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(54) **METHOD FOR DISTRIBUTING COOLING AIR INTO A ROOM**

VERFAHREN ZUM VERTEILEN VON KÜHLLUFT IN EINEM RAUM

PROCEDE POUR LA DISTRIBUTION D'AIR DE REFROIDISSEMENT DANS UN LOCAL

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Description

[0001] The present invention relates to a method for distributing cooling air into a room in accordance with the pre-characterising portion of claim 1. Such a method is known from DE-A-4 015 665.

[0002] In modern professional buildings, the demand for cooling of personnel rooms is greater than demand for heating. This is especially true for office buildings where light, office machines and people, plus sunshine through the windows, may create a significant surplus of heat.

[0003] Cooling of personnel rooms is in terms of ventilation engineering far more demanding than heating. While a stream of warm air feels comfortable in a room that needs heating, will a noticeable stream of cooled air in the warm room feel uncomfortable, and will often be perceived as a draft.

[0004] When a large demand for cooling is to be met with cooled ventilation air, which is common in modern ventilation systems, could this be done with a small amount of strongly cooled air, or with a less supply of moderately cooled air. In practice, the supplied air should not be colder than 8-10 °C below the room temperature in order to avoid so-called cold*, (vertical streams of cold air along walls and windows), uneven room temperature or a feeling of draft. Less cooling of ventilation air means a correspondingly larger amount of supplied air, which means a relatively expensive supply- and distribution system for the cooled ventilation air in order to avoid noticeable air streams in the room. Noticeable air streams gives a feeling of draft, even with small temperature differences. Large amounts of air also means higher air speeds in the ventilation system. This presents* increased demands to sound insulation of the system in order to avoid bothersome noise from the ventilation system.

[0005] The problem with a large demand for cooling may be solved by building in cooled surfaces in the room rather than basing the whole cooling on ventilation. Such a cooled surface must lie in the ceiling in order to avoid cold* from the walls or a room with cold floor. Cooling ceilings is known from the ventilation engineering. The ceiling in the room will be partly or totally cooled down with built-in piping loops with cold water or a cooling medium. Built-in channels with cooled air is also used. Such cooling feeling give a comfortable and uniform cooling effect, partly by radiation and partly by draft-free natural convection. Cooling ceilings may be used alone or in combination with traditional cooling through the ventilation system. Cooling ceiling reduces the demand for air cooling, so that the cooling air may be supplied without draft problems.

[0006] Cooling ceilings are, however, an expensive solution, and therefore it is no longer widely used.

[0007] According to the present invention, one can achieve cooling of personnel room that gives the same advantages as a cooling ceiling in combination with tra-

ditional air cooling with ventilation, but without high costs incurred by the use of cooling ceiling. These advantages are achieved with the method according to the invention as defined by the features set forth in the claims.

[0008] Figure 1 of the drawing shows schematically a side view of the device according to the invention, mounted on a ceiling in a room, and figure 2 shows a corresponding view another embodiment which does not fall within the scope of the claims.

[0009] Below the ceiling 1 in the room to be ventilated and cooled, is built in a ceiling element 2 consisting of a plate of a heat conductive material. This is a single metal plate with a rounded shape, which forms a limited basin for ventilation air under the ceiling of the room. A moderate amount of ventilation air, cold enough to meet the entire rooms demand for cooling, is supplied to the air basin above the ceiling element 2 with a ventilation channel 3 and one or more supply devices 4, which distribute the air uniformly and very low speed into the air basin over the ceiling element 2. The cold air sinks naturally down to the bottom of the basin and cools the ceiling element 2, which thereby functions as a cooling ceiling for the room below. As a result of the cooling effect will the ceiling element absorb heat from the room, partly through radiation, partly through convection, and this heat will be transferred to the cooling air and increase its temperature. The cooling air which is prewarmed in this way rises naturally up and passes further into the room as ventilation air through slits 5. This air is still cool, but no longer so cool that it gives any effect of draft in the room. The large area of the slits 5 causes the air speed to be low, in the area of 0,2 to 0,6 m/sec, and causes therefore no air motion or streams that can be perceived as draft in the room (diffuse air supply).

[0010] The ceiling element 2 has a convex outside shape as shown on figure 1. The shape in terms of air flow, must be such that the most prewarmed cooling air passes out in the room through the slits 5. The convex shape shown in figure 1 is considered the most suitable.

[0011] The ceiling element 2 may be made in metal or other material. A sound dampening layer on the lower side of the element or a double plate where the lower plate is perforated, may often be desirable because of the acoustic conditions in the room. The entire element must have sufficient heat conductivity to transfer the necessary part of the cooling effect of the air through the material of the element 2, and from there to the room. A lower conductivity, as for example a thin building plate, will demand a correspondingly larger area of the element 2 to create the same effect. It is also possible to increase the heat conductivity by using a corrugated plate or a plate with ribs or similar.

[0012] By the preferred embodiment of the invention, the cooling air from the ceiling element 2 may be 30-50 % of the rooms need for cooling, while the prewarmed cooling air from the slits 5 covers the remaining demands for cooling. The temperature of the ventilation air

from the channel 3 may be 12-14 °C lower than the room temperature without creating the effect of draft in the room. Typical cooling capacity for ceiling element 2 is in the area of 30-60 W/m².

[0013] A supply device for cooling air to room cooling presents demands to the purity of the supplied cooling air. It must contain a minimum of particles that could be deposited as dust in the bottom of the air basin over the ceiling element 2. Such a layer of dust will reduce the heat conductivity through the element, and dust could be blown out in the room when the amount of cooling air increases. It has been found suitable to make the supply devices 4 as one or more filter bags in order to separate dust from the cooling air, which are replaceably mounted on the air channel 3. The ceiling element 2 is sectioned and turnably mounted on the ceiling, so that it can be turned down for cleaning on the top side and for replacing of the filter bags as a part of routine maintenance.

Claims

1. Method for distributing cooling air into a room from the ceiling (1), where cool, filtered air is delivered through an air channel (3) and to at least one air supply device (4) above a ceiling element (2) made of a heat conductive material, said cool air descending from said at least one air supply device (4) into at least a part of the ceiling element (2) thereby cooling the ceiling element (2), which in turn cools the room by radiation and convection, said ceiling element (2) being shaped as a basin and being cooled by the cold air from the supply device (4), the air being warmed by the upper side of the ceiling element (2), **characterised in that** the basin has a rounded shape with a lowermost centre portion and **in that** the air rises from the lowermost centre portion when being heated, to horizontal slits (5) near the upper edge of the ceiling element (2) near the ceiling of the room, the air being distributed from said slits (5) into the room.
2. Method according to claim 1, **characterised by** the air flow noise being dampened to a predetermined level an by acoustic dampening layer in the air supply device (4).
3. Method according to claim 1 or 2, **characterised by** lowering the ceiling element (2) for cleaning and maintenance, for which purpose the ceiling element (2) is sectioned.

Patentansprüche

1. Verfahren zum Verteilen von Kühlluft in einen Raum von dessen Decke (1) aus, bei dem kühle, gefilterte

Luft durch einen Luftkanal (3) zu mindestens einer Luftzufuhrvorrichtung (4), die über einem Deckenelement (2) aus Wärme leitendem Material angeordnet ist, geleitet wird, wobei die kühle Luft von der mindestens einen Luftzufuhrvorrichtung (4) in mindestens einen Teil des Deckenelements (2) absinkt und dadurch das Deckenelement (2) abkühlt, welches wiederum den Raum durch Strahlung und Konvektion abkühlt, wobei das Deckenelement (2) als Becken geformt ist und durch die von der Zufuhrvorrichtung (4) kommenden kalten Luft gekühlt wird, wobei die Luft durch die Oberseite des Deckenelements (2) erwärmt wird, **dadurch gekennzeichnet, dass** das Becken eine runde Form mit einem die tiefste Stelle bildenden Mittelbereich aufweist und dass die Luft von dem die tiefste Stelle bildenden Mittelbereich bei Erwärmung in Richtung horizontaler Schlitze (5) in der Nähe der Oberkante des Deckenelements (2) in der Nähe der Decke des Raums aufsteigt, wobei die Luft von den Schlitzen (5) in den Raum verteilt wird.

2. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** Luftströmungsgeräusche durch eine akustische Dämpfungsschicht in der Luftzufuhrvorrichtung (4) gedämpft werden.
3. Verfahren nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** das Deckenelement (2) zu Reinigungs- und Wartungszwecken abgesenkt wird, zu welchen Zwecken das Deckenelement (2) in Sektionen unterteilt ist.

Revendications

1. Procédé pour la distribution d'air de refroidissement dans un local depuis le plafond (1), dans lequel on délivre de l'air refroidi filtré à travers un canal d'air (3) à au moins un dispositif de fourniture d'air (4) disposé au dessus d'un élément de plafond (2) constitué d'un matériau conducteur de chaleur, ledit air refroidi descendant dudit au moins un dispositif de fourniture d'air (4) pour pénétrer dans au moins une partie de l'élément de plafond (2) et refroidissant ainsi l'élément de plafond (2) qui à son tour refroidit le local par radiation et par convection, ledit élément de plafond (2) ayant la forme d'une cuvette et étant refroidi par l'air refroidi provenant du dispositif de fourniture (4), l'air étant réchauffé par le côté supérieur de l'élément de plafond (2), **caractérisé en ce que** la cuvette a une forme arrondie avec une partie centrale au niveau le plus bas et **en ce que** l'air s'élève en partant de la partie centrale la plus basse lorsqu'il est chauffé vers des fentes horizontales (5) qui sont disposées à proximité du bord supérieur de l'élément de plafond (5) pour pénétrer dans le local.

2. Procédé selon la revendication 1, **caractérisé en ce que** le bruit de la circulation d'air est atténué à un niveau prédéterminé au moyen d'une couche d'amortissement acoustique qui est disposée dans le dispositif de fourniture d'air (4).

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3. Procédé selon la revendication 1 ou 2, **caractérisé en ce que** l'on abaisse l'élément de plafond (2) pour les opérations de nettoyage et de maintenance, l'élément de plafond (2) étant compartimenté, dans ce but.

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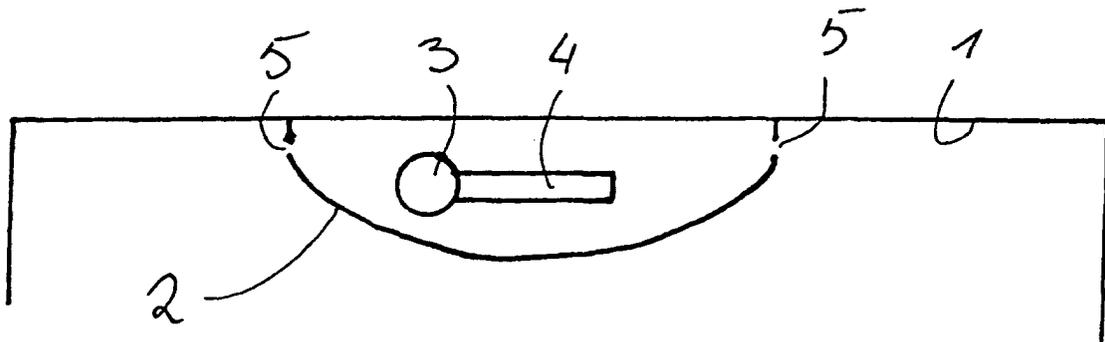


Fig. 1

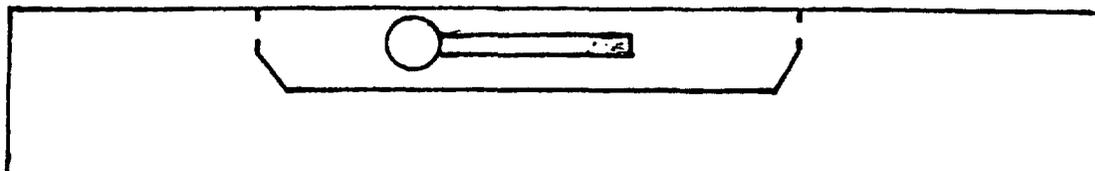


Fig. 2