

【DESCRIPTION】**【Invention Title】**

AIR CONDITIONING SYSTEM USING DEHUMIDIFYING COOLING DEVICE

【Technical Field】

<1> The present invention relates to an air conditioning system using a dehumidifying cooling device, and more particularly, to an air conditioning system using a dehumidifying cooling device which can carry out an air cooling operation by supplying hot water, produced by large-scale or small-scale district heating systems, or gas or oil boilers installed in individual households, into the dehumidifying cooling device.

【Background Art】

<2> There is spreading a prospect that the recent high oil price situation is not a temporary problem, but is continuously maintained and fixed. Thereby, main energy consuming countries of the world increasingly take a great effort for securing stable energy resources. With the effectuation of the Tokyo protocol dealing with a reduction in the discharge of greenhouse gas for the sake of preventing global warming, it will be expected that an international pressure about the use limit of fossil energy, the criterion of energy efficiency, etc. will be strengthened.

<3> According to the published energy report, the amount of energy consumed in domestic and business fields of Korean in 2003 is approximately 55 millions TOE a year, and occupies 25.2% of the total national consumption energy. This rate also corresponds to 41.9% on the basis of electricity. For the past four years, the energy consumption of domestic and business fields shows an average annual rate of increase of 5.3%, whereas the consumption of electricity shows an average annual rate of increase of 12%. Accordingly, it will be appreciated that the consumption of electricity particularly has a rapid increase. Estimating on the basis of a variation in the monthly energy consumption of residential buildings and sample survey results about non-residential buildings as the subject of energy controlment, it is analyzed that 50% of the energy consumption of residential buildings

and 47% of the energy consumption of business buildings are used for air conditioning. In conclusion, of the energy consumption of buildings, energy required for air conditioning occupies 13% of the national total energy consumption of Korea.

<4> Accordingly, to guarantee the efficient use of energy and the continuous development of energy industry while observing related international agreements, it is necessary to improve the use efficiency of energy for air conditioning in domestic and business fields. From this viewpoint, there is put in force a so-called collective-energy industry in which thermal energy and electricity, generated from energy generation facilities concentrated on a specific place for improving the use efficiency of energy in domestic and business fields, are supplied collectively to a plurality of users in residential and business areas. It is reported that the collective-energy industry utilizes waste heat occurred during power generation as a heating source for space heating and hot water heating, thereby achieving not only a reduction of energy by approximately 20 to 30% by virtue of an improved use efficiency of energy, but also an improvement of air environment by approximately 30 to 40% by virtue of a reduction usage of fuel and intensive environmental managements. The collective-energy industry is evaluated as an effective industry capable of dealing with related international environmental restrictions including a climatic change convention, etc. In the affirmative evaluation's debt, in Korea, approximately 1.2 million families share in the benefits of district heating in 2003, and in particular, 85% of supplied energy is generated by combined heat and power generation. Korea has a plan to expand the propagation range of district heating to 2 million families by 2010.

<5> In the combined heat and power generation, namely, cogeneration, the generation ratio of electricity to heat is fixed at 3 : 5. Therefore, it is important to keep the ratio of electricity to heat at an appropriate level for maximizing the effect of the collective-energy industry. In Korea, the above mentioned generation ratio can be fulfilled in winter, but the summer

of Korea has an increased electricity load for air cooling and substantially no heat load. As a result, the operation rate of district heating in summer decreases to less than 10%, and this causes a deterioration in the economical efficiency of cogeneration. Actually, no generation results reported between June and September in 2003.

<6> To improve the operation rate of collective-energy generation facilities for sufficiently utilizing the effects of the industry, excavating the demand of heat in summer is necessary, and in particular, development and propagation of a technology for supplying cooling energy using district heating facilities is necessary.

<7> In one example of the above described cooling energy supply technology, an absorption chiller is installed to a receptor, such as a large-scale building, etc. such that the chiller performs a central cooling operation using energy delivered from district heating facilities.

<8> The absorption chiller is designed to chill water flowing in a pipe by use of heat generated during the evaporation of a liquid-phase refrigerant and condense the evaporated gas-phase refrigerant for the reuse thereof.

【Disclosure】

【Technical Problem】

<9> However, despite of various researches and developments for improving the performance thereof, the absorption chiller has a limit in the improvement of performance due to a low temperature of a heating source. In addition, the absorption chiller has an uneconomical high water return temperature because it cannot use water having a temperature of 80°C or less, and suffers from a little difference between the temperature of supplied water and the temperature of water to be returned.

<10> When the absorption chiller is installed to an apartment, etc. occupying the most part of district heating, so as to carry out a central cooling operation, there is a problem in that cold water pipes have to be additionally installed regardless of hot water supply pipes.

<11> Therefore, the present invention has been made in view of the above

problems, and it is an object of the present invention to provide an air conditioning system using a dehumidifying cooling device which can carry out an efficient air cooling operation by supplying hot water, produced by large-scale or small-scale district heating systems, or gas or oil boilers installed in individual households, into the dehumidifying cooling device installed in each household.

【Technical Solution】

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In accordance with one aspect of the present invention, the above and other objects can be accomplished by the provision of an air conditioning system using a dehumidifying cooling device comprising: a heating source for producing hot water having a predetermined temperature; a heat exchanger for transferring heat from the hot water produced by the heating source to circulating water; a circulation pump for circulating the resulting hot water heat exchanged in the heat exchanger by a predetermined pressure; a heating pipeline connected to the circulation pump for conveying the hot water to a heat supply target area or withdrawing used water from the heat supply target area; a user heat exchanger connected to the heating pipeline for conveying the hot water in the heating pipeline to the heat supply target area; and a dehumidifying cooling device connected to a hot water pipe, which is associated with the user heat exchanger and mounted in each household within the heat supply target area, so as to be installed to the household, the dehumidifying cooling device serving to remove moisture contained in air by use of the hot water supplied from the hot water pipe for dealing with latent heat load and to lower the temperature of the dehumidified air via evaporation of water contained in the air, thereby producing and supplying cooling air.

<13>

Preferably, the heating source is any one selected from among a cogeneration plant, a heating boiler, a micro-turbine, a small gas engine, and a small gas turbine.

<14>

Preferably, the hot water produced by the heating source has a temperature of 60 to 120°C.

<15> In accordance with another aspect of the present invention, the above and other objects can be accomplished by the provision of an air conditioning system using a dehumidifying cooling device comprising: a heating source installed to each household for producing hot water having a predetermined temperature; a hot water pipe for conveyance of the hot water produced by the heating source or withdrawal of used water; and a dehumidifying cooling device installed to each household and connected to the hot water pipe, the dehumidifying cooling device serving to remove moisture contained in air by use of the hot water supplied from the hot water pipe for dealing with latent heat load, and to lower the temperature of the air via evaporation of water contained in the dehumidified air, thereby producing and supplying cooling air.

<16> Preferably, the heating source is a gas boiler or an oil boiler.

<17> Preferably, the hot water produced by the heating source has a temperature of 60 to 120°C.

【Advantageous Effects】

<19> According to an air conditioning system using a dehumidifying cooling device of the present invention having the above described configuration, there is an advantage of carrying out an efficient air cooling operation by supplying hot water, produced by large-scale or small-scale district heating systems, or gas or oil boilers installed in individual households, into the dehumidifying cooling device installed in each household.

【Description of Drawings】

<20> The above and other objects, features and other advantages of the present invention will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

<21> FIG. 1 is a view illustrating the configuration of an air conditioning system using a dehumidifying cooling device according to a first embodiment of the present invention; and

<22> FIG. 2 is a view illustrating the configuration of an air conditioning system using a dehumidifying cooling device according to a second embodiment of the present invention.

【Best Mode】

<23> -First Embodiment-

<24> Now, the configuration of an air conditioning system using a dehumidifying cooling device according to a first embodiment of the present invention will be described in detail with the accompanying drawing.

<25> In the following description of the present invention, a detailed description of known functions and configurations incorporated herein will be omitted when it may make the subject matter of the present invention rather unclear. Also, the terms used in the following description are terms defined taking into consideration the functions obtained in accordance with the present invention. The definitions of these terms should be determined based on the whole content of this specification because they may be changed in accordance with the option of a user or operator or a usual practice.

<26> FIG. 1 is a view illustrating the configuration of an air conditioning

system using a dehumidifying cooling device according to a first embodiment of the present invention.

<27> Referring to FIG. 1, the air conditioning system 100 using a dehumidifying cooling device according to the first embodiment of the present invention comprises a heating source 110, a heat exchanger 120, a circulation pump 130, a heating pipeline 140, a user heat exchanger 150, and a dehumidifying cooling device 160.

<28> The heating source 110 is used to produce hot water of 60 to 120°C. The heating source 110 is any one selected from among a cogeneration plant, a heating boiler, a micro-turbine, a small gas engine, and a small gas turbine such that the heating source 110 can use hot water produced by large-scale and small-scale district heating facilities. Preferably, the heating source 110 has a heat reservoir (not shown) for storing hot water.

<29> The heat exchanger 120 carries out a heat exchange operation of the hot water produced from the heating source 110, and conveys the hot water.

<30> The circulation pump 130 is used to circulate the hot water heat exchanged in the heat exchanger 120.

<31> The heating pipeline 140 is connected to the circulation pump 130 for the conveyance of hot water into a heat supply target area A or the withdrawal of used water from the heat supply target area A.

<32> The user heat exchanger 150 is installed in a control office of the heat supply target area A, etc. The user heat exchanger 150 is connected to the heating pipeline 140 for conveying the hot water in the heating pipeline 140 to the heat supply target area A.

<33> The dehumidifying cooling device 160 is installed to each household within the heat supply target area A. For this, the dehumidifying cooling device 160 is connected to a hot water pipe 151 associated with the user heat exchanger 150 and mounted in the household. The dehumidifying cooling device 160 is adapted to remove moisture contained in air by use of the hot water supplied from the hot water pipe 151 for dealing with latent heat load and to lower the temperature of the dehumidified air via evaporation of water in the

air, thereby producing and supplying cooling air. Here, the dehumidifying cooling device 160 carries out an air cooling operation by use of a regenerative evaporative cooler (REC). The regenerative evaporative cooler is designed such that the interior of the cooler is divided into a dry channel and a wet channel. In operation of the regenerative evaporative cooler, if a part of the air, passing through the dry channel, is delivered into the wet channel, the air is cooled as water is evaporated by the high-temperature surface of the wet channel, thereby acting to absorb heat from the remaining higher temperature air passing through the dry channel. Thereby, the air passing through the dry channel can be cooled to a dew-point temperature to the maximum extent without an increase of humidity.

<34> Hereinafter, the operation of the air conditioning system using the dehumidifying cooling device according to the first embodiment of the present invention will be described in detail with reference to FIG. 1.

<35> First, if the heating source 110 produces hot water, the heat exchanger 120 carries out the heat exchange of the hot water from the heating source 110 with water circulating along the heating pipeline 140, so as to transfer heat from the hot water into the circulating water in the heating pipeline 140 .

<36> After being completely heat exchanged in the heat exchanger 120, the resulting hot water is circulated in the heating pipeline 140 by operation of the circulation pump 130 installed to the heating pipeline 140.

<37> Thereby, the hot water is conveyed to the heat supply target area A by way of the heating pipeline 140. The heating pipe 140 is also used for the withdrawal of the used water from the heat supply target area A.

<38> If the hot water is conveyed to the user heat exchanger 150 connected to the heating pipeline 140, the heat exchanger 150 carries out a heat exchange operation to transfer heat from the conveyed hot water to water passing through the hot water pipe 151.

<39> The resulting hot water is supplied into the dehumidifying cooling device 160 installed to each household within the heat supply target area A

by way of the hot water pipe 151 that is connected to the user heat exchanger 150 and the dehumidifying cooling device 160. The dehumidifying cooling device 160 operates to remove moisture contained in air by use of the hot water supplied from the hot water pipe 151 for dealing with latent heat load and to lower the temperature of the dehumidified air via evaporation of water in the air, thereby producing and supplying cooling air.

<40> -Second Embodiment-

<41> Now, the configuration of an air conditioning system using a dehumidifying cooling device according to a second embodiment of the present invention will be described in detail with reference to the accompanying drawing.

<42> In the following description of the present invention, a detailed description of known functions and configurations incorporated herein will be omitted when it may make the subject matter of the present invention rather unclear. Also, the terms used in the following description are terms defined taking into consideration the functions obtained in accordance with the present invention. The definitions of these terms should be determined based on the whole content of this specification because they may be changed in accordance with the option of a user or operator or a usual practice.

<43> FIG. 2 is a view illustrating the configuration of an air conditioning system using a dehumidifying cooling device according to a second embodiment of the present invention.

<44> Referring to FIG. 2, the air conditioning system 200 using a dehumidifying cooling device according to the second embodiment of the present invention comprises a heating source 210, a hot water pipe 220, and a dehumidifying cooling device 230.

<45> The heating source 210 is used to produce hot water of 60 to 120°C. The heating source 210 is a gas boiler or an oil boiler installed to each household. If necessary, the heating source 210 may be a briquette boiler.

<46> The hot water pipe 220 is installed for a room heating of each household, and is used for conveyance of hot water from the heating source

210 or withdrawal of used water.

<47> The dehumidifying cooling device 230 is connected to the hot water pipe 220 and installed to each household. The dehumidifying cooling device 230 is adapted to remove moisture contained in air by use of hot water supplied from the hot water pipe 220 for dealing with latent heat load and to lower the temperature of the dehumidified air via evaporation of water contained in the air, thereby producing and supplying cooling air. Here, the dehumidifying cooling device 230 carries out an air cooling operation by use of a regenerative evaporative cooler (REC). The regenerative evaporative cooler is designed such that the interior of the cooler is divided into a dry channel and a wet channel. In the regenerative evaporative cooler, if a part of the air, passing through the dry channel, is delivered into the wet channel, the air is cooled as water is evaporated by the high-temperature surface of the wet channel, thereby acting to absorb heat from the remaining higher temperature air passing through the dry channel. Thereby, the air passing through the dry channel can be cooled to a dew-point temperature to the maximum extent without an increase of humidity.

<48> Hereinafter, the operation of the air conditioning system using the dehumidifying cooling device according to the second embodiment of the present invention will be described in detail with reference to FIG. 2.

<49> If the heating source 210 produces hot water, the hot water is supplied into the hot water pipe 220.

<50> The hot water is supplied into the dehumidifying cooling device 230 installed to each household and connected to the hot water pipe 220. The dehumidifying cooling device 230 operates to remove moisture contained in air by use of the hot water supplied from the hot water pipe 151 for dealing with latent heat load and to lower the temperature of the dehumidified air via evaporation of water in the air, thereby producing and supplying cooling air.

<51> Consequently, with the use of the dehumidifying cooling device, it is possible to carry out a dehumidifying cooling operation of each household by supplying the hot water into the dehumidifying cooling device.

【Industrial Applicability】

<52> As apparent from the above description, an air conditioning system using a dehumidifying cooling device according to the present invention can be installed to residential and business buildings, etc. In the air conditioning system, hot water, produced by large-scale or small scale district heating facilities, or a gas or oil boiler installed to each household, can be used in a dehumidifying cooling device installed to the household such that hot water for heating a room can be used to cool the room.

<53> Although the preferred embodiments of the present invention have been disclosed for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.

【CLAIMS】**【Claim 1】**

- <55> An air conditioning system using a dehumidifying cooling device comprising:
- <56> a heating source for producing hot water having a predetermined temperature;
- <57> a heat exchanger for transferring heat from the hot water produced by the heating source to circulating water;
- <58> a circulation pump for circulating the resulting hot water heat exchanged in the heat exchanger by a predetermined pressure;
- <59> a heating pipeline connected to the circulation pump for conveying the hot water to a heat supply target area or withdrawing used water from the heat supply target area;
- <60> a user heat exchanger connected to the heating pipeline for conveying the hot water in the heating pipeline to the heat supply target area; and
- <61> a dehumidifying cooling device connected to a hot water pipe, which is associated with the user heat exchanger and mounted in each household within the heat supply target area, so as to be installed to the household, the dehumidifying cooling device serving to remove moisture contained in air by use of the hot water supplied from the hot water pipe for dealing with latent heat load and to lower the temperature of the dehumidified air via evaporation of water contained in the air, thereby producing and supplying cooling air.

【Claim 2】

- <62> The system according to claim 1, wherein the heating source is any one selected from among a cogeneration plant, a heating boiler, a micro-turbine, a small gas engine, and a small gas turbine.

【Claim 3】

- <63> The system according to claim 1, wherein the hot water produced by the heating source has a temperature of 60 to 120°C.

【Claim 4】

- <64> An air conditioning system using a dehumidifying cooling device comprising:
- <65> a heating source installed to each household for producing hot water having a predetermined temperature;
- <66> a hot water pipe for conveyance of the hot water produced by the heating source or withdrawal of used water; and
- <67> a dehumidifying cooling device connected to the hot water pipe to thereby installed to each household, the dehumidifying cooling device serving to remove moisture contained in air by use of the hot water supplied from the hot water pipe for dealing with latent heat load and to lower the temperature of the dehumidified air via evaporation of water contained in the air, thereby producing and supplying cooling air.

【Claim 5】

- <68> The system according to claim 4, wherein the heating source is any one selected from among a gas boiler and an oil boiler.

【Claim 6】

- <69> The system according to claim 4, wherein the hot water produced by the heating source has a temperature of 60 to 120℃.