

(19)



(11)

EP 2 336 569 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:

22.06.2011 Bulletin 2011/25

(51) Int Cl.:

F04D 25/06 ^(2006.01)**F04D 25/08** ^(2006.01)**F04D 29/32** ^(2006.01)**F04D 29/54** ^(2006.01)**F04D 29/66** ^(2006.01)(21) Application number: **10163729.6**(22) Date of filing: **25.05.2010**

(84) Designated Contracting States:

**AL 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 SM TR**

Designated Extension States:

BA ME RS(30) Priority: **18.12.2009 TW 098143619**(71) Applicant: **Yen Sun Technology Corp.****Renwu Township****Kao hsiung 814 (TW)**

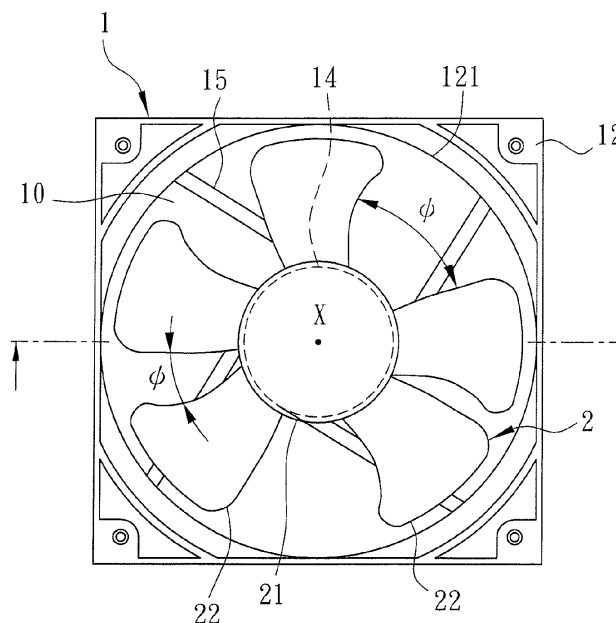
(72) Inventors:

- **Chen, Chien-Jung**
814, Kaohsiung County (TW)
- **Hsu, Chih-Tsung**
814, Kaohsiung County (TW)
- **Wu, Hsin-Hsien**
815, Kaohsiung County (TW)

(74) Representative: **Hübner, Gerd****Rau, Schneck & Hübner****Patentanwälte****Königstrasse 2****90402 Nürnberg (DE)**(54) **Fan device**

(57) A fan device includes: a fan housing (1) configured with a receiving space (10) defined among opposite top and bottom walls (12, 11), and a surrounding side wall (13); and a fan impeller (2) mounted in the receiving space (10), disposed adjacent to an air outlet (121) in the top wall (12) and operable to rotate about a central axis (X) transverse to the top and bottom walls (12, 11)

of the fan housing (1). The fan impeller (2) includes a hub body (21) disposed coaxially with the central axis (X), and a plurality of angularly spaced apart fan blades (22) extending outwardly and radially from the hub body (21). An angular distance (ϕ) between each adjacent pair of the fan blades (22) is different from that of any other adjacent pair of the fan blades (22).

**FIG. 1****EP 2 336 569 A1**

Description

[0001] The invention relates to a fan device, and more particularly to a fan device capable of reducing acoustic noise.

[0002] A conventional fan device includes a fan impeller mounted in a fan housing. The fan impeller includes a hub body, and a plurality of angularly spaced apart fan blades extending outwardly and radially from the hub body. However, in such a configuration, greater acoustic noise occurs during rotation of the fan impeller at a speed within a certain speed range.

[0003] Therefore, an object of the present invention is to provide a fan device that can overcome the aforesaid drawback of the prior art.

[0004] According to the present invention, a fan device comprises:

a fan housing configured with a receiving space, and having a bottom wall formed with an air inlet in spatial communication with the receiving space, a top wall formed with an air outlet in spatial communication with the receiving space, and a surrounding side wall transverse to and interconnecting the top and bottom walls, and cooperating with the top and bottom walls to define the receiving space thereamong; and a fan impeller mounted in the receiving space in the fan housing, disposed adjacent to the air outlet in the top wall of the fan housing, and operable to rotate about a central axis that is transverse to the top and bottom walls of the fan housing, the fan impeller including a hub body disposed coaxially with the central axis, and a plurality of angularly spaced apart fan blades extending outwardly and radially from the hub body, an angular distance between each adjacent pair of the fan blades being different from that of any other adjacent pair of the fan blades.

[0005] Other features and advantages of the present invention will become apparent in the following detailed description of the preferred embodiments with reference to the accompanying drawings, of which:

Figure 1 is a schematic top view showing the first preferred embodiment of a fan device according to the present invention;

Figure 2 is a schematic sectional view of the first preferred embodiment taken along line II-II in Figure 1;

Figure 3 is a schematic bottom view showing the second preferred embodiment of a fan device according to the present invention;

Figure 4 is a perspective view showing the second preferred embodiment without a fan impeller;

Figure 5 is a partly schematic sectional view showing the second preferred embodiment;

Figure 6 is a schematic top view showing the third preferred embodiment of a fan device according to

the present invention without a fan impeller; and Figure 7 is a schematic top view showing a variation of the third preferred embodiment.

[0006] Before the present invention is described in greater detail, it should be noted that like elements are denoted by the same reference numerals throughout the disclosure.

[0007] Referring to Figures 1 and 2, the first preferred embodiment of a fan device according to the present invention is shown to include a fan housing 1, and a fan impeller 2.

[0008] The fan housing 1 is configured with a receiving space 10, and has a bottom wall 11, a top wall 12 and a surrounding side wall 13. The bottom wall 11 is formed with an air inlet 111 in spatial communication with the receiving space 10. The top wall 12 is formed with an air outlet 121 in spatial communication with the receiving space 10. The surrounding side wall 13 is transverse to and interconnects the top and bottom walls 12, 11, and cooperates with the top and bottom walls 12, 11 to define the receiving space 10 thereamong. In this embodiment, the fan housing 1 further includes a connecting member 14 and a plurality of connecting ribs 15. The connecting member 14 is placed in the receiving space 10, and is disposed adjacent to the air inlet 111. The connecting ribs 15 interconnect the connecting member 14 and the surrounding side wall 131.

[0009] The fan impeller 2 is mounted in the receiving space 10 in the fan housing 1, is disposed adjacent to the air outlet 121 in the top wall 12 of the fan housing 1, and is operable to rotate about a central axis (X) that is transverse to the top and bottom walls 12, 11. The fan impeller 2 includes a hub body 21, and a plurality of fan blades 22 extending outwardly and radially from the hub body 21. It is noted that an angular distance ($\emptyset$) between each adjacent pair of the fan blades 22 is different from that of any other adjacent pair of the fan blades 22. An air passage is formed between each adjacent pair of the fan blades 22.

[0010] In use, rotation of the fan impeller 2 draws air to flow from the air inlet 111 toward the air outlet 121 through the air passages, as indicated by solid-line arrows in Figure 2.

[0011] Since the angular distances ($\emptyset$) are different from each other, noise with different frequencies occurs when air flows through the air passages, thereby avoiding accumulation of noise with the same frequency. According to experimental measurement results, acoustic noise about 25.1dB caused by the fan device of the present invention during operation is less than that (about 45.9dB) of the conventional fan device with angularly equidistant fan blades. Therefore, the fan device of the present invention can be operated with reduced acoustic noise.

[0012] Figures 3 to 5 illustrate the second preferred embodiment of a fan device according to this invention, which is a modification of the first preferred embodiment.

As composed to the first preferred embodiment, the connecting member 14 and the connecting ribs 15 are dispensed with. Furthermore, the fan device further includes an air-guiding unit 3.

[0013] The air-guiding unit 3 is mounted fixedly in the receiving space 10 in the fan housing 1, and is disposed adjacent to the air inlet 111 in the bottom wall 11 of the fan housing 1. The air-guiding unit 3 includes a center connecting member 31 disposed coaxially with the central axis (X), and a plurality of air-guiding blades 32 angularly spaced apart from each other and interconnecting the central connecting member 31 and the surrounding side wall 13 of the fan housing 1. An angular distance (θ) between each adjacent pair of the air-guiding blades 32 is different from that of any other adjacent pair of the air-guiding blades 32. In this embodiment, the center connecting member 31 includes a circular cap body 312, and a tube body 311 extending integrally from the cap body 312 toward the hub body 21 and disposed coaxially with the central axis (X).

[0014] When the fan impeller 2 is driven to rotate, air flowing from the air inlet 111 is guided by the air-guiding blades 32, and then flows toward the air outlet 121 through the air passages, as indicated by solid-line arrows in Figure 5. Therefore, due to the presence of the air-guiding unit 3, air pressure produced by the fan device can be enhanced. Furthermore, since the angular distances (θ) are different from each other, acoustic noise caused by the fan device can be further reduced.

[0015] Figure 6 illustrates the third preferred embodiment of a fan device according to this invention, which is a modification of the second preferred embodiment. As compared to the second preferred embodiment, the air-guiding unit 3' further includes a plurality of auxiliary air-guiding blades 33 extending inwardly and radially from the surrounding side wall 13 of the fan housing 1 toward the central connecting member 31. Each auxiliary air-guiding blade 33 is disposed between a corresponding adjacent pair of the air-guiding blades 32, and is spaced apart from the corresponding adjacent pair of the air-guiding blades 32 and the central connecting member 31. In this embodiment, the auxiliary air-guiding blades 33 have the same length. Figure 7 illustrates a variation of the third preferred embodiment, wherein each of the auxiliary air-guiding blades 33 of the air-guiding unit 3' has a length different from that of any other one of the auxiliary air-guiding blades 33.

Claims

1. A fan device characterized by:

a fan housing (1) configured with a receiving space (10), and having a bottom wall (11) formed with an air inlet (111) in spatial communication with said receiving space (10), a top wall (12) formed with an air outlet (121) in spatial

communication with said receiving space (10), and a surrounding side wall (13) transverse to and interconnecting said top and bottom walls (12, 11), and cooperating with said top and bottom walls (12, 11) to define said receiving space (10) thereamong; and

a fan impeller (2) mounted in said receiving space (10) in said fan housing (1), disposed adjacent to said air outlet (121) in said top wall (12) of said fan housing (1), and operable to rotate about a central axis (X) that is transverse to said top and bottom walls (12, 11) of said fan housing (1), said fan impeller (2) including a hub body (21) disposed coaxially with the central axis (X), and a plurality of angularly spaced apart fan blades (22) extending outwardly and radially from said hub body (21), an angular distance (ϕ) between each adjacent pair of said fan blades (22) being different from that of any other adjacent pair of said fan blades (22).

2. The fan device as claimed in Claim 1, further characterized by an air-guiding unit (3) mounted fixedly in said receiving space (10) in said fan housing (1) and disposed adjacent to said air inlet (111) in said bottom wall (11) of said fan housing (1), said air-guiding unit (3) including a center connecting member (31) disposed coaxially with the central axis (X), and a plurality of air-guiding blades (32) angularly spaced apart from each other and interconnecting said central connecting member (31) and said surrounding side wall (13) of said fan housing (1), an angular distance (θ) between each adjacent pair of said air-guiding blades (32) being different from that of any other adjacent pair of said air-guiding blades (32).

3. The fan device as claimed in Claim 2, further characterized in that said air-guiding unit (3) further includes a plurality of auxiliary air-guiding blades (33) extending inwardly and radially from said surrounding side wall (13) of said fan housing (1) toward said central connecting member (31), each of said auxiliary air-guiding blades (33) being disposed between a corresponding adjacent pair of said air-guiding blades (32) and being spaced apart from the corresponding adjacent pair of said air-guiding blades (32) and said central connecting member (31).

4. The fan device as claimed in Claim 3, further characterized in that said auxiliary air-guiding blades (22) of said air-guiding unit (3') have the same length.

5. The fan device as claimed in Claim 3, further characterized in that each of said auxiliary air-guiding blades (33) of said air-guiding unit (3') has a length different from that of any other one of said auxiliary

air-guiding blades (32).

5

10

15

20

25

30

35

40

45

50

55

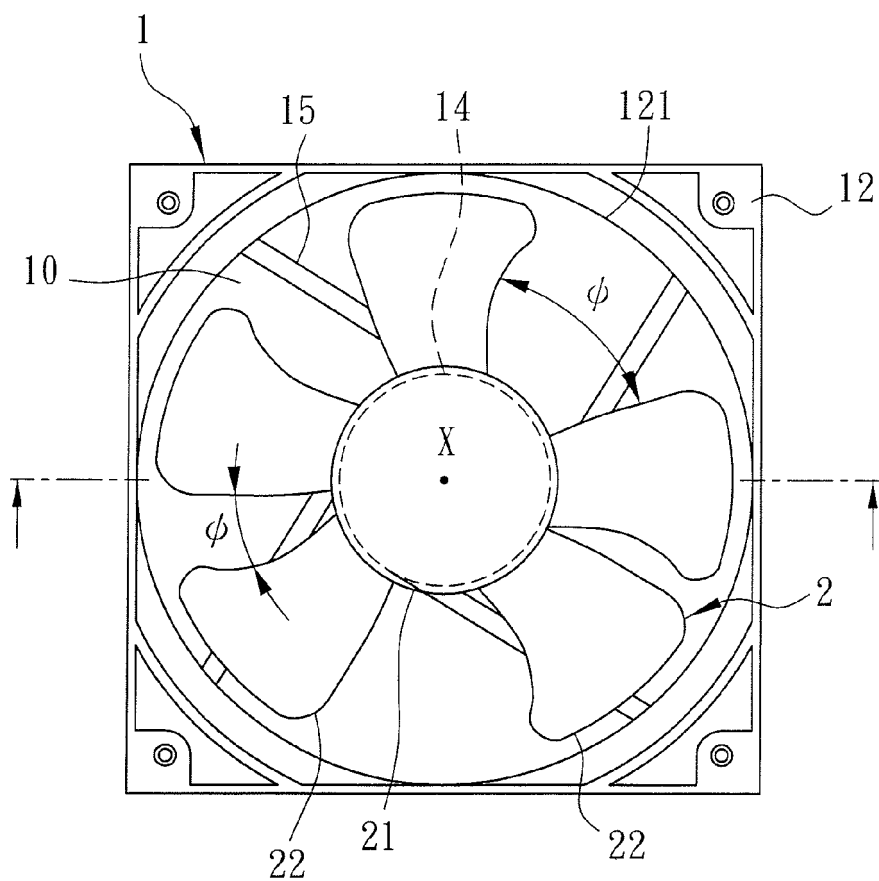


FIG. 1

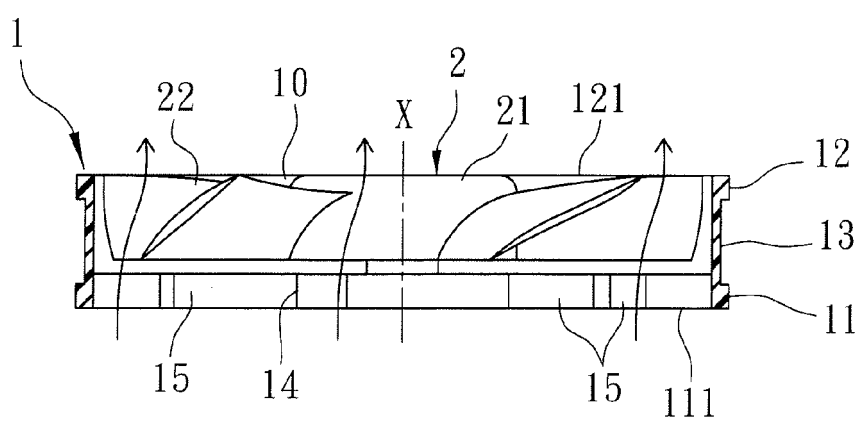


FIG. 2

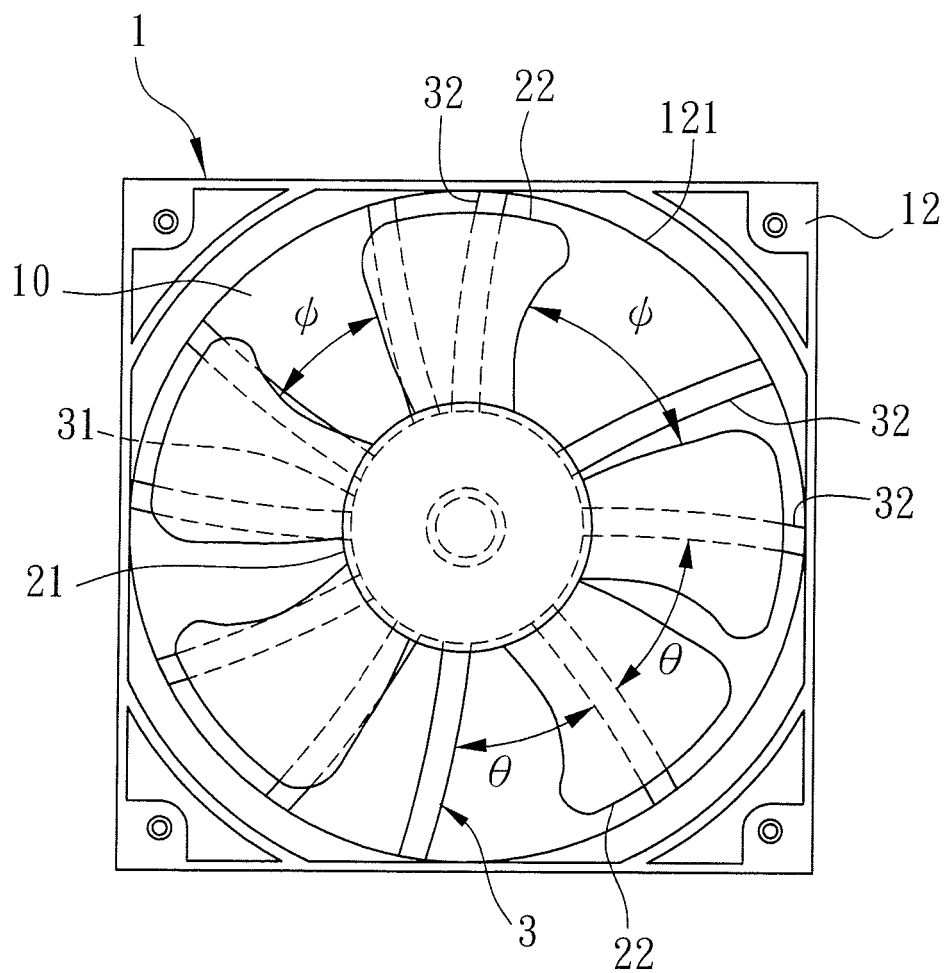


FIG. 3

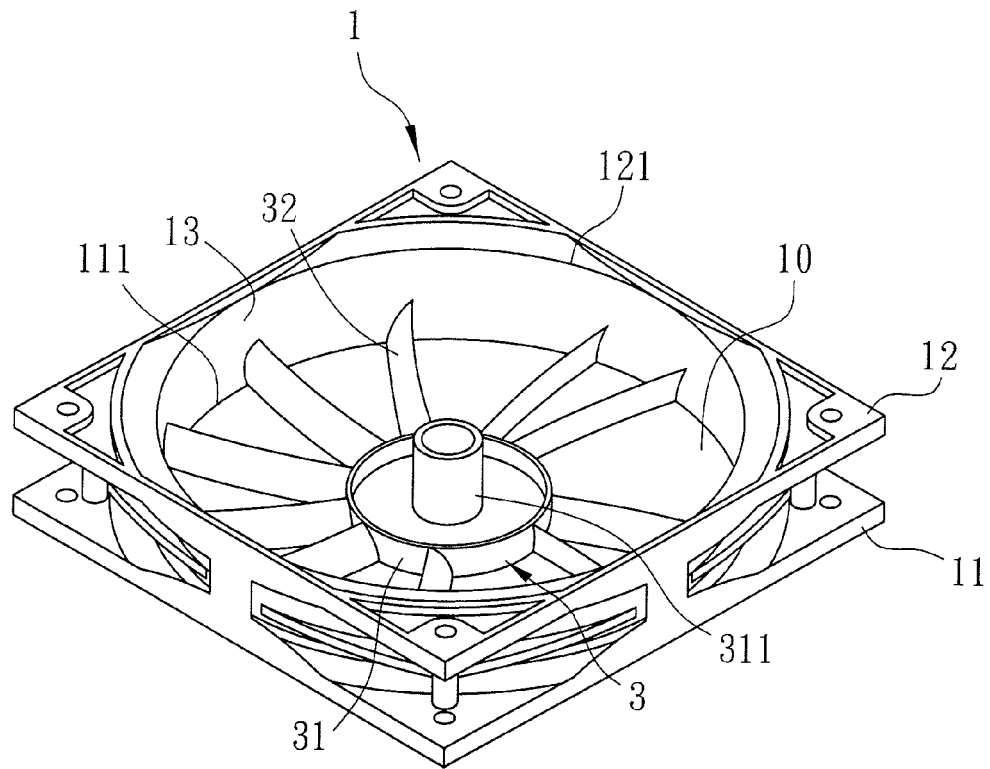


FIG. 4

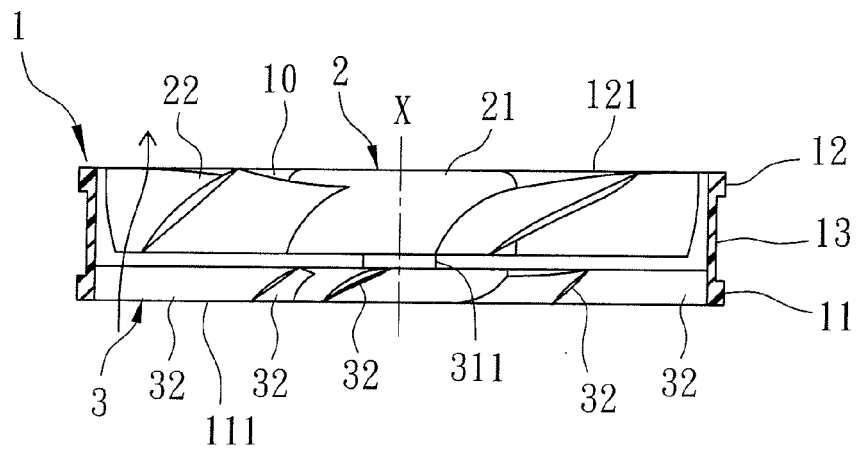


FIG. 5

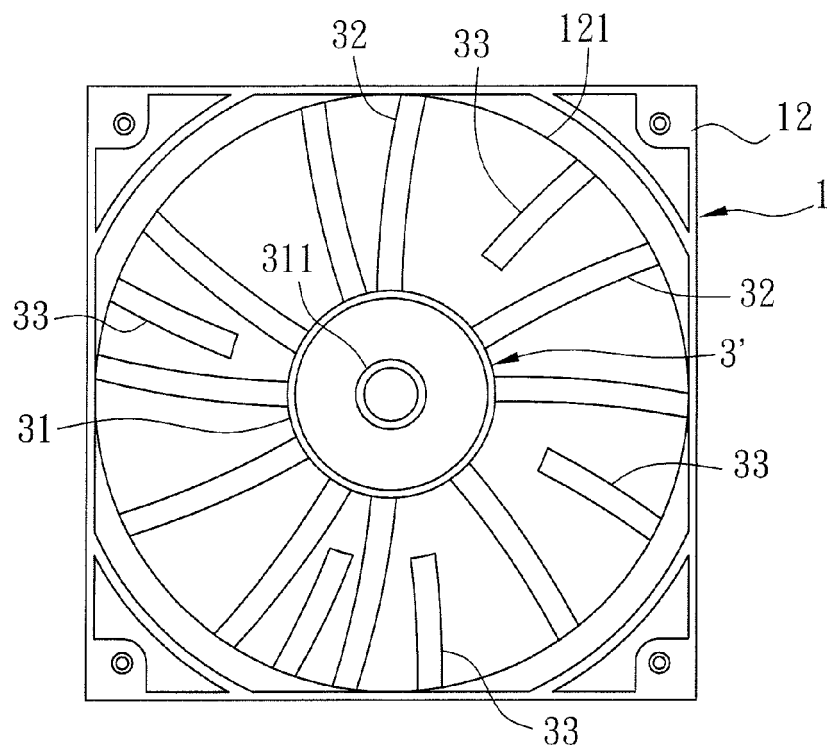


FIG. 6

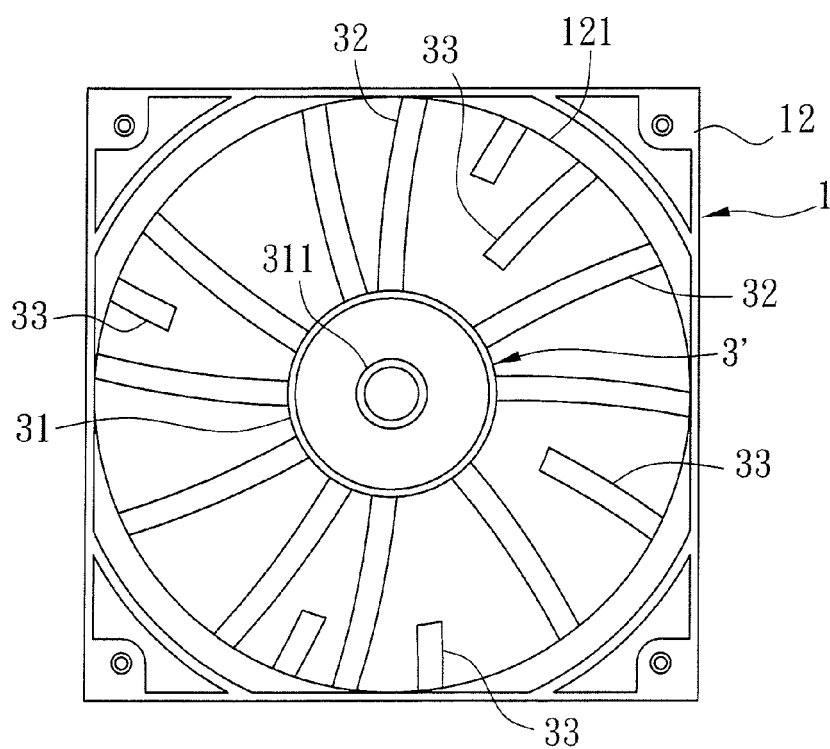


FIG. 7



EUROPEAN SEARCH REPORT

Application Number
EP 10 16 3729

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	US 2002/182053 A1 (MIYAZAWA ATSUSHI [JP]) 5 December 2002 (2002-12-05)	1	INV. F04D25/06
Y	* paragraphs [0002], [0100] - [0102]; figures 4,5,10; table 1 *	2-5	F04D25/08 F04D29/32 F04D29/54 F04D29/66
X	US 2008/101936 A1 (LEE JEONG-HAN [KR] ET AL) 1 May 2008 (2008-05-01) * paragraphs [0009], [0024] - [0031]; figures 1,10; table 1 *	1	
X	GB 2 038 426 A (FORD MOTOR CO) 23 July 1980 (1980-07-23) * page 1, lines 68-85; figure 1 *	1	
X	JP 56 085594 A (MATSUSHITA SEIKO KK) 11 July 1981 (1981-07-11) * abstract; figure 2 *	1	
Y	JP 2008 303778 A (NIHON DENSAN KK) 18 December 2008 (2008-12-18) * abstract; figure 13 *	2	
Y	JP 49 024005 B (UNKNOWN) 20 June 1974 (1974-06-20) * figures 1,2 *	2	TECHNICAL FIELDS SEARCHED (IPC) F04D H05K
Y	ANONYMOUS: "Stille Brise - Richtige Auslegung geraeuscharmer Geraetelueftungen" F & M MECHATRONIK, CARL HANSER VERLAG, MUNCHEN, DE, vol. 112, 1 October 2004 (2004-10-01), pages 20-22, XP009137935 ISSN: 1619-0424 * page 21, right-hand column *	2	
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 26 August 2010	Examiner Homan, Peter
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			

1
EPO FORM 1503 03.82 (P04C01)



EUROPEAN SEARCH REPORT

Application Number
EP 10 16 3729

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	DE 10 2005 023868 B3 (MINEBEA CO LTD [JP]) 20 July 2006 (2006-07-20) * paragraphs [0007], [0038]; figures 7,9 *	2	
Y	----- US 2007/048129 A1 (CHANG PEI-YU [TW] ET AL) 1 March 2007 (2007-03-01) * paragraphs [0005], [0015] - [0016], [0018]; figures 3,5 *	3-5	
A	----- US 2006/257254 A1 (HO SHIH-HUA [TW] ET AL) 16 November 2006 (2006-11-16) * figures 1A, 1B, 2A *	1-5	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
Place of search		Date of completion of the search	Examiner
Munich		26 August 2010	Homan, Peter
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			

1
EPO FORM 1503 03.82 (P04C01)

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

EP 10 16 3729

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.

26-08-2010

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2002182053 A1	05-12-2002	JP 4075264 B2	16-04-2008
		JP 2001214894 A	10-08-2001
US 2008101936 A1	01-05-2008	CN 101173674 A	07-05-2008
		DE 102006061122 A1	08-05-2008
		JP 2008115845 A	22-05-2008
		KR 20080039599 A	07-05-2008
GB 2038426 A	23-07-1980	DE 2945223 A1	12-06-1980
		DE 7931621 U1	19-06-1980
		JP 55078197 A	12-06-1980
JP 56085594 A	11-07-1981	NONE	
JP 2008303778 A	18-12-2008	NONE	
JP 49024005 B	20-06-1974	NONE	
DE 102005023868 B3	20-07-2006	NONE	
US 2007048129 A1	01-03-2007	TW 276743 B	21-03-2007
US 2006257254 A1	16-11-2006	DE 102005047861 A1	23-11-2006
		JP 4244388 B2	25-03-2009
		JP 2006316787 A	24-11-2006