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(54) **LED lamp brightness adjusting circuit connectable to AC power and LED lighting device using the same**

(57) A LED lamp brightness adjusting circuit has a regulating circuit (10), multiple rectification diodes (D1, D2) and filtering capacitors (C1, C2). Each filtering capacitor (C1, C2) is connectable to a LED module in parallel (20, 30). The LED lamp brightness adjusting circuit is connected to an output terminal of a light regulator (102). Based on the control of light regulator (102), the

regulating circuit (10) produces a regulated AC input voltage. The positive and negative half cycles of the regulated AC input voltage are further rectified and filtered to drive different corresponding LED modules (20, 30). Therefore, the amplitude of the drive voltages for the LED modules (20, 30) are controllable to adjust the brightness of the emitted light.

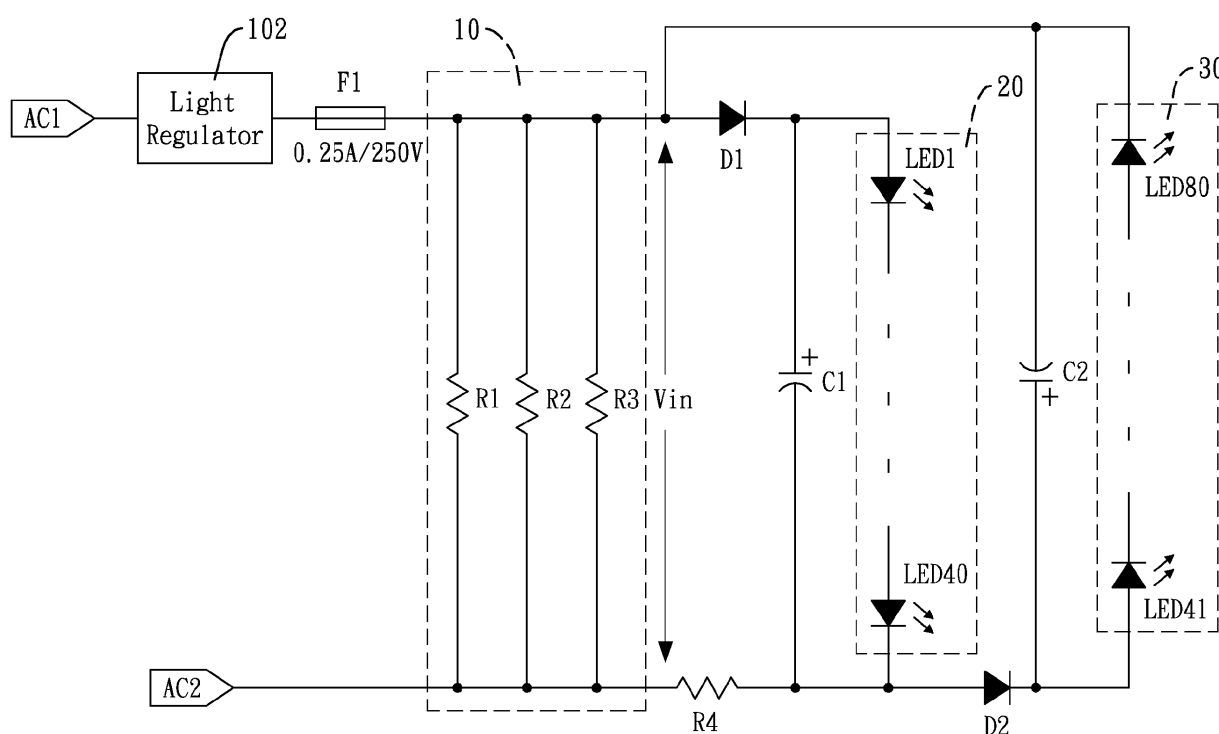


FIG. 1

Description

1. Field of the Invention

[0001] The present invention relates to a LED lamp brightness adjusting circuit connectable to AC power and a LED lighting device using the brightness adjusting circuit, especially to a brightness adjusting circuit that allows a light regulator to alter the brightness of the LED lamp.

2. Description of the Related Art

[0002] Light adjustable lamps are often used to provide comfortable ambiance. With reference to Fig. 2, a conventional light adjustable lamp mainly includes an incandescent lamp (101) and a light regulator (102) connected in series. The light regulator (102) is composed of silicon-controlled elements such as DIAC (diode for alternating current) and TRIAC (triode for alternating current). By changing a triggering voltage applied to the silicon-controlled element, the conduction angle of the silicon-controlled element is adjusted to control the AC voltage across the incandescent lamp (101) and accordingly regulate the brightness of the incandescent lamp (101) to a desired level.

[0003] More and more LED-based lamps are used as lighting equipment and are replacing conventional incandescent lamps for saving energy and reducing power consumption. The LED-based lamps are driven by low DC voltages. However, the light regulator (102) is unable to directly regulate the DC voltage and cannot adjust the brightness of the LED-based lamps. Therefore, users have to use particular regulators to substitute the existed light regulators and almost abandon all original related control circuits.

[0004] To overcome the shortcomings, the present invention provides a LED lamp brightness adjusting circuit connectable to AC power to mitigate or obviate the aforementioned problems.

[0005] The main objective of the invention is to provide a LED lamp brightness adjusting circuit, wherein the brightness adjusting circuit allows a light regulator to change the brightness of the LED lamp.

[0006] To achieve the objective, the LED lamp brightness adjusting circuit includes a regulating circuit, multiple rectification diodes and filtering capacitors. Each filtering capacitor is connectable to a LED module in parallel. The LED lamp brightness adjusting circuit is connected to an output terminal of a light regulator that receives an AC voltage. As the light regulator adjusts the amplitude of the AC voltage, the regulating circuit produces a regulated AC input voltage. The positive and negative half cycles of the regulated AC input voltage are further rectified and filtered to drive different corresponding LED modules. Because the amplitude of the drive voltages for the LED modules are adjustable, the brightness of the emitted light can be changed depend on a user's requirement.

[0007] Other objectives, advantages and novel features of the invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings.

Fig. 1 is a circuit diagram of a LED lamp brightness adjusting circuit connectable to AC power in accordance with the present invention; and

Fig. 2 is a block circuit diagram of a conventional light adjustable lamp.

[0008] With reference to Fig. 1, a LED lamp brightness adjusting circuit in accordance with the present invention is operated with a light regulator 102 and comprises a regulating circuit 10, a first rectification diode D1, a second rectification diode D2, a first filtering capacitor C1, a second filtering capacitor C2 and a current limiting resistor R4. The light regulator 102 has an input terminal connected to a first AC input terminal AC1 of an AC power source.

[0009] The regulating circuit 10 has a first terminal and a second terminal and comprises multiple resistors R1 to R3 connected in parallel. The first terminal is coupled to an output terminal of the light regulator 102. The second terminal is coupled to a second AC input terminal AC2 of the AC power source. An optional fuse F1 may be connected between the regulator 102 and the regulating circuit 10 to provide over current protection. The resistors R1 to R3 of the regulating circuit 10 in this embodiment have the same resistance value. The regulating circuit 10 allows the light regulator 102 to linearly regulate the AC voltage and produces a regulated input voltage V_{in} across the first terminal and the second terminal.

[0010] The first rectification diode D1 has an anode and a cathode, wherein the anode is connected to the first terminal of the regulating circuit 10 and the cathode is connected to the first filtering capacitor C1.

[0011] The first filtering capacitor C1 has a positive terminal and a negative terminal. The positive terminal is connected to the cathode of the first rectification diode D1. The current limiting resistor R4 is connected between the second terminal of the regulating circuit 10 and the negative terminal of the first filtering capacitor C1. The first filtering capacitor C1 can be connected in parallel to a first LED module 20 that includes multiple light emitting diodes LED 1 to LED 40 connected in series. The first LED module 20 has a positive input correspondingly connected to the positive terminal of the first filtering capacitor C1, and a negative input correspondingly connected to the negative terminal of the first filtering capacitor C1.

[0012] The second rectification diode D2 has an anode and a cathode, wherein the anode is connected to the second AC input terminal AC2 through the current limiting resistor R4, and the cathode is connected to the second filtering capacitor C2.

[0013] The second filtering capacitor C2 has a positive terminal and a negative terminal. The positive terminal is connected to the cathode of the second rectification

diode D2. The negative terminal is connected to the first terminal of the regulating circuit 10 and the anode of the first rectification diode D 1. The second filtering capacitor C2 can be connected in parallel to a second LED module 30 that includes multiple light emitting diodes LED 41 to LED 80 connected in series. The second LED module 30 has a positive input correspondingly connected to the positive terminal of the second filtering capacitor C2, and a negative input correspondingly connected to the negative terminal of the second filtering capacitor C2.

[0014] For the AC voltage input from the two AC input terminals AC1, AC2, the light regulator 102 can regulate the amplitude of the AC voltage to adjust the regulated input voltage V_{in} . Therefore, the driving voltages across the first and second filtering capacitors C1, C2 are changed. Because the first and the second LED modules 20, 30 are respectively coupled to the first and the second filtering capacitors C1, C2, the driving currents flowing through the LED modules 20, 30 are altered to adjust the brightness of the emitted light. When the AC voltage is in the positive half cycle, the positive half cycle voltage passes through the first rectification diode D 1 and is filtered by the first filtering capacitor C 1 to produce a first filtered driving voltage for activating the first LED module 20. When the AC voltage is in the negative half cycle, the negative half cycle voltage passes through the second rectification diode D2 and is filtered by the second filtering capacitor C2 to produce a second filtered driving voltage for activating the second LED module 30. The first rectified driving voltage and the second rectified driving voltage are alternately produced.

[0015] The brightness adjusting circuit of the present invention allows the light regulator 102 to adjust the amplitude of the received AC voltage and produce a regulated input voltage V_{in} . The regulated input voltage V_{in} , either the positive or negative half cycle voltage, is further rectified and filtered by the rectification diodes D1, D2 and the filtering capacitors C1, C2 to drive the LED modules 20, 30 and alter the brightness of the LED modules 20, 30.

[0016] Even though numerous characteristics and advantages of the present invention have been set forth in the foregoing description, together with details of the structure and features of the invention, the disclosure is illustrative only. Changes may be made in the details, especially in matters of shape, size, and arrangement of parts within the principles of the invention to the full extent indicated by the broad general meaning of the terms in which the appended claims are expressed.

Claims

1. A LED lamp brightness adjusting circuit, **characterized in that** the brightness adjusting circuit comprises:

a regulating circuit (10) having a first terminal

and a second terminal and comprising multiple resistors (R1, R2, R3) connected in parallel, the first terminal adapted to connect to an output terminal of a light regulator (102), the second terminal adapted to connect to an AC power source, the regulating circuit (10) output a regulated input voltage with a desired amplitude in response to the control of the light regulator (102);

a first rectification diode (D1) having an anode and a cathode, the anode connected to the first terminal of the regulating circuit (10);

a first filtering capacitor (C1) having a positive terminal and a negative terminal, the positive terminal connected to the cathode of the first rectification diode (D1), the negative terminal connected to the second terminal of the regulating circuit (10), wherein the first filtering capacitor (C1) is connectable to a first LED module (20) in parallel;

a second rectification diode (D2) having an anode and a cathode, the anode connected to the second terminal of the regulating circuit (10); and

a second filtering capacitor (C2) having a positive terminal and a negative terminal, the positive terminal connected to the cathode of the second rectification diode (D2), the negative terminal connected to the first terminal of the regulating circuit (10), wherein the second filtering capacitor (C2) is connectable to a second LED module (30) in parallel.

2. The LED lamp brightness adjusting circuit as claimed in claim 1, wherein the resistors (R1, R2, R3) of the regulating circuit (10) have the same resistance value.
3. The LED lamp brightness adjusting circuit as claimed in claim 1 or 2, further comprising a current limiting resistor (R4) connected between the second terminal of the regulating circuit (10) and the anode of the second rectification diode (D2) .
4. The LED lamp brightness adjusting circuit as claimed in claim 3 further comprising a fuse connected between the first terminal of the regulating circuit and the light regulator.
5. The LED lamp brightness adjusting circuit as claimed in claim 1, wherein
a first rectified driving voltage across the first rectifying capacitor (C1) drives the first LED module (20);
a second rectified driving voltage across the second rectifying capacitor (C2) drives the second LED module (30); and
the first rectified driving voltage and the second rectified driving voltage are alternately produced.

6. A LED lighting device comprising:

a light regulator (102) having an input terminal connected to a first AC input terminal of an AC power source; 5
 a regulating circuit (10) having a first terminal and a second terminal and comprising multiple resistors (R1, R2, R3) connected in parallel, the first terminal connected to an output terminal of the light regulator (102), the second terminal connected to a second AC input terminal of the AC power source, the regulating circuit (10) outputting a regulated input voltage with a desired amplitude in response to the control of the light regulator (102); 10
 a first rectification diode (D1) having an anode and a cathode, the anode connected to the first terminal of the regulating circuit (10);
 a first filtering capacitor (C1) having a positive terminal and a negative terminal, the positive terminal connected to the cathode of the first rectification diode (D1), the negative terminal connected to the second terminal of the regulating circuit (10); 15
 a first LED module (10) connected to the first filtering capacitor (C1) in parallel; 25
 a second rectification diode (D2) having an anode and a cathode, the anode connected to the second terminal of the regulating circuit (10);
 a second filtering capacitor (C2) having a positive terminal and a negative terminal, the positive terminal connected to the cathode of the second rectification diode (D2), the negative terminal connected to the first terminal of the regulating circuit (10); and 30
 a second LED module (30) connected to the second filtering capacitor (C2) in parallel. 35

rectifying capacitor (C2) drives the second LED module (30); and
 the first rectified driving voltage and the second rectified driving voltage are alternately produced.

7. The LED lighting device as claimed in claim 6, wherein the resistors (R1, R2, R3) of the regulating circuit have the same resistance value. 40
8. The LED lighting device as claimed in claim 6 or 7, further comprising a current limiting resistor (R4) connected between the second terminal of the regulating circuit (10) and the anode of the second rectification diode (D2). 45
9. The LED lighting device as claimed in claim 7 further comprising a fuse connected between the first terminal of the regulating circuit (10) and the light regulator (102). 50
10. The LED lighting device as claimed in claim 6, wherein 55
 a first rectified driving voltage across the first rectifying capacitor (C1) drives the first LED module (20);
 a second rectified driving voltage across the second

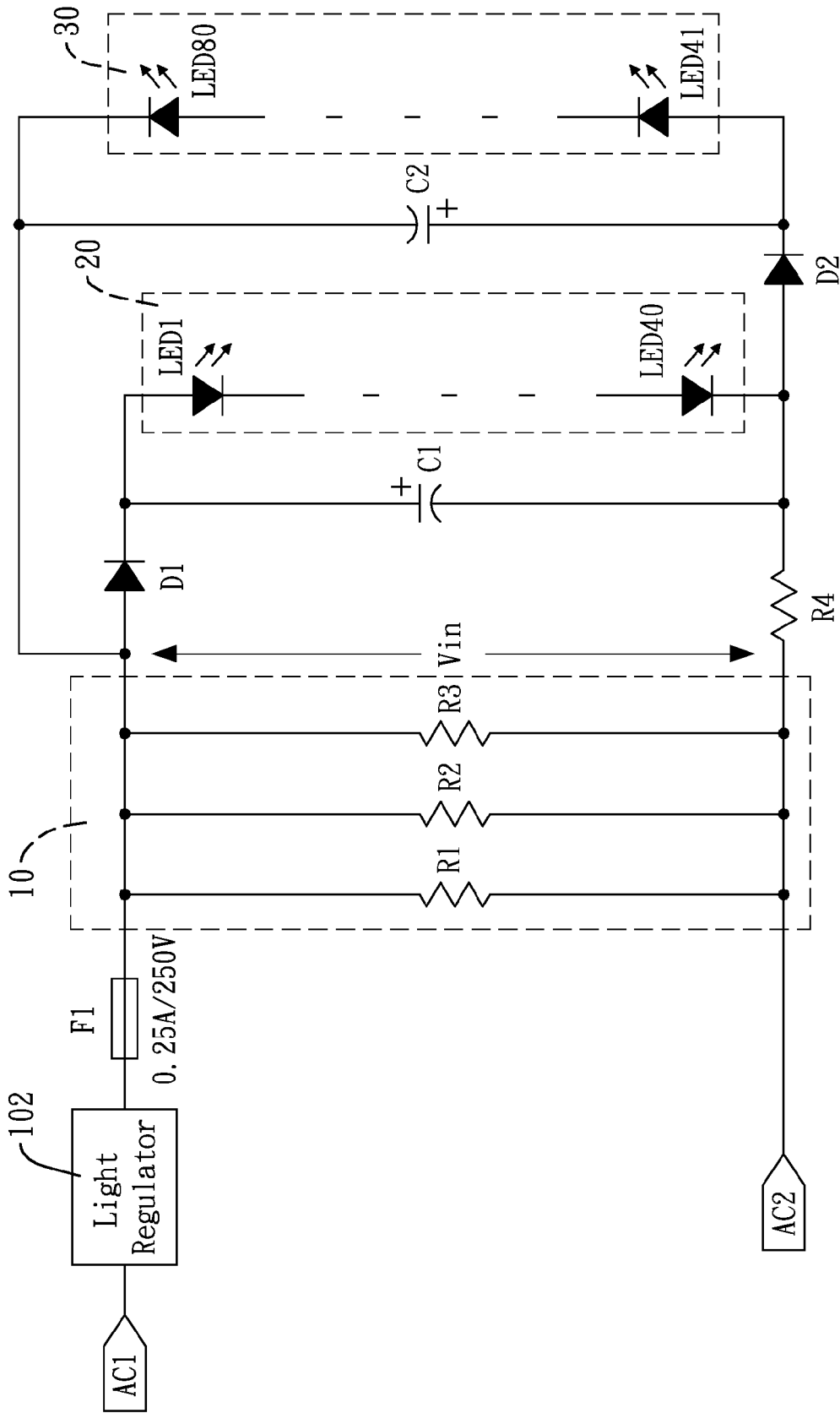


FIG. 1

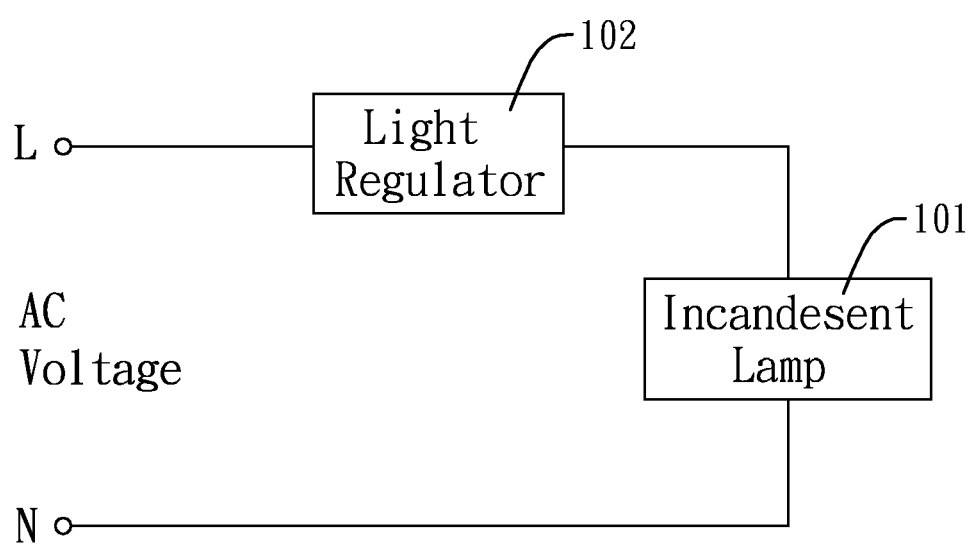


FIG. 2



EUROPEAN SEARCH REPORT

Application Number
EP 10 16 8978

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 2009/251059 A1 (VELTMAN ANDRE [NL]) 8 October 2009 (2009-10-08) * abstract * * figures 2-5,6A,6B * * paragraphs [0004] - [0013], [0042] - [0050] *	1-10	INV. H05B33/08	
X	WO 2005/115058 A1 (POLYBRITE INTERNATIONAL INC [US]; SCIANNA CARLO [US]) 1 December 2005 (2005-12-01) * paragraphs [0006] - [0014], [0034] - [0036]; figures 1-8 *	1-10		
X	GB 2 435 724 A (MOOD CONCEPTS LTD [GB]; LIGHT LTD E [GB]) 5 September 2007 (2007-09-05) * the whole document *	1-10		
X	US 5 661 645 A (HOCHSTEIN PETER A [US]) 26 August 1997 (1997-08-26) * figures 3,6a,6b * * column 7, line 17 - column 8, line 17 *	1-10		TECHNICAL FIELDS SEARCHED (IPC)
X	US 2002/158590 A1 (SAITO YUTAKA [JP] ET AL) 31 October 2002 (2002-10-31) * paragraphs [0095] - [0097], [0132]; figures 7,9,13 *	1-10		H05B
X	JP 62 147366 U (NOT AVAILABLE) 17 September 1987 (1987-09-17) * figure 4 *	1-10		
X	US 2002/047606 A1 (GUTHRIE DON W [US] ET AL) 25 April 2002 (2002-04-25) * the whole document *	1-10		
		-/--		
The present search report has been drawn up for all claims				
Place of search The Hague		Date of completion of the search 19 November 2010	Examiner João Carlos Silva	
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				

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EUROPEAN SEARCH REPORT

Application Number
EP 10 16 8978

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	WO 2006/004337 A1 (SEOUL OPTO DEVICE CO LTD [KR]; LEE CHUNG-HOON [KR]; LEE KEON YOUNG [KR]) 12 January 2006 (2006-01-12) * the whole document *	1-10	
A	ECKOLD F: "LEUCHTDIODEN RICHTIG EINGESETZT//CORRECT APPLICATIONS OF LIGHT EMITTING DIODES", E. ELEKTRONIK-TECHNOLOGIE, ELEKTRONIK-ANWENDUNGEN, ELEKTRONIK-MARKETING, KONRADIN VERLAG, LEINFELDEN-ECHTERDINGEN, DE, vol. 4, no. 5, 1 March 1986 (1986-03-01), pages 49-54, XP001086420, ISSN: 0174-7452 * the whole document *	1-10	
A	US 2007/182338 A1 (SHTEYNBERG ANATOLY [US] ET AL) 9 August 2007 (2007-08-09) * the whole document *	1-10	
			TECHNICAL FIELDS SEARCHED (IPC)
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 19 November 2010	Examiner João Carlos Silva
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	

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EPO FORM 1503 03-02 (P04C01)

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

EP 10 16 8978

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.

19-11-2010

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2009251059 A1	08-10-2009	WO 2009121956 A1	08-10-2009
WO 2005115058 A1	01-12-2005	AU 2005246918 A1	01-12-2005
		CA 2536307 A1	01-12-2005
		CN 1843061 A	04-10-2006
		EP 1752022 A1	14-02-2007
		HK 1094853 A1	20-05-2010
		JP 2007538378 T	27-12-2007
		MX PA06005602 A	17-08-2006
		NZ 545325 A	29-08-2008
		US 2008258647 A1	23-10-2008
GB 2435724 A	05-09-2007	NONE	
US 5661645 A	26-08-1997	AU 3399097 A	14-01-1998
		CA 2259258 A1	31-12-1997
		EP 0907999 A1	14-04-1999
		WO 9750168 A1	31-12-1997
US 2002158590 A1	31-10-2002	AU 1889201 A	25-06-2001
		WO 0145470 A1	21-06-2001
		JP 4353667 B2	28-10-2009
		JP 2009200053 A	03-09-2009
JP 62147366 U	17-09-1987	NONE	
US 2002047606 A1	25-04-2002	NONE	
WO 2006004337 A1	12-01-2006	EP 1787336 A1	23-05-2007
		EP 2144286 A2	13-01-2010
		JP 2008505478 T	21-02-2008
		JP 2010034610 A	12-02-2010
		US 2008017871 A1	24-01-2008
		US 2010109031 A1	06-05-2010
US 2007182338 A1	09-08-2007	NONE	