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(72) Inventors:
• **Hamada, Masayuki
Kusatsu-shi
Shiga 525-0041 (JP)**
• **Nakamura, Yasuhiro
Ritto-shi
Shiga 520-3037 (JP)**

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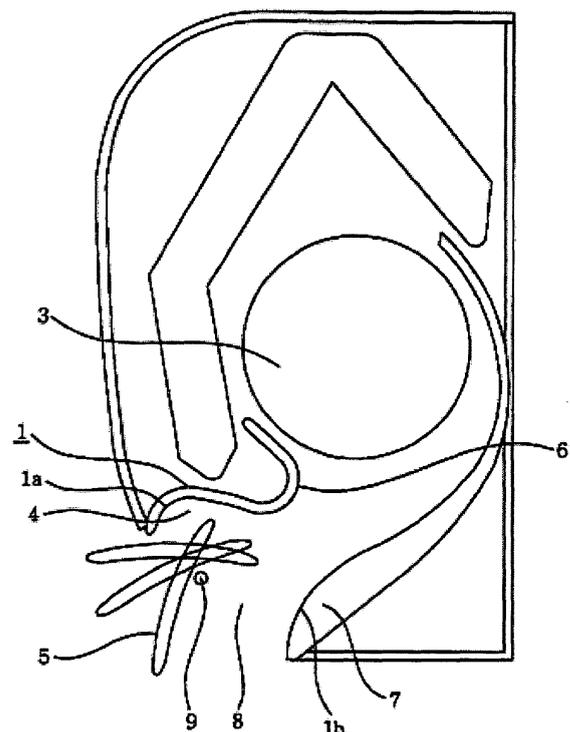
(74) Representative: **Turi, Michael et al
Samson & Partner
Widenmayerstrasse 5
80538 München (DE)**

(71) Applicant: **MATSUSHITA ELECTRIC INDUSTRIAL
CO., LTD.
Kadoma-shi, Osaka 571-8501 (JP)**

(54) **Air conditioner**

(57) An air conditioner includes an indoor unit having a fan (3), an air discharge opening (8), an up-down vane (5) installed at the air discharge opening for dispersing air flow in a vertical direction while having a rotational movement and an air flow duct (1) extended from the fan to the air discharge opening. Further, a groove portion (4) is provided on an upper surface of the air discharge opening (8) of the air flow duct (1), the groove portion (4) having a concave cross section to prevent a rotational movement of the up-down vane (5) from being obstructed, and its lengthwise direction is substantially perpendicular to an airflow direction, an upper end of the up-down vane (5) being substantially coinciding with an upper end of the air discharge opening (8) when the up-down vane (5) closes the air discharge opening (8).

FIG. 1



Description

[0001] The present invention relates to an air conditioner having an up-down vane installed to have a rotational movement at an air discharge opening.

[0002] A conventional air conditioner has an air flow duct extended from a fan to an air discharge opening. When viewed in a cross section cut perpendicularly to the front face of the air conditioner (to be called as a vertical cross section hereinafter), an upper surface of the air flow duct is prepared straight, while a lower surface thereof is smoothly connected with a curve extended from the upstream thereof (see, for example, Japanese Patent Laid-open Application No. 2002-106948: Reference 1).

[0003] Referring to Fig. 3, there is illustrated a vertical cross sectional view of the conventional air conditioner disclosed in Reference 1. As shown in the figure, the air conditioner includes fan 3, up-down vane 5, air discharge opening 8 and air flow duct 1 extended from fan 3 to air discharge opening 8. Room air drawn into the air conditioner is directed toward air discharge opening 8 via air flow duct 1 by fan 3 after heat exchange to be blown out to the room through air discharge opening 8, while it is dispersed in a vertical direction by up-down vane 5 that is driven to have a rotational motion about rotation shaft 9.

[0004] In the foregoing configuration of the conventional air conditioner, however, since the up-down vane has a rotational motion, there should be prepared a clearance space between an upper end of the up-down vane and the upper surface of the air flow duct in order to prevent the upper surface of the air flow duct from blocking a rotation track of the up-down vane, obstructing the rotational movement of the up-down vane. Accordingly, when the up-down vane closes the air discharge opening, there remains a relatively large gap left opened between the up-down vane and the upper end of the air discharge opening.

[0005] It is, therefore, an object of the present invention to provide an air conditioner having an improved design feature by minimizing a gap between an upper end of an up-down vane and an upper end of an air discharge opening, while improving an air blowing efficiency.

[0006] In accordance with the present invention, there is provided an air conditioner including an indoor unit having a fan, an air discharge opening, an up-down vane installed at the air discharge opening for dispersing air flow in a vertical direction while having a rotational movement and an air flow duct extended from the fan to the air discharge opening, wherein a groove portion is provided on an upper surface of the air discharge opening of the air flow duct, the groove portion having a concave cross section to prevent a rotational movement of the up-down vane from being obstructed, and its lengthwise direction is substantially perpendicular to an airflow direction, an upper end of the up-down vane being substantially coinciding with an upper end of the air discharge opening when the up-down vane closes the air discharge

opening.

[0007] The above and other objects and features of the present invention will become apparent from the following description of preferred embodiments given in conjunction with the accompanying drawings, in which:

Fig. 1 is a vertical cross sectional view of an air conditioner in accordance with a first preferred embodiment of the present invention;

Fig. 2 presents a vertical cross sectional view of an air conditioner in accordance with a second preferred embodiment of the present invention; and

Fig. 3 sets forth a vertical cross sectional view of a conventional air conditioner.

[0008] Hereinafter, preferred embodiments of the present invention will be described with reference to the accompanying drawings. However, it is to be noted that the present invention is not limited thereto.

(First preferred embodiment)

[0009] Fig. 1 provides a vertical cross sectional view of an air conditioner in accordance with a first preferred embodiment of the present invention.

[0010] Referring to Fig. 1, room air drawn into the air conditioner is blown to air discharge opening 8 via air flow duct 1 by fan 3 after heat exchange to be finally blown back into the room through air discharge opening 8 while being dispersed in a vertical direction by up-down vane 5 that is driven to have a rotational movement about rotation shaft 9.

[0011] As for air flow duct 1 extended from fan 3 to air discharge opening 8, its upper surface 1a on the side of air discharge opening 8 is provided with groove portion 4 shaped similar to a rotation track of up-down vane 5. By forming groove portion 4 such that it conforms to the rotation track of up-down vane 5, up-down vane 5 is allowed to have a rotational movement without being obstructed by air flow duct 1. Specifically, groove portion 4 has an arc-shaped cross section and its lengthwise direction is substantially perpendicular to an airflow direction. Also, when up-down vane 5 closes the air discharge opening 8, the upper end of up-down vane 5 is arranged to substantially coincide with the upper end of air discharge opening 8. Therefore, a gap between the upper end of up-down vane 5 and the upper end of air discharge opening 8 can be minimized.

[0012] Further, first protruding portion 6 is formed at upstream of groove portion 4 in a manner that its surface is curved to be smoothly connected with the surface of groove portion 4 and a lengthwise direction of first protruding portion 6 is substantially parallel to groove portion 4. First protruding portion 6 has a cross section whose periphery is arc-shaped.

[0013] Also, second protruding portion 7 is provided on lower surface 1b of air flow duct 1 on the side of air discharge opening 8 such that its surface is curved to be

smoothly connected with the surface on air discharge opening 8 of air flow duct 1. Second protruding portion 7 has a convex cross section and a lengthwise direction of second protruding portion 7 is substantially perpendicular to the airflow direction.

[0014] An operation of the air conditioner having the above-described configuration will now be explained.

[0015] While the air conditioner is not operated, up-down vane 5 is kept closed and its upper end substantially coincides with the upper end of air discharge opening 8. Thus, the gap between the upper end of up-down vane 5 and the upper end of air discharge opening 8 is minimized, so that an interior of the air conditioner cannot be seen from outside, and the design feature of the appearance of the air conditioner can be improved. Moreover, in this configuration, pollutants such as dust can be prevented from entering into the air conditioner, whereby contamination of the interior of the air conditioner can be prevented, which in turn prevents performance degradation of the air conditioner. Besides, unlike the conventional configuration of the air conditioner in which the gap between the upper end of up-down vane 5 and the upper end of air discharge opening 8 should be big enough to prevent the rotary movement of up-down vane 5 from being obstructed, air flow duct 1 need not be formed larger than necessary in accordance with the present invention. Therefore, the static pressure of the air can be increased, so that a backflow of the air through air discharge opening 8 and a generation of rustling noise thereby can be prevented, and an air blowing efficiency of the air conditioner can be improved.

[0016] Moreover, since it is possible to locate rotation shaft 9 of up-down vane 5 closer to the center of air discharge opening 8, up-down vane 5 can be installed near the center of airflow discharged from air discharge opening 8. Therefore, rectification of air gets easier, and the air blowing efficiency can be improved. In particular, rectification in an upward direction can be effectively facilitated to thereby make it feasible to control the direction of the airflow upwardly such that the air can be prevented from being blown to a user directly. Further, since rotation shaft 9 of up-down vane 5 can be located closer to the center of air discharge opening 8, a torque on up-down vane 5 is reduced, which in turn reduces a driving force required for driving up-down vane 5 by using, e.g., a stepping motor. Therefore, using low-priced components are possible.

[0017] Furthermore, as described above, first protruding portion 6, whose cross sectional periphery is arc-shaped, is formed at an upstream side of groove portion 4 of upper surface 1a on the side of air discharge opening 8 of air flow duct 1 such that its surface is curved to be smoothly connected with the surface of groove portion 4 substantially in parallel therewith. Here, in proportion to the amount of the protrusion of first protruding portion 6, the area of air flow duct 1 will be reduced, resulting in an increase of the static pressure of the air. Further, by smoothly connecting first protruding portion 6 to groove

portion 4 on the upper surface of the air flow duct 1, resistance to air flow can be reduced, so that peeling can be effectively prevented. Also, since this configuration facilitates the air flow along the surface of the air flow duct, the air blowing efficiency of the air conditioner can be improved.

[0018] Moreover, as described above, second protruding portion 7 having the convex cross section is formed on lower surface 1b on the side of air discharge opening 8 of air flow duct 1 such that its surface is curved to be smoothly connected with the surface of air discharge opening 8 of air flow duct 1, while its lengthwise direction is set to be substantially perpendicular to the airflow direction. In proportion to the amount of the protrusion of second protruding portion 7, the area of air flow duct 1 will be reduced, resulting in an increase of the static pressure of the air. Further, by configuring second protruding portion 7 having the convex cross section to be smoothly connected with lower surface 1b of air flow duct 1, resistance to air flow can be reduced, so that peeling can be further prevented. Also, since this configuration facilitates the flow of the air along the surface of the air flow duct, the air blowing efficiency of the air conditioner can be further improved.

[0019] As described above, in accordance with the first preferred embodiment of the present invention, a groove portion of a concave cross section is formed on the upper surface of the air flow duct extended from the fan to the air discharge opening in a manner that the lengthwise direction of the groove portion is substantially perpendicular to an airflow direction. By providing the groove portion shaped as explained, the up-down vane is allowed to make a rotary movement without being obstructed by the presence of the air flow duct. Accordingly, since the upper end of the up-down vane can be made to substantially coincide with the upper end of the air flow duct when the up-down vane closes the air discharge opening, the gap between the upper end of the up-down vane and the upper end of the air discharge opening can be minimized, whereby the design feature of the air conditioner can be improved. Further, the first protruding portion, whose cross sectional periphery is arc-shaped, is formed at an upstream side of the groove portion such that its surface is curved to be smoothly connected with the surface of the groove portion substantially in parallel therewith. Also, the second protruding portion having a convex cross section is formed on the lower surface on the side of the air discharge opening of the air flow duct such that its surface is curved to be smoothly connected with the lower surface of the air flow duct, while its lengthwise direction is set to be substantially perpendicular to the airflow direction. By forming the first and the second protruding portion, the area of the air flow duct can be reduced, and the static pressure of the air can be increased. Also, since it is possible to locate the rotation shaft of the up-down vane closer to the center of the air discharge opening, rectification of air by the up-down vane gets easier, whereby the air blowing efficiency can be improved.

(Second preferred embodiment)

[0020] As can be seen from a vertical cross sectional view of the air conditioner in Fig. 2 in accordance with a second preferred embodiment of the present invention, second protruding portion 7 provided on lower surface 1b of air flow duct 1 can be shaped to have a flat surface. By installing protruding portion 7 of the flat surface on the lower surface of the air flow duct, the area of the air flow duct can be reduced, resulting in an increase of the static pressure of the air. As a result, resistance to air flow decreases, so that peeling can be prevented. Thus, the flow of air along the surface of the air flow duct is facilitated, so that the air blowing efficiency of the air conditioner can be improved.

[0021] As described above, the air conditioner in accordance with the present invention has a configuration in which a gap between the air discharge opening and the up-down vane rotated thereat is minimized. Accordingly, the design feature of the air conditioner can be improved and the air blowing efficiency can be enhanced. As a result, the present invention can be favorably applied to a blower, a dehumidifier, a fan heater and so forth.

[0022] While the invention has been shown and described with respect to the preferred embodiments, it will be understood by those skilled in the art that various changes and modifications may be made without departing from the scope of the invention as defined in the following claims.

Claims

1. An air conditioner including an indoor unit having a fan, an air discharge opening, an up-down vane installed at the air discharge opening for dispersing air flow in a vertical direction while having a rotational movement and an air flow duct extended from the fan to the air discharge opening, wherein a groove portion is provided on an upper surface of the air discharge opening of the air flow duct, the groove portion having a concave cross section to prevent a rotational movement of the up-down vane from being obstructed, and its lengthwise direction is substantially perpendicular to an airflow direction, an upper end of the up-down vane being substantially coinciding with an upper end of the air discharge opening when the up-down vane closes the air discharge opening.
2. The air conditioner of claim 1, wherein a first protruding portion having a concave cross section is formed at an upstream side of the groove portion, a lengthwise direction of the first protruding portion is substantially parallel to the groove portion.
3. The air conditioner of claim 1 or 2, wherein the periphery of the cross section of the first protruding por-

tion is of an arc shape.

4. The air conditioner of claim 2 or 3, wherein the groove portion and the first protruding portion of the upper surface of the air flow duct are curved to be smoothly connected with each other.
5. The air conditioner of any one of claims 1 to 4, wherein a second protruding portion having a convex cross section is formed on a lower surface of the air discharge opening of the air flow duct, and a lengthwise direction of the second protruding portion is substantially perpendicular to the airflow direction.
6. The air conditioner of claim 5, wherein a curved or a flat surface of the second protruding portion and the surface of the air discharge opening are smoothly connected with each other.
7. The air conditioner of claim 5, wherein the second protruding portion has a flat surface and is connected with the air flow duct.

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FIG. 1

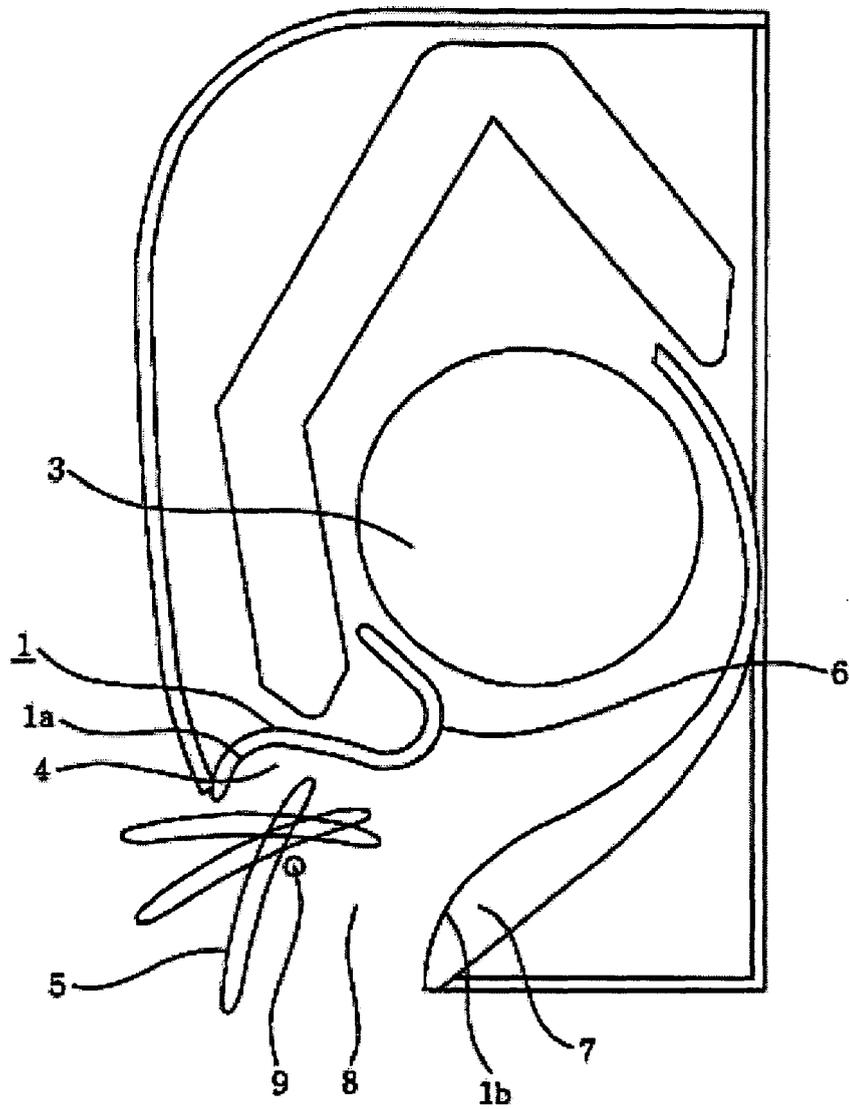


FIG. 2

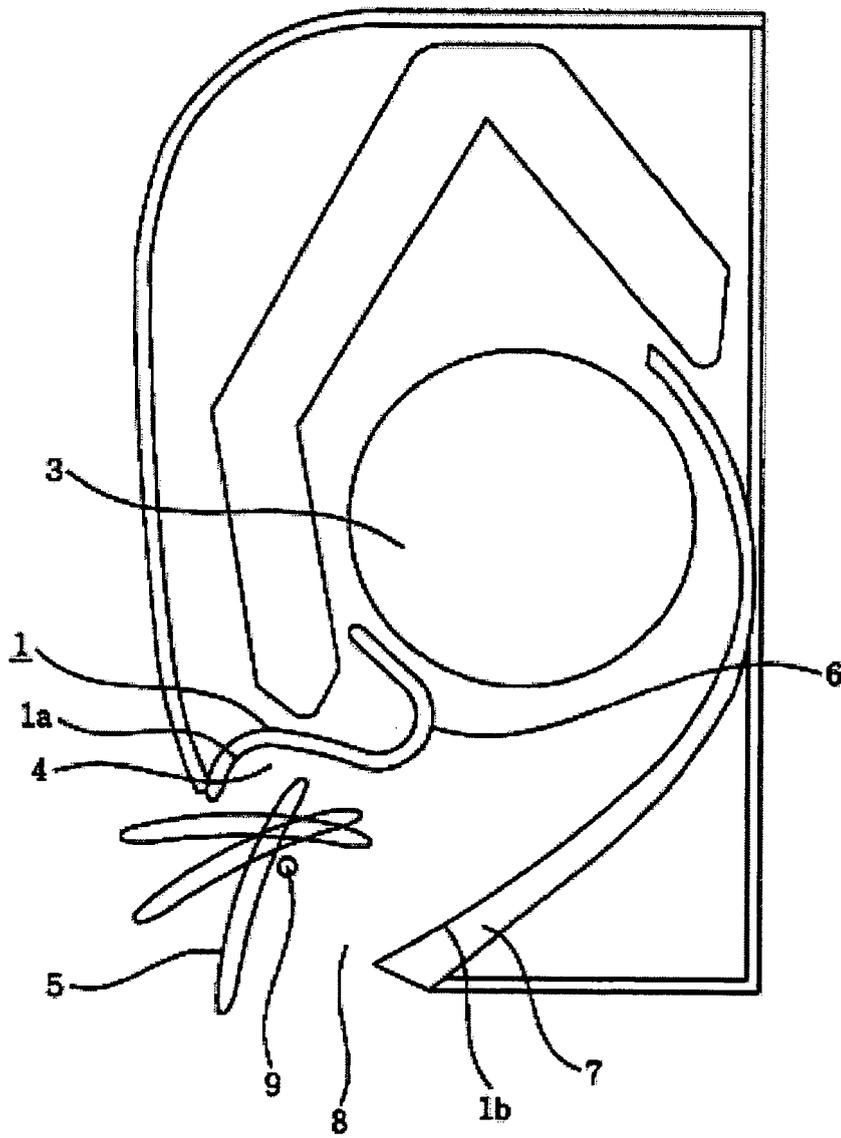
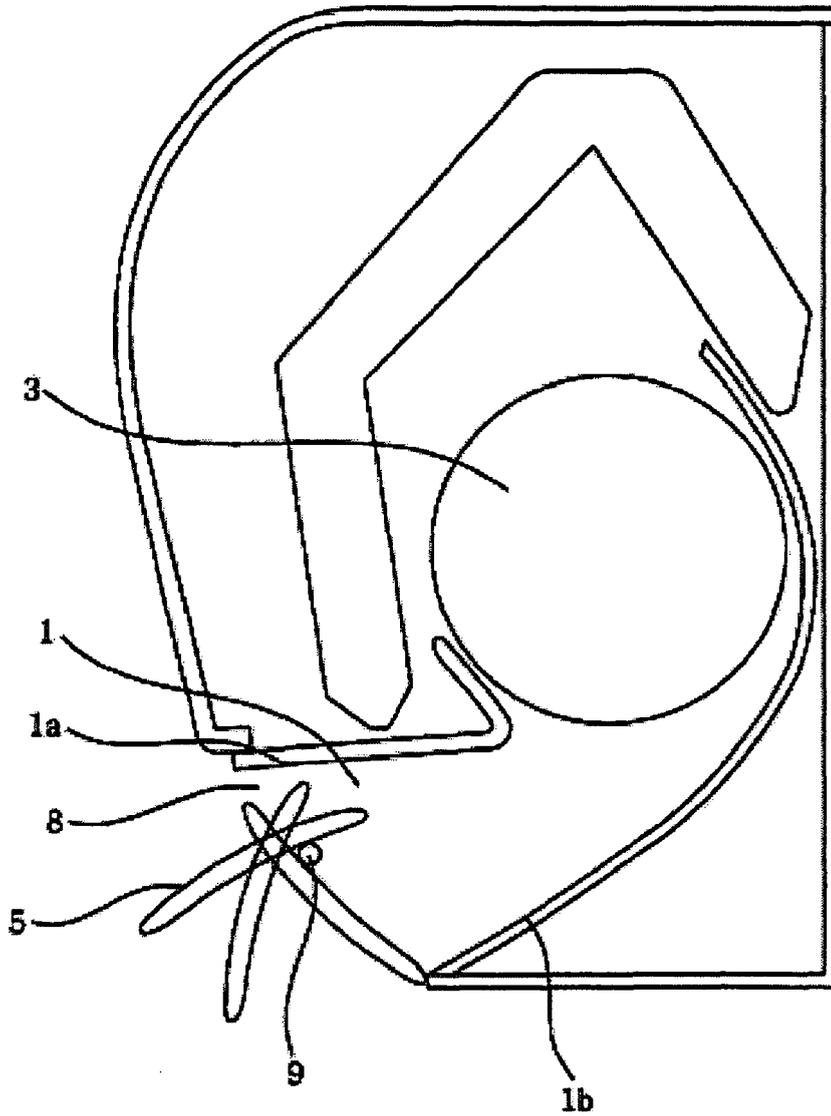


FIG.3
(PRIOR ART)





DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 1 380 797 A (FUJITSU GENERAL LIMITED) 14 January 2004 (2004-01-14) * paragraphs [0032] - [0036], [0069], [0070]; figures 2A,3A *	1-4	F24F1/00
X	PATENT ABSTRACTS OF JAPAN vol. 1997, no. 07, 31 July 1997 (1997-07-31) & JP 09 060960 A (FUJITSU GENERAL LTD), 4 March 1997 (1997-03-04) * abstract *	1-7	
X	PATENT ABSTRACTS OF JAPAN vol. 1998, no. 05, 30 April 1998 (1998-04-30) & JP 10 009658 A (TOSHIBA CORP), 16 January 1998 (1998-01-16) * abstract *	1-7	
X	PATENT ABSTRACTS OF JAPAN vol. 2003, no. 12, 5 December 2003 (2003-12-05) & JP 2004 144325 A (CORONA CORP), 20 May 2004 (2004-05-20) * abstract *	1-4	
			TECHNICAL FIELDS SEARCHED (IPC)
			F24F
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
Munich		3 April 2006	Lienhard, D
CATEGORY OF CITED DOCUMENTS			
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1 EPO FORM 1503 03.02 (P04C01)

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

EP 05 02 8070

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
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03-04-2006

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 1380797 A	14-01-2004	AU 2003212017 A1	29-01-2004
		CN 1506626 A	23-06-2004
		JP 2004044929 A	12-02-2004
		US 2004007002 A1	15-01-2004

JP 09060960 A	04-03-1997	NONE	

JP 10009658 A	16-01-1998	JP 3171786 B2	04-06-2001
		KR 251812 B1	15-04-2000

JP 2004144325 A	20-05-2004	NONE	
