way joint 20, a first medium pipeline, a second medium pipeline 23, a buffer pipeline 25, a pressure-release pipeline 29, a one-way valve 24, an expansion tank 251, a medium pump 26, a relief valve 27, a flow meter 28, and a pressure gauge 9, etc..

[57] The first medium pipeline comprises a first medium inlet pipeline 21 and a first medium return pipeline 22.

[58] The first medium inlet pipeline 21 is installed on the base 1 parallel to the base along a forward and rearward direction of the base 1. The first medium inlet pipeline 21 has an inlet end which is equipped with a connection port, and has an outlet end which communicates with a first vent of the four-way joint 20, wherein the connection port can be a connection elbow 211. The one-way valve 24, a three-way joint 213, and the medium pump 26 are installed sequentially in the first medium inlet pipeline 21 in a medium flow direction. The expansion tank 251 is connected to a third vent of the three-way joint 213 via the buffer pipeline 25. In this way, the expansion tank 251 is connected to an inlet of the medium pump 26, and is located between the one-way valve 24 and the medium pump 26. On the one hand, in case of normally using water, the expansion tank 251 may absorb an impact force generated by a pressure fluctuation in the medium circulating system to have an effect of buffering, so as to ensure that the medium can be circulated steadily. On the other hand, in the case of stagnation, when no water is used for a long time, or a consumption of water is small such that a temperature of the medium and an amount of vaporization are increased, air bubbles mixed in the medium will flow reversely into the expansion tank 251 via the first medium return pipeline 22 which prevents the components of the solar energy heating system such as the heat collector and the heat exchanger from breaking and ensures a reliable circulation of the medium. The expansion tank 251 is installed on the base 1 horizontally. The expansion tank 251 may have a

shape of a column or other shapes such as a rectangular shape and the like, so as to lower its height.

[59] The first medium return pipeline 22 has an inlet end which communicates with a second vent of the four-way joint 20, and has an outlet end (protruding end) which protrudes towards the outside of a rear end surface of the base 1, and is provided with a connection port 222. The first medium return pipeline 22 is disposed parallel to the first medium inlet pipeline 21. In order to reduce an area of the base 1 being occupied, in this embodiment, the first medium return pipeline 22 may be positioned above the first medium inlet pipeline 21, and the first medium return pipeline 22 may be bent several times such that the inlet end of the first medium inlet pipeline 21 is adjacent to an outlet end of the second medium return pipeline 22. The flow meter 28 is installed in the first medium return pipeline 22, and preferably, the flow meter 28 is installed at a position between the inlet end of the first medium return pipeline 22 and the second vent of the four-way joint 20.

[60] The second medium pipeline 23 disposed parallel to the first medium inlet pipeline 21 has one end (protruding end) which also protrudes towards the outside of the rear end surface of the base 1, and is provided with a connection port 231, and has the other end which is provided with a connection elbow 232 (see Fig. 3).

[61] The pressure-release pipeline 29 disposed parallel to the first medium inlet pipeline 21 too, has one end (protruding end) which protrudes towards the outside of the rear end surface of the base 1, and is provided with a connection port 292, and has the other end which communicates with the relief valve 27 connected to a third vent of the four-way joint 20. When the pressure in the medium circulating system is higher than a set safety value, the relief valve 27 will be opened automatically to release pressure to protect the medium circulating system from damage. The pressure gauge 9 is installed on a fourth vent of the four-way joint 20. In the first embodiment, the protruding ends of the first medium return pipeline 22, the second medium

pipeline 23, and the pressure-release pipeline 29 lie in the same plane, thus the pipelines are arranged aesthetically. For further reducing the volume of the solar workstation, these pipelines may be further arranged in two rows in such a way that one row vertically overlaps the other row.

[62] As shown in Fig. 4, in the embodiment, the base 1 may be a metal sheet. Several notches 11 for fixing the first medium return pipeline 22, the second medium pipeline 23, and the pressure-release pipeline 29 (see Fig. 1) are provided in a rear edge on a top surface of the base 1, and several legs 12 are provided on a bottom surface of the base 1. A through hole 1211 is provided in the base 1 at a position corresponding to the connection elbow 211 (see Fig. 1) of the first medium inlet pipeline 21 to allow the connection elbow 211 to protrude below the base 1, and a through hole 1232 is provided in the base 1 at a position corresponding to the connection elbow 232 (see Fig. 3) of the second medium pipeline 23 to allow the connection elbow 232 to protrude below the base 1. The notch 11 may be a clamping portion with other structures such as a circular hole and the like, as long as it can be used to fix the pipeline. An expansion tank accommodation opening 125 is provided in the base 1 at a position corresponding to the expansion tank 251 (see Fig. 1), so as to allow the expansion tank 251 to partly pass through. A vertical plate 7 is provided on the top surface of the base 1 in the rear of the expansion tank accommodation opening 125. On the one hand, the vertical plate 7 may be used to restrict displacement of the expansion tank 251, and on the other hand, the vertical plate 7 may be used to fix the controller 8 (see Fig. 1). The controller 8 is provided with several connector ports at a lower portion thereof. An L-shaped expansion tank support plate 1125 (see Fig. 3) is provided on the bottom surface of the base 1 at a position adjacent to the expansion tank accommodation opening 125. The L-shaped expansion tank support plate 1125 can also be used as the leg. A medium pump opening 126 for allowing the medium pump 26 to partly pass through is

provided in the base 1 at a position corresponding to the medium pump 26, and two L-shaped medium pump support plates 1126 are provided on the bottom surface of the base 1. The two L-shaped medium pump support plates 1126 are arranged so as to face each other and close to opposed edges of the medium pump opening 126. The L-shaped medium pump support plates 1126 may also be used as legs.

[63] The top surface of the base 1 is provided with several support members 13 for supporting the first medium inlet pipeline 21, the second medium pipeline 23, the pressure-release pipeline 29, and the buffer pipeline 25 (see Fig. 1). Alternatively, the support member 13 may be some other auxiliary fixing element such as a hoop and the like instead. A pipe supporting plate 16 is provided on the top surface of the base 1 at a position corresponding to a connection portion between the buffer pipeline 25 and the expansion tank 251. Furthermore, an upper end of the pipe supporting plate 16 is provided with a groove matching a connection port of the buffer pipeline 25 (see Fig. 1). The notches 11, the legs 12, the support members 13, the pipe supporting plate 16, the expansion tank support plate 1125, the medium pump supporting plates 1126, and the vertical plate 7 may all be combined with the base 1 to form an integrated structure.

[64] In the first embodiment, the bottom of the base 1 may have a shape matching a top shape of the thermal insulation water tank in the solar energy heating system. For example, if the top of the thermal insulation water tank has a flat shape such as semi-circle shape, circle shape, rectangle shape and the like, the base 1 may correspondingly have a flat bottom shape such as semi-circle shape, circle shape, rectangle shape and the like. However, the bottom shape of the base 1 is not limited to these shapes listed above but rather, the base can have any bottom shape as long as it matches the top shape of the thermal insulation water tank. In this way, the solar workstation of the present invention can be conveniently placed on the top of the thermal insulation water tank, so as to sufficiently utilize the space

above the thermal insulation water tank, and the entire solar energy heating system may be arranged in a neat manner. Since the base 1 in the first embodiment is made of a metal sheet, the bottom shape of the base 1 substantially conforms to the shape of the entire base. The solar workstation of the first embodiment placed on top of the thermal insulation water tank is generally suitable to be applied to the case in which the top surface of the thermal insulation water tank is a plane. The base 1 is not limited to the shapes listed above matching the top shape of the thermal insulation water tank but rather, the base 1 may have other shapes which do not match the shape of the top surface of the thermal insulation water tank but which are suitable to be placed on other objects. Meanwhile, the solar workstation of the embodiment may not only be placed horizontally, but also be placed vertically. The base 1 is not limited to the above metal sheet but rather, it may be made of other existing sheet materials.

[65] The solar workstation of the first embodiment can further comprise an outer cover (not shown) which may be connected to the base 1 by means of snaps or bolts. In order to further fasten each of the pipelines, notches are provided in a bottom end of the outer cover at positions corresponding to the protruding ends of the first medium return pipeline 22, the second medium pipeline 23, and the pressure-release pipeline 29 (see. Fig. 1), respectively, so as to be aligned with the corresponding notches 11 located on the base 1. If the clamping portion for fixing each of the pipelines is a circular hole, it is not necessary to provide the notches in the bottom end of the outer cover. A rear panel which is convenient for opening and closing is provided on the outer cover at a position corresponding to the controller, so as to facilitate maintenance of the controller 8. The outer cover may not only function to assist in fixing various pipelines, but also covers all components of the solar workstation so as to play a role of protection. The outer cover may play a role of thermal insulation if it is made of a thermal insulation material such as EPP or melamine.

[66] When it is intended to install the medium circulating system on the base 1, the four-way joint 20 is fixed on the top surface of the base 1 and adjacent to a front end/edge of the base 1; and the protruding ends of each pipeline in the medium circulating system are snap-fitted in the corresponding notches 11 provided in the rear end on the top surface of the base 1; the medium pump 26 is placed at the medium pump opening 126; the expansion tank 251 is placed at the expansion tank accommodation opening 125; and the expansion tank 251 communicates with the first medium inlet pipeline 21 by means of the buffer pipeline 25.

[67] During installation of the solar workstation according to the first embodiment, the solar workstation may be placed on the top surface of the thermal insulation water tank. The connection elbow 211 of the first medium inlet pipeline 21 is connected to an outlet pipeline of the heat exchanger in the solar energy heating system; the connection port 222 of the first medium return pipeline 22 is connected to an inlet pipeline of a heat collector; the connection port 231 of the second medium pipeline 23 is connected to an outlet pipeline of the heat collector; and the connection elbow 232 of the second medium pipeline 23 is connected to the inlet pipeline of the heat exchanger (see Fig. 1). In this embodiment, the leg 12 may not be provided on the base 1. In such a case, a pad may be added between the top surface of the thermal insulation water tank and the base 1 instead, so that there is a certain space between the top surface of the thermal insulation water tank and the base 1 to receive a connection elbow or a connection port of the heat collector or heat exchanger.

[68] The high temperature medium from the heat exchanger flows into the heat exchanger which is positioned in the water tank via the connection elbow 232 (see Fig. 2) at the outlet end of the second medium pipeline 23, (see Fig. 1) so as to transmit heat to the water in the water tank and thus, to turn into a low temperature medium. The medium then flows into the first medium inlet pipeline 21 via the con-

nection elbow 211 at the inlet end of the first medium inlet pipeline 21, flows into the first medium return pipeline 22 via the one-way valve 24, the three-way joint 213, the medium pump 26, and the four-way joint 20 sequentially, and further flows into the heat collector via the connection port 222. The medium thereafter flows into the heat exchanger via the second medium pipeline 23 to pass into the next circulation. In this way, the temperature of the water within the water tank is increased. By way of a customer terminal water pipe which communicates with the thermal insulation water tank, the customer can use hot water.

Second Embodiment

[69] The solar workstation of the second embodiment is different from that of the first embodiment only in that: the medium circulating system of the second embodiment is provided with an additional hot water return pipe 30 which is installed parallel to the first medium inlet pipeline 21. The hot water return pipe 30 has one end protruding out of the rear end surface of the base 1 and being provided with a connection port 301, and has the other end being provided with a connection elbow 302. The protruding end of the hot water return pipe 30 lies in the same plane with the protruding ends of the first medium return pipeline 22, the second medium pipeline 23, and the pressure-release pipeline 29.

[70] Correspondingly, a notch for fixing the hot water return pipe 30 and a support member(s) for supporting the hot water return pipe 30 are provided in the rear end on the top surface of the base 1, and a through hole 1302 (see Fig. 4) for allowing the connection elbow 302 (see Fig. 1) to protrude below the base 1 is provided in the base 1 at a position corresponding to the connection elbow 302. In use, the connection elbow 302 communicates with the thermal insulation water tank, and the connection port 301 communicates with the customer terminal water pipe. Therefore, the hot water may flow from the thermal insulation water tank to the customer terminal water pipe via the hot

water return pipe 30. In this way, the pipelines of the solar energy heating system may be arranged in an appropriate order aesthetically.

[71] The other portions of the solar workstation of the second embodiment are identical to those of the first embodiment.

Third Embodiment

[72] The solar workstation of the third embodiment is different from the solar workstation of the second embodiment only in that: the medium circulating system is provided with a hot water inlet pipe 31 installed parallel to the first medium inlet pipeline 21, and is further provided with a water pump 32 installed on the hot water inlet pipe 31. The hot water inlet pipe 31 has one end protruding out of the rear end surface of the base 1 and being provided with a connection port 311, and has the other end being provided with a connection elbow 312. The protruding end of the hot water inlet pipe 31 lies in the same plane with the protruding ends of the hot water return pipe 30, the first medium return pipeline 22, the second medium pipeline 23, and the pressure-release pipeline 29 (see Fig. 1).

[73] Correspondingly, a notch for fixing the hot water inlet pipe 31 and a support member(s) for supporting the hot water inlet pipe 31 are provided in the rear edge on the top surface of the base 1, and a through hole 1312 (see Fig. 4) for allowing the connection elbow 312 to protrude below the base 1 is provided in the base 1 at a position corresponding to the connection elbow 312. Moreover, a water pump accommodation opening 321 for allowing the water pump 32 to partly pass through is provided in the base 1 at a position corresponding to the water pump 32, and two water pump support plates 1321 are provided on the bottom surface of the base 1. The two water pump support plates 1321 are arranged to face each other and are adjacent to the opposite edges of the water pump accommodation opening 321 (see Fig. 4). In use, the connection elbow 312 communicates with the thermal insulation water tank, and the connection port 311 communi-

cates with the customer terminal water pipe (see Fig. 1). Thus the hot water inlet pipe 31, the thermal insulation water tank, the hot water return pipe 30, and the customer terminal water pipe constitute an instant hot water circulating system. When a water temperature in the customer terminal water pipe is decreased to a temperature lower than a temperature set by the control system, and a water temperature in the thermal insulation water tank is higher by a certain value, for example 5°C, than a set pipeline temperature, the water pump will be enabled to pump cold water from the pipeline to the thermal insulation water tank, such that the water at a high temperature in the thermal insulation water tank is mixed with the cold water from the pipeline once again to produce hot water which meets the setting condition. When the customer uses water, hot water will flow out instantly upon opening of the water tap.

[74] The solar workstation of the third embodiment may provide hot water instantly upon turning on. The other portions of the third embodiment which are identical to those of the second embodiment in the structure will not be described any more herein.

Fourth Embodiment

[75] As shown in Figs. 5, 6, 7, and 8, the solar workstation of the fourth embodiment comprises a base 5, a controller 8, and a medium circulating system 2. All components of the medium circulating system 2 are installed on the base 5. The controller 8 can also be installed on the base 5.

[76] The medium circulating system 2 comprises a four-way joint 20, a first medium pipeline, a second medium pipeline 23, a buffer pipeline 25, a pressure-release pipeline 29, a one-way valve 24, an expansion tank 251, a medium pump 26, a relief valve 27, a flow meter 28, and a pressure gauge 9, etc.. The pipelines are arranged substantially parallel to each other, and protruding ends of the pipelines are all positioned behind the base. Moreover, the pipelines are substantially paral-

lel to the base. That is, the medium circulating system of the fourth embodiment is identical to that of the first embodiment in the structure, and thereby will not be described any more. The main difference between the fourth and first embodiments is the structure of the base.

[77] In the solar workstation of the fourth embodiment, the base 5 is a thick plate with a certain thickness in which various recesses can be provided. Preferably, the base 5 is made of a thermal insulation material such as EPP or melamine but not limited to this. The bottom shape of the base 5 matches to that of the thermal insulation water tank in the solar energy heating system. For example, if the top shape of the thermal insulation water tank is spherical, the bottom shape of the thermal insulation base 5 will correspondingly be spherical (see Fig. 11). The bottom shape of the base is not limited to spherical shape, but rather it may have any shape as long as it matches the shape of the top surface of the thermal insulation water tank. In this way, the solar workstation of the fourth embodiment may be conveniently placed on top of the thermal insulation water tank and attached to the thermal insulation water tank. Thereby, the solar workstation may not only fully utilize space above the thermal insulation water tank, so as to compactly and appropriately arrange the entire solar energy heating system equipped with the solar workstation, but it may also replace the thermal insulation layer on the top of the thermal insulation water tank. Thus, the base may play a role of thermal insulation.

[78] As shown in Figs. 5 and 8, in the fourth embodiment, several recesses 511 for fixing the first medium inlet pipeline 21, the second medium pipeline 23, the first medium return pipeline 22, and the pressure-release pipeline 29 of the medium circulating system are provided in the top surface of the base 5 along the forward and rearward directions. A radius of the recess 511 may be equal to or slightly larger than a radius of the corresponding pipeline received therein. Through holes 512 are provided on the base 5 at positions respectively corresponding to the connection ports of the first medium inlet pipeline 21 and the

second medium pipeline 23. A medium pump accommodation recess 526 (see Fig. 9) for accommodating a part of the medium pump 26 is provided on the base 5 at a position corresponding to the medium pump 26 (see Fig. 9). An expansion tank accommodation recess 525 for accommodating a part of the expansion tank 251 is provided on the base 5 at a position corresponding to the expansion tank 251 (see Fig. 8). A partition plate 53 is provided on the base 5 between the medium circulation pipeline and the expansion tank 251. A wiring through hole 17 is further provided in the base 5 so that various control wires may protrude outwards from the underside of the base which are to be connected to the controller.

[79] The solar workstation of the fourth embodiment may further comprise an outer cover (not shown) which may be connected to the base 5, and notches are provided in a bottom end of the outer cover at positions respectively corresponding to the protruding ends of the pipelines. The outer cover not only plays a role of assisting to fix the pipelines, but also a role of protection by covering all components of the solar workstation. The outer cover may be made of a thermal insulation material such as EPP or melamine, so it may further play a role of thermal insulation.

[80] When it is intended to install the medium circulating system on the base 1, the four-way joint 20 is fixed on the top surface of the base 1 at a position adjacent to a front edge of the base 1; each of the pipelines in the medium circulating system is placed in the corresponding recess 511; the medium pump 26 is placed in the medium pump accommodation recess 526; the expansion tank 251 is placed in the expansion tank accommodation recess 525, and communicates with the first medium inlet pipeline 21 via the buffer pipeline 25.

[81] The solar workstation of the fourth embodiment and the other portions of the solar energy heating system are identical to those of the first embodiment in the structure.

Fifth Embodiment

[82] The parts of the solar workstation of the fifth embodiment which are identical to those of the fourth embodiment in structure will not be described further. The solar workstation of the fifth embodiment is different from the fourth embodiment in that: the medium circulating system is provided with an additional hot water return pipe 30 installed parallel to the first medium inlet pipeline 21.

[83] Correspondingly, an accommodation recess for fixing the hot water return pipe 30 is further provided on the top surface of the base 5, and a through hole is provided on the base 5 at a position corresponding to the connection port of the hot water return pipe 30. The structure of the hot water return pipe 30, the positional relation between the hot water return pipe 30 and the base 5 as well as the principle with respect to the hot water return pipe 30 are identical to those of the second embodiment.

Sixth Embodiment

[84] The parts of the solar workstation of the sixth embodiment the structures of which are identical to those of the fifth embodiment will not be described further. The solar workstation of the sixth embodiment is different from the fifth embodiment in that: the medium circulating system is provided with an additional hot water inlet pipe 31 which is installed parallel to the first medium inlet pipeline 21, and a water pump 32 which is installed on the hot water inlet pipe 31.

[85] Correspondingly, a recess for fixing the hot water inlet pipe 31 is provided on the top surface of the base 5, and a through hole 531 is provided in the base 5 at a position corresponding to the other connection port of the hot water inlet pipe 31. Moreover, a water pump accommodation recess 532 for accommodating a part of the water pump 32 is provided in the base 5 at a position corresponding to the water pump 32. The structure of the hot water inlet pipe 31, the positional relation between the hot water inlet pipe 31 and the base 5 as

well as the principle with respect to the hot water inlet pipe 31 are identical to those described in the third embodiment.

Seventh Embodiment

[86] The solar workstation of the seventh embodiment is different from the fourth to sixth embodiments in that: according to the seventh embodiment, several bearing seats 54 are provided on the top surface of the base 5 and integrated in the base. One of the bearing seats is positioned on a rear portion of the base 5, and other bearing seats are positioned on a middle portion and a front portion of the base 5, respectively. Accommodation recesses 511 for accommodating the respective pipelines of the medium circulating system may be provided in the bearing seats 54. Accommodation recesses for accommodating the medium pump 26 and the water pump 32 may also be provided in the bearing seats 54 (see Fig. 8). The seventh embodiment further comprises a clamping member 15 for assisting to fix the pipelines (see Fig. 6). This clamping member 15 can be an L-shaped plate with a vertical portion and a horizontal portion. The vertical portion may have a plurality of notches 151 for being clamped on the pipelines, and the horizontal or vertical portions may be fixed in position on the thermal insulation water tank or the vertical plate 7. In this way, the pipelines can be fixed more reliably. In this embodiment, since the accommodation recesses are provided in the bearing seat 54 having a certain height, there is a distance between the pipelines accommodated within these recesses and the top surface of the base 5. Thus, it is not necessary for the connection elbows at the connection ports of the pipelines to protrude below the base 5. When it is intended to connect the medium pipeline of the solar workstation to the heat collector and the heat exchanger, the connection ports of the heat collector and the heat exchanger may protrude above the top surface of the base 5 via the corresponding through holes. Thereby the connection of the pipelines may be completed above the base 5. Thus, connecting operations are more con-

venient.

[87] The other portions of the solar workstation of the seventh embodiment which are identical to the fourth to sixth embodiments will not be described further.

Eighth Embodiment

[88] As shown in Fig. 9, the solar workstation of the eighth embodiment is different from the fourth to seventh embodiments in that: the accommodation recesses provided on the base 5 for accommodating the pipelines, such as the accommodation recesses for the first medium return pipeline 22, the second medium pipeline 23, the pressure-release pipeline 29, the hot water return pipe 30, and the hot water inlet pipe 31 (see Fig. 5) may be arranged in such a way that any two of the accommodation recesses are overlapped in the upwards and downwards direction to form one combined accommodation recess, so as to form the combined accommodation recess, such that two pipelines may be arranged in one combined accommodation recess in an overlapping manner along the upwards and downwards direction. In this way, the number of the recesses for accommodating the pipelines can be reduced and the arrangement of the pipelines can be more compact, so that the overall arrangement of the solar workstation is more compact. In addition, with regard to installation of the expansion tank, the expansion tank may be held in position by three expansion tank fixing ribbed plates 55 (the plates 55 are parallel to each other and installed on the thermal insulation base 5) and the vertical plate 7. In such a case, it is not necessary to provide the expansion tank accommodation recess on the thermal insulation base 5.

[89] The portions of the solar workstation of the eighth embodiment which are identical to the fourth to seventh embodiments will not be described further.

Ninth Embodiment

[90] As shown in Fig. 10, the solar workstation according to the ninth embodiment is different from the fourth to eighth embodiments in that: according to the ninth embodiment, the solar workstation further comprises a cover plate 6 covering a part of the base 5 and being positioned on one side of the expansion tank 251. The cover plate 6 covers the accommodation recesses provided at positions corresponding to the first medium inlet pipeline 21, the first medium return pipeline 22, the second medium pipeline 23, the hot water return pipe 30, and the hot water inlet pipe 31, respectively. A gap for allowing the medium pump to be exposed to the outside is provided in the cover plate 6 at a position corresponding to the medium pump 26, and a gap for allowing the water pump to be exposed to the outside is also provided in the cover plate 6 at a position corresponding to the water pump 32. The cover plate 6 may be made of a thermal insulation material which is identical to that of the base 5. Therefore, according to this embodiment, the cover plate 6 can play a role of assisting to fix the pipelines on the one hand, and providing a thermal insulation to the pipelines on the other hand. In addition, a controller accommodation recess for fixing the controller 8 may be provided in the top of the cover plate 6 so that the controller 8 can be installed in the solar workstation horizontally with respect to the base 5. Of course, the controller 8 may be installed at any angle, for example, the controller may be installed vertically or inclined at a certain angle and the like.

[91] The other portions of the solar workstation of the ninth embodiment which are identical to the fourth to eighth embodiments will not be described any more.

[92] In the solar workstation of the invention, the fixing of the medium circulation pipeline is not limited to the manners mentioned above such as utilizing the notches or the recesses., Instead, other conventional manners such as utilizing the pipeline clamps and the like are also applicable for fixing the solar workstation of the present invention. Similarly, the fixing of the medium pump, the water pump, and the ex-

pansion tank are also not limited to those mentioned above such as utilizing the recesses or the fixing ribbed plates or the accommodating opening in cooperation with the strutting plate. Instead, other conventional manners are also applicable for the present invention.

[93] Although the present invention has been described with reference to several preferred embodiments, it should be understood that the terms used herein are merely illustrative and exemplary, not restrictive. Since the present invention may be embodied in various forms without departing from its spirit, it should be understood that the above-described embodiments are not limited to any detail set forth above, and should be construed to illustrate the scope the claims.

CLAIMS

1. A solar workstation for a solar energy heating system comprising a thermal insulation water tank, comprising:

a controller;

a medium circulating system, wherein the medium circulating system comprises a medium circulating pipeline composed of a first medium pipeline and a second medium pipeline, a pressure-release pipeline and a buffer pipeline respectively communicating with the medium circulating pipeline, a one-way valve and a medium pump installed in the medium circulating pipeline, an expansion tank installed in the buffer pipeline, and a relief valve installed in the pressure-release pipeline; and

a base on which all components of the medium circulating system are provided integrally.

2. The solar workstation according to claim 1, further comprising a hot water return pipe installed on the base.

3. The solar workstation according to any one of claims 1 or 2, further comprising a hot water inlet pipe and a water pump installed on the hot water inlet pipe.

4. The solar workstation according to any one of claims 1-3, wherein the first medium pipeline, the second medium pipeline, the pressure-release pipeline and the expansion tank of the medium circulating system are all installed on the base parallel to the base; each of the first medium pipeline, the second medium pipeline, and the pressure-release pipeline having one end protruding out of a rear end surface of the base; each of the first medium pipeline and the second medium pipeline having the other end corresponding to a through hole which is provided in the base.

5. The solar workstation according to claim 4, further comprising a hot water return pipe installed on the base parallel to the base, having one end protruding out of the rear end surface of the base, and having the other end corresponding to a through hole which is provided on the base.

6. The solar workstation according to any one of claims 4 or 5, further comprising a hot water inlet pipe installed on the base parallel to the base, and a water pump installed on the hot water inlet pipe, wherein the hot water inlet pipe has one end protruding out of the rear end surface of the base, and has the other end corresponding to a through hole which is provided on the base.

7. The solar workstation according to any one of claims 1-6, wherein the first medium pipeline comprises a first medium inlet pipeline and a first medium return pipeline which are arranged in parallel and communicate with each other at one end.

8. The solar workstation according to claim 7, wherein the one-way valve and the medium pump are installed in the first medium inlet pipeline in a medium flow direction sequentially, and the buffer pipeline communicates with the first medium inlet pipeline at a position between the one-way valve and the medium pump.

9. The solar workstation according to any one of claims 1-8, wherein the pipelines of the solar workstation are arranged in at least two rows in such a way that one row vertically overlaps the other row.

10. The solar workstation according to any one of claims 1-9, wherein the base has a bottom shape matching a top shape of the thermal insulation water tank of the solar energy heating system.

11. The solar workstation according to any one of claims 1-10, wherein several clamping portions for fixing the first and second medium pipelines are provided on a top surface of the base, and an expansion tank fixing means and a medium pump accommodating and fixing means are provided on the base.

12. The solar workstation according to claim 11, wherein the expansion tank fixing means comprises an expansion tank accommodation opening provided on the base at a position corresponding to the expansion tank for allowing the expansion tank to partly pass through, and an expansion tank support plate provided on a bottom surface of the base at a position adjacent to the expansion tank accommodation opening; the medium pump accommodating and the fixing means comprising a medium pump opening provided on the base at a position corresponding to the medium pump for allowing the medium pump to partly pass through, and two medium pump support plates provided on the bottom surface of the base at positions near opposing edges of the medium pump opening.

13. The solar workstation according to any one of claims 1-12, wherein auxiliary fixing elements for supporting the first medium pipeline, the second medium pipeline, the pressure-release pipeline, and the buffer pipeline are provided on the top surface of the base.

14. The solar workstation according to claim 13, wherein the base is a metal plate having several legs attached to the bottom surface of the base; the clamping portions, the legs, the auxiliary fixing elements, the expansion tank support plate, and the medium pump support plates all being combined with the base to form an integral structure.

15. The solar workstation according to any one of claims 1-14, wherein

the solar workstation further comprises a hot water return pipe installed on the base; wherein several clamping portions for fixing the hot water return pipe are provided on the top surface of the base.

16. The solar workstation according to any one of claims 1-15, wherein several clamping portions for fixing the hot water inlet pipe are provided on the top surface of the base, and a water pump accommodating and fixing means is provided on the base.

17. The solar workstation according to any one of claims 11-16, wherein the water pump accommodating and fixing means comprises a water pump accommodation opening provided on the base at a position corresponding to the water pump for allowing the water pump to partly pass through, and two water pump support plates provided on the bottom surface of the base at positions near the opposite edges of the water pump accommodation opening.

18. The solar workstation according to any one of claims 1-17, characterized in that the solar workstation further comprises an outer cover connected to the base.

19. The solar workstation according to claim 18, wherein a rear panel for opening and closing is provided on the outer cover at a position corresponding to the controller.

20. The solar workstation according to any one of claims 11-19, wherein several recesses for fixing the first medium pipeline, the second medium pipeline, and the pressure-release pipeline of the medium circulating system are provided in the top surface of the base; at least two expansion tank fixing ribbed plates parallel to each other or an expansion tank accommodation recess capable of accommodating a part of the expansion tank being provided on the base at a position corre-

sponding to the expansion tank; a medium pump accommodation recess for accommodating a part of the medium pump being provided on the base at a position corresponding to the medium pump.

21. The solar workstation according to claim 20, wherein a recess for fixing the hot water return pipe is further provided in the top surface of the base.

22. The solar workstation according to any one of claims 11-21, wherein a recess for fixing the hot water inlet pipe and a water pump accommodation recess for accommodating a part of the water pump are further provided in the top surface of the base.

23. The solar workstation according to any one of claims 11-22, wherein several bearing seats are further provided on the top surface of the base, and the recesses are respectively provided in the bearing seats.

24. The solar workstation according to any one of claims 1-23, wherein the solar workstation further comprises a clamping member for assisting to fix respective pipelines.

25. The solar workstation according to any one of claims 22-24, wherein any two of the accommodation recesses are arranged in an overlapping manner in an upwards and downwards direction to form one combined accommodation recess for accommodating pipelines arranged in a manner overlapping each other.

26. The solar workstation according to any one of claims 22-25, wherein any two of the accommodation recesses are arranged in an overlapping manner in an upwards and downwards direction to form one combined accommodation recess for accommodating pipelines arranged in a manner overlapping each other.

27. The solar workstation according to claim 26, wherein the solar workstation further comprises a cover plate for covering a part of the base and being positioned on one side of the expansion tank; the cover plate covering the accommodation recesses provided at positions corresponding to the first medium pipeline and the second medium pipeline, respectively, and a gap for allowing the medium pump to be exposed to the outside being provided at a position corresponding to the medium pump in the cover plate.

28. The solar workstation according to claim 27, wherein the cover plate covers the recess provided at a position corresponding to the hot water return pipe.

29. The solar workstation according to any one of claims 27 or 28, wherein the cover plate covers the recess provided at a position corresponding to the hot water inlet pipe; and a gap for allowing the water pump to be exposed to the outside being provided in the cover plate at a position corresponding to the water pump.

30. The solar workstation according to any one of claims 27-29, wherein a controller recess for fixing the controller is provided in a top of the cover plate.

31. The solar workstation according to any one of claims 27-30, wherein both the base and the cover plate are made of a thermal insulation material.

32. The solar workstation according to any one of claims 1-31, wherein the solar workstation further comprises an outer cover connected to the base, a notch being provided in a bottom of the outer cover at positions corresponding to protruding ends of the pipelines.

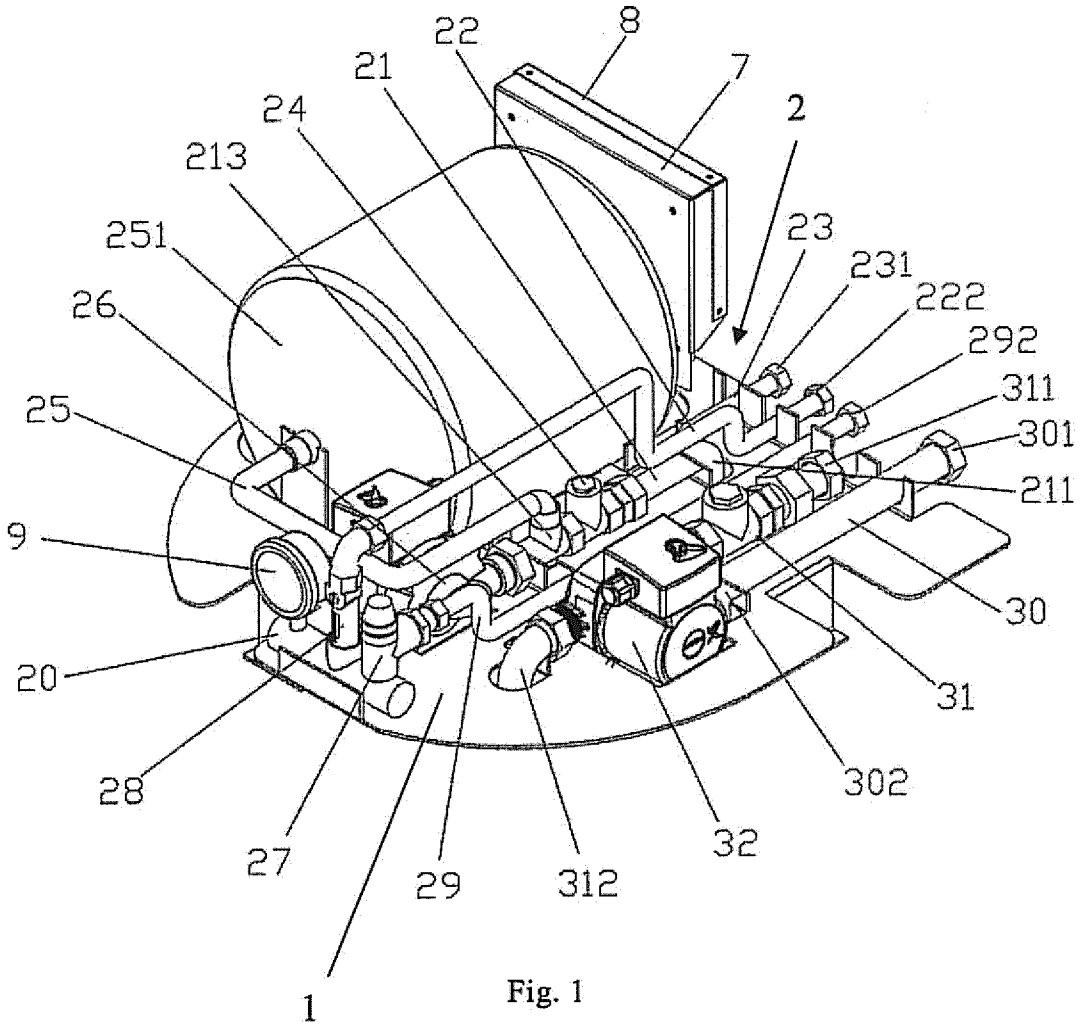
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Fig. 1

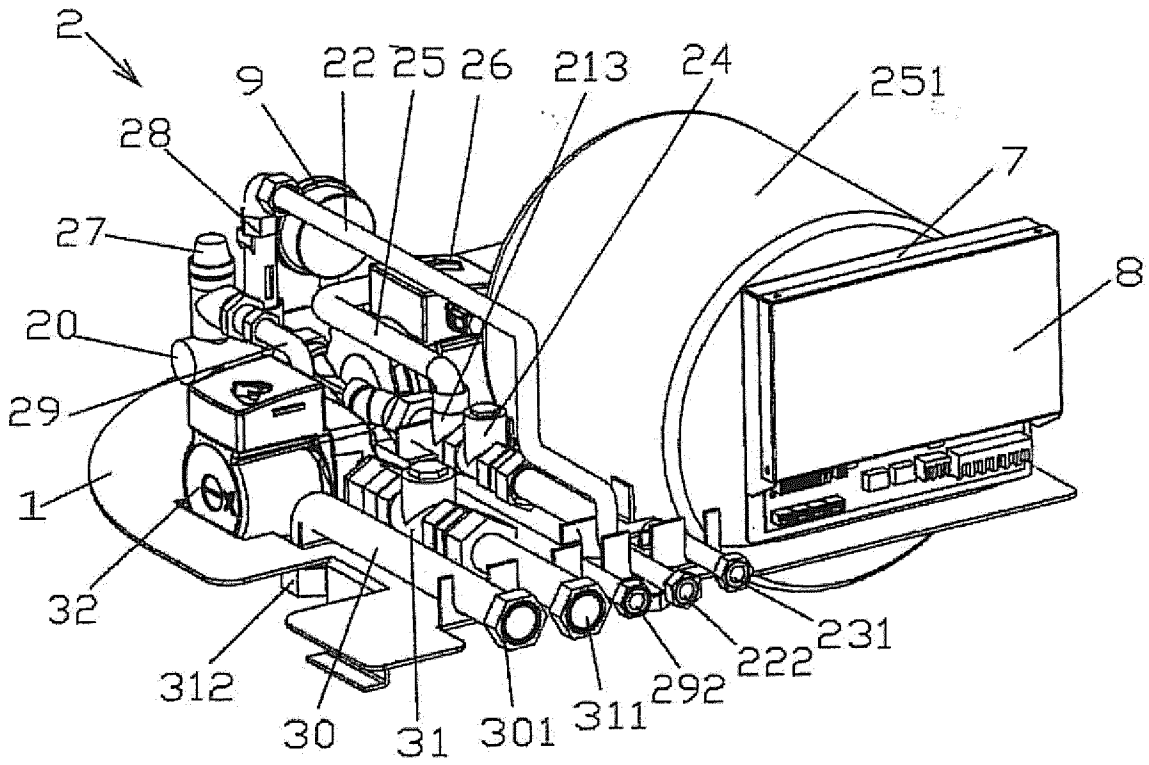
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Fig. 2

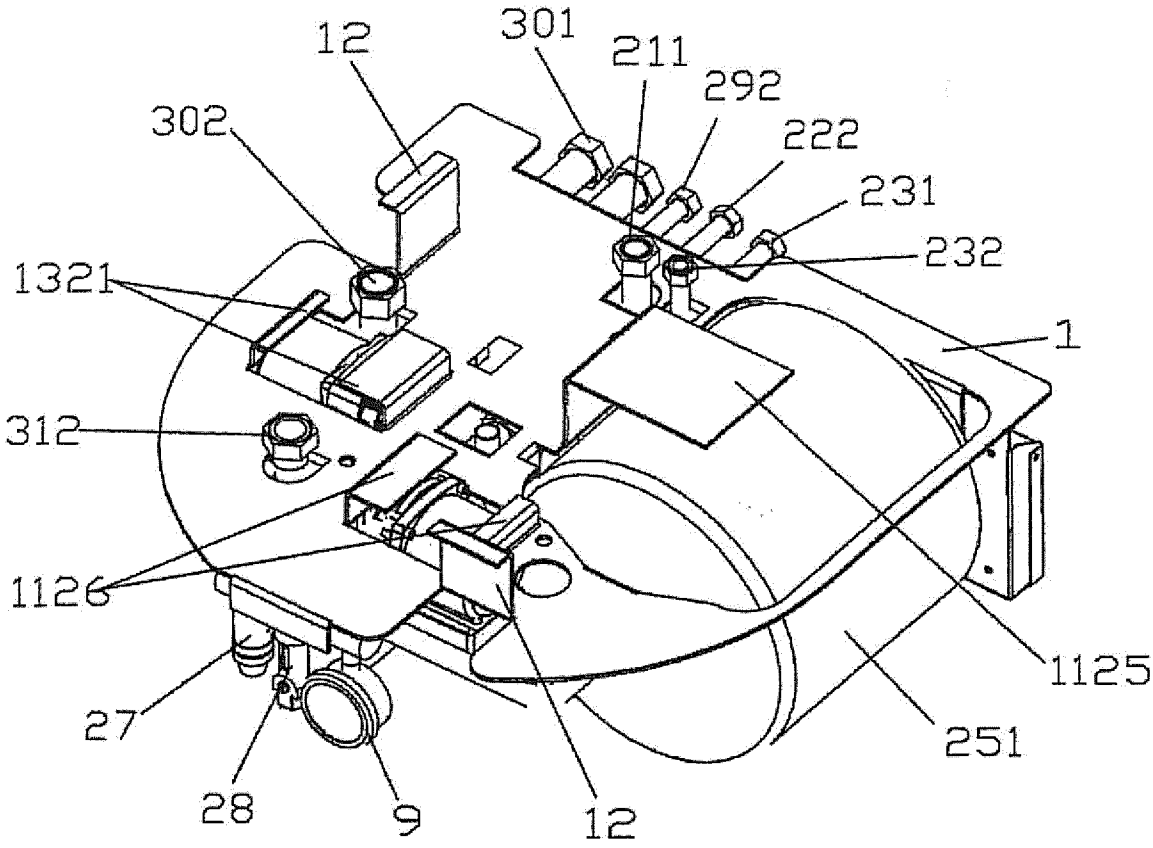

Fig. 3

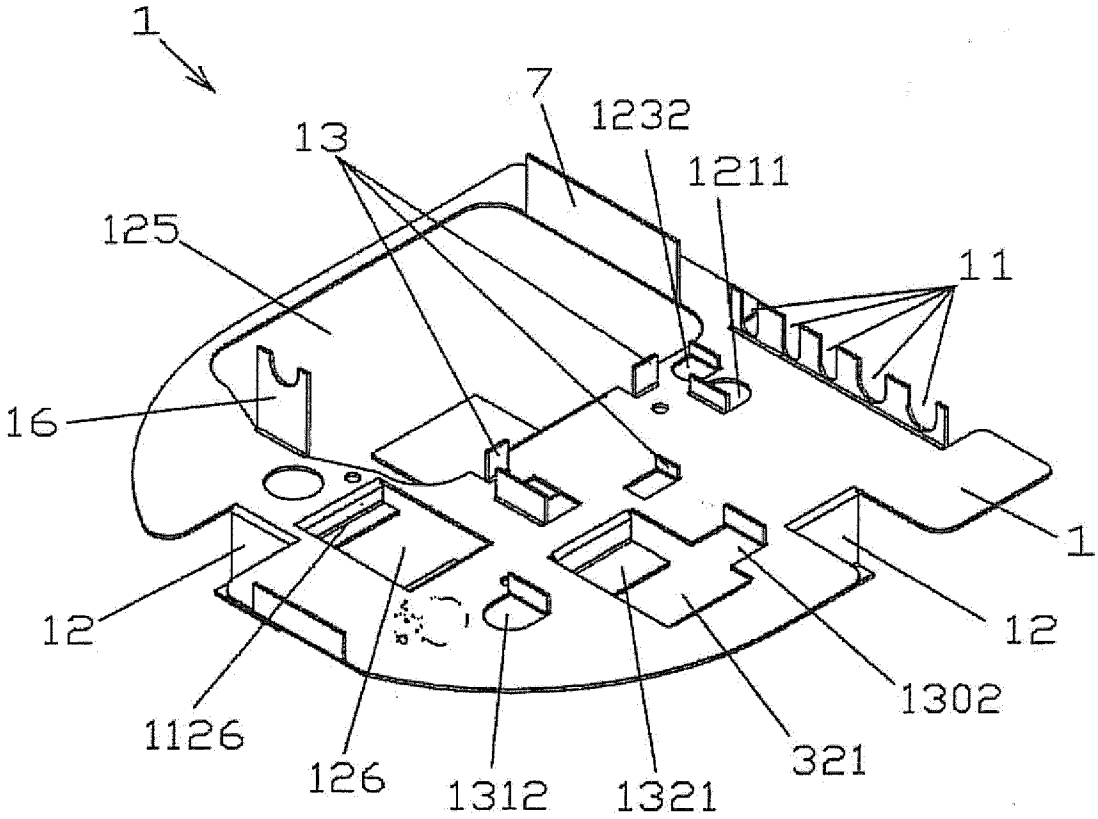

Fig. 4

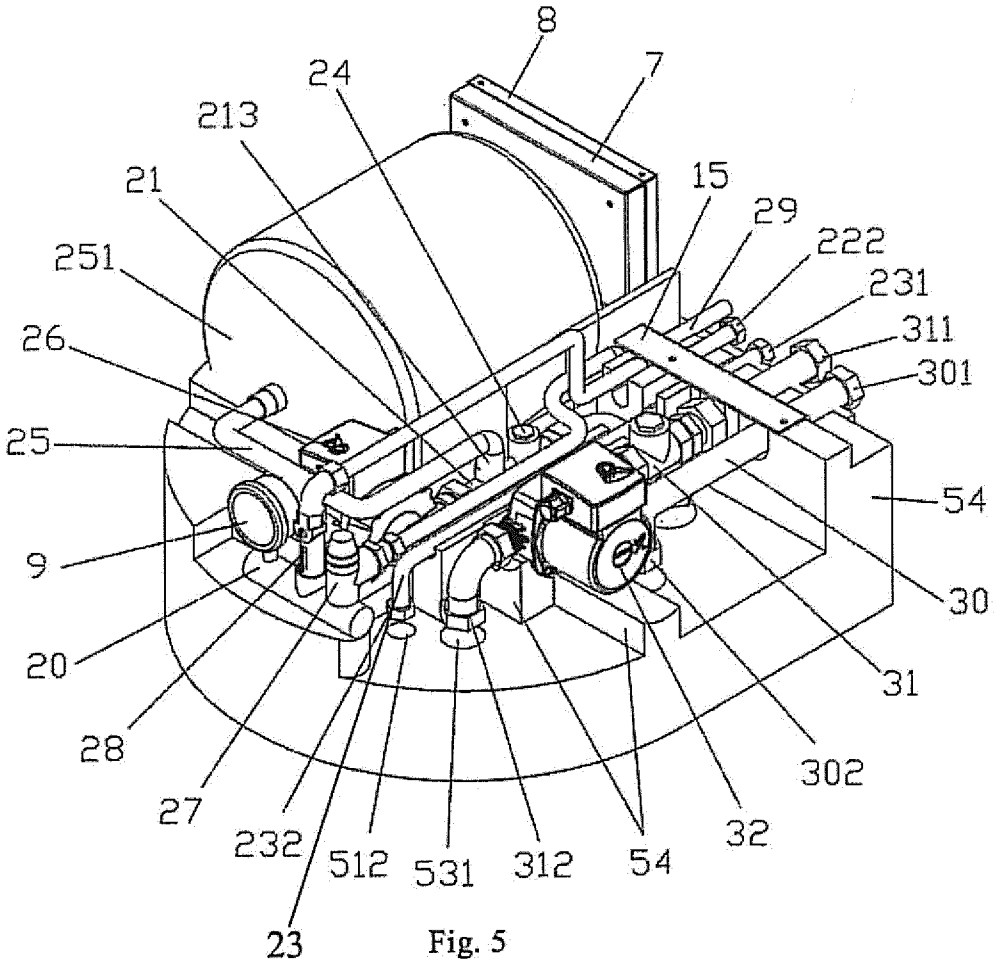
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Fig. 5

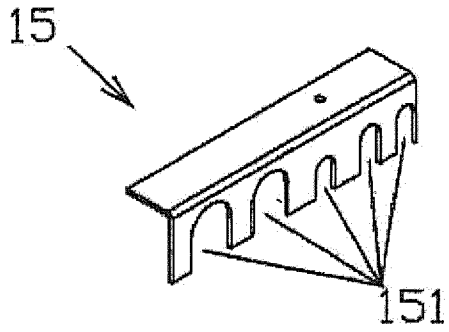

Fig. 6

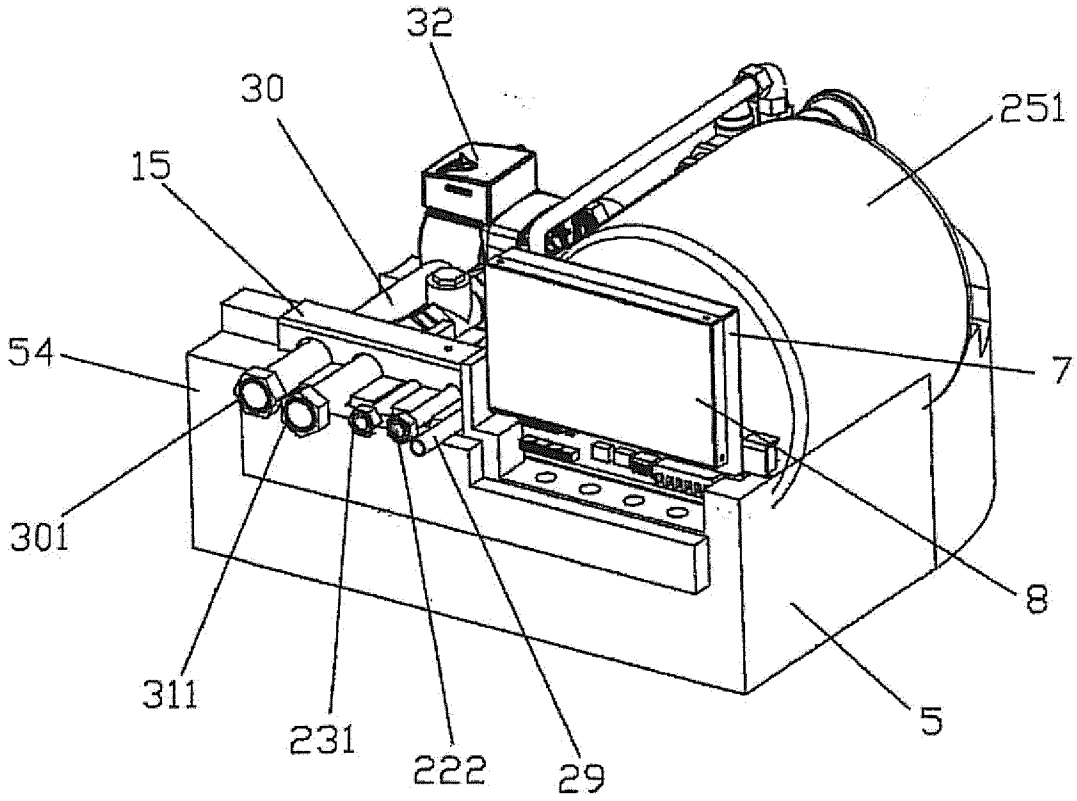

Fig. 7

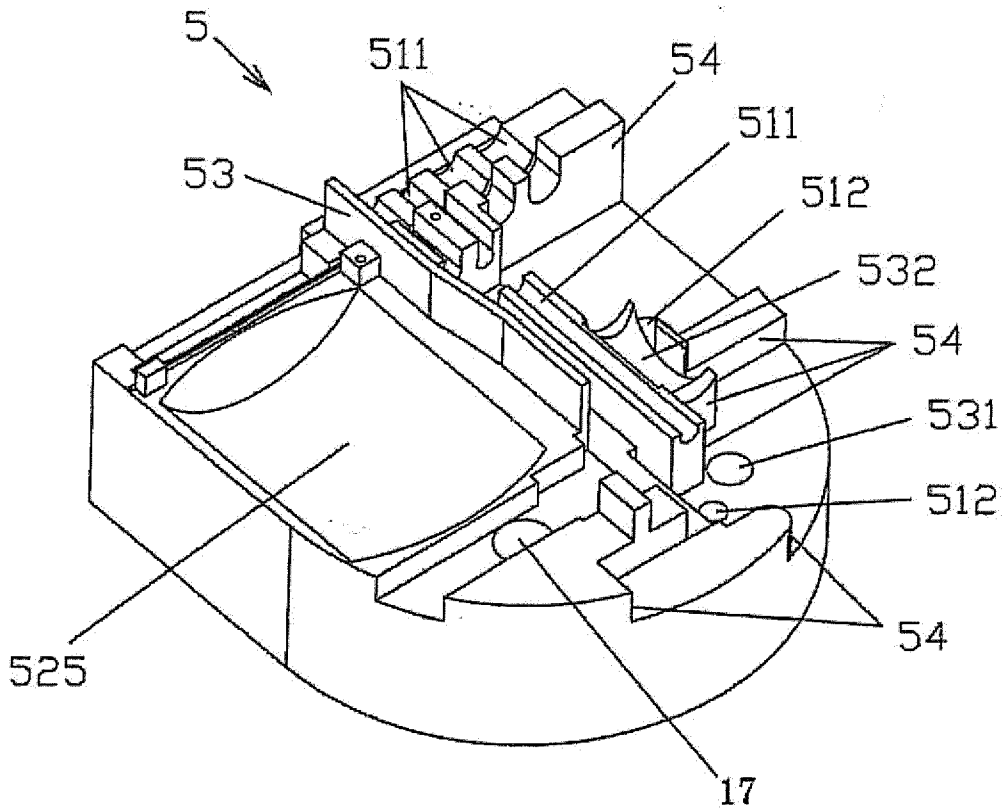

Fig. 8

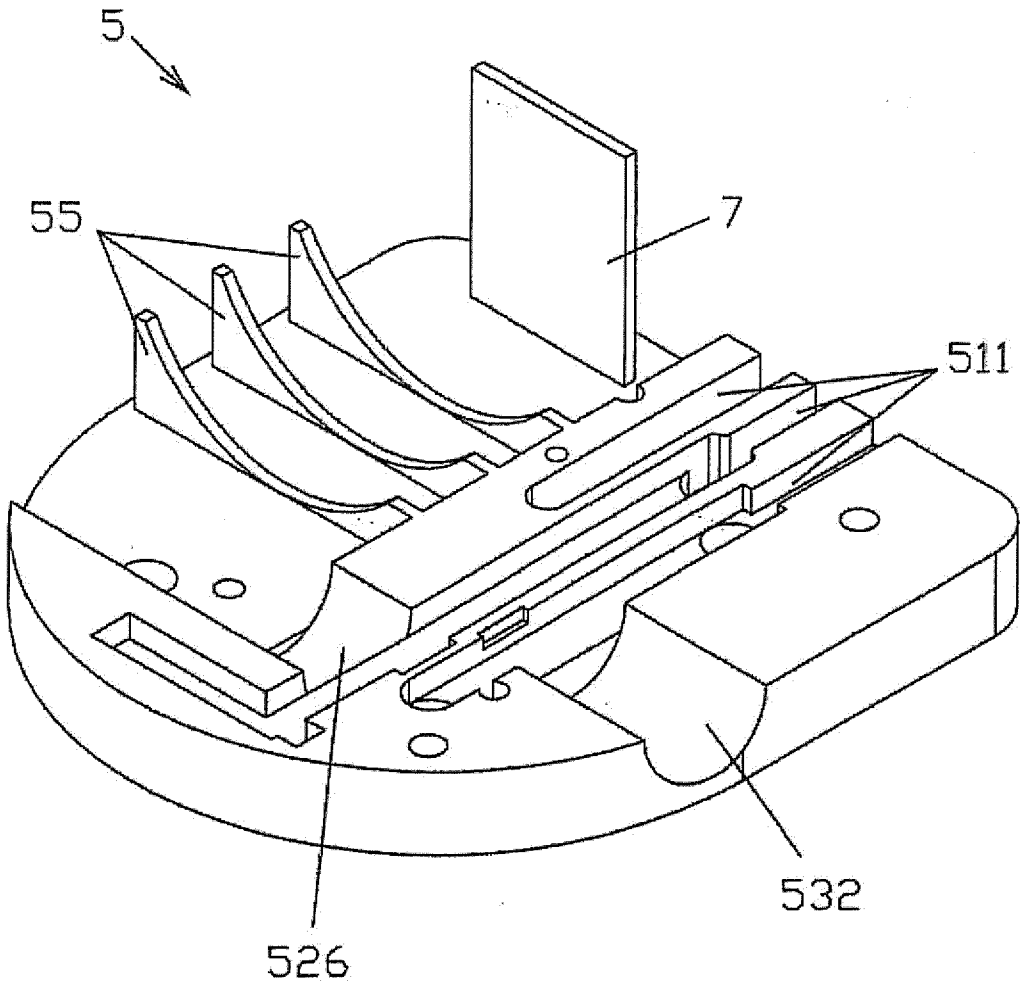

Fig. 9

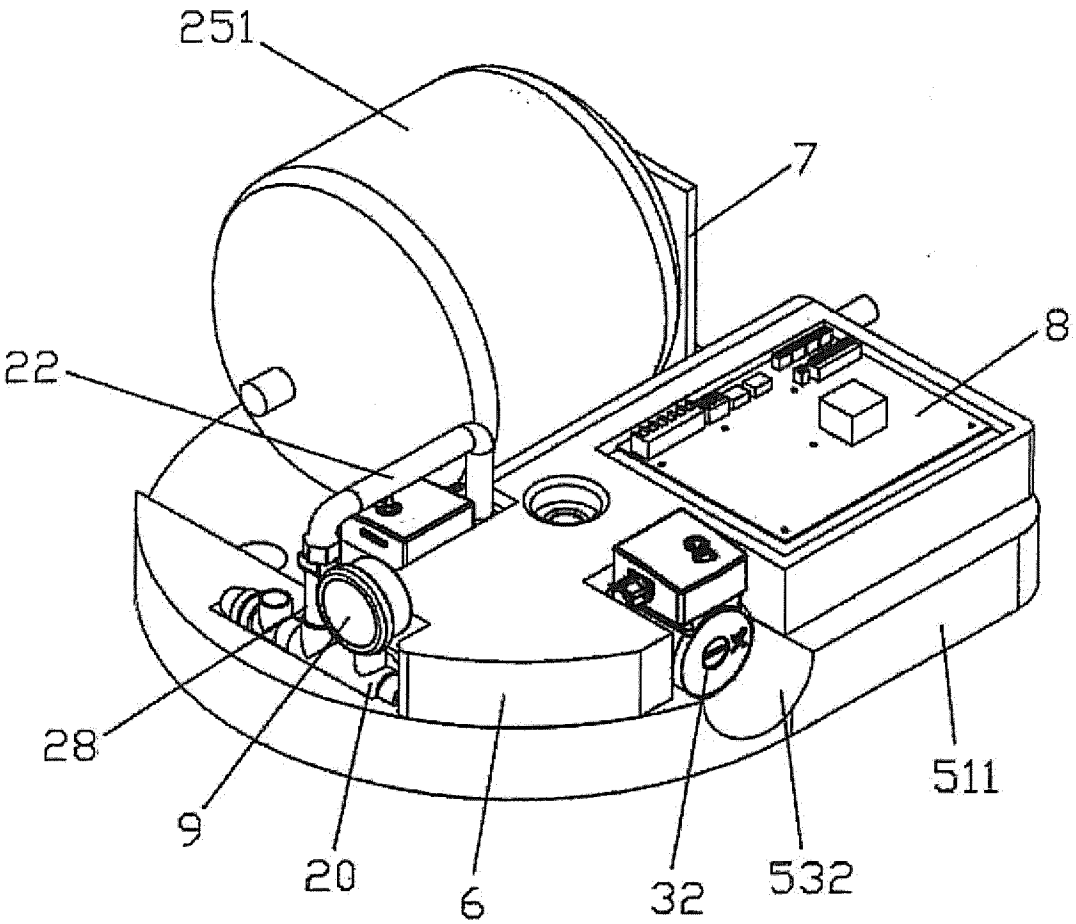

Fig. 10

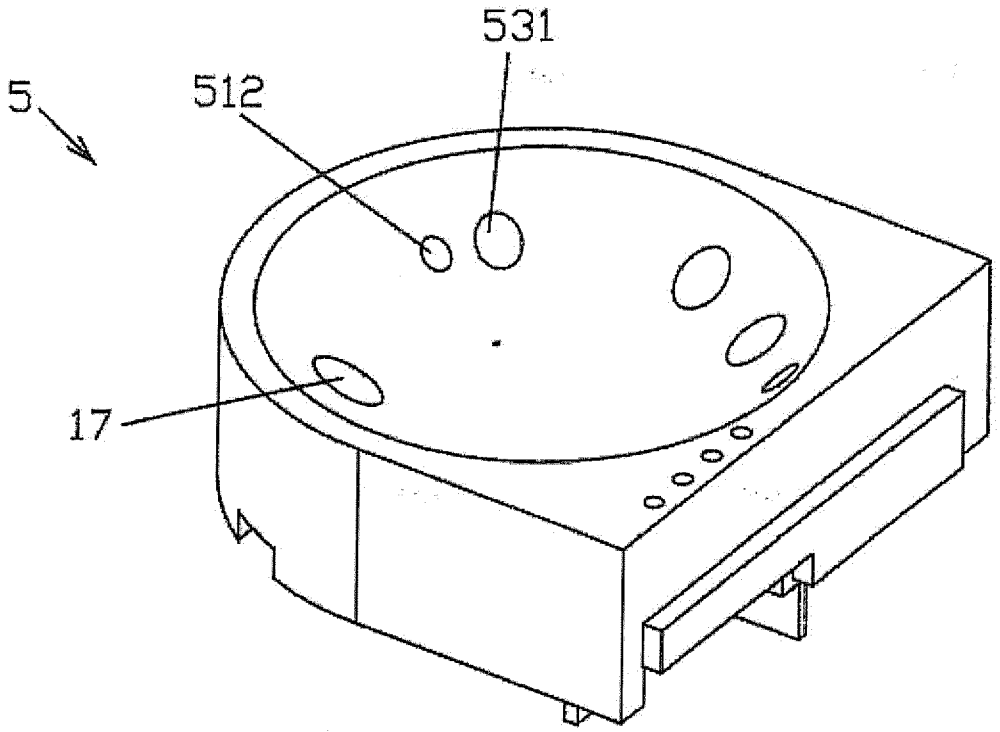

Fig. 11