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(54) Sensor device for determining the angular position of a wash drum of a washing machine

(57) There is described a sensor device (11) for determining the angular position of a wash drum (5) of a washing machine (1), which wash drum is mounted inside a wash tub (4) to rotate about an axis of rotation (A), and has a shaft (16) extending through a wall (6) of the wash tub (4); the shaft (16) being fitted with a pulley (7) rotated about the axis of rotation (A) by an electric motor (10); the sensor device (11) has a permanent magnet (12) generating a magnetic field, a sensor (13) for determining the intensity of the magnetic field, and a band (14) of ferromagnetic material fixed to the pulley (7). The sensor (13) and the permanent magnet (12) being fixed stably to the wall (6) of the wash tub (4) so that both face the same outer peripheral edge (15) of the pulley (7).

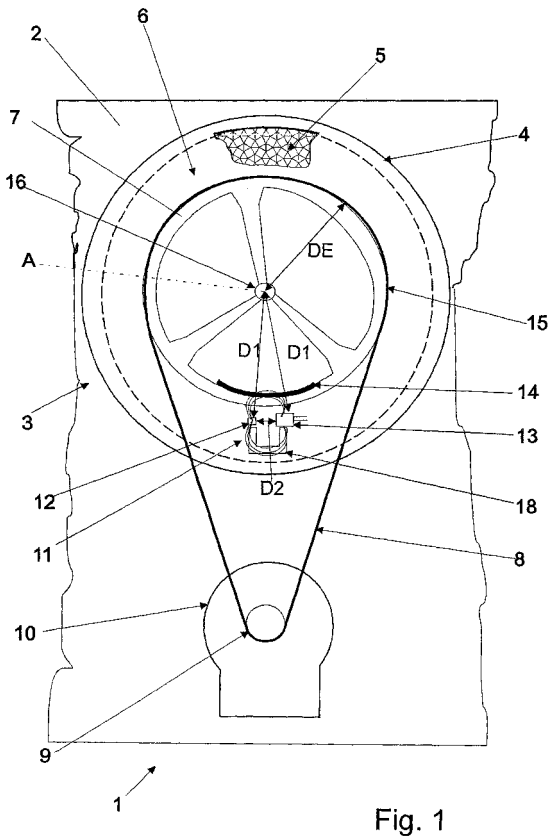

Fig. 1

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Description

[0001] The present invention relates to a sensor device for determining the angular position of a wash drum of a washing machine.

[0002] As is known, certain latest-generation washing machines are fitted with a device for determining the angular position of the wash drum, to enable an electric control system to set the wash drum to a predetermined angular position at the end of the wash cycle.

[0003] More specifically, the wash drum is normally mounted inside a wash tub to rotate about a longitudinal axis, and is rotated by an electric drive unit via an external pulley fitted to the shaft rotating the wash drum.

[0004] Patent Application FR-2784402 describes a device for determining the angular position of a wash drum of a washing machine, and which comprises a magnetic switch device; a permanent magnet; and a strip or band of ferromagnetic material fixed to the wash drum rotation pulley, and which is interposed between the permanent magnet and the magnetic switch device when the wash drum is in a predetermined angular position.

[0005] More specifically, the magnetic switch device comprises an internal switch with two normally-open blades of conducting material, which are brought into contact with each other when subjected to a magnetic field of intensity above a given threshold, and are parted, thus opening the switch, when subjected to a magnetic field of intensity below the threshold.

[0006] The switch device is fixed stably to the rear wall of the wash tub, in such a position as to face the outer peripheral edge of the pulley; the permanent magnet is fixed stably to the rear wall of the wash tub, inwards of the pulley and facing the inner peripheral edge of the pulley, on the opposite side with respect to the magnetic switch; and the band of ferromagnetic material is of predetermined length and fixed to a portion of the pulley.

[0007] As the pulley and the wash drum rotate, the ferromagnetic band is interposed cyclically between the permanent magnet and the switch device, so that the switch closes temporarily whenever the pulley is set to a given angular position. In fact, when interposed between the switch device and the permanent magnet, the ferromagnetic band conducts the field lines towards the switch device, so that the intensity of the field on the switch blades exceeds the predetermined threshold, thus closing the switch.

[0008] The above device has a number of drawbacks, on account of the way in which it is installed on the washing machine. That is, in the event the permanent magnet and the switch device are positioned too far apart, the magnetic field towards the switch device may decrease, thus resulting in failure of the switch device to close when the band is interposed between the switch device and the permanent magnet, and hence in failure to determine the angular position of the wash drum.

[0009] Moreover, the device must be assembled before the pulley is fitted to the wash drum shaft, which obviously complicates both assembly of the washing machine and subsequent servicing of the device itself. In the latter case, in fact, the device can only be removed from the wall of the wash drum after first removing the pulley from the wash drum shaft, which is not only awkward but also a time-consuming job, thus increasing customer service cost.

[0010] It is therefore an object of the present invention to provide a device for determining the angular position of the wash drum of a washing machine, which, besides being cheap to produce and install, is also independent of assembly of the pulley to the washing machine.

[0011] According to the present invention, there is provided a device for determining the angular position of a wash drum of a washing machine, as claimed in the accompanying Claims.

[0012] A non-limiting embodiment of the present invention will be described by way of example with reference to the accompanying drawings, in which:

Figure 1 shows, schematically, a portion of a washing machine fitted with a device for determining the angular position of a wash drum in accordance with the teachings of the present invention, and with the wash drum in a first angular position;

Figure 2 shows, schematically, the Figure 1 washing machine portion, with the wash drum in a second angular position.

[0013] Number 1 in Figure 1 indicates as a whole a washing machine substantially comprising an outer casing 2; and a wash assembly 3, in turn comprising a wash tub 4 housed stably inside outer casing 2, and a laundry wash drum 5 (shown partly in the attached drawings) housed inside wash tub 4.

[0014] Wash drum 5 is mounted inside wash tub 4 to rotate about an axis of rotation A, and has a shaft 16 extending, coaxially with axis of rotation A, through a vertical rear wall 6 of wash tub 4, and projecting partly outwards of wash tub 4.

[0015] The end of shaft 16 projecting from vertical wall 6 of wash tub 4 is fitted with a pulley 7, which is connected by a drive belt 8 to an output shaft 9 of an electric motor 10 for rotating wash drum 5.

[0016] Washing machine 1 also comprises a sensor device 11 for determining the angular position of wash drum 5.

[0017] Sensor device 11 substantially comprises a permanent magnet 12 generating a magnetic field of predetermined intensity; a sensor 13 for determining the intensity of the magnetic field; and a strip or band 14 of ferromagnetic material, which is fixed stably to pulley 7 in a predetermined position related to a given angular position of wash drum 5.

[0018] Unlike known devices, permanent magnet 12 and sensor 13 of sensor device 11 are both fixed stably to wall 6 in a position facing and outwards of the outer peripheral edge 15 of pulley 7.

[0019] More specifically, in the example shown schematically in the attached drawings, permanent magnet 12 and sensor 13 are located on wall 6 at a distance D1, from axis of rotation A, greater than the outside diameter DE of pulley 7, so as to be located completely outwards of pulley 7.

[0020] More specifically, permanent magnet 12 and sensor 13 are located a given distance D2 apart on wall 6, so that both are located completely outwards of the projection of outer peripheral edge 15 of pulley 7 onto wall 6.

[0021] In the example shown, sensor 13 comprises a Hall-effect sensor, which supplies an electric output signal of a current/voltage value proportional to the intensity of the measured magnetic field to which the sensor is subjected; and band 14 has a predetermined length, so as to extend along a circular portion of pulley 7.

[0022] Sensor device 11 also comprises a core 18 of ferromagnetic material, which is fixed stably to wall 6 of wash tub 4, between sensor 13 and permanent magnet 12, and outwards of pulley 7.

[0023] In actual use, when band 14 of ferromagnetic material on pulley 7 is positioned alongside and adjacent to permanent magnet 12 and sensor 13 (as shown in Figure 1), it defines a magnetic circuit which closes the flux lines of the magnetic field generated by permanent magnet 12 on sensor 13, thus increasing the intensity of the field on sensor 13.

[0024] Conversely, when band 14 of ferromagnetic material on pulley 7 is not positioned adjacent to sensor 13 and permanent magnet 12 (as shown in Figure 2), sensor 13 is only subjected to a small portion of the flux lines of the magnetic field generated by magnet 12, which in this case travel through the air surrounding sensor 13.

[0025] By appropriately processing the magnetic field intensity contained in the signal generated by sensor 13, it is therefore possible to determine whether or not band 14 on pulley 7 is positioned facing a fixed angular reference associated with the portion of wall 6 in which sensor device 11 is positioned, and so determine the instant in which pulley 7 and hence wash drum 5 reach a predetermined angular position.

[0026] Sensor device 11 as described above is extremely advantageous : locating sensor 13 and permanent magnet 12 completely outwards of pulley 7 simplifies assembly of sensor device 11 to wall 6, by making assembly of the device completely independent of assembly of pulley 7.

[0027] Moreover, using a Hall-effect sensor, the angular position of the wash drum is determined by processing the variation in the intensity of the magnetic field, a condition which is independent of the distance between permanent magnet 12 and sensor 13.

[0028] Clearly, changes may be made to the angular position sensor device as described and illustrated herein without, however, departing from the scope of the present invention as defined in the accompanying Claims.

Claims

1. A sensor device (11) for determining the angular position of a wash drum (5) of a washing machine (1); said wash drum (5) being mounted inside a wash tub (4) to rotate about an axis of rotation (A), and having a shaft (16) coaxial with said axis of rotation (A) and which extends through a wall (6) of said wash tub (4); said shaft (16) being fitted with a pulley (7) rotated about said axis of rotation (A) by drive means (10); said sensor device (11) comprising a permanent magnet (12) generating a magnetic field, sensor means (13) for determining the intensity of the magnetic field, and a band (14) of ferromagnetic material fixed to said pulley (7) so as to occupy a portion of the pulley (7); and said sensor device (11) being **characterized in that** said sensor means (13) and said permanent magnet (12) are fixed stably to said wall (6) of said wash tub (4) so that both face the same peripheral edge (15) of said pulley (7).

2. A device as claimed in Claim 1, wherein said sensor means (13) and said permanent magnet (12) are fixed stably to said wall (6) of said wash tub (4) outwards of said pulley (7), so that both are positioned facing the outer peripheral edge (15) of the pulley (7).

3. A device as claimed in Claim 1 or 2, wherein said sensor means (13) and said permanent magnet (12) are fixed stably to said wall (6) of said wash tub (4), at a distance (D1), from said axis of rotation (A), greater than the outside diameter (DE) of said pulley (7), so as to be located completely outwards of the pulley (7).

4. A device as claimed in any one of the foregoing Claims, wherein said sensor means (13) and said permanent magnet (12) are located a given distance (D2) apart on said wall (6), so that both are located completely outwards of the projection of the outer peripheral edge (15) of the pulley (7) onto said wall (6).

5. A device as claimed in any one of the foregoing Claims, wherein said sensor means (13) comprise a Hall-effect sensor.

6. A device as claimed in any one of the foregoing Claims, and comprising a core (18) of ferromagnetic material, which is located outwards of said pulley (7), between said sensor means (13) and said permanent magnet (12).

7. A washing machine (1) comprising an outer casing (2) housing a wash tub (4); and a wash drum (5) mounted inside the wash tub (4) to rotate about an axis of rotation (A), and having a shaft (16) coaxial with said axis of rotation (A) and which extends

through a wall (6) of the wash tub (4); the washing machine (1) also comprises a pulley (7) fitted to said shaft (16), and drive means (10) for rotating said pulley (7) about said axis of rotation (A); and said washing machine being **characterized by** comprising a sensor device (11) for determining the angular position of said wash drum (5), as claimed in any one of the foregoing Claims.

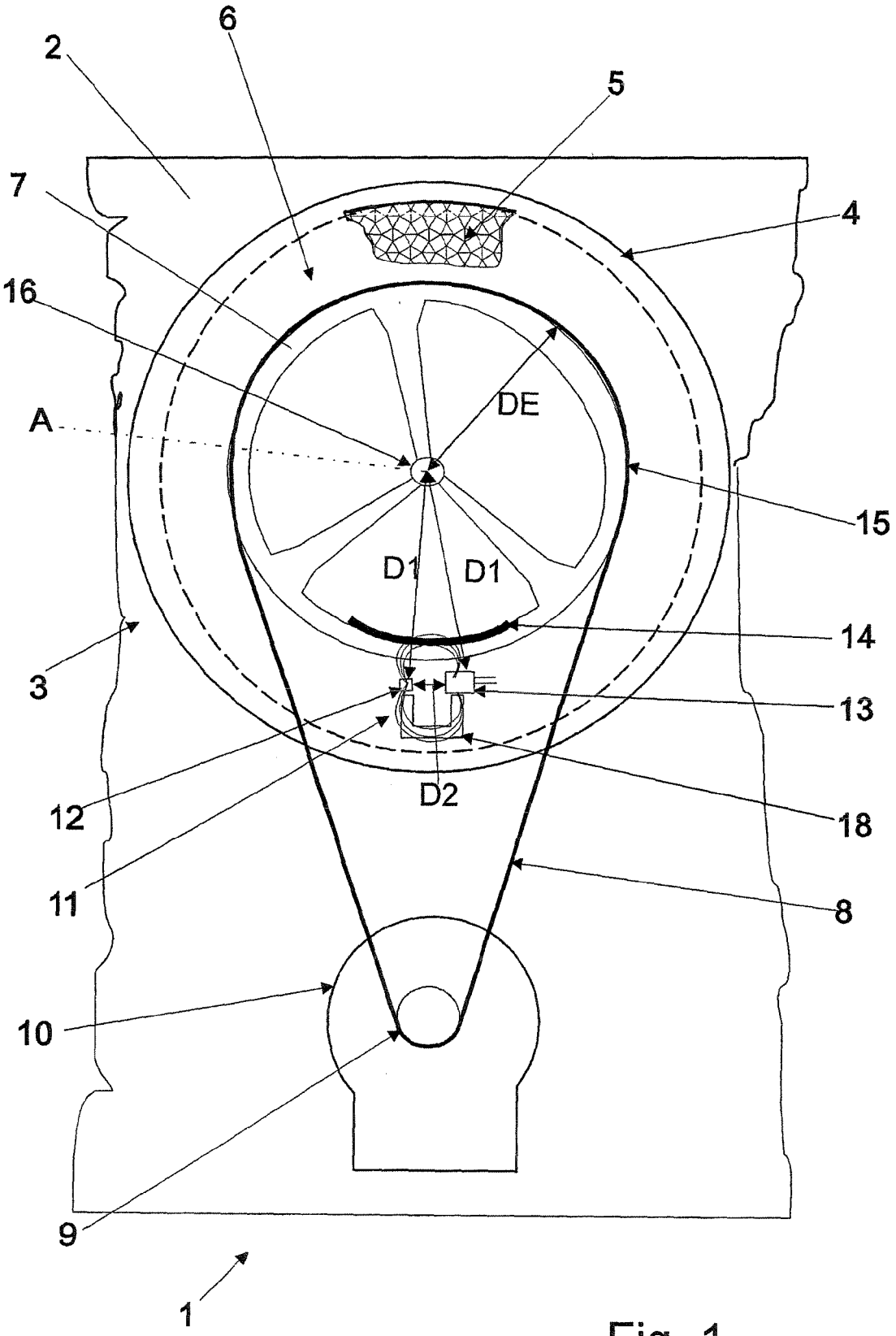

Fig. 1

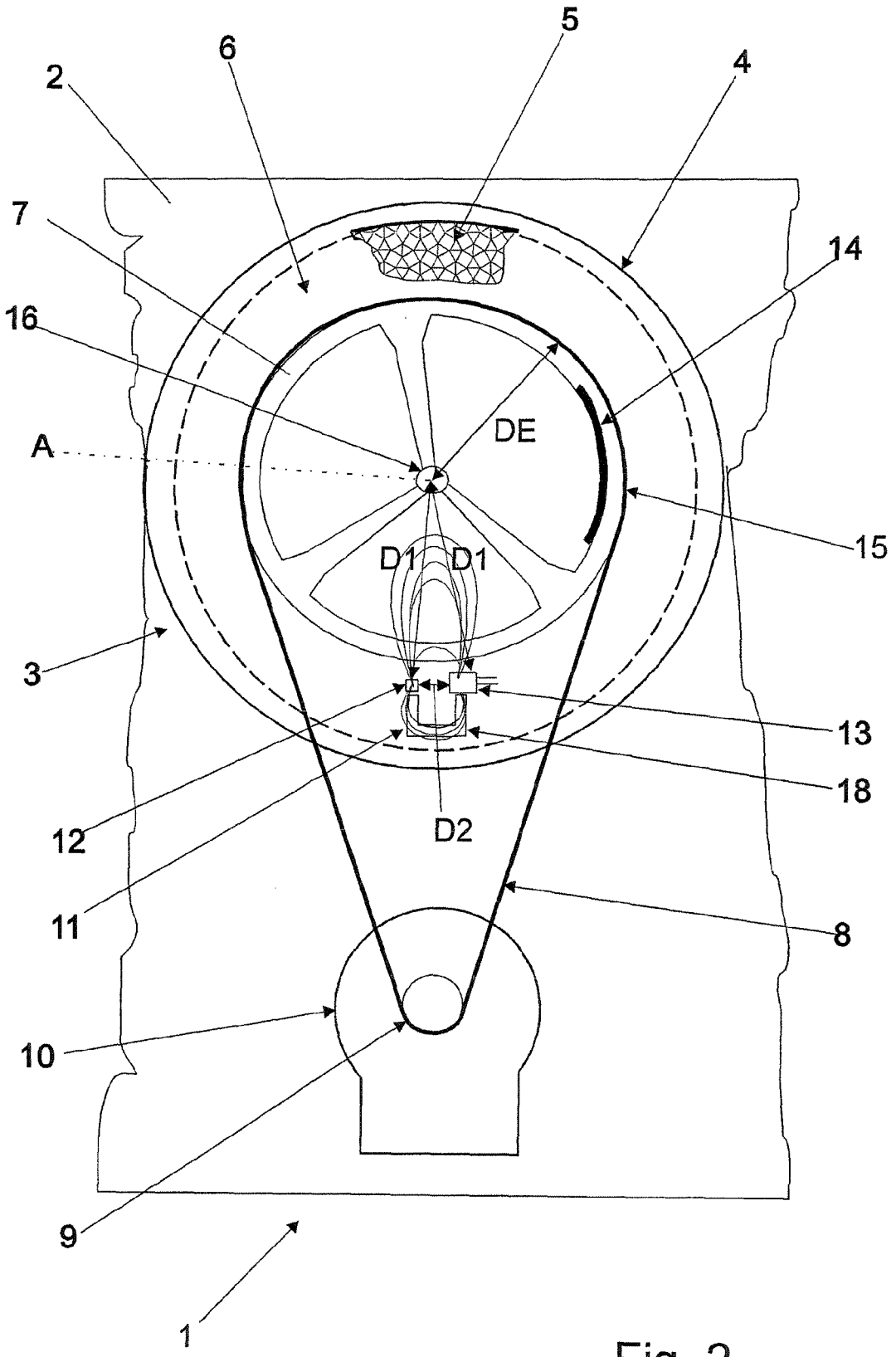

Fig. 2

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 07 10 0256

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A,D	FR 2 784 402 A1 (ELBI INT SPA [IT] ELBI INTERNAT SPA [IT]) 14 April 2000 (2000-04-14) * the whole document *	1-7	INV. D06F37/30
A	FR 2 873 133 A1 (ELECTROLUX HOME PRODUCTS FRANC [FR]) 20 January 2006 (2006-01-20) * the whole document *	1-7	

TECHNICAL FIELDS SEARCHED (IPC)

D06F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	24 May 2007	DIAZ, M

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 07 10 0256

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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24-05-2007

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
FR 2784402 A1	14-04-2000	DE 19948622 A1	04-05-2000
		IT 1303116 B1	30-10-2000
FR 2873133 A1	20-01-2006	NONE	

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

REFERENCES CITED IN THE DESCRIPTION

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