VAPOR INJECTING ICE AND HOT WATER GENERATING DEVICE

Field of the invention

The present invention relates to an ice and hot water generating device, and particularly to a vapor injecting ice and hot water generating device, wherein the devices for making ice water and hot water are integrated as an integral body so as to save power and cost.

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Background of the invention

The present invention provides a vapor injecting ice and hot water generating device. The vapor injecting ice and hot water generating device is capable of producing ice and hot water at the same time. The device comprises a main condenser system, an auxiliary condensing system, a heat supply system, an ice water supply system; detecting and control elements.

The main condenser system is formed by an evaporator and a condenser; a plurality of Laffer nozzles being installed between the evaporator and the condenser; a suction end of each nozzle being connected to the evaporator; and an output end of each nozzle being connected to the condenser; and a middle throat being smaller than the two ends. The auxiliary condensing system including a plurality of auxiliary condensers, a plurality of auxiliary Laffer nozzles and a muffler. The heat supply system including a vapor boiler, an electromagnetic valve, a vapor cooler, a three phase control valve, and a vapor container. The ice water supply system comprising a refrigerating water storage tank; an ice water adjusting tank, and a hot water adjusting tank. The

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auxiliary water system including an auxiliary water tank, a water storage tank and a filter; and detecting and control elements including a pressure meter; a pressure transducer, a temperature monitor, a temperature signal transmitter, a level detecting controller, a level control valve, a manometer, and a check valve.

By above components, the Laffer nozzles are used as main working elements. When vapor from the vapor boiler flows through the Laffer nozzle; the suction end of the Laffer nozzle has a negative pressure so as to remove the latent heat of cycling water in the evaporator connected to the suction end. Thereby, the temperature of the water is reduced continuously to a preset value; then the water is sent to the ice water adjusting tank for being used. Another, the vapor passing through the Laffer nozzle entering into the condenser; the condensed water with a temperature lower than that of the vapor flowing down from a top of the condenser for condensing the vapor. The condensed hot water is collected to the cycling condensing water storage tank to be sent to the hot water adjusting tank for being used. When the refrigerating water cycling flow and condensed cycling water are evaporated and used so that each levels of tanks are reduced to a preset value. The level detecting controller and level control valve will drive the auxiliary water system to supply water automatically; by above mentioned structure, power is saved.

The auxiliary Laffer nozzles and the auxiliary condensers are serially connected indirectly; by the transformation of the plurality of auxiliary Laffer nozzles and auxiliary condensers of the auxiliary condensing system, the latent heat of the condensed cycling water is removed rapidly, then the latent heat is vented to air from the muffler of the condensers so as to increase the pumping speed; the latent heat can be removed rapidly.

The various objects and advantages of the present invention will be more readily understood from the following detailed description when read in conjunction with the appended drawing.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a schematic view showing the process of the present invention.

Fig. 2 is a schematic view showing the operation of the present invention.

Fig. 3 is a schematic view showing the process of the refrigerating water cycling flow of the present invention.

Fig. 4 is a schematic view showing the process of the condensed water cycling flow of the present invention.

Fig. 5 is a schematic view showing the auxiliary water supply system of the present invention.

Fig. 6 is a schematic view showing that the present invention is in a mode of providing hot water uniquely.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to Fig. 1, the flow diagram of the present invention is illustrated and further referring to other drawings of the present invention. It is known that the present invention is formed by a main condenser system **1**, an auxiliary condenser **2**, an heat supply system **3**, a ice water supply system **4**, a hot water supply system **5**, and an auxiliary water system **6**. The main condenser system **1** is formed by an evaporator **12**, a condenser **13**, and a plurality of Laffer nozzles **11** between the evaporator **12** and the condenser **13**. The suction end **111** of the nozzle is connected to the

evaporator **12** (referring to Fig. 2). The outlet end **113** thereof is connected to be upon the condenser **13**. The middle throat **112** is smaller the gap between the two ends. The pipe of the evaporator **12** is installed with an pressure meter B and a pressure transducer C. The auxiliary condensing system **2** is formed by a plurality of auxiliary condensers **21**, a plurality of auxiliary Laffer nozzles **11**, and mufflers **23**. The auxiliary Laffer nozzles **22** and the auxiliary condensers **21** are serially connected indirectly and a distal end thereof is connected to a muffler **23**. The heat supply system **3** is formed by a vapor boiler **31**, an electromagnetic valve **32**, a vapor cooler **33**, a three phase control valve **34**, and a vapor container **35**. The electromagnetic valve **32** serves to control the flowing of the vapor boiler **31**. The vapor cooler **33** serves to separate the condensing water from vapor and then guides the water to a condensing water cycling storage tank **51**. The three phase control valve **34** serves for controlling the flow of vapor according to the use of the system (making ice and hot water at the same time or only making hot water). The ice water supply system **4** is formed by a refrigerating water storage tank 41, an ice water adjusting tank **42** and a heat exchanger **43**. A temperature monitor D, a temperature signal transmitter E, and a level detecting controller F are installed in each of the ice water adjusting tank **42** and the refrigerating water storage tank **41**. Thereby, the refrigerating water cycling pumps **411** between the refrigerating water storage tank **41** and the heat exchange **43** and the ice water heat exchange cycling pump **421** between the cooling water adjusting tank **42** and the heat exchanger **43** can be opened and closed automatically. There are two refrigerating water cycling pumps **411** which are arranged in parallel. One is used as a standby pump for updating

as the other one is damaged. The refrigerating water cycling pump **411** is installed with a manometer G for measuring pressures. The hot water supply system **5** is formed by a cycling condensing water storage tank **51** and hot water adjusting tank **52**. The cycling condensing water storage tank **51** is installed with a temperature monitor D, a temperature signal transmitter E, a level detecting controller F, and a vapor coil pipe **512**. The hot water adjusting tank **52** has a level control valve H. By above components, the hot water supplying pump **521** between the condensing water cycling pump **511** and the hot water supplying pump **521** can open and close automatically. Each of the condensing water cycling pump **511** and hot water supplying pump **521** has two set which are arranged in parallel. One is used as a standby pump for updating as the other one is damaged. The condensing water cycling pump **511** and hot water supplying pump **521** are installed with a manometer G for measuring pressures. The auxiliary water system **6** is formed by an auxiliary water tank, **61**, a water storage tank **63** and a filter **62**. The auxiliary water tank **61** has a level detecting controller F. The water storage tank **63** is installed with a level control valve H. By above components, the system can acquire auxiliary water at any time for being used by detecting and control elements, such as the pressure meter B, pressure transducer C, temperature monitor D, temperature signal transmitter E, level detecting controller F, level control valve H, manometer G, control valves A, A1 to A4 and check valve N.

The vapor injecting ice and hot generating device may produce ice water and hot water at the same time. The whole system may be divided into an ice water manufacturing portion and a hot water manufacturing portion.

For the ice water manufacturing portion, in the operation starts, water of normal temperature is filled into a refrigerating water storage tank **41** of a ice water supply system **4** to a preset level. Then the refrigerating water cycling pump **411** is actuated. When the cooled water of normal temperature passes through the heat exchanger **43** and the evaporator **12** of the main condenser system **1** and then returns to the refrigerating water storage tank **41** so as to form a cycling water flow (referring to Fig. 3). Next, the vapor boiler **31** is actuated, so that the vapor boiler **31** of the water supply system WS may manufacture vapor until the vapor pressure in the vapor boiler **31** until 0. 9Mpa so as to actuate the electromagnetic valve **32**. Then vapor passes through the vapor cooler **33**, three phase control valve **34**, vapor container **35** and then enters into the pipes. The condensed water in this section is fed back to the system through the vapor cooler **33**. Thereby, the efficiency of vapor can be sustained. Thereby, vapor passes through the each vapor pipes, the vapor container **35** and the control valve A and then enters into the Laffer nozzle **11** and the auxiliary Laffer nozzle **22**. When vapor passes through the throat **112** of the nozzle, since the diameter of the pipe reduced, the vapor is compressed. When the vapor passes through the throat **112** of the nozzle, the pipe becomes larger abruptly. As a result, the vapor flow expands rapidly to be near sound speed. As a result, the suction end **111** of the Laffer nozzle **11** has a negative pressure of about **100** Torr (about 13 Kpa). Thereby, the evaporator **12** connected to the air inlet channel of the Laffer nozzle **11** has the effect of sucking air. As a result, the latent heat of the refrigerating water cycling flow can be removed rapidly. Thus, the refrigerating water cycling flow is evaporated. Then the water temperature of the refrigerating water cycling flow

is reduced continuously. This process continues so that the refrigerating water cycling flow achieves a temperature of about **5** ℃ or more lower temperature (the primary object is to manufacture ice water of 5℃ and hot water, and thus, the temperature monitor D and the temperature signal transmitter E of the ice water supply system **4** is adjusted to 5℃ which is a preset temperature of ice water). After the refrigerating water cycling flow has achieved the preset temperature, the ice water heat exchange cycle **421** is actuated so that the water in the ice water adjusting tank **42** is transferred. The water passes through the heat exchange **43** to heat exchange with the refrigerating water cycling flow until the water in the ice water adjusting tank **42** is reduced to a preset temperature. If the water in the ice water adjusting tank **42** is consumed, the level detecting controller F will open or close the level control valve H so as to control the inlet flow of the water of the auxiliary water system 6.

In the whole ice water manufacturing system, monitors and controllers are used, and therefore, no operators are required. The process can be performed automatically. If the ice water in the down flow is not used. The temperature of the / refrigerating water cycling flow is reduced to a preset critical point, the vapor boiler **31** will stop automatically, until the refrigerating water cycling flow increases to a preset value so that the boiler can be refueled for saving fuels. Moreover, if the ice water in the down stream ice water heat exchange cycling pump **421** has stopped, the refrigerating water cycling pump **411** also stopped. However, a time period is required from starting up to the temperature of the refrigerating water cycling flow achieving to a preset value (a default temperature). Thereby, each cycling pump of the ice water supply system **4** or the vapor boiler **31** has a buffer

actuating and stop times. Whether it is required to operate the vapor boiler **31** is determined by individual condition.

The manufacturing of hot water will be described hereinafter. Before actuating the hot water supply system **5**, cycling condensing water storage tank **51** is filled with water of normal temperature. After system is actuated, the condensing water cycling pump **511** actuates, the water of normal temperature in the cycling condensing water storage tank **51** is sent to the condenser **13** of the main condenser system **1** and each auxiliary condensers **21** in the condenser system **2** (referring to Fig. 4). Thereby, vapor from the Laffer nozzle **11** to the condenser **13** and the auxiliary condensers **21** from the auxiliary Laffer nozzles **22** are condensed. Since in the condensed water in the process of condensing recycled continuously, the temperature of condensed water cycling flow increased gradually due to the high temperature from the vapor to a value of 60℃ or a preset temperature (the temperature is controlled by the temperature monitor D and temperature signal transmitter E in the cycling condensing water storage tank **51**). Then, the hot water is sent to the hot water supplying pump **521** to the hot water adjusting tank **52** for use until the level in the hot water adjusting tank **52** achieves a preset value. If a large amount of hot water in the down stream is required due to evaporation and thus a large amount of hot water is sent out, the level of the cycling condensing water storage tank **51** is reduced to a preset value, the level control valve H in the cycling condensing water storage tank **51** is opened, and water of normal temperature is filled through the auxiliary water system **6**.

The way for condensing the vapor injected into the condenser **13** is to use the condensing cycling water, it is

identical to general used vapor condenser, but the difference there between is that in the present invention, a rear end of the main condenser system **1** is installed with a plurality of parallel auxiliary Laffer nozzle **11**, and a plurality of serial connected auxiliary condensers **21**, causing the system to sustain a high operation efficiency. The high temperature cooling water is used as condensed cycling water is obviously different from the general used vapor condenser. The reason will be discussed in the following. If in the present invention, only the main condenser system **1** is installed without the auxiliary condensers **21** and auxiliary Laffer nozzles **22**, although initially, since the condensed cycling water used in the device is a water of normal temperature, which has a great temperature difference with water injected into the condenser **13**, and thus the vapor entering into the condenser **13** can be condensed quickly. The operation efficiency is high. With the increasing of the condensed cycling water, the temperature difference between the condensed cycling water and the vapor is smaller and smaller, the range for heat conduction is smaller and smaller. This is disadvantageous to the condensation of the vapor and thus it will affect the operation efficiency of this device.

Therefore, the rear end of the main condenser system **1** is installed with an auxiliary condensing system **2** having a plurality of auxiliary Laffer nozzles **22** and a plurality of auxiliary condensers **21**. The auxiliary Laffer nozzles **22** and the auxiliary condensers **21** are indirectly serially connected. In a continuous operation, since when vapor flows into the main condenser system **1**, it is also transferred to the auxiliary condensing system **2**. The suction end of the auxiliary condensing system **2** also pump the air in the condenser **13** of the main condenser system **1**. As a

result, a large amount of latent heat of the condensed cycling water passes through the condenser **13** of the main condenser system **1** is removed greatly. The latent heat enters into the auxiliary condensing system **2**. By the transformation of the plurality of auxiliary Laffer nozzles **22** and the auxiliary condensers **21**, the latent heat is finally released to air by the auxiliary condensers **21** at the distal end. Moreover, since the auxiliary Laffer nozzles **22** and the auxiliary condensers **21** are arranged as a series connection, the speed of the vapor and water enters into the auxiliary Laffer nozzles **22** and the auxiliary condensers **21** are increased gradually. The pumping speed of each auxiliary condenser **21** is also increased gradually to achieve **40** Torr. More and more latent heat of the condensing water passing through each auxiliary condenser **21** is removed so that the vapor passing through the condenser **13** and the auxiliary condensers **21** can be condensed quickly. As a result, the object of removing latent heat quickly and increasing pumping speed is achieved.

The advantage of the serial connected auxiliary Laffer nozzles **22** and auxiliary condensers **21** is that since the work of the auxiliary Laffer nozzles **22** in operation, the condenser **13** has the effect of condensation, but for the auxiliary Laffer nozzles, since the evaporation effect, the removing of the latent heat of the condensing water passing through the condenser **13** can be incremented. Likely, the auxiliary condensers **21** have the effect of condensation, but due to the work of the auxiliary Laffer nozzles **22**, it has the effect of evaporation. Although the present invention uses cycling water of normal temperature for condensing the vapor passing through the condenser, the efficiency of condensing is only reduced slightly because of the

serial connected auxiliary Laffer nozzles **22** and auxiliary condensers **21**. If required in some case, the air inlets and the injecting outlets of the auxiliary Laffer nozzles **22** and the condensers **21** can be serially connected to work by nozzles of multiple stages so as to increase the pumping speed. Thus the pump effect is increased further. Since the main requirement is an optimum balance point of the power consumption and work, the content will not be described further.

If in a long time period, only hot water is required, but no ice water is required, the three phase control valve **34** behind the vapor cooler **33** in front of the vapor container **35** can be changed to have output end from the lower end (referring to Fig. 6) and the controls A in the vapor output control pipes are closed, but the control valve A1 below the vapor cooler **33** is opened so that the vapor boiler **31** works continuously. Then, the vapor flows into the vapor coil pipe **512** of the cycling condensing water storage tank **51** by the pipes below the three phase control valve **34**. By the vapor coil pipe **512**, the traveling length of the vapor is increased so as to reduce the speed of the vapor for preventing the vapor to vent out. Then, the vapor fills into the cycling condensing water storage tank **51** so as to increase the water in the cycling condensing water storage tank **51** to a preset value. Then the vapor is sent to the hot water adjusting tank **52** through the hot water supplying pump **521**. This operation way is used when only hot water is required. Since only the hot water supplying pump **521** is opened and other pump is stopped, and thereby, the power is saved.

To avoid the interference of quality of water to some devices, the auxiliary water system **6** of the present invention is installed with a filter **62** and an auxiliary water boost filtering pump **631**

(referring to Fig. 5). In operation, when level of the auxiliary water tank 61 is descended to a preset point. The level detector H above the auxiliary water tank **61** emits signals to actuate the auxiliary water boost filtering pump **631** so that the water in the normal water tank **63** is boosted and then sent through the filter **62** and then enters into the auxiliary water tank **61** until the level in the auxiliary water tank **61** is achieved to a preset high level. The water supply of the normal water tank **63** is from a running water source W.

Since the water goes through the processes of deposition, filtering, and killing bacteria. Then the water is sent to each user for use. However, some undesired elements, such as dusts, are still in the water. In general, a filter is used to filter the water before it is drunk or the water is boiled. However, in above example, a filter **62** is used, but it is possible that the filter **62** will be blocked by undesired objects so that the quality of water is deteriorated or the water flow is reduced.

To avoid this effect, in the present invention, a reverse flow pump **611** is formed between the auxiliary water tank **61** and the filter **62**. If the filter **62** is blocked so that the pressure of the water flowing there through is increased and thus the quality of water is deteriorated or the water flow is reduced. Then control valves A2 and A3 will be closed and the reverse flow pump **611** and the reverse flow outlet control valve A4 is opened so that the dirty objects on the filter **62** can be removed to be drained to the waster water draining system W2. After the reverse flow process is completed. The reverse flow pump **611** and the control valve A4 are closed. Then the control valves A2 and A3 in the auxiliary water system **6** are opened so that the filter **62** completes the whole standby process. This reverse flow process

can be processed manually.

The present invention is thus described, it will be obvious that the same may be varied in many ways. Such variations are not to be regarded as a departure from the spirit and scope of the present invention, and all such modifications as would be obvious to one skilled in the art are intended to be included within the scope of the following claims.

WHAT IS CLAIMED IS:

1. A vapor injecting ice and hot water generating device capable of producing ice and hot water at the same time comprising:

a main condenser system formed by an evaporator and a condenser; a plurality of Laffer nozzles being installed between the evaporator and the condenser; a suction end of each nozzle being connected to the evaporator; and an output end of each nozzle being connected to the condenser; and a middle throat being smaller than the two ends;

an auxiliary condensing system including a plurality of auxiliary condensers, a plurality of auxiliary Laffer nozzles and a muffler;

a heat supply system including a vapor boiler, an electromagnetic valve, a vapor cooler, a three phase control valve, and a vapor container;

an ice water supply system comprising a refrigerating water storage tank; an ice water adjusting tank, and a hot water adjusting tank;

an auxiliary water system including an auxiliary water tank, a water storage tank and a filter; and

detecting and control elements including a pressure meter; a pressure transducer, a temperature monitor, a temperature signal transmitter, a level detecting controller, a level control valve, a manometer, and a check valve;

wherein by above components, the Laffer nozzles are used as main working elements, when vapor from the vapor boiler flows through the Laffer nozzle; the suction end of the Laffer nozzle has a negative pressure so as to remove the latent heat of cycling water in the evaporator connected to the suction end;

thereby, the temperature of the water is reduced continuously to a preset value; then the water is sent to the ice water adjusting tank for being used; another, for the vapor passing through the Laffer nozzle entering into the condenser; the condensed water with a temperature lower than that of the vapor flows down from a top of the condenser for condensing the vapor; the condensed hot water is collected in the cycling condensing water storage tank for being sent to the hot water adjusting tank; when the refrigerating water cycling flow and condensed cycling water are evaporated and used and thus each levels of tanks are reduced to preset values, the level detecting controller and level control valve will drive the auxiliary water system to supply water automatically; by above mentioned structure, power is saved.

2. The vapor injecting ice and hot water generating device as claimed in claim 1, wherein when the vapor of the vapor boiler enters into the main condenser system, the vapor is at the same time transferred to the auxiliary condensing system, the suction end of the auxiliary condensing system has a pump effect to the main condenser system, thereby, the latent heat of the condensed cycling water of the main condenser system is removed.

3. The vapor injecting ice and hot water generating device as claimed in claim 1 or 2, wherein the auxiliary Laffer nozzles and the auxiliary condensers are serially connected indirectly; by the transformation of the plurality of auxiliary Laffer nozzles and auxiliary condensers of the auxiliary condensing system, the latent heat of the condensed cycling water is removed rapidly, then the latent heat is vented to air from the muffler of the condensers so as to increase the pumping speed; the latent heat

is removed rapidly.

4. The vapor injecting ice and hot water generating device as claimed in claim 1, 2 or 3,wherein if only hot water is required, by the three phase control valve of the heat supply system, the vapor from the vapor boiler is directly transferred to the hot water supply system so as to reduce the consumption of heat in transferring process.

5. The vapor injecting ice and hot water generating device as claimed in any one of the preceding claims, wherein the ice water supply system and hot water supply system have a plurality of cycling pumps; two sets of cycling pumps are arranged in parallel, one is a standby pump for updating as the other one is damaged.

6. The vapor injecting ice and hot water generating device as claimed in any one of the preceding claims, wherein a reverse flow pump is formed between the auxiliary water tank and the filter; if the filter is blocked; the reverse flow pump will be actuated so that the dirty objects on the filter are removed to be drained to the waster water draining system.

7. The vapor injecting ice and hot water generating device as claimed in any one of the preceding claims, wherein each system has a monitor and controller, thereby, the vapor injecting ice and hot water generating device is operated automatically.