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(11) Publication number:

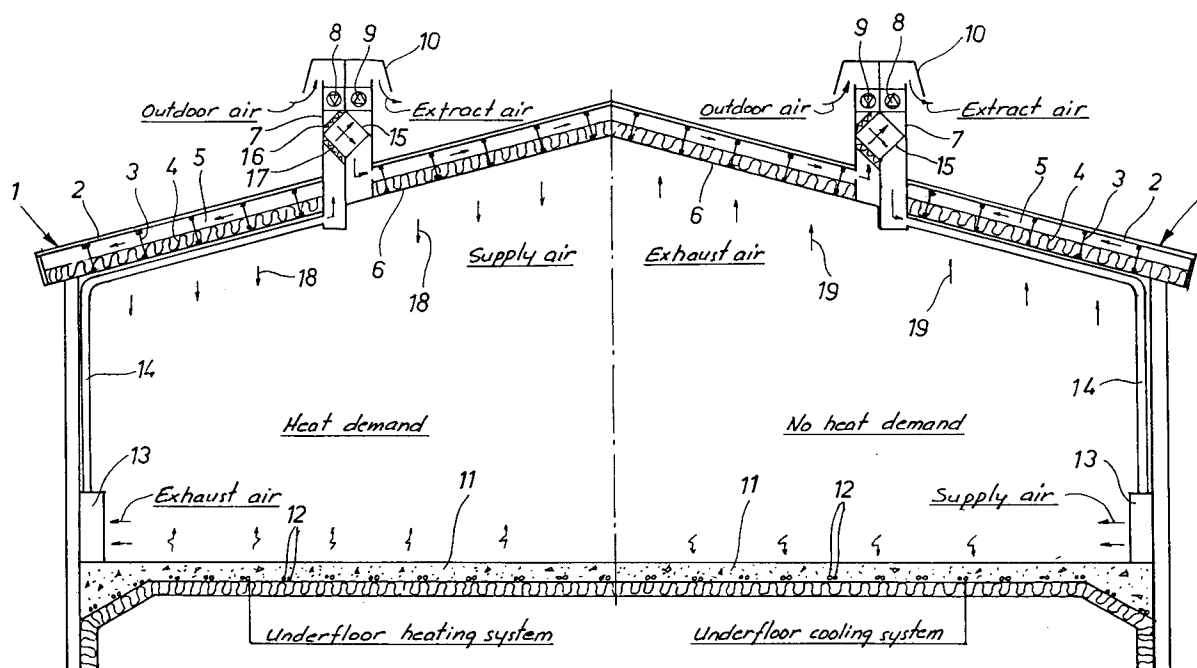
0 536 446 A1

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EUROPEAN PATENT APPLICATION(21) Application number: **91202643.2**(51) Int. Cl.⁵: **F24D 5/04, F24F 7/10**(22) Date of filing: **11.10.91**(43) Date of publication of application:
14.04.93 Bulletin 93/15(84) Designated Contracting States:
AT CH DE DK ES GB GR IT LI SE(71) Applicant: **CA BYGG AB**
Box 716
S-391 27 Kalmar(SE)(72) Inventor: **Kylefalk, Erik**
Saltkrakevägen 12
S-393 63 Kalmar(SE)(74) Representative: **Nydell, Peder**
Nydells Patentbyrå Hägnen 2573
S-380 30 Rockneby (SE)(54) **A method for heating the air in a building.**

(57) A method for heating the air in a building having a counterflow roof (1) and a floor being designed as a radiation source. Exhaust air is extracted from the building during simultaneous energy exchange with outdoor air, such that this will be pre-heated by energy recovery from the exhaust air before it enters

the building as supply air through the counterflow roof. Heat from the radiation source at the floor is used only as supplementary heat, i.e. for final controlling of the temperature of the air in the building. The exhaust air is extracted from the building via low velocity air terminal devices (13) at floor level.

**EP 0 536 446 A1**

TECHNICAL FIELD

The present invention relates to a method according to the preamble of claim 1 for heating the air in a building, the building being of the type in which outdoor air is caused to flow as supply air into the building through an air-permeable roof, i.e. a so-called counterflow-type roof, and the floor being designed as a radiation source for delivering heat to the roof and to the supply air entering therethrough.

BACKGROUND ART

A method of the aforementioned kind is known from WO 90/04135. The known method is based on the principle that substantially no supply air for the building is pre-heated, and that it flows downwards through the counter-flow roof, whereas the entire heat demand of the building is fulfilled by heat from the base slab. However, such a method will limit the amount of supply air, particularly in buildings having a low roof height. Therefore, many buildings that have a big air demand have to supplement its air distribution by any conventional technique.

Additionally, the known method requires that the energy recovery which is prescribed according to present statutes has to be performed entirely by means of heat pump technique in order to enable the recovered energy to return to the heating or consumption medium of the building. This technique is very expensive with regard to installation work, and also requires repeated maintenance work in order to maintain its efficiency.

DISCLOSURE OF INVENTION

The object of the present invention is, therefore, to provide a method of the aforementioned kind, where the above-mentioned drawbacks are eliminated, and where the energy recovery system is just as simple as the supply air system.

This object is achieved by a method according to the invention having the characterizing features of claim 1.

Further developments of the invention are apparent from the sub-claims.

BRIEF DESCRIPTION OF DRAWINGS

The invention will be described in more detail by reference to the accompanying drawing, where the single Figure illustrates a section of a building, where the method in accordance with the invention is applicable.

DESCRIPTION OF ONE EMBODIMENT OF THE INVENTION

The Figure schematically illustrates a building using the method according to the invention for controlling the temperature of the incoming supply air. The left half of the Figure shows the method according to the invention where there is a demand of heating the air in the building, whereas the right half of the Figure shows, for the sake of completeness, a reversed method, where there is no heat demand.

A roof structure which is of counterflow-type and is generally designated 1, comprises an outer roofing 2, structural beams 3 and insulation 4. The beams 3 are suitably open, i.e. they have a web which allows air to pass, such that a coherent air gap 5 is defined above the insulation 4. The insulation 4 may conveniently consist of mineral wool, insulating fibres or the like, and rests on a pressure drop layer 6 which simultaneously can form the ceiling. The pressure drop layer serves to uniformly distribute the air flow over the entire roof surface in the gap 5 by the formation of a positive pressure in the gap 5, and may consist of an air-permeable cloth, a perforated board or the like.

Mounted on the roof is a housing 7 for accommodating two reversible fans 8 and 9 for blowing supply air or extracting exhaust air in a way to be described below. The housing 7 is protected by a rainhood 10.

The building rests, in the embodiment shown, on a base slab 11 which is disposed directly on the ground. Conduits 12 are positioned under the base slab, and a heating medium, such as water, is caused to circulate in said conduits. The conduits are preferably laid under the concrete, but can also be cast into the base slab. Alternatively, the positioning of the conduits may be in framed floors.

A low velocity air terminal device 13, which may serve either as an exhaust air means or as a supply air means, is positioned at floor level in the building. The air terminal device 13 communicates via a conduit 14 with the housing 7.

The air streams generated by the fans 8 and 9 are in heat transfer relation with one another because the two air streams cross one another in an energy exchanger 15 being positioned in the housing 7, the exchanger being for instance a cross stream exchanger, battery exchanger or rotary exchanger or the like. The two inputs of the energy exchanger has a respective air cleaning filter 16 and 17, respectively, thereby maintaining the efficiency of the energy exchanger.

The left half of the Figure shows the case where there is a demand of heating the air in the building, whereas the right half of the Figure shows the reversed case where no heat demand exists,

although the last-mentioned case does not constitute any part of the invention.

To provide heating of the air, see the left half of the Figure, the fan 8 blows outdoor air into the housing 7, through the energy exchanger 15, then through the insulation 4 and downwards through the air-permeable roof layer 6, as is shown by arrows 18.

Exhaust air is extracted from the building via the low velocity air terminal device 13, which, accordingly, in this case serves as an exhaust air means. The exhaust air is conducted via the conduit 14 up to the housing 7 at the roof and through the energy exchanger 15, from which it is extracted to the environment by the fan 9. Energy recovery will thereby be performed in the energy exchanger 15 by the heat delivery from the exhaust air to the outdoor air such that this will be pre-heated before it enters as supply air down through the counterflow roof into the building.

The heat from the radiating floor 11 will thus be used only to supplement the heat obtained by energy recovery from the exhaust air, i.e. for final adjustment of the temperature of the air in the building.

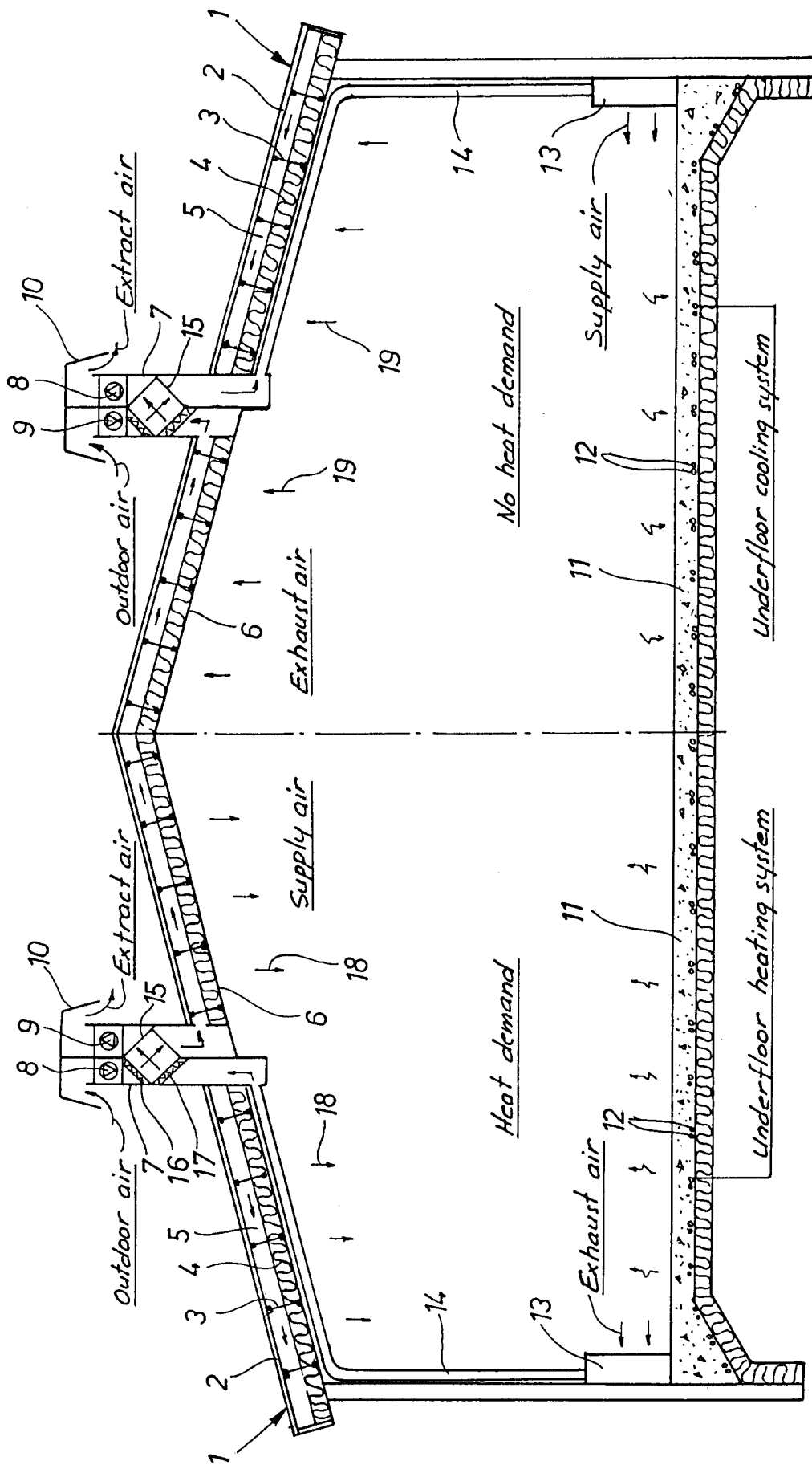
To provide cooling of the air, see the right half of the Figure, the fans 8 and 9 are reversed, i.e. the fan 9 blows outdoor air from the environment via the energy exchanger 15 down through the conduit 14 to the means 13, which, thus, in this case serves as a low velocity supply air terminal device. The exhaust air thereby flows upwards, see the arrows 19, and out through the air-permeable roof, which now serves as a parallel flow roof instead of a counterflow roof, and thereafter flows through the energy exchanger 15, and is finally extracted into the environment by the fan 8. Thanks to the energy exchanger 15, the outdoor air will, if the outdoor temperature exceeds the exhaust air temperature, be cooled somewhat by the exhaust air, before the outdoor air is delivered as supply air by the means 13. By, in this case, delivering the supply air at a low level (at the floor) during simultaneous extracting of exhaust air at the roof, a good ventilation will be obtained without any temperature increase of the supply air and with maintained thermodynamic motions.

Claims

1. A method for heating the air in a building, the building being of the type in which outdoor air is caused to flow as supply air through an air-permeable roof (1), i.e. a so-called counterflow-type roof, and the floor (11) being designed as a radiation source for delivering heat to the roof (1) and to the supply air entering therethrough, **characterized** in that exhaust air is

extracted from the building during simultaneous energy exchange with said outdoor air, so that this will be pre-heated by energy recovery from the exhaust air before it enters as said supply air into the building through the counterflow roof, said heat from the floor being used only to supplement the heat obtained by the energy recovery, i.e. for final adjustment of the temperature of the air in the building.

2. A method according to claim 1, **characterized** in that the exhaust air is extracted from the building via low velocity air terminal devices (13) at floor level.
3. A method according to any preceding claim, **characterized** in that the outdoor air and the exhaust air are energy exchanged with one another in a housing (7) at the roof by an energy exchanger (15) located therein.





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EUROPEAN SEARCH REPORT

Application Number

EP 91 20 2643

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
D,Y	WO-A-9 004 135 (GIVENT ROGER ERICSSON AB) * claim 1 *	1	F24D 5/04 F24F 7/10
Y	--- PATENT ABSTRACTS OF JAPAN vol. 8, no. 238 (M-335)(1675) 31 October 1984 & JP-A-59 115 925 (KAZUYOSHI OOSHITA) 4 July 1984 * abstract *	1	
A	--- EP-A-0 317 961 (SCHONHAMMER) * column 3, line 45 - column 4, line 10; figure 1 *	3	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			F24D F24F
The present search report has been drawn up for all claims			
Place of search BERLIN		Date of completion of the search 09 JUNE 1992	Examiner PIEPER C.
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application I : document cited for other reasons & : member of the same patent family, corresponding document	