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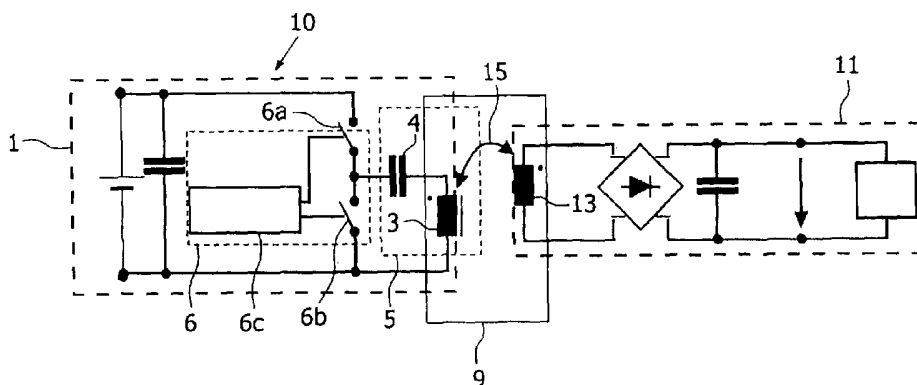
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[Continued on next page]

(54) Title: A WIRELESS POWERING DEVICE, AN ENERGIZABLE LOAD, A WIRELESS SYSTEM AND A METHOD FOR A WIRELESS ENERGY TRANSFER



(57) Abstract: A wireless resonant powering device (1) according to the invention comprises a first inductor winding (3), which is arranged to form a transformer (9) with the inductor winding (13) of the energizable load (11). The first inductor winding (3) is arranged to form a resonant circuit (5), which may comprise a suitable plurality of electric capacitances and coils. The components of the resonant circuit (5) are selected such that the magnetic energy received by the inductor winding (13) damps the energy flow in the resonant circuit so that the induced voltage in the inductor winding (13) is substantially constant and is independent of the magnetic coupling between the first inductor winding (3) and the inductor winding 13 at the operating frequency of the driving means (6). The resonant circuit is driven by the driving means (6), comprising a control unit (6c) arranged to induce an alternating voltage between a first semiconductor switch (6a) and a second semiconductor switch (6b). At the output of the transformer (9) an alternating voltage is generated, which is rectified to a DC-voltage by a diode rectifier, filtered by an output capacitance. The resonant circuit (5) is operable on its coupling independent point by the driving means (6). This figure schematically illustrates a situation, where a variable coupling between the first inductor winding (3) and the inductor winding (13) exists. The invention further relates to a wireless inductive powering device, an energizable load, a wireless system and a method for wireless power transfer.

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INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2005/051394

<p>A. CLASSIFICATION OF SUBJECT MATTER INV. H01F38/14 H02J7/02</p>		
<p>According to International Patent Classification (IPC) or to both national classification and IPC</p>		
<p>B. FIELDS SEARCHED</p>		
<p>Minimum documentation searched (classification system followed by classification symbols) H01F H02J</p>		
<p>Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched</p>		
<p>Electronic data base consulted during the international search (name of data base and, where practical, search terms used) EPO-Internal, PAJ, WPI Data</p>		
<p>C. DOCUMENTS CONSIDERED TO BE RELEVANT</p>		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 333 388 A (AMERICAN TELEPHONE AND TELEGRAPH COMPANY; AT&T CORP) 20 September 1989 (1989-09-20) abstract page 4, lines 27-38; figure 1	1-4, 19, 32, 33
A	EP 1 221 753 A (SAMSUNG ELECTRONICS CO., LTD) 10 July 2002 (2002-07-10) paragraphs [0027] - [0032]; figure 5	1-3, 19-24, 27, 28, 32, 33
A	US 2002/154518 A1 (ELFERICH REINHOLD ET AL) 24 October 2002 (2002-10-24) abstract paragraphs [0055] - [0065], [0077]; figures 1-5, 10	1, 4, 19-28, 30, 32, 33
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<p><input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.</p>		
<p>* Special categories of cited documents :</p>		
<p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"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)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p>		<p>"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</p> <p>"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</p> <p>"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.</p> <p>"&" document member of the same patent family</p>
<p>Date of the actual completion of the international search 10 October 2005</p>		<p>Date of mailing of the international search report 31.03.05</p>
<p>Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016</p>		<p>Authorized officer Reder, M</p>

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2005/051394

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 817 351 A (UNIDEN CORPORATION) 7 January 1998 (1998-01-07) abstract column 7, line 25 - column 9, line 55; figures 1,3,5 -----	1,19-21, 32,33
A	US 5 341 083 A (KLONTZ ET AL) 23 August 1994 (1994-08-23) column 8, line 14 - column 9, line 48; figure 7 column 12, line 50 - column 15, line 38; figures 9-16 -----	1-3, 14-16, 19,32, 33,38

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB2005/051394

Box II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1-4
14-16; 17 and 18 when depending on 14-16; 19-32 when depending on 1-4 or 14-16; 33; 35-37 when depending on 33; 38

Remark on Protest

- The additional search fees were accompanied by the applicant's protest.
- No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-4,14-16;17 and 18 when depending on 14-16; 19-32 when depending on 1-4 or 14-16; 33; 35-37 when depending on 33; 38

Resonant wireless powering system using inductive energy transfer between primary and secondary coil with the induced voltage in the secondary coil being independent of magnetic coupling between primary and secondary coil.

2. claims: 5-13; 17 and 18 when depending on 5-13; 19-32 when depending on 5-13; 34; 35-37 when depending on 34

Wireless powering system using inductive energy transfer between primary and secondary coil with the primary coil being surrounded by a soft magnetic core which can be opened to receive also the secondary coil.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IB2005/051394

Patent document cited in search report.		Publication date	Patent family member(s)	Publication date
EP 0333388	A	20-09-1989	AT 130448 T	15-12-1995
			AU 3146889 A	21-09-1989
			CA 1327848 C	15-03-1994
			DE 68924792 D1	21-12-1995
			DE 68924792 T2	02-05-1996
			HK 124296 A	19-07-1996
			JP 1940007 C	09-06-1995
			JP 2007838 A	11-01-1990
			JP 6069275 B	31-08-1994
			KR 9207372 B1	31-08-1992
			US 4802080 A	31-01-1989
EP 1221753	A	10-07-2002	CN 1363940 A	14-08-2002
			JP 2002262468 A	13-09-2002
			KR 2002057469 A	11-07-2002
			US 2002110013 A1	15-08-2002
US 2002154518	A1	24-10-2002	DE 10119283 A1	24-10-2002
			EP 1253695 A2	30-10-2002
			JP 2002369414 A	20-12-2002
EP 0817351	A	07-01-1998	JP 10023677 A	23-01-1998
			US 5929598 A	27-07-1999
US 5341083	A	23-08-1994	NONE	