



US008421574B2

(12) **United States Patent**
Suzuki et al.

(10) **Patent No.:** **US 8,421,574 B2**
(45) **Date of Patent:** **Apr. 16, 2013**

(54) **CONTACTLESS POWER TRANSMISSION APPARATUS AND A METHOD OF MANUFACTURING A SECONDARY SIDE THEREOF**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **12/665,025**

(22) PCT Filed: **Jun. 12, 2008**

(86) PCT No.: **PCT/JP2008/060779**

§ 371 (c)(1),
(2), (4) Date: **Dec. 16, 2009**

(87) PCT Pub. No.: **WO2008/156025**

PCT Pub. Date: **Dec. 24, 2008**

(65) **Prior Publication Data**

US 2010/0181842 A1 Jul. 22, 2010

(30) **Foreign Application Priority Data**

Jun. 20, 2007 (JP) 2007-163051
Jun. 20, 2007 (JP) 2007-163058

(51) **Int. Cl.**

H01F 5/00 (2006.01)
H01F 27/28 (2006.01)
H01F 27/24 (2006.01)

(52) **U.S. Cl.**

USPC **336/200**; 336/232; 336/233

(58) **Field of Classification Search** 336/200,
336/232, 233

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,594,672 A * 7/1971 Frenkel 336/132
3,676,814 A * 7/1972 Trunzo et al. 336/205

(Continued)

FOREIGN PATENT DOCUMENTS

JP 62-36512 U 3/1987
JP 3-232207 A 10/1991

(Continued)

OTHER PUBLICATIONS

International Search Report for the Application No. PCT/JP2008/060779 mailed Jul. 15, 2008.

(Continued)

Primary Examiner — Mohamad Musleh

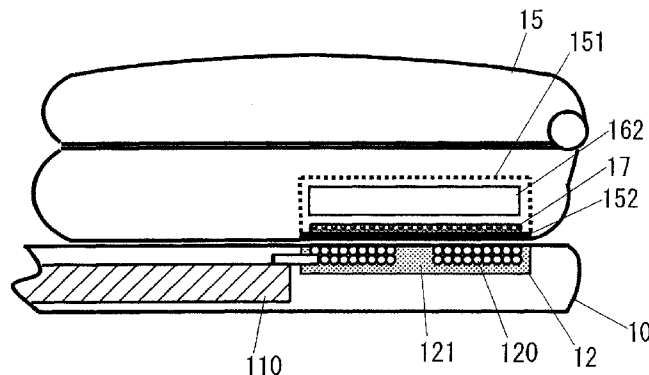
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(57) **ABSTRACT**

According to a first aspect, a secondary side of contactless power transmission apparatus includes: a holding member which is physically separated from a primary side; a magnetic layer; a shield layer for shielding electromagnetic noise; and a heat insulation layer. The secondary coil is a planar coil and supported by the holding member, and at least the magnetic layer is laminated on one side of the planar coil and unified with the planar coil. According to a second aspect, the secondary side of the apparatus includes a plurality of magnetic layers. Each permeability of the magnetic layers is different from each other, and each of the magnetic layers forms a magnetic path with the primary side.

20 Claims, 12 Drawing Sheets



U.S. PATENT DOCUMENTS

| | | | | |
|--------------|------|---------|-----------------------|---------|
| 4,496,896 | A * | 1/1985 | Melocik et al. | 320/108 |
| 4,543,553 | A * | 9/1985 | Mandai et al. | 336/83 |
| 5,062,197 | A * | 11/1991 | Charles | 29/606 |
| 5,198,647 | A | 3/1993 | Mizuta | |
| 5,430,424 | A * | 7/1995 | Sato et al. | 336/200 |
| 5,500,632 | A * | 3/1996 | Halser, III | 336/180 |
| 6,008,622 | A * | 12/1999 | Nakawatase | 320/108 |
| 6,265,789 | B1 * | 7/2001 | Honda et al. | 307/33 |
| 6,603,382 | B1 * | 8/2003 | Komai et al. | 336/200 |
| 7,042,325 | B2 * | 5/2006 | Giandalia et al. | 336/200 |
| 2003/0020583 | A1 * | 1/2003 | Hui et al. | 336/200 |
| 2005/0007296 | A1 * | 1/2005 | Endo et al. | 343/895 |
| 2006/0266435 | A1 * | 11/2006 | Yang et al. | 148/105 |
| 2007/0001921 | A1 * | 1/2007 | Takahashi et al. | 343/788 |
| 2007/0030659 | A1 * | 2/2007 | Suzuki et al. | 361/793 |
| 2007/0090790 | A1 * | 4/2007 | Hui | 320/108 |
| 2007/0103952 | A1 * | 5/2007 | Sakai et al. | 363/171 |

| | | | |
|----|-------------|-----|---------|
| JP | 2000-90221 | A | 3/2000 |
| JP | 2000-252143 | A | 9/2000 |
| JP | 2000269059 | A * | 9/2000 |
| JP | 2000-340440 | A | 12/2000 |
| JP | 2003-68544 | A | 3/2003 |
| JP | 2003-173921 | A | 6/2003 |
| JP | 2003-244855 | A | 8/2003 |
| JP | 2003-272938 | A | 9/2003 |
| JP | 2004-47701 | A | 2/2004 |
| JP | 2006-311712 | A | 11/2006 |
| JP | 2006-314181 | A | 11/2006 |
| JP | 2006-353094 | A | 12/2006 |

OTHER PUBLICATIONS

Notification of Reasons for Refusal for Application No. 2007-163058 from Japan Patent Office mailed Mar. 29, 2011.

FOREIGN PATENT DOCUMENTS

JP 8-79976 A 3/1996

* cited by examiner

FIG. 1A

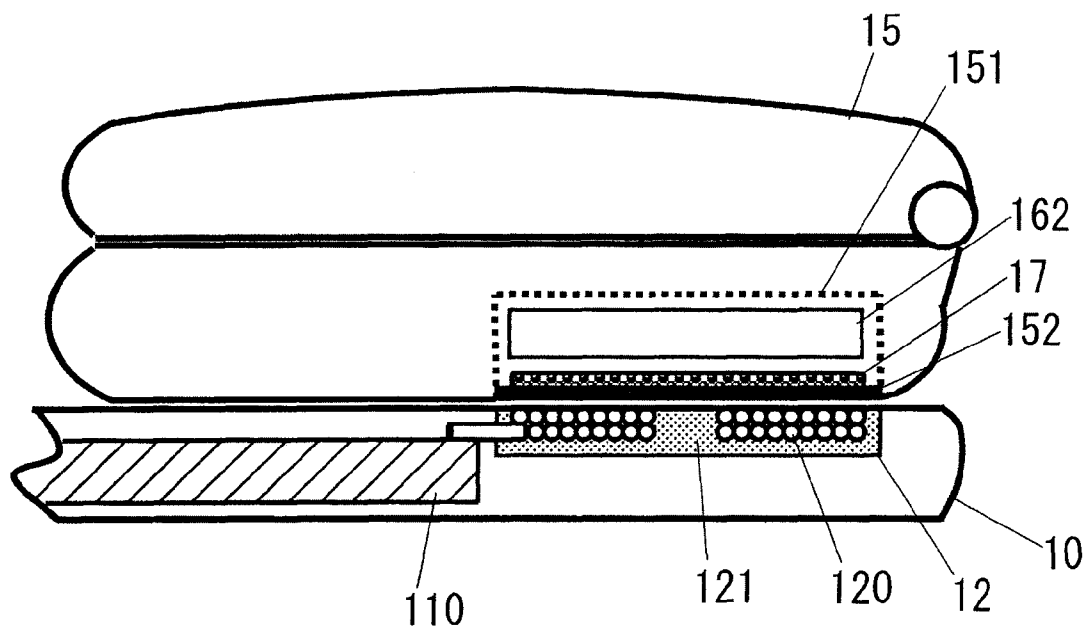


FIG. 1B

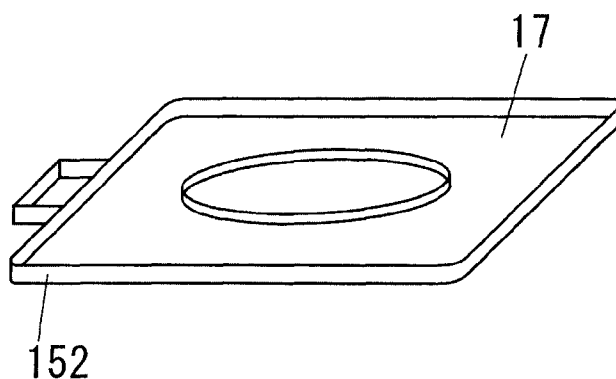


FIG. 2

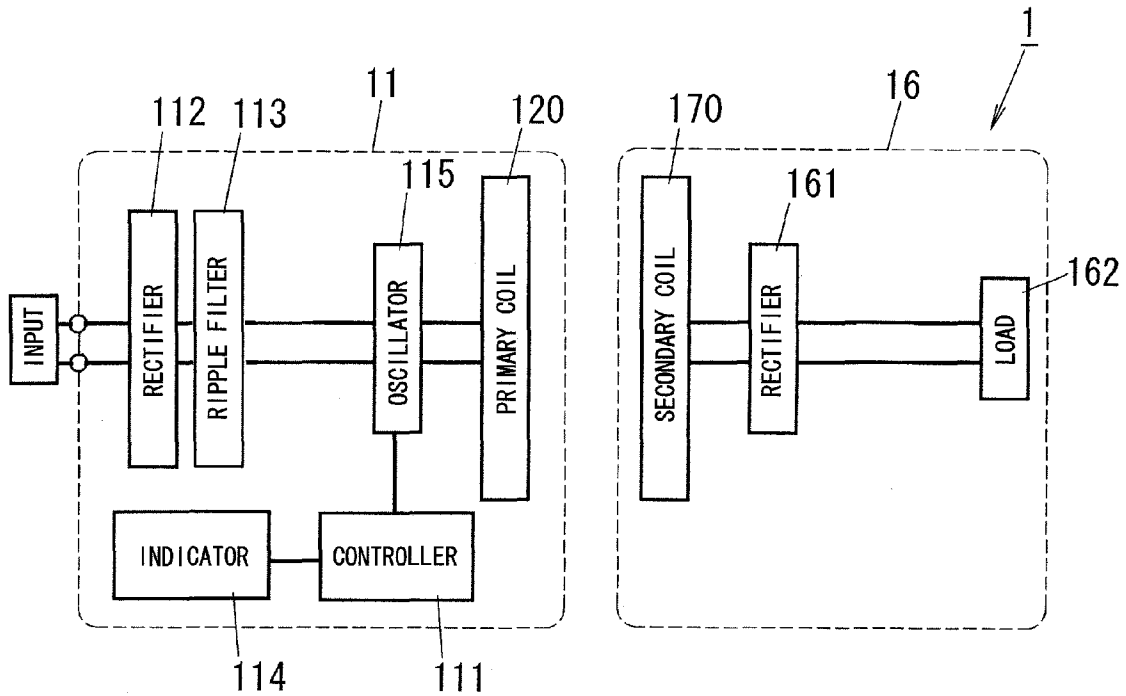
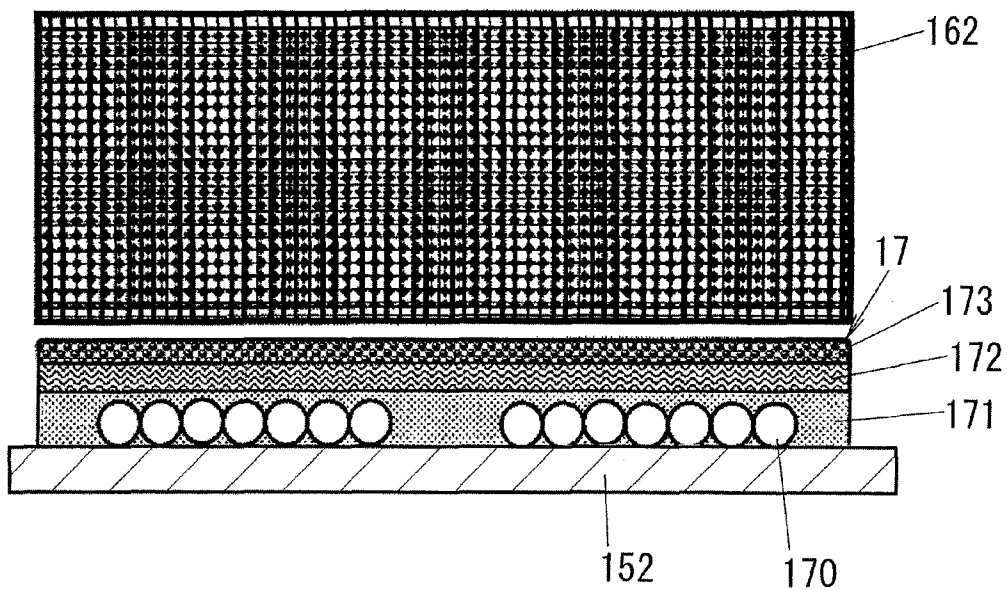


FIG. 3



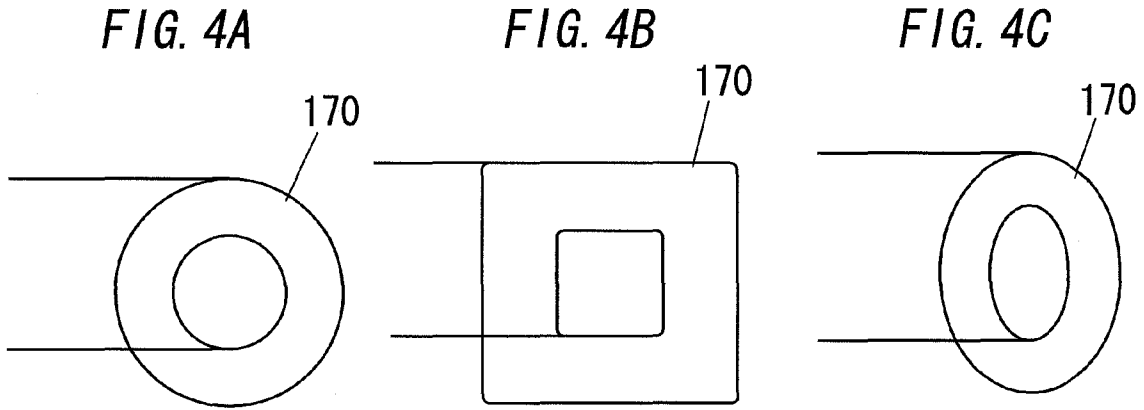
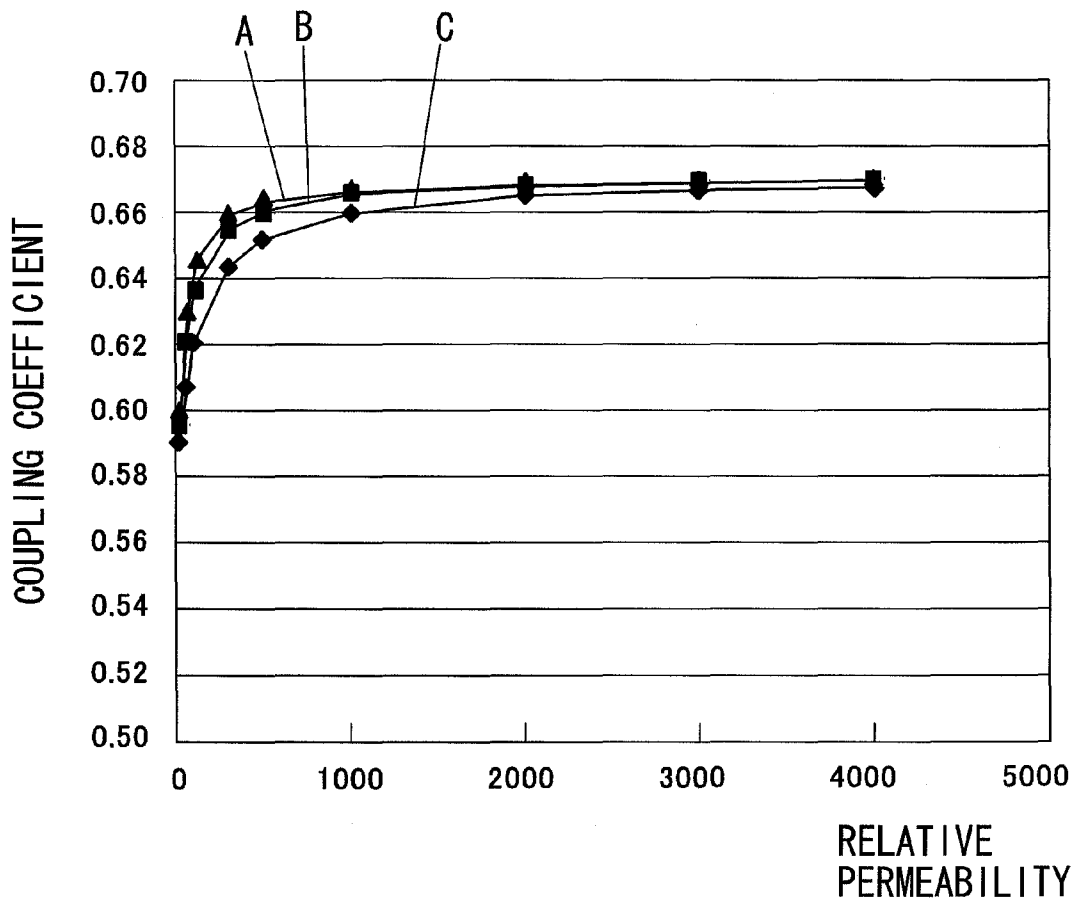


FIG. 5



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