



(51) International Patent Classification:
F16C 11/00 (2006.01)

(21) International Application Number:
PCT/CN2010/078088

(22) International Filing Date:
25 October 2010 (25.10.2010)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
200920262270.4 30 December 2009 (30.12.2009) CN

(71) Applicant (for all designated States except US): **BYD COMPANY LIMITED** [CN/CN]; No. 3001, Hengping Road, Pingshan, Longgang, Shenzhen, Guangdong 518118 (CN).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **HE, Luxi** [CN/CN]; No.3001, Hengping Road, Pingshan, Longgang, Shenzhen, Guangdong 518118 (CN). **JIANG, Conghua** [CN/CN]; No.3001, Hengping Road, Pingshan, Longgang, Shenzhen, Guangdong 518118 (CN). **LUO, Genxiang** [CN/CN]; No.3001, Hengping Road, Pingshan, Longgang, Shenzhen, Guangdong 518118 (CN).

(74) Agent: **TSINGYIHUA INTELLECTUAL PROPERTY LLC**; Room 301, Trade Building, Zhaolanyuan, Tsinghua University, Haidian, Beijing 100084 (CN).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— with international search report (Art. 21(3))

(54) Title: ROTATING SHAFT DEVICE AND LAPTOP COMPUTER DEVICE COMPRISING THE SAME

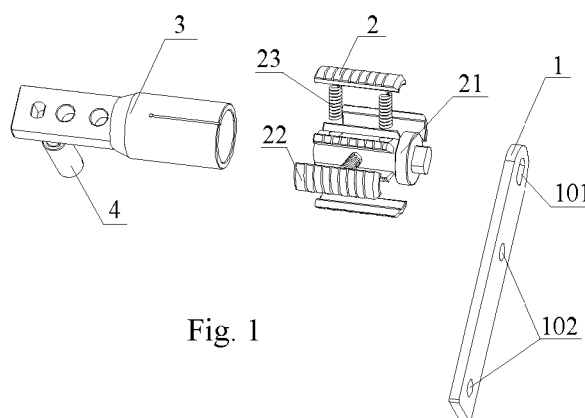


Fig. 1

(57) Abstract: A rotating shaft device is provided, which may comprise a male shaft member (2) and a female shaft member (3) fitted over the male shaft member. The male shaft member may comprise: a male shaft portion (21), at least two positioning portions (2101) axially formed on an external surface of the male shaft portion with a blade (22) having an arc-shaped outer surface (2201) fitted between two abutted position portions and an elastic element (23) radially disposed between the male shaft portion and the blade. A laptop computer device comprising the rotating shaft device is also provided.

ROTATING SHAFT DEVICE AND LAPTOP COMPUTER DEVICE COMPRISING THE SAME

CROSS-REFERENCE TO RELATED APPLICATION

5 This application claims priority to, and benefits of Chinese Patent Application No. 200920262270.4 filed with State Intellectual Property Office, P. R. C. on December 30th, 2009, the entire content of which is incorporated herein by reference.

FIELD

10 The present disclosure relates to a pivoting mechanism, more particularly to improvement of a clapping type rotating shaft device and a laptop computer device comprising the same.

BACKGROUND

15 A rotating shaft is usually inserted between rotating parts of a folded device to facilitate opening and/or closing of the folded device. Clapping type rotating shaft devices are widely used in devices which is foldable for lower manufacturing cost.

The clapping type rotating shaft device generally includes a female shaft member and a male shaft member, where the male shaft member comprises a first connecting portion and a rotating portion, and the female shaft portion comprises a second connecting portion and a sleeve portion.
20 The rotating portion of the male shaft member may be rotatably connected with the sleeve portion of the female shaft member, the second connecting portion of the female shaft member may be connected with a first rotating part such as a base of a notebook, and the first connecting portion of the male shaft member may be connected with a second rotating part such as an upper cover of the notebook. Thus, the first rotating part may rotate in an axial direction of the sleeve portion, so
25 that the device is foldable due to the two rotating parts thus connected.

As for a conventional clapping type rotating shaft device, a torque is provided substantially by surface friction force between the rotating portion and the sleeve portion. The surface friction force therebetween may be determined by the changing fitting condition between the rotating portion and the sleeve portion. Once the friction surface is worn, there may be a fitting deficiency
30 between the rotating portion and the sleeve portion. And the friction force and the torque thereof may be reduced to a great extent, which may seriously affect the performance and the life span of the rotating shaft device.

SUMMARY

35 In viewing thereof, the present disclosure is directed to solve at least one of the problems existing in the prior art. Accordingly, a rotating shaft device with enhanced dimension tolerance

performance and a laptop computer device comprising the same may be needed to be provided.

According to an aspect of the present disclosure, a rotating shaft device may be provided, which may comprise a male shaft member and a female shaft member fitted over the male shaft member. The male shaft member may comprise: a male shaft portion; at least two positioning portions axially formed on an external surface of the male shaft portion with a blade having an arc-shaped outer surface fitted between two abutted positioning portions and an elastic element radially disposed between the male shaft portion and the blade.

According to an embodiment of the present disclosure, at least one fixing hole may be formed on the external surface of the male shaft portion between two abutted positioning portions for fixing an end of the elastic element.

According to an embodiment of the present disclosure, the male shaft portion may have an end formed with a positioning flange abutted on a free end of the female shaft member.

According to a further embodiment of the present disclosure, there may be four positioning portions distributed evenly in a circumferential direction of the male shaft portion.

According to an embodiment of the present disclosure, the blade may have a thickness larger than a height of the positioning portion in a radial direction of the male shaft portion.

According to an embodiment of the present disclosure, the female shaft member may comprise: a sleeve portion formed with an axial slot; and a first connecting portion connected with the sleeve portion.

According to an embodiment of the present disclosure, at least an oil reserving groove may be circumferentially formed on the outer surfaces of the blade and the positioning portions.

According to an embodiment of the present disclosure, the elastic element may be a disk spring or a screw spring.

According to another embodiment of the present disclosure, the rotating shaft device may further comprise a first bracket perpendicularly mated at the end of the male shaft portion where the positioning flange is formed.

According to yet another embodiment of the present disclosure, the rotating shaft device may further comprise a second bracket perpendicularly connected with the first connecting portion.

According to another aspect of the present disclosure, a laptop computer device comprising the rotating shaft device described above may also be provided.

According to some embodiments of the present disclosure, an elastic element may be radially fitted in the rotating shaft device, which may improve the mechanical properties of the rotating shaft device. In this way, not only requirements for dimensions and tolerances of assembling the male and female shaft members may be decreased, but also the fitting between the male and female shaft members may be adjusted automatically when the friction surface is worn between the male and the female shaft members. Therefore, the torsion may be compensated due to the

elasticity of the elastic element. Thus, the performance and the life span of the rotating shaft device may be increased.

Additional aspects and advantages of the embodiments of the present disclosure will be given in part in the following descriptions, become apparent in part from the following descriptions, or be learned from the practice of the embodiments of the present disclosure.

BRIEF DISCRIPTION OF THE DRAWINGS

These and other aspects and advantages of the present disclosure will become apparent and more readily appreciated from the following descriptions taken in conjunction with the drawings in which:

Fig. 1 is an exploded perspective view of a rotating shaft device according to an embodiment of the present disclosure;

Fig. 2 is a perspective view of a male shaft portion according to an embodiment of the present disclosure;

Fig. 3 is a perspective view of a blade according to an embodiment of the present disclosure;

Fig. 4 is a perspective view of a female shaft member according to an embodiment of the present disclosure;

Fig. 5 is a perspective view of an assembled male shaft member according to an embodiment of the present disclosure; and

Fig. 6 is a perspective view of an assembled rotating shaft device according to an embodiment of the present disclosure.

DETAILED DISCRIPTION OF THE EMBODIMENTS

Reference will be made in detail to embodiments of the present disclosure. The embodiments described herein are explanatory, illustrative, and used to generally understand the present disclosure. The embodiments shall not be construed to limit the present disclosure. The same or similar elements and the elements having same or similar functions are denoted by like reference numerals throughout the descriptions.

According to an embodiment of the present disclosure, a rotating shaft device is disclosed. The rotating shaft device may be a clapping type one. As shown in Figs. 1-4, the rotating shaft device may comprise: a first bracket 1; a male shaft member 2; a female shaft member 3; and a second bracket 4. At least an oil reserving groove 5 may be formed on the male shaft member 2, and lubricant or lubricating oil may be coated therein to improve the contact friction condition between the male shaft member 2 and the female shaft member 3.

The first bracket 1 may have a first connecting hole 101 and at least one second connecting hole 102. The first bracket 1 may be integrated with a second connecting portion 2104 of a male

shaft portion 21 via the first connecting hole 101, and the first bracket 1 may be fixed to a first rotating part such as an upper cover of a notebook via the second connecting hole 102.

The male shaft member 2 may be cylindrical, which may comprise: a male shaft portion 21; a blade 22; and an elastic element 23. The male shaft member 2 may further have at least an oil
5 reserving groove on an outer surface thereof. The male shaft portion 21 may comprise: a front end 211 and a back end 212; at least two positioning portions 2101; a shaft portion 2102; at least two fixing holes 2103 formed on an outer surface of the shaft portion 2102; and a second connecting portion 2104 and a positioning flange 2105 at the front end 211 of the male shaft portion 21. In
10 some embodiments, as shown in Fig. 2, there are four positioning portions 2101 distributed evenly in a circumferential direction of the male shaft portion 21. In some embodiments, at least an oil reserving groove is circumferentially formed on the outer surfaces of the blade 22 and the positioning portions 2101. In some embodiments, at least one fixing hole 2103 is formed on a
15 surface 2106 of the shaft portion 2102 between two abutted positioning portions 2101 for fixing an end of the elastic element 23. The elastic element 23 may be fitted in the fixing hole 2103, and when the blade is positioned between the two neighboring positioning portions 2101, the elastic element 23 may be in a compressed state. The positioning portions 2101 may be contacted with a
20 side 2203 of the blade 22, while a surface 2106 of the shaft portion 2102 may be contacted with an inner surface 2202 of the blade 22 to ensure that the blade 22 rotates synchronously with the male shaft portion 21 whereas there is no relative movement between the blade 22 and the male shaft portion 21. The positioning flange 2105 may be contacted with a first end surface 2204 of
the blade 22 to prevent the sliding of the blade 22 in an axial direction of the male shaft portion 21. The second connecting portion 2104 may be fastened to the first bracket 1, so that the male shaft portion 21 may rotate synchronously with the first bracket 1.

As shown in Fig. 3, the blade 22 may be a thin sheet with a fan-shaped cross section. The
25 blade 22 may have a thickness not less than the height of the positioning portions 2101 in a radial direction of the male shaft portion 21. Furthermore, the blade 22 may comprise a first end surface 2204, a second end surface 2205, two sides 2203, an outer surface 2201 and an inner surface 2202. In some embodiments, the outer surface 2201 may be arc-shaped. The outer surface 2201 of the
30 blade 22 may be fitted in an inner cylindrical surface 3102 of the sleeve portion 31 of the female shaft member 3, so that the female shaft member 3 and the male shaft member 2 may rotate relative to each other. The inner surface 2202 of the blade 22 may be contacted with the surface 2106 of the shaft portion 2102 of the male shaft portion 21, and two sides 2203 of the blade 22
35 may be contacted with the positioning portions 2101 to achieve the synchronous rotation of the blade 22 and the male shaft portion 21. The first end surface 2204 of the blade 22 may be contacted with the positioning flange 2105, and the shaft portion 2102 of the male shaft portion 21 may not extend out of the second end surface 2205 of the blade 22. In this way, the blade 22 and

the male shaft portion 21 may be positioned in the axial direction of the male shaft portion 21, and may not slide relative to each other.

The elastic element 23 may be, but not limited to, a disc spring or a screw spring, which may be fitted in the fixing hole 2103 of the male shaft portion 21, while an end of the elastic element 23 may be contacted with the inner surface 2202 of the blade 22 to be compressed. In this way, the elastic element 23 may be radially disposed between the male shaft portion 21 and the blade 22.

The female shaft member 3 may comprise: a sleeve portion 31; a first connecting part 32; an axial slot 3101; and a cylindrical hole in the interior of the sleeve portion 31 with an inner cylindrical surface 3102 connected with the outer surface 2201 of the blade 22. The axial slot 3101 may enhance the elasticity of the sleeve portion 31 so as to bring convenience for assembling the rotating shaft device. The first connecting part 32 may comprise a through hole 3201 to be fastened to the second bracket 4, and at least one assembling hole 3202 fastened to a second rotating part such as a base of a notebook via a fastening part. The fastening part may include, but not limited to, a screw or a bolt. In this way, the second bracket 4 may be fastened to the first connecting part 32 of the female shaft member 3 via the through hole 3201, so as to be fastened to a second rotating part such as the base of the notebook.

Referring to Figs. 5 and 6, in the assembled rotating shaft device, the male shaft member 2 may have the following structure. Two sides 2203 of the blade 22 may be contacted with the sides of the positioning portions 2101; the inner surface 2202 of the blade 22 may be contacted with the surface 2106 of the shaft portion 2102 and the elastic element 23, which is in a compressed state; and the second end surface 2205 may be in a plane where the side of the shaft portion 2102 is located, and the first end surface 2204 may be contacted with the positioning flange 2105 of the male shaft portion 21, thus preventing the blade 22 from sliding on the male shaft portion 21. The assembled male shaft member 2 may have a cylindrical shape, as shown in Fig. 5. The outer surface of the male shaft member 2 may include the outer surface 2201 of the blade 22 and a surface 2111 of the positioning portions 2101, and may be contacted with an inner cylindrical surface 3102 of the sleeve portion 31. The female shaft member 3 and the male shaft member 2 may rotate relative to each other with friction therebetween to provide torsion force for the rotating shaft device. In other words, the torsion force of the rotating shaft device may be resulted from the frictional contact between the male shaft member 2 and the female shaft member 3.

During the rotating process, wear may be generated on the contact surface between the female shaft member 3 and the male shaft member 2. Then the elastic element 23 may extend outwards and press the blade 22 by the elastic force contained therein, so that the blade 22 may be always fitted in the inner cylindrical surface 3102 of the sleeve portion 31 by the elastic force of the elastic element 23. In this way, the torsion force compensation may be generated.

The elastic element 23 is fitted in the rotating shaft device, which may improve the mechanical properties of the rotating shaft device as well as the life span thereof. In this way, not only requirements for the size and the tolerance of assembling the male and female shaft members 2, 3 may be decreased, but also the fitting between the male and female shaft members 2, 3 may be adjusted automatically when the surfaces between the male and female shaft members 2, 3 are worn due to the wearing therebetween. Therefore, the torsion may be compensated automatically, and the performance and the life span of the rotating shaft device may be increased accordingly.

Although explanatory embodiments have been shown and described, it would be appreciated by those skilled in the art that changes, alternatives, and modifications may be made in the embodiments without departing from spirit and principles of the disclosure. Such changes, alternatives, and modifications all fall into the scope of the claims and their equivalents.

WHAT IS CLAIMED IS:

1. A rotating shaft device comprising:

a male shaft member comprising:

a male shaft portion;

at least two positioning portions axially formed on an external surface of the male shaft portion with a blade having an arc-shaped outer surface fitted between two abutted positioning portions and an elastic element radially disposed between the male shaft portion and the blade; and

a female shaft member fitted over the male shaft member.

2. The rotating shaft device according to claim 1, wherein at least one fixing hole is formed on the external surface of the male shaft portion between two abutted positioning portions for fixing an end of the elastic element.

3. The rotating shaft device according to claim 1, wherein the male shaft portion has an end formed with a positioning flange abutted on a free end of the female shaft member.

4. The rotating shaft device according to claim 1, wherein there are four positioning portions distributed evenly in a circumferential direction of the male shaft portion.

5. The rotating shaft device according to claim 1, wherein the blade has a thickness larger than a height of the positioning portion in a radial direction of the male shaft portion.

6. The rotating shaft device according to claim 1, wherein the female shaft member comprises:

a sleeve portion formed with an axial slot; and

a first connecting portion connected with the sleeve portion.

7. The rotating shaft device according to claim 1, wherein at least an oil reserving groove is circumferentially formed on the outer surfaces of the blade and the positioning portions.

8. The rotating shaft device according to claim 1, wherein the elastic element is a disk spring or a screw spring.

9. The rotating shaft device according to claim 3, further comprising a first bracket perpendicularly mated at the end of the male shaft portion where the positioning flange is formed.

10. The rotating shaft device according to claim 9, further comprising a second bracket perpendicularly connected with the first connecting portion.

11. A laptop computer device, comprising the rotating shaft device according to claim 1.

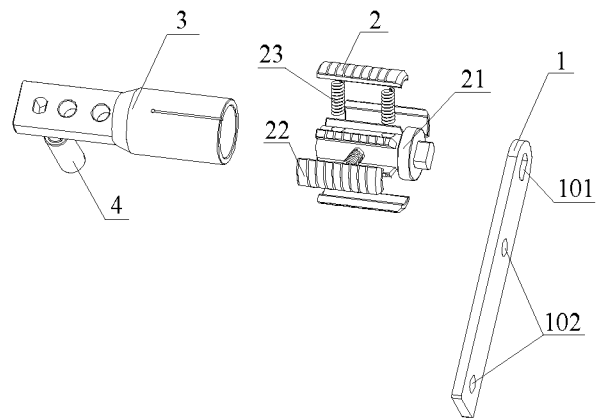


Fig. 1

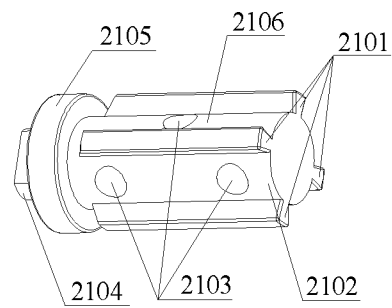


Fig. 2

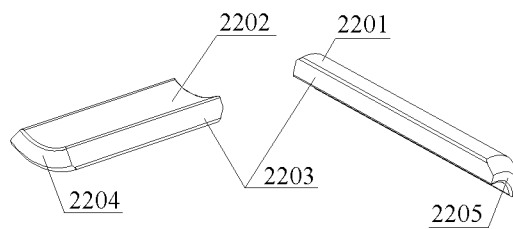


Fig. 3

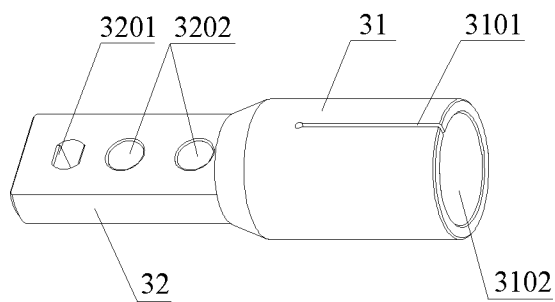


Fig. 4

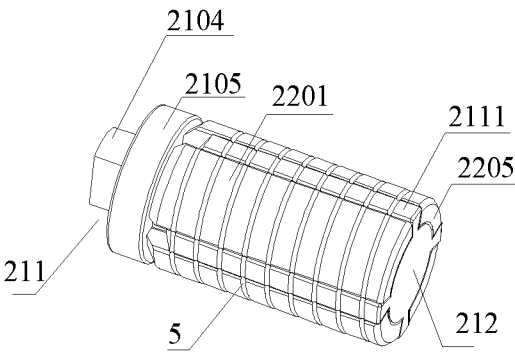


Fig. 5

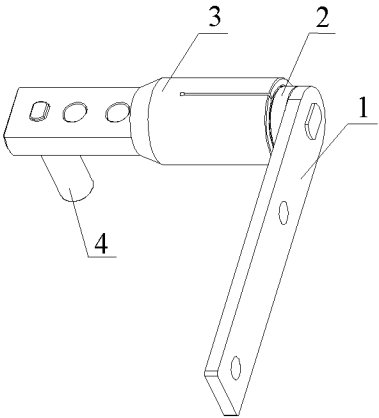


Fig. 6

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2010/078088

A. CLASSIFICATION OF SUBJECT MATTER

F16C11/00 (2006.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: F16C11/-, E05D11/-

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC, WPI, CNPAT, CNKI: ELASTIC+ OR SPRING? OR ELASTIC+, (PROTRUDE??? OR CONVEX??) W (STRIP? OR BAR? OR KEY?), RIB? OR STIFFENER? OR SPLINE?, AXES OR SHAFT OR SPINDLE OR POLE, BLADE? OR PIECE? OR SHEET? OR SLICE? OR FLAKE?

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP2004347122A (MOJI HIDEAKI) 09 Dec. 2004 (09.12.2004) paragraphs 0018-0023; figs.4-5,7	1-11
A	CN1527660A (NIFCO INC) 08 Sep. 2004 (08.09.2004) the whole document	1-11
A	CN201025279Y (CAI, Yongming) 20 Feb. 2008 (20.02.2008) the whole document	1-11
A	CN101205946A (IWASAKI SEIKI CORP) 25 Jun. 2008 (25.06.2008) the whole document	1-11
A	JP2004150498A (KATO ELECTRIC & MACHINERY CO) 27 May 2004 (27.05.2004) the whole document	1-1
A	CN1401058A (SUGATSUNE KOGYO) 05 Mar. 2003 (05.03.2003) the whole document	

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:	“T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
“A” document defining the general state of the art which is not considered to be of particular relevance	“X” document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
“E” earlier application or patent but published on or after the international filing date	“Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
“L” document which may throw doubts on priority claim (S) or which is cited to establish the publication date of another citation or other special reason (as specified)	“&” document member of the same patent family
“O” document referring to an oral disclosure, use, exhibition or other means	
“P” document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search
11 Jan. 2011 (11.01.2011)

Date of mailing of the international search report
27 Jan. 2011 (27.01.2011)

Name and mailing address of the ISA/CN
The State Intellectual Property Office, the P.R.China
6 Xitucheng Rd., Jimen Bridge, Haidian District, Beijing, China
100088
Facsimile No. 86-10-62019451

Authorized officer
WANG Han
Telephone No. (86-10)62085483

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2010/078088

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
JP2004347122A	09.12.2004	JP3819011B2	06.09.2006
CN1527660A	08.09.2004	GB2399140A	08.09.2004
		JP2004270714A	30.09.2004
		US2004181909A1	23.09.2004
		KR20040079822A	16.09.2004
		TW200418302A	16.09.2004
CN201025279Y	20.02.2008	None	
CN101205946A	25.06.2008	KR20080056080A	20.06.2008
		JP2009014195A	22.01.2009
		TW200825302A	16.06.2008
		JP4358880B2	04.11.2009
JP2004150498A	27.05.2004	JP4094932B2	04.06.2008
CN1401058A	05.03.2003	WO0248558A1	20.06.2002
		JP2002181031A	26.06.2002
		EP1251286A1	23.10.2002
		KR20020073541A	26.09.2002
		US2003056325A1	27.03.2003
		TW576075A	11.02.2004
		US6990711B2	31.01.2006
		CN1211591C	20.07.2005
		JP3825627B2	27.09.2006
		KR100786935B	17.12.2007