

(19)



(11)

EP 2 966 661 A3

(12)

EUROPEAN PATENT APPLICATION

(88) Date of publication A3:
20.01.2016 Bulletin 2016/03

(51) Int Cl.:
H01F 27/28 ^(2006.01) **H01L 23/64** ^(2006.01)

(43) Date of publication A2:
13.01.2016 Bulletin 2016/02

(21) Application number: **14196615.0**

(22) Date of filing: **05.12.2014**

(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 RS SE SI SK SM TR**
 Designated Extension States:
BA ME

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(30) Priority: **09.07.2014 US 201462022205 P**

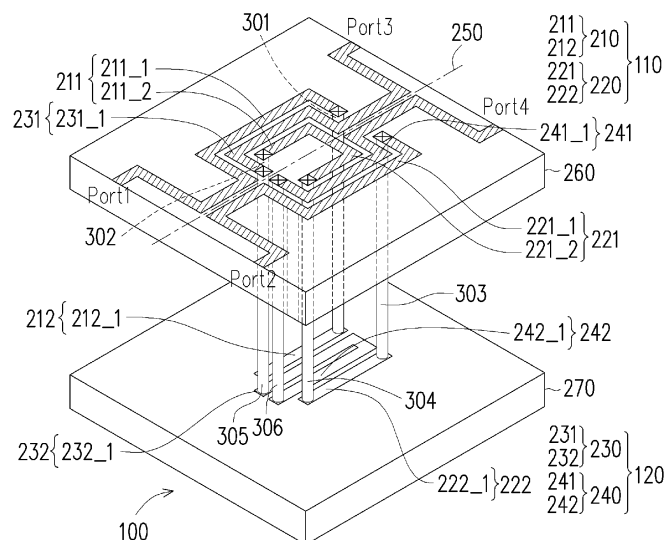
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(54) **Three-dimension symmetrical vertical transformer**

(57) First and second paths of the primary-coil of the transformer are located at different sides of the symmetry-line. First terminals of the first and second paths are first and second ports of the primary-coil. Second terminals of the first and second paths are connected to each other. Two partial paths of the first path are connected to each other by TSV. Two partial paths of the second path are connected to each other by TSV. Third and

fourth paths of the secondary-coil of the transformer are located on different sides of the symmetry-line. First terminals of the third and fourth paths are first and second ports of the secondary-coil. Second terminals of the third and fourth paths are connected to each other. Two partial paths of the third path are connected to each other by TSV. Two partial paths of the fourth path are connected to each other by TSV.

**FIG. 3****EP 2 966 661 A3**



EUROPEAN SEARCH REPORT

Application Number
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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 2013/307656 A1 (CARPENTER GARY D [US] ET AL) 21 November 2013 (2013-11-21)	1,4-6, 8-12	INV. H01F27/28 H01L23/64
Y	* abstract *	2,3	
A	* page 2, paragraph 17 - page 4, paragraph 34 *	7	
	* figures 1-4,5A-C *		
Y	US 2013/020675 A1 (KIREEV VASSILI [US] ET AL) 24 January 2013 (2013-01-24)	2,3	TECHNICAL FIELDS SEARCHED (IPC) H01F H01L
	* abstract *		
	* page 6, paragraph 75 - page 7, paragraph 81 *		
	* figures 1-9 *		
A	US 2011/140825 A1 (KIM SEONG-IL [KR] ET AL) 16 June 2011 (2011-06-16)	1-12	
	* abstract *		
	* page 3, paragraph 40-45; figure 5 *		
A	US 2008/272875 A1 (HUANG DAQUAN [US] ET AL) 6 November 2008 (2008-11-06)	1-12	
	* abstract *		
	* page 3, paragraph 46 - page 4, paragraph 54 *		
	* figures 4A,4B *		
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 4 December 2015	Examiner Kardinal, Ingrid
<p>CATEGORY OF CITED DOCUMENTS</p> <p>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</p> <p>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</p>			

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EPO FORM 1503 03.02 (P04C01)

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

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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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04-12-2015

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2013307656 A1	21-11-2013	CN 103426859 A US 2013307656 A1	04-12-2013 21-11-2013
US 2013020675 A1	24-01-2013	US 2013020675 A1 WO 2013012450 A1	24-01-2013 24-01-2013
US 2011140825 A1	16-06-2011	KR 20110067929 A US 2011140825 A1	22-06-2011 16-06-2011
US 2008272875 A1	06-11-2008	CN 101142638 A JP 2009503909 A KR 20080031153 A TW I408796 B US 2008272875 A1 WO 2007019280 A2	12-03-2008 29-01-2009 08-04-2008 11-09-2013 06-11-2008 15-02-2007

EPO FORM P0459

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