



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
11.11.2009 Bulletin 2009/46

(51) Int Cl.:
F24F 3/06 (2006.01)

(21) Application number: **09397510.0**

(22) Date of filing: **02.04.2009**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO SE SI SK TR

(72) Inventor: **Mäkinen, Pekka**
FI-20100, Turku (FI)

(30) Priority: **06.05.2008 FI 20085411**

(74) Representative: **Heinänen, Pekka Antero et al**
Heinänen Oy Patent Agency
Airport Plaza
Äyritie 8 D
01510 Vantaa (FI)

(71) Applicant: **Fläkt Woods AB**
55184 Jönköping (SE)

(54) **Method for cooling supply air**

(57) Method for cooling supply air in the cooling system of a building, in which method the cooling water in the main circulation circuit (2) is cooled with a cooling compressor (1), and in which method cooling water is taken to the cooling radiator (3) from the main circulation circuit (2) for cooling the supply air, and in which method cooling water is taken to the room unit, such as to the chilled beam network (4) from the main circulation circuit (2) and mixed to the desired temperature, e.g. approx.

15 °C. The invention is implemented such that in an operating situation the cooling water of the main circulation circuit (2) is cooled to a temperature of over 7 °C, preferably to a temperature of approx. 12 °C, and such that in an exceptional situation such as when the supply air is humid, the temperature of the room unit, such as of the chilled beam network (4), is raised higher to prevent condensation and at the same time the temperature of the water of the main circulation circuit (2) is reduced lower.

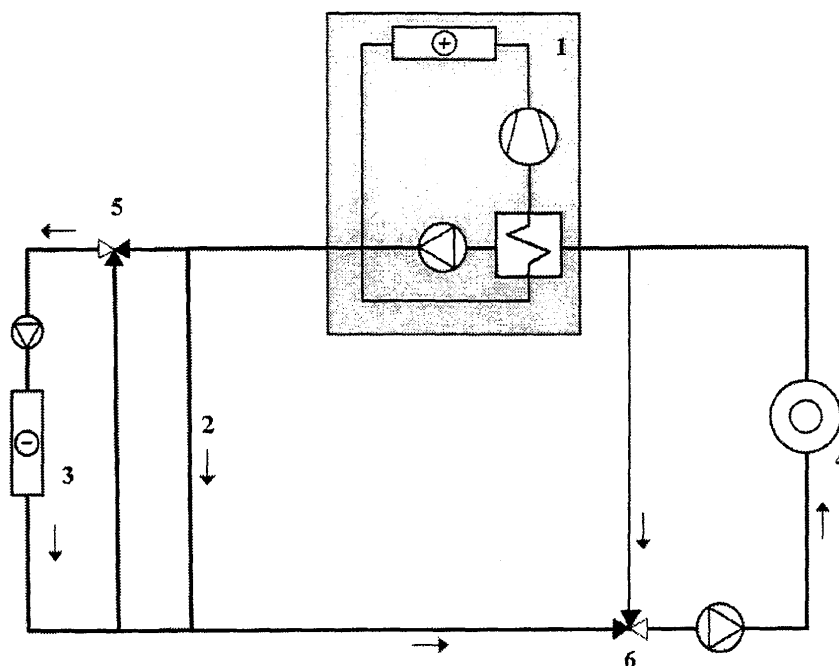


Fig. 1

Description

[0001] The object of this invention is a method for cooling supply air in the cooling system of a building, in which method the cooling water in the main circulation circuit is cooled with a cooling compressor, and in which method cooling water is taken to the cooling radiator from the main circulation circuit for cooling the supply air, and in which method cooling water is taken to the room unit, such as to the chilled beam network, from the main circulation circuit and mixed to the desired temperature, e.g. approx. 15 °C.

[0002] The cooling of air-conditioning is normally implemented using a separate water cooler, the task of which is to produce cold water for implementing cooling in the air-conditioning. Normally water, of which the temperature is 7 °C, and which cools the supply air of the building, which can be outdoor air, circulating air or a mixture of them, is used in the cooling radiator or corresponding for cooling the supply air of the ventilation. Buildings typically also contain room-specific cooling units, such as e.g. chilled beams. The temperature of the water used in the beams is higher, typically approx. 15 °C. All the cooling power produced by the cooling plant must however be produced at a temperature of 7 °C, in which case water of 15 °C is produced by mixing. In prior art solutions, in which the supply air contains a lot of humidity, it is necessary also to dry it, so that the humidity will not condense onto the chilled beams in the room spaces.

[0003] If it were possible to produce the cooling power at a higher temperature, it would have a significant impact on the efficiency ratio of the cooling plant. The efficiency ratio rapidly improves when the temperature of the cooling water rises. It is not, however, possible to do this, but instead water at a temperature of 7 °C is used because then the cooling radiator of the supply air can be made smaller and more efficient compared to when warmer water is used. In addition, 7 °C water is sufficiently cold to have the desired drying effect on the supply air. When the supply air contains a lot of humidity, it must be dried so that the humidity will not condense onto the chilled beams in the room spaces. In order to achieve these characteristics and functions, water that is always 7 °C is typically produced with a water cooler.

[0004] The total power of a cooling system in existing systems is thus dimensioned such that drying of the supply air occurs all the time. This is not advantageous from the standpoint of overall efficiency.

[0005] The purpose of the invention is to achieve a method for producing cooling power more economically and with a better efficiency ratio than before. The method according to the invention is **characterized in that** in an operating situation the cooling water of the main circulation circuit is cooled to a temperature of over 7 °C, preferably to a temperature of approx. 12 °C, and in that in an exceptional situation such as when the supply air is humid, the temperature of the room unit, such as of

the chilled beam network, is raised higher to prevent condensation and at the same time the temperature of the water of the main circulation circuit is reduced lower.

[0006] One preferred embodiment of the method according to the invention is **characterized in that** in the aforementioned exceptional situation the thermal power released by the room unit, such as the chilled beam network, is used for drying the supply air.

[0007] Another preferred embodiment of the method according to the invention is **characterized in that** in the aforementioned exceptional situation the temperature of the room unit, such as of the chilled beam network, is raised e.g. to approx. 17 °C.

[0008] Yet another preferred embodiment of the method according to the invention is **characterized in that** when the maximum cooling power of the cooling compressor is known to be limited, the cooling power released from the room unit, such as from the chilled beam network, is transferred to cooling the supply air, in which case sufficient cooling power for the building is obtained all the time.

[0009] With the method according to the invention a number of advantages compared to prior-art solutions are achieved. The cooling power is produced at a higher temperature for a larger proportion of the operating time. Only when there is a need to dry the supply air, a lower temperature of the water is used. In this case the water cooler is used only momentarily at a worse efficiency ratio. Thus in this case the total efficiency of the cooling system does not need to be dimensioned according to drying of the supply air occurring all the time. The dimensioning of total power occurs without drying and only when power is released from the room unit, such as from the chilled beam circuit, the released power is transferred to additional cooling or drying of the supply air.

[0010] In the following, the invention will be described in more detail by the aid of a preferred embodiment with reference to the attached drawing, which presents the method according to the invention as a circuit diagram.

[0011] In the method according to the invention the cooling compressor 1 (water cooler) produces cooling water for the main circulation circuit 2 at a temperature of 12 °C. The cooling radiator 3 of the supply air takes cooling water from the main circulation circuit 2 via the valve 5 and cools the supply air to the desired temperature.

[0012] The room unit, such as the chilled beam network 4, takes cooling water from the main circulation circuit 2 via the valve 6 and mixes it typically to a temperature of 15 °C. In a normal operating situation, 12 °C water does not remove humidity from the supply air (drying does not occur). The extraction of water from the air (drying) consumes a lot of energy. Since drying does not occur, the electrical energy used by a 12 °C water cooler is smaller. It is thus advantageous from the standpoint of energy economy to dimension the system such that water is used that is so warm, e.g. 12 °C, that drying does not occur. The electrical energy consumed in the cooling

of air-conditioning is in this case substantially smaller.

[0013] On a few days a year, the humidity of the outdoor air is exceptionally high. In this case there is a danger that the humidity will condense on the surface of the room units, such as the chilled beams 4, and the beams will start to drip water. To prevent this the supply air is typically dried to some extent in the air-conditioning system. In addition, the water circuit of the chilled beams comprises a system that raises the temperature of the water of the beam circuit if, despite drying, water condenses on the surface of the pipe. When the temperature of the water is high, e.g. 17 °C, instead of the normal 15 °C, condensation of water is prevented.

[0014] In the method according to the invention the cooling power is thus produced at a higher temperature for a larger proportion of the operating time. Only when there is a need to dry the supply air, a lower temperature of the water is used. In this case the water cooler is used only momentarily at a worse efficiency ratio.

[0015] The maximum power of the water cooler can be dimensioned such that it is adequate to cool the supply air and to cool the room units, but not to additionally dry the supply air. When the supply air contains so much humidity that it is necessary to raise the temperature of the water of the room unit, such as of the chilled beam network, e.g. from 15 °C to 17 °C, in order to prevent condensation, the cooling power of the chilled beams is reduced at the same time. In this case a part of the maximum power of the water cooler remains unused and the cooling power produced for the building decreases. This released cooling power is transferred to cooling the supply air such that the temperature of the water is lowered e.g. from 12 °C to 7 °C. At the lower temperature of the water the power of the cooling radiator increases and replaces the reduced power of the beam circuit.

[0016] It is obvious to the person skilled in the art that the invention is not limited only to the embodiments presented above, but that it can be varied within the scope of the claims presented below. It must be understood that the diagram presented in the drawing and the actuators presented by it are examples, and do not limit the invention. The object of the invention is a method and the appliance within its scope can be implemented in many different ways.

Claims

1. Method for cooling supply air in the cooling system of a building, in which method the cooling water in the main circulation circuit (2) is cooled with a cooling compressor (1), and in which method cooling water is taken to the cooling radiator (3) from the main circulation circuit (2) for cooling the supply air, and in which method cooling water is taken to the room unit, such as to the chilled beam network (4), from the main circulation circuit (2) and mixed to the desired temperature, e.g. approx. 15 °C, **characterized in**

that in an operating situation the cooling water of the main circulation circuit (2) is cooled to a temperature of over 7 °C, preferably to a temperature of approx. 12 °C, and **in that** in an exceptional situation, such as when the supply air is humid, the temperature of the room unit, such as of the chilled beam network (4), is raised higher to prevent condensation and at the same time the temperature of the water of the main circulation circuit (2) is reduced lower.

2. Method according to claim 1, **characterized in that** in the aforementioned exceptional situation the thermal power released by the room unit, such as by the chilled beam network (4), is used for additional cooling and drying of the supply air.
3. Method according to claim 1 or 2, **characterized in that** in the aforementioned exceptional situation the temperature of the room unit, such as of the chilled beam network (4), is raised e.g. to approx. 17 °C.
4. Method according to any of claims 1-3, **characterized in that** when the maximum cooling power of the cooling compressor (1) is known to be limited, the cooling power released from the room unit, such as from the chilled beam network (4), is transferred to cooling the supply air, in which case sufficient cooling power for the building is obtained all the time.

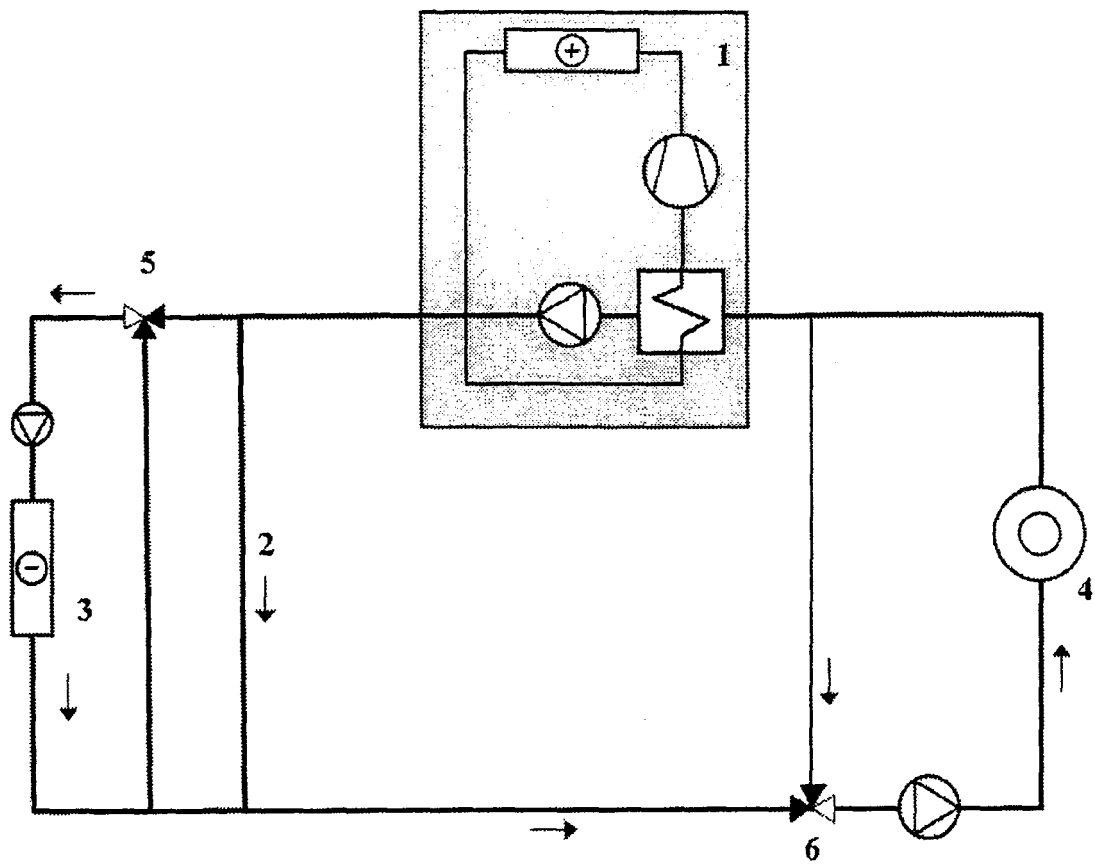


Fig. 1