



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11) **EP 1 319 902 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
18.06.2003 Bulletin 2003/25

(51) Int Cl.7: **F24F 5/00**, F24F 1/01,
F24F 1/00

(21) Application number: **02445162.7**

(22) Date of filing: **29.11.2002**

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
IE IT LI LU MC NL PT SE SK TR**
Designated Extension States:
AL LT LV MK RO SI

(72) Inventor: **Ekman, Christer Vilhelm**
03220 Tervalampi (FI)

(74) Representative: **Modin, Jan**
Ehrner & Delmar Patentbyrå AB
Box 10316
100 55 Stockholm (SE)

(30) Priority: **07.12.2001 SE 0104123**

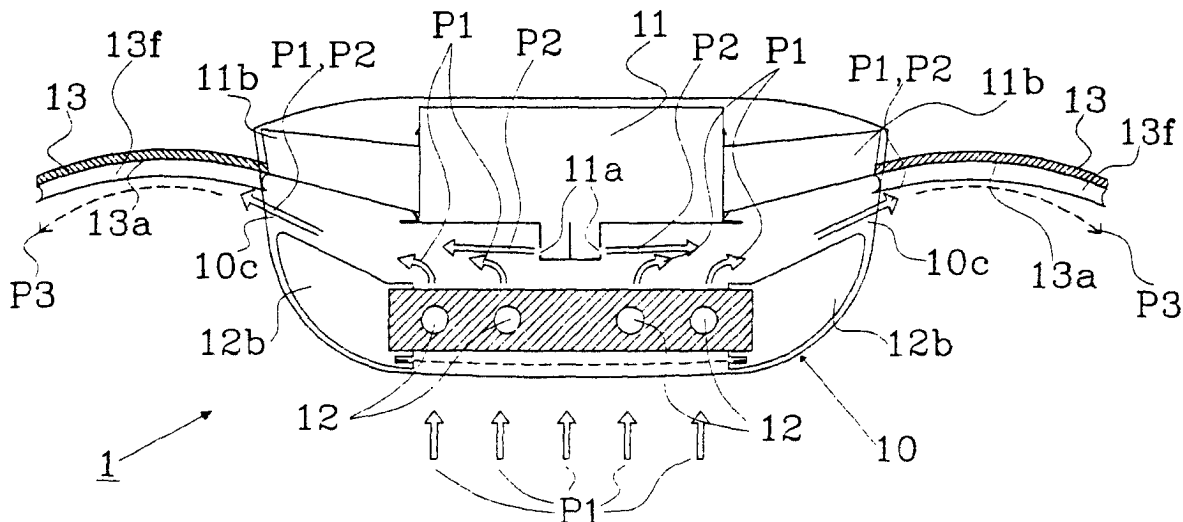
(71) Applicant: **Fläkt Woods AB**
55184 Jönköping (SE)

(54) **A heating device to be mounted at a ceiling**

(57) A ceiling heating device to be mounted at the ceiling of a room. The device has an air flow chamber (10) with an outflow opening (10c) of the supply of warm air from the device to the room. Adjacent to the outflow opening, there is metal panel (13) which, upon supply

of the warm air, will be heated to a temperature which brings its downwardly facing surface to emit heat radiation downwardly to the room. In this way, an effective heat transfer to the air in the living zone of the room is obtained.

Fig. 3



EP 1 319 902 A1

Description

FIELD OF THE INVENTION

[0001] The present invention relates to a device to be mounted adjacent to a ceiling of a room for the supply of heat to the room. The device comprises an air flow chamber with at least one outflow opening for the delivery of warm air from the device to the room.

PRIOR ART

[0002] Such devices are known in different forms. A kind used frequently at present is constituted by a cooling baffle which supplies fresh air to a mixing chamber, to which air is recirculated from the room with convective flow. The supply air sucks in the recirculated air from the room while operating like an ejector, and the mixed air streams flow out adjacent to the ceiling of the room and will then mix with the ambient air of the room. The outflowing air is normally being cooled by letting the recirculated room air pass by cooled surfaces, for example tubes through which a refrigerating fluid is circulated. Examples of such devices are disclosed in EP-A2-0967443 (Stifab Farex AB) and SE-0003246-6 (ABB Fläkt AB).

[0003] At such devices, it is also known (see the above-mentioned EP publication) to supplement the baffle with a hot water loop or other heating device so as to enable the supply of warm air to the room, if so desired. This may be desirable at night in office premises, which only have to be cooled at daytime, or in buildings located in climate zones which need cooling at certain times of the year and heating at other times of the year.

[0004] Upon supplying warm air adjacent to a ceiling of a room, the warm air tends to stay in the upper part of the room and form an air cushion, at least if the flow rate is low or moderate. This tendency is even more pronounced if a fan driven air flow is switched off at night, as occurs frequently in office and factory premises. The warm air adjacent to the ceiling will effect a certain heating to the room, but the warm air will not reach all the way down to the living zone of the room. In this living zone, the temperature will therefore be much lower, and if the room climate is to be acceptable, there is a need for a substantial supply of heat adjacent to the ceiling. When fresh air is supplied, the fresh air will moreover remain in the upper part of the room and will not reach the living zone.

SUMMARY OF THE INVENTION

[0005] Against this background, the main object of the invention is to provide a ceiling heating device of the kind referred to above which will provide a more effective supply of heat to the room. Another object is to facilitate that the supplied fresh air will reach the living

zone of the room.

[0006] This main object is achieved for a device designed as set forth in claim 1. Accordingly, it is essential that the air flowing out of the outflow opening of the device will pass along a metal panel having a surface facing down towards the room. In this way, the metal panel will be heated to a relatively high temperature by the outflowing warm air, and the downwardly facing surface will then emit heat radiation into the room.

[0007] At the same time, the outflowing air will be cooled somewhat while transferring heat to the metal panel, causing the air to obtain an increased density, whereby it will flow more easily downwards so as to mix with the air in the living zone of the room. This effect can be reinforced if the metal panel is designed so as to deflect the outflowing air downwardly. This can be accomplished by giving the metal panel a curved configuration, so that the air will follow the curved, possibly arcuate shape of the metal panel and will be deflected from an upward flow direction into a downward flow direction. Such a configuration will also give rise to an especially good heat transfer to the metal panel, since the air will effectively touch the surface of the metal panel while being deflected.

[0008] Several embodiments are possible within the inventive concept. An advantageous variant is to combine an air supply baffle with an illumination device, wherein an arcuately, e.g. cylindrically curved metal panel constitutes a downwardly facing reflector being located above an elongated light source. Such a light source may be constituted by an ordinary light tube.

[0009] In another embodiment, the metal panel is included in the lower part of an outflow chamber having one or more, preferably slot-like outflow openings. In this case, the metal panel may be substantially horizontal, if so desired, while the outflow openings may be designed for a downwardly directed air flow, preferably obliquely downwards.

[0010] In order to make the device especially effective, it is advantageous to dispose insulating material above the heating panel, or possibly above the outflow chamber, as the case may be, so that the major part of the supplied heating power is delivered to the room air and will not be lost by way of heat conduction upwards.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] The invention will now be explained more fully with reference to the appended drawings illustrating some embodiments.

[0012] Fig. 1 illustrates schematically, in a side view and partially in section, a ceiling heating device according to the invention.

[0013] Fig. 2 shows a cross-section through the device shown in Fig. 1, according to a first embodiment.

[0014] Fig. 3 shows a cross-section through a second embodiment.

[0015] Fig. 4 shows a cross-section through a third

embodiment with an outflow chamber.

[0016] Fig. 5 shows a cross-section through a fourth embodiment which is combined with an illumination device.

[0017] Fig. 6 shows a cross-section through a fifth embodiment provided with insulation material.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0018] The device to be arranged at a ceiling, as shown in figure 1, is constituted by a supply air baffle 1, which may be mounted in a ceiling structure (not shown) or may hang freely below the ceiling of a room, which is to be ventilated, heated and possibly also cooled during certain time periods or when so desired. The room may be an office, a factory or any other room where people will stay for a longer or shorter duration.

[0019] Fig. 2 shows a cross-section of a first embodiment of the device of fig. 1. The device comprises an elongated air flow chamber 10, which is substantially box-like and extends along the whole length of the device. The air flow chamber 10 is open at its lower side 10a and, in this embodiment, also at its upper side 10b, so that room air can flow vertically through the chamber 10, as illustrated by the arrows in figures 1 and 2. Moreover, in the chamber 10, supply air channels 11 are disposed, these channels being provided with supply air openings. The latter are preferably located at the upper side of the supply air channels 11, so that upwardly directed supply air will flow through the upper side 10b of the air flow chamber 10. See the arrows P2. Hereby, the vertical flow of room air (P1) is reinforced by ejector action.

[0020] In the air flow chamber 10, there are also arranged a number of tubes 12, through which a cooling or a heating fluid is circulated. These tubes 12 interact primarily with the recirculated room air (arrows P1). The outflow air, supplied through the channels 11, may likewise be cooled or heated.

[0021] According to the invention, the air flow chamber 10 adjoins to at least one metal panel, in this case two metal panels 13, which are designed and disposed in such a way that the air (P1 and P2) flowing out from the air flow chamber through the outflow opening 10b will flow along the downwardly facing surface 13a of each metal panel. In case the air streams P1 and P2 are heated to a relatively high temperature, this flow along the surfaces 13a will cause the metal panels to obtain an elevated temperature, which in turn causes the surfaces 13 to emit radiating heat downwardly into the room. Thus, the heated air will cause an indirect heating of the room by way of the metal panels 13 radiating heat downwards. In this process, the air (the streams P1 and P2) will be cooled somewhat, and these air streams will therefore mix more easily with the ambient room air. Apart from the advantage in supplying heat to the living zone of the room, there will also be an increased content

of fresh air in the room (from the supply air channels 11).

[0022] The inventive concept can be applied in many different ways. In the embodiment shown in figure 3, the air flow chamber is designed substantially in the same manner, in its central portion, as the air conditioning device disclosed in SE-0003246-6. Accordingly, the ceiling baffle 1 is here provided with an upper supply air channel 11 with downwardly disposed supply air openings 11a and a lower cooling/heating element equipped with tubes 12 for a circulating cooling or heating fluid. The ceiling baffle 1 also has outflow openings 10c located between upper and lower side flanges 11b, 12b, so that the air streams P1, P2 flow substantially sideways adjacent to the respective metal panel 13. In this case, the metal panels 13 are arranged sideways at mutual distance and adjoining each upper side flange 11b, respectively. Moreover, the metal panels 13 are substantially arcuate in cross-section (according to figure 3), so that the air streams P1, P2, which flow substantially in parallel to the lower surfaces 13a of the metal panels 13, will follow these lower surfaces. When flowing out from the chamber 10 (at the air flow openings 10c), the air streams P1, P2 are directed obliquely upwards, whereupon they are directed obliquely downwards when they leave the respective metal panel, as indicated by the arrows P3, after having been deflected along the arcuate metal panels. Hereby, the mixing of the air streams with the room air will be facilitated.

[0023] The metal panels 13 also have flanges 13f extending sideways (in parallel with the air flow) and enlarging the effective area of the metal panels 13, so that the heat exchange between the air streams P1, P2 and the metal panels 13 is improved.

[0024] In the embodiment shown in figure 4, the air flow chamber 10 is designed in the same way as in figure 3, but the laterally adjoining metal panels 13 are in this case disposed as a lower wall of an air outflow box. The metal panels 13 have longitudinally distributed openings, slots or perforations 13b, through which the air streams P1, P2 flow out sideways or obliquely sideways. See the arrows P4. Even in this case, the metal panels 13 are heated by the warm air streams and will emit heat radiation downwards to the room.

[0025] The embodiment according to figure 5 corresponds substantially to the embodiment of figure 3 in respect of air flow and thermal characteristics. However, the metal panels 13 have an additional function, namely as a reflector to a light source 15, so that the light source 15 and the arcuately bent metal panel 13 together form an illumination device. In figure 5, the lines L depict light rays. The metal panels serving as a reflector may be, e. g., circularly cylindrically curved, but it is of course also possible to give the metal panels 13 a different geometrical configuration, if so desired from an optical point of view.

[0026] In figure 6, there is shown a schematic, simple embodiment with substantially planar, horizontal metal panels 13 on each side of the air flow chamber 10. In

order to ensure that heat is not transferred upwards, a heat insulating material 16 is disposed above the air flow chamber 10 and the two metal panels 13. Preferably, such an insulating material is arranged also in the preceding embodiments, although this is not shown in the drawing figures. Moreover, the metal panels are provided with perforation holes 13c for the absorption of sound.

[0027] A frequent practical operation is that the ceiling baffle 1 serves as a supply air device and cooling device at daytime. At night, when the heat generating apparatuses are switched off, there is a need for heat supply. This will be accomplished by circulating hot water through the tubes 12, whereby the room air will be heated as well as the metal panels 13. Now, the supply air in the supply air channel 11 can be cut off, if so desired, by switching of centrally disposed fans.

[0028] The invention can be applied in many ways within the scope of the invention as defined in the claims. The shape of the air flow chamber can be modified by those skilled in art. Also, the device can be provided with heating elements only. The configuration of the metal panels may also be varied. For example, the chamber may have an outlet opening at one side only. Moreover, the term "metal panel" also incorporates mixed or composite materials having a good heat conductive capacity. It is essential that the panels 13 have the capacity of accumulating heat from the outflowing air and emitting heat radiation downwardly to the room.

Claims

1. A device (1) to be mounted at the ceiling of a room for the supply of heat to the room, comprising an air flow chamber (10) with an outflow opening for the supply of warm air (10b, 10c, 13b) from the device to the room, **characterised in that** the outflow opening is arranged to bring the outflow air to flow along at least one metal panel (13) having a surface (13a) facing downwardly towards the room, and causing said metal panel to be heated by the warm air to an elevated temperature, said metal panel being dimensioned so as to cause its downwardly facing surface, upon being heated to said elevated temperature, to emit heat radiation downwardly to the room and thereby transfer heat to the room.
2. A device according to claim 1, **characterised in that** the device is arranged for intermittent operation, wherein the air flow chamber (10) is arranged to bring either cooled air or heated air to flow through said outflow opening.
3. A device according to claim 2, **characterised in that** it is included in a supply air baffle provided with cooling and heating elements (12).
4. A device according to any one of the preceding claims, **characterised in that** the device (1) is elongated along a longitudinal direction with a longitudinally extended or distributed outflow opening for bringing the outflowing air to flow transversely relative to said longitudinal direction.
5. A device according to any one of the preceding claims, **characterised in that** the metal panel (13) is curved so as to deflect the supplied air and direct it downwards (P3), upon passing along said downwardly facing surface.
6. A device according to any one of the preceding claims, **characterised in that** the surface of the metal panel (13) also serves as a reflector for a light source (15).
7. A device according to any one of the preceding claims, **characterised in that** a heat insulating material (16) is disposed at the upper side of the metal panel.
8. A device according to any one of the preceding claims, **characterised in that** the metal panel (13) is provided with perforations (13c) for sound absorption.
9. A device according to any one of the preceding claims, **characterised in that** the metal panel (13) is included in an outflow channel (14) having a plurality of downwardly directed outflow openings (13b).
10. A device according to any one of the preceding claims, **characterised in that** the metal panel is provided with surface enlarging flanges (13f).

Fig. 1

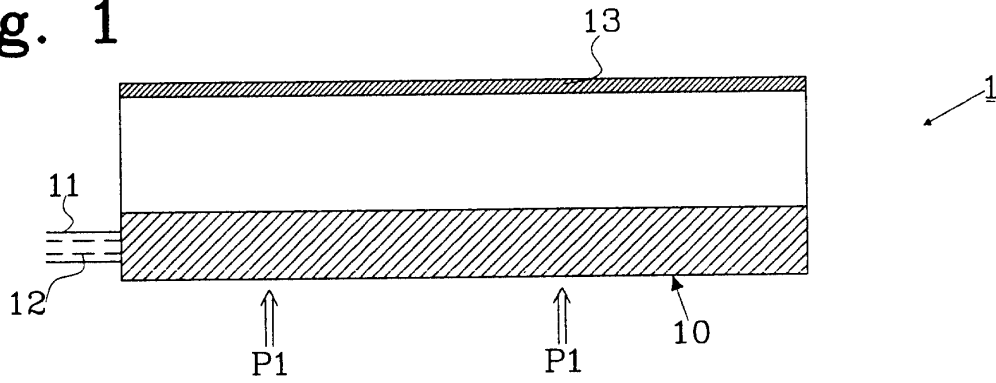


Fig. 2

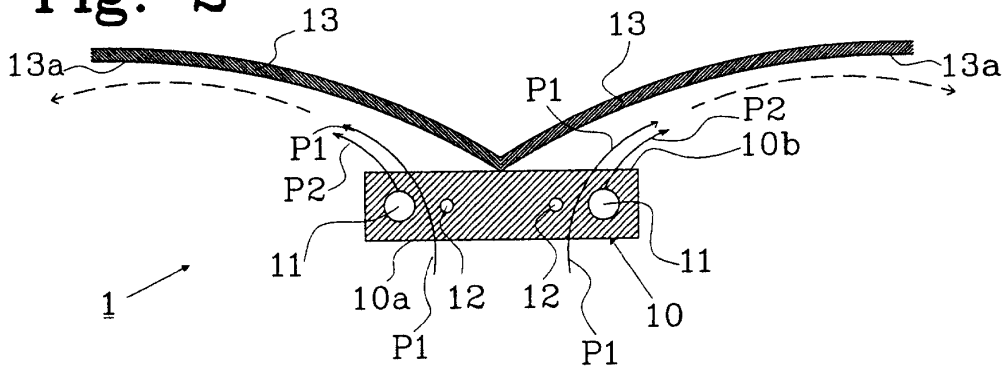


Fig. 3

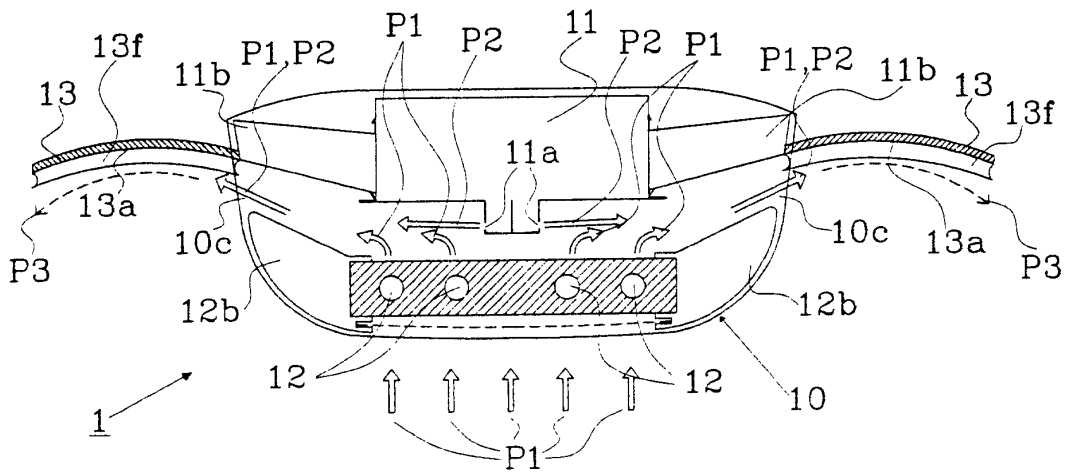


Fig. 4

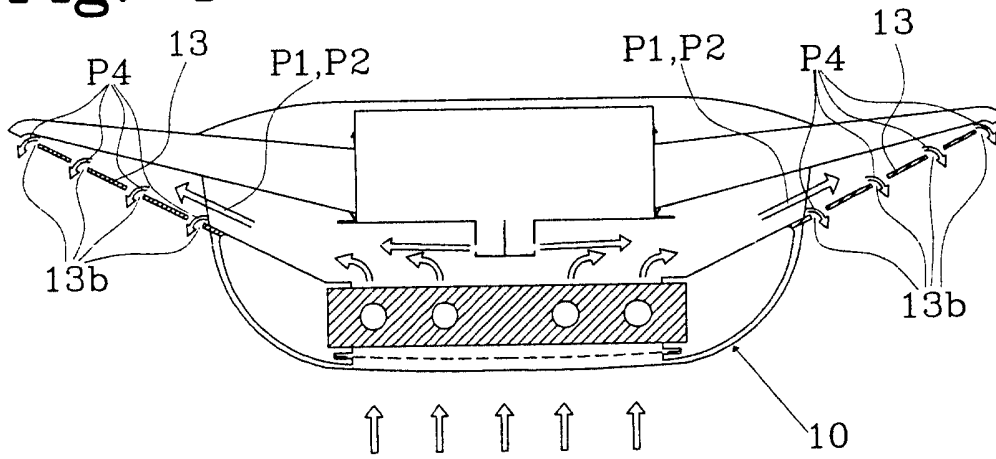


Fig. 5

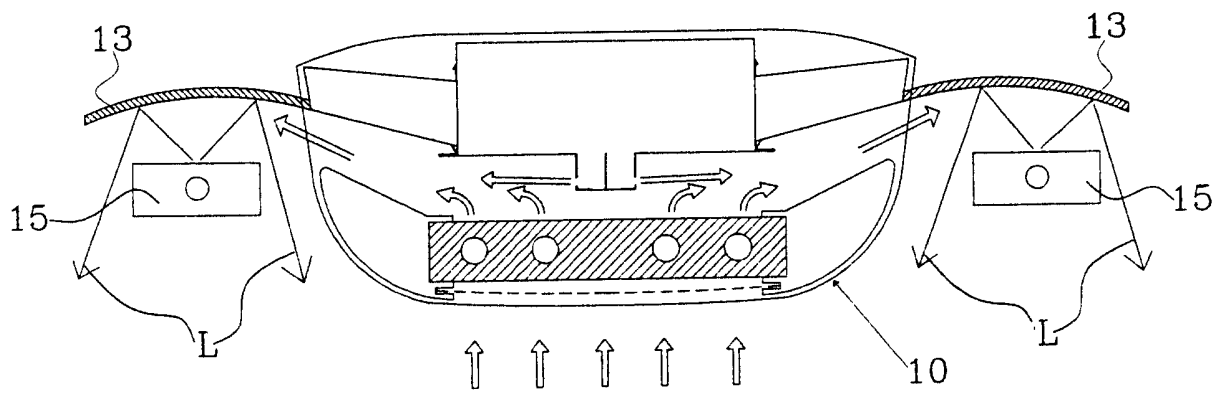
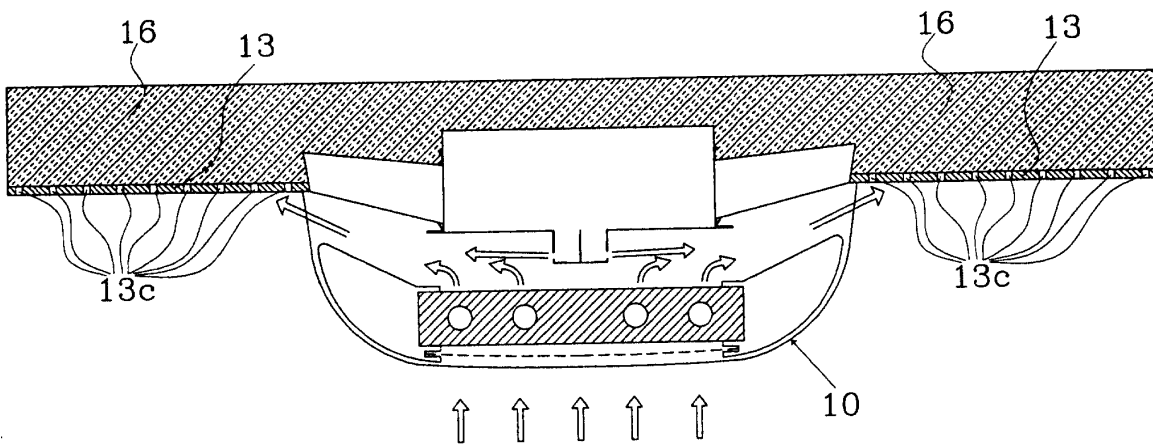


Fig. 6





European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 02 44 5162

DOCUMENTS CONSIDERED TO BE RELEVANT				
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.CI.7)	
X	WO 95 19528 A (FLAEKT AB ;ELIASSON LEIF (SE)) 20 July 1995 (1995-07-20) * page 7, paragraph 3; claim 1; figures *	1,2,4	F24F5/00 F24F1/01 F24F1/00	
X	GB 2 349 688 A (HALTON OY) 8 November 2000 (2000-11-08) * abstract; figures 1,3B,5 *	1,3		
A	US 1 492 750 A (BROWN WILLARD W ET AL) 6 May 1924 (1924-05-06) * page 2, line 51 - line 67; figures *	5		
A	US 5 363 908 A (KOESTER HELMUT) 15 November 1994 (1994-11-15) * column 9, line 13 - line 17; figures 6,10,12,16 *	6-9		
A	EP 0 967 444 A (STIFAB FAREX AB) 29 December 1999 (1999-12-29) * abstract; figure 1 *	1,9		
A	DE 93 15 709 U (ZENT FRENGER STRAHLUNGSHEIZUNG) 10 February 1994 (1994-02-10) * figures *	10		TECHNICAL FIELDS SEARCHED (Int.CI.7) F24F
A	DE 201 13 303 U (ABB INSTALLAATIOT OY HELSINKI) 15 November 2001 (2001-11-15) * page 11, last paragraph - page 12, paragraph 1; claim 1; figure 3 *	6,7		
The present search report has been drawn up for all claims				
Place of search THE HAGUE		Date of completion of the search 6 March 2003	Examiner Gonzalez-Granda, 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 L : document cited for other reasons & : member of the same patent family, corresponding document		

EPO FORM 1503 03/02 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 02 44 5162

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

06-03-2003

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
WO 9519528	A	20-07-1995	AU 1547895 A	01-08-1995
			SE 9400096 A	18-07-1995
			WO 9519528 A1	20-07-1995
GB 2349688	A	08-11-2000	FI 990362 A	20-08-2000
			DE 10007452 A1	31-08-2000
			FR 2790068 A1	25-08-2000
			NO 20000808 A	21-08-2000
			SE 0000474 A	20-08-2000
US 1492750	A	06-05-1924	US 1414209 A	25-04-1922
US 5363908	A	15-11-1994	DE 4005914 A1	29-08-1991
			DE 4031062 A1	09-04-1992
			DE 4032113 A1	16-04-1992
			AT 97731 T	15-12-1993
			AU 7254791 A	18-09-1991
			CA 2075478 A1	25-08-1991
			DE 69100687 D1	05-01-1994
			DE 69100687 T2	26-05-1994
			WO 9113294 A1	05-09-1991
			EP 0516674 A1	09-12-1992
EP 0967444	A	29-12-1999	EP 0967444 A2	29-12-1999
			NO 993088 A	27-12-1999
			SE 9802216 A	24-12-1999
DE 9315709	U	10-02-1994	DE 4318833 A1	08-12-1994
			DE 9315709 U1	10-02-1994
DE 20113303	U	15-11-2001	FI 4708 U1	23-11-2000
			DE 20113303 U1	15-11-2001
			NO 20014015 A	19-02-2002
			SE 0102686 A	19-02-2002

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82