108. (new) The inductive power transfer pad as claimed in claim 97, wherein the means for shielding against said magnetic flux comprises at least one side wall about the pad.

109. (new) The inductive power transfer pad as claimed in claim 108 wherein the side wall is substantially perpendicular to the second plane.

110. (new) The inductive power transfer pad as claimed in claim 97, wherein the means for channeling said magnetic flux comprises one or more pieces of ferromagnetic material.

111. (new) The inductive power transfer pad of claim 97 wherein a magnetic dipole produced by said flux generating means is generally perpendicular to said plane of said means for channeling said magnetic flux.

112. (new) The inductive power transfer pad of claim 97 wherein said means for shielding against magnetic flux is formed of metal.

113. (new) The inductive power transfer pad of claim 112 wherein the metal comprises aluminium.

114. (new) The inductive power transfer pad of claim 97 wherein the means for shielding against magnetic flux further comprises a backplate and a metal strip, the metal strip defining a barrier, wherein said backplate and said metal strip are arranged to control said magnetic flux.

115. (new) An inductive power transfer system comprising two inductive power transfer pads

as claimed in claim 97, wherein the two inductive power transfer pads are used in combination, one of the pads being used as a pickup pad and the other pad as a charging pad.

REMARKS

Claims 72, 74 and 76-82 have been amended, claims 84-92 have been canceled and claims 93-115 have been added. Claims 72-83 and 93-115 are in the case, with claims 72 and 97 being in independent form. No new matter has been added.

In response to the Restriction Requirement dated April 12, 2012, Applicants hereby elect to continue prosecution of Group I, claims 72-83. In addition, it is respectfully submitted that new claims 93-115 also correspond to the elected group and accordingly should also be examined on the merits.

The Office is hereby authorized to charge any additional fees which may be required in connection with this amendment and to credit any overpayment to our Deposit Account No. 50-5504.

If petition for an extension of time is required to make this response timely, this paper should be considered to be such a petition, and the Commissioner is authorized to charge the requisite fees to our Deposit Account No. 50-5504.

If a telephone interview could advance the prosecution of this application, the Examiner is respectfully requested to call the undersigned attorney.

Entry of this amendment and allowance of this application are respectfully requested.

Respectfully submitted,

RICHARD F. JAWORSKI
Reg. No. 33,515
Attorney for Applicant
The Law Office of Richard F. Jaworski, PC
Tel.: (631) 659-3608

TFW

Dkt. 1172/69068

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application of : John Talbot BOYS et al.

Serial No. : 12/451,436 Examiner: Edward H. Tso

Date Filed : January 13, 2010 GAU: 2859

For : MULTI POWER SOURCED ELECTRIC VEHICLE

273 Walt Whitman Road, Suite 327
Huntington Station, New York 11746

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

PETITION FOR EXTENSION OF TIME

Sir:

It is respectfully requested that the time for responding to the Restriction Requirement dated April 12, 2012 be extended by one month (i.e., from May 12, 2012 to June 12, 2012).

The $150.00 statutory extension fee for filing a response within the first month pursuant to 1.136(a) by other than a small entity may be charged as indicated on the enclosed Credit Card Payment Form.

The Office is hereby authorized to charge any additional fees which may be required in connection with this paper and to credit any overpayment to our Deposit Account No. 50-5504.

Respectfully submitted,

RICHARD F. JAWORSKI
Registration No. 33,515
Attorney for Applicant
The Law Office of
Richard F. Jaworski, P.C.
Tel.: (631) 659-3608

I hereby certify that this paper is being deposited this date with the U.S. Postal Service as first class mail addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450

June 12, 2012
Richard F. Jaworski Date
Reg. No. 33,515

06/14/2012 HVUONG1 00000037 12451436
01 FC:1251 150.00 OP

PTO/SB/06 (07-06)
Approved for use through 1/31/2007. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number	Filing Date	☐ To be Mailed
12/451,436	01/13/2010	

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY ☐ RATE ($)	SMALL ENTITY ☐ FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	x $ =		OR	x $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	x $ =			x $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT 06/14/2012	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	SMALL ENTITY ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 36	Minus	** 21	= 15	x $ =		OR	x $60=	900
Independent (37 CFR 1.16(h))	* 3	Minus	***5	= 0	x $ =		OR	x $250=	0
☐ Application Size Fee (37 CFR 1.16(s))									
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	**900**

AMENDMENT	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)		RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	*	Minus	**	=	x $ =		OR	x $ =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	x $ =		OR	x $ =	
☐ Application Size Fee (37 CFR 1.16(s))									
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

Legal Instrument Examiner:
/KIMBERLY PANNELL/

Document code: WFEE

United States Patent and Trademark Office
Sales Receipt for Accounting Date: 07/25/2012

KPANNELL SALE #00000002 Mailroom Dt: 06/14/2012 505504 12451436
01 FC : 1202 900.00 DA

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/451,436	01/13/2010	John Talbot Boys	6081/81072	4685

14443 7590 12/11/2012

The Law Office of Richard F. Jaworski, PC
273 Walt Whitman Road
Suite 327
Huntington Station, NY 11746-4149

EXAMINER	
NGUYEN, TUYEN T	
ART UNIT	PAPER NUMBER
2832	

MAIL DATE	DELIVERY MODE
12/11/2012	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	12/451,436	BOYS ET AL.	
	Examiner	Art Unit	
	TUYEN NGUYEN	2832	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *14 June 2012.*

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

5)☒ Claim(s) *72-83 and 93-115* is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *72-83 93-115* is/are rejected.

8)☐ Claim(s) _____ is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

12)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *11/10/09, 7/22/11 & 7/26/11.*
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. ____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 72, 97 are rejected under 35 U.S.C. 102(b) as being anticipated by Beart et al [WO 2005/024865 A2.]

Beart et al. discloses an inductive device comprising:

- a support backplate [200];

- a flux generating unit [coils 50] provided on the support backplate; and

- a flux shield [70] made of electrically conductive material.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 73-83, 92-96 and 98-115 are rejected under 35 U.S.C. 103(a) as being unpatentable over Beart et al. in view of Boys et al. [US 5,528,113.]

Regarding claims 72-83, Beart et al. discloses the instant claimed invention except for the specific arrangement of the coil/winding relative to the ferromagnetic slabs.

The specific arrangement of the coil/winding relative to the ferromagnetic slabs would have been an obvious design consideration for the purpose of facilitating magnetic flux/field characteristics.

Regarding claims 92-96, Beart et al. discloses the instant claimed invention except for the specific material use for the backplate.

The specific metal use for the backplate would have been an obvious design consideration based on the intended application and/or environments uses.

Regarding claims 98-115, Beart et al. discloses the instant claimed invention except for the specific use of the inductive device.

Boys et al. discloses the use of inductive device in charging system.

It would have been obvious to one having ordinary skilled in the art at the time the invention was made to use the inductive of Beart et al. in a charging system, as suggested by Boys et al., for the purpose of providing induction for the charging system.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to TUYEN NGUYEN whose telephone number is (571)272-1996. The examiner can normally be reached on M-F 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, ELVIN ENAD can be reached on 571-272-1990. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/TUYEN T NGUYEN/
Primary Examiner, Art Unit 2832

Notice of References Cited	Application/Control No. 12/451,436	Applicant(s)/Patent Under Reexamination BOYS ET AL.	
	Examiner TUYEN NGUYEN	Art Unit 2832	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
	A	US-			
	B	US-			
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Form PTO-1449	U.S. Department of Commerce Patent and Trademark Office	Atty. Docket No. 1172/69068	Serial No. 12/451,436
		Applicant John Talbot BOYS et al.	
	INFORMATION DISCLOSURE CITATION BY APPLICANT (Use several sheets if necessary)	Filing Date January 13, 2010	Group NYA

U.S. PATENT DOCUMENTS

Examiner Initial		Document Number	Date	Name	Class	Subclass	Filing Date if Appropriate
	AA						
	AB						
	AC						
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	AM						
	AN						
	AO						
	AP						

FOREIGN PATENT DOCUMENTS

		Document Number	Date	Country	Class	Subclass	Translation Yes	Translation No
/TN/	AQ	06-643937	Sept. 9, 1994	Japan			Yes	
	AR							
	AS							
	AT							

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)

	AU	
	AV	
	AW	
	AX	

EXAMINER	/Tuyen Nguyen/	DATE CONSIDERED	10/31/2012

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609: Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /TN/

Form PTO-1449 — U.S. Department of Commerce, Patent and Trademark Office

INFORMATION DISCLOSURE CITATION BY APPLICANT (Use several sheets if necessary)

Atty. Docket No.	Serial No.
1172/69068	12/451,436
Applicant	
John Talbot BOYS et al.	
Filing Date	**Group**
January 13, 2010	NYA

U.S. PATENT DOCUMENTS

Examiner Initial		Document Number	Date	Name	Class	Subclass	Filing Date if Appropriate
	AA						
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	AP						

FOREIGN PATENT DOCUMENTS

		Document Number	Date	Country	Class	Subclass	Translation Yes	Translation No
/TN/	AQ	06 - 6 4 3 9 3	Sept. 9, 1994	Japan				
/TN/	AR	03 - 23 9 1 3 6	Oct. 24, 1991	Japan			Abst.	
	AS							
	AT							

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)

	AU	
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	AW	
	AX	

EXAMINER /Tuyen Nguyen/ — DATE CONSIDERED 10/31/2012

***EXAMINER:** Initial if reference considered, whether or not citation is in conformance with MPEP 609: Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /TN/

12451436 - GAU: 2832

Form PTO-1449 U.S. Department of Commerce Patent and Trademark Office	Atty. Docket No. 6081/81072	Serial No. Not Yet Assigned
	Applicant Grant Anthony Covic et al.	
INFORMATION DISCLOSURE CITATION BY APPLICANT (Use several sheets if necessary)	Filing Date Concurrently Herewith	Group

U.S. PATENT DOCUMENTS

Examiner Initial		Document Number	Date	Name	Class	Subclass	Filing Date if Appropriate
/TN/	AA	5 5 2 8 1 1 3	June 18, 1996	Boys et al.			
/TN/	AB	5 7 1 0 5 0 2	January 20, 1998	Poumey			
/TN/	AC	5 8 2 1 6 3 8	October 13, 1998	Boys et al.			
/TN/	AD	6 9 3 4 1 6 7	August 23, 2005	Jang et al.			
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	AP						
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	AH						
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	AK						
	AL						
	AM						
	AN						
	AO						
	AP						

FOREIGN PATENT DOCUMENTS

		Document Number	Date	Country	Class	Subclass	Translation Yes	Translation No
/TN/		WO 2005 02 48 6 5	March 17, 2005	PCT				
/TN/		WO 2006 10 12 8 5	September 28, 2006	PCT				

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)

	B	
	B	
	B	
	A,D	

EXAMINER	/Tuyen Nguyen/	DATE CONSIDERED	10/31/2012

***EXAMINER:** Initial if reference considered, whether or not citation is in conformance with MPEP 609: Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /TN/

Search Notes

Application/Control No.	Applicant(s)/Patent under Reexamination	
12/451,436	BOYS ET AL.	
Examiner	**Art Unit**	
TUYEN NGUYEN	2832	

SEARCHED			
Class	Subclass	Date	Examiner
336	84R, 84C, 200, 212, 232	9/24/2012	TN

INTERFERENCE SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES (INCLUDING SEARCH STRATEGY)		
	DATE	EXMR

Dkt. 1172/69068

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application of : John Talbot BOYS et al.

Serial No. : 12/451,436 Examiner: Tuyen T. Nguyen

Date Filed : January 13, 2010 GAU: 2832

For : MULTI POWER SOURCED ELECTRIC VEHICLE

273 Walt Whitman Rd.
Suite 327
Huntington Station, NY 11746

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

SECOND SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT

The information listed in the attached form PTO-1449 is brought to the attention of the Examiner. In accordance with 37 C.F.R. §1.92(a)(2)(ii), copies of U.S. Patents listed herein need not be provided.

It is respectfully requested that the information cited in annexed Form PTO-1449 be considered by the Examiner in connection with the above-identified patent application, and that such art be made of record in said application.

I hereby certify that this paper is being deposited this date with the U.S. Postal Service as first class mail addressed to the Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450

April 11, 2013
Date

Richard F. Jaworski
Reg. No. 33,515

The documents submitted herewith were cited in an Office Action issued by a foreign office in connection with a corresponding foreign application. "Teaching Reference 3" (JP-T2007-505480) cited in the foreign Office Action is identified as being a translation of "the first document cited in the search report" (e.g., WO-2005/024865) which is already of record (see English Translation of Notice of Reasons for Rejection.)

Document AA (U.S. Patent 5,469,036) is an English language equivalent of Document AQ (JP6-277358).

The citation of the listed items is not a representation that they constitute a complete or exhaustive listing of the relevant art or that these items are prior art. The items listed are submitted in good faith, but are not intended to substitute for the Examiner's search. It is hoped, however, that in addition to apprising the Examiner of the particular items, they will assist in identifying fields of search and in making as full and complete a search as possible.

The filing of this Information Disclosure Statement is not an admission that the information cited herein is, or is considered to be, material to patentability as defined in 37 C.F.R. §1.56(b).

This Information Disclosure Statement is being submitted after issuance of a non-final office action on the merits and prior to the mailing date of a final action, a notice of allowance or an action that otherwise closes prosecution and is accompanied by the required statement below.

It is respectfully submitted that each item of information contained in this information disclosure statement was first cited in a communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement.

It is believed that no fee is required for consideration of the present Information Disclosure Statement. However, if a fee is deemed to be required, the Office is authorized to charge any fees to Deposit Account 50-5504.

Early and favorable consideration of the case is respectfully requested.

Respectfully submitted,

RICHARD F. JAWORSKI
Registration No. 33,515
Attorney for Applicant
Customer No. 14443
The Law Office of Richard F. Jaworski, PC
Tel. (631) 659-3608

Form PTO-1449 — U.S. Department of Commerce, Patent and Trademark Office

INFORMATION DISCLOSURE CITATION BY APPLICANT
(Use several sheets if necessary)

Atty. Docket No.	Serial No.
1172/69068	12/451,436
Applicant	
John Talbot BOYS et al.	
Filing Date	**Group**
January 13, 2010	2832

U.S. PATENT DOCUMENTS

Examiner Initial		Document Number	Date	Name	Class	Subclass	Filing Date if Appropriate
	AA	5 4 6 9 0 3 6	Nov. 21, 1995	Eto			
	AB						
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FOREIGN PATENT DOCUMENTS

		Document Number	Date	Country	Class	Subclass	Translation Yes	Translation No
	AQ	JP 06 - 27 73 5 8	Oct. 4, 1994	Japan			Abst.	
	AR	JP 20 02 - 23 15 45	Aug. 16, 2002	Japan			Abst.	
	AS	JP 8 - 23 83 2 6	Sept. 17, 1996	Japan			Abst.	
	AT	JP T2 00 7- 50 54 80		Japan				

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)

	AU	Notice of Reasons for Rejection in corresponding Japanese application p2010-507347 (Original and English Translation)
	AV	
	AW	
	AX	

EXAMINER	DATE CONSIDERED

***EXAMINER**: Initial if reference considered, whether or not citation is in conformance with MPEP 609: Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 06-277358
(43)Date of publication of application : 04.10.1994

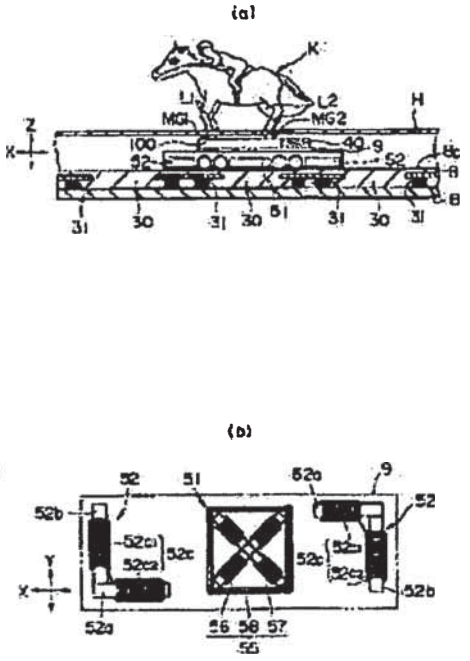
(51)Int.Cl. A63F 9/14
A63H 13/02

(21)Application number : 05-070422
(22)Date of filing : 29.03.1993

(71)Applicant : ETOU DENKI KK
(72)Inventor : ETO TETSUTARO

(54) FEED DEVICE FOR ELECTRICAL DRIVE MEANS ON MOVABLE BODY

(57)Abstract:
PURPOSE: To provide a feed device for an electrical drive means on a movable body, capable of properly feeding power without any adverse effect due to oxidation.
CONSTITUTION: A movable body 9 laid on the placement surface of a travel board 8 is fitted with a motor for driving the body 9 to travel along the placement surface. Also, a primary coil is laid under the placement surface, while secondary coils 52c and 55 for receiving power from the primary coil are laid on the movable body 9.



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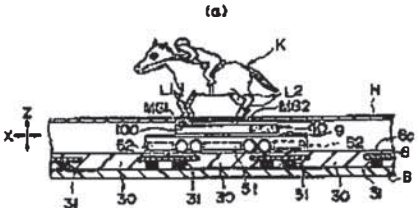
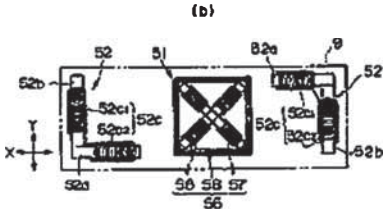
(54)【発明の名称】　可動体側電動駆動手段への給電装置

(57)【要約】

【目的】　この発明は、酸化による影響を受けることなく良好に給電できる可動体側電動駆動手段への給電装置を提供すること。

【構成】走行板８の載置面上に載置した可動体９に該可動体９を前記載置面に沿って移動駆動させるモータ１４，１７が設けられ、載置面の下方に一次コイル３３，３４が配設され、該一次コイル３３，３４からの電力を受け取る二次コイル５２ｃ，５５が前記可動体９に設けられている。





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【特許請求の範囲】

【請求項１】　走行板の載置面上に載置した可動体に該可動体を前記載置面に沿って移動駆動させる電動駆動手段が設けられ．固定給電源からの電力を受け取る電力受取手段が前記可動体に設けられた可動体側電動駆動手段への給電装置であって、

前記固定給電源は前記載置面に沿って該載置面下方に配設された一次コイルであり．前記電力受取手段は前記可動体に装着された二次コイルであることを特徴とする可動体側電動駆動手段への給電装置。

【請求項２】　前記一次コイルは前記載置面に沿う方向に複数並設されていることを特徴とする請求項１に記載の可動体側電動駆動手段への給電装置。

【請求項３】　前記複数の一次コイルの隣接するものの一方には位相制御回路を介して他方と逆位相の交流が交流源から供給されることを特徴とする請求項２に記載の可動体側電動駆動手段への給電装置。

【請求項４】　前記二次コイルは、前記載置面と平行で互いに交差する軸回りにそれぞれ捲回された第１．第２コイルと、前記載置面に沿う方向に捲回された第３コイルを有することを特徴とする請求項１～３のいずれか１つに記載の可動体側電動駆動手段への給電装置。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】この発明は、可動体に臨む載置面側の固定給電源から可動体の電動駆動手段に電力を供給する電力受取手段が前記可動体に設けられた可動体側電動駆動手段への給電装置に関するものである。

【０００２】

【従来の技術】従来からゲームセンター等には競馬用の遊戯装置が設置されていることが多い。この遊戯装置においては、競馬人形の駆動に例えば図１４に示すような駆動機構が用いられている。

【０００３】この駆動機構では、複数の案内溝１ａを有する走行板１上には、この走行板１上を走行する走行体２が載置されている。

【０００４】また、この走行体２の駆動機構は．駆動手段としてのモータ３の駆動により図示しない減速ギヤを介して回転し．走行体２の直進方向（案内溝の延びる方向）の移動を行なう駆動車輪４、及びモータ５の駆動により回転し且つ．前記走行板１の案内溝１ａに噛み合って走行体２の左右方向の移動を行なうスプロケット６，６等により主に構成されている。

【０００５】このうち、前記駆動直輪４は、外周にゴム帯４ｃ，４ｄを有する二つの分割直輪４ａ，４ｂに分割されると共に．支持軸７．７に対して．各々左右方向に摺動可能となるように軸支されている。

【０００６】このため、この分割直輪４ａ又は４ｂのゴム帯４ｃ又は４ｄが前記走行板１上に当接している時に．前記スプロケット６．６の回転により、走行体２が

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左右方向に移動すると、この分割直輪４ａ又は４ｂが、支持軸７上を右又は左方向に移動する。この結果．前記走行体２は、駆動直輪４によって前進しながら．スプロケット６，６によって左右方向へも進めるので．前記走行板１上を斜行することができる。なお、この種のものとしては、例えば特開平２－９２３８３号公報等に記載されたようなものがある。

【０００７】ところで、この様なモータ３，５には走行体２に設けた蓄電器（図示せず）から電力が供給され、走行体２にはスタート位置で固定側電源から電力が供給されるようになっている。

【０００８】この蓄電器への電力供給は、走行体２に設けられ且つ蓄電器に接続されたブラシと、競馬人形のスタート位置に設けられた固定側給電端子を介して行われる。即ち、競馬人形が走行体２と一体にスタート位置に戻って停止している間に前記ブラシを給電端子に接触させることにより．この給電端子及びブラシを介して固定側電源から電力を蓄電器に供給するようにしている。

【０００９】

【発明が解決しようとする課題】しかしながら．この給電はブラシを用いているために、長期使用ではブラシ及び固定側給電端子の接触部が酸化して．良好に給電ができなくなることもあり、好ましいものではなかった。

【００１０】そこで、この発明は、この様な酸化による影響を受けることなく可動体の電動駆動手段に良好に給電できる可動体側電動駆動手段への給電装置を提供することを目的とするものである。

【００１１】

【課題を解決するための手段】この目的を達成するため．請求項１の発明は、走行板の載置面上に載置した可動体に該可動体を前記載置面に沿って移動駆動させる電動駆動手段が設けられ、固定給電源からの電力を受け取る電力受取手段が前記可動体に設けられた可動体側電動駆動手段への給電装置であって、前記固定給電源は前記載置面に沿って該載置面下方に配設された一次コイルであり．前記電力受取手段は前記可動体に装着された二次コイルである可動体側電動駆動手段への給電装置としたことを特徴とする。

【００１２】また、請求項２の発明は．前記一次コイルは前記載置面に沿う方向に複数並設されていることを特徴とする。

【００１３】請求項３の発明は、前記複数の一次コイルの隣接するものの一方には位相制御回路を介して他方と逆位相の交流が交流源から供給されることを特徴とする。

【００１４】請求項４の発明、前記二次コイルは．前記載置面と平行で互いに交差する軸回りにそれぞれ捲回された第１，第２コイルと．前記載置面に沿う方向に捲回された第３コイルを有することを特徴とする。

【００１５】

【実施例】以下，この発明の実施例を図面に基づいて説明する。図1～図13は，この発明の一実施例を示すものである。

【0016】図1において，ベースB上には樹脂製の走行板8が配設され，走行板8の上には走行体9が配設され，走行体9上には脚駆動装置100が装着され，脚駆動装置100上には樹脂製の表面板Hが配設され，表面板Hの上には競馬人形Kが配設されている。この競馬人形Kは，前足L1及び後足L2の下端部に設けたマグネット(図示せず)が脚駆動装置100に装着されたマグネットMG1，MG2に表面板Hを介し磁着されて，走行体2と一体に表面板H上を摺接移動するようになっている。

【0017】[走行板8側の機械的構成]走行板8は，図6(a)に示した様に複数に分割したストレートのパネル8a（図7参照）と，セクター状のパネル8b（図8参照）から構成され，上面が走行体9を載置する載置面（走行面）8cとなっている。この走行板8上には，縦ラック10と横ラック10aとを備える案内手段12が形成されている。

【0018】この縦ラック10は，前記走行体9の主走行方向に対して等ピッチで配設された複数条の横ラック10aから構成されている。横ラック10aは，複数のラック歯10bを長手方向に等ピッチで有する。尚，符号11aはラック歯10b，10b間に形成された係合溝である。この係合溝11aの底面の高さは，他の走行板8上の高さよりもやや高くなるように形成されている。

【0019】尚，横ラック10aの各ラック歯10bは配列方向側面10cを垂直な面に形成したが，必ずしもこれに限定されるものではない。例えば，側面10cを複数の横ラック10aの配列方向の歯面形状と同様な曲線形状に形成することもできる。即ち，側面10cをインボリュート曲線を用いた歯面形状とすることもできる。

【0020】また，走行板8のストレートのパネル8a及びセクター状のパネル8bの下面には，図1，図2，図7，図8に示した様に多数の突部30及びこの多数の突部30間に形成された碁盤の目或は網目状の溝31が設けられている。この多数の突部30には図1，図2に示した様に走行面8cに沿うように溝31に配設した一次コイル33，34が固定給電源として交互に嵌着されている。

【0021】この一次コイル33は辺33a，33b，33c，33dから略方形に形成され，一次コイル34も辺34a，34b，34c，34dから略一次コイル33と同形状に形成されている。しかも，パネル8a，8bには，各辺33a，34a，33b，34b，33c，34c，33d，34dと交差するフェライト等の導磁性材料製の導磁体35がインサート成形により埋設されている。尚，実際には，図2(b)の如く，一次コイル33，34の対角線方向にも導磁体35を配設して，対角線方向の磁気抵抗を他の方向の磁気抵抗より小さくして，得られる磁場が大きくなるようにする。

【0022】また，走行板8を複数のパネルからトラック状に接合した例を示したが，必ずしもこれに限定されるものではなく，図6(b)の如く走行板8を一枚の平板から形成すると共に，図2(b)の如く一次コイル33または34及び導磁体35を設けたパネルPを図6(b)の如くトラックTに沿って走行板8の下方に配設してもよい。

【0023】[走行体9側の機械的構成]走行体9は，主に走行体本体9aと，この走行体本体9aの両側に配設され且つ前記縦ラック10と噛合わされて走行体本体9aをこの縦ラック10の配設方向に移動させる走行直輪13と，この駆動直輪13を回転駆動する駆動手段の一としてのモータ14（駆動駆動部）及び減速ギヤ部15と，前記横ラック10aと噛合わされて走行体本体9aをこの横ラック10aの延設方向に移動させるスプロケット28，29と，このスプロケット28，29を回転駆動する駆動手段の一としてモータ17（駆動駆動部）及び減速ギヤ部18等から構成されている。尚，モータ14，17にはパルスモータが用いられている。

【0024】走行体本体9aは，前壁9b，後壁9c及び取付部材9gを左右側壁9d，9eで挟持することにより，上下面に開口を有する直方体形状の外枠を構成している。

【0025】この走行体本体9aの前側略半分には前側走行モジュールM1が，後側略半分には前側走行モジュールM1と略同じ構造を有する後側走行モジュールM2が各々配設されている。

【0026】つまり，この走行体本体9aの両側壁9d，9eには，側方に突出する2本の回転軸19，19が長手方向に間隔をおいて夫々取り付けられている。この回転軸19には，各々走行直輪13及びこの走行直輪13に固着した従動ギヤ20が回動自在に配設され，前側走行モジュールM1の一部を前側の左右2本づつの走行車輪13及び前記駆動手段が，後側走行モジュールM2の一部を後側の左右2本の走行直輪13及び前記駆動手段を主に構成するようにしている。

【0027】まず前側走行モジュールM1について説明する。この前側走行モジュールM1の左右各走行車輪13，13の周縁部には，90°毎に前記走行板8上の係合突起10aと噛み合う係合溝13aが形成されて係合歯部13bを呈している。

【0028】そしてこの係合歯部13bには，棒状ベアリング21が，円弧方向に渡って配設されるピン21aを中心として回転自在に取り付けられている。この棒状ベアリング21の外周は，前記走行車輪13の周面の高さよりもやや高くすると共に，略同じ曲率に形成されて

いる。そして、この樽状ベアリング２１の回転方向は、前記走行車輪１３の駆動方向と直交する方向としている。

【００２９】また、駆動手段としての前記モータ１４は、前記右側壁９ｅに、取付部材９ｆを介して固着されている。このモータ１４のモータ軸にはピニオンギヤ２２が設けられ、このピニオンギヤ２２は駆動軸２３を回転駆動する減速ギヤ２４に噛み合わされている。

【００３０】そしてこの駆動軸２３の先端部分には、従動ギヤ２０，２０と噛み合う駆動ギヤ２５が設けられて、前記駆動軸２３の回転が前記走行車輪１３に伝達されるようになっている。この前記前後一組の従動ギヤ２０，２０の噛み合わせ位置は、図１０に示すように、前記走行車輪１３，１３の位相が４５°ずらされて噛み合うように設定されている。

【００３１】このため、前記前側走行モジュールＭ１の前後一組の走行車輪１３，１３は、前記駆動ギヤ２５の回転により、一の走行車輪１３の係合歯部１３ｂが前記縦ラック１０に噛み合う時に、他の走行車輪１３の一の樽状ベアリング２１が、前記走行板８上に当接するように同期して回転駆動される。

【００３２】さらに、図１２に示すように、この走行体本体９ａの略中央位置には、前記駆動手段の一としてのモータ１７が前記取付部材９ｇにモータケースを固着されて配設されている。このモータ１７のモータ軸にはピニオンギヤ２６が設けられ、減速ギヤ群１８ａと共に、減速ギヤ部１８を構成している。また、前記前後側壁９ｂ，９ｃ間には、回動自在に軸支される回転軸２７が配設され、前記ピニオンギヤ２６の回転駆動は、前記減速ギヤ群１８ａを介してこの回転軸２７に伝達されるように連結されている。

【００３３】そして、この回転軸２７の前後両端側位置には、前記走行板８に設けられた横ラック１０ａと噛み合うスプロケット２８，２９が配設されている。このため、回転軸２７の回転により、前記走行体本体９ａを前記横ラック１０ａの配設方向に移動させるようにしている。

【００３４】このスプロケット２８，２９の長さは、前記走行板８上の縦ラック１０と隣合う縦ラック１０との間隙に比してやや長く設定されている。

【００３５】そして、前記モータ１４，１７は、図示しない電源を含むコントローラによって、その回転駆動を制御されている。

【００３６】後側走行モジュールＭ２についても前記前側走行モジュールＭ１と略同様の構成としているので、図９から図１１中の一部の符号とその説明とを省略する。

【００３７】また、走行体９には、図１に示した様に、給動電源としての蓄電器４０が装着されていると共に、一次コイル３３，３４（固定給電源）からの電力を授受する可動電力受取装置５０が取り付けられている。

【００３８】この可動電力受取装置５０は、走行体９の中央に装着された第１コイル組立体５１と、走行体９の前後（長手方向）両端に装着された第２コイル組立体５２を有する。このコイル組立体５１は、図１(b)，図３に示した様に、フェライト等の導磁性材料製からなる第１，第２の導磁体５３，５４と、一次コイル３３，３４（固定給電源）からの電力を授受する二次コイル５５（電力受取手段）を有する。この導磁体５３，５４は、互いに直交した状態で固定されていると共に、軸線は走行板８の載置面８ａと平行に設けられている。尚、図２において、左右方向をＸ方向とし、上下方向をＹ方向とし、紙面に直交する方向をＺ方向とすると、導磁体５３，５４はＸ，Ｙ方向に対して４５°の方向に向けられている。

【００３９】二次コイル５５は、第１，第２の導磁体５３，５４に夫々巻回された第１，第２コイル５６，５７と、載置面８ａに沿う方向に第１，第２の導磁体５３，５４の端面■りに巻■された第３コイル５８を有する。

【００４０】第２コイル組立体５２は、図１(b)に示した様に、フェライト等の導磁性材料製からなりＸ，Ｙ方向にそれぞれ向けられた第１，第２の導磁体５２ａ，５２ｂと、一次コイル３３，３４（固定給電源）からの電力を授受する二次コイル５２ｃ（電力受取手段）を有する。この導磁体５２ａ，５２ｂは、互いに直交した状態で固定されていると共に、軸線は走行板８の載置面８ａと平行に設けられている。また、二次コイル５２ｃは、第１，第２の導磁体５２ａ，５２ｂに夫々巻回された第１，第２コイル５２ｃ１，５２ｃ２を有する。

【００４１】[給電回路]給電回路は、ベースＢに設けられる図４の固定側回路６０と、走行体９に設けられる図５の可動側回路７０を有する。

【００４２】この固定側回路６０は、商用電源６１（交流源）に接続された電源回路６２と、電源回路６２からの交流周波数を高周波に変調させる周波数変調回路６３と、周波数変調回路６３からの電圧・電流の位相を制御する位相制御回路６４と、位相制御回路６４らの電力を複数の一次コイル３３にそれぞれ分配供給する電力分配器６５と、周波数変調回路６３からの電力を一次コイル３４に分配する分配器６６を有する。

【００４３】周波数変調回路６３は１０ＫＨｚ～３０ＫＨｚの範囲内の周波数の交流を出力するように設定され、各一次コイル３３，３４からは３０ｗ程度の電力を供給可能に電源回路６２及び変調回路６３が設定されている。

【００４４】この位相制御回路６５は、一次コイル３３に供給される交流の位相を一次コイル３４に供給される交流の位相と逆にさせる様に設定されている。これにより、複数の一次コイルの隣接するものには逆位相の交流が交流源から供給される。

【００４５】また、可動側回路７０は、図５に示した様に二次コイル５２ｃのコイル５２ｃ１、５２ｃ２及び二次コイル５１のコイル５６、５７，５８と、３コイル５２ｃ１，５２ｃ２，５６、５７，５８に夫々接続され且つ出力側が互いに直列に接続された整流回路５２ｄ１，５２ｄ２，７１、７２，７３と、整流回路５２ｄ１，５２ｄ２，７１、７２，７３から供給される直流で作動してモータ１４、１７に供給制御するパルス数を制御する演算制御回路８０を有する。

【００４６】尚、本実施例では、整流回路５２ｄ１，５２ｄ２，７１、７２，７３を直列に接続して、コイル５２ｃ１，５２ｃ２，５６、５７，５８のいずれかの電圧・電流が走行体の移動位置によって小さくなって、整流回路５２ｄ１、５２ｄ２、７１，７２、７３のいずれかの電圧・電流が小さくなっても、最終的に得られる電流・電圧が一定レベル以上に成るように互いに補うようにしたが、この条件を満足できれば整流回路５２ｄ１，５２ｄ２，７１、７２，７３を並列に接続してもよいことは勿論である。

【００４７】この演算制御回路８０には、ＣＰＵを有するコントローラ８１からの制御情報が光通信手段８２を介して常時供給されるようになっている。このコントローラ８１には、コントロールパネル８３から入力されたデータを基に制御情報を構築するようになっている。また、光通信手段８２は、演算制御回路８０の入力側に接続され且つ走行体９に取り付けられた受光素子８２ａ（取付位置図示せず）と、コントローラ８１の出力側に接続され且つ走行板８と表面板９との間に位置させてベースＢ側に取り付けられた発光素子８２ｂ（取付位置図示せず）を有する。

【００４８】尚、演算制御回路８０は、整流回路、５２ｄ１、５２ｄ２、７１，７２，７３から供給される電圧が高い位置に走行体９があるときに、整流回路５２ｄ１、５２ｄ２、７１，７２、７３から供給される電力の一部を蓄電器４０に充電させ整流回路５２ｄ１、５２ｄ２、７１，７２、７３から供給される電圧が低い位置に走行体９があるときに、蓄電器４０から電力を利用して、モータ１４、１７の駆動制御を行うようになっている。

【００４９】[実施例の作用]次に、この実施例の作用について説明する。

【００５０】（電力供給）この様な走行体９の走行に際しては、商用電源６１からの電力が固定側回路６０を介して互いに隣接する一次コイル３３、３４に供給される。この際、一次コイル３３には、一次コイル３４と逆位相の交流が位相制御回路６５により供給される。この結果、一次コイル３３，３４の周囲に発生する磁束は、隣接部での磁束の上下に向うベクトルの向きが同方向となって、打ち消し合わずにプラスされる。

【００５１】また、一次コイル３３、３４からはＸ，Ｙ，Ｚ方向に向う磁束ベクトル成分が発生している。

【００５２】そして、二次コイル５５の第１，第２，第３コイル５６、５７，５８のうち、第１コイル５６には一次コイル３３、３４のＸ、Ｙ方向の磁束ベクトル変化を受けて交流起電力を生じ、第２コイル５７には一次コイル３３，３４のＸ，Ｙ方向の磁束ベクトル変化を受けて交流起電力を生じ、第３コイル５８には一次コイル３３、３４のＺ方向の磁束ベクトル変化を受けて交流起電力を生じる。また、コイル５２ｃ１には一次コイル３３、３４のＸ方向の磁束ベクトル変化を受けて交流起電力を生じ、コイル５２ｃ２には一次コイル３３、３４のＹ方向の磁束ベクトル変化を受けて交流起電力を生じる。

【００５３】この各コイル５２ｃ１、５２ｃ２、５６，５７、５８で生じた交流は整流器５２ｄ１，５２ｄ２，７０、７１，７２を介して直流に変換され、この整流器５２ｄ１，５２ｄ２，７０、７１，７２からの直流は合成されて演算制御回路８０に供給される。

【００５４】この結果、整流器５２ｄ１，５２ｄ２，７０、７１，７２から出力されて合成された合成電流は、コイル組立体５１が各一次コイル３３、３４の中央側上方に位置しても、一次コイル３３，３４の隣接部上に位置している場合と略同じレベルになる。即ち、この合成電流は、コイル組立体５１の移動位置に拘らず常時一定になる。従って、走行体９の移動時も無接触で電力を演算制御回路８０に供給できる。

【００５５】また、演算制御回路８０は、整流回路，５２ｄ１，５２ｄ２，７１、７２，７３から供給される電圧が高い位置に走行体９があるときに、整流回路５２ｄ１、５２ｄ２、７１，７２、７３から供給される電力の一部を蓄電器４０に充電させ整流回路５２ｄ１、５２ｄ２、７１，７２、７３から供給される電圧が低い位置に走行体９があるときに、蓄電器４０から電力を利用して、モータ１４、１７の駆動制御を行う。

【００５６】（走行体９の駆動）今、演算制御回路８０は、整流器５２ｄ１，５２ｄ２，７０、７１，７２からの電力が供給されると、モータ１４、１７に駆動パルスを供給可能な状態となる。

【００５７】そして、縦方向の移動制御情報がコントローラ８１から光通信手段８２を介して演算制御回路８０に入力されると、演算制御回路８０はこの制御情報を基にモータ１４に駆動パルスを供給してモータ１４を駆動制御する。このモータ１４の駆動により、前記走行直輪１３、１３が走行板８の縦ラック１０の配列方向に回転駆動すると、前記前後一組の走行直輪１３，１３の嵌合溝１３ａ，１３ａが、前記縦ラック１０の係合突起１０ａ、１０ａに順次交互に噛合いながら、この走行体９を前記縦ラック１０の配列方向に移動させる。

【００５８】このとき前記走行直輪１３，１３の嵌合溝１３ａ，１３ａのうち、いずれかの嵌合溝１３ａが常に

前記走行板8の係合突起10aに噛み合っているので、従来走行体の駆動機構の様にスリップすることがない。このため、走行体9を走行車輪13の回転数に応じた量だけ確実に移動させることができる。

【0059】したがって、モータ14として、ステッピングモータ等を用いた場合は、予めこのモータ14に入力されるパルス数によって走行車輪13の回転数を決定し、走行距離を制御することが出来、前記走行体9を目標位置まで正確に移動させることが出来る。このため、移動距離を測定する移動距離センサ等を配設して、フィードバック制御を行なう必要が全く無い。

【0060】また、横方向の移動制御情報がコントローラ81から光通信手段82を介して演算制御回路80に入力されると、演算制御回路80はこの制御情報を基にモータ17に駆動パルスを供給してモータ17を駆動制御する。

【0061】このモータ17の駆動により、前記ピニオンギヤ26、減速ギヤ部18a、回転軸27を介して前記スプロケット28，29が回転駆動されると、前記走行体本体9aが前記横ラック10aの配設方向に移動される。

【0062】この際には、前記走行車輪13，13が転動していても、前側走行モジュールM1の少なくとも一の走行直輪13の樽状ベアリング21と後側走行モジュールM2の少なくとも一の走行直輪13の樽状ベアリング21とが、走行板8上に当接し、走行体9を支えているので、前記縦ラック10の延設方向に移動する際の抵抗は、樽状ベアリング21の転がり抵抗となり、従来の走行体の駆動機構において、駆動直輪、支持軸間に発生する摺動抵抗に比して、小さな抵抗で走行体9を斜行又は、横方向に移動させることが出来る。

【0063】尚、この実施例の走行の移動機構では、前後走行モジュールM1，M2を走行体本体9aの前後に配設しているが、これに限らず、一方の走行モジュールM1又はM2のみを前記走行体本体9aに配設するようにしても良い。この場合でも、少なくとも一の走行直輪13の樽状ベアリング21が、走行板8上に当接しているので、前記の2つの樽状ベアリング21，21が当接している場合と同様に小さな抵抗で走行体9を斜行又は、横方向に移動させることが出来る。

【0064】しかも、従来の走行体の移動機構においては、駆動直輪が支持軸の端部に到達し、この支持軸を支えている走行体の側壁に当接すると、それ以上は左右方向へ、駆動直輪を摺動させることが出来ず、横方向への走行体の移動は、制限されてしまう。

【0065】これに対し、この実施例では、樽状ベアリング21が横ラック10aの配設方向に転動するので、横方向への走行体9の移動が制限されることなく、前記走行板8上を横ラック10aの配設方向のみにでも、確実に移動することが可能である。

【0066】この実施例の走行体9の駆動機構では、走行体9が横ラック10aの配設方向にもスムーズに移動できるので、モータ17のエネルギーロスを最小限に抑えることが出来るため、駆動手段の小型、軽量化を図ることが可能となった。

【0067】しかも、走行模型として競馬ゲームの馬の模型を前記走行体9の上方に配設する走行面上に乗せ、この馬の模型と前記走行体9とを磁力で吸着等させて、走行体9の移動にこの馬の模型を追従させるようにすると、この馬の模型は、前記走行面上を軌道による制約なしに前後、斜行、左右方向にスムーズに動いて目的の位置に確実に到達するので、より実際の馬の挙動に近い臨場感を醸し出すことが出来る。

【0068】この実施例の走行体の移動機構では、走行板8の案内手段として縦ラック10と横ラック10aとをラック歯10bで構成しているが、これに限らず、縦ラック10を案内溝で形成する等、複数列の縦ラック及び横ラックが縦横方向に交差配列されるものならば、どの様な案内手段としても良い。

【0069】この場合、走行直輪13の係合歯部の嵌合溝13aの替わりに突起形状部を用いなければならないのは当然である。

【0070】また、上記実施例では、縦ラック10と横ラック10aとを縦横方向に交差配列し、横ラック10aにスプロケット28，29を噛み合わせて、前記走行体9を横ラック10aの配設方向に移動させているが、この横ラック10a及び、スプロケット28，29等を用いずに、縦ラック10の延設方向の移動を他の移動手段によって行なうようにしても良い。

【0071】この場合、走行体9が樽状ベアリング13によって支えられているので、ラック歯としての縦ラック10の配列方向に正確に移動しながら、スムーズに縦ラック10の係号突起10aの延設方向へも移動させることが出来る。このため、正確に相対位置を移動させつつ、この移動方向に対して直交する方向に、確実に移動することが求められるあらゆる搬送手段に応用することができる。

【0072】

【発明の効果】以上説明した様に、請求項1の発明は、走行板の載置面上に載置した可動体に該可動体を前記載置面に沿って移動駆動させる電動駆動手段が設けられ、固定給電源からの電力を受け取る電力受取手段が前記可動体に設けられた可動体側電動駆動手段への給電装置であって、前記固定給電源は前記載置面に沿って該載置面下方に配設された一次コイルであり、前記電力受取手段は前記可動体に装着された二次コイルである可動体側電動駆動手段への給電装置としたので、従来の様な給電のための接触部がなく、酸化による影響を受けることなく良好に給電できる。

【0073】また、請求項2の発明は、前記一次コイル

は前記載置面に沿う方向に複数並設されている構成としたので、載置面のいずれの位置でも可動体の蓄電器への給電を無接触で行うことができる。

【００７４】請求項３の発明は、前記複数の一次コイルの隣接するものの一方には位相制御回路を介して他方と逆位相の交流が交流源から供給される構成としたので、一次コイルの隣接部での磁束が打ち消されることなくプラスされて、可動体の蓄電器への給電効率を向上させる。

【００７５】請求項４の発明は、前記二次コイルは、前記載置面と平行で互いに交差する輪回りにそれぞれ捲回された第１，第２コイルと，前記載置面に沿う方向に捲回された第３コイルを有する構成としたので、一次コイルの内側の空間に臨む部分に二次コイルが移動しても、この部分における一次コイルの磁束変化を第３コイルがピックアップして起電力を発生させ，第３コイルから可動体の蓄電器への給電を良好に行うことができる。

【図面の簡単な説明】

【図１】(a)はこの発明にかかる可動体側電動駆動手段への給電装置を備える遊戯装置の概略断面図、(b)は(a)の走行体を下方から見たときのコイル組立体の配置を示す概略説明図である。

【図２】(a)は図１に示した走行板の部分底面図、(b)は図１(a)の走行板に設ける一次コイルと導磁体の他の例をを示す説明図である。

【図３】図１に示した受力受取手段の要部説明斜視図である。

【図４】図１に示した一次コイルを有する固定側給電回路の説明図である。

【図５】図３に示した二次コイルを有する可動側給電回＊路の説明図である。

＊【図６】(a)は図１に示した走行板の平面図，(b)は図１に示した走行板の他の例を示す概略平面図である。

【図７】図６の走行板を構成するストレートなパネルの底面図である。

【図８】図６の走行板を構成するセクター状のパネルの底面図である。

【図９】この発明の実施例の走行体が走行板上で移動している様子を示す全体斜視図である。

【図１０】この発明の実施例のうち，特に走行板と走行車輪との関係を示す要部側面図である。

【図１１】この発明の実施例の走行体を上方から見た平面図である。

【図１２】この発明の実施例の走行体のスプロケットの駆動機構を示す図９のＡ－Ａ断面図である。

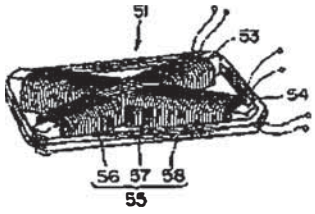
【図１３】この発明の実施例の走行体の減速ギヤ部を示す図１１のＢ－Ｂ断面図である。

【図１４】従来例の走行体が走行板上で移動している様子を示す全体斜視図である。

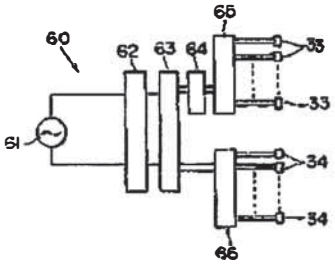
【符号の説明】

８…走行板
８ｃ…載置面
９…走行体
３３，３４…一次コイル（固定側給電源）
４０…蓄電器
５５…二次コイル（可動側給電源）
５６…第１コイル
５７…第２コイル
５８…第３コイル
６４…位相制御回路

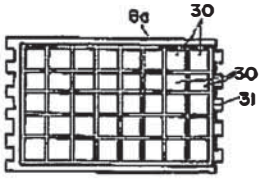
【図３】



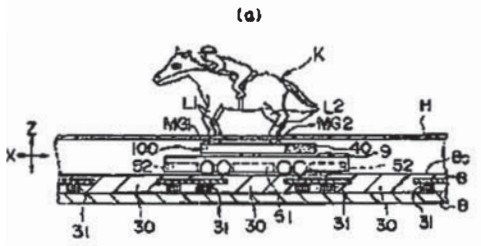
【図４】



【図７】



【図1】



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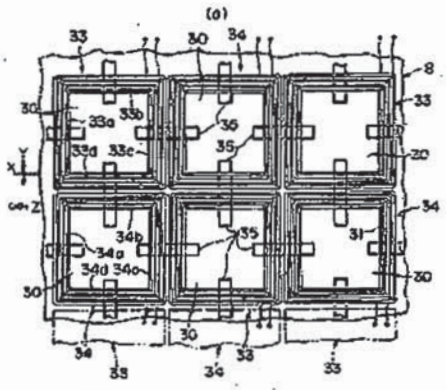

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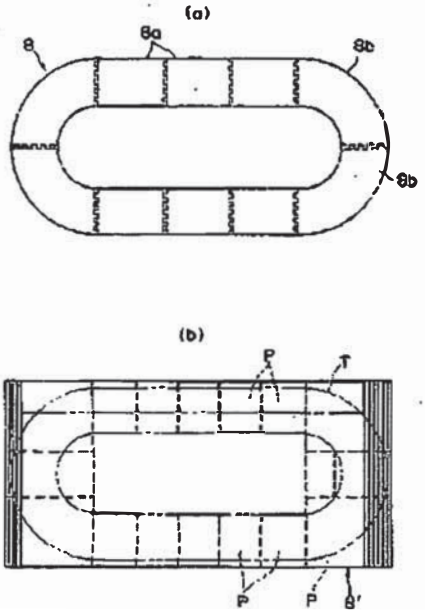

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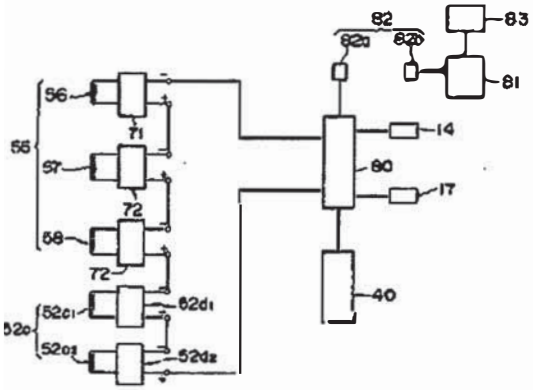

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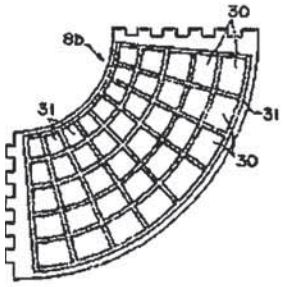

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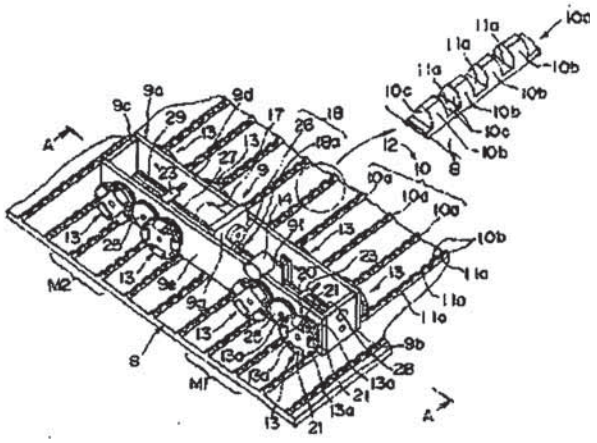

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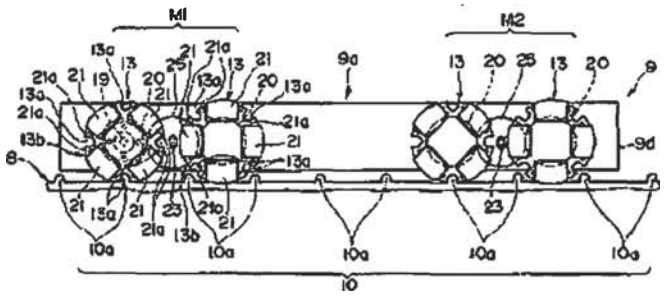

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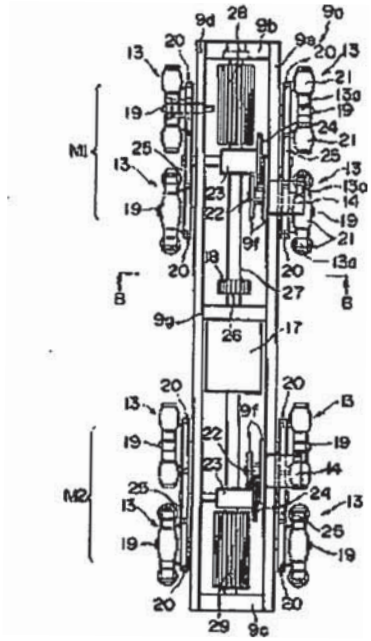

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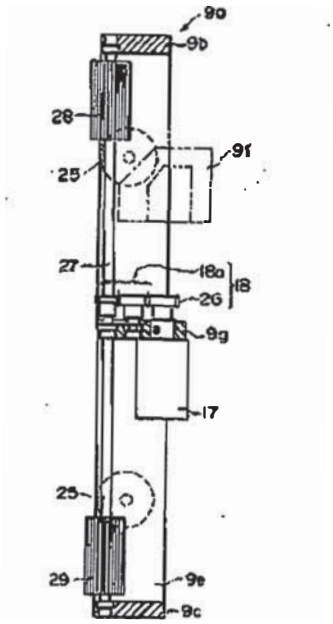
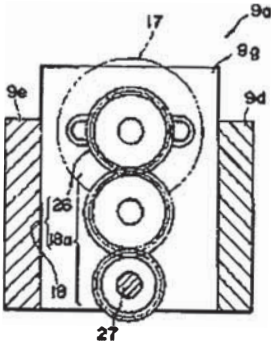
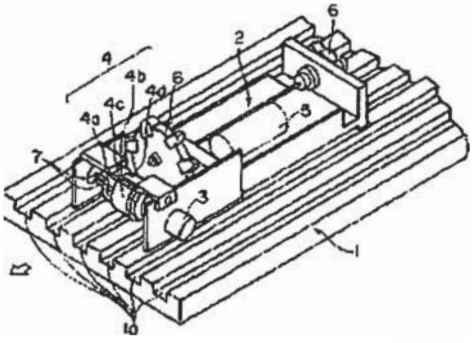


【図13】



【図14】



No documents available for this priority number.

Espacenet

Bibliographic data: JP2002231545 (A) — 2002-08-16

NONCONTACT POWER UNIT

Inventor(s): NAKANISHI TAKAHIRO; HIGASHIDE TAKASHI; ONO MAKOTO ± (NAKANISHI TAKAHIRO, ; HIGASHIDE TAKASHI, ; ONO MAKOTO)

Applicant(s): MATSUSHITA ELECTRIC IND CO LTD ± (MATSUSHITA ELECTRIC IND CO LTD)

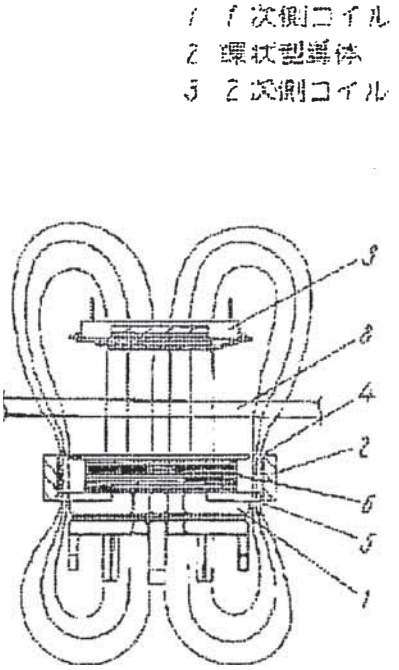
Classification: - international: ***H01F38/14; H02J17/00;*** (IPC1-7): H01F38/14; H02J17/00
- cooperative:

Application number: JP20010026421 20010202

Priority number (s): JP20010026421 20010202

Abstract of JP2002231545 (A)

PROBLEM TO BE SOLVED: To provide a noncontact power unit in which primary and secondary coils are magnetically coupled with each other in a satisfactory state. SOLUTION: In this noncontact power unit composed of the primary and secondary coils 1 and 3, an annular conductor 2 is provided on the outer periphery of the primary coil 1.



Last updated: 19.12.2012 Worldwide Database 5.8.4; 92p

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特開2002－231545
（Ｐ2002－231545Ａ）
(43)公開日　平成14年８月16日(2002.8.16)

(51)Int.Cl.'	識別記号	ＦＩ		テーマコード'（参考）
Ｈ０１Ｆ　38/14		Ｈ０２Ｊ　17/00		Ｂ
Ｈ０２Ｊ　17/00		Ｈ０１Ｆ　23/00		Ｂ

審査請求　未請求　請求項の数６　ＯＬ　（全４頁）

(21)出願番号　特願2001－28421(Ｐ2001－28421)

(22)出願日　平成13年２月２日(2001.2.2)

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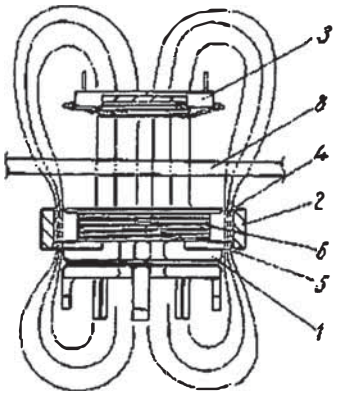
(54)【発明の名称】　非接触電源装置

(57)【要約】
【課題】　１次、２次側コイル間の磁気結合の良好な非接触電源装置を提供する。
【解決手段】　１次側コイル１と、２次側コイル３とからなる非接触電源装置において、１次側コイル１の外周に環状型導体２を設けた。

1　１次側コイル
2　環状型導体
3　２次側コイル



1

【特許請求の範囲】

【請求項１】　電力の供給を行う充電器本体ケースの内側に装着した１次側コイルと、前記充電器本体ケース外において前記１次側コイルから電力を受け取る２次側コイルとからなる非接触電源装置において、環状型導体を１次側コイルの外周に設けたことを特徴とする非接触電源装置。

【請求項２】　天面開口部と底面開口部が同じ大きさの環状型導体を、１次側コイルの外周に設けたことを特徴とする請求項１に記載の非接触電源装置。

【請求項３】　天面開口部が底面開口部より小さい環状型導体を、１次側コイルの外周に設けたことを特徴とする請求項１に記載の非接触電源装置。

【請求項４】　天面開口部が底面開口部より小さく、尚に天面開口部がわん曲形状の環状型導体を、１次側コイルの外周に設けたことを特徴とする請求項１に記載の非接触電源装置。

【請求項５】　環状型導体を、電力供給巻線のみに設けたことを特徴とする請求項２～４のいずれか一つに記載の非接触電源装置。

【請求項６】　環状型導体を、電力供給巻線と補助巻線に設けたことを特徴とする請求項２～４のいずれか一つに記載の非接触電源装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、家庭用コードレス電話器、携帯電話、ＰＨＳ、ＰＤＡ等の小型ポータブル機器等の電磁誘導を利用した非接触電源装置に関するものである。

【０００２】

【従来の技術】図７に従来の技術を示す。すなわち、電力の供給を行う充電器本体ケースの内側に装着した１次側コイル１と、前記充電器本体ケース外において前記１次側コイル１から電力を受け取る２次側コイル３とからなる構成であった。

【０００３】

【発明が解決しようとする課題】距離（ギャップ）を介して１次側コイル１から発生した磁束の内、２次側コイル３が受けることのできる磁束量は少なく、高出力が得られないものであった。

【０００４】従って、高出力を得るために、距離（ギャップ）を介して１次側コイル１から発生した磁束の内、２次側コイル３が受けることのできる磁束量を、いかに増加させるかが課題であった。

【０００５】

【課題を解決するための手段】本発明は上記課題を解決するために、環状型導体を１次側コイルに設けることにより２次側コイルが受けることができる磁束量を増加させたものである。

【０００６】

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【発明の実施の形態】本発明の請求項１に記載の発明は、電力の供給を行う充電器本体ケースの内側に装着した１次側コイルと、前記充電器本体ケース外において前記１次側コイルから電力を受け取る２次側コイルとからなる非接触電源装置において、環状型導体を１次側コイルの外周に設けたものであり、１次側コイルから発生した磁束の内、２次側コイルが受けることのできる磁束量を増加させることができ、１次側コイル～２次側コイル間の磁気結合の向上が図れるため、高出力が得られるという作用を有する。

【０００７】本発明の請求項２に記載の発明は、天面開口部と底面開口部が同じ大きさの環状型導体を１次側コイルの外周に設けるため、１次側コイルから発生した磁束の内、２次側コイルが受けることのできる磁束量を増加させることができ、１次側コイル～２次側コイル間の磁気結合の向上が図れるため、高出力が得られるという作用を有する。

【０００８】請求項３に記載の発明は、天面開口部が底面開口部より小さい環状型導体を１次側コイルの外周に設けるため、請求項２に示した発明と比較して、環状型導体を１次側コイルから遠ざけても、２次側コイルが受けることのできる磁束量を増加させることができ、１次側コイル～２次側コイル間の磁気結合の向上が図れるため、高出力が得られるという作用を有する。

【０００９】請求項４に記載の発明は、天面開口部が底面開口部より小さく、尚に天面開口部がわん曲形状の環状型導体を、１次側コイルの外周に設けるため、請求項３に示した発明と比較して、環状型導体を１次側コイルから遠ざけても、２次側コイルが受けることのできる磁束量を増加させることができ、１次側コイル～２次側コイル間の磁気結合の向上が図れるため、高出力が得られるという作用を有する。

【００１０】請求項５に記載の発明は、１次側コイルの電力供給巻線の外周にのみ環状型導体を設けるため、１次側コイルから発生した磁束の内、２次側コイルが受けることのできる磁束量を増加させることができ、１次側コイル～２次側コイル間の磁気結合の向上が図れるため、高出力が得られるという作用を有する。

【００１１】請求項６に記載の発明は、１次側コイルの電力供給巻線と補助巻線の外周に環状型導体を設けるため、１次側コイルから発生した磁束の内、２次側コイルが受けることのできる磁束量を増加させることができ、１次側コイル～２次側コイル間の磁気結合の向上が図れるため、高出力が得られるという作用を有する。

【００１２】（実施の形態１）図１に示すごとく本実施形態では、電力の供給を行う充電器本体ケース（図示せず）の内側に装着した１次側コイル１と、前記充電器本体ケース外において前記１次側コイル１から電力を受け取る２次側コイル３とからなる非接触電源装置において、環状型導体２を１次側コイル１の外周に設けたもの

である。

【００１３】具体的には．１次側コイル１の電力供給巻線６の外周に．天面開口部４と底面開口部５が同じ大きさで．少なくとも１Ｔ以上の環状型導体２を設けたものであり，１次側コイル１から発生した磁束の内．２次側コイル３が受けることのできる磁束量を増加させることができ、１次側コイル１～２次側コイル３間の磁気結合の向上が図れるため、高出力が得られるものである。なお図１の８はギャップで．これより下が充電器本体ケース側．上が各種機器側となる。

【００１４】（実施の形態２）図２は環状型導体２の天面開口部４を底面開口部５より小さくして磁束を絞ってより２次側コイル３側に向かうようにしたものである。

【００１５】（実施の形態３）図３は環状型導体２の天面開口部４を底面開口部５より小さく．更に天面開口部４はわん曲している形状としたものであり、実施の形態２と同様の効果が得られるものである。

【００１６】（実施の形態４）図４は１次側コイル１の電力供給巻線６と補助巻線７の外周に．天面開口部４と底面開口部５が同じ大きさで、少なくとも１Ｔ以上の環状型導体２を設けたものであり、実施の形態１と同様の効果が得られるものである。

【００１７】（実施の形態５）図５は１次側コイル１の電力供給巻線６と補助巻線７の外周に．天面開口部４が底面開口部５より小さく．少なくとも１Ｔ以上の環状型導体２を設けるため、実施の形態２と同様の効果が得られるものである。

【００１８】（実施の形態６）図６は１次側コイル１の＊電力供給巻線６と補助巻線７の外周に．天面開口部４が底面開口部５より小さく．更に天面開口部４がわん曲している形状の環状型導体２を設けたものであり．実施の形態３と同様の効果が得られるものである。

【００１９】

【発明の効果】以上のように本発明は．１次側コイルの外周に環状型導体を設けたものであるので、２次側コイルの受ける磁束量を増大させることができ、１次側コイル～２次側コイル間の磁気結合の向上が図れるため、高出力を得ることが可能である。

【図面の簡単な説明】

【図１】本発明の実施の形態１の構成図

【図２】本発明の実施の形態２の構成図

【図３】本発明の実施の形態３の構成図

【図４】本発明の実施の形態４の構成図

【図５】本発明の実施の形態５の構成図

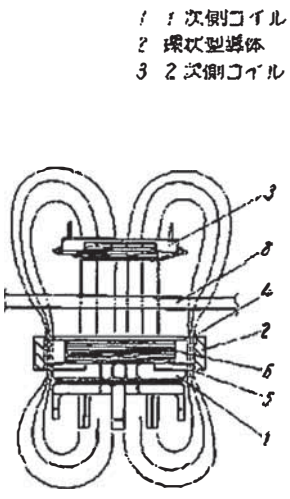
【図６】本発明の実施の形態６の構成図

【図７】従来例の構成図

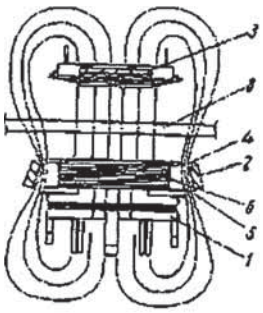
【符号の説明】

1　１次側コイル
2　環状型導体
3　２次側コイル
4　環状型導体の天面の開口部
5　環状型導体の底面の開口部
6　１次側コイル電力供給巻線
7　１次側コイル補助巻線
8　ギャップ

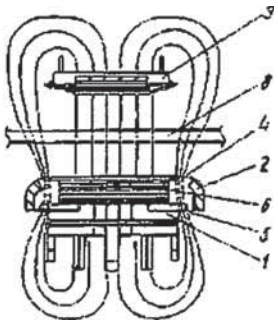
【図１】



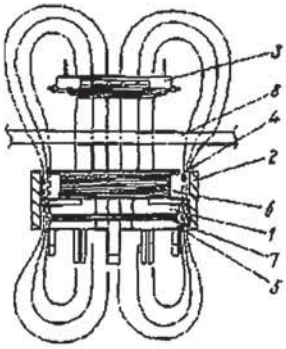
【図２】



【図３】



【図4】



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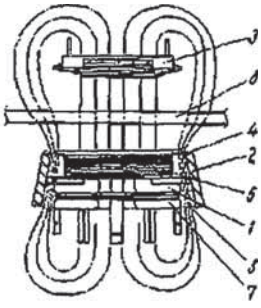

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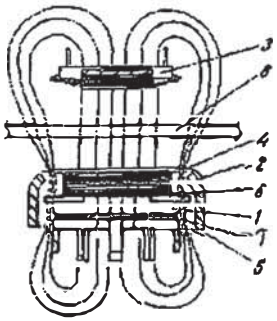

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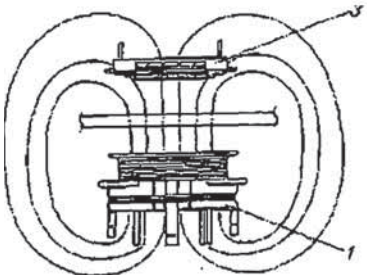


No documents available for this priority number.

Espacenet

Bibliographic data: JP8238326 (A) — 1996-09-17

PRIMARY SIDE CORE OF TRANSFORMER FOR CONTACTLESS ENERGY TRANSMISSOIN SYSTEM

Inventor(s): SAITO MASARU; HIRACHI KATSUYA; MAEJIMA YASUSHI + (SAITO MASARU, ; HIRACHI KATSUYA, ; MAEJIMA YASUSHI)

Applicant(s): KAJIO PAGING RES LAB KK; TABUCHI DENKI KK + (KAAJIOPEESHINGU RES LAB:KK, ; TABUCHI DENKI KK)

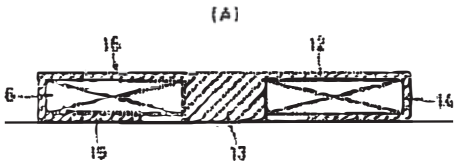
Classification: - international:***A61N1/378; H02J17/00; H02J7/00;*** (IPC1-7): A61N1/378
- cooperative:

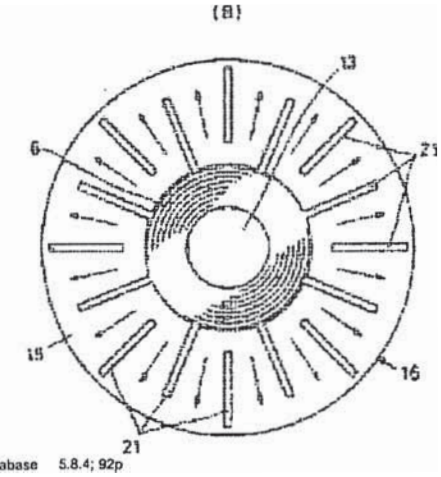
Application number: JP19950070904 19950303

Priority number (s): JP19950070904 19950303

Abstract of JP8238326 (A)

PURPOSE: To make it possible to suppress raising in the temp. of a transformer to be used for percutaneous charging system for a pace maker and to improve the efficiency of a charging system by preventing the overcurrent of a primary side core of this transformer. CONSTITUTION: The surface facing the secondary core of a circumferential outer leg 14 of the primary side core 16 is provided with an expanded width part 15 expanded in an inner circumferential direction. This expanded width part 15 is radially provided with many slits 21 from its center. The eddy current of the expanded width part 15 is prevented by these slits 21, by which the efficiency of the system is improved and heat generation is suppressed.





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Ａ６１Ｎ　1/378			Ａ６１Ｎ　1/378	

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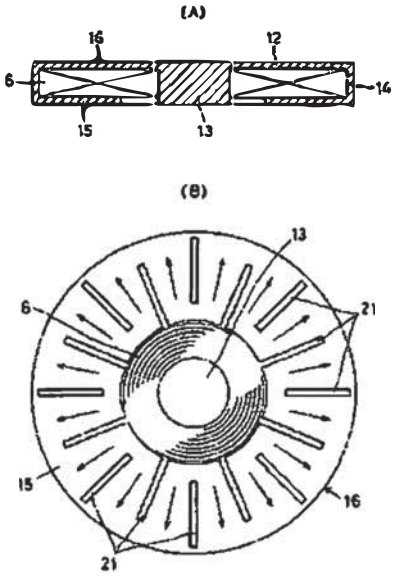
最終頁に続く

(54)【発明の名称】　非接触エネルギー伝送システム用トランスの１次側コア

(57)【要約】
【目的】　ペースメーカー用経皮充電システムに用いるトランスの１次側コアの過電流を防止し、トランスの温度上昇の抑制や充電システムの効率の向上を可能にする。
【構成】　１次側コア１６の周囲外足１４の２次側コアに対向する面に内周方向に拡張した拡幅部分１５を設け、この拡幅部分１５に中心から放射状の配置で多数のスリット２１を設け、このスリット２１で拡幅部分１５の過電流を防止し、システムの効率の向上および発熱の抑制を実現することができる。



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【特許請求の範囲】

【請求項１】　１次側コイルを中央中足に巻装した１次側コアと、２次側コイルを平板状に巻線した２次側コアとを非接触に配置し、１次側コイルに誘起された磁束を１次側コアの中央中足から周囲外足部分を介して２次側コアに伝送して２次側コイルにエネルギーを誘起させる非接触エネルギー伝送システム用トランスの１次側コアにおいて、該１次側コアの周囲外足部分の２次側コアに対向する面を内側や外側に拡張した円盤状の拡幅部分に形成し、この拡幅部分に中心から放射状の配置でスリットを設けたことを特徴とする非接触エネルギー伝送システム用トランスの１次側コア。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】この発明は、体内埋め込み形心臓ペースメーカーなど、トランスの１次側と２次側の間に大きな間隔を設けて電力を伝送する充電器などに使用するトランスの形状の改善．特にそのトランスの１次側コアの形状に関する。

【０００２】

【従来の技術】図３は心臓ペースメーカー用経皮充電システムの概要を示す。同図において．鎖線で囲んだ部分はペースメーカー（Ａ）を示し、体内に埋め込まれる。その中にはパルスを発生するパルスジェネレータ１やその電源である２次電池２などが収納されている。

【０００３】上記パルスジェネレータ１で作られたパルス信号は電極リード３を介して心臓４に伝えられ．この心臓４を規則正しく拍動させる。

【０００４】また、体外には高周波インバータ５を設置して．トランスの１次側コイル６を励磁し、体内のペースメーカー（Ａ）の内部に収納されたトランスの２次側コイル７に電力を伝送する。

【０００５】２次側コイル７に発生した電圧は整流回路８で直流に変換されて電池２を充電する。１次側コイル６と２次側コイル７の間には皮膚９や脂肪などが存在する。従って、１次側コイル６と２次側コイル７は１０ｍｍまたは、それ以上の大きな間隔を介してエネルギーを伝送しなければならない。

【０００６】上記のように．１次側コイルと２次側コイルの間に大きな間隔が存在する場合は．極力コイルを大きくし、１次側コイルと２次側コイルの対向する面積を大きくしなければ、１次側と２次側の結合率を大きくすることはできない。

【０００７】しかし、２次側コイルはペースメーカー内部に収納されるものであるので、極力体積を小さくする必要があり、図４（Ａ）．（Ｂ）に示すように．２次側コア１１は、円盤状の薄いアモルファスからなり．２次側コイル７は０．１ｍｍ程度の細い線材を渦巻き状に巻回して、大変薄い形状にしている。

【０００８】これに対し．従来の１次側コイル６は、図

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５に示すように．円盤状部分１２の１面側に、中央中足１３と周囲の外足１４を設け、外足１４の２次側コアに対向する面を内側に向かって拡張した円盤状の拡幅部分１５にして１次側コア１６を形成し．この１次側コア１６の外足１４と拡幅部分１５で包み込まれた空間に１次側コイル６を配置した構造になっている。

【０００９】上記１次側コイル６と２次側コイル７は、図５に示すように、中心軸心を一致させて対向状に配置される。このように配置して１次側コイル６に電流を流すことにより１次側コイル６を励磁し．２次側コイル７に磁束を伝える。

【００１０】図６に磁束の方向を示す．１次側コイル６におけるコア１６の中足１３部分に発生した磁束は２次側コイル７におけるコア１１の中心付近に伝わり．２次側コア１１の周辺部分から１次側コア１６の外足１４の拡張された部分に進む。そして、１次側コア１６の外足１４と底部円盤状部分１２を経て中足１３に戻る。

【００１１】

【発明が解決しようとする課題】上記のように．従来のトランスでも体内に配置された２次側コイル７に体外の１次側コイル６から磁束を伝えることができ、２次側コイル７に電力を伝送することができる。

【００１２】しかし、１次側コイル６のコア１６が外足１４に拡幅部分１５を設けた構造では．図７に示すように拡幅部分１５に矢印で示す方向の大きな渦電流が流れる。この渦電流による発熱のため、拡幅部分１５の温度上昇を招き、時には人体に低温火傷を与えることがあった。

【００１３】また、渦電流による電力損失のため．経皮充電器の効率の低下を招いていた。

【００１４】そこで、この発明の課題は、１次側コアの拡幅部分に渦電流が流れるのを防ぎ．温度上昇の発生がなく．１次側コイルと２次側コイルの間の結合率を大きくすることができる非接触エネルギー伝送システム用トランスの１次側コアを提供することにある。

【００１５】

【課題を解決するための手段】上記のような課題を解決するため、この発明は、１次側コアの周囲外足部分の２次側コアに対向する面を内側や外側に拡張した円盤状の拡幅部分に形成し、この拡幅部分に中心から放射状の配置でスリットを設けた構成を採用したものである。

【００１６】

【作用】１次側コアの拡幅部分に中心から放射状にスリットを設けたので、拡幅部分に生じようとする渦電流の経路がスリットによって絶たれ、渦電流を大幅に減少させることができ．拡幅部分の温度上昇を抑えることができる。また、スリットは磁束の流れを妨げることがなく．経皮充電器の効率を向上させることができる。

【００１７】

【実施例】以下．この発明の実施例を添付図面の図１と

図２に基づいて説明する。

【００１８】図１に示す第１の実施例において．１次側コア１６は、フエライトからなる円盤状部分１２の一面側に．中央中足１３と周囲に外足１４を設け、外足１４の２次側コアと対向する面に内側に向かって拡張した円盤状の拡幅部分１５を設け．この拡幅部分１５に中心から放射状に多数のスリット２１を設けている。この１次側コア１６の中央中足１３に１次側コイル６を巻装している。

【００１９】図１（Ｂ）に示す矢印は．拡幅部分１５の中を流れる磁束の向きを示し、スリット２１を設けることにより渦電流の経路が絶たれ、磁束は拡幅部分１５の中心から放射状に流れる。従って．このように拡幅部分１５にスリット２１を入れても磁束の流れは妨げられることはなく、磁石によると２次側コアへのエネルギーの伝達はスムーズに行なわれる。このように、スリット２１を入れると磁束の流れを妨げることはなく、渦電流を大幅に減少させることができる。

【００２０】図２（Ａ）．（Ｂ）は第２の実施例を示し．第１の実施例では拡幅部分１５を内側に向って拡張したのに対し．この第２の実施例では拡幅部分１５を外足１４から外側に向って拡張し、この拡幅部分１５に中心から外部に向って放射状に多数のスリット２１を設けている。

【００２１】この第２の実施例においても、第１の実施例と同様に磁束の流れを妨げることなく渦電流を大幅に抑制することができ、効率の向上及び発熱の抑制を実現することができる。

【００２２】次に、図２に示した第２の実施例の形状におけるスリットの効果の実験結果を表に示す。

【００２３】図２において．円盤状部分１２の直径（Ｄ）を３６ｍｍとし、拡幅部分１５の寸法（ａ）が７ｍｍと１７ｍｍの２種類の場合においてコアの鉄損を測定した。

【００２４】拡幅部分１５の寸法（ａ）が７ｍｍの場合において、スリットなしの時１００ｍＷの鉄損となるようにトランスを励磁した場合、スリットを入れると鉄損は８４ｍＷに減少した。

【００２５】また、拡幅部分１５の寸法（ａ）が１７ｍｍの場合においてスリットなしの時１００ｍＷの鉄損となるようにトランスを励磁した場合．スリットを入れると鉄損は７６ｍＷに減少した。

【００２６】

【表１】

表　１

ａ寸法	スリットなし	スリットあり
７ｍｍ	１００ｍＷ	８４ｍＷ
１７ｍｍ	１００ｍＷ	７６ｍＷ

【００２７】このように．拡幅部分にスリットを設けると．２０％前後の損失の低減が実現できる。

【００２８】なお、この発明は、上記のようなペースメーカ用経皮充電システムに利用できるだけでなく．人工心臓などの、体外から体内に磁束を介して電力を伝送するシステムの全般について適用することができる。さらに．例えば、携帯用機器の２次電池の充電などの非接触状態で電力を伝送するシステムの全般について利用できる。

【００２９】

【発明の効果】以上のように、この発明によると．１次側コアから２次側コアの磁束の流れを阻害することなく．効果的に渦電流を防止することができ、ペースメーカーなどに用いられる非接触エネルギー伝送システムの効率の向上および発熱の抑制を実現することができる。

【図面の簡単な説明】

【図１】（Ａ）はこの発明に係る１次側コアの第１の実施例を示す縦断正面図、（Ｂ）は同上の底面図。

【図２】（Ａ）は１次側コアの第２の例を示す縦断正面図．（Ｂ）は同上の底面図。

【図３】心臓ペースメーカ用経皮的エネルギー伝送システムの概要を示す回路図。

【図４】（Ａ）は従来の２次コイルを示す側面図．（Ｂ）は同上の底面図。

【図５】従来の１次側コイルと２次側コイルを示す縦断側面図。

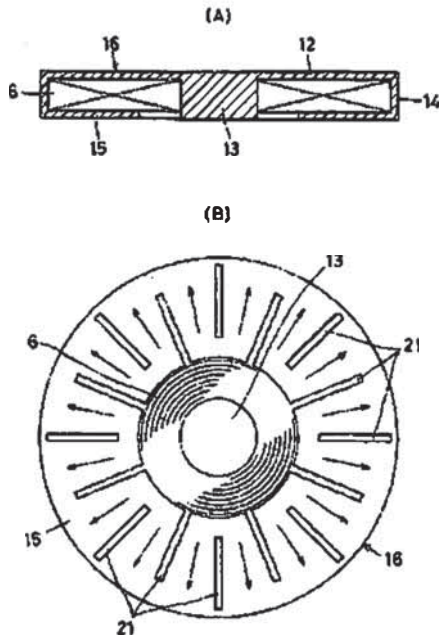
【図６】１次側コアと２次側コイルの磁束の流れを示す縦断側面図。

【図７】従来の１次側コアを示し、（Ａ）は縦断側面図．（Ｂ）は同上の渦電流を示す底面図。

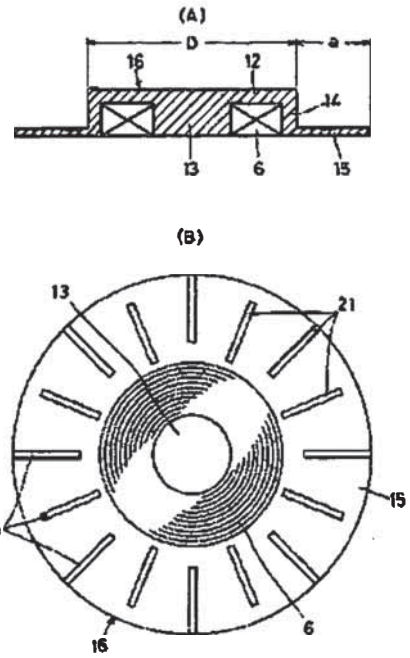
【符号の説明】

６	１次側コイル
７	２次側コイル
１２	円盤状部分
１３	中央中足
１４	外足
１５	拡幅部分
１６	１次側コア
２１	スリット

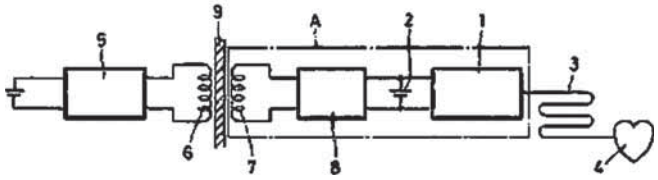
【図１】



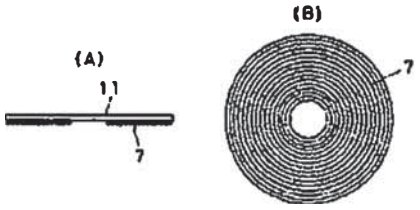
【図２】



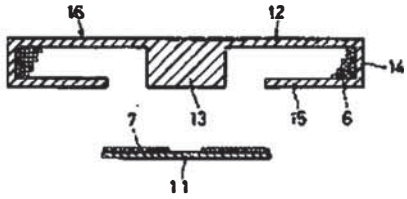
【図３】



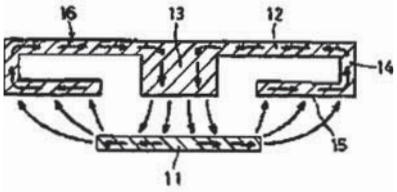
【図４】



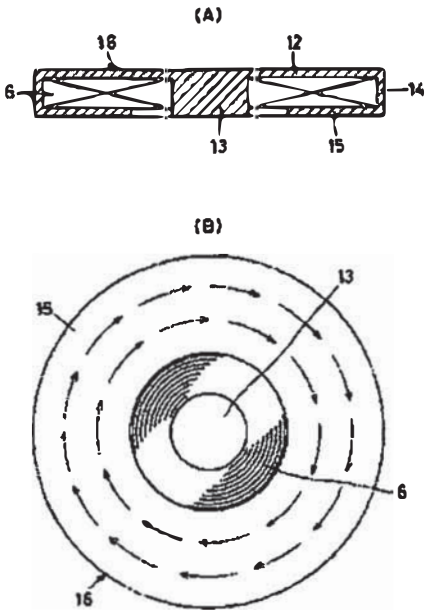
【図５】



【図6】



【図7】



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Dkt. 1172/69068

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application of : John Talbot BOYS et al.

Serial No. : 12/451,436 Examiner: Tuyen T. Nguyen

Date Filed : January 13, 2010 GAU: 2832

For : MULTI POWER SOURCED ELECTRIC VEHICLE

273 Walt Whitman Road, Suite 327
Huntington Station, New York 11746

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

AMENDMENT

Sir:

In response to the Office Action dated December 11, 2012, please amend the above-identified application as follows:

Amendments to the claims are reflected in the listing of claims which begin on page 2 of this paper.

Remarks begin on page 9 of this paper.

I hereby certify that this paper is being deposited this date with the U.S. Postal Service as first class mail addressed to the Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450

June 11, 2013
Richard F. Jaworski Date
Reg. No. 33,515

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Claims 1-71 (previously canceled)

72. (currently amended) An inductive power transfer pad comprising:

one or more ferromagnetic slabs in a first layer;

a coil having at least one turn of a conductor, the coil being arranged in a second layer ~~plane~~ substantially parallel to that of said ferromagnetic slabs; and

a shield member comprising a backplate defining a third layer ~~second plane substantially parallel to that of said ferromagnetic slabs~~, said backplate arranged to control said magnetic field generated by said coil.

73. (previously presented) The inductive power transfer pad as claimed in claim 72, wherein each ferromagnetic slab is arranged such that its length extends radially from a common point but spaced apart therefrom.

74. (previously amended) The inductive power transfer pad as claimed in claim 73, wherein the coil is positioned to wind around the common point such that it passes each slab at approximately a center of the length of each slab.

75. (previously presented) The inductive power transfer pad as claimed in claim 72, wherein:

a subset of the ferromagnetic slabs extend radially from a common point but are spaced

apart therefrom;

a further subset of the ferromagnetic slabs extend radially from a different common point but are spaced apart therefrom;

a still further subset of the ferromagnetic slabs are aligned perpendicularly to the direction of an imaginary straight line connecting the said common points, whereby the still further subset of ferromagnetic slabs are positioned equidistantly from the imaginary line but spaced equally along its length and equally on each side of the imaginary line.

76. (previously amended) The inductive power transfer pad as claimed in claim 72, wherein the backplate is substantially rigid.

77. (previously amended) The inductive power transfer pad as claimed in claim 72, wherein the plane of the or each of the ferromagnetic slabs is located between the second plane and the plane of the coil.

78. (previously amended) The inductive power transfer pad as claimed in claim 72, wherein each ferromagnetic slab is spaced apart from the backplate by a thermally conductive and mechanically insulating material.

79. (previously amended) The inductive power transfer pad as claimed in claim 72, wherein the backplate is formed from a material which substantially inhibits the passage of magnetic flux therethrough.

80. (previously amended) The inductive power transfer pad as claimed in claim 72, wherein the shield member forms a side wall around the pad.

81. (previously amended) The inductive power transfer pad as claimed in claim 80, wherein the side wall extends from the backplate and is integrally formed therewith.

82. (previously amended) The inductive power transfer pad as claimed in claim 72, wherein the one or more ferromagnetic slabs comprise ferrite.

83. (previously presented) An inductive power transfer system comprising two inductive power transfer pads as claimed in claim 72, wherein the two inductive power transfer pads are used in combination, one of the pads being used as a pickup pad and the other pad as a charging pad.

Claims 84 – 92 (previously canceled).

93. (previously presented) The inductive power transfer pad of claim 72, wherein a magnetic dipole produced by said coil is generally perpendicular to said plane defined by said ferromagnetic slabs.

94. (previously presented) The inductive power transfer pad of claim 72, wherein said backplate is formed of metal.

95. (previously presented) The inductive power transfer pad of claim 94, wherein said backplate is formed of aluminum.

96. (previously presented) The inductive power transfer pad of claim 72, wherein said shield member further comprises a metal strip defining a barrier, wherein said backplate and said metal strip are arranged to control said magnetic field generated by said coil.

97. (presently amended) An inductive power transfer pad comprising:

means for generating a magnetic ~~flux~~ field in a first layer;

means for ~~channeling~~ controlling said magnetic ~~flux~~ field, said means for generating said magnetic ~~flux~~ field arranged in a ~~plane~~ second layer substantially parallel to that of said means for ~~channeling~~ controlling said magnetic ~~flux~~ field; and

means for shielding against said magnetic ~~flux~~ field, said means for shielding further defining a ~~second plane substantially parallel to that of said means for channeling~~ third layer and arranged to control said magnetic field generated by said means for generating said magnetic ~~flux~~ field.

98. (presently amended) The inductive power transfer pad as claimed in claim 97, wherein said means for channeling said magnetic ~~flux~~ field comprises a plurality of magnetically permeable members.

99. (previously presented) The inductive power transfer pad as claimed in claim 98 wherein each magnetically permeable member is arranged such that it extends radially from a common point.

100. (presently amended) The inductive power transfer pad as claimed in claim 97, wherein the means for generating a magnetic ~~flux~~ field is positioned adjacent to one side of the means for channeling said magnetic ~~flux~~ field.

101. (presently amended) The inductive power transfer pad as claimed in claim 100 wherein said second plane is located on the other side of the means for channeling said magnetic ~~flux~~ field.

102. (presently amended) The inductive power transfer pad as claimed in claim 97, wherein the means for shielding against said magnetic ~~flux~~ field is substantially rigid.

103. (presently amended) The inductive power transfer pad as claimed in claim 97, wherein the plane of the means for channeling said magnetic ~~flux~~ field is located between the second plane and the plane of the means for generating said magnetic ~~flux~~ field.

104. (presently amended) The inductive power transfer pad as claimed in claim 97, wherein a thermally conductive means is provided between the means for channeling said magnetic ~~flux~~ field and the means for shielding against said magnetic ~~flux~~ field.

105. (presently amended) The inductive power transfer pad as claimed in claim 97 wherein a mechanically insulating means is provided between the means for channeling said magnetic ~~flux~~ field and the means for shielding against said magnetic ~~flux~~ field.

106. (previously presented) The inductive power transfer pad as claimed in claim 105 wherein the mechanically insulating means comprises a thermally conductive means.

107. (presently amended) The inductive power transfer pad as claimed in claim 97, wherein the means for shielding against said magnetic ~~flux~~ field comprises a material which substantially inhibits the passage of magnetic ~~flux~~ field therethrough.

108. (presently amended) The inductive power transfer pad as claimed in claim 97, wherein the means for shielding against said magnetic ~~flux~~ field comprises at least one side wall about the pad.

109. (previously presented) The inductive power transfer pad as claimed in claim 108 wherein the side wall is substantially perpendicular to the second plane.

110. (presently amended) The inductive power transfer pad as claimed in claim 97, wherein the means for channeling said magnetic ~~flux~~ field comprises one or more pieces of ferromagnetic material.

111. (presently amended) The inductive power transfer pad of claim 97 wherein a magnetic dipole produced by said ~~flux~~ field generating means is generally perpendicular to said plane of said means for channeling said magnetic ~~flux~~ field.

112. (presently amended) The inductive power transfer pad of claim 97 wherein said means for shielding against magnetic ~~flux~~ field is formed of metal.

113. (previously presented) The inductive power transfer pad of claim 112 wherein the metal comprises aluminium.

114. (presently amended) The inductive power transfer pad of claim 97 wherein the means for shielding against magnetic ~~flux~~ field further comprises a backplate and a metal strip, the metal strip defining a barrier, wherein said backplate and said metal strip are arranged to control said magnetic ~~flux~~ field.

115. (previously presented) An inductive power transfer system comprising two inductive power transfer pads as claimed in claim 97, wherein the two inductive power transfer pads are used in combination, one of the pads being used as a pickup pad and the other pad as a charging pad.

REMARKS

The application has been reviewed in light of the Office Action dated December 11, 2012. Claims 72, 97, 98, 100-105, 107, 108, 110-112 and 114 have been amended. Claims 72-83 and 93-115 are in the case, with claims 72 and 97 being in independent form. No new matter has been added.

Claims 72 and 97 were rejected under 35 U.S.C. §102(b) as allegedly anticipated by WO 2005/024865 to Beart et al. Claims 73-83, 93-96 and 98-115 were rejected under 35 U.S.C. §103(a) as allegedly obvious from Beart et al. in view of U.S. Patent 5,528,113 to Boys et al. Applicants have carefully considered the Examiner's comments and the cited art, and respectfully submit independent claims 72 and 97 are patentably distinct from the cited art for at least the following reasons.

Independent claim 72 relates to an inductive power transfer pad comprising one or more ferromagnetic slabs in a first layer, a coil having at least one turn of a conductor, the coil being arranged in a second layer substantially parallel to that of the ferromagnetic slabs and a shield member comprising a backplate defining a third layer, the backplate arranged to control the magnetic field generated by the coil.

According to an embodiment of the present disclosure an inductive power transfer pad has ferromagnetic slabs and coil in respective parallel layers together with a controlling shield. This arrangement provides salient benefits including, for example, providing efficient power transfer properties suitable for use in charging an electric car or the like. Embodiments of the present disclosure provide a controlled, directed or more focused magnetic flux pattern with results in reduced splaying of the magnetic flux parallel to the pad. This not only improves inductive coupling for example for more efficient charging of an electric car, but additionally reduces the

chance that any undesired objects will be subjected to the induced fields during use. Leakage of magnetic flux to such objects can cause damage, for example causing nearby wheel bearings to erode. Of course, the claims are not limited to the disclosed embodiments.

Beart et al., as understood by Applicants, relates to an inductive power transfer unit having flux shields. As shown in Fig. 1 of Beart et al., a flux generating unit 50 includes perpendicular coils 10 shaped into a flat solenoid wound around a former 20 in the form of a thin sheet of magnetic material. As understood by Applicants, the arrangement disclosed by Beart et al. results in a wide horizontal magnetic flux pattern which is intended to allow for some variation in the positioning of the inductive power transfer unit and a secondary device requiring charging. As such, Beart et al. is primarily concerned with achieving a wide magnetic flux pattern suitable for these aims.

In contrast, Applicants' presently claimed multi-layer structure results in a device aimed at avoiding such a wide pattern. Applicants find no teaching or suggestion in Beart et al. of such a multi-layer structure. In particular, Applicants find no teaching or suggestion in Beart et al. of an inductive power transfer pad comprising one or more ferromagnetic slabs in a first layer, a coil having at least one turn of a conductor, the coil being arranged in a second layer substantially parallel to that of the ferromagnetic slabs and a shield member comprising a backplate defining a third layer, the backplate arranged to control the magnetic field generated by the coil, as recited in independent claim 72.

In addition, Applicants find no teaching or suggestion in Beart et al. of an inductive power transfer pad comprising means for generating a magnetic field in a first layer, means for controlling the magnetic field, the means for generating the magnetic field arranged in a second layer substantially parallel to that of the means for controlling the magnetic field and means for shielding against the magnetic field, the means for shielding further defining a third layer and arranged to

control the magnetic field generated by the means for generating the magnetic field, as recited in independent claim 97.

Accordingly, Applicants submit independent claims 72 and 97 are patentably distinct from the cited art.

The Office is hereby authorized to charge any additional fees which may be required in connection with this amendment and to credit any overpayment to our Deposit Account No. 50-5504.

If petition for an extension of time is required to make this response timely, this paper should be considered to be such a petition, and the Commissioner is authorized to charge the requisite fees to our Deposit Account No. 50-5504.

If a telephone interview could advance the prosecution of this application, the Examiner is respectfully requested to call the undersigned attorney.

Entry of this amendment and allowance of this application are respectfully requested.

Respectfully submitted,

RICHARD F. JAWORSKI
Reg. No. 33,515
Attorney for Applicant
The Law Office of Richard F. Jaworski, PC
Tel.: (631) 659-3608

Dkt. 1172/69068

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application of : John Talbot BOYS et al.

Serial No. : 12/451,436 Examiner: Tuyen T. Nguyen

Date Filed : January 13, 2010 GAU: 2832

For : MULTI POWER SOURCED ELECTRIC VEHICLE

273 Walt Whitman Road, Suite 327
Huntington Station, New York 11746

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

PETITION FOR EXTENSION OF TIME

Sir:

It is respectfully requested that the time for responding to the Office Action dated December 11, 2012 be extended by three months (i.e., from March 11, 2013 to June 11, 2013).

The $1400.00 statutory extension fee for filing a response within the third month pursuant to 1.136(a) by other than a small entity may be charged to Deposit Account No. 50-5504.

The Office is hereby authorized to charge any additional fees which may be required in connection with this paper and to credit any overpayment to our Deposit Account No. 50-5504.

Respectfully submitted,

RICHARD F. JAWORSKI
Registration No. 33,515
Attorney for Applicant
The Law Office of
Richard F. Jaworski, P.C.
Tel.: (631) 659-3608

06/13/2013 ZTHOMAS1 00000025 505504 12451436
01 FC:1251 1400.00 DA

I hereby certify that this paper is being deposited this date with the U.S. Postal Service as first class mail addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450

June 11, 2013
Richard F. Jaworski Date
Reg. No. 33,515

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 12/451,436	Filing Date 01/13/2010	☐ To be Mailed

ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	x $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	x $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x $ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x $ =	
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	

AMENDMENT	06/13/2013	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 35	Minus	** 36	= 0	x $80 =	0
	Independent (37 CFR 1.16(h))	* 3	Minus	*** 3	= 0	x $420 =	0
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	**0**

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

LIE
/THERESA LINDSAY/

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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Alexandria, Virginia 22313-1450
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NOTICE OF ALLOWANCE AND FEE(S) DUE

14443 7590 09/09/2013

The Law Office of Richard F. Jaworski, PC
273 Walt Whitman Road
Suite 327
Huntington Station, NY 11746-4149

EXAMINER	
NGUYEN, TUYEN T	
ART UNIT	PAPER NUMBER
2832	

DATE MAILED: 09/09/2013

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/451,436	01/13/2010	John Talbot Boys	6081/81072	4685

TITLE OF INVENTION: MULTI POWER SOURCED ELECTRIC VEHICLE

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1780	$300	$0	$2080	12/09/2013

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

14443 7590 09/09/2013
The Law Office of Richard F. Jaworski, PC
273 Walt Whitman Road
Suite 327
Huntington Station, NY 11746-4149

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission
I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/451,436	01/13/2010	John Talbot Boys	6081/81072	4685

TITLE OF INVENTION: MULTI POWER SOURCED ELECTRIC VEHICLE

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1780	$300	$0	$2080	12/09/2013

EXAMINER	ART UNIT	CLASS-SUBCLASS
NGUYEN, TUYEN T	2832	336-08400C

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

❑ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

❑ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

(1) the names of up to 3 registered patent attorneys or agents OR, alternatively,

(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 _____

2 _____

3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. The following fee(s) are submitted:

❑ Issue Fee

❑ Publication Fee (No small entity discount permitted)

❑ Advance Order - # of Copies _____

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**

❑ A check is enclosed.

❑ Payment by credit card. Form PTO-2038 is attached.

❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)

❑ Applicant certifying micro entity status. See 37 CFR 1.29	NOTE: Absent a valid certification of Micro Entity Status (see form PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
❑ Applicant asserting small entity status. See 37 CFR 1.27	NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
❑ Applicant changing to regular undiscounted fee status.	NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

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UNITED STATES DEPARTMENT OF COMMERCE
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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14443 7590 09/09/2013

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Huntington Station, NY 11746-4149

EXAMINER	
NGUYEN, TUYEN T	

ART UNIT	PAPER NUMBER
2832	

DATE MAILED: 09/09/2013

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 360 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 360 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

PTOL-85 (Rev. 02/11)

Privacy Act Statement

The Privacy Act of 1974 (**P.L. 93-579**) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No. 12/451,436	Applicant(s) BOYS ET AL.	
	Examiner TUYEN NGUYEN	Art Unit 2832	AIA (First Inventor to File) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *amendment filed 6/13/2013.*
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on_____.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are *72-83 and 93-115.* As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.
4. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☒ All b) ☐ Some *c) ☐ None of the:
   1. ☒ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. ____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☒ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date 4/15/2013
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date ____ .
5. ☒ Examiner's Amendment/Comment
6. ☐ Examiner's Statement of Reasons for Allowance
7. ☐ Other ____.

/TUYEN T NGUYEN/
Primary Examiner, Art Unit 2832

The present application is being examined under the pre-AIA first to invent provisions.

EXAMINER'S AMENDMENT

An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

The application has been amended as follows:

- In the specification, on page 1, line 2, before "Field of the Invention", insert –This application is a 371 of PCT/ZN2008/000103 filed 05/09/2008.—

Any inquiry concerning this communication or earlier communications from the examiner should be directed to TUYEN NGUYEN whose telephone number is (571)272-1996. The examiner can normally be reached on M-F 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, ELVIN ENAD can be reached on 571-272-1990. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/TUYEN T NGUYEN/
Primary Examiner, Art Unit 2832

Search Notes	Application/Control No.	Applicant(s)/Patent under Reexamination	
	12/451,436	BOYS ET AL.	
	Examiner	Art Unit	
	TUYEN NGUYEN	2832	

SEARCHED			
Class	Subclass	Date	Examiner
336	84R, 84C, 200, 212, 232	8/8/2013	TN

INTERFERENCE SEARCHED			
Class	Subclass	Date	Examiner
same as above		8/8/2013	TN

SEARCH NOTES (INCLUDING SEARCH STRATEGY)		
	DATE	EXMR

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

BIB DATA SHEET

CONFIRMATION NO. 4685

SERIAL NUMBER	FILING or 371(c) DATE RULE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
12/451,436	01/13/2010	336	2832	6081/81072

APPLICANTS

John Talbot Boys, Auckland, NEW ZEALAND;
Grant Anthony Covic, Auckland, NEW ZEALAND;

**** CONTINUING DATA ***************************

This application is a 371 of PCT/NZ2008/000103 05/09/2008

**** FOREIGN APPLICATIONS ***************************

NEW ZEALAND 555128 05/10/2007
NEW ZEALAND 556646 07/20/2007

**** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ****

01/26/2010

Foreign Priority claimed	☑ Yes ☐ No	☐ Met after Allowance	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
35 USC 119(a-d) conditions met	☑ Yes ☐ No					
Verified and Acknowledged	/TUYEN T NGUYEN/ Examiner's Signature	/TN/ Initials	NEW ZEALAND	5	21	5

ADDRESS

The Law Office of Richard F. Jaworski, PC
273 Walt Whitman Road
Suite 327
Huntington Station, NY 11746-4149
UNITED STATES

TITLE

MULTI POWER SOURCED ELECTRIC VEHICLE

FILING FEE RECEIVED		
2502	FEES: Authority has been given in Paper No._____ to charge/credit DEPOSIT ACCOUNT No._____ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit

Issue Classification	Application/Control No.	Applicant(s)/Patent under Reexamination	
	12/451,436	BOYS ET AL.	
	Examiner	Art Unit	
	TUYEN NGUYEN	2832	

ISSUE CLASSIFICATION

ORIGINAL			CROSS REFERENCE(S)							
CLASS	SUBCLASS	CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)							
336	84C									
INTERNATIONAL CLASSIFICATION										
H 0 1 F	27/32									
	/									
	/									
	/									
	/									

none (Assistant Examiner) (Date)	/Tuyen Nguyen/ Primary Examiner 8/8/2013 (Primary Examiner) (Date)	Total Claims Allowed: 35
(Legal Instruments Examiner) (Date)		O.G. Print Claim(s): 1 / O.G. Print Fig.: 3

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
	1		31		61		91		121		151		181
	2		32		62		92		122		152		182
	3		33		63	13	93		123		153		183
	4		34		64	14	94		124		154		184
	5		35		65	15	95		125		155		185
	6		36		66	16	96		126		156		186
	7		37		67	17	97		127		157		187
	8		38		68	18	98		128		158		188
	9		39		69	19	99		129		159		189
	10		40		70	20	100		130		160		190
	11		41		71	21	101		131		161		191
	12		42	1	72	22	102		132		162		192
	13		43	2	73	23	103		133		163		193
	14		44	3	74	24	104		134		164		194
	15		45	4	75	25	105		135		165		195
	16		46	5	76	26	106		136		166		196
	17		47	6	77	27	107		137		167		197
	18		48	7	78	28	108		138		168		198
	19		49	8	79	29	109		139		169		199
	20		50	9	80	30	110		140		170		200
	21		51	10	81	31	111		141		171		201
	22		52	11	82	32	112		142		172		202
	23		53	12	83	33	113		143		173		203
	24		54		84	34	114		144		174		204
	25		55		85	35	115		145		175		205
	26		56		86		116		146		176		206
	27		57		87		117		147		177		207
	28		58		88		118		148		178		208
	29		59		89		119		149		179		209
	30		60		90		120		150		180		210

Dkt. 1172/69068

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application of : John Talbot BOYS et al.

Serial No. : 12/451,436 Examiner: Tuyen T. Nguyen

Date Filed : January 13, 2010 GAU: 2832

For : MULTI POWER SOURCED ELECTRIC VEHICLE

273 Walt Whitman Rd.
Suite 327
Huntington Station, NY 11746

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

SECOND SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT

The information listed in the attached form PTO-1449 is brought to the attention of the Examiner. In accordance with 37 C.F.R. §1.92(a)(2)(ii), copies of U.S. Patents listed herein need not be provided.

It is respectfully requested that the information cited in annexed Form PTO-1449 be considered by the Examiner in connection with the above-identified patent application, and that such art be made of record in said application.

I hereby certify that this paper is being deposited this date with the U.S. Postal Service as first class mail addressed to the Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450

April 11, 2013
Richard F. Jaworski Date
Reg. No. 33,515

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /TN/

The documents submitted herewith were cited in an Office Action issued by a foreign office in connection with a corresponding foreign application. "Teaching Reference 3" (JP-T2007-505480) cited in the foreign Office Action is identified as being a translation of "the first document cited in the search report" (e.g., WO-2005/024865) which is already of record (see English Translation of Notice of Reasons for Rejection.)

Document AA (U.S. Patent 5,469,036) is an English language equivalent of Document AQ (JP6-277358).

The citation of the listed items is not a representation that they constitute a complete or exhaustive listing of the relevant art or that these items are prior art. The items listed are submitted in good faith, but are not intended to substitute for the Examiner's search. It is hoped, however, that in addition to apprising the Examiner of the particular items, they will assist in identifying fields of search and in making as full and complete a search as possible.

The filing of this Information Disclosure Statement is not an admission that the information cited herein is, or is considered to be, material to patentability as defined in 37 C.F.R. §1.56(b).

This Information Disclosure Statement is being submitted after issuance of a non-final office action on the merits and prior to the mailing date of a final action, a notice of allowance or an action that otherwise closes prosecution and is accompanied by the required statement below.

It is respectfully submitted that each item of information contained in this information disclosure statement was first cited in a communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /TN/

It is believed that no fee is required for consideration of the present Information Disclosure Statement. However, if a fee is deemed to be required, the Office is authorized to charge any fees to Deposit Account 50-5504.

Early and favorable consideration of the case is respectfully requested.

Respectfully submitted,

RICHARD F. JAWORSKI
Registration No. 33,515
Attorney for Applicant
Customer No. 14443
The Law Office of Richard F. Jaworski, PC
Tel. (631) 659-3608

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /TN/

Form PTO-1449 — U.S. Department of Commerce, Patent and Trademark Office

INFORMATION DISCLOSURE CITATION BY APPLICANT
(Use several sheets if necessary)

Atty. Docket No.	Serial No.
1172/69068	12/451,436
Applicant	
John Talbot BOYS et al.	
Filing Date	**Group**
January 13, 2010	2832

U.S. PATENT DOCUMENTS

Examiner Initial		Document Number	Date	Name	Class	Subclass	Filing Date if Appropriate
/TN/	AA	5 4 6 9 0 3 6	Nov. 21, 1995	Eto			
	AB						
	AC						
	AD						
	AE						
	AF						
	AG						
	AH						
	AI						
	AJ						
	AK						
	AL						
	AM						
	AN						
	AO						
	AP						

FOREIGN PATENT DOCUMENTS

		Document Number	Date	Country	Class	Subclass	Translation Yes	Translation No
/TN/	AQ	JP 06 - 27 73 5 8	Oct. 4, 1994	Japan			Abst.	
/TN/	AR	JP 20 02 - 23 15 45	Aug. 16, 2002	Japan			Abst.	
/TN/	AS	JP 8 - 23 83 2 6	Sept. 17, 1996	Japan			Abst.	
/TN/	AT	JP T2 00 7- 50 54 80	no date	Japan				

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)

/TN/	AU	Notice of Reasons for Rejection in corresponding Japanese application p2010-507347 (Original and English Translation)
	AV	
	AW	
	AX	

EXAMINER /Tuyen Nguyen/ — DATE CONSIDERED 8/12/2013

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609: Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /TN/

IFW
RCE

PTO/SB/30 (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Request for Continued Examination (RCE) Transmittal

Address to:
Mail Stop RCE
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Application Number	12/451,436
Filing Date	January 13, 2010
First Named Inventor	John Talbot BOYS
Art Unit	2832
Examiner Name	Tuyen T. Nguyen
Attorney Docket Number	1172/69068

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.
Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. See Instruction Sheet for RCEs (not to be submitted to the USPTO) on page 2.

1. Submission required under 37 CFR 1.114 Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).

a. ☐ Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.

i. ☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____

ii. ☐ Other _____

b. ☑ Enclosed

i. ☑ Amendment/Reply
ii. ☐ Affidavit(s)/ Declaration(s)
iii. ☑ Information Disclosure Statement (IDS)
iv. ☐ Other _____

2. Miscellaneous

a. ☐ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of _____ months. (Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)

b. ☐ Other _____

3. Fees The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.

a. ☑ The Director is hereby authorized to charge the following fees, any underpayment of fees, or credit any overpayments, to Deposit Account No. 50-5504 .

i. ☑ RCE fee required under 37 CFR 1.17(e)
ii. ☐ Extension of time fee (37 CFR 1.136 and 1.17)
iii. ☐ Other _____

12/12/2013 CCHAU1 00000004 12451436
01 FC:1801 1200.00 OP

b. ☐ Check in the amount of $ _____ enclosed

c. ☑ Payment by credit card (Form PTO-2038 enclosed)

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

Signature		Date	December 9, 2013
Name (Print/Type)	Richard F. Jaworski	Registration No.	33,515

CERTIFICATE OF MAILING OR TRANSMISSION

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Mail Stop RCE, Commissioner for Patents, P. O. Box 1450, Alexandria, VA 22313-1450 or facsimile transmitted to the U.S. Patent and Trademark Office on the date shown below.

Signature			
Name (Print/Type)	Richard F. Jaworski	Date	December 9, 2013

Dkt. 1172/69068

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application of : John Talbot BOYS et al.

Serial No. : 12/451,436 Examiner: Tuyen T. Nguyen

Date Filed : January 13, 2010 GAU: 2832

For : MULTI POWER SOURCED ELECTRIC VEHICLE

273 Walt Whitman Road, Suite 327
Huntington Station, New York 11746

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

PRELIMINARY AMENDMENT

Sir:

Prior to examination on the merits, please amend the above-identified application as follows:

Amendments to the claims are reflected in the listing of claims which begin on page 2 of this paper.

Remarks begin on page 9 of this paper.

I hereby certify that this paper is being deposited this date with the U.S. Postal Service as first class mail addressed to the Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450

Richard F. Jaworski
Reg. No. 33,515

December 9, 2013
Date

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Claims 1-71 (previously canceled)

72. (currently amended) An inductive power transfer pad for transmitting wireless power to a wireless power receiver seperable from the inductive power transfer pad, the inductive power transfer pad comprising:

one or more ferromagnetic slabs in a first layer;

a coil having at least one turn of a conductor, the coil being arranged in a second layer substantially parallel to that of said ferromagnetic slabs; and

a shield member comprising a backplate defining a third layer, said backplate arranged to control said magnetic field generated by said coil.

73. (previously presented) The inductive power transfer pad as claimed in claim 72, wherein each ferromagnetic slab is arranged such that its length extends radially from a common point but spaced apart therefrom.

74. (previously presented) The inductive power transfer pad as claimed in claim 73, wherein the coil is positioned to wind around the common point such that it passes each slab at approximately a center of the length of each slab.

75. (previously presented) The inductive power transfer pad as claimed in claim 72, wherein:

a subset of the ferromagnetic slabs extend radially from a common point but are spaced apart therefrom;

a further subset of the ferromagnetic slabs extend radially from a different common point but are spaced apart therefrom;

a still further subset of the ferromagnetic slabs are aligned perpendicularly to the direction of an imaginary straight line connecting the said common points, whereby the still further subset of ferromagnetic slabs are positioned equidistantly from the imaginary line but spaced equally along its length and equally on each side of the imaginary line.

76. (previously presented) The inductive power transfer pad as claimed in claim 72, wherein the backplate is substantially rigid.

77. (previously presented) The inductive power transfer pad as claimed in claim 72, wherein the plane of the or each of the ferromagnetic slabs is located between the second plane and the plane of the coil.

78. (previously presented) The inductive power transfer pad as claimed in claim 72, wherein each ferromagnetic slab is spaced apart from the backplate by a thermally conductive and mechanically insulating material.

79. (previously presented) The inductive power transfer pad as claimed in claim 72, wherein the backplate is formed from a material which substantially inhibits the passage of magnetic flux therethrough.

80. (previously presented) The inductive power transfer pad as claimed in claim 72, wherein the shield member forms a side wall around the pad.

81. (previously presented) The inductive power transfer pad as claimed in claim 80, wherein the side wall extends from the backplate and is integrally formed therewith.

82. (previously presented) The inductive power transfer pad as claimed in claim 72, wherein the one or more ferromagnetic slabs comprise ferrite.

83. (previously presented) An inductive power transfer system comprising two inductive power transfer pads as claimed in claim 72, wherein the two inductive power transfer pads are used in combination, one of the pads being used as a pickup pad and the other pad as a charging pad.

Claims 84 – 92 (previously canceled).

93. (previously presented) The inductive power transfer pad of claim 72, wherein a magnetic dipole produced by said coil is generally perpendicular to said plane defined by said ferromagnetic slabs.

94. (previously presented) The inductive power transfer pad of claim 72, wherein said backplate is formed of metal.

95. (previously presented) The inductive power transfer pad of claim 94, wherein said

backplate is formed of aluminum.

96. (previously presented) The inductive power transfer pad of claim 72, wherein said shield member further comprises a metal strip defining a barrier, wherein said backplate and said metal strip are arranged to control said magnetic field generated by said coil.

97. (presently amended) An inductive power transfer pad for transmitting wireless power to a wireless power receiver seperable from the inductive power transfer pad, the inductive power transfer pad comprising:

means for generating a magnetic field in a first layer;

means for controlling said magnetic field, said means for generating said magnetic field arranged in a second layer substantially parallel to that of said means for controlling said magnetic field; and

means for shielding against said magnetic field, said means for shielding further defining a third layer and arranged to control said magnetic field generated by said means for generating said magnetic field.

98. (previously presented) The inductive power transfer pad as claimed in claim 97, wherein said means for channeling said magnetic field comprises a plurality of magnetically permeable members.

99. (previously presented) The inductive power transfer pad as claimed in claim 98 wherein each magnetically permeable member is arranged such that it extends radially from a common point.

100. (previously presented) The inductive power transfer pad as claimed in claim 97, wherein the means for generating a magnetic field is positioned adjacent to one side of the means for channeling said magnetic field.

101. (previously presented) The inductive power transfer pad as claimed in claim 100 wherein said second plane is located on the other side of the means for channeling said magnetic field.

102. (previously presented) The inductive power transfer pad as claimed in claim 97, wherein the means for shielding against said magnetic field is substantially rigid.

103. (previously presented) The inductive power transfer pad as claimed in claim 97, wherein the plane of the means for channeling said magnetic field is located between the second plane and the plane of the means for generating said magnetic field.

104. (previously presented) The inductive power transfer pad as claimed in claim 97, wherein a thermally conductive means is provided between the means for channeling said magnetic field and the means for shielding against said magnetic field.

105. (previously presented) The inductive power transfer pad as claimed in claim 97 wherein a mechanically insulating means is provided between the means for channeling said magnetic field and the means for shielding against said magnetic field.

106. (previously presented) The inductive power transfer pad as claimed in claim 105 wherein the mechanically insulating means comprises a thermally conductive means.

107. (previously presented) The inductive power transfer pad as claimed in claim 97, wherein the means for shielding against said magnetic field comprises a material which substantially inhibits the passage of magnetic field therethrough.

108. (previously presented) The inductive power transfer pad as claimed in claim 97, wherein the means for shielding against said magnetic field comprises at least one side wall about the pad.

109. (previously presented) The inductive power transfer pad as claimed in claim 108 wherein the side wall is substantially perpendicular to the second plane.

110. (previously presented) The inductive power transfer pad as claimed in claim 97, wherein the means for channeling said magnetic field comprises one or more pieces of ferromagnetic material.

111. (previously presented) The inductive power transfer pad of claim 97 wherein a magnetic dipole produced by said field generating means is generally perpendicular to said plane of said means for channeling said magnetic field.

112. (previously presented) The inductive power transfer pad of claim 97 wherein said means for shielding against magnetic field is formed of metal.

113. (previously presented) The inductive power transfer pad of claim 112 wherein the metal comprises aluminium.

114. (previously presented) The inductive power transfer pad of claim 97 wherein the means for shielding against magnetic field further comprises a backplate and a metal strip, the metal strip defining a barrier, wherein said backplate and said metal strip are arranged to control said magnetic field.

115. (previously presented) An inductive power transfer system comprising two inductive power transfer pads as claimed in claim 97, wherein the two inductive power transfer pads are used in combination, one of the pads being used as a pickup pad and the other pad as a charging pad.

REMARKS

This Preliminary Amendment is being submitted with a concurrently filed Request for Continued Examination. Claims 72 and 97 have been amended. Claims 72-83 and 93-115 are in the case, with claims 72 and 97 being in independent form. No new matter has been added.

The Office is hereby authorized to charge any additional fees which may be required in connection with this amendment and to credit any overpayment to our Deposit Account No. 50-5504.

If petition for an extension of time is required to make this response timely, this paper should be considered to be such a petition, and the Commissioner is authorized to charge the requisite fees to our Deposit Account No. 50-5504.

If a telephone interview could advance the prosecution of this application, the Examiner is respectfully requested to call the undersigned attorney.

Entry of this amendment and allowance of this application are respectfully requested.

Respectfully submitted,

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Dkt. 1172/69068

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application of : John Talbot BOYS et al.

Serial No. : 12/451,436 Examiner: Tuyen T. Nguyen

Date Filed : January 13, 2010 GAU: 2832

For : MULTI POWER SOURCED ELECTRIC VEHICLE

273 Walt Whitman Rd.
Suite 327
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Commissioner for Patents
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Alexandria, VA 22313-1450

INFORMATION DISCLOSURE STATEMENT

The information listed in the attached form PTO-1449 is brought to the attention of the Examiner. In accordance with 37 C.F.R. §1.92(a)(2)(ii), copies of U.S. Patents listed herein need not be provided.

It is respectfully requested that the information cited in annexed Form PTO-1449 be considered by the Examiner in connection with the above-identified patent application, and that such art be made of record in said application.

I hereby certify that this paper is being deposited this date with the U.S. Postal Service as first class mail addressed to the Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450

December 9, 2013
Richard F. Jaworski Date
Reg. No. 33,515

The citation of the listed items is not a representation that they constitute a complete or exhaustive listing of the relevant art or that these items are prior art. The items listed are submitted in good faith, but are not intended to substitute for the Examiner's search. It is hoped, however, that in addition to apprising the Examiner of the particular items, they will assist in identifying fields of search and in making as full and complete a search as possible.

The filing of this Information Disclosure Statement is not an admission that the information cited herein is, or is considered to be, material to patentability as defined in 37 C.F.R. §1.56(b).

This Information Disclosure Statement is being submitted along with a Request for Reconsideration.

It is believed that no fee is required for consideration of the present Information Disclosure Statement. However, if a fee is deemed to be required, the Office is authorized to charge any fees to Deposit Account 50-5504.

Early and favorable consideration of the case is respectfully requested.

Respectfully submitted,

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Form PTO-1449 — U.S. Department of Commerce, Patent and Trademark Office

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Applicant	
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U.S. PATENT DOCUMENTS

Examiner Initial		Document Number	Date	Name	Class	Subclass	Filing Date if Appropriate
	AA	4 8 7 3 6 7 7	Oct. 10, 1989	Sakamoto et al.			
	AB	6 5 0 1 3 6 4	Dec. 31, 2002	Hui et al.			
	AC	6 9 0 6 4 9 5	Jun. 14, 2005	Cheng et al.			
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	AL						
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FOREIGN PATENT DOCUMENTS

		Document Number	Date	Country	Class	Subclass	Translation Yes	Translation No
	AQ	WO 20 08 05 16 1 1	May 2, 2008	WIPO				
	AR	20 02 - 34 36 5 5	Nov. 29, 2002	Japan			X	
	AS	20 00 - 20 07 2 5	July 18, 2000	Japan			X	
	AT	6 - 8 6 3 2 1	Dec. 13, 1994	Japan			X	

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)

	AU	
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	AQ	6-662062	Sept. 16, 1994	Japan			X	
	AR	11-097263	Apr. 9, 1999	Japan			X	
	AS	2004-47701	Feb. 12, 2004	Japan			X	
	AT							

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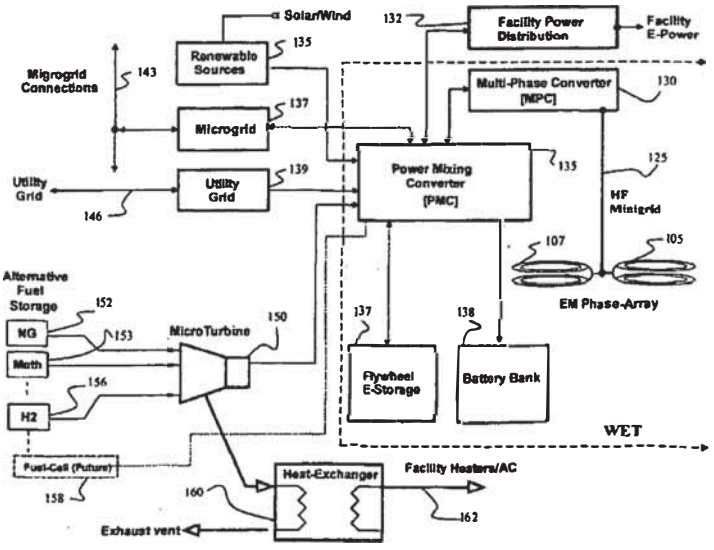

(57) Abstract: A high power wireless resonant energy transfer system transfers energy across an airgap.

WO 2008/051611 A2

HIGH POWER WIRELESS RESONANT ENERGY TRANSFER SYSTEM

This application claims the benefit of provisional application number 60/854,673 to Farkas filed on October 25, 2006.

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] This invention relates to a high power wireless resonant energy transfer system.

Description of the Related Art

[0002] Traditional electrical energy sources used to power vehicles and buildings typically rely on centralized production and a long-distance redistribution network of transmission lines to provide electrical energy to consumers. The centralized production of energy itself can be both inefficient (with only ~30-35% efficiency) and highly polluting. Additionally, most of the fossil fuels used for electric power generation produce waste heat at the power plants and in the transmission lines. This heat can lost to the environment.

[0003] Although electric vehicles may help offset some of this pollution, as well as pollution caused by their gasoline counterparts, such vehicles must typically recharge their onboard batteries on a regular basis by physically plugging into an electrical source. Mass transit vehicles, such as electrically powered busses, vans and other higher occupancy vehicles, run continuously for extended periods of time, and hence require multiple recharges over shorter periods of time.

SUMMARY OF THE INVENTION

[0004] One aspect of the invention provides a high power wireless resonant energy transfer system, comprising an energy transmission system that is arranged to wirelessly transfer energy across an airgap. An energy reception system is positioned to receive the transferred energy across the airgap through a resonant inductive coupling between the transmission and reception system. The energy transmission system is arranged to automatically and electronically vary the spatial direction of the resonant inductive coupling with the alignment between the transmission and reception system, such that energy transfer occurs at a desired location, frequency and power level.

[0005] Another aspect of the invention provides a combined heat and power generation, comprising a local energy generation system that is arranged to generate and provide electrical energy for a local site and for an electrically chargeable vehicle in proximity to the local site, used in conjunction with the previously described high power wireless resonant energy transfer system.

[0006] Another aspect of the invention provides a method to wireless energy transfer that includes positioning an electrically chargeable vehicle within electromagnetic proximity of a transmitter, modulating a phase angle of an input signal to a transmitter to locate an optimal electromagnetic field distribution for energy transfer and auto-adjusting an energy transfer frequency based on a position of the energy receiver. Auto-adjusting of an energy transfer power is accomplished by modulating a pulse width of an input signal to the transmitter. The transmitter transfers energy to the receiver.

[0007] Another aspect of the invention provides a detachable E-pod, comprising a wheel assembly that is removably attached to a vehicle. A wireless energy reception system is arranged on the wheel assembly to receive wirelessly transmitted energy from an energy transmission system. A propulsion system comprising an electric motor is arranged on the wheel assembly and fueled by the wirelessly transmitted energy to move the vehicle. An electronic controller interface system is arranged to electrically connect the wheel assembly with the vehicle to control the propulsion system from the vehicle.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] FIG. 1 is a diagram illustrating one embodiment of a high power wireless resonant energy transfer system that uses a roadside and pickup array to wirelessly transfer energy.

[0009] FIG. 2 is a schematic diagram showing a dual coil assembly array.

[0010] FIG. 3(a) is a perspective view and FIG. 3(b) is a cross-sectional view showing one arrangement of a roadside and pick-up array.

[0011] FIG. 4 is a schematic diagram illustrating resonantly inductive roadside and pick-up arrays.

[0012] FIG. 5(a) and 5(b) are diagrams showing an example of the magnetic flux performance of a wireless energy transfer magnetic structure.

[0013] FIGs. 6(a), 6(b), and 6(c) are diagrams showing the magnetic flux lines and directional gradient of an energy transmission system.

[0014] FIG. 7 is a scope display output of the voltage and current outputs of a multi-phase converter and a graph presentation illustrating some typical vehicle

charging power parameters during operation generated from actual test data obtained from a 100kW energy transfer Test-Stand.

[0015] FIGs. 8(a), 8(b), and 8(c) are diagrams showing magnetic field density vector gradients.

[0016] FIG. 9 is a schematic diagram showing a wireless energy transfer with multiple roadside arrays.

[0017] FIG. 10 is a schematic diagram showing a local energy generation system that can be used in conjunction with a wireless energy transfer system.

[0018] FIG. 11 is a schematic diagram showing an electrified highway lane wireless energy transfer power equivalent circuit.

[0019] FIGs. 12(a) and 12(b) are perspective views showing an electrified highway roadway array.

[0020] FIG. 13 is a diagram showing a cargo truck operating on an electrified highway.

[0021] FIG. 14 is a perspective view showing an E-pod.

[0022] FIG. 15 is a perspective view illustrating an E-pod attached to a cargo truck.

[0023] FIG. 16 is a perspective view showing a Bumper-Charger mounted to a bus.

[0024] FIG. 17 is a schematic diagram showing a co-resonant inductive array circuit equivalent.

[0025] FIG. 18(a) is a graph illustration showing the magnetic field strength of a co-resonant array. FIG. 18(b) is a simulation output and graph illustration of the energy distribution of a co-resonant array. FIG. 18(c) is a perspective view of a co-resonant wireless energy transmission system.

[0026] FIG. 19 is a perspective view of a vehicle using a co-resonant energy transmission system.

[0027] FIG. 20 is a flow diagram showing a method for wireless energy transfer.

DETAILED DESCRIPTION OF THE INVENTION

[0028] FIG. 1 illustrates one embodiment of a high power wireless resonant energy transfer system. This embodiment includes an energy transmission system 105 for wirelessly transmitting energy to an energy reception system 106 when the transfer system is activated.

[0029] The energy transmission system 105 is preferably disposed beneath a roadway surface, although transmission systems disposed on the surface are contemplated as well. The energy reception system 106 is preferably disposed on the undercarriage of a vehicle 101, which uses the transferred electrical power to either charge an onboard energy storage device unit 115 or for propulsion/use directly. The storage unit 115 typically includes a set of batteries and/or capacitors which store the energy until it is needed by the vehicle for propulsion. This storage and use is typically controlled by onboard power electronics 110. Although FIG. 1 shows a particular arrangement of this embodiment, other arrangements are also possible. For example, the energy transmission system 105 can be located above vehicle 101, rather than beneath a roadway surface, and the energy reception system 106 can be disposed on the top of vehicle 101. Additionally, the energy storage system 115 and onboard power electronics 110 may be disposed anywhere in or on the vehicle.

[0030] FIG. 2 illustrates an energy transmission system with a single flat magnetic assembly that includes ridge 309 that divides the single magnetic assembly into sections 305 and 306. Alternatively, two separate magnetic assemblies can be arranged adjacently to form sections 305 and 306 and ridge 309. The magnetic assembly is preferably a ferrite core magnetic diverter,

and can be alternatively referred to as a magnetic core. Conductive coil windings 202 and 201 are preferably arranged within each section such that the top of the coil structure is preferably flush with the top surface of its respective magnetic assembly, although this is not required. Each coil structure 201 and 202 include input leads 308 and 307, respectively, for receiving input current. The magnetic assembly and pair of coil-windings together form a roadside array, or transmission array.

[0031] FIGs. 3(a) and 3(b) show one arrangement of the energy reception system 106, used in conjunction with the energy transmission system 105 of FIG. 2. Like the energy transmission system 105, the reception system 106 preferably has a flat magnetic assembly with ridge 309 that creates sections 405 and 406, as well as coils 203 and 204 arranged in each section 405 and 406. The reception system 106 is also known as a pick-up array, or reception/receiver array.

[0032] For both the transmission system 105 and the reception system 106, the coil windings are preferably multi-turn Litz-wire, which can help reduce any skin effects that can occur at the typical 20-30kHz operational frequency. The Litz-wire coils are preferably wound flat into a composite material case, and are typically secured on the case of the magnetic cores 305 and 306 as one single assembly, though other assemblies are contemplated as well.

[0033] The magnetic cores are preferably tile-shaped low loss power ferrites with material composition optimized for 10-50kHz power transformer application. The magnetic ridge between the coils sets the coupling coefficient between the adjacent coils. The pole face in the center of the coils improves the coupling coefficient between the transmitter and receiver magnetic assemblies.

The assembly is preferably a 'flat magnetics' construction with less than 1" overall thickness for ease of roadway and vehicle installation.

[0034] During operation, the transmission system 105 and reception system 106 are preferably arranged such that the coils 201 and 202 of transmission system 105 face the coils 203 and 204 of the reception system 106 as shown in FIG. 3(a) and FIG. 3(b). FIG. 3(b) shows a cross section of the energy transmission and reception system in one arrangement used during operation. An airgap between transmission system 105 and reception system 106 separates the receiver and roadside arrays. This airgap may not be even, and the transmission and reception systems may not be aligned during typical operation. Despite the airgap and any potential misalignment, energy transfer from the transmission system 105 to the reception system 106 occurs due to resonant inductive coupling between the roadside and pick-up arrays.

[0035] FIG. 4 shows one example of a simplified circuit schematic that produces the resonant inductive coupling effects. Various other circuit details and elements are assumed, and not shown. The energy transmission system includes at least one roadside array, which comprises primary magnetic core windings Lp1 and Lp2. Lp1 includes coil winding 202 arranged in section 305 of a magnetic core, and Lp2 includes coil winding 201 arranged in section 306 of the same or adjacent magnetic core used in Lp1, as previously described. Lp1 and Lp2 are each also known as "primaries", "primary coils" or "primary windings".

[0036] The two primaries are connected to H-Bridge converters 440 and 441 of Multi-Phase Converter ("MPC") 130 through capacitors CR-1 and CR-2, as shown in FIG. 4.

The combination of each primary winding and its capacitor forms a single resonant circuit. Because the coil winding 201 installed on core 306 and winding 202 installed on core 305 are coplanar and arranged next to each other, Lp1 and Lp2 inductively couple. Due to this coupling between the two primaries, the two series resonant circuits resonate at a common frequency when the primaries are simultaneously supplied with current by the MPC 130.

[0037] FIG. 4 also illustrates the energy reception system 106 that includes at least one pick-up array comprising magnetic core windings Ls1 and Ls2. Ls1 includes coil winding 204 arranged in section 405 of a magnetic core, and Ls2 includes coil winding 203 arranged in section 406 of the same or adjacent magnetic core used in Ls1. Ls1 and Ls2 are also coupled to each other in the same manner as the primaries. Ls1 and Ls2 are also known as "secondaries", "secondary coils", or "secondary windings".

[0038] When the secondary coils are brought within proximity of an energized set of primary coils, several coupling effects influence the overall flux coupling and hence the peak power of the energy transferred across the airgap. One coupling effect involves the secondary coils inductively coupling to the primary coils, thereby introducing an additional complex load to the otherwise undamped (high Q) series-resonant circuits formed by Lp1 and Lp2 and their corresponding capacitors. This additional complex load is typically caused by various elements connected to energy reception system 106, typically including the energy storage battery 451 and/or capacitor 450 of the vehicle, as well as other elements. Due to coupling between the secondary and primary coils, the resonant circuit of the energy transmission system

experiences this complex impedance, and thus the circuit resonant frequency and quality factor (Q) change. The frequency change is detected by an auto-frequency tracking regulator which is part of the PWM electronics 442 that are part of Multi-Phase Converter 130. The auto-frequency tracking regulator is configured to synchronize the input H-Bridge 440 and 441 to switch relative to the zero-crossing time instances of the measured resonant current signal. Thus, the switching frequency is locked to the natural resonant frequency of the entire primary, secondary and load circuit. As the natural resonant frequency measured by the resonant current signal changes due to the load and airgap size variations, the input switching frequency is preferably locked to the natural frequency. The coupling distance is defined by the airgap between the energy transmission system 105 and the energy reception system 106. The natural resonant frequency typically varies by a few kHz due to the load and airgap. Thus, the peak power transferred over the airgap is affected. The power variation is regulated by the same PWM electronics which change the pulse width of the switching devices in H-bridge 440 and 441. In this manner, the peak power transferred is automatically adjusted to compensate for the size of the airgap and the secondary circuit's load.

[0039] Another coupling effect that influences the peak power transfer is that which occurs between each of the primary coils and between each of the secondary coils. These couplings assure a common system resonant frequency for the pair of resonant circuits. The couplings also keep the relative current change in the primaries identical during directional phase-control. For example, as shown in FIG. 7, Current A increases and Current B decrease symmetrically during relative phase-

control mode. The relative phase control between the pair primary resonant circuits is preferably accomplished by the PWM electronics.

[0040] Additionally, each of the primary coils cross-couples with each secondary coil, thereby contributing to the total inductance and to the coupling coefficient between the roadside and pickup arrays.

[0041] The described coupling effects combine to influence coupling coefficients between the different inductive elements and hence define the system's common resonance frequency and overall energy transfer capability. For large airgaps (7"-9"), the net coupling coefficient can be smaller (in the range of K_c=0.6-0.7), than in equivalent power transformers. Transferring energy over large airgaps in resonant mode may also require significant reactive/real power ratio in the resonant circuit, which can lower power transmission efficiency. Transmission of 100kW power can be achieved over 7" airgap at 85% efficiency. Operating resonant frequency for this performance can be typically between 20-30kHz. However, other airgap sizes, amount of power and frequency ranges are also contemplated.

[0042] The desired location of the energy transfer itself is preferably along the central plane between energy transmission system 105 and energy reception system 106 shown in FIG. 3(b), or at least limited to the area between the transmission and reception systems. The currents supplied to the primary coils preferably flow in the same direction, as shown in FIG. 2, thereby causing the electromagnetic flux density to concentrate along the center axis of the roadside and pick-up arrays as shown in FIG. 5(a). As shown in FIG. 5(a) and 5(b), the field density and location of energy transfer can concentrate beneath a vehicle center line and taper off

along the edges. Residual stray field outside the envelope of the vehicle can thus be minimized.

[0043] As shown in FIG. 6(a), 6(b) and 6(c), the wireless transfer system can also automatically compensate for horizontal misalignment between the energy transmission system 105 and reception system by adjusting the spatial direction of the energy transfer. MPC 130 can perform this spatial direction adjustment by varying the relative phase angle between the input currents provided to the roadside array's primary coils 201 and 202 by switchmode single phase converters 440 and 441 (shown in FIG. 4). The phase converters generate a square wave bipolar output that can be used to excite the energy transmission system 105. The phase converters can be synchronized to the zero crossing of the resonant current, so that the excitation frequency trails the resonant frequency. When the resonant frequency changes due to a load introduced by the presence of secondary coils, these converters can follow the resonant frequency and thus maintain a high power factor for efficient real power transfer. For example, FIG. 7 shows an input PWM voltage and resonant current I-1 and I-2. The relative phase-angle between the driving voltages V-1 and V-2 can change the relative magnitudes of I-1 and I-2, which can produce the field gradient shift shown in FIGs. 6(a), 6(b) and 6(c) and FIG. 8(a), 8(b) and 8(c). The gradient vector tilt can also produce the current magnitude variation in the outputs, causing the transferred power to also vary between the pair of receiver coils 203 and 204. However, the total power transferred preferably remains constant. Power in excess of 100kW can be transferred over large air-gaps (7-9") at a frequency ranging from 20-30khz. However, other airgap sizes,

amount of power, and frequency ranges are also contemplated.

[0044] In another embodiment of the wireless transfer system, multiple roadside arrays can be arranged to provide an energy transfer system that can be used for larger vehicles. FIG. 9 shows one implementation of this embodiment, where an additional roadside array 505 can be added to increase the size of the energy transfer system. Directional control can be enhanced, since the electromagnetic field of each array can be spatially directed independently. Additionally, multiple pick-up arrays can be used to receive wireless energy transfer ("WET") to power multiple loads independently. Roadside arrays 505 and 105 can both be connected to a multi-phase converter to receive current, which is preferably supplied so that the generated electromagnetic flux combines to transfer energy in the same direction.

[0045] FIG. 10 shows another embodiment of the high power wireless resonant energy transfer system. This embodiment provides a local energy source that can power buildings and equipment at the local site and/or wirelessly transmit the generated energy to an electrically chargeable vehicle using the same or similar energy transmission 105 and reception system 106 discussed for the first embodiment.

[0046] In this embodiment, a Power Mixing Converter (PMC) 135 can receive energy from one or more sources, and can coordinate the distribution of that energy to one or more outputs. One source of energy includes one or more microturbine generator(s) 150, which can convert fuel from one or more fuel sources into energy. These fuel sources can include, but are not limited to, a methane source 153, natural gas source 152, and/or hydrogen source 156. The fuel sources are preferably

stored on-site for convenience, but can also be transported in through pipe or by other means. Heat generated by the microturbine 150 can be captured in a heat exchanger 160, and can be used for heating and cooling needs at the site, such as warming water, or driving a turbine to provide additional electrical power to the site.

[0047] Other energy sources for the PMC 135 can include energy from renewable sources 135, such as solar and wind power. PMC 135 can also receive energy from other sites connected through microgrid 137 and from the standard utility grid 139, as well as one or more on-site energy storage units, such as flywheel(s) 137, and/or one or more battery banks 138. The PMC 135 can select its energy source(s) based on a variety of factors, including, but not limited to source availability, storage capacity and real-time costs of each of the energy sources.

[0048] In addition to receiving energy from one or more sources, the PMC 135 can also distribute energy to one or more outputs. These outputs include, but are not limited to, the site facility power distribution system 132 for powering the site itself, one or more flywheel storage banks 137 and battery banks 138 for load leveling and backup power, the microgrid 137 for powering other sites, the standard utility grid 139, and the MPC 130 for wirelessly transferring the energy to an electrically chargeable vehicle through arrays 105 and 107. The PMC 135 can also calculate which output to send the energy to. For example, during low load periods, the PMC 135 may choose to output energy to the fly-wheel storage 137 or batter bank 138 for storage. During peak load periods, the PMC 135 can draw power from the fly-wheel storage 137 and/or battery banks 138 to provide load-

leveling. PMC 135 can determine its energy source and outputs either in real-time or by using past data. Thus, the PMC 135 can optionally calculate energy trends over a period of time, and even optionally anticipate and adjust for energy supply and demand. Typical PMC 135 energy transfers can involve between 250kW to 2MW of power.

[0049] Another embodiment of the high power wireless resonant energy transfer system includes providing an electric vehicle with the transmission reception system 106 of the previous embodiment, onboard power electronics (OPE) 110, and onboard energy storage device (OSD) 115, as shown in FIG. 4. The OPE 110 preferably can rectify an input AC voltage from the wireless reception system 106, and can supply the output DC current to the OSD 115. The OSD 115 comprises a battery bank 451 preferably capable of storing at least five miles of propulsion energy (typically 10kWh for a 40' bus) and a mega-capacitor (MegaCap) 450 capable of providing sufficient energy to accelerate the vehicle and receiving the initial charging current surge from the wireless transmission system. A steering inverter (not shown) within the OPE can be arranged to control the power flow into and out of battery bank 451 and mega-capacitor 450. In another embodiment, the OPE is configured to invert power back to the roadside energy storage through providing PWM power to the secondaries drawn from the OSD. The primary resonant circuit can feed the resonant current back to the DC bus through the H-Bridge converters operating in rectifier mode. In this embodiment the vehicle can operate as an emergency or standby power source for site equipment. Preferably, the battery bank 451 comprises batteries made of NMH or Li-Ion, but other types of energy storage devices are contemplated as well.

[0050] Another embodiment of the high power wireless resonant energy transfer system shown in FIG. 20 provides a method for wireless energy transfer, comprising positioning an electrically chargeable vehicle within electromagnetic proximity of a transmitter. A beam-searching of the receiver can be performed by modulating a phase angle of an input signal to a transmitter to locate an optimal electromagnetic field distribution. Typical beam-searching modulation is shown in FIG. 7, where Current A (I-1) and Current B (I-2) symmetrically modulated in both directions, and then return to the center position. An auto-adjustment of an energy transfer frequency based on a position of the energy receiver can be accomplished. An auto-adjusting of an energy transfer power can be performed by modulating a pulse width of an input signal to the transmitter. Energy can be transferred from the transmitter to the receiver. Additionally, power can be generated at a local site to power the site and the transmitter.

[0051] Another embodiment of the wireless transfer system provides for activating the energy transfer system shown in FIG. 1. This embodiment uses the same wireless transmission and reception system described in the first embodiment. As vehicle 101 approaches transmission system 105, its onboard computers can send a signal to activate the energy transmission system 105. This signal is preferably sent automatically, and may be encrypted. As the vehicle 101 comes to a rest over transmission system 105, transmission system 105 can transmit an electromagnetic beam to search for the position of the reception system 106. Once transmission system 105 determines the location of the reception system using the electromagnetic beam sweep, it automatically adjusts the location of the energy transfer to maximize the transfer.

[0052] Another embodiment of the high power wireless resonant energy transfer system provides an E-pod and an electric highway for continuous electrical propulsion power for heavy highway vehicles, such as cargo trucks and 40'-60' rapid transit buses. In this embodiment, an energy reception system can be mounted to the undercarriage of a vehicle to collect power from a series of road-surface energy transmission systems that have transmission arrays. The activated transmission arrays directly under the vehicle can provide most of the vehicle's propulsion energy. Thus, the vehicle needs only a small energy storage onboard. The roadway transmission arrays are preferably active for the short period of time required for the vehicle to pass over the array. Thus, the output power transmitted can be high but the duty cycle is small. The pickup coils of the moving vehicle, however, see a practically continuous power-rail.

[0053] The equivalent circuit schematic diagram in FIG. 11 shows a typical dual coil arrangement for the roadway magnetic pad. The Dual-Phase Converter drives LP-1 and LP-2 coil segments such that the currents oppose each other in the return path. The coils are preferably on the top surface of the magnetic core, and the coaxial returns are underneath with the Dual-Phase converter packaged into the roadway assembly.

[0054] The roadway pad is shown in FIGs. 12(a) and 12(b). The roadway pad can comprise a ferrite magnetic core 1001, the two coils 1002 and 1003, and the Dual-Phase Inverter 1005. The coaxial returns 1006 and 1007 connect the coils to the converter.

[0055] The roadway pads can be lined up in the middle of a highway lane such that the vehicles activate the pads as they pass over them. Otherwise the pads are

deactivated. FIG. 13 shows one example of an Electrified Highway Lane using the pads of FIG. 12. Vehicle 601--a cargo truck--passes over the row of roadway pads 801, and the attachable E-Pod 701 collects the energy from the activated pads.

[0056] The E-Pod shown in FIG. 14 is one embodiment of an attachable wireless energy transfer module for large vehicles, which has the effect of converting the diesel vehicle into a hybrid-electric vehicle due to the attached E-pod. The E-Pod of FIG. 14 comprises the pickup coils 705 and 706, the HF rectifiers 712, battery packs 710 and the electric motor drive 715. This E-Pod has two sets of these components driving the front and back wheels separately. Other variations are also possible.

[0057] In this cargo truck embodiment, the E-Pod 701 can be rolled under and installed to the bottom frame of the cargo container section 610 (shown in FIG. 13). FIG. 15 shows the E-Pod 701 installation under the cargo truck 601. The electronic interface to the driver can be plugged in so that the Rig is operating in dual-mode. When the vehicle travels over an electrified section of the highway, the E-Pod can be hydraulically lowered so that the wheels contact the roadway surface, and the electric drives can be activated to take over most of the propulsion power from the diesel tractor. During braking, the regenerated power can be fed back to the E-Pod batteries.

[0058] Preferably, the electrified lanes of the highway align the Wireless Energy Transfer roadway assemblies such that the dual coil pickup assemblies hover over the activated segments of the roadway. Thus, full power transfer can be spread over a longer distance—such as 16′ to 24′—under the E-Pod. Through sequential

activation, the power availability wave remains just under the E-Pod at all times, while the other segments under the Rig and on the highway idle preferably without power.

[0059] The power system feeding an Electrified Highway Lane can include a set of stationary Solid Oxide Fuel Cells (SOFC units) fed by alternative fuel sources, and a network of interconnecting microgrids described in a previous embodiment. Thus, the Electrified Highway Lane can have its own distributed energy generation system with combined heat capture and optional roadside Hydrogen generation. Where utility power is available, inexpensive, and environmentally acceptable, the microgrid can tap into the utility grid system.

[0060] The E-Pod shown in this embodiment uses cargo trucks for illustrative purposes only. Other types of vehicles, such as buses and utility vehicles can also be fitted with an E-pod, and can similarly use the Electrified Highway lanes for electric propulsion.

[0061] In another embodiment of the high power wireless resonant energy transfer system, electric or hybrid vehicles that are regularly parked on the same location for extended period, such as school buses and passenger cars, can use Bumper Chargers with Wireless Energy Transfer ("WET") for replenishing their onboard energy storage. FIG. 16 shows a school bus 901 being recharged from an elevated Bumper Charger. The coils of the WET can be installed in the bumper 905 of the vehicle, and on the parkway in the bumper curb 903. The vehicle energy storage 910 can be recharged over a few hours while the school bus is waiting. The required power is small because of the long charging time available.

[0062] Hybrid and electric automobiles can use the WET installed in parking lots and home driveways. An average automobile can require about 0.3kWh/mi for regular city cycles. Therefore, the recharge power requirements can be modest in comparison the buses and trucks (preferably 2.5kWh/mi and 4kWh/mi respectively). A medium power alternative of the series resonant inductive coupling array can be used to recharge power typically in the range of 5 to 15kW. The principle block diagram in FIG. 17 shows the co-resonant inductively coupled phase-array technique, whose secondary receiving circuits 1302 and 1304 are tuned to the same frequency as the primary circuits 1308 and 1306. Although the primary circuits are weakly coupled to the secondary circuits, the high quality factor (Q) of the resonant circuits assures co-resonance at a common frequency. The operating resonant frequency can be over 100kHz. The tuned circuit comprises split coils 1050 and 1051 (Lp11 and Lp12) resonating with the coaxial capacitor 1052, which is arranged near the middle of the LRC circuit as shown in FIG. 17. The receiving secondary resonant circuit comprises inductors 1060 and 1061 arranged as shown with capacitor 1062. The second pair of primary-secondary circuits 1306 and 1304, are substantially identical. The coils preferably have an air-core, with ferrite diverters preferably used only externally to shield residual flux entering the vehicle. The Multi-Phase Converters 1055 and 1065 can be integrated with the dual coil-capacitor field generators as shown in FIG. 14. As described in a previous embodiment, controlling the driving voltage phase angle between the primaries generates field direction change for power optimization that compensates for vehicle misalignment by shifting the location of the transfer.

[0063] FIG. 18(a) shows one example of a B-vector field distribution in a pair of primary-secondary coils. The co-resonating primary and secondary B fields 1071 and 1072 are dense in and around the coils, but the flux density is small in the airgap between the roadside assembly and the vehicle. FIG. 18(b) shows the energy being concentrated at and around the coils, and decaying rapidly toward the middle of the airgap.

[0064] Corresponding to FIG. 9, which shows the extended double dual-coil configuration for the series-resonant inductive coupling for large vehicles, FIG. 18(c) shows the equivalent four coil configuration of the co-resonant inductive coupling for smaller vehicles, having an MPC 1081 and coils 1082, 1083, 1084, and 1086 arranged as shown.

[0065] FIG. 19 shows a typical automobile 1010 which, once electrified, can use the co-resonant inductive WET installed into driveways and parking lots. WET installation under the roadway surface preferably uses the double dual-coil phase-array 1020, which can adjust and correct for large misalignment as described earlier. The curb-charger variation of the WET 1015 has adjustment for one direction. Due to the symmetry between the roadside and onboard power conversion, the energy can flow in both directions. Charging from the roadside can be reversed, and the energy stored in the onboard energy storage can be fed back to the roadside. The vehicle parked over the WET can be used as a non-contact emergency power source.

[0066] While various implementations and embodiments of the high power wireless resonant energy transfer system have been described, it will be apparent to those of ordinary skill in the art that many more are possible.

WHAT IS CLAIMED IS:

1. A high power wireless resonant energy transfer system, comprising:

an energy transmission system arranged to wirelessly transfer energy across an airgap; and

an energy reception system positioned to receive said transferred energy across said airgap through a resonant inductive coupling between said transmission and said reception system, said energy transmission system arranged to automatically and electronically vary the spatial direction of said resonant inductive coupling with the alignment between said transmission and reception system, such that energy transfer occurs at a desired location, frequency and power level.

2. The system of claim 1, wherein said energy transmission system comprises at least one pair of primary resonant circuits, each one of said at least one pair arranged to inductively couple with another of said at least one pair by an inductive coupling to establish a common resonant frequency for said at least one pair of primary resonant circuits.

3. The system of claim 2, wherein said energy reception system comprises at least one pair of secondary coils arranged to inductively couple with said at least one pair of primary resonant circuits to provide an electrical load for said primary resonant circuits, said electrical load adjusting said common resonant frequency of said coupled primary and secondary circuits.

4. The system of claim 2, further comprising a controller that adjusts relative input voltage phase in said at least one pair of primary resonant circuits, said controller connected to receive an input voltage having an automatically adjustable input voltage phase to adjust said spatial direction of said resonant inductive coupling.

5. The system of claim 2, further comprising a controller that adjusts a pulse width of an input current to each of said at least one pair of primary resonant circuits to adjust the output power of said resonant inductive coupling.

6. The system of claim 1, wherein said desirable location is centered along a centerline of said receiver, and does not extend substantially beyond the limits of said receiver.

7. The system of claim 1, wherein said energy transmission system is arranged in proximity to a roadway and said energy reception system is arranged on an underside of an electrically chargeable vehicle.

8. The system of claim 7, wherein a plurality of said energy transmission systems are arranged in proximity to said roadway such that said electrically chargeable vehicle receives said transferred energy while in motion.

9. The system of claim 1, wherein said energy transmission system comprises at least one pair of primary coils, with the coils of each pair arranged in a

ferrite core magnetic diverter and substantially coplanar with each other.

10. The system of claim 1, wherein said energy transmission system comprises at least one pair of secondary coils, with the coils of each pair arranged in a ferrite core magnetic diverter and substantially coplanar with each other.

11. The system of claim 8, wherein said at least one pair of primary coils and said at least one pair of secondary coils comprise Litz-wire.

12. A combined heat and power generation and high power wireless resonant energy transfer system, comprising:

a local energy generation system arranged to generate, store and provide electrical energy for a local site and for an electrically chargeable vehicle in proximity to said local site;

an energy transmission system arranged to wirelessly transfer energy across an airgap; and

an energy reception system positioned to receive said transferred energy across said airgap through a resonant inductive coupling between said transmission and said reception systems, said energy transmission system arranged to automatically and electronically vary the spatial direction of said resonant inductive coupling with the alignment between said transmission and reception system, such that energy transfer occurs at a desired location, frequency and power level.

13. The system of claim 12, wherein said energy transmission system comprises at least one pair of

primary coils arranged to form a common resonant circuit, with the coils of each pair arranged to inductively couple to establish a common resonant frequency for said at least one pair of primary resonant circuits.

14. The system of claim 13, wherein said energy reception system comprises at least one pair of secondary coils arranged to inductively couple with said at least one pair of primary resonant circuits to provide an electrical load for said primary resonant circuits, said electrical load adjusting said common resonant frequency of said primary resonant circuits.

15. The system of claim 13, further comprising a controller that adjusts relative input voltage phase in said at least one pair of primary resonant circuits, said controller connected to receive an input voltage having an automatically adjustable input voltage phase to adjust said spatial direction of said resonant inductive coupling.

16. The system of claim 13, further comprising a controller that adjusts a pulse width of an input current to each of said at least one pair of primary resonant circuits to adjust the output power of said resonant inductive coupling.

17. The system of claim 12, wherein said desirable location is centered along a centerline of said receiver, and does not extend substantially beyond the limits of said receiver.

18. The system of claim 12, wherein said energy transmission system is arranged in proximity to a roadway

and said energy reception system is arranged on an underside of an electrically chargeable vehicle.

19. The system of claim 18, wherein a plurality of said energy transmission systems are arranged in proximity to said roadway such that said electrically chargeable vehicle receives said transferred energy while in motion.

20. The system of claim 12, wherein said energy generation system comprises a generator and an alternative and renewable energy source for fueling said generator.

21. The system of claim 12, wherein said energy generation system comprises a multi-directional converter for controlling said electrical energy provided to said local site and said electrically chargeable vehicle.

22. A method for wireless energy transfer, comprising:

positioning an electrically chargeable vehicle within electromagnetic proximity of a transmitter;

beam-searching said receiver by modulating a phase angle of an input signal to a transmitter to locate an optimal electromagnetic field distribution;

auto-adjusting an energy transfer frequency based on a position of said energy receiver;

auto-adjusting an energy transfer power by modulating a pulse width of an input signal to said transmitter;

transferring energy from said transmitter to said receiver.

23. The method of claim 23, further comprising generating power at a local site to power said site and said transmitter.

24. A detachable E-pod, comprising:

a wheel assembly removably attached to a vehicle;

a wireless energy reception system arranged on said wheel assembly to receive wirelessly transmitted energy from an energy transmission system;

a propulsion system comprising an electric motor arranged on said wheel assembly and powered by said wirelessly transmitted energy to move said vehicle; and

an electronic controller interface system arranged to electrically connect said wheel assembly with said vehicle to control said propulsion system from said vehicle.

25. The system of claim 22, further comprising an electrified highway having a plurality of energy transmission systems arranged to periodically provide energy to said wireless energy reception system, said wheel assembly lowered to receive energy from said transmission system and to propel said vehicle.

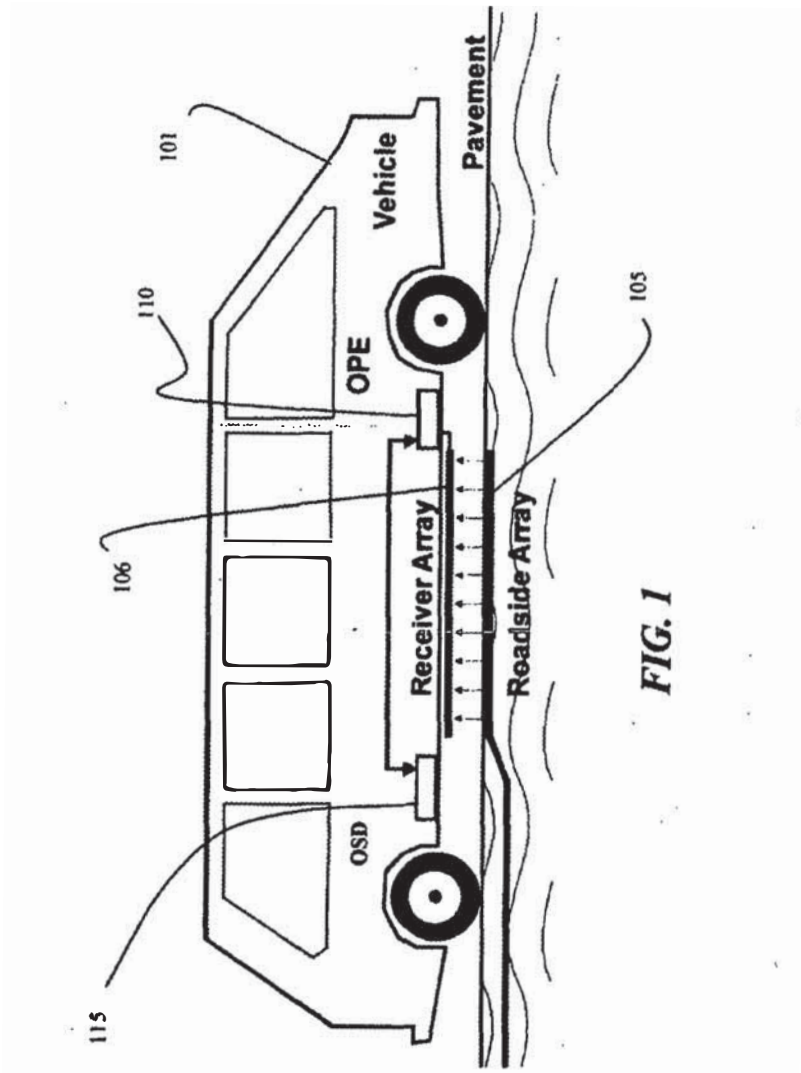

FIG. 1

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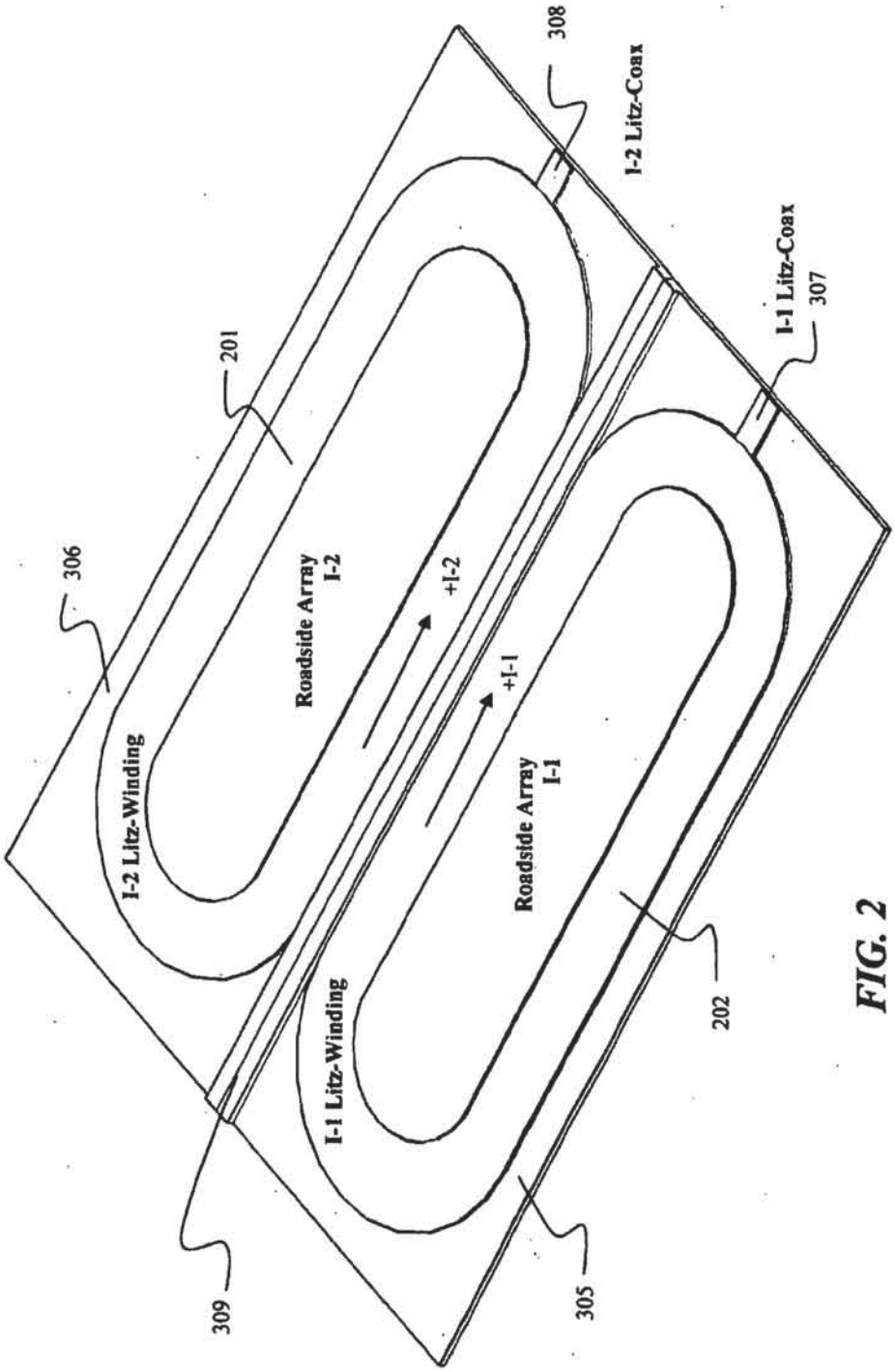

FIG. 2

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FIG. 3(a)

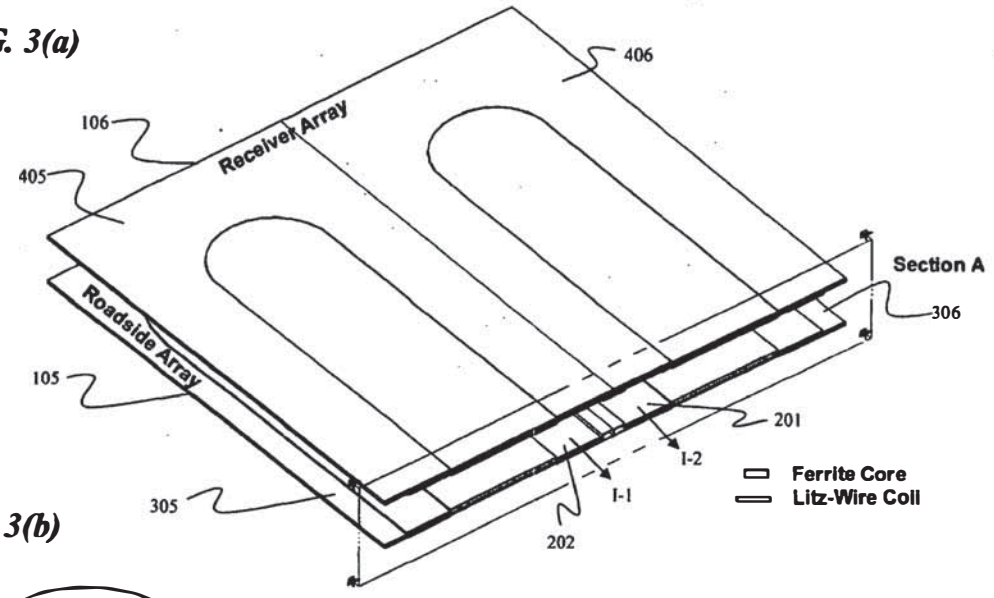
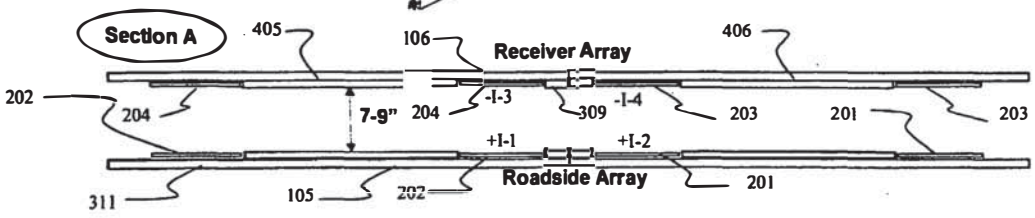

406
106
Receiver Array
405
Section A
306
Roadside Array
105
201
I-2
I-1
Ferrite Core
Litz-Wire Coil
305
202

FIG. 3(b)


Section A
405
106
Receiver Array
406
202
204
7-9"
204
-I-3
309
-I-4
203
201
203
+I-1
+I-2
Roadside Array
311
105
202
201

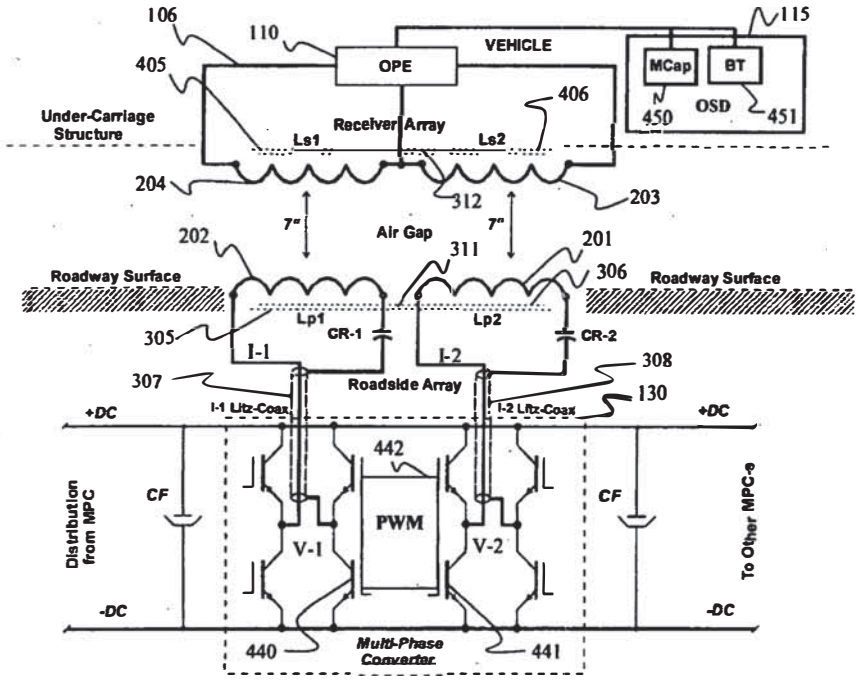

106
110
115
VEHICLE
OPE
MCap
BT
405
406
N
450
OSD
451
Under-Carriage Structure
Receiver Array
Ls1
Ls2
204
312
203
7"
Air Gap
7"
202
311
201
306
Roadway Surface
Roadway Surface
Lp1
Lp2
305
CR-1
CR-2
I-1
I-2
308
307
Roadside Array
130
+DC
I-1 Litz-Coax
I-2 Litz-Coax
+DC
442
CF
PWM
CF
Distribution from MPC
V-1
V-2
To Other MPC-s
-DC
-DC
440
Multi-Phase Converter
441

FIG. 4

FIG. 5(a)

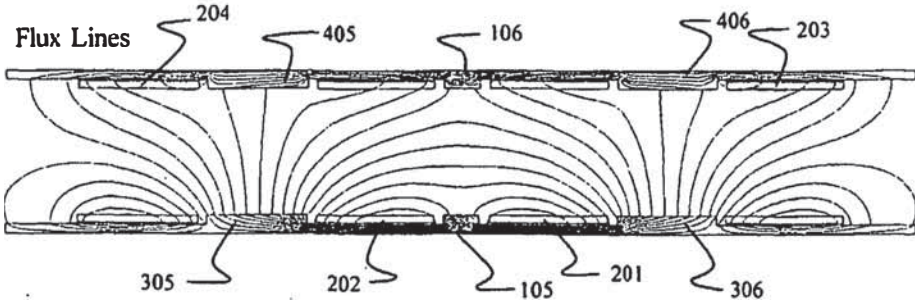


FIG. 5(b)

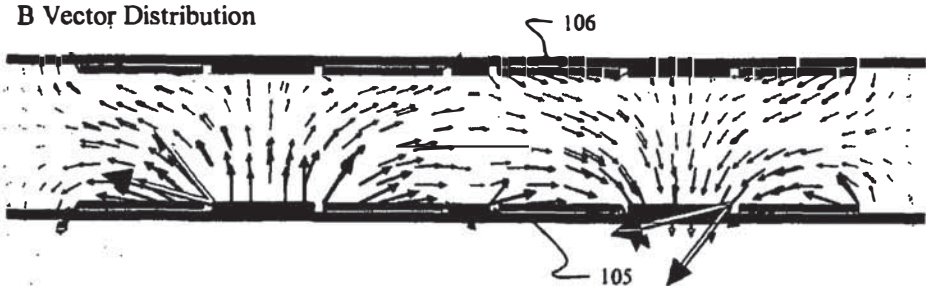


FIG. 6(a)

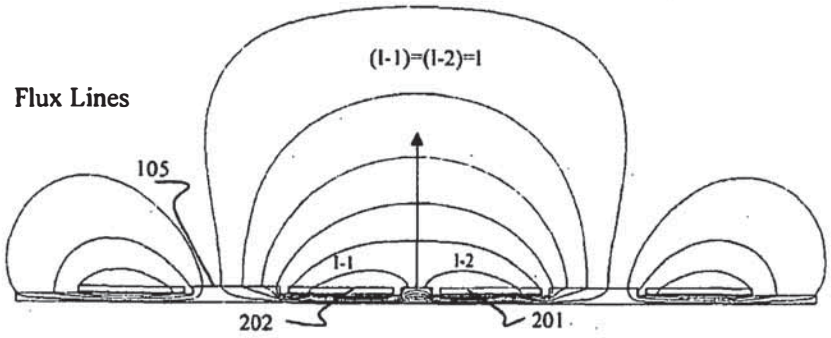


FIG. 6(b)

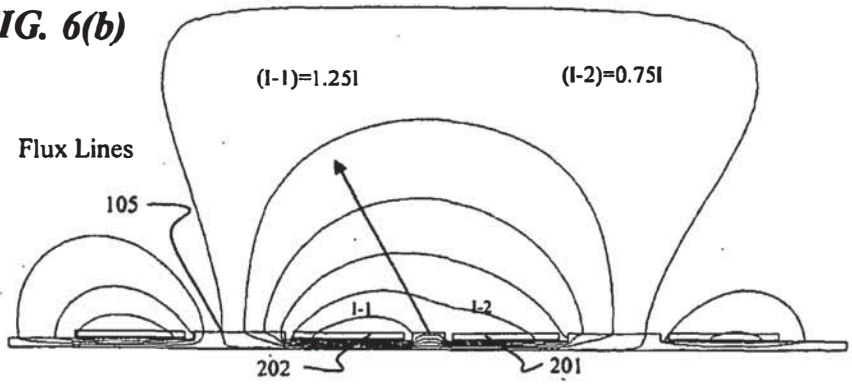
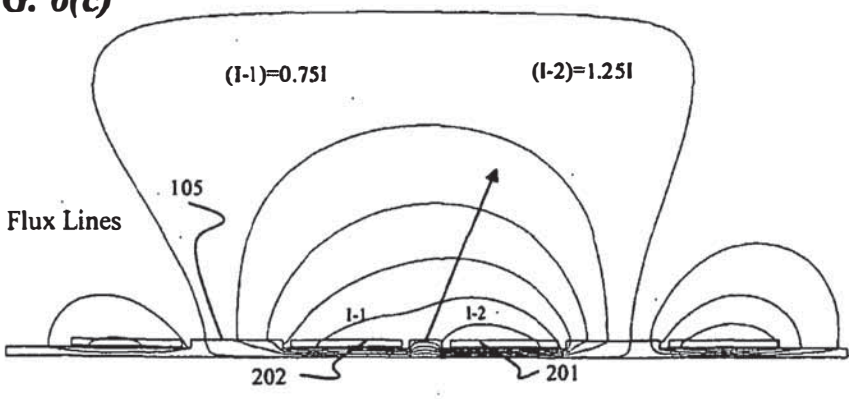


FIG. 6(c)



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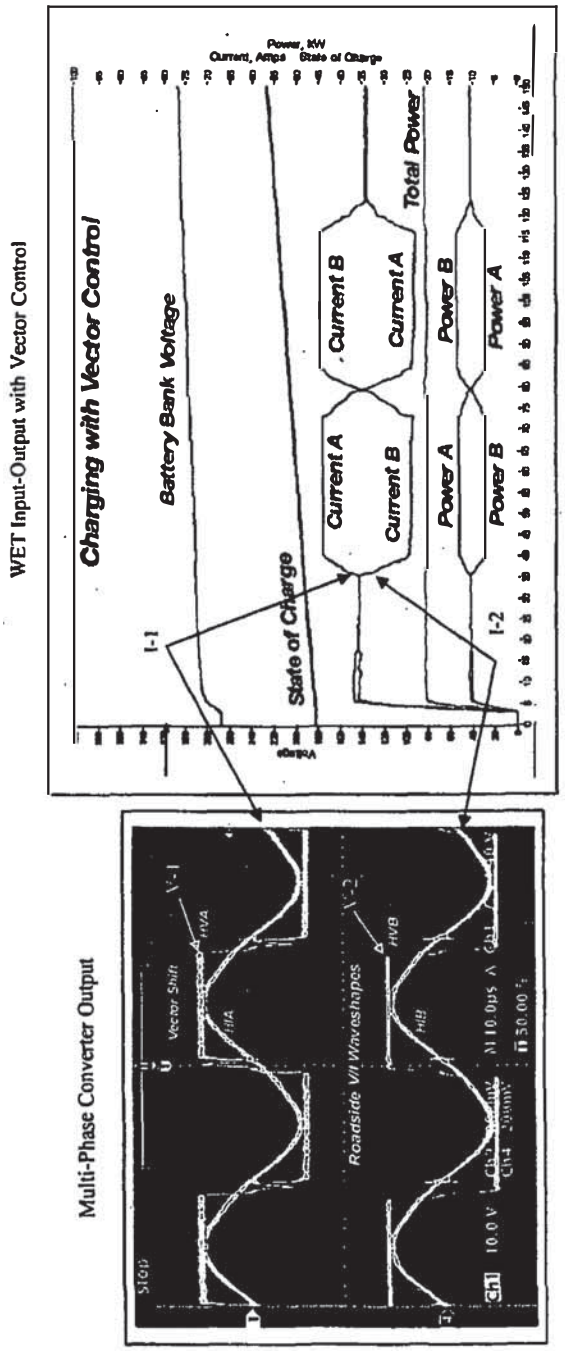

FIG. 7

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FIG. 8(a)

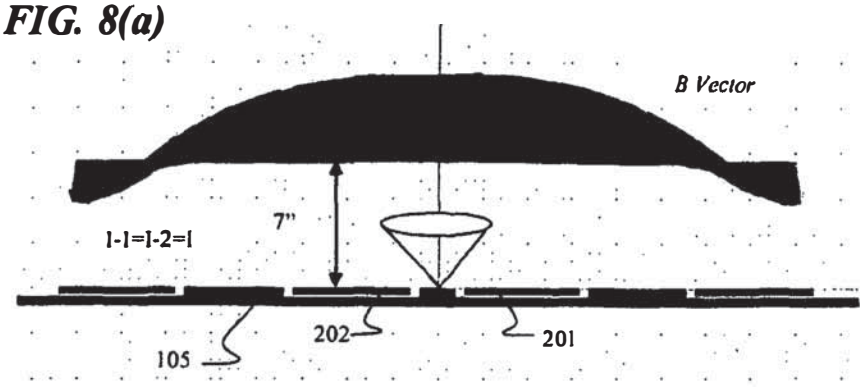


FIG. 8(b)

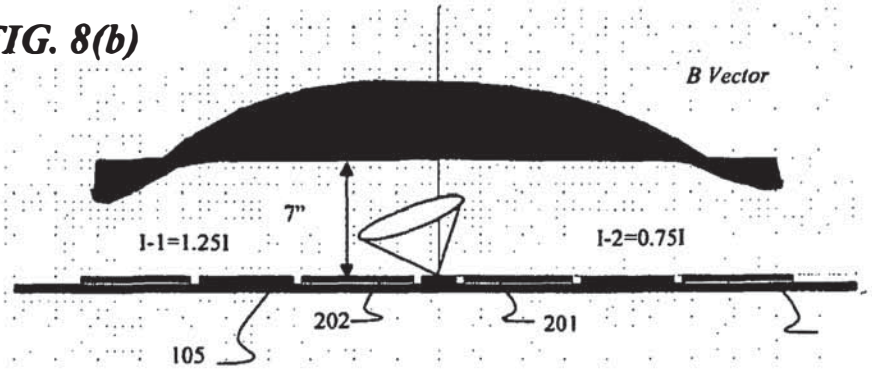
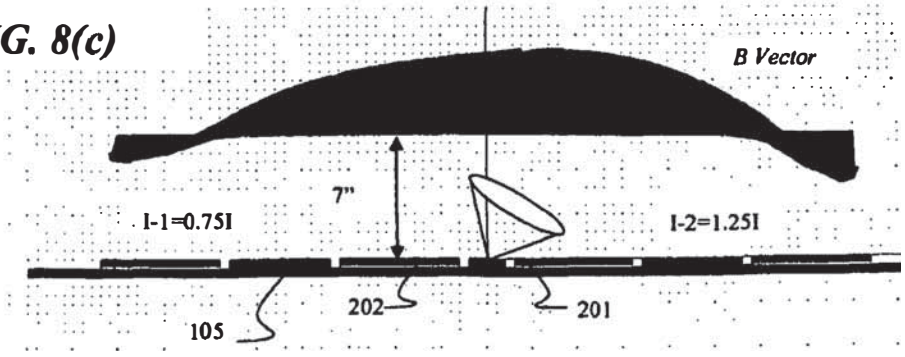


FIG. 8(c)



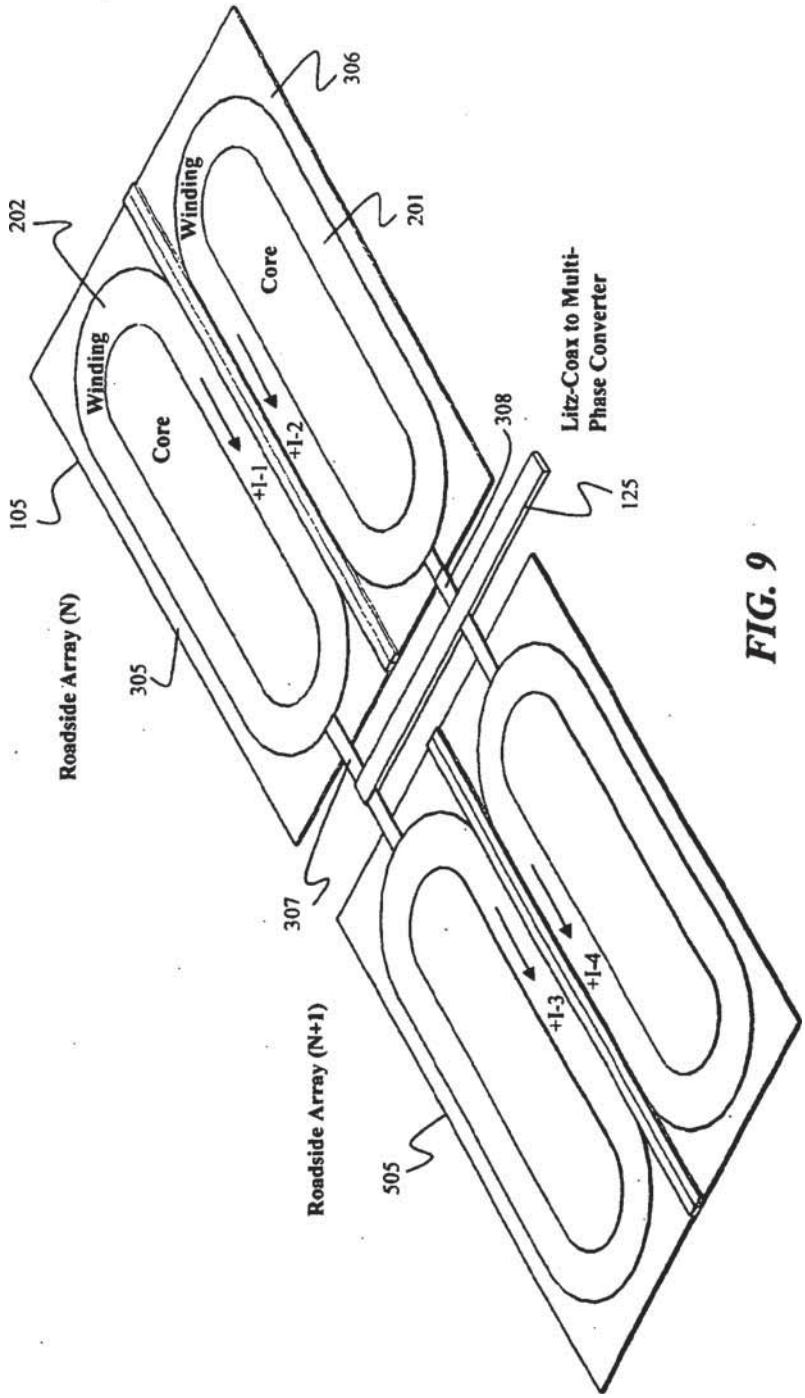


FIG. 9

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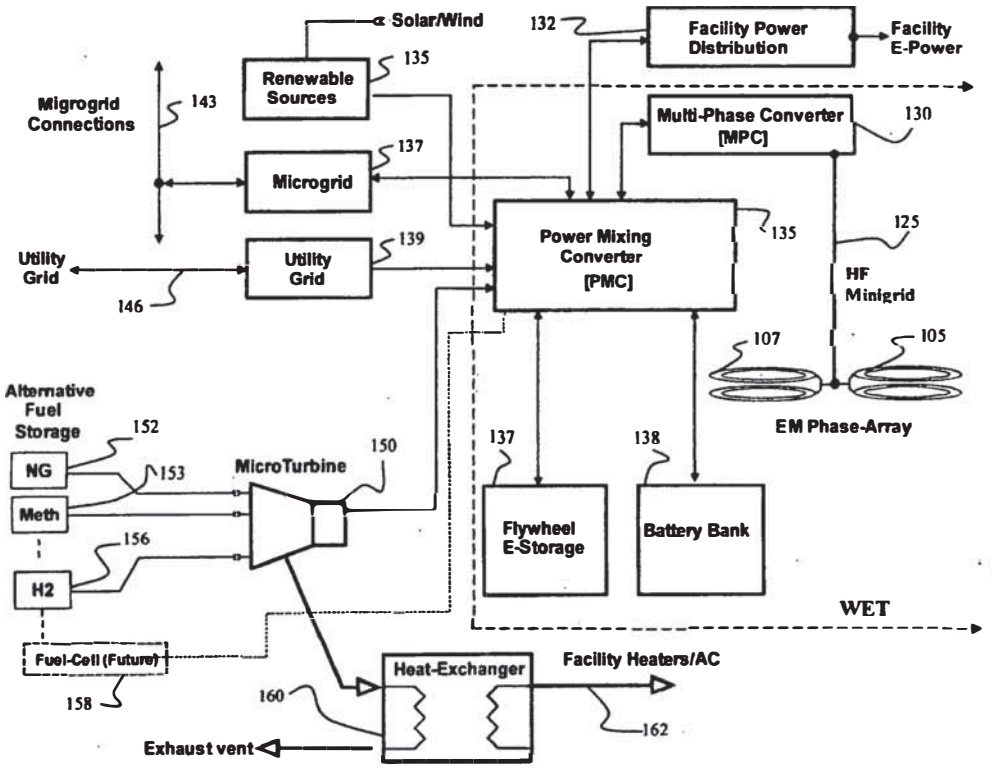
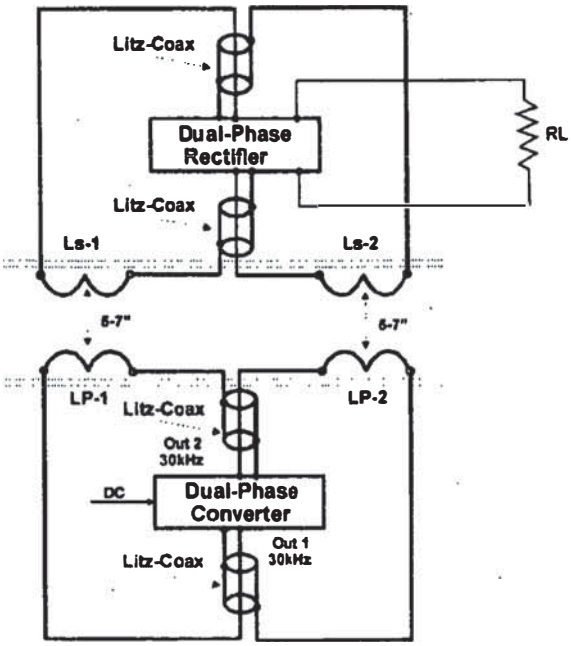

Solar/Wind
132
Facility Power Distribution
Facility E-Power
135
Renewable Sources
Migrogrid Connections
143
Multi-Phase Converter [MPC]
130
137
Microgrid
Power Mixing Converter [PMC]
135
125
139
Utility Grid
Utility Grid
146
HF Minigrid
107
105
EM Phase-Array
Alternative Fuel Storage
152
NG
153
MicroTurbine
150
Meth
156
H2
137
138
Flywheel E-Storage
Battery Bank
WET
Fuel-Cell (Future)
158
Heat-Exchanger
Facility Heaters/AC
160
162
Exhaust vent

FIG. 10



Equivalent Circuit

FIG. 11

FIG. 12(a)

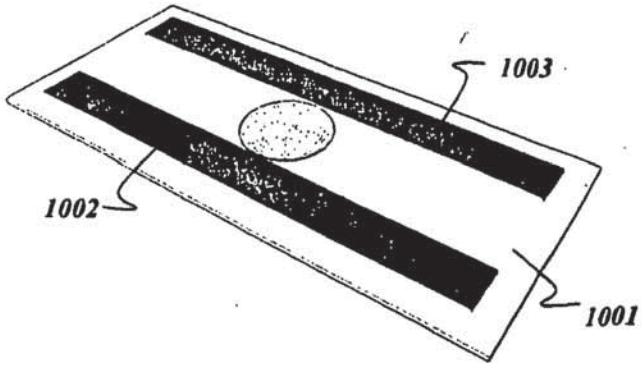
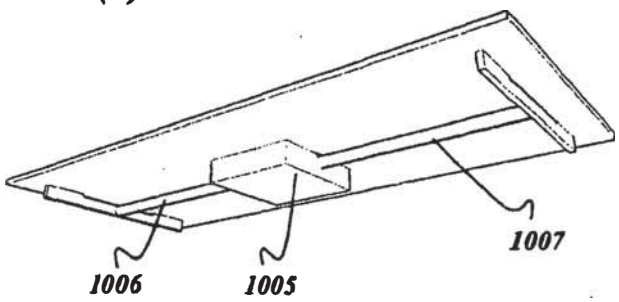


FIG. 12(b)



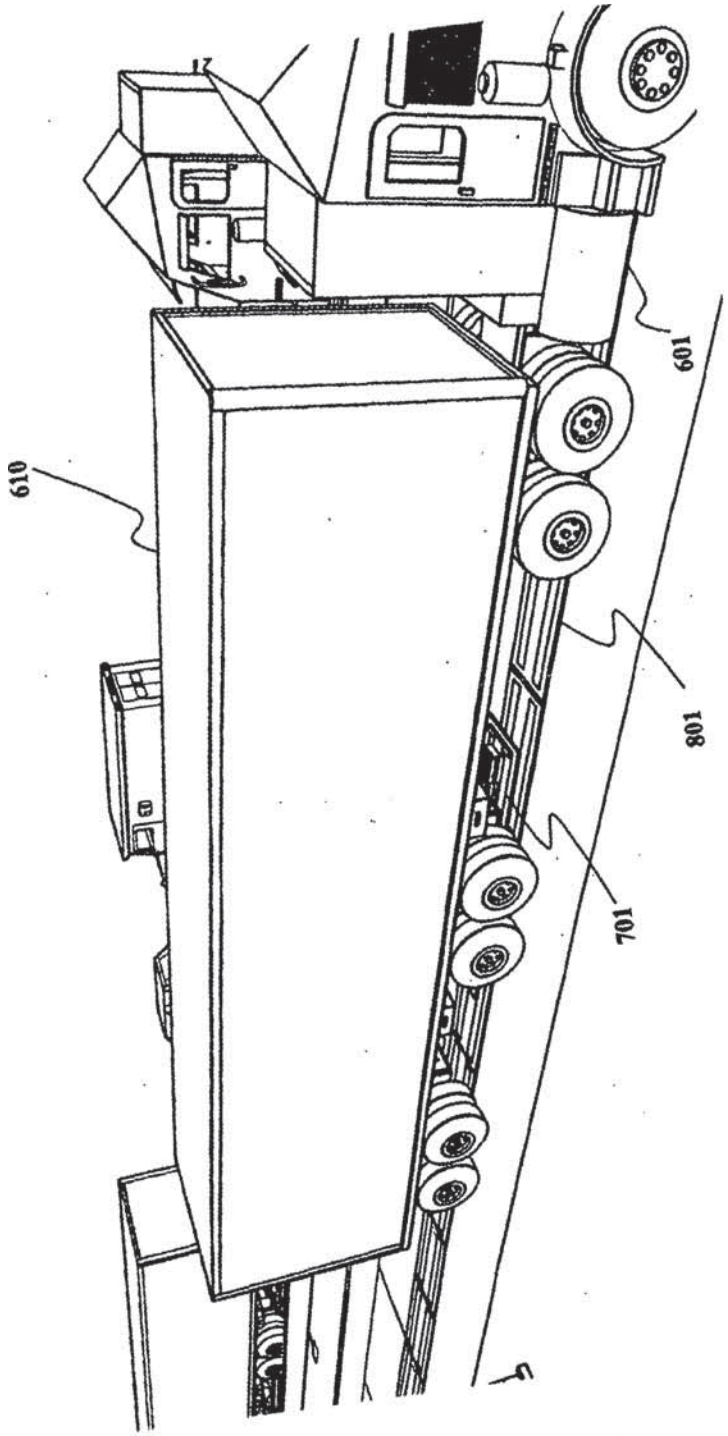


FIG. 13

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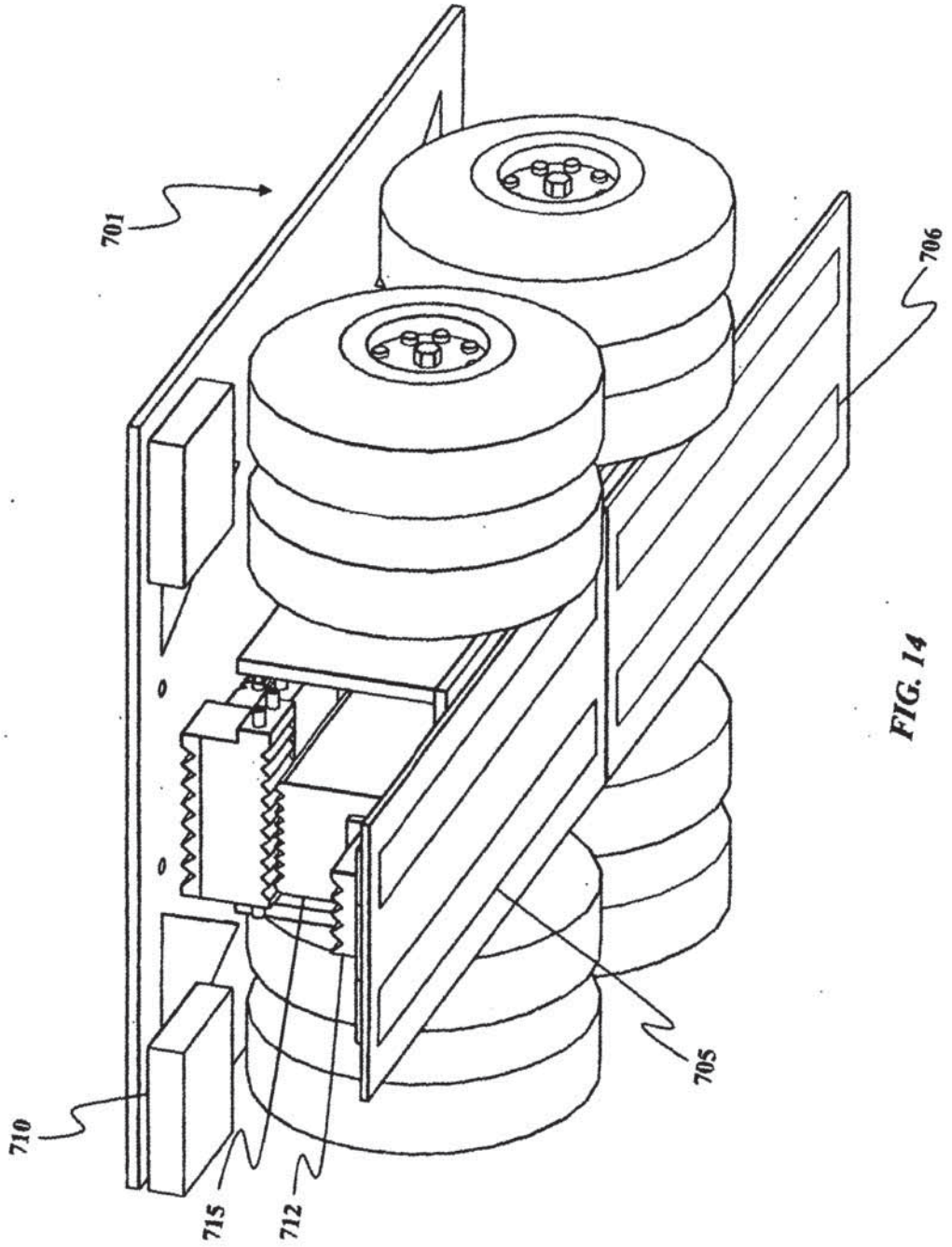

FIG. 14

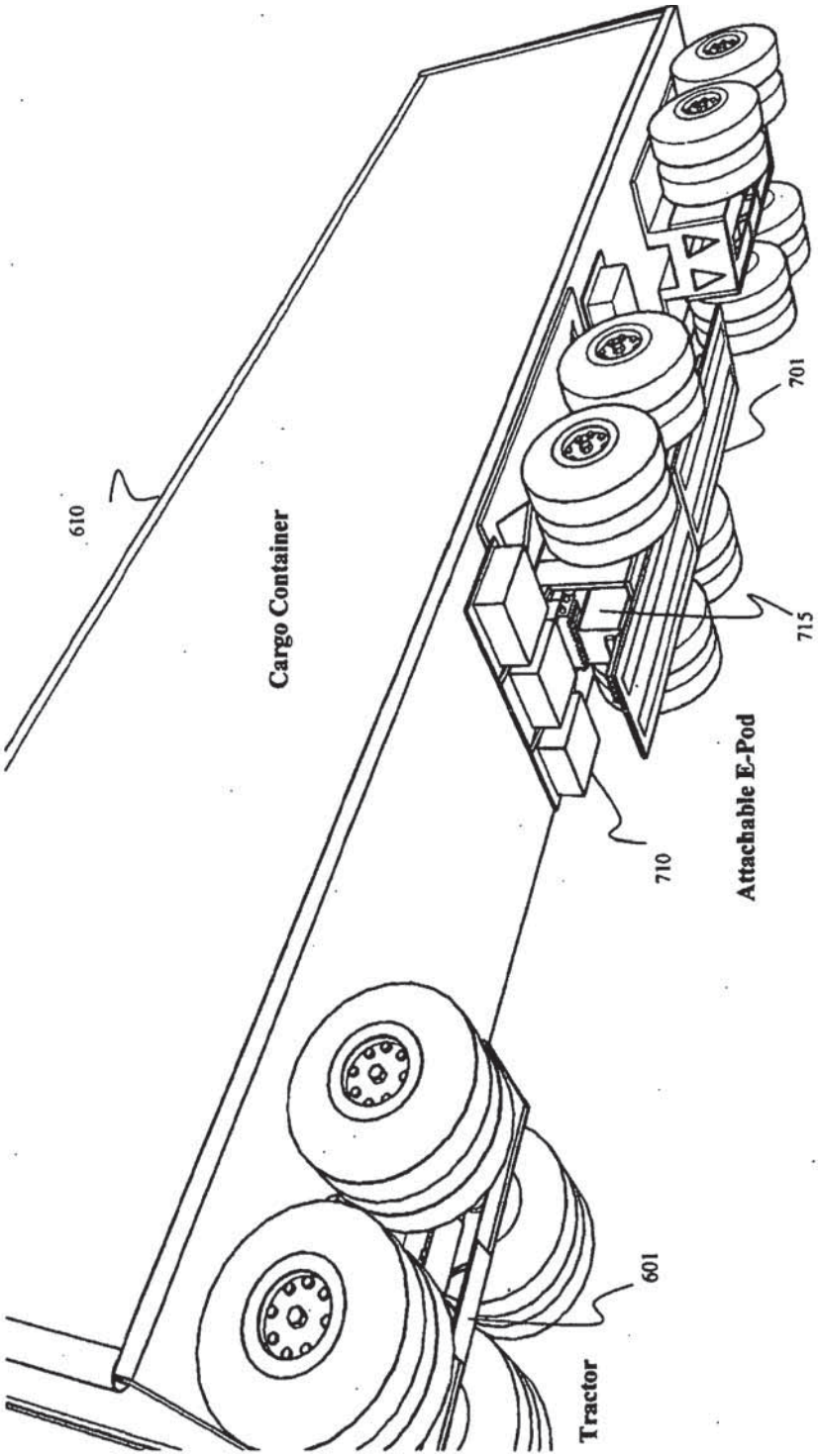

FIG. 15

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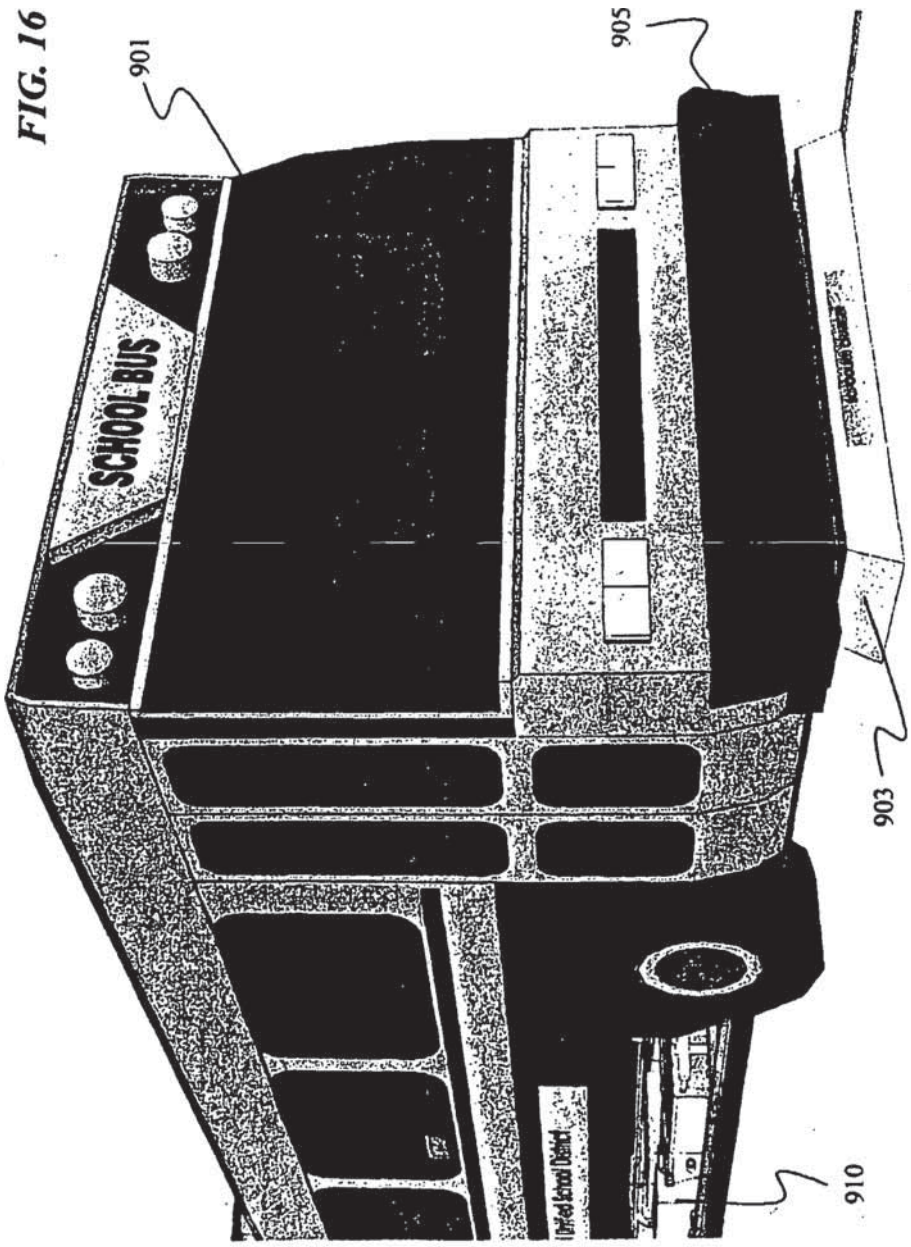
FIG. 16



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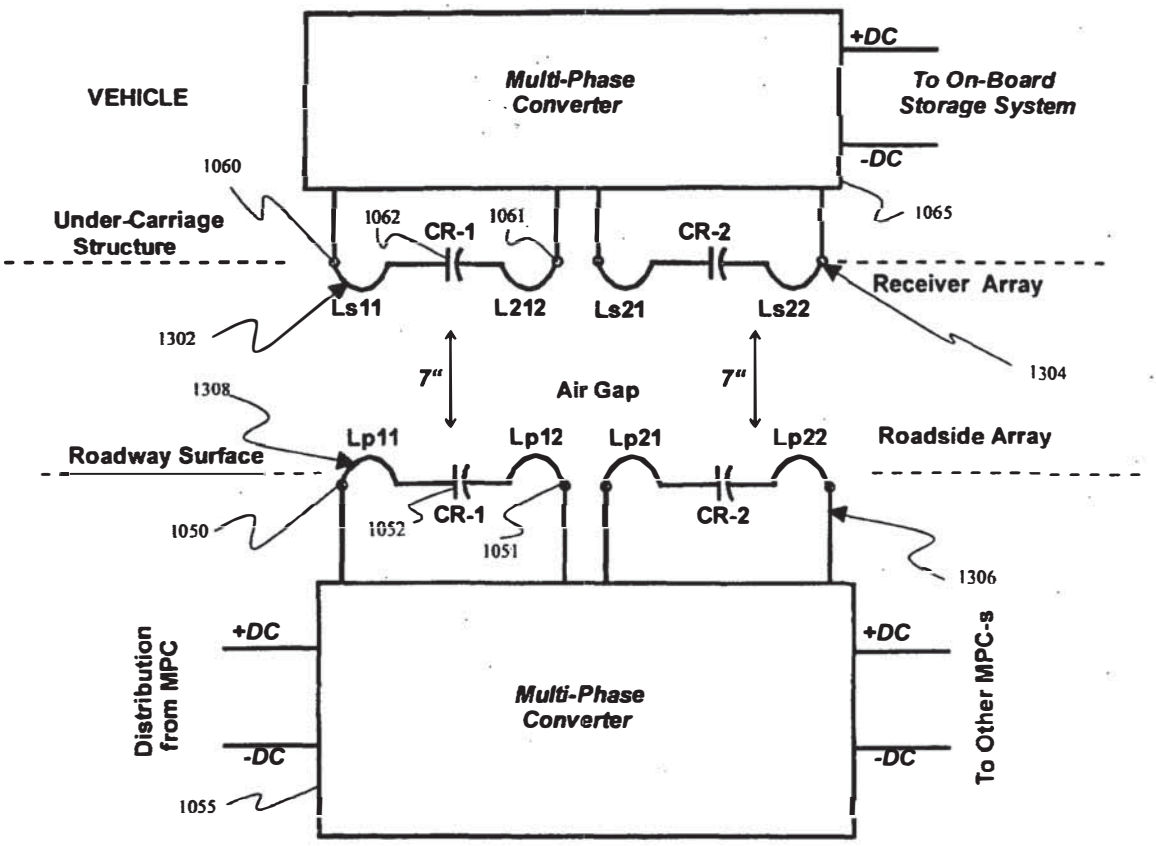

VEHICLE
Multi-Phase Converter
+DC
To On-Board Storage System
-DC
1060
1065
Under-Carriage Structure
1062
CR-1
1061
CR-2
Receiver Array
Ls11
L212
Ls21
Ls22
1302
1304
7"
Air Gap
7"
1308
Roadway Surface
Lp11
Lp12
Lp21
Lp22
Roadside Array
1050
1052
CR-1
1051
CR-2
1306
Distribution from MPC
+DC
-DC
1055
Multi-Phase Converter
+DC
-DC
To Other MPC-s

FIG. 17

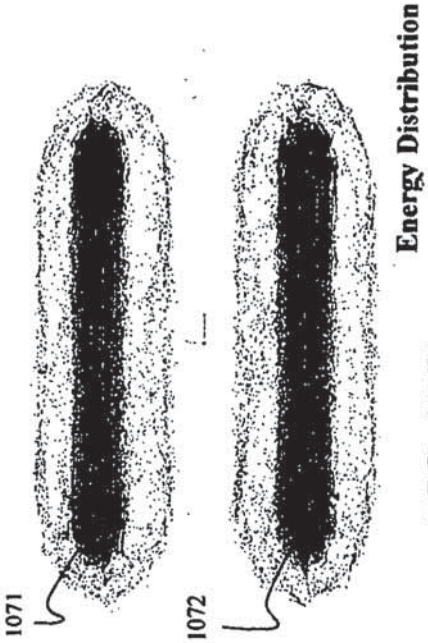


FIG. 18(b)

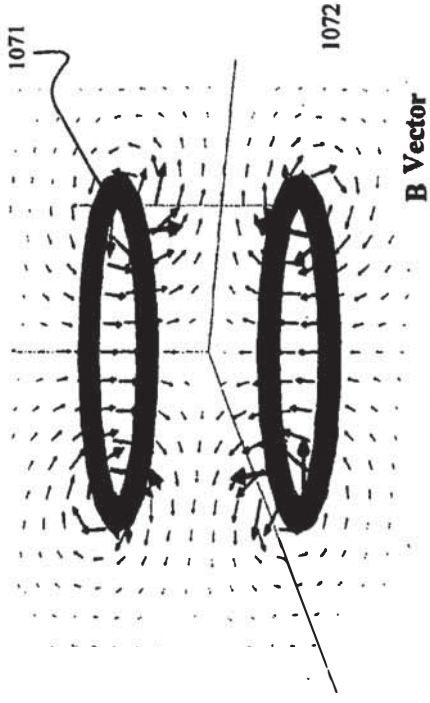


FIG. 18(a)

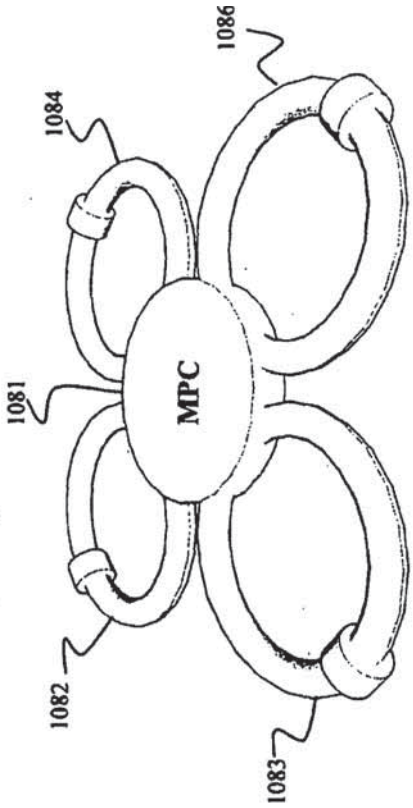


FIG. 18(c)

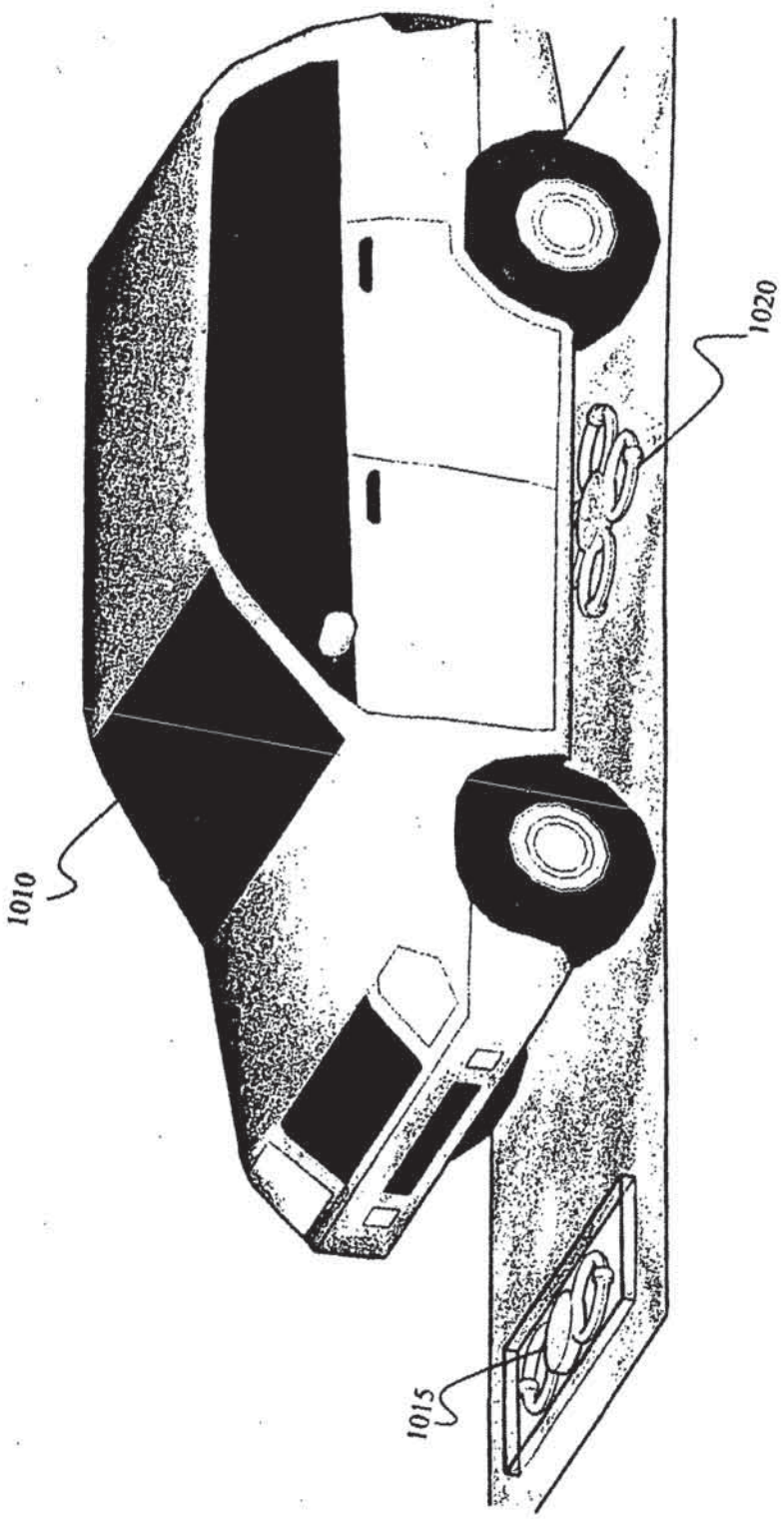
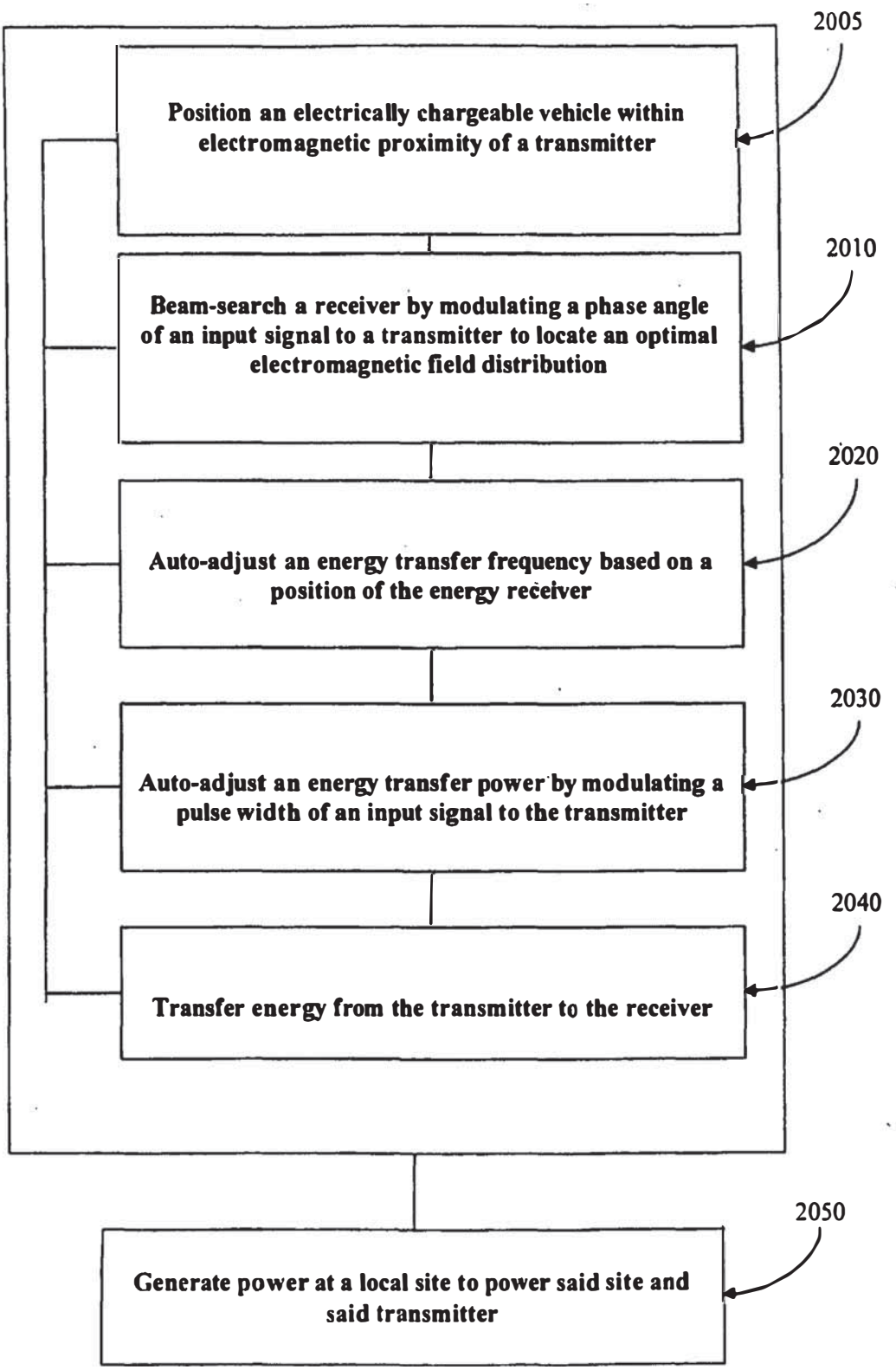


FIG. 19

SUBSTITUTE SHEET (RULE 26)

FIG. 20



PATENT ABSTRACTS OF JAPAN

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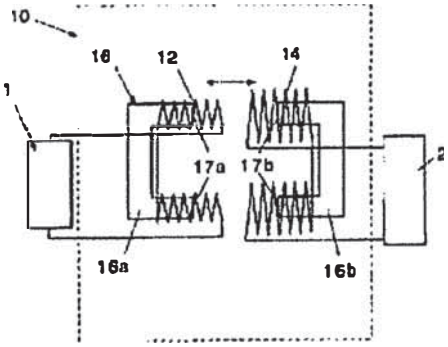
(54) MAGNETIC COUPLING CONNECTOR FOR HIGH VOLTAGE AND HEAVY CURRENT

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a simply detachable connector capable of effectively propagating pulse current of high voltage (e.g., 10 kV), heavy current (e.g., 100 kA or more), and pulse width (e.g., 30 μ sec or less).
SOLUTION: The connector comprises a primary winding 12 connected to a high-voltage and high current power supply 1, a secondary winding 14 connected to a molded electromagnetic coil 2, and a conductive core 16 for conducting flux generated by the primary coil to the secondary coil. The conductive core 16 comprises a primary core 16a, wound by the primary winding and a secondary core 16b wound by the secondary winding. The primary core and the secondary core brought into contact or are drawn close to be magnetically connected to each other, and are spaced apart to be electrically cut-off each other.



CLAIMS

[Claim(s)]
[Claim 1]A magnetic connection connector for high-tension high currents characterized by what it has the following, and this primary side core and a secondary core stick or approach mutually, and are connected magnetically, an interval is separated mutually, and is cut electrically.
A primary side coil (12) connected to a high-tension high current power supply (1).
Secondary winding (14) connected to an electromagnetic molded coil (2).
A primary side core which it became from a conductive core (16) for leading magnetic flux generated by a primary side coil to secondary winding and around which, as for a conductive core (16), a primary side coil was coiled (16a).
A secondary core around which secondary winding was coiled (16b).

[Claim 2]The magnetic connection connector for high-tension high currents according to claim 1 which the aforementioned conductive core (16) is the closed rectangular shape, and is characterized by a U-shaped thing for which the aforementioned primary side core (16a) and a secondary core (16b) cut this rectangular shape in a surface.
[Claim 3]The magnetic connection connector for high-tension high currents according to claim 2 characterized by what the aforementioned cutting plane sticks or approaches mutually at the time of connection, and is constituted so that an interval may be mutually separated at the time of cutting.
[Claim 4]The magnetic connection connector for high-tension high currents according to claim 1 characterized by what is wound around each core so that a primary side coil (12) and secondary winding (14) may lap concentrically at the time of connection.
[Claim 5]The magnetic connection connector for high-tension high currents according to claim 1 characterized by what the aforementioned conductive core (16) consists of a silicon steel plate, a ferrite material, or amorphous material.
[Claim 6]The magnetic connection connector for high-tension high currents according to claim 1 characterized by what is done by plastic resin for the mold of the aforementioned primary side coil (12) and the secondary winding (14), respectively.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]The present invention relates to the magnetic connection connector for high-tension high currents which can be desorbed by non-contact.
[0002]
[Description of the Prior Art]The tandem press and the transfer press are used from the former, although comparatively complicated solid forming parts, such as a body of an automobile and a door panel, are processed at high speed, for example. However, difficult press forming occurred in a conventional tandem press and transfer press. For example, when press forming of the complicated form was carried out partially, at one process of a press, an edge could not mold the portion of the handle of a door panel, etc. exactly, but they had a problem of not being made to accurate form. Therefore, when especially high quality was required, two to 3 process was needed, as a result, more than one needed to be provided also like two or more sets of up-and-down mold sets being not only required but the press operator, and there was a problem which productivity is deteriorated and serves as cost increase. Although molding of the aluminum material was increasingly demanded for the weight saving of vehicles, since springback of aluminum was large as compared with a griddle, there was a problem that a form was not finished accurately.
[0003]In order to solve this problem, the applicant of the present invention originated the continuous press system which can mold also in complicated form with the small number of press bases, and can process aluminum without springback into predetermined form, and applied (the application for patent 2000-65265, unpublished).
[0004]This continuous press system is a tandem press or a transfer press provided with two or more sets of presses, and is provided with at least one electromagnetic forming device provided between presses in a press.
[0005]Since it has an electromagnetic forming device between presses in a tandem press or the press of a transfer press according to the constitution of this invention, It can use together with the usual mechanical press or a hydraulic press, and magnetic forming (Electromagnetic Forming:EMF) of the work material (panel) can be carried out. This magnetic forming has the various characteristics -- it can mold also in complicated form by the rapidity of molding, etc., and aluminum can be molded without springback.
Molding which was impossible until now is attained.

[0006]
[Problem to be solved by the invention]The electromagnetic forming device mentioned above comprises a power supply unit, a switching circuit, etc. which were electrically connected to the electromagnetic molded coil embedded under the mold, and this coil. In this case, the power supply unit, the switching circuit, etc. are large-sized, and since it is installed in the holding part besides a press, the connector which electrically connects an electromagnetic molded coil, a power supply unit, etc. and which can be desorbed becomes indispensable.
[0007]It is necessary to send high tension (for example, 10 kV), a high current (for example, not

less than 100 kA), and the sign half wave waveform pulse current of high frequency (for example, not less than 30 kHz) through an electromagnetic molded coil in magnetic forming.
[0008]However, the conventional connector contacts a conductor and conductors (busbar etc.) by mechanical torque or mounting torque, and had the problem that time and a labor were applied to desorption of a bolt, etc. too much. In the connector which can be desorbed without desorption of a bolt, in order to send a high current, there was a problem that the loss by the contact resistance of a connection part could not spread efficiently largely the high-tension high current pulse mentioned above.
[0009]Since the scope of frequency was limited to the low voltage low (about 20 kHz), the non-contact power supply technology furthermore used for feed systems, such as physical distribution-related, etc. is the target high-tension high current pulse in the present invention, and was not able to be applied to a not less than 30-kHz sign half wave waveform. Since a primary side and the downstream were fixed, desorption of the pulse transformer for high-tension high currents which makes electrical energy spread by magnetic combination was not completed.
[0010]The present invention is originated in order to solve the problem mentioned above. That is, there is the object of this invention in being able to spread efficiently high tension (for example, 10 kV), a high current (for example, not less than 100 kA), and the pulse current of pulse width (for example, less than 30microsec), and desorption providing an easy connector.
[0011]
[Means for solving problem]The primary side coil (12) which is connected to a high-tension high current power supply (1) according to the present invention, Consist the secondary winding (14) connected to an electromagnetic molded coil (2), and the magnetic flux generated by a primary side coil of a conductive core (16) for leading to secondary winding, and a conductive core (16), Consist of a primary side core (16a) around which the primary side coil was coiled, and a secondary core (16b) around which secondary winding was coiled, and this primary side core and a secondary core, The magnetic connection connector for high-tension high currents characterized by what it sticks or approaches mutually, and connects magnetically, an interval is separated mutually, and is cut electrically is provided.
[0012]According to the composition of the present invention, a primary side core (16a) and a secondary core (16b), By sticking or approaching mutually, it connects magnetically, the magnetic flux generated in a primary side coil according to a high-tension high current power supply (1) is led to secondary winding, a high-tension high current pulse is induced by this magnetic flux by secondary winding (14), a seal of approval can be carried out to an electromagnetic molded coil (2), and magnetic forming can be carried out to it. Since it connects magnetically, high tension (for example, 10 kV), a high current (for example, not less than 100 kA), and the sign half wave waveform pulse current of pulse width (for example, less than 30microsec) can be spread efficiently. Namely, when connection generally uses the conventional not direct continuation but magnetic combination to the electrical energy propagation by a high current pulse with the extra-high tension which becomes large-scale, It becomes that high withstand voltage and connection resistance do not arise and possible to use it for the power supply which the connector which can be desorbed is constituted easily and needs desorption frequently, and load. Thereby, a time baton becomes possible [incorporating easily the equipment which uses a high current pulse for the factory line which poses a problem with extra-high tension].
[0013]according to the preferable embodiment of the present invention, the aforementioned conductive core (16) is the closed rectangular shape, and the aforementioned primary side core (16a) and the secondary core (16b) cut this rectangular shape in the surface -- it is U-shaped. By this composition, the conductive core (16) which can be desorbed can be constituted easily, and leakage magnetic flux at the time of connection can be made small.
[0014]The aforementioned cutting plane sticks or approaches mutually at the time of connection, and it is constituted so that an interval may be mutually separated at the time of cutting. This composition can desorb a high-tension high current easily only by adhesion (or contiguity) and secession of a cutting plane non-contact.

[0015]what is wound around each core so that a primary side coil (12) and secondary winding (14) may lap concentrically at the time of connection --- this -- better -- **. By this composition, the magnetic flux generated in the primary side coil can be reliably led to secondary winding, the leakage magnetic flux at the time of connection can be reduced, and coupling efficiency can be improved.
[0016]The aforementioned conductive core (16) has good ** which consists of a silicon steel plate, a ferrite material, or amorphous material. Coupling efficiency can be raised more by using not only the usual silicon steel plate but a ferrite material, and amorphous material.
[0017]The mold of the aforementioned primary side coil (12) and the secondary winding (14) is carried out by plastic resin, respectively. Vibration of the winding by a high current can be suppressed by this composition, securing the withstand voltage of winding.
[0018]
[Mode for carrying out the invention]Hereafter, the preferable embodiment of the present invention is described with reference to Drawings. In each figure, the same code is given to a common portion and the duplicate description is omitted.
[0019]Fig.1 is a principle figure of magnetic forming and, as for (A), in cylindrical molding, (B) shows the case of sheet forming. Magnetic forming is the metalworking method for using the energy which a magnetic field has, and in order to acquire sufficient processing force, it needs a powerful magnetic field. Therefore, a strong magnetic field is used at the moment of producing by sending the discharge current from the capacitor 3 (capacitor bank) of large scale and high tension through ********** 2. Namely, by storing energy in the mass capacitor 3 by the high tension of about 10 kV, and closing the discharge switch 4, as shown in Fig.1 (A) and (B), A high current (for example, 150 kA, 30 microseconds) flows into ********** 2 in an instant, a strong magnetic field occurs, the molding material 5 is flown soon in the magnetic field, and high velocity forming is made along with a mold. This magnetic forming does not need the water etc. which transmit processing force like explosive forming or electrodischarge forming, but is made also in the atmosphere or a vacuum, and its working speed is quick, and almost all processings are ended within in 1 ms. This magnetic forming has the various characteristics of it being able to mold also in complicated form by the rapidity of molding, etc., and being able to mold aluminum without springback into predetermined form.
[0020]Fig.2 is a principle figure of magnetic forming which used the magnetic connection connector for high-tension high currents of the present invention. As shown in this figure, the present invention is characterized by the magnetic connection connector 10 for high-tension high currents comprising the following.
The primary side coil 12 connected to the high-tension high current power supply 1.
Secondary winding 14 connected to the electromagnetic molded coil 2.
The conductive core 16 for leading magnetic flux generated by the primary side coil 12 to secondary winding.
The high-tension high current power supply 1 consists of the high voltage direct current power supply 1a, the capacitor 1b, and the charge switch 1c in this example. 150 kA and the high current for 30 microseconds can be sent through pulse form at the primary side coil 12 by storing energy in the mass capacitor 3, for example via the charge switch 1c with the about 10-kV high voltage direct current power supply 1a, and closing the discharge switch 4 by this composition.
[0021]Fig.3 is a principle figure of the magnetic connection connector for high-tension high currents of the present invention shown in Fig.2.As shown in this figure, the conductive core 16 consists of the primary side core 16a around which the primary side coil 12 was coiled, and the secondary core 16b around which the secondary winding 14 was coiled. In this example, electric conduction core 16 sex is the hollow square-shaped closed rectangular shape. the primary side core 16a and the secondary core 16b cut the rectangular shape of the core 16 by the cutting plane 17a and b -- it is U-shaped. Although the sectional shape of a core is square in this example, the present invention may not be limited to this but a rectangle, circular, an ellipse, and any other sectional shape may be sufficient as it. The cutting plane 17a of the primary side core 16a and the secondary core 16b and b stick or approach mutually so that leakage magnetic flux

may be made small at the time of connection of a connector. This cutting plane 17a and b are separated by the interval through which the magnetic flux generated with the primary side core 16a at the time of cutting of a connector does not flow into the secondary core 16b.
[0022]As typically shown in Fig.3, the primary side coil 12 and the secondary winding 14, It is wound around each core, the magnetic flux generated in the primary side coil is reliably led to secondary winding, the leakage magnetic flux at the time of connection is reduced, and coupling efficiency is improved so that the primary side coil 12 and the secondary winding 14 may lap concentrically at the time of connection of a connector.
[0023]Fig.4 is a mimetic diagram of the high-tension high current spread by the magnetic connection connector for high-tension high currents of the present invention. In this example, the target high-tension [connector / 10 / for high-tension high currents / of the present invention / magnetic connection] high current is a pulse width [sec of about 30micro] sin half wave, that peak voltage is about 10 kV, and that peak current is about 150 kA. By setting the winding ratio of the primary side coil 12 and the secondary winding 14 to 1:1, at the high power transmission efficiency of not less than about 90%, it passed to the primary side coil 12, for example, 150 kA and the high current pulse for 30 microseconds can be passed to the secondary winding 14 as it is by composition of the present invention mentioned above.
[0024]Fig.5 - Fig.7 are the specific embodiment figures of the magnetic connection connector 10 for high-tension high currents of the present invention.Among these, it is a cross sectional view [in / the Fig.6 can set Fig.5 in a perspective view, can be set to a section structure figure, and / in Fig.7 / the A-A line of Fig.6].In Fig.6 and Fig.7, (A) shows the cutting condition of a connector and (B) shows the connectable state.
[0025]As shown in Fig.5, this magnetic connection connector 10 for high-tension high currents has stored the primary side portion and the secondary part in the separate housing 18a and b, in order to shield an electromagnetic noise. The housing 18a and b are grounded in the ground line which does not carry out a ******** graphic display. As shown in Fig.6, an opening portion laps mutually and the housing 18a and the mutual connecting part of b serve as full close, when it is opened wide and combined mechanically and magnetically (connection). In Fig.5, in order to shield an electromagnetic noise, the coaxial cable is used for the input/output cable. The handle is attached to the primary side housing 18a in order to make pushing of a primary side portion and drawing easy. It has sensors, such as a proximity switch, so that it may turn out as an electrical signal that a primary side and the downstream were combined completely.
[0026]As shown in Fig.6 and Fig.7, in this example, the core 16 is a longitudinal position and attachment and detachment of a primary side and the downstream perform it horizontally.The conductive core 16 consists of a silicon steel plate, a ferrite material, or amorphous material. The mold of the primary side coil 12 and the secondary winding 14 is carried out by the base material 19a and b (for example, plastic resin), respectively.
[0027]Winding is given so that the primary side coil 12 and the secondary winding 14 may lap at the time of connection. Between a primary side coil and secondary winding, about 1-2-mm clearance is provided between the primary side housing and the downstream housing between a core and winding so that a primary side and the downstream can connect smoothly mechanically.

[0028]According to the composition of the present invention mentioned above, the primary side core 16a and the secondary core 16b, By sticking or approaching mutually, it connects magnetically, the magnetic flux generated in a primary side coil according to the high-tension high current power supply 1 is led to secondary winding, a high-tension high current pulse is induced by this magnetic flux by the secondary winding 14, a seal of approval can be carried out to the electromagnetic molded coil 2, and magnetic forming can be carried out to it. Since it connects magnetically, high tension (for example, 10 kV), a high current (for example, not less than 100 kA), and the sign half wave waveform pulse current of pulse width (for example, less than 30microsec) can be spread efficiently.
[0029]Of course, it can change variously in the range which the present invention is not limited to the embodiment mentioned above, and does not deviate from the summary of the present invention. For example, the magnetic connection connector for high-tension high currents of the

present invention can also be used for uses other than magnetic forming.
[0030]
[Effect of the Invention]As mentioned above, when connection generally uses the conventional not direct continuation but magnetic combination to the electrical energy propagation by a high current pulse with the extra-high tension which becomes large-scale, high withstand voltage and connection resistance arise and twist, and the connector which can be desorbed can be constituted easily. Therefore, it becomes possible to use it for the power supply which needs desorption frequently, and load. Thereby, a time baton becomes possible [incorporating easily the equipment with which it has been made difficult to incorporate on the factory line which poses a problem and which uses a high current pulse with extra-high tension].
[0031]Therefore, the magnetic connection connector for high-tension high currents of the present invention can spread efficiently high tension, a high current, and the pulse current of high frequency, and has the effect which was excellent in desorption being easy and there being etc.

[Translation done.]

TECHNICAL FIELD

[Field of the Invention]The present invention relates to the magnetic connection connector for high-tension high currents which can be desorbed by non-contact.

[Translation done.]

PRIOR ART

[Description of the Prior Art]The tandem press and the transfer press are used from the former, although comparatively complicated solid forming parts, such as a body of an automobile and a door panel, are processed at high speed, for example. However, difficult press forming occurred in a conventional tandem press and transfer press. For example, when press forming of the complicated form was carried out partially, at one process of a press, an edge could not mold the portion of the handle of a door panel, etc. exactly, but they had a problem of not being made to accurate form. Therefore, when especially high quality was required, two to 3 process was needed, as a result, more than one needed to be provided also like two or more sets of up-and-down mold sets being not only required but the press operator, and there was a problem which productivity is deteriorated and serves as cost increase. Although molding of the aluminum material was increasingly demanded for the weight saving of vehicles, since springback of aluminum was large as compared with a griddle, there was a problem that a form was not finished accurately.
[0003]In order to solve this problem, the applicant of the present invention originated the continuous press system which can mold also in complicated form with the small number of press bases, and can process aluminum without springback into predetermined form, and applied (the application for patent 2000-65265, unpublished).
[0004]This continuous press system is a tandem press or a transfer press provided with two or more sets of presses, and is provided with at least one electromagnetic forming device provided between presses in a press.
[0005]Since it has an electromagnetic forming device between presses in a tandem press or the press of a transfer press according to the constitution of this invention, It can use together with the usual mechanical press or a hydraulic press, and magnetic forming (Electromagnetic Forming:EMF) of the work material (panel) can be carried out. This magnetic forming has the various characteristics -- it can mold also in complicated form by the rapidity of molding, etc., and aluminum can be molded without springback.
Molding which was impossible until now is attained.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention]As mentioned above, when connection generally uses the conventional not direct continuation but magnetic combination to the electrical energy propagation by a high current pulse with the extra-high tension which becomes large-scale, high withstand voltage and connection resistance arise and twist, and the connector which can be desorbed can be constituted easily. Therefore, it becomes possible to use it for the power supply which needs desorption frequently, and load. Thereby, a time baton becomes possible [incorporating easily the equipment with which it has been made difficult to incorporate on the factory line which poses a problem and which uses a high current pulse with extra-high tension].
[0031]Therefore, the magnetic connection connector for high-tension high currents of the present invention can spread efficiently high tension, a high current, and the pulse current of high frequency, and has the effect which was excellent in desorption being easy and there being etc.

[Translation done.]

TECHNICAL PROBLEM

[Problem to be solved by the invention]The electromagnetic forming device mentioned above comprises a power supply unit, a switching circuit, etc. which were electrically connected to the electromagnetic molded coil embedded under the mold, and this coil. In this case, the power supply unit, the switching circuit, etc. are large-sized, and since it is installed in the holding part besides a press, the connector which electrically connects an electromagnetic molded coil, a power supply unit, etc. and which can be desorbed becomes indispensable.
[0007]It is necessary to send high tension (for example, 10 kV), a high current (for example, not less than 100 kA), and the sign half wave waveform pulse current of high frequency (for example, not less than 30 kHz) through an electromagnetic molded coil in magnetic forming.
[0008]However, the conventional connector contacts a conductor and conductors (busbar etc.) by mechanical torque or mounting torque, and had the problem that time and a labor were applied to desorption of a bolt, etc. too much. In the connector which can be desorbed without desorption of a bolt, in order to send a high current, there was a problem that the loss by the contact resistance of a connection part could not spread efficiently largely the high-tension high current pulse mentioned above.
[0009]Since the scope of frequency was limited to the low voltage low (about 20 kHz), the non-contact power supply technology furthermore used for feed systems, such as physical distribution-related, etc. is the target high-tension high current pulse in the present invention, and was not able to be applied to a not less than 30-kHz sign half wave waveform. Since a primary side and the downstream were fixed, desorption of the pulse transformer for high-tension high currents which makes electrical energy spread by magnetic combination was not completed.
[0010]The present invention is originated in order to solve the problem mentioned above. That is, there is the object of this invention in being able to spread efficiently high tension (for example, 10 kV), a high current (for example, not less than 100 kA), and the pulse current of pulse width (for example, less than 30microsec), and desorption providing an easy connector.

[Translation done.]

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2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

MEANS

[Means for solving problem]The primary side coil (12) which is connected to a high-tension high current power supply (1) according to the present invention, Consist the secondary winding (14) connected to an electromagnetic molded coil (2), and the magnetic flux generated by a primary side coil of a conductive core (16) for leading to secondary winding, and a conductive core (16), Consist of a primary side core (16a) around which the primary side coil was coiled, and a secondary core (16b) around which secondary winding was coiled, and this primary side core and a secondary core, The magnetic connection connector for high-tension high currents characterized by what it sticks or approaches mutually, and connects magnetically, an interval is separated mutually, and is cut electrically is provided.
[0012]According to the composition of the present invention, a primary side core (16a) and a secondary core (16b), By sticking or approaching mutually, it connects magnetically, the magnetic flux generated in a primary side coil according to a high-tension high current power supply (1) is led to secondary winding, a high-tension high current pulse is induced by this magnetic flux by secondary winding (14), a seal of approval can be carried out to an electromagnetic molded coil (2), and magnetic forming can be carried out to it. Since it connects magnetically, high tension (for example, 10 kV), a high current (for example, not less than 100 kA), and the sign half wave waveform pulse current of pulse width (for example, less than 30microsec) can be spread efficiently. Namely, when connection generally uses the conventional not direct continuation but magnetic combination to the electrical energy propagation by a high current pulse with the extra-high tension which becomes large-scale, It becomes that high withstand voltage and connection resistance do not arise and possible to use it for the power supply which the connector which can be desorbed is constituted easily and needs desorption frequently, and load. Thereby, a time baton becomes possible [incorporating easily the equipment which uses a high current pulse for the factory line which poses a problem with extra-high tension].
[0013]according to the preferable embodiment of the present invention, the aforementioned conductive core (16) is the closed rectangular shape, and the aforementioned primary side core (16a) and the secondary core (16b) cut this rectangular shape in the surface -- it is U-shaped. By this composition, the conductive core (16) which can be desorbed can be constituted easily, and leakage magnetic flux at the time of connection can be made small.
[0014]The aforementioned cutting plane sticks or approaches mutually at the time of connection, and it is constituted so that an interval may be mutually separated at the time of cutting. This composition can desorb a high-tension high current easily only by adhesion (or contiguity) and secession of a cutting plane non-contact.
[0015]what is wound around each core so that a primary side coil (12) and secondary winding (14) may lap concentrically at the time of connection -- this — better — **. By this composition, the magnetic flux generated in the primary side coil can be reliably led to secondary winding, the leakage magnetic flux at the time of connection can be reduced, and coupling efficiency can be improved.
[0016]The aforementioned conductive core (16) has good ** which consists of a silicon steel plate, a ferrite material, or amorphous material. Coupling efficiency can be raised more by using

not only the usual silicon steel plate but a ferrite material, and amorphous material.
[0017]The mold of the aforementioned primary side coil (12) and the secondary winding (14) is carried out by plastic resin, respectively. Vibration of the winding by a high current can be suppressed by this composition, securing the withstand voltage of winding.
[0018]
[Mode for carrying out the invention]Hereafter, the preferable embodiment of the present invention is described with reference to Drawings. In each figure, the same code is given to a common portion and the duplicate description is omitted.
[0019]Fig.1 is a principle figure of magnetic forming and, as for (A), in cylindrical molding, (B) shows the case of sheet forming. Magnetic forming is the metalworking method for using the energy which a magnetic field has, and in order to acquire sufficient processing force, it needs a powerful magnetic field. Therefore, a strong magnetic field is used at the moment of producing by sending the discharge current from the capacitor 3 (capacitor bank) of large scale and high tension through ********** 2. Namely, by storing energy in the mass capacitor 3 by the high tension of about 10 kV, and closing the discharge switch 4, as shown in Fig.1 (A) and (B), A high current (for example, 150 kA, 30 microseconds) flows into ********** 2 in an instant, a strong magnetic field occurs, the molding material 5 is flown soon in the magnetic field, and high velocity forming is made along with a mold. This magnetic forming does not need the water etc. which transmit processing force like explosive forming or electrodischarge forming, but is made also in the atmosphere or a vacuum, and its working speed is quick, and almost all processings are ended within in 1 ms. This magnetic forming has the various characteristics of it being able to mold also in complicated form by the rapidity of molding, etc., and being able to mold aluminum without springback into predetermined form.
[0020]Fig.2 is a principle figure of magnetic forming which used the magnetic connection connector for high-tension high currents of the present invention. As shown in this figure, the present invention is characterized by the magnetic connection connector 10 for high-tension high currents comprising the following.
The primary side coil 12 connected to the high-tension high current power supply 1.
Secondary winding 14 connected to the electromagnetic molded coil 2.
The conductive core 16 for leading magnetic flux generated by the primary side coil 12 to secondary winding.
The high-tension high current power supply 1 consists of the high voltage direct current power supply 1a, the capacitor 1b, and the charge switch 1c in this example. 150 kA and the high current for 30 microseconds can be sent through pulse form at the primary side coil 12 by storing energy in the mass capacitor 3, for example via the charge switch 1c with the about 10-kV high voltage direct current power supply 1a, and closing the discharge switch 4 by this composition.
[0021]Fig.3 is a principle figure of the magnetic connection connector for high-tension high currents of the present invention shown in Fig.2.As shown in this figure, the conductive core 16 consists of the primary side core 16a around which the primary side coil 12 was coiled, and the secondary core 16b around which the secondary winding 14 was coiled. In this example, electric conduction core 16 sex is the hollow square-shaped closed rectangular shape. the primary side core 16a and the secondary core 16b cut the rectangular shape of the core 16 by the cutting plane 17a and b -- it is U-shaped. Although the sectional shape of a core is square in this example, the present invention may not be limited to this but a rectangle, circular, an ellipse, and any other sectional shape may be sufficient as it. The cutting plane 17a of the primary side core 16a and the secondary core 16b and b stick or approach mutually so that leakage magnetic flux may be made small at the time of connection of a connector. This cutting plane 17a and b are separated by the interval through which the magnetic flux generated with the primary side core 16a at the time of cutting of a connector does not flow into the secondary core 16b.
[0022]As typically shown in Fig.3, the primary side coil 12 and the secondary winding 14, It is wound around each core, the magnetic flux generated in the primary side coil is reliably led to secondary winding, the leakage magnetic flux at the time of connection is reduced, and coupling efficiency is improved so that the primary side coil 12 and the secondary winding 14 may lap

concentrically at the time of connection of a connector.
[0023]Fig.4 is a mimetic diagram of the high-tension high current spread by the magnetic connection connector for high-tension high currents of the present invention. In this example, the target high-tension [connector / 10 / for high-tension high currents / of the present invention / magnetic connection] high current is a pulse width [sec of about 30micro] sin half wave, that peak voltage is about 10 kV, and that peak current is about 150 kA. By setting the winding ratio of the primary side coil 12 and the secondary winding 14 to 1:1, at the high power transmission efficiency of not less than about 90%, it passed to the primary side coil 12, for example, 150 kA and the high current pulse for 30 microseconds can be passed to the secondary winding 14 as it is by composition of the present invention mentioned above.
[0024]Fig.5 - Fig.7 are the specific embodiment figures of the magnetic connection connector 10 for high-tension high currents of the present invention.Among these, it is a cross sectional view [in / the Fig.6 can set Fig.5 in a perspective view, can be set to a section structure figure, and / in Fig.7 / the A-A line of Fig.6].In Fig.6 and Fig.7, (A) shows the cutting condition of a connector and (B) shows the connectable state.
[0025]As shown in Fig.5, this magnetic connection connector 10 for high-tension high currents has stored the primary side portion and the secondary part in the separate housing 18a and b, in order to shield an electromagnetic noise. The housing 18a and b are grounded in the ground line which does not carry out a ******** graphic display. As shown in Fig.6, an opening portion laps mutually and the housing 18a and the mutual connecting part of b serve as full close, when it is opened wide and combined mechanically and magnetically (connection). In Fig.5, in order to shield an electromagnetic noise, the coaxial cable is used for the input/output cable. The handle is attached to the primary side housing 18a in order to make pushing of a primary side portion and drawing easy. It has sensors, such as a proximity switch, so that it may turn out as an electrical signal that a primary side and the downstream were combined completely.
[0026]As shown in Fig.6 and Fig.7, in this example, the core 16 is a longitudinal position and attachment and detachment of a primary side and the downstream perform it horizontally.The conductive core 16 consists of a silicon steel plate, a ferrite material, or amorphous material. The mold of the primary side coil 12 and the secondary winding 14 is carried out by the base material 19a and b (for example, plastic resin), respectively.
[0027]Winding is given so that the primary side coil 12 and the secondary winding 14 may lap at the time of connection. Between a primary side coil and secondary winding, about 1-2-mm clearance is provided between the primary side housing and the downstream housing between a core and winding so that a primary side and the downstream can connect smoothly mechanically.

[0028]According to the composition of the present invention mentioned above, the primary side core 16a and the secondary core 16b, By sticking or approaching mutually, it connects magnetically, the magnetic flux generated in a primary side coil according to the high-tension high current power supply 1 is led to secondary winding, a high-tension high current pulse is induced by this magnetic flux by the secondary winding 14, a seal of approval can be carried out to the electromagnetic molded coil 2, and magnetic forming can be carried out to it. Since it connects magnetically, high tension (for example, 10 kV), a high current (for example, not less than 100 kA), and the sign half wave waveform pulse current of pulse width (for example, less than 30microsec) can be spread efficiently.
[0029]Of course, it can change variously in the range which the present invention is not limited to the embodiment mentioned above, and does not deviate from the summary of the present invention. For example, the magnetic connection connector for high-tension high currents of the present invention can also be used for uses other than magnetic forming.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]It is a principle figure of magnetic forming.
[Drawing 2]It is a principle figure of magnetic forming using the magnetic connection connector for high-tension high currents of the present invention.
[Drawing 3]It is a principle figure of the magnetic connection connector for high-tension high currents of the present invention.
[Drawing 4]It is a mimetic diagram of the high-tension high current spread by the magnetic connection connector for high-tension high currents of the present invention.
[Drawing 5]It is a perspective view of the magnetic connection connector for high-tension high currents of the present invention.
[Drawing 6]It is a section structure figure of the magnetic connection connector for high-tension high currents of the present invention.
[Drawing 7]It is a cross sectional view in the A-A line of Fig.6.
[Explanations of letters or numerals]
1 A high-tension high current power supply and 2 An electromagnetic molded coil and 3 A capacitor and 4 Switch, 5 A molding material and 10 [A conductive core and 16a / A primary side core, 16b secondary core, and 17a and 17b / A cutting plane, 18a, 18b housing, and 19a and 19b / Base material] The magnetic connection connector for high-tension high currents, and 12 A primary side coil and 14 Secondary winding and 16

[Translation done.]

* NOTICES *

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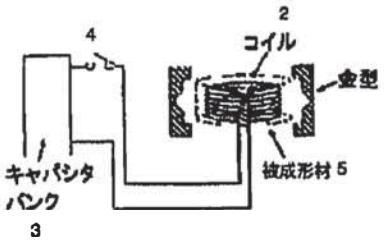
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

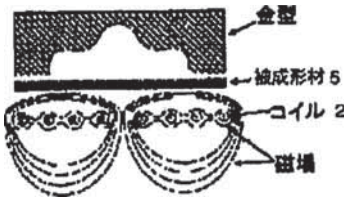
DRAWINGS

[Drawing 1]

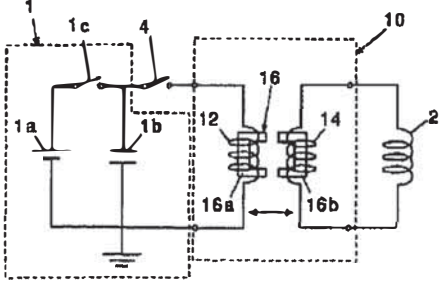
(A)



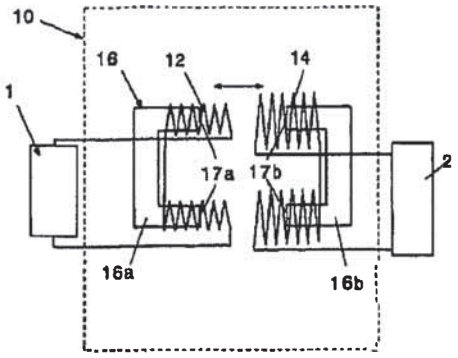
(B)



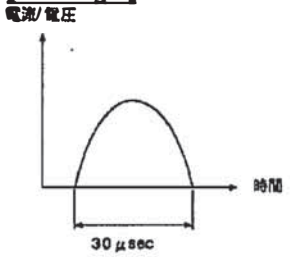
[Drawing 2]



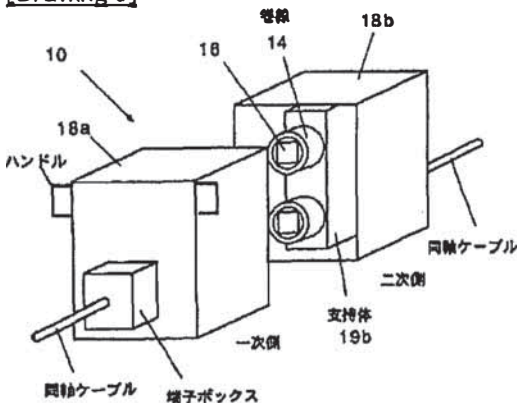
[Drawing 3]



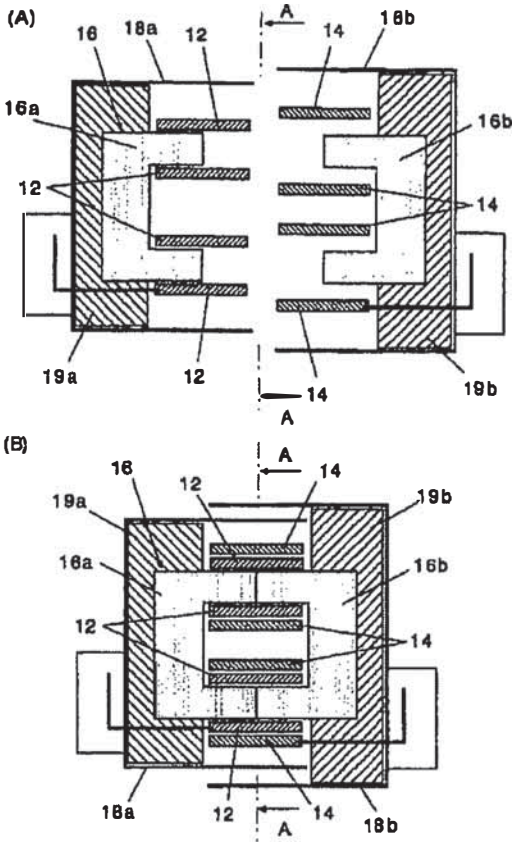
[Drawing 4]



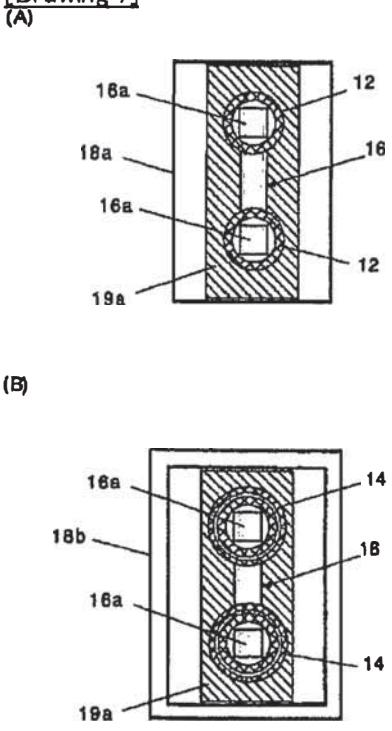
[Drawing 5]



[Drawing 6]


(A)
16
18a
12
A
14
18b
16a
16b
12
14
19a
12
14
19b
A
(B)
A
16
12
14
19a
19b
16a
16b
12
14
18a
12
14
A
18b

[Drawing 7]


(A)
16a
12
18a
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16a
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19a
(B)
16a
14
18b
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16a
14
19a

[Translation done.]

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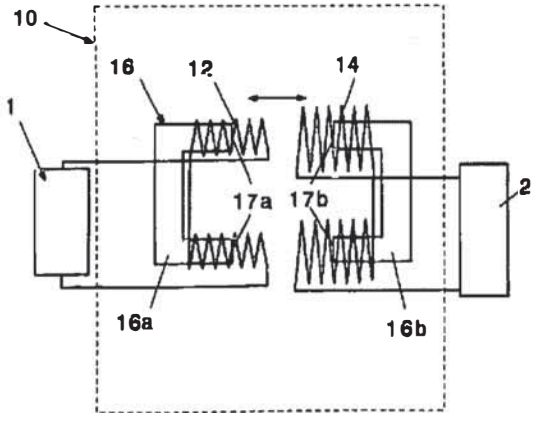
最終頁に続く

(54)【発明の名称】　高電圧大電流用磁気結合コネクタ

(57)【要約】
【課題】　高電圧（例えば１０ｋＶ）、大電流（例えば１００ｋＡ以上）、パルス幅（例えば３０μｓｅｃ以下）のパルス電流を、効率よく伝播でき、かつ脱着が容易なコネクタを提供する。
【解決手段】　高電圧大電流電源１に接続される一次側巻線１２と、電磁成形コイル２に接続される二次側巻線１４と、一次側巻線により発生する磁束を二次側巻線に導くための導電性コア１６とからなる。導電性コア１６は、一次側巻線が巻かれた一次側コア１６ａと、二次側巻線が巻かれた二次側コア１６ｂとからなる。一次側コアと二次側コアは、互いに密着または近接して磁気的に接続し、互いに間隔を隔てて電気的に切断される。



【特許請求の範囲】
【請求項１】　高電圧大電流電源（１）に接続される一次側巻線（１２）と、電磁成形コイル（２）に接続される二次側巻線（１４）と、一次側巻線により発生する磁束を二次側巻線に導くための導電性コア（１６）とからなり、
導電性コア（１６）は、一次側巻線が巻かれた一次側コア（１６ａ）と、二次側巻線が巻かれた二次側コア（１６ｂ）とからなり、該一次側コアと二次側コアは、互いに密着または近接して磁気的に接続し、互いに間隔を隔てて電気的に切断される、ことを特徴とする高電圧大電流用磁気結合コネクタ。
【請求項２】　前記導電性コア（１６）は、閉じた矩形形状であり、前記一次側コア（１６ａ）と二次側コア（１６ｂ）は、該矩形形状を面で切断したコの字形状である、ことを特徴とする請求項１に記載の高電圧大電流用磁気結合コネクタ。
【請求項３】　前記切断面が、接続時に互いに密着または近接し、切断時に互いに間隔を隔てるように構成される、ことを特徴とする請求項２に記載の高電圧大電流用磁気結合コネクタ。
【請求項４】　接続時に一次側巻線（１２）と二次側巻線（１４）が同心に重なるように、各コアに巻かれている、ことを特徴とする請求項１に記載の高電圧大電流用磁気結合コネクタ。
【請求項５】　前記導電性コア（１６）は、珪素鋼板、フェライト材、またはアモルファス材からなる、ことを特徴とする請求項１に記載の高電圧大電流用磁気結合コネクタ。
【請求項６】　前記一次側巻線（１２）と二次側巻線（１４）は、それぞれプラスチックレジンによりモールドされている、ことを特徴とする請求項１に記載の高電圧大電流用磁気結合コネクタ。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、非接触で脱着可能な高電圧大電流用磁気結合コネクタに関する。
【０００２】
【従来の技術】タンデムプレスやトランスファプレスは、例えば自動車のボディやドアパネルなど、比較的複雑な立体成形部品を高速に加工するのに、従来から用いられている。しかし、従来のタンデムプレスやトランスファプレスでは難しいプレス成形があった。例えば、ドアパネルの把手の部分など、部分的に複雑な形状をプレス成形する場合には、プレスの１工程では縁がきちんと成形できず、適確な形状にできない等の問題があった。そのため、特に高品質を要求される場合に、２～３工程を必要とし、その結果、上下の金型セットが複数組必要なばかりか、プレス工程も複数設ける必要があり、生産性が低下しコストアップとなる問題点があった。また、車両の軽量化のためにアルミニウム材の成形が要望されるようになってきているが、鉄板に比較してアルミニウムは、スプリングバックが大きいため、形が適確に仕上がらない問題点があった。
【０００３】かかる問題点を解決するために、本発明の出願人は、少ないプレス台数で複雑な形状でも成形でき、かつスプリングバックなしにアルミニウムを所定の形状に加工することができる連続プレス設備を創案し、出願した（特願２０００－６５２６５、未公開）。
【０００４】この連続プレス設備は、複数台のプレスを備えたタンデムプレス又はトランスファプレスであって、プレス内又はプレス間に設けられた少なくとも１つの電磁成形装置を備えるものである。
【０００５】この発明の構成によれば、タンデムプレス又はトランスファプレスのプレス内又はプレス間に電磁成形装置を備えるので、通常の機械プレス又は液圧プレスと併用して被加工材（パネル）を電磁成形（Ｅｌｅｃｔｒｏｍａｇｎｅｔｉｃ　Ｆｏｒｍｉｎｇ：ＥＭＦ）することができる。またこの電磁成形は、成形の高速性などにより複雑な形状でも成形でき、かつスプリングバックなしにアルミニウムを成形することができる等、種々の特徴を有しており、今まで不可能だった成形が可能となる。
【０００６】
【発明が解決しようとする課題】上述した電磁成形装置は、金型に埋設された電磁成形コイルと、このコイルに電気的に接続された電源ユニット及びスイッチング回路等で構成される。この場合、電源ユニット及びスイッチング回路等は、大形でありプレス外の固定部に設置されるため、電磁成形コイルと電源ユニット等を電気的に接続する脱着可能なコネクタが不可欠となる。
【０００７】また、電磁成形では、高電圧（例えば１０ｋＶ）、大電流（例えば１００ｋＡ以上）、高周波数（例えば３０ｋＨｚ以上）のサイン半波波形パルス電流を電磁成形コイルに流す必要がある。
【０００８】しかし、従来のコネクタは、導体と導体（ブスバー等）を機械的トルクもしくは締付トルクによって接触させるものであり、ボルトの脱着等に時間と労力がかかりすぎる問題点があった。また、ボルトの脱着なしに脱着可能なコネクタでは、大電流を流すため接続部の接触抵抗によるロスが大きく、上述した高電圧大電流パルスを効率よく伝播できない問題点があった。
【０００９】さらに物流関係等の給電システム等に利用されている非接触給電技術は、周波数の適用範囲が低く（約２０ｋＨｚ程度）、かつ低電圧に限定されるため、本発明で対象としている高電圧大電流パルスでかつ３０ｋＨｚ以上のサイン半波波形には適用できなかった。また、磁気的結合により電気エネルギを伝播させる高電圧大電流用パルストランスは、一次側と二次側が固定されているため脱着ができなかった。

【００１０】本発明は、上述した問題点を解決するために創案されたものである。すなわち、本発明の目的は、高電圧（例えば１０ｋＶ）、大電流（例えば１００ｋＡ以上）、パルス幅（例えば３０μｓｅｃ以下）のパルス電流を、効率よく伝播でき、かつ脱着が容易なコネクタを提供することにある。

【００１１】

【課題を解決するための手段】本発明によれば、高電圧大電流電源（１）に接続される一次側巻線（１２）と、電磁成形コイル（２）に接続される二次側巻線（１４）と、一次側巻線により発生する磁束を二次側巻線に導くための導電性コア（１６）とからなり、導電性コア（１６）は、一次側巻線が巻かれた一次側コア（１６ａ）と、二次側巻線が巻かれた二次側コア（１６ｂ）とからなり、該一次側コアと二次側コアは、互いに密着または近接して磁気的に接続し、互いに間隔を隔てて電気的に切断される、ことを特徴とする高電圧大電流用磁気結合コネクタが提供される。

【００１２】本発明の構成によれば、一次側コア（１６ａ）と二次側コア（１６ｂ）を、互いに密着または近接することにより磁気的に接続し、高電圧大電流電源（１）により一次側巻線で発生する磁束を二次側巻線に導き、二次側巻線（１４）でこの磁束により高電圧大電流パルスを誘起し、電磁成形コイル（２）に印可して、電磁成形することができる。また、磁気的に接続するため高電圧（例えば１０ｋＶ）、大電流（例えば１００ｋＡ以上）、パルス幅（例えば３０μｓｅｃ以下）のサイン半波波形パルス電流を、効率よく伝播できる。すなわち、一般的には、接続が大掛かりとなる特別高圧で大電流パルスによる電気エネルギ伝播に対し、従来の直接接続ではなく、磁気的結合を使用することにより、高耐電圧、接続抵抗が生じない、容易に脱着可能なコネクタが構成され、頻繁に脱着を必要とする電源と負荷に使用することが可能となる。これにより、タイムタクトが問題となる生産ラインに特別高圧で大電流パルスを使用する装置を容易に組み込むことが可能となる。

【００１３】本発明の好ましい実施形態によれば、前記導電性コア（１６）は、閉じた矩形形状であり、前記一次側コア（１６ａ）と二次側コア（１６ｂ）は、該矩形形状を面で切断したコの字形状である。この構成により、脱着可能な導電性コア（１６）を容易に構成でき、かつ接続時の漏えい磁束を小さくすることができる。

【００１４】また、前記切断面が、接続時に互いに密着または近接し、切断時に互いに間隔を隔てるように構成される。この構成により、切断面の密着（または近接）と離脱のみで、非接触で高電圧大電流を容易に脱着できる。

【００１５】さらに、接続時に一次側巻線（１２）と二次側巻線（１４）が同心に重なるように、各コアに巻かれている、ことがこのましい。この構成により、一次側巻線で発生した磁束を二次側巻線に確実に導くことができ、接続時の漏えい磁束を低減し結合効率を向上させることができる。

【００１６】前記導電性コア（１６）は、珪素鋼板、フェライト材、またはアモルファス材からなる、のがよい。通常の珪素鋼板だけではなく、フェライト材やアモルファス材を使用することにより、より結合効率を高めることができる。

【００１７】前記一次側巻線（１２）と二次側巻線（１４）は、それぞれプラスチックレジンによりモールドされている。この構成により、巻線の耐電圧を確保しながら、大電流による巻線の振動を抑えることができる。

【００１８】

【発明の実施の形態】以下、本発明の好ましい実施形態を図面を参照して説明する。なお、各図において、共通する部分には同一の符号を付し，重複した説明を省略する。

【００１９】図１は、電磁成形の原理図であり、（Ａ）は円筒状成形の場合、（Ｂ）はシート成形の場合を示している。電磁成形は、磁場のもつエネルギを利用する金属加工法であり、十分な加工力を得るために強力な磁場を必要とする。そのため、大容量・高電圧のコンデンサ３（キャパシタバンク）からの放電電流を磁成形コイル２に流すことによって生じる瞬間強磁場が用いられる。すなわち、図１（Ａ）（Ｂ）に示すように、例えば１０ＫＶ程度の高電圧で大容量のコンデンサ３にエネルギを蓄え、放電スイッチ４を閉じることにより、瞬時に大電流（例えば、１５０ｋＡ、３０μｓ）が磁成形コイル２に流れ、強い磁場が発生し、被成形材５がその磁場ではじき飛ばされ、金型に沿って高速成形がなされる。かかる電磁成形は、爆発成形や放電成形のように加工力を伝達する水等を必要とせず、大気中でも真空中でもでき、かつ加工速度が速く、ほとんどの加工は１ｍｓ以内で終了する。また、この電磁成形は、成形の高速性などにより複雑な形状でも成形でき、かつスプリングバックなしにアルミニウムを所定の形状に成形することができる等の種々の特徴を有している。

【００２０】図２は、本発明の高電圧大電流用磁気結合コネクタを用いた電磁成形の原理図である。この図に示すように、本発明の高電圧大電流用磁気結合コネクタ１０は、高電圧大電流電源１に接続される一次側巻線１２と、電磁成形コイル２に接続される二次側巻線１４と、一次側巻線１２により発生する磁束を二次側巻線に導くための導電性コア１６とからなる。高電圧大電流電源１は、この例では、高電圧直流電源１ａ、コンデンサ１ｂ、及び充電スイッチ１ｃからなる。この構成により、例えば１０ＫＶ程度の高電圧直流電源１ａで充電スイッチ１ｃを介して大容量のコンデンサ３にエネルギを蓄え、放電スイッチ４を閉じることにより、一次側巻線１２に例えば、１５０ｋＡ、３０μｓの大電流をパルス状

に流すことができる。

【0021】図3は、図2に示した本発明の高電圧大電流用磁気結合コネクタの原理図である。この図に示すように、導電性コア16は、一次側巻線12が巻かれた一次側コア16aと、二次側巻線14が巻かれた二次側コア16bとからなる。この例で、導電コア16性は、閉じたロの字状の矩形形状である。また、一次側コア16aと二次側コア16bは、コア16の矩形形状を切断面17a，bで切断したコの字形状である。なお、コアの断面形状はこの例では正方形であるが、本発明はこれに限定されず、長方形、円形、楕円、その他の任意の断面形状でもよい。また、一次側コア16aと二次側コア16bの切断面17a，bは、コネクタの接続時に漏えい磁束を小さくするように、互いに密着または近接する。この切断面17a，bは、コネクタの切断時には一次側コア16aで発生した磁束が二次側コア16bに流れない間隔に隔てられる。

【0022】図3に模式的に示すように、一次側巻線12と二次側巻線14は、コネクタの接続時に一次側巻線12と二次側巻線14が同心に重なるように、各コアに巻かれ、一次側巻線で発生した磁束を二次側巻線に確実に導き、接続時の漏えい磁束を低減して結合効率を向上させるようになっている。

【0023】図4は、本発明の高電圧大電流用磁気結合コネクタで伝播する高電圧大電流の模式図である。この例において、本発明の高電圧大電流用磁気結合コネクタ10が対象とする高電圧大電流は、パルス幅約30μsecのsin半波であり、そのピーク電圧は約10kV、そのピーク電流は約150kAである。上述した本発明の構成により、一次側巻線12と二次側巻線14の巻線比を1：1にすることにより、約90%以上の高い電力伝達効率で、一次側巻線12に流した、例えば、150kA、30μsの大電流パルスをそのまま二次側巻線14に流すことができる。

【0024】図5～図7は、本発明の高電圧大電流用磁気結合コネクタ10の具体的な実施形態図である。このうち、図5は斜視図、図6は断面構造図、図7は図6のA-A線における断面図である。なお、図6、図7において、（A）はコネクタの切断状態、（B）は接続状態を示している。

【0025】図5に示すように、この高電圧大電流用磁気結合コネクタ10は、電磁ノイズをシールドするために、一次側部分と二次側部分を別々の筐体18a，bに収めている。筐体18a，bは、それぞれ図示しない接地ラインで接地されている。また、図6に示すように、筐体18a，bの相互の結合部分は開放され、機械的、磁気的に結合（接続）されたときに開放部分が互いに重なって全閉となる。図5において、電磁ノイズをシールドするために、入出力ケーブルには同軸ケーブルが用いられている。また、一次側部分の押し込み、引き抜きを容易にするために、一次側筐体18aにはハンドルが取り付けられている。さらに、一次側と二次側が完全に結合されたことが電気信号としてわかるように、近接スイッチ等のセンサを備えている。

【0026】図6、図7に示すように、この例では、コア16は縦向き位置であり、一次側と二次側の着脱は水平方向に行うようになっている。導電性コア16は、珪素鋼板、フェライト材、またはアモルファス材からなる。また、一次側巻線12と二次側巻線14は、それぞれ支持体19a，b（例えばプラスチックレジン）によりモールドされている。

【0027】また、接続時に一次側巻線12と二次側巻線14が重なるように、巻線が施されている。なお、一次側と二次側が機械的にスムースに接続できるように、コアと巻線の間、一次側筐体と二次側筐体の間、一次側巻線と二次側巻線の間には、1～2mm程度のクリアランスが設けられている。

【0028】上述した本発明の構成によれば、一次側コア16aと二次側コア16bを、互いに密着または近接することにより磁気的に接続し、高電圧大電流電源1により一次側巻線で発生する磁束を二次側巻線に導き、二次側巻線14でこの磁束により高電圧大電流パルスを誘起し、電磁成形コイル2に印可して、電磁成形することができる。また、磁気的に接続するため高電圧（例えば10kV）、大電流（例えば100kA以上）、パルス幅（例えば30μsec以下）のサイン半波波形パルス電流を、効率よく伝播できる。

【0029】なお、本発明は上述した実施の形態に限定されず、本発明の要旨を逸脱しない範囲で種々変更できることは勿論である。例えば、本発明の高電圧大電流用磁気結合コネクタは、電磁成形以外の用途に用いることもできる。

【0030】

【発明の効果】上述したように、一般的には、接続が大掛かりとなる特別高圧で大電流パルスによる電気エネルギ伝播に対し、従来の直接接続ではなく、磁気的結合を使用することにより、高耐電圧、接続抵抗が生じない、容易に脱着可能なコネクタが構成できる。そのため、頻繁に脱着を必要とする電源と負荷に使用することが可能となる。これにより、タイムタクトが問題となる生産ライン上に組み込むことが困難とされてきた、特別高圧で大電流パルスを使用する装置を容易に組み込むことが可能となる。

【0031】従って、本発明の高電圧大電流用磁気結合コネクタは、高電圧、大電流、高周波数のパルス電流を、効率よく伝播でき、かつ脱着が容易である、等の優れた効果を有する。

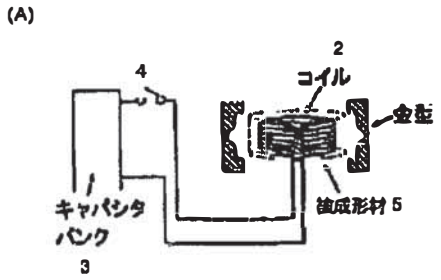
【図面の簡単な説明】

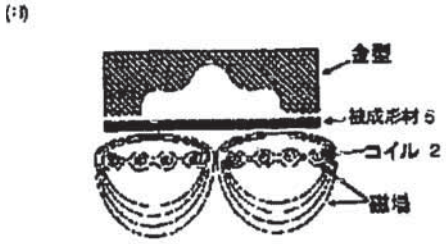
【図1】電磁成形の原理図である。

【図2】本発明の高電圧大電流用磁気結合コネクタを用

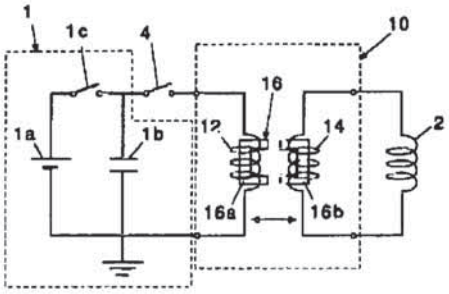
いた電磁成形の原理図である。
【図３】本発明の高電圧大電流用磁気結合コネクタの原理図である。
【図４】本発明の高電圧大電流用磁気結合コネクタで伝播する高電圧大電流の模式図である。
【図５】本発明の高電圧大電流用磁気結合コネクタの斜視図である。
【図６】本発明の高電圧大電流用磁気結合コネクタの断面構造図である。
【図７】図６のA-A線における断面図である。
【符号の説明】
１　高電圧大電流電源、２　電磁成形コイル、３　コンデンサ、４　スイッチ、５　被成形材、１０　高電圧大電流用磁気結合コネクタ、１２　一次側巻線、１４　二次側巻線、１６　導電性コア、１６ａ　一次側コア、１６ｂ　二次側コア、１７ａ，１７ｂ　切断面、１８ａ，１８ｂ　筐体、１９ａ，１９ｂ　支持体

【図１】

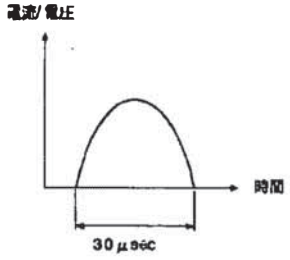




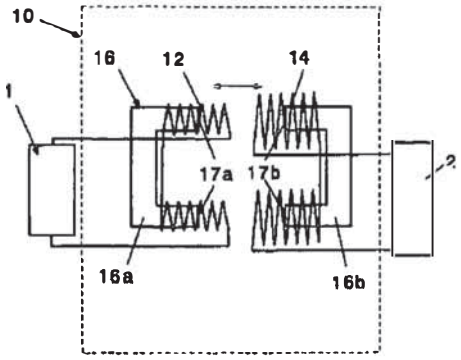
【図２】



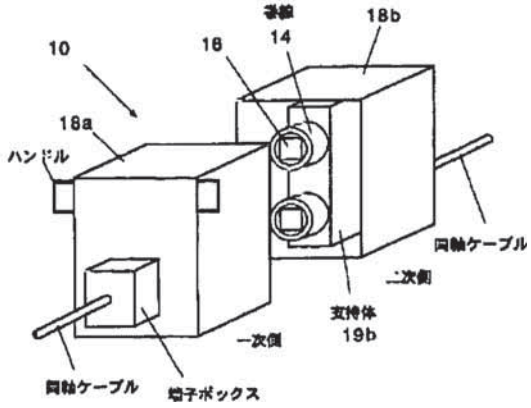
【図４】



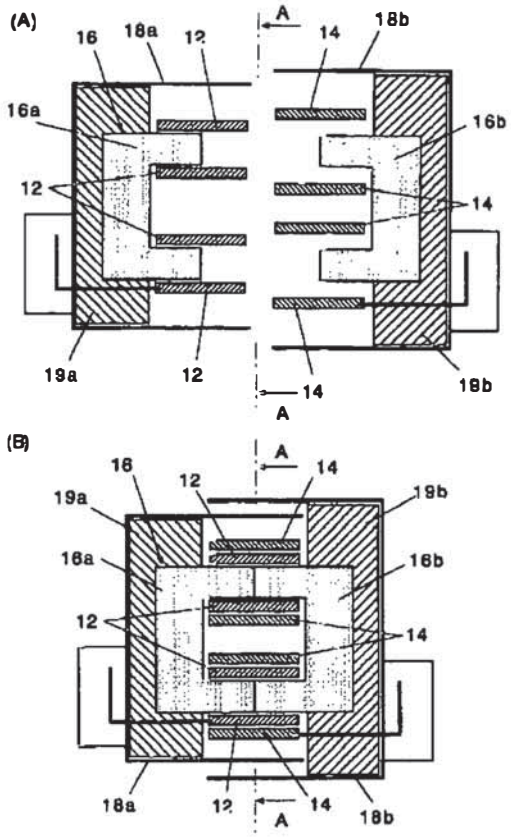
【図３】



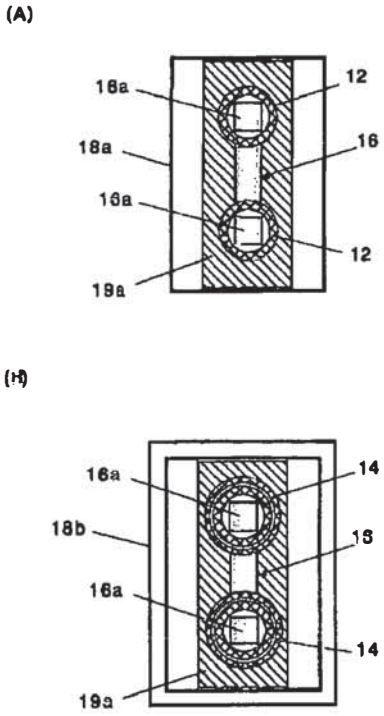
【図５】



【図6】



【図7】



フロントページの続き

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MAGNETIC COUPLING CONNECTOR FOR HIGH VOLTAGE AND HEAVY CURRENT

No documents available for this priority number.

Inventor(s): KOBAYASHI YASUO; MAJIMA TAKASHI; SASAKI YUJI + (KOBAYASHI YASUO, ; MAJIMA TAKASHI, ; SASAKI YUJI)

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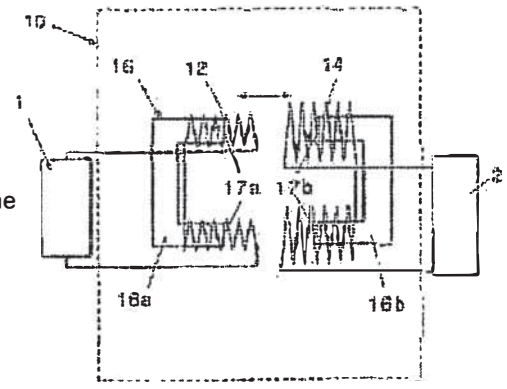
Abstract of JP2002343655 (A)

PROBLEM TO BE SOLVED: To provide a simply detachable connector capable of effectively propagating pulse current of high voltage (e.g., 10 kV), heavy current (e.g., 100 kA or more), and pulse width (e.g., 30 [mu]sec or less). SOLUTION: The connector comprises a primary winding 12 connected to a high-voltage and high current power supply 1, a secondary winding 14 connected to a molded electromagnetic coil 2, and a conductive core 16 for conducting flux generated by the primary coil to the secondary coil. The conductive core 16 comprises a primary core 16a, wound by the primary winding and a secondary core 16b wound by the secondary winding. The primary core and the secondary core brought into contact or are drawn close to be magnetically connected to each other, and are spaced apart to be electrically cut-off each other.



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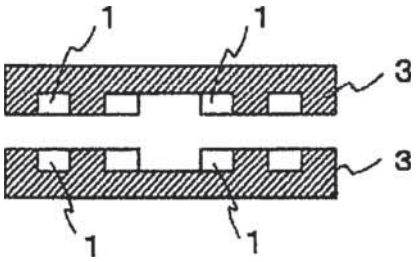
TSUCHIYA HARUHIKO

(54) NON-CONTACT POWER TRANSMISSION DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To improve the transmission efficiency of a non-contact power transmission device and to miniaturize it by providing recessed parts where coils are buried for soft magnetic materials installed on the opposite sides of sides where the confronting coils are confronted each other through a gap.
SOLUTION: A non-contact power transmission device where one side becomes a transmission side and the other side becomes a reception side, coils 1 confronting one another through a gap 1, soft magnetic materials 3 are installed on the opposite sides of the sides where the coils 1 are confronted one another, and power is transmitted without contact by using an electromagnetic guidance operation occurred between the confronting coils. Recessed parts of forms into which the coils 1 can be inserted are formed in the soft magnetic materials 3 and the coils 1 are inserted into the recessed parts. The heights of the coils can be lower than the soft magnetic materials but can be higher. They can separately be used by purposes. For forming the soft magnetic materials, a method for integrally press-forming it by a metallic mold, a method for combining a flat plate and a flat plate where coil-like holes are made and a method by application can be considered but any method can be used.



2/12/2013

CLAIMS

[Claim(s)]
[Claim 1]A coil from which one side serves as the transmitting side and another side serves as a receiving side and which opposes via a gap is included, Non-contact transfer-of-power equipment, wherein the aforementioned soft magnetic material has a concave part which embeds the aforementioned coil in non-contact transfer-of-power equipment which transmits electric power to non-contact using an electromagnetic induction action which provides a soft magnetic material to a side and an opposite side where the aforementioned coil opposes, and is produced between the aforementioned coils which counter.
[Claim 2]A coil from which one side serves as the transmitting side and another side serves as a receiving side and which opposes via a gap is included, In non-contact transfer-of-power equipment which transmits electric power to non-contact using an electromagnetic induction action which provides a soft magnetic material to a side and an opposite side where the aforementioned coil opposes, and is produced between the aforementioned coils which counter, Non-contact transfer-of-power equipment which the aforementioned soft magnetic material has a concave part which embeds the aforementioned coil to both sides, and is characterized by being the structure in which double-side transmission is possible.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]The present invention relates to electric power, a signal, or the non-contact transfer-of-power equipment both transmitted simultaneously by non-contact by the electromagnetic induction action generated between coils.
[0002]
[Description of the Prior Art]Conventionally, this kind of non-contact transfer-of-power equipment was form between which a soft magnetic material puts the coil which will place the shape of a plate meander, or the monotonous spiral coil 1 on the soft magnetic material 2 of a plate, and will be the primary order [2nd], as shown in Fig.4 and Fig.5.Therefore, as magnetic resistance showed largely Fig.6, generating of leakage flux had increased. Since it was such a structure, it had become the hindrance of slimming down and a miniaturization.
[0003]
[Problem to be solved by the invention]Therefore, transmission efficiency of problem of the present invention improves and there is in moreover providing the miniaturized non-contact transfer-of-power equipment.
[0004]
[Means for solving problem]As for the present invention, one side contains the coil from which the transmitting side and another side serve as a receiving side and which opposes via a gap, In the non-contact transfer-of-power equipment which transmits electric power to non-contact using the electromagnetic induction action which provides a soft magnetic material to the side and opposite side where the aforementioned coil opposes, and is produced between the aforementioned coils which counter, the aforementioned soft magnetic material is non-contact transfer-of-power equipment having a concave part which embeds the aforementioned coil.
[0005]As for the present invention, one side contains the coil from which the transmitting side and another side serve as a receiving side and which opposes via a gap, In the non-contact transfer-of-power equipment which transmits electric power to non-contact using the electromagnetic induction action which provides a soft magnetic material to the side and opposite side where the aforementioned coil opposes, and is produced between the aforementioned coils which counter, The aforementioned soft magnetic material is non-contact transfer-of-power equipment which has a concave part which embeds the aforementioned coil to both sides, and is characterized by being the structure in which double-side transmission is possible.
[0006]In the present invention, magnetic resistance and leakage flux decrease by using form of a soft magnetic material as the mere uneven type which was not monotonous and met the form of the coil, and embedding a coil into it. Therefore, transmission efficiency can be improved.
[0007]Since transmission efficiency improves, a loss decreases, and input power is small and ends by lessening leakage flux, the further miniaturization and slimming down are attained.
[0008]
[Mode for carrying out the invention]Hereafter, an embodiment of the invention is described with reference to Drawings.

[0009]Fig.1 is a cross sectional view of the non-contact transfer-of-power equipment of the present invention. Fig.2 is a side view showing the flow of the magnetic flux in the non-contact transfer-of-power equipment of the present invention.
[0010]As shown in Fig.1, the non-contact transfer-of-power equipment of the present invention forms the concave part of the form which can insert the coil 1 in the soft magnetic material 3, and inserts the coil 1 in this concave part.
[0011]The height of a coil may be when not only the case where it is lower than a soft magnetic material but high, and is properly used according to the use.
[0012]As shown in Fig.2, when the gap of a transmission section and a receive section is the same, it turns out that the way of the present invention becomes the distance into which magnetic flux flows through a soft magnetic material conventionally (Fig.6) is long, and short in the distance passing through the inside of the air, and magnetic resistance becomes small.
[0013]Which method may be used although the method of carrying out press forming integrally with a mold, the method of combining a plate and the plate which the coiled hole was able to open, the method by application, etc. can be considered to the formation method of a soft magnetic material.
[0014]The cross sectional view of the non-contact transfer-of-power equipment of other examples of the present invention is shown in Fig.3. In this case, both sides of the one magnetic body 13 are equipped with 2 sets of coils 1, and double-side transmission is made possible.
[0015]
[Effect of the Invention]As described above, according to the present invention, transmission efficiency was able to improve and, moreover, the miniaturized non-contact transfer-of-power equipment was able to be provided.

[Translation done.]

TECHNICAL FIELD

[Field of the Invention]The present invention relates to electric power, a signal, or the non-contact transfer-of-power equipment both transmitted simultaneously by non-contact by the electromagnetic induction action generated between coils.

[Translation done.]

PRIOR ART

[Description of the Prior Art]Conventionally, this kind of non-contact transfer-of-power equipment was form between which a soft magnetic material puts the coil which will place the shape of a plate meander, or the monotonous spiral coil 1 on the soft magnetic material 2 of a plate, and will be the primary order [2nd], as shown in Fig.4 and Fig.5.Therefore, as magnetic resistance showed largely Fig.6, generating of leakage flux had increased. Since it was such a structure, it had become the hindrance of slimming down and a miniaturization.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention]As described above, according to the present invention, transmission efficiency was able to improve and, moreover, the miniaturized non-contact transfer-of-power equipment was able to be provided.

[Translation done.]

TECHNICAL PROBLEM

[Problem to be solved by the invention]Therefore, transmission efficiency of problem of the present invention improves and there is in moreover providing the miniaturized non-contact transfer-of-power equipment.

[Translation done.]

* NOTICES *

MEANS

[Means for solving problem]As for the present invention, one side contains the coil from which the transmitting side and another side serve as a receiving side and which opposes via a gap, In the non-contact transfer-of-power equipment which transmits electric power to non-contact using the electromagnetic induction action which provides a soft magnetic material to the side and opposite side where the aforementioned coil opposes, and is produced between the aforementioned coils which counter, the aforementioned soft magnetic material is non-contact transfer-of-power equipment having a concave part which embeds the aforementioned coil.
[0005]As for the present invention, one side contains the coil from which the transmitting side and another side serve as a receiving side and which opposes via a gap, In the non-contact transfer-of-power equipment which transmits electric power to non-contact using the electromagnetic induction action which provides a soft magnetic material to the side and opposite side where the aforementioned coil opposes, and is produced between the aforementioned coils which counter, The aforementioned soft magnetic material is non-contact transfer-of-power equipment which has a concave part which embeds the aforementioned coil to both sides, and is characterized by being the structure in which double-side transmission is possible.
[0006]In the present invention, magnetic resistance and leakage flux decrease by using form of a soft magnetic material as the mere uneven type which was not monotonous and met the form of the coil, and embedding a coil into it. Therefore, transmission efficiency can be improved.
[0007]Since transmission efficiency improves, a loss decreases, and input power is small and ends by lessening leakage flux, the further miniaturization and slimming down are attained.
[0008]
[Mode for carrying out the invention]Hereafter, an embodiment of the invention is described with reference to Drawings.
[0009]Fig.1 is a cross sectional view of the non-contact transfer-of-power equipment of the present invention. Fig.2 is a side view showing the flow of the magnetic flux in the non-contact transfer-of-power equipment of the present invention.
[0010]As shown in Fig.1, the non-contact transfer-of-power equipment of the present invention forms the concave part of the form which can insert the coil 1 in the soft magnetic material 3, and inserts the coil 1 in this concave part.
[0011]The height of a coil may be when not only the case where it is lower than a soft magnetic material but high, and is properly used according to the use.
[0012]As shown in Fig.2, when the gap of a transmission section and a receive section is the same, it turns out that the way of the present invention becomes the distance into which magnetic flux flows through a soft magnetic material conventionally (Fig.6) is long, and short in the distance passing through the inside of the air, and magnetic resistance becomes small.
[0013]Which method may be used although the method of carrying out press forming integrally with a mold, the method of combining a plate and the plate which the coiled hole was able to open, the method by application, etc. can be considered to the formation method of a soft magnetic material.
[0014]The cross sectional view of the non-contact transfer-of-power equipment of other

examples of the present invention is shown in Fig.3. In this case, both sides of the one magnetic body 13 are equipped with 2 sets of coils 1, and double-side transmission is made possible.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]The cross sectional view of the non-contact transfer-of-power equipment of the present invention.
[Drawing 2]The side view showing the flow of the magnetic flux in the non-contact transfer-of-power equipment of the present invention.
[Drawing 3]The cross sectional view of the non-contact transfer-of-power equipment of other examples of the present invention.
[Drawing 4]The plan view of conventional non-contact transfer-of-power equipment.
[Drawing 5]The cross sectional view of conventional non-contact transfer-of-power equipment.
[Drawing 6]The side view showing the flow of the magnetic flux in conventional non-contact transfer-of-power equipment.
[Explanations of letters or numerals]
1 Coil
2 (Former) Soft magnetic material
3 and 13 Soft magnetic material (present invention)
4 (The flow of magnetic flux is shown) Arrow

[Translation done.]

* NOTICES *

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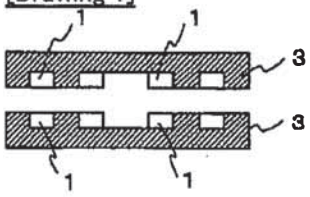
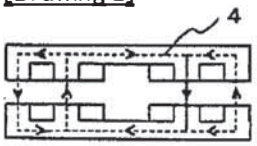
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

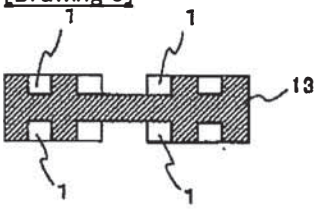
[Drawing 1]



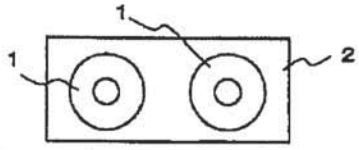
[Drawing 2]



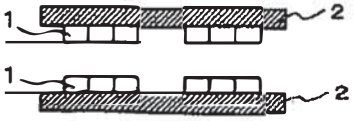
[Drawing 3]



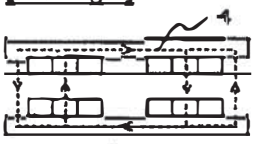
[Drawing 4]



[Drawing 5]



[Drawing 6]



[Translation done.]

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（P2000－200725A）
(43)公開日　平成12年７月18日(2000.7.18)

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Ｈ０２Ｊ　17/00		Ｈ０２Ｊ　17/00	Ｂ	

審査請求　未請求　請求項の数２　ＦＤ　（全 3 頁）

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(22)出願日　平成10年12月29日(1998.12.29)

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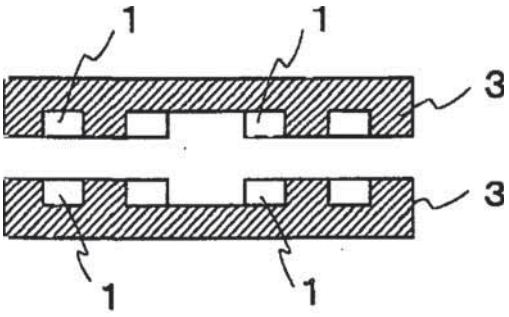
最終頁に続く

(54)【発明の名称】　非接触電力伝送装置

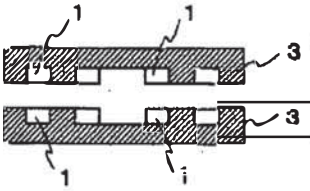
(57)【要約】
【課題】　伝送効率が向上し、その上、小型化した非接触電力伝送装置を提供する。
【解決手段】　軟磁性体３にコイル１を挿入できる形状の凹部を形成し、この凹部にコイル１を挿入する。空隙を介してコイル１を対向させる。



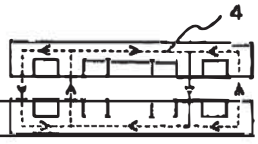
【特許請求の範囲】
【請求項１】　一方が送信側、他方が受信側となる、空隙を介して対向するコイルを含み、軟磁性体を前記コイルの対向する側と反対側に設け、前記対向するコイル間に生じる電磁誘導作用を利用して非接触に電力を伝送する非接触電力伝送装置において、前記軟磁性体は、前記コイルを埋め込む凹部を有することを特徴とする非接触電力伝送装置。
【請求項２】　一方が送信側、他方が受信側となる、空隙を介して対向するコイルを含み、軟磁性体を前記コイルの対向する側と反対側に設け、前記対向するコイル間に生じる電磁誘導作用を利用して非接触に電力を伝送する非接触電力伝送装置において、前記軟磁性体は、両面に前記コイルを埋め込む凹部を有し、両面伝送可能な構造であることを特徴とする非接触電力伝送装置。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、コイル間に発生する電磁誘導作用により非接触で電力、信号あるいは両方同時に伝送する非接触電力伝送装置に関する。
【０００２】
【従来の技術】従来、この種の非接触電力伝送装置は、図４及び図５に示すように、平板の軟磁性体２上に、平板ミアンダ状あるいは平板渦巻き状のコイル１を載置し、１次、２次となるコイルを軟磁性体が挟み込む形状であった。そのため、磁気抵抗が大きく、図６に示すように、漏れ磁束の発生が多くなっていた。また、このような構造であるため、薄型化、小型化の妨げとなっていた。
【０００３】
【発明が解決しようとする課題】従って、本発明の課題は、伝送効率が向上し、その上、小型化した非接触電力伝送装置を提供することにある。
【０００４】
【課題を解決するための手段】本発明は、一方が送信側、他方が受信側となる、空隙を介して対向するコイルを含み、軟磁性体を前記コイルの対向する側と反対側に設け、前記対向するコイル間に生じる電磁誘導作用を利用して非接触に電力を伝送する非接触電力伝送装置において、前記軟磁性体は、前記コイルを埋め込む凹部を有することを特徴とする非接触電力伝送装置である。
【０００５】また、本発明は、一方が送信側、他方が受信側となる、空隙を介して対向するコイルを含み、軟磁性体を前記コイルの対向する側と反対側に設け、前記対向するコイル間に生じる電磁誘導作用を利用して非接触に電力を伝送する非接触電力伝送装置において、前記軟磁性体は、両面に前記コイルを埋め込む凹部を有し、両面伝送可能な構造であることを特徴とする非接触電力伝送装置である。
【０００６】本発明において、軟磁性体の形状を、単なる平板ではなく、コイルの形状にそった凹凸型にして、その中にコイルを埋め込むことにより、磁気抵抗及び漏れ磁束が減少する。そのため、伝送効率を向上させることができる。
【０００７】また、漏れ磁束を少なくすることで、伝送効率が向上し、損失が減少し、入力電力が小さくてすむため、更なる小型化及び薄型化が可能となる。
【０００８】
【発明の実施の形態】以下、本発明の実施の形態を図面を参照して説明する。
【０００９】図１は、本発明の非接触電力伝送装置の断面図である。図２は、本発明の非接触電力伝送装置における磁束の流れを示す側面図である。
【００１０】本発明の非接触電力伝送装置は、図１に示すように、軟磁性体３にコイル１を挿入できる形状の凹部を形成し、この凹部にコイル１を挿入したものである。
【００１１】なお、コイルの高さは、軟磁性体より低い場合だけでなく、高い場合でもよく、その用途に応じて使い分けられる。
【００１２】図２に示すように、送信部と受信部の間隙が同じ場合、本発明のほうが、従来（図６）より磁束が軟磁性体を流れる距離が長く、空気中を通る距離が短く磁気抵抗が小さくなることがわかる。
【００１３】なお、軟磁性体の形成方法には、金型により一体にプレス成形する方法、平板とコイル状の穴が開けられた平板を組み合わせる方法、塗布による方法等が考えられるが、いずれの方法でもよい。
【００１４】図３に、本発明の他の例の非接触電力伝送装置の断面図を示す。この場合、１個の磁性体１３の両面に２組のコイル１を装着して両面伝送可能にしている。
【００１５】
【発明の効果】以上説明したように、本発明によれば、伝送効率が向上し、その上、小型化した非接触電力伝送装置を提供することができた。
【図面の簡単な説明】
【図１】本発明の非接触電力伝送装置の断面図。
【図２】本発明の非接触電力伝送装置における磁束の流れを示す側面図。
【図３】本発明の他の例の非接触電力伝送装置の断面図。
【図４】従来の非接触電力伝送装置の平面図。
【図５】従来の非接触電力伝送装置の断面図。
【図６】従来の非接触電力伝送装置における磁束の流れを示す側面図。
【符号の説明】
１　　コイル
２　　（従来の）軟磁性体
３、１３　　（本発明の）軟磁性体

4　（磁束の流れを示す）矢印

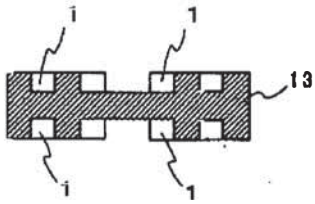
【図1】



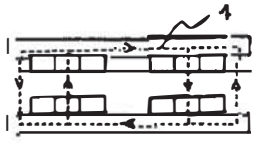
【図2】



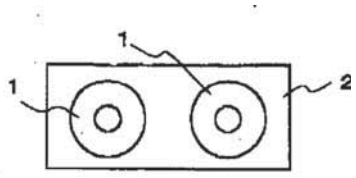
【図3】



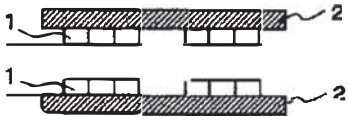
【図6】



【図4】



【図5】



フロントページの続き

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Bibliographic data: JP2000200725 (A) — 2000-07-18

NON-CONTACT POWER TRANSMISSION DEVICE

No documents available for this priority number.

Inventor(s): SATO NAOTO; UMEMURA TSUGUO; ONODERA KEIZO; TSUCHIYA HARUHIKO ± (SATO NAOTO, ; UMEMURA TSUGUO, ; ONODERA KEIZO, ; TSUCHIYA HARUHIKO)

Applicant(s): TOKIN CORP ± (TOKIN CORP)

Classification: - international: ***H01F38/14; H02J17/00;*** (IPC1-7): H01F38/14; H02J17/00

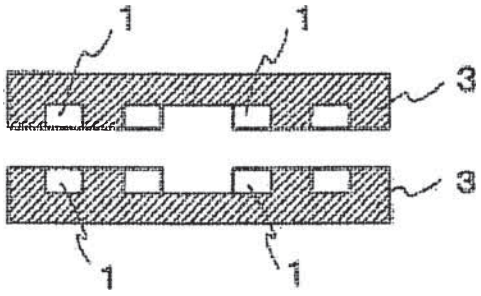
- cooperative:

Application number: JP19980377219 19981229

Priority number (s): JP19980377219 19981229

Abstract of JP2000200725 (A)

PROBLEM TO BE SOLVED: To improve the transmission efficiency of a non-contact power transmission device and to miniaturize it by providing recessed parts where coils are buried for soft magnetic materials installed on the opposite sides of sides where the confronting coils are confronted each other through a gap. SOLUTION: A non-contact power transmission device where one side becomes a transmission side and the other side becomes a reception side, coils 1 confronting one another through a gap 1, soft magnetic materials 3 are installed on the opposite sides of the sides where the coils 1 are confronted one another, and power is transmitted without contact by using an electromagnetic guidance operation occurred between the confronting coils. Recessed parts of forms into which the coils 1 can be inserted are formed in the soft magnetic materials 3 and the coils 1 are inserted into the recessed parts. The heights of the coils can be lower than the soft magnetic materials but can be higher. They can separately be used by purposes. For forming the soft magnetic materials, a method for integrally press-forming it by a metallic mold, a method for combining a flat plate and a flat plate where coil-like holes are made and a method by application can be considered but any method can be used.



Last updated: 09.10.2013 Worldwide Database 5.8.11.5; 92p

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実開平6－86321

(43)公開日　平成６年(1994)12月13日

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27/28	Ｋ	8834－5Ｅ		

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(22)出願日　平成５年(1993)６月28日

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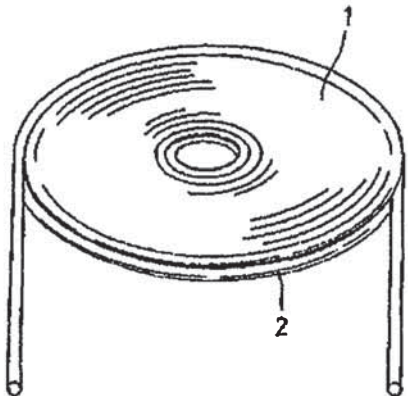
(54)【考案の名称】　空芯チョークコイル

(57)【要約】
【目的】従来の空芯チョークコイルは，巻芯方向に長いいわゆるソレノイド巻きにて形成されるため，リアクタンスを増大させるときは，巻数を多くするか，複数を直列接続する等の手段を講ずる必要があり，この場合，インダクタンスがせいぜい巻数，個数等に比例して増大するに止まり，全体として，形態がかなり大きくなって，多くのスペースを専有し，また，巻線抵抗が必要以上に増大してＱが悪くなる。本発明は，これを解決しようとするものである。
【構成】巻数を同数乃至ほぼ同数にした複数の渦巻状コイル１，２を，同芯状に隣接させるとともに，これらの渦巻状コイルの作る磁束が相加わる方向に生ずるよう直列接続したものである。



1

【実用新案登録請求の範囲】

【請求項１】　巻線を渦巻状に巻回し、絶縁性接着材で固結させたことを特徴とする空芯チョークコイル。

【請求項２】　巻数を同数乃至ほぼ同数にした複数の渦巻状コイルを、同芯状に隣接させるとともに、これらの渦巻状コイルの作る磁束が相加わる方向に生ずるよう直列接続したことを特徴とする空芯チョークコイル。

【図面の簡単な説明】

2

＊【図１】　本考案の空芯チョークコイルの実施例を示す斜視図である。

【図２】　同例の縦断側面図である。

【図３】　同例の構成要領説明図である。

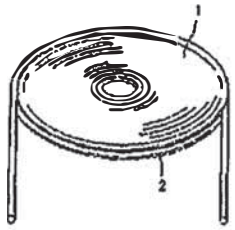
【図４】　従来例を示す斜視図である。

【符号の説明】

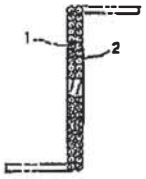
１、２…渦巻状コイル

＊

【図１】

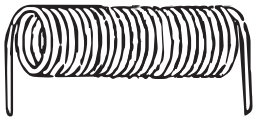


【図２】



【図３】

【図４】



【考案の詳細な説明】

【０００１】

【産業上の利用分野】

本考案は、空芯チョークコイルに係る。

【０００２】

【従来の技術】

従来の空芯チョークコイルは、一般に、図４に示すように、軸芯方向に長いいわゆるソレノイド巻きにて形成されている。

【０００３】

【考案が解決しようとする課題】

しかし、このような形態のものでリアクタンスを増大させるときは、巻数を多くするか、複数を直列接続する等の手段を講ずる必要があり、その結果、

① インダクタンスがせいぜい巻数、個数等に比例して増大するに止まるため、全体として、その形態かなり大きくなり、多くのスペースを専有することになる。

② 巻線抵抗が必要以上に増大し、Ｑ（Ｑ＝ωＬ／Ｒ　ω：角速度　Ｌ：インダクタンス　Ｒ：巻線抵抗）が悪くなる。

等の問題点を生ずる。

本考案は、かかる問題点を解決しようとするものであり、小型化、扁平化を可能にし、Ｑの改善を図ろうとするものである。

【０００４】

【課題を解決するための手段】

上記目的達成のため、請求項１の考案は、巻線を渦巻状に巻回し、絶縁性接着材で固結させたことを特徴とする。

また、請求項２の考案は、巻数を同数乃至ほぼ同数にした複数の渦巻状コイルを、同芯状に隣接させるとともに、これらの渦巻状コイルの作る磁束が相加わる方向に生ずるよう直列接続したことを特徴とする。

【０００５】

【作用】

如上の構成であるから、請求項１の渦巻状に巻回した空芯チョークコイルは、単数乃至複数の成層での使用を可能にし、したがって、形態の小型化、扁平化を可能にするとともに、請求項２の空芯チョークコイルの成立を可能にする。

請求項２の空芯チョークコイルでは、各渦巻状コイルの自己インダクタンスの他に、渦巻状コイル相互間で相互誘導による相互インダクタンスを生じ、この渦巻状コイル相互間の相互インダクタンスは、複数の渦巻状コイルの作る磁束が相加わることからコイル数に応じて格段に大きなものとなり、渦巻状コイル相互間が密接した状態で最大となる。

而して、全インダクタンスは、各渦巻状コイルの自己インダクタンスの総和にそのような相互インダクタンスの総和が加算されたものとなるが、渦巻状コイル相互間がすべて密接した全相互インダクタンスが最大の状態では、一つの渦巻状コイルが有する自己インダクタンスにコイル数のほぼ二乗倍を乗じた極めて大きな値となる。なお、この値は、渦巻状コイル相互間を離間させることで相互インダクタンスが減少して小さくなるので、任意な調整が可能である。

また、斯様な全インダクタンスに比べ、巻線抵抗は、全渦巻状コイルが有する分に止まるため、Ｑの格段の改善が可能となる。

【０００６】

【実施例】

図１乃至図３は、本考案の実施例を示している。

図示のものは、巻数を同数乃至ほぼ同数にしかつ巻き方向相互に逆向きとした二つの渦巻状コイル１，２を、同芯状に密着にて隣接させるとともに、両コイルの作る磁束が相加わる方向に生ずるよう双方の巻芯部で直列接続して成る。

具体的には、両渦巻状コイル１，２は、一本の巻線の中間点を巻芯部に位置させて、その両側を相互逆方向に渦巻状に巻回して、一体かつ二層に形成し、絶縁性接着材により固結させる。

例えば、両渦巻状コイル１，２の自己インダクタンスをそれぞれ４μＨとし、両渦巻状コイルを図示のように密接させて最大の相互インダクタンスを生じさせたとすれば、全体としてほぼ１６μＨとなり、従来の約２倍となる。

なお、作業性を考慮すると、両渦巻状コイル１，２の形成には撚線を用いると

よい。

以上の実施例では、二つの渦巻状コイル１，２から成るが、生ずる磁束が相加わる状態である限り、その数は任意であり、また、間隔の調整も任意である。

【０００７】

【考案の効果】

請求項１の考案によれば、渦巻状の巻回に巻回するから、単数乃至複数の成層での使用ができ、これにより、形態の小型化、扁平化を図ることができ、請求項２の優れた空芯チョークコイルを得ることができる。

また、請求項２の考案によれば、巻数を同数乃至ほぼ同数にした複数の渦巻状コイルが同芯状に隣接し、これらの渦巻状コイルの作る磁束が相加わる状態で直列接続されているので、渦巻状コイル相互間にコイル数に応じて格段に大きくなる相互インダクタンスを生じさせることができ、かかる相互インダクタンスの総和と各渦巻状コイルの自己インダクタンスの総和との加算により、全インダクタンスをコイル数に応じて格段に増大した大きなものとすることができる。したがって、形態を小型化、扁平化でき、専有スペースを大幅に縮減できる。更に、インダクタンスの増大にもかかわらず、巻線抵抗が両渦巻状コイル１，２の分に止まるため、Ｑを格段に改善させることができる。

CLAIMS

[Claims]
[Claim 1]An air core choke coil carrying out caking of the winding with winding and an insulating binder spirally.
[Claim 2]An air core choke coil carrying out the series connection of the number of turns so that magnetic flux which these spiral coils make may arise in the additive **** direction, while making the same number thru/or two or more spiral coils substantially made into the same number adjoin concentrically.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed explanation of the device]
[0001]
[Industrial Application]
This design starts an air core choke coil.
[0002]
[Description of the Prior Art]
Generally, the conventional air core choke coil is formed in the shaft core direction in what is called long solenoid winding, as shown in Fig.4.
[0003]
[Problem(s) to be Solved by the Device]
However, when it is a thing of such a form and a reactance is increased, It is necessary to increase a number of turns or to lecture on means, such as carrying out the series connection of the plurality, and, as a result, **. In order to stop at an inductance increasing in proportion to a number of turns, the number, etc. at most, as a whole, it becomes in the form, and becomes largely, and much space is monopolized. **.
** A wirewound resistor increases more than needed and Q (angular-velocity L: Q=omega L/R omega : inductance R : wirewound resistor) worsens.
The problem of ** is produced.
This design tends to solve this problem, enables miniaturization and flattening, and tries to aim at the improvement of Q.
[0004]
[Means for solving problem]
The device of Claim 1 carried out caking of the winding with winding and an insulating binder spirally for the above-mentioned purpose achievement.
The series connection of the device of Claim 2 was carried out so that the magnetic flux which these spiral coils make might produce in the additive **** direction, while making a number of turns the same number thru/or two or more spiral coils substantially made into the same number adjoin concentrically.
[0005]
[Function]
Since it is the composition on **, the air core choke coil which Claim 1 wound spirally enables formation of the air core choke coil of Claim 2 while it enables use by the singular number thru/or two or more stratification, therefore enables miniaturization of a form, and flattening.
In the air core choke coil of Claim 2, besides the self-inductance of each spiral coil, the magnetic flux which produces the mutual inductance by mutual induction between spiral coils and from which two or more spiral coils make the mutual inductance between this spiral coil -- additive **** -- according to the number of coils, it is markedly alike from things, and will become big, and it becomes the maximum after between spiral coils has been close.
Although it ** and a total inductance becomes that by which total of such a mutual inductance was added to total of the self-inductance of each spiral coil, In the greatest state, the total mutual inductance to which between [all] spiral coils were close serves as a very big value

which multiplied by twice the self-inductance which one spiral coil has the second [about] power of the number of coils. Since a mutual inductance decreases and this value becomes small by making between spiral coils separate, arbitrary adjustments are possible for it.
** -- since it stops at the part in which a full-spiral coil has a wirewound resistor compared with a total inductance [like], the marked improvement of Q is attained.
[0006]
[Working example]
Fig.1 thru/or Fig.3 show the working example of this design.
The series connection of the illustrated thing is carried out by both reel core parts so that the magnetic flux which both coils make may produce in the additive **** direction, while making a number of turns the same number thru/or the two spiral coils 1 and 2 which were substantially made into the same number and were made reverse at both the directions of winding adjoin by adhesion concentrically.
Specifically, both the spiral coils 1 and 2 make the halfway point of one winding be placed at a reel core part, wind the both sides around a mutual opposite direction spirally, and form them in one and a bilayer, and caking is carried out with an insulating binder.
For example, the self-inductance of both the spiral coils 1 and 2 shall be 4 microhenries, respectively, and if it was made close like a graphic display of both the spiral coil and the greatest mutual inductance was produced, it is set to about 16 microhenries as a whole, and becomes twice [about] over the past.
When workability is taken into consideration, it is good for formation of both the spiral coils 1 and 2 to use a stranded wire.
Although the two spiral coils 1 and 2 are comprised in the above working example, as long as the magnetic flux to produce is in an additive **** state, the number is arbitrary and its adjustment of an interval is also arbitrary.
[0007]
[Effect of the Device]
According to the device of Claim 1, since it winds around spiral winding, use by the singular number thru/or two or more stratification can be performed, thereby, miniaturization of a form and flattening can be attained and the air core choke coil which was excellent in Claim 2 can be obtained.
Since the series connection of the magnetic flux from which the same number thru/or two or more spiral coils substantially made into the same number adjoin concentrically, and these spiral coils make a number of turns is carried out in the state of additive **** according to the device of Claim 2, Can make it produce and the mutual inductance which looks between spiral coils markedly according to the number of coils, and becomes it largely by addition with total of this mutual inductance, and total of the self-inductance of each spiral coil, a total inductance can be made into the big thing which was markedly alike and increased according to the number of coils. Therefore, a form can be miniaturized and flattened and exclusive space can be cut down substantially. since a wirewound resistor stops at the part of both the spiral coils 1 and 2 in spite of increase of an inductance, Q can be boiled markedly and it can be made to improve

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[Translation done.]

TECHNICAL FIELD

[Industrial Application]
This design starts an air core choke coil.
[0002]

[Translation done.]

PRIOR ART

[Description of the Prior Art]
Generally, the conventional air core choke coil is formed in the shaft core direction in what is called long solenoid winding, as shown in Fig.4.
[0003]

[Translation done.]

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EFFECT OF THE INVENTION

[Effect of the Device]
According to the device of Claim 1, since it winds around spiral winding, use by the singular number thru/or two or more stratification can be performed, thereby, miniaturization of a form and flattening can be attained and the air core choke coil which was excellent in Claim 2 can be obtained.
Since the series connection of the magnetic flux from which the same number thru/or two or more spiral coils substantially made into the same number adjoin concentrically, and these spiral coils make a number of turns is carried out in the state of additive **** according to the device of Claim 2, Can make it produce and the mutual inductance which looks between spiral coils markedly according to the number of coils, and becomes it largely by addition with total of this mutual inductance, and total of the self-inductance of each spiral coil, a total inductance can be made into the big thing which was markedly alike and increased according to the number of coils. Therefore, a form can be miniaturized and flattened and exclusive space can be cut down substantially. since a wirewound resistor stops at the part of both the spiral coils 1 and 2 in spite of increase of an inductance, Q can be boiled markedly and it can be made to improve

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Device]
However, when it is a thing of such a form and a reactance is increased, It is necessary to increase a number of turns or to lecture on means, such as carrying out the series connection of the plurality, and, as a result, **. In order to stop at an inductance increasing in proportion to a number of turns, the number, etc. at most, as a whole, it becomes in the form, and becomes largely, and much space is monopolized. **.
** A wirewound resistor increases more than needed and Q (angular-velocity L: Q=omega L/R omega : inductance R : wirewound resistor) worsens.
The problem of ** is produced.
This design tends to solve this problem, enables miniaturization and flattening, and tries to aim at the improvement of Q.
[0004]

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MEANS

[Means for solving problem]
The device of Claim 1 carried out caking of the winding with winding and an insulating binder spirally for the above-mentioned purpose achievement.
The series connection of the device of Claim 2 was carried out so that the magnetic flux which these spiral coils make might produce in the additive **** direction, while making a number of turns the same number thru/or two or more spiral coils substantially made into the same number adjoin concentrically.
[0005]

[Translation done.]

OPERATION

[Function]
Since it is the composition on **, the air core choke coil which Claim 1 wound spirally enables formation of the air core choke coil of Claim 2 while it enables use by the singular number thru/or two or more stratification, therefore enables miniaturization of a form, and flattening.
In the air core choke coil of Claim 2, besides the self-inductance of each spiral coil, the magnetic flux which produces the mutual inductance by mutual induction between spiral coils and from which two or more spiral coils make the mutual inductance between this spiral coil -- additive **** -- according to the number of coils, it is markedly alike from things, and will become big, and it becomes the maximum after between spiral coils has been close.
Although it ** and a total inductance becomes that by which total of such a mutual inductance was added to total of the self-inductance of each spiral coil, In the greatest state, the total mutual inductance to which between [all] spiral coils were close serves as a very big value which multiplied by twice the self-inductance which one spiral coil has the second [about] power of the number of coils. Since a mutual inductance decreases and this value becomes small by making between spiral coils separate, arbitrary adjustments are possible for it.
** -- since it stops at the part in which a full-spiral coil has a wirewound resistor compared with a total inductance [like], the marked improvement of Q is attained.
[0006]

[Translation done.]

EXAMPLE

[Working example]
Fig.1 thru/or Fig.3 show the working example of this design.
The series connection of the illustrated thing is carried out by both reel core parts so that the magnetic flux which both coils make may produce in the additive **** direction, while making a number of turns the same number thru/or the two spiral coils 1 and 2 which were substantially made into the same number and were made reverse at both the directions of winding adjoin by adhesion concentrically.
Specifically, both the spiral coils 1 and 2 make the halfway point of one winding be placed at a reel core part, wind the both sides around a mutual opposite direction spirally, and form them in one and a bilayer, and caking is carried out with an insulating binder.
For example, the self-inductance of both the spiral coils 1 and 2 shall be 4 microhenries, respectively, and if it was made close like a graphic display of both the spiral coil and the greatest mutual inductance was produced, it is set to about 16 microhenries as a whole, and becomes twice [about] over the past.
When workability is taken into consideration, it is good for formation of both the spiral coils 1 and 2 to use a stranded wire.
Although the two spiral coils 1 and 2 are comprised in the above working example, as long as the magnetic flux to produce is in an additive **** state, the number is arbitrary and its adjustment of an interval is also arbitrary.
[0007]

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]It is a perspective view showing the working example of the air core choke coil of this design.
[Drawing 2]It is a vertical section side view of the example.
[Drawing 3]It is a composition point explanatory view of the example.
[Drawing 4]It is a perspective view showing a conventional example.
[Explanations of letters or numerals]
1, 2 --- Spiral coil

[Translation done.]

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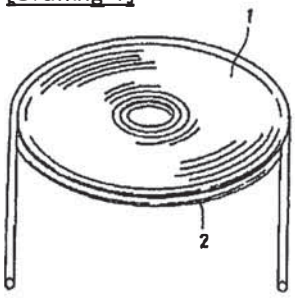
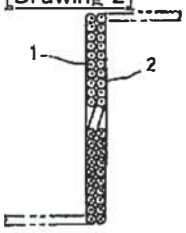
DRAWINGS

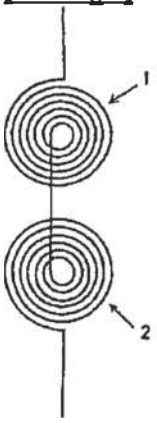
[Drawing 1]



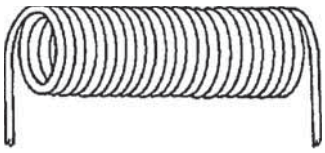
[Drawing 2]



[Drawing 3]



[Drawing 4]



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(43)公開日　平成6年(1994)9月16日

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審査請求　未請求　請求項の数１　ＯＬ　（全２頁）

(21)出願番号　実願平5－6329

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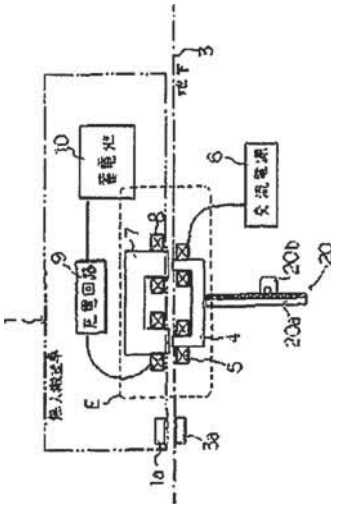
(54)【考案の名称】　移動体の充電装置

(57)【要約】
【目的】　走行路に設けた電源から移動体の蓄電池に充電するに際しての相互の位置決めを容易にする。
【構成】　走行路３に一次鉄心4及びこれに巻装した一次コイル５を、また無人搬送車１には二次鉄心７及びこれに巻装した二次コイル８を夫々設け、一次コイル５を交流電源６に接続し、また二次コイル８を充電回路９を介して蓄電池10に接続する一方、前記一次鉄心4と二次鉄心７とが対向する部分の断面積は一次鉄心４のそれよりも二次鉄心７のそれをより大きくする。



1

【実用新案登録請求の範囲】

【請求項1】 蓄電池を備えた移動体の移動域に臨み、移動体に対して相対移動する位置に変圧器の片側を構成する一次鉄心、一次コイルを設け、また前記移動体に二次鉄心、二次コイルを設け、前記一次鉄心、二次鉄心を対向させ、一次コイルに通電して二次コイルに電流を発生させ、この電流にて前記蓄電池を充電するようにした移動体の充電装置において、前記一次鉄心と二次鉄心との磁気的結合を行わせるべく対向させる面の断面積を異ならせたことを特徴とする移動体の充電装置。

【図面の簡単な説明】

【図1】本考案に係る充電装置の模式的側面断面図である。

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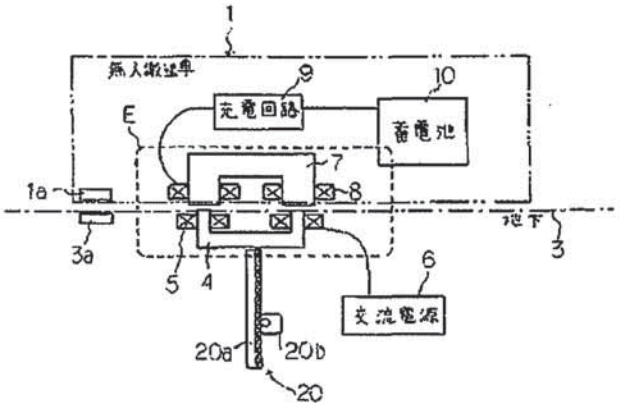
*【図2】従来の充電装置を示す側面断面図である。

【図3】従来の他の充電装置を示す側面断面図である。

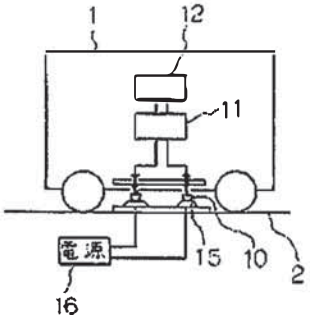
【符号の説明】

1 無人搬送車
3 走行路
4 一次鉄心
5 一次コイル
6 交流電源
7 二次鉄心
8 二次コイル
9 充電回路
10 蓄電池

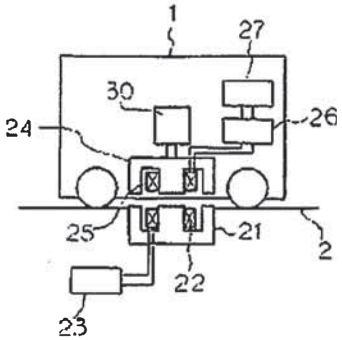
【図1】



【図2】



【図3】



【考案の詳細な説明】

【０００１】

【産業上の利用分野】

本考案は無人搬送車、磁気浮上搬送車等が搭載している蓄電池に対する充電装置に関する。

【０００２】

【従来の技術】

図２は特開平４－236102号公報に開示された従来の無人搬送車の構成を示す模式的側面断面図である。

図２において、１は無人搬送車、２はその走行軌道を示している。この無人搬送車１には、外部からの給電を受けるための集電端子10を、また軌道２上には前記集電端子10と接触して電気的接続をとるための電極15を設けてある。前記集電端子10は無人搬送車１に設けてある充電回路11を介在させて蓄電池12に接続されている。また電極15は交流電源16に接続されている。

【０００３】

無人搬送車１の蓄電池12に充電する時は、集電端子10が電極15に接触する場所に無人搬送車１を停止させ、電源16から電極15，集電端子10，充電回路11を介して蓄電池12を充電する。

しかしこのような従来の充電装置は、蓄電池12への充電を電極15と集電端子10との機械的接触で行っており、接触不良を防ぐために集電端子10を電極11に対して摺接させるため、塵埃が発生し、また電極15が露出しているために感電する危険があり、更に、これらの近傍の導電性の物体と電極15との間でショートする等の危険があった。

【０００４】

この対策として機械的には非接触の状態で給電を行う方式が提案されている（特開平4-236102号公報）。この方式は図３に示す如く無人搬送車１の軌道の一部に一次鉄心21及びこれに巻装した一次コイル22を配設し、前記一次コイル22を交流電源23に接続する。一方無人搬送車１には前記一次鉄心21，及び一次コイル22と対向可能な位置に二次鉄心24及びこれに巻装した二次コイル25を配設し、二次

コイル25は充電回路26を介在させて蓄電池27に接続する。30は昇降装置である。無人搬送車1の蓄電池27に充電するときは二次鉄心24，二次コイル25が一次鉄心21，一次コイル22と対向するよう無人搬送車1を停止させ、一次コイル22に交流電源23から給電し、これに交流磁界を誘起させる。

【0005】

交流磁界は一次鉄心21から二次鉄心24に入り、二次コイル25は供給された二次鉄心24の交流磁界にて交流電流をを誘起させる。充電回路26は二次コイル25から交流電流を受けて直流電流に整流し、これを蓄電池27に供給し、充電する。

【0006】

【考案が解決しようとする課題】

ところでこのような従来装置にあっては、一次鉄心21、二次鉄心24の結合部（磁束空間結合部）の断面積が同じであるため、結合に際しての位置決めに高い精度を必要とする。正確に位置決めがなされない場合には一次鉄心21、二次鉄心24を近接させても必要な磁気回路が形成されず、エネルギーの伝達が効率的に行ない得なくなる。更に位置ずれが生じたときは無人搬送車1の二次鉄心24周辺の金属体を不要な磁束が通過し、意図しない起電力が誘起される危険もあった。

本考案はかかる事情に鑑みなされたものであって、その目的とするところは高い位置決め精度を要求されず、効率的な充電を可能とした移動体の充電装置を提供するにある。

【0007】

【課題を解決するための手段】

本考案に係る移動体の充電装置は、蓄電池を備えた移動体の移動域に臨み、移動体に対して相対移動する位置に変圧器の片側を構成する一次鉄心、一次コイルを設け、また前記移動体に二次鉄心，二次コイルを設け、前記一次，二次鉄心を対向させ、一次コイルに通電して二次コイルに電流を発生させ、この電流を用いて前記蓄電池を充電するようにした移動体の充電装置において、前記一次鉄心と二次鉄心との磁気的結合を行わせるべく対向させる面の断面積を異ならせたことを特徴とする。

【0008】

【作用】

本考案にあっては一次鉄心と二次鉄心との磁気結合回路の物理的大きさ、即ち一次鉄心，二次鉄心相互の対向させるべき断面積を異ならせることで、一次鉄心と二次鉄心との位置ずれに対する許容範囲が拡大され、位置決め精度に対する要求を緩和出来る。

【０００９】

【実施例】

以下本考案をその実施例を示す図面に基づき具体的に説明する。

図１は本考案に係る移動体の充電装置を示す模式図であり、図中１は無人搬送車、３は走行路を示している。走行路３の下部には上向きコ字形をなす一次鉄心（カットコア）４及びこれに巻装した一次コイル５がその端面及び一次コイル５の表面を走行路３の表面又は表面近傍に臨ませて配設し、一次コイル５には交流電源６を接続してある。交流電源６としては商用電源又は150Hz 程度の周波数の電源を用いる。

一次鉄心４の下方にはこれを昇降させる昇降装置20が配設されている。昇降装置20は、例えばラック20a とギア20b とを組合せて構成され、図示しないモータにてギア20b を正・逆駆動させることにより、一次鉄心４を一次コイル５と共に昇降せしめるようになっている。

【００１０】

一方無人搬送車１には下向きコ字形をなす二次鉄心（カットコア）７及びこれに巻装した二次コイル８が配設されており、前記一次鉄心４と対向可能な位置に設置されている。二次コイル８は充電回路９を介在させて蓄電池10に接続されている。一次鉄心４，二次鉄心７の対向端部断面積は一次鉄心４を必要なエネルギーを得る上での飽和磁気回路の限界の断面積とし、二次鉄心７はそれよりも大きくなるようにしてある。

逆に一次鉄心４の面積の方を二次鉄心７のそれよりも大きくしてもよいことは勿論である。

その他、図中1aは無人搬送車１に設けた受光器、3aは走行路３に設けた発光器である。なお、これら受光器1a，発光器3aに代えて発振器，受信器を用いてもよ

い。

【0011】

次にこのような本考案装置の動作を説明する。

無人搬送車1をその走行路3下に設けた一次鉄心4上に移動させ、二次鉄心7を一次鉄心4と対向させて停止させる。これによってここに変圧器Eが形成される。無人搬送車1の位置決めは走行路3に設けた発光器3aが無人搬送車1に設けた受光器1aと対向したとき無人搬送車1を停止することで行われる。

【0012】

昇降装置20を作動して一次鉄心4の端面が二次鉄心7の端面と略2mm以下の寸法で対向するように一次鉄心を上昇させ、また一次コイル5に交流電源6から交流電流を供給する。一次コイルに誘起された交流磁界は一次鉄心4、二次鉄心7にわたって形成され、二次コイル8に交流電流が誘起せしめられる。この交流電流は充電回路9にて整流され、直流電流に変換されて蓄電池10へ供給され、充電が行われる。充電が終了すると昇降装置20を動作して一次鉄心4，一次コイル5を下降する。

【0013】

なお上述の実施例は無人搬送車1の蓄電池10への充電を行う場合を示したが、磁気浮上で走行する車輌等の蓄電池に対する充電にも適用し得ることは勿論である。

また上述の実施例は一次鉄心4，一次コイル5を走行路3に固定した場合を示したが、必ずしも固定する必要はなく、無人搬送車1と同じ速度で移動しつつ充電を行うこととしてもよい。

【0014】

【考案の効果】

以上の如く本考案にあっては移動体に対して相対移動する側に設けた一次鉄心と、移動体に設けた二次鉄心との対向面積を異ならせたから、相互の位置決めに対する条件が緩和され、相互の位置決めが容易となり、効率的な充電が可能となる等本考案は優れた効果を奏するものである。

CLAIMS

[Claims]
[Claim 1]Attend a move region of a mobile body provided with a storage battery, and a primary iron core which constitutes one side of a transformer in a position which carries out relative displacement to a mobile body, and a primary coil are provided, In charging equipment of a mobile body which provides a secondary iron core and a secondary coil to the aforementioned mobile body, makes the aforementioned primary iron core and a secondary iron core oppose, energizes to a primary coil, makes a secondary coil generate current, and charged the aforementioned storage battery with this current, Charging equipment of a mobile body changing a cross-sectional area of a surface made to oppose in order to make magnetic combination of the aforementioned primary iron core and a secondary iron core perform.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claims]
[Claim 1]Attend a move region of a mobile body provided with a storage battery, and a primary iron core which constitutes one side of a transformer in a position which carries out relative displacement to a mobile body, and a primary coil are provided, In charging equipment of a mobile body which provides a secondary iron core and a secondary coil to the aforementioned mobile body, makes the aforementioned primary iron core and a secondary iron core oppose, energizes to a primary coil, makes a secondary coil generate current, and charged the aforementioned storage battery with this current, Charging equipment of a mobile body changing a cross-sectional area of a surface made to oppose in order to make magnetic combination of the aforementioned primary iron core and a secondary iron core perform.

[Translation done.]

DETAILED DESCRIPTION

[Detailed explanation of the device]
[0001]
[Industrial Application]
This design is related with the charging equipment to the storage battery which an automatic guided vehicle, a magnetic-levitation-transfer vehicle, etc. are mounting.
[0002]
[Description of the Prior Art]
Fig.2 is a typical side surface cross sectional view showing the composition of the conventional automatic guided vehicle disclosed in JP,H4-236102,A.
In Fig.2, 1 shows an automatic guided vehicle and 2 shows the traveling track. In this automatic guided vehicle 1, the electrode 15 for contacting the aforementioned collecting terminals 10 on the trajectory 2 in the collecting terminals 10 for receiving the electric supply from the outside again, and taking an electrical link is provided. The aforementioned collecting terminals 10 interpose the charge circuit 11 currently provided to the automatic guided vehicle 1, and are connected to the storage battery 12. The electrode 15 is connected to AC power supply 16.
[0003]
When charging the storage battery 12 of the automatic guided vehicle 1, the collecting terminals 10 make the place in contact with the electrode 15 stop the automatic guided vehicle 1, and charge the storage battery 12 via the electrode 15, the collecting terminals 10, and the charge circuit 11 from the power supply 16.
However, such conventional charging equipment is performing charge to the storage battery 12 by mechanical contact with the electrode 15 and the collecting terminals 10.
There was a risk of receiving an electric shock, since it was generated by dust in order to prevent loose connection and to make the collecting terminals 10 **** to the electrode 11, and the electrode 15 is exposed, and there was danger of short-circuiting between a conductive object of these neighborhood and the electrode 15 further.

[0004]
The system which supplies electric power in the non-contact state mechanically as this measure is proposed (JP,H4-236102,A). This system arranges the primary coil 22 wound around a part of trajectory of the automatic guided vehicle 1 at the primary iron core 21 and this, as shown in Fig.3, and it connects the aforementioned primary coil 22 to AC power supply 23. On the other hand to the automatic guided vehicle 1, the aforementioned primary iron core 21, and the primary coil 22 and the secondary coil 25 wound around the position which can be countered at the secondary iron core 24 and this are arranged, and the secondary coil 25 interposes the charge circuit 26, and connects it to the storage battery 27. 30 is a lifting device.
The automatic guided vehicle 1 is stopped so that the secondary iron core 24 and the secondary coil 25 may oppose with the primary iron core 21 and the primary coil 22, when charging the storage battery 27 of the automatic guided vehicle 1, and electric power is supplied to the primary coil 22 from AC power supply 23, and this is made to induce an alternating current magnetic field.

[0005]
An alternating current magnetic field goes into the secondary iron core 24 from the primary iron core 21, and the secondary coil 25 induces ********** in the alternating current magnetic field of the supplied secondary iron core 24. The charge circuit 26 rectifies from the secondary coil 25 to a direct current in response to alternating current, supplies this to the storage battery 27, and is charged.
[0006]
[Problem(s) to be Solved by the Device]
By the way, if it is in equipment such conventionally, since the cross-sectional area of the bond part (magnetic flux space bond part) of the primary iron core 21 and the secondary iron core 24 is the same, high accuracy is needed for positioning for combination. When positioning is not made correctly, even if it makes the primary iron core 21 and the secondary iron core 24 approach, a required magnetic circuit is not formed, but it becomes impossible for transmission of energy to carry out efficiently. There was also a risk of unnecessary magnetic flux passing the metal body of secondary iron core 24 periphery of the automatic guided vehicle 1, when positional displacement arises, and the electromotive force which is not meant being induced. This design is made in view of this situation, high positioning accuracy is not required of the place made into the purpose, but it is to provide the charging equipment of the mobile body which enabled efficient charge.
[0007]
[Means for solving problem]
The charging equipment of the mobile body concerning this design attends the move region of the mobile body provided with the storage battery, The primary iron core which constitutes one side of a transformer in the position which carries out relative displacement to a mobile body, Provide a primary coil and a secondary iron core and a secondary coil are provided to the aforementioned mobile body, In the charging equipment of the mobile body which makes the aforementioned primary one and a secondary iron core oppose, energizes to a primary coil, makes a secondary coil generate current, and charged the aforementioned storage battery using this current, The cross-sectional area of the surface made to oppose in order to make the magnetic combination of the aforementioned primary iron core and a secondary iron core perform was changed.
[0008]
[Function]
If it is in this design, it is changing the physical size of the magnetic connection circuit of a primary iron core and a secondary iron core, i.e., a primary iron core, and the cross-sectional area between secondary iron cores which should be made to oppose, and the tolerance level to the positional displacement of a primary iron core and a secondary iron core is expanded, and the demand to positioning accuracy can be eased.
[0009]
[Working example]
This design is specifically described based on the Drawings in which the working example is shown below.
Fig.1 is a mimetic diagram showing the charging equipment of the mobile body concerning this design, one in a figure shows an automatic guided vehicle, and 3 shows the traveling line. The primary coil 5 wound around the primary iron core (cut core) 4 and this which make upward KO type in the lower part of the traveling line 3 makes the end face and the surface of the primary coil 5 overlook near the surface of the traveling line 3, or the surface, arranges, and has connected AC power supply 6 to the primary coil 5. As AC power supply 6, commercial power or a power supply with a frequency of about 150 Hz is used.
The lifting device 20 which makes it go up and down this under the primary iron core 4 is arranged. The lifting device 20 is constituted, for example combining the rack 20a and the gear 20b, and makes it go up and down the primary iron core 4 for the gear 20b with the primary coil 5 positive and by making it reverse-drive by the motor which is not illustrated.
[0010]

On the other hand, the secondary coil 8 wound around the secondary iron core (cut core) 7 and this which make downward KO type is arranged by the automatic guided vehicle 1, and it is installed in the position in which the aforementioned primary iron core 4 and opposite are possible. The secondary coil 8 interposes the charge circuit 9, and is connected to the storage battery 10. The opposite end cross-sectional area of the primary iron core 4 and the secondary iron core 7 makes the primary iron core 4 the cross-sectional area of the limit of a saturation magnetic circuit when acquiring required energy, and it is made for the secondary iron core 7 to have become largely rather than it.
Conversely, of course, the area of the primary iron core 4 may be enlarged rather than that of the secondary iron core 7.
In addition, the inside 1a of a figure is the light receiver provided to the automatic guided vehicle 1, and the light emitter which 3a provided to the traveling line 3. It may replace with these light receivers 1a and the light emitter 3a, and an oscillator and a receiver may be used.
[0011]
Next, operation of such this equipment is described.
The automatic guided vehicle 1 is moved on the primary iron core 4 provided under the traveling line 3, and the secondary iron core 7 is made to oppose with the primary iron core 4, and is stopped. The transformer E is formed here of this. Positioning of the automatic guided vehicle 1 is performed by stopping the automatic guided vehicle 1, when the light emitter 3a provided to the traveling line 3 opposes with the light receiver 1a provided to the automatic guided vehicle 1.

[0012]
A primary iron core is raised so that the lifting device 20 may be operated and the end face of the primary iron core 4 may oppose with the end face of the secondary iron core 7, and the dimension not more than abbreviated 2mm, and alternating current is supplied to the primary coil 5 from AC power supply 6. The alternating current magnetic field induced by the primary coil is formed over the primary iron core 4 and the secondary iron core 7, and alternating current is made to induce it by the secondary coil 8. This alternating current is rectified in the charge circuit 9, it converts to a direct current, the storage battery 10 is supplied, and charge is performed. After charge is completed, the lifting device 20 is operated and the primary iron core 4 and the primary coil 5 are descended.
[0013]
Although the above-mentioned working example showed the case where charge to the storage battery 10 of the automatic guided vehicle 1 was performed, of course, it can apply also to the charge over storage batteries, such as a vehicle it runs by magnetic levitation.
Although the above-mentioned working example showed the case where the primary iron core 4 and the primary coil 5 were fixed to the traveling line 3, it is good also as charging necessarily not fixing and moving at the same speed as the automatic guided vehicle 1.
[0014]
[Effect of the Device]
The primary iron core provided to the side which carries out relative displacement to a mobile body if it was in this design like the above, Since the opposing area with the secondary iron core provided to the mobile body was changed, this design -- the conditions over mutual positioning are eased, mutual positioning becomes easy, and efficient charge is attained -- generates the outstanding effect.

[Translation done.]

TECHNICAL FIELD

[Industrial Application]
This design is related with the charging equipment to the storage battery which an automatic guided vehicle, a magnetic-levitation-transfer vehicle, etc. are mounting.
[0002]

[Translation done.]

PRIOR ART

[Description of the Prior Art]
Fig.2 is a typical side surface cross sectional view showing the composition of the conventional automatic guided vehicle disclosed in JP,H4-236102,A.
In Fig.2, 1 shows an automatic guided vehicle and 2 shows the traveling track. In this automatic guided vehicle 1, the electrode 15 for contacting the aforementioned collecting terminals 10 on the trajectory 2 in the collecting terminals 10 for receiving the electric supply from the outside again, and taking an electrical link is provided. The aforementioned collecting terminals 10 interpose the charge circuit 11 currently provided to the automatic guided vehicle 1, and are connected to the storage battery 12. The electrode 15 is connected to AC power supply 16.
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However, such conventional charging equipment is performing charge to the storage battery 12 by mechanical contact with the electrode 15 and the collecting terminals 10.
There was a risk of receiving an electric shock, since it was generated by dust in order to prevent loose connection and to make the collecting terminals 10 **** to the electrode 11, and the electrode 15 is exposed, and there was danger of short-circuiting between a conductive object of these neighborhood and the electrode 15 further.

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The system which supplies electric power in the non-contact state mechanically as this measure is proposed (JP,H4-236102,A). This system arranges the primary coil 22 wound around a part of trajectory of the automatic guided vehicle 1 at the primary iron core 21 and this, as shown in Fig.3, and it connects the aforementioned primary coil 22 to AC power supply 23. On the other hand to the automatic guided vehicle 1, the aforementioned primary iron core 21, and the primary coil 22 and the secondary coil 25 wound around the position which can be countered at the secondary iron core 24 and this are arranged, and the secondary coil 25 interposes the charge circuit 26, and connects it to the storage battery 27. 30 is a lifting device.
The automatic guided vehicle 1 is stopped so that the secondary iron core 24 and the secondary coil 25 may oppose with the primary iron core 21 and the primary coil 22, when charging the storage battery 27 of the automatic guided vehicle 1, and electric power is supplied to the primary coil 22 from AC power supply 23, and this is made to induce an alternating current magnetic field.
[0005]
An alternating current magnetic field goes into the secondary iron core 24 from the primary iron core 21, and the secondary coil 25 induces ********** in the alternating current magnetic field of the supplied secondary iron core 24. The charge circuit 26 rectifies from the secondary coil 25 to a direct current in response to alternating current, supplies this to the storage battery 27, and is charged.

[0006]

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Device]
The primary iron core provided to the side which carries out relative displacement to a mobile body if it was in this design like the above, Since the opposing area with the secondary iron core provided to the mobile body was changed, this design -- the conditions over mutual positioning are eased, mutual positioning becomes easy, and efficient charge is attained — generates the outstanding effect.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Device]
By the way, if it is in equipment such conventionally, since the cross-sectional area of the bond part (magnetic flux space bond part) of the primary iron core 21 and the secondary iron core 24 is the same, high accuracy is needed for positioning for combination. When positioning is not made correctly, even if it makes the primary iron core 21 and the secondary iron core 24 approach, a required magnetic circuit is not formed, but it becomes impossible for transmission of energy to carry out efficiently. There was also a risk of unnecessary magnetic flux passing the metal body of secondary iron core 24 periphery of the automatic guided vehicle 1, when positional displacement arises, and the electromotive force which is not meant being induced. This design is made in view of this situation, high positioning accuracy is not required of the place made into the purpose, but it is to provide the charging equipment of the mobile body which enabled efficient charge.
[0007]

[Translation done.]

MEANS

[Means for solving problem]
The charging equipment of the mobile body concerning this design attends the move region of the mobile body provided with the storage battery, The primary iron core which constitutes one side of a transformer in the position which carries out relative displacement to a mobile body, Provide a primary coil and a secondary iron core and a secondary coil are provided to the aforementioned mobile body, In the charging equipment of the mobile body which makes the aforementioned primary one and a secondary iron core oppose, energizes to a primary coil, makes a secondary coil generate current, and charged the aforementioned storage battery using this current, The cross-sectional area of the surface made to oppose in order to make the magnetic combination of the aforementioned primary iron core and a secondary iron core perform was changed.
[0008]

[Translation done.]

OPERATION

[Function]
If it is in this design, it is changing the physical size of the magnetic connection circuit of a primary iron core and a secondary iron core, i.e., a primary iron core, and the cross-sectional area between secondary iron cores which should be made to oppose, and the tolerance level to the positional displacement of a primary iron core and a secondary iron core is expanded, and the demand to positioning accuracy can be eased.
[0009]

[Translation done.]

EXAMPLE

[Working example]
This design is specifically described based on the Drawings in which the working example is shown below.
Fig.1 is a mimetic diagram showing the charging equipment of the mobile body concerning this design, one in a figure shows an automatic guided vehicle, and 3 shows the traveling line. The primary coil 5 wound around the primary iron core (cut core) 4 and this which make upward KO type in the lower part of the traveling line 3 makes the end face and the surface of the primary coil 5 overlook near the surface of the traveling line 3, or the surface, arranges, and has connected AC power supply 6 to the primary coil 5. As AC power supply 6, commercial power or a power supply with a frequency of about 150 Hz is used.
The lifting device 20 which makes it go up and down this under the primary iron core 4 is arranged. The lifting device 20 is constituted, for example combining the rack 20a and the gear 20b, and makes it go up and down the primary iron core 4 for the gear 20b with the primary coil 5 positive and by making it reverse-drive by the motor which is not illustrated.
[0010]
On the other hand, the secondary coil 8 wound around the secondary iron core (cut core) 7 and this which make downward KO type is arranged by the automatic guided vehicle 1, and it is installed in the position in which the aforementioned primary iron core 4 and opposite are possible. The secondary coil 8 interposes the charge circuit 9, and is connected to the storage battery 10. The opposite end cross-sectional area of the primary iron core 4 and the secondary iron core 7 makes the primary iron core 4 the cross-sectional area of the limit of a saturation magnetic circuit when acquiring required energy, and it is made for the secondary iron core 7 to have become largely rather than it.
Conversely, of course, the area of the primary iron core 4 may be enlarged rather than that of the secondary iron core 7.
In addition, the inside 1a of a figure is the light receiver provided to the automatic guided vehicle 1, and the light emitter which 3a provided to the traveling line 3. It may replace with these light receivers 1a and the light emitter 3a, and an oscillator and a receiver may be used.
[0011]
Next, operation of such this equipment is described.
The automatic guided vehicle 1 is moved on the primary iron core 4 provided under the traveling line 3, and the secondary iron core 7 is made to oppose with the primary iron core 4, and is stopped. The transformer E is formed here of this. Positioning of the automatic guided vehicle 1 is performed by stopping the automatic guided vehicle 1, when the light emitter 3a provided to the traveling line 3 opposes with the light receiver 1a provided to the automatic guided vehicle 1.

[0012]
A primary iron core is raised so that the lifting device 20 may be operated and the end face of the primary iron core 4 may oppose with the end face of the secondary iron core 7, and the dimension not more than abbreviated 2mm, and alternating current is supplied to the primary coil 5 from AC power supply 6. The alternating current magnetic field induced by the primary coil is

formed over the primary iron core 4 and the secondary iron core 7, and alternating current is made to induce it by the secondary coil 8. This alternating current is rectified in the charge circuit 9, it converts to a direct current, the storage battery 10 is supplied, and charge is performed. After charge is completed, the lifting device 20 is operated and the primary iron core 4 and the primary coil 5 are descended.

[0013]

Although the above-mentioned working example showed the case where charge to the storage battery 10 of the automatic guided vehicle 1 was performed, of course, it can apply also to the charge over storage batteries, such as a vehicle it runs by magnetic levitation.

Although the above-mentioned working example showed the case where the primary iron core 4 and the primary coil 5 were fixed to the traveling line 3, it is good also as charging necessarily not fixing and moving at the same speed as the automatic guided vehicle 1.

[0014]

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]It is a typical side surface cross sectional view of the charging equipment concerning this design.
[Drawing 2]It is a side surface cross sectional view showing the conventional charging equipment.
[Drawing 3]It is a side surface cross sectional view showing other conventional charging equipment.
[Explanations of letters or numerals]
1 Automatic guided vehicle
3 Traveling line
4 Primary iron core
5 Primary coil
6 AC power supply
7 Secondary iron core
8 Secondary coil
9 Charge circuit
10 Storage battery

[Translation done.]

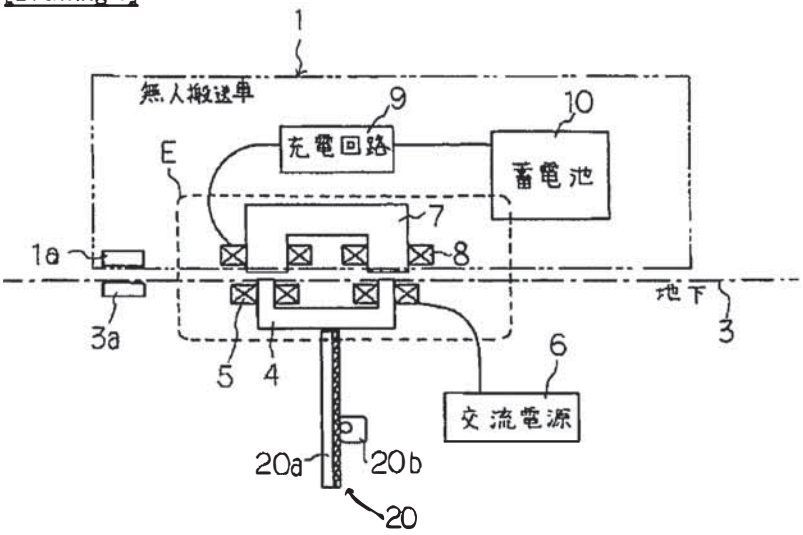
* NOTICES *

JPO and INPIT are not responsible for any damages caused by the use of this translation.

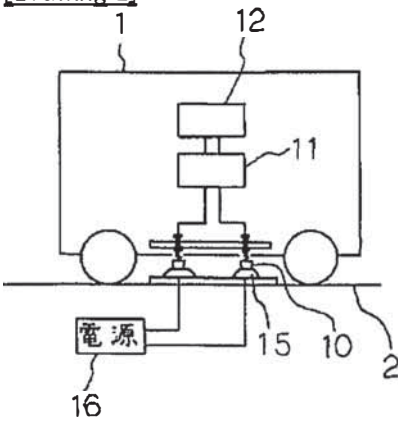
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

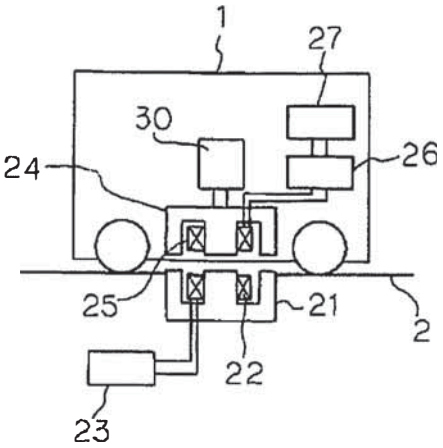
[Drawing 1]



[Drawing 2]



[Drawing 3]



[Translation done.]

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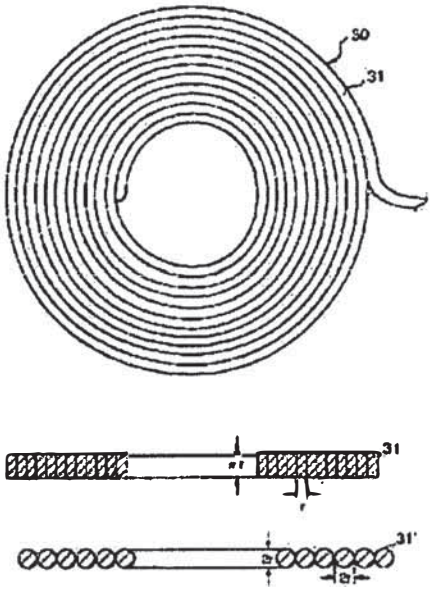
(71)Applicant : **TOKIN CORP**
(72)Inventor : **SATO NAOTO**
SAITOU KOUICHI

(54) NON-CONTACT POWER TRANSMITTER AND SPIRAL COIL USED THEREFOR

(57)Abstract:
PROBLEM TO BE SOLVED: To increase the inductance value by forming a spiral coil, using a wire having substantially rectangular cross section.
SOLUTION: The spiral coil 30 is made by spirally winding a wire 31 using a flat wire having a rectangular cross section e.g. having a width (minor axis length) r and height (major axis length) πr, i.e., the major axis of the wire being perpendicular to the winding plane of the coil 30. This cross sectional area of the wire 31 is equal to that of a round wire 31' but its width r is a half the width 2r of the wire 31', and hence the no. of turns is twice that of the wire 31' on the same area. Thus the winding is twice to increase the flux and hence the power to be transmitted, though the distance between the power transmitter and receiver is slightly longer.



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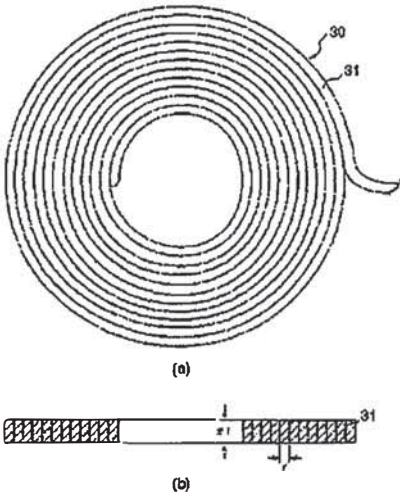
(54)【発明の名称】　非接触式電力伝送装置およびそれに使用される巻線型コイル

(57)【要約】
【課題】　スペースファクタが良好で、インダクタンス値を大きくし、流す電流を小さく抑えて銅損を軽減する。
【解決手段】　非接触式電力伝送装置に使用される巻線型コイル３０を構成する線材３１の断面形状を矩形とする。



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【特許請求の範囲】

【請求項1】 互いに離間して対向配置された送電部及び受電部を備え，前記送電部から前記受電部へ非接触で電力を伝送する非接触式電力伝送装置であって，前記送電部および前記受電部の各々は，軟磁性材と，該軟磁性材上に搭載された複数個の渦巻型コイルとを含む，前記非接触式電力伝送装置において，

前記渦巻型コイルを構成する線材の断面形状が実質的に矩形であることを特徴とする非接触式電力伝送装置。

【請求項2】 前記線材は長軸と短軸とを持ち，前記線材の長軸方向が前記渦巻型コイルが巻回される平面と直交する方向に延在している，請求項1に記載の非接触式電力伝送装置。

【請求項3】 非接触式電力伝送装置に使用される渦巻型コイルにおいて，前記渦巻型コイルを構成する線材の断面形状が実質的に矩形であることを特徴とする渦巻型コイル。

【請求項4】 前記線材は長軸と短軸とを持ち，前記線材の長軸方向が前記渦巻型コイルが巻回される平面と直交する方向に延在している，請求項3に記載の渦巻型コイル。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は非接触式電力伝送装置およびそれに使用される渦巻型コイルに関する。

【0002】

【従来の技術】この種の非接触式電力伝送装置として，本願出願人は非接触で二次電池を充電可能な「非接触充電器」というものを既に提案している（例えば，特開平-231586号公報参照）。この非接触充電器では，送電側から受電側へ電磁誘導作用を利用して非接触に電力を伝送している。

【0003】図に従来の非接触式電力伝送装置を示す。図2において，（a）は断面図，（b）は送電部の平面図である。図示の非接触式電力伝送装置は，互いに所定距離d離間して対向配置された送電部10及び受電部20を備えており，送電部10から受電部20へ非接触で電力を伝送する装置である。

【0004】送電部10は，送電側軟磁性材11と，この送電側軟磁性材11上に搭載された複数個（図示の例では2個）の送電側渦巻型コイル12，13とを含む。同様に，受電部20は，受電側軟磁性材21と，この受電側軟磁性材21上に搭載された複数個（図示の例では2個）の受電側渦巻型コイル22，23とを含む。軟磁性材としてはフェライトが使用される。

【0005】送電部10において，送電側渦巻型コイル12，13は互いに発生する磁束の方向が逆となるように巻回され，直列に接続されている。そして，送電側渦巻型コイル12，13のそれぞれの一端は，図示の如く，交流電源（例えば，商用交流電源）15に接続される。また，受電部20において，受電側渦巻型コイル22，22は，それぞれ送電側渦巻型コイル12，13と対向するように配置され，送電側渦巻型コイル12，13で発生された磁束の変化により発生する電流の向きが同一方向となるように巻回され，直列に接続されている。

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【0006】このような構成の非接触式電力伝送装置において，送電部10から受電部20へ伝送される電力は，磁束の大きさと距離dとで決定される。すなわち，磁束が大きい程，伝送される電力が大きくなり，距離dが短い程，伝送される電力が大きくなる。また，磁束の大きさは，渦巻型コイルに流れる電流と巻数とで決定される。すなわち，電流が大きい程，磁束が大きくなり，巻数が多い程，磁束が大きくなる。従って，伝送される電力を大きくする為には，距離dを短く，巻数を多く，流す電流を大きくすれば良い。

【0007】図2（b）に，電流iを図の矢印の向きに流したときの磁束の向きを示している。すなわち，"○の中に×"で示す記号は紙面上方より下方への磁束の方向を，"○の中に・"で示す記号は記号は紙面下方より上方への磁束の方向を示している。また，図2（a）の矢印Aによって磁束の向きを示している。

【0008】このような構成の非接触式電力伝送装置では，送電部10の送電側渦巻型コイル12，13に図に示したような電流iを流したとすると，送電側渦巻型コイル12，13で発生された磁束Aは，送電側渦巻型コイル12→送電側軟磁性材11→送電側渦巻型コイル13→受電側渦巻型コイル23→受電側軟磁性材21→受電側渦巻型コイル22→送電側渦巻型コイル12というような順序の経路から成る閉磁路を通るので，磁束が外部に漏れるのを防止することができる。したがって，受電側軟磁性材21に近接して電子部品を配置したとしても，この電子部品が上記磁束によって加熱されることがない。

【0009】図3に上記非接触式電力伝送装置に使用される従来の渦巻型コイル30′を示す。図3において，（a）は平面図，（b）は断面図である。従来の渦巻型コイル30′は，線材31′を渦巻状に巻回することによって製造されるが，図3（b）に示すように，この線材31′としてその断面形状が円形の丸線を使用している。なお，この線材（丸線）31′としては自己融着線が使用される。ここで「自己融着線」とは，銅線を絶縁膜で被覆し，さらに絶縁膜を自己融着層で覆った線をいう。

【0010】

【発明が解決しようとする課題】上述したように，従来の非接触式電力伝送装置では，それに使用される渦巻型コイル30′として，断面形状が円形の線材（丸線）31′を使用しているので，デットスペースが大きく，スペースファクタが悪いので，渦巻型コイル30′のイ

ンダクタンス値を大きくできないという問題点がある。

【0011】したがって、本発明の課題は、スペースファクタが良好で、インダクタンス値を大きくできる渦巻型コイルを備えた非接触式電力伝送装置を提供することにある。

【0012】本発明の他の課題は、流す電流を小さく抑えて銅損を軽減出来る渦巻型コイルを備えた非接触式電力伝送装置を提供することにある。

【0013】

【課題を解決するための手段】本発明によれば、互いに離間して対向配置された送電部及び受電部を備え、前記送電部から前記受電部へ非接触で電力を伝送する非接触式電力伝送装置であって、前記送電部および前記受電部の各々は、磁性体材と、該軟磁性材上に搭載された複数個の渦巻型コイルとをさむ、前記非接触式電力伝送装置において、前記渦巻型コイルを構成する線材の断面形状が実質的に矩形であることを特徴とする非接触式電力伝送装置が得られる。

【0014】また、本発明によれば、非接触式電力伝送装置に使用される渦巻型コイルにおいて、前記渦巻型コイルを構成する線材の断面形状が実質的に矩形であることを特徴とする渦巻型コイルが得られる。

【0015】上記非接触式電力伝送装置および上記渦巻型コイルにおいて、前記線材は長軸と短軸とを持ち、前記線材の長軸方向が前記渦巻型コイルが巻回される平面と直交する方向に延在していることが好ましい。

【0016】

【作用】断面形状が円形の丸線と断面形状が矩形の平角線との相違について述べる。丸線の半径がｒであるとすると、その断面積は$\pi \cdot r^2$であり、高さ及び幅は直径２ｒに等しい。平角線の断面形状が正方形であるとする。この場合、円形断面の丸線と同じ断面積とした場合の正方形断面の平角線の１辺の長さは、$\sqrt{\pi} \cdot r$で約１．７７ｒで、丸線の直径２ｒよりも短くなる。すなわち、円形断面の丸線に比較して正方形断面の平角線の方が、高さおよび幅とも短くなる。したがって、このような正方形断面の平角線を渦巻型コイルの線材として使用することより、円形断面の丸線を使用した場合に比較して、同一領域における渦巻型コイルの巻数を多くでき、また送電部と受電部間の距離も短くできる。結果として、伝送できる電力を大きくできる。

【0017】一方、高さ（長辺）が２ｒで断面積が丸線と等しい矩形断面の平角線の幅（短辺）は、（π／２）・ｒで約１．５７ｒとなる。したがって、このような矩形断面の平角線を渦巻型コイルの線材として使用することより、円形断面の丸線を使用した場合に比較して、渦巻型コイルの巻数を多くでき、結果として、伝送できる電力を大きくできる。

【0018】また、幅（長辺）が２ｒで断面積が丸線と等しい矩形断面の平角線の高さ（短辺）は、（π／２）・ｒで約１．５７ｒとなる。したがって、このような矩形断面の平角線を渦巻型コイルの線材として使用することより、円形断面の丸線を使用した場合に比較して、送電部と受電部間の距離を短くでき、結果として、伝送できる電力を大きくできる。

【0019】尚、断面積が丸線と等しく、巻数を丸線の場合よりも非常に多くしたい場合には、高さ（長軸の長さ）を幅（短軸の長さ）に比べて比較的長くすれば良い。この場合、送電部と受電部間の距離を短くできないが、巻数が非常に多くなるので磁束を大きくでき、結果として、伝送できる電力を大きくできる。

【0020】

【発明の実施の形態】次に、本発明について図面を参照して詳細に説明する。

【0021】本発明に係る非接触式電力伝送装置の基本的構成は図２に示したものと同様であり、従来との相違点は、それに使用される渦巻型コイルにある。したがって、以下では渦巻型コイルについてのみ説明し、非接触式電力伝送装置の説明については省略する。

【0022】図１に本発明の一実施の形態に係る渦巻型コイル３０を示す。図１において、（ａ）は平面図、（ｂ）は断面図である。図示の渦巻型コイル３０は、線材３１を渦巻状に巻回することによって製造されるが、図１（ｂ）に示すように、この線材３１としてその断面形状が矩形の平角線を使用している。なお、この線材（平角線）３１としては、従来と同様に自己融着線が使用される。

【0023】例えば、線材（平角線）３１として、図１の示すように、幅（短辺の長さ）がｒで、高さ（長辺の長さ）が$\pi \cdot r$の平角線を使用したとする。すなわち、線材３１の長辺方向が渦巻型コイル３０が巻回される平面と直交する方向に延在させている。この平角線３１の断面積は、上記従来の丸線３１´のそれに等しい。しかしながら、平角線３１は、その幅ｒが丸線３１´の幅２ｒの半分なので、同じ領域上に巻回される巻数を、丸線３１´の２倍にすることができる。その結果、送電部１０と受電部２０間の距離ｄが従来のものよりも若干長くなるものの、巻数が２倍になるので、磁束を大きくすることができる。その結果、伝送できる電力を従来よりも大きくすることができる。

【0024】このように、渦巻型コイル３０を構成する線材３１の断面形状を矩形とすることにより、スペースファクタを良くして、効率良く巻くことが可能となり、インダクタンス値を大きくすることができる。従って、丸線３１´の場合と磁束の大きさが同じくする場合には、平角線３１の方が、回路的に電流を小さく抑えることができ、結果として、銅損を軽減することが出来る。

【0025】以上、本発明について好ましい実施の形態を図に参照して説明したが、本発明は上述した実施の形態に限定せず、本発明の要旨を逸脱しない範囲内で種々の

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変更が可能なのはいうまでもない。例えば、渦巻型コイルの巻数やそれを構成する線材の断面形状は、上述した実施の形態のものに限定しないのは勿論である。例えば、断面形状は正方形でも良い。また、巻数を増やすために高さ（長軸（長辺）の長さ）を幅（短軸（短辺）の長さより）も比較的長くしても良い。

【0026】

【発明の効果】以上説明したように、本発明に係る非接触式電力伝送装置は、それに使用される渦巻型コイルを構成する線材の断面形状を矩形としたので、従来の円形断面の丸線に比較して、効率良く巻くことができる。また、円形断面の丸線に比較して矩形断面の平角線は、スペースファクタが良く、インダクタンス値を大きくすることが出来る。また、磁束の大きさが同じ場合には、丸線に比較して平角線の方が流す電流を小さく抑えることが出来、銅損を軽減出来るという利点もある。

【図面の簡単な説明】

【図1】本発明の一実施の形態による非接触式電力伝送＊

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＊装置に使用される渦巻型コイルを示す図で、（a）は平面図、（b）は断面図である。

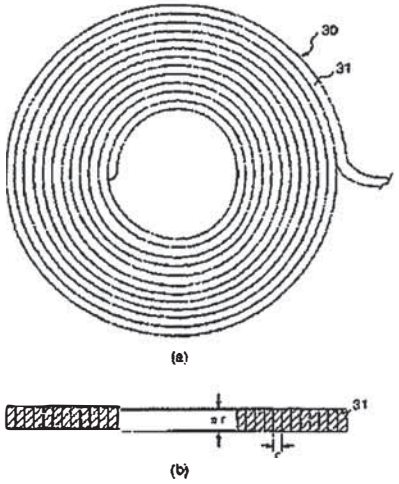
【図2】従来の非接触式電力伝送装置の概略構成を示す図で、（a）は断面図、（b）は送電部の平面図である。

【図3】従来の非接触式電力伝送装置に使用される渦巻型コイルを示す図で、（a）は平面図、（b）は断面図である。

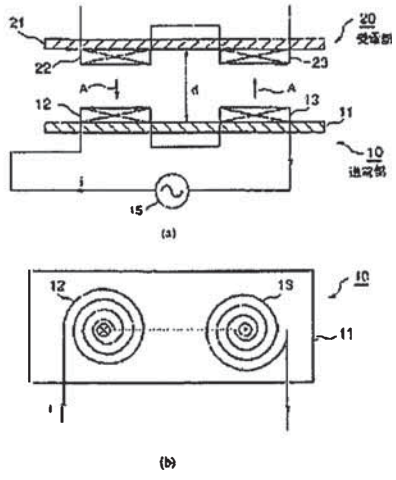
【符号の説明】

10 10　送電部
11　軟磁性材
12．13　渦巻型コイル
20　受電部
21　軟磁性材
22．23　渦巻型コイル
30　渦巻型コイル
31　線材（平角線）

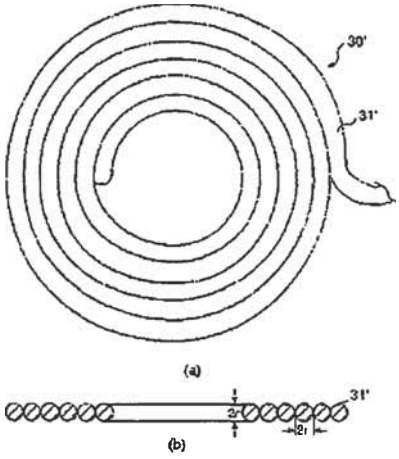
【図1】



【図2】



【図3】



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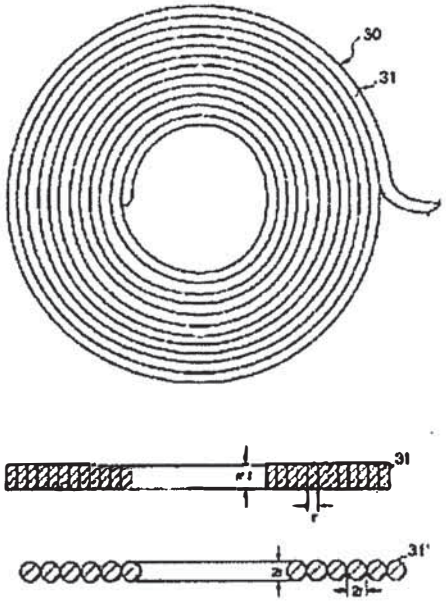
(72)Inventor : **SATO NAOTO**
SAITOU KOUICHI

(54) NON-CONTACT POWER TRANSMITTER AND SPIRAL COIL USED THEREFOR

(57)Abstract:
PROBLEM TO BE SOLVED: To increase the inductance value by forming a spiral coil, using a wire having substantially rectangular cross section.
SOLUTION: The spiral coil 30 is made by spirally winding a wire 31 using a flat wire having a rectangular cross section e.g. having a width (minor axis length) r and height (major axis length) πr, i.e., the major axis of the wire being perpendicular to the winding plane of the coil 30. This cross sectional area of the wire 31 is equal to that of a round wire 31' but its width r is a half the width 2r of the wire 31', and hence the no. of turns is twice that of the wire 31' on the same area. Thus the winding is twice to increase the flux and hence the power to be transmitted, though the distance between the power transmitter and receiver is slightly longer.



CLAIMS

[Claim(s)]
[Claim 1]It is noncontact type transfer-of-power equipment which is provided with a power transmission part and a receiving part which separated mutually and were arranged oppositely, and transmits electric power to the aforementioned receiving part by non-contact from the aforementioned power transmission part, and each of the aforementioned power transmission part and the aforementioned receiving part is soft magnetism material.
Two or more swirl type coils mounted on this soft magnetism material.
In the aforementioned noncontact type transfer-of-power equipment provided with the above, Noncontact type transfer-of-power equipment, wherein sectional shape of a wire rod which constitutes the aforementioned swirl type coil is substantially rectangular.

[Claim 2]The noncontact type transfer-of-power equipment according to claim 1 with which the aforementioned wire rod had a major axis and a minor axis, and a major axis direction of the aforementioned wire rod has extended in the direction orthogonal to a plane where the aforementioned swirl type coil is wound.
[Claim 3]A swirl type coil characterized by sectional shape of a wire rod which constitutes the aforementioned swirl type coil being substantially rectangular in a swirl type coil used for noncontact type transfer-of-power equipment.
[Claim 4]The swirl type coil according to claim 3 to which the aforementioned wire rod had a major axis and a minor axis, and a major axis direction of the aforementioned wire rod has extended in the direction orthogonal to a plane where the aforementioned swirl type coil is wound.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]The present invention relates to the swirl type coil used for noncontact type transfer-of-power equipment and it.
[0002]
[Description of the Prior Art]As this kind of noncontact type transfer-of-power equipment, applicant of this application has already proposed a "noncontact charger" which can charge a rechargeable battery by non-contact (for example, refer to the publication-number-No. 231586 gazette). In this noncontact charger, electric power is transmitted to non-contact from the power transmission side to the power receiving side using an electromagnetic induction action.
[0003]Conventional noncontact type transfer-of-power equipment is shown in a figure. In Fig.2, (a) is a cross sectional view and (b) is a plan view of a power transmission part. Illustrated noncontact type transfer-of-power equipment is provided with the power transmission part 10 and the receiving part 20 which were arranged oppositely by carrying out prescribed distance d alienation mutually.
It is equipment which transmits electric power to the receiving part 20 by non-contact from the power transmission part 10.

[0004]The power transmission part 10 contains the power transmission side soft magnetism material 11 and the power transmission side swirl type coils [two or more (an illustrated example two pieces)] 12 and 13 mounted on this power transmission side soft magnetism material 11. Similarly, the receiving part 20 contains the power receiving side soft magnetism material 21 and the power receiving side swirl type coils [two or more (an illustrated example two pieces)] 22 and 23 mounted on this power receiving side soft magnetism material 21. A ferrite is used as soft magnetism material.
[0005]In the power transmission part 10, the power transmission side swirl type coils 12 and 13 are wound so that the direction of the magnetic flux generated mutually may become reverse, and they are connected in series. And each end of the power transmission side swirl type coils 12 and 13 is connected to like and illustrated AC power supply (for example, commercial alternating current power) 15. In the receiving part 20, the power receiving side swirl type coils 22 and 22 are arranged so that it may oppose with the power transmission side swirl type coils 12 and 13, respectively, they are wound so that direction of the current generated by change of the magnetic flux generated with the power transmission side swirl type coils 12 and 13 may turn into a uniform direction, and they are connected in series.
[0006]In the noncontact type transfer-of-power equipment of such composition, the electric power transmitted to the receiving part 20 from the power transmission part 10 is determined in the size and the distance d of magnetic flux. That is, the electric power transmitted, so that magnetic flux is large becomes largely, and the electric power transmitted becomes largely, so that the distance d is short. The size of magnetic flux is determined with the current and the number of turns which flow into a swirl type coil. That is, magnetic flux becomes largely, so that current is large, and magnetic flux becomes largely, so that there are many numbers of turns.

Therefore, what is necessary is just to enlarge the current which passes many numbers of turns for the distance d short, in order to enlarge the electric power transmitted.
[0007]Direction of magnetic flux when the current I is sent through direction of the arrow of a figure is shown in Fig.2 (b). Namely, as for the sign, the sign with which the sign shown by x" in "O shows the direction of downward magnetic flux -" in "O from the paper side upper part shows the direction of upward magnetic flux from the paper side lower part. The arrow A of Fig.2 (a) shows direction of magnetic flux.
[0008]In such noncontact type transfer-of-power equipment of composition, Supposing it sends the current I as shown in the figure at the power transmission side swirl type coils 12 and 13 of the power transmission part 10, the magnetic flux A generated with the power transmission side swirl type coils 12 and 13. the power transmission side swirl type coil 12 -> power transmission side soft magnetism -- material 11 -> power transmission side swirl type coil 13 -> power receiving side swirl type coil 23->, since it passes along the closed magnetic circuit which comprises the course of an order which is called swirl type coil 12 as for a power receiving side soft magnetism material 21 -> power receiving side swirl type coil 22 -> power transmission side, Magnetic flux can be prevented from leaking outside. Therefore, even if the power receiving side soft magnetism material 21 is approached and it arranges electronic parts, these electronic parts are not heated by the above-mentioned magnetic flux.
[0009]Conventional swirl type coil 30' used for the above-mentioned noncontact type transfer-of-power equipment is shown in Fig.3. In Fig.3, (a) is a plan view and (b) is a cross sectional view. Conventional swirl type coil 30' is using the wire with that circular sectional shape as this wire rod 31', as it is shown in Fig.3 (b), although spirally manufactured wire rod 31' by winding ******. A self welding wire is used as this wire rod (wire) 31'. The "self welding wire" refers to the line which covered copper wire with the insulator layer and covered the insulator layer in the self welding layer further here.
[0010]
[Problem to be solved by the invention]As mentioned above, in conventional noncontact type transfer-of-power equipment, Since wire rod (wire) 31' with circular sectional shape is used as swirl type coil 30' used for it, there is a problem that it cannot do largely the inductance value of swirl type coil 30' since DETTO space has the bad SUTEPESU factor.
[0011]Therefore, the problem of the present invention has a good space factor, and there is in providing noncontact type transfer-of-power equipment provided with the swirl type coil which can do an inductance value largely.
[0012]There are other problems of the present invention in providing noncontact type transfer-of-power equipment provided with the swirl type coil which suppresses the current to send small and can reduce copper loss.
[0013]
[Means for solving problem]According to the present invention, are noncontact type transfer-of-power equipment which is provided with the power transmission part and receiving part which separated mutually and were arranged oppositely, and transmits electric power to the aforementioned receiving part by non-contact from the aforementioned power transmission part, and each of the aforementioned power transmission part and the aforementioned receiving part Soft magnetism material, Noncontact type transfer-of-power equipment, wherein the sectional shape of the wire rod which constitutes the aforementioned swirl type coil in the aforementioned noncontact type transfer-of-power equipment containing two or more swirl type coils mounted on this soft magnetism material is substantially rectangular is obtained.
[0014]According to the present invention, in the swirl type coil used for noncontact type transfer-of-power equipment, a swirl type coil, wherein the sectional shape of the wire rod which constitutes the aforementioned swirl type coil is substantially rectangular is obtained.
[0015]In the above-mentioned noncontact type transfer-of-power equipment and the above-mentioned swirl type coil, it is preferable that the aforementioned wire rod had a major axis and a minor axis, and the major axis direction of the aforementioned wire rod has extended in the direction orthogonal to the plane where the aforementioned swirl type coil is wound.
[0016]

[Function]The difference with a wire with circular sectional shape and a rectangular wire with rectangular sectional shape is described. Supposing the radius of a wire is r, the cross-sectional area is pi-r^2, and height and width are equal to the diameter 2r. Suppose that the sectional shape of a rectangular wire is square. in this case, a length of one side of the rectangular wire of the square cross section at the time of considering it as the same cross-sectional area as the wire of a circular section -- root pi-r -- about -- it is 1.77r and becomes shorter than the diameter 2r of a wire. That is, as compared with the wire of a circular section, the direction of the rectangular wire of a square cross section becomes short also with height and width. Therefore, from using the rectangular wire of such a square cross section as a wire rod of a swirl type coil, as compared with the case where the wire of a circular section is used, the number of turns of the swirl type coil in the same region is increased, and distance between a power transmission part and a receiving part can also be shortened. As a result, electric power which can be transmitted can be done largely.

[0017]on the other hand -- height (long side) -- 2r -- the width (shorter side) of the rectangular wire of a rectangular cross section with a cross-sectional area equal to a wire -(pi/2) r -- about -- it is set to 1.57r. Therefore, from using the rectangular wire of such a rectangular cross section as a wire rod of a swirl type coil, as compared with the case where the wire of a circular section is used, the number of turns of a swirl type coil is increased, and electric power which can be transmitted can be largely done as a result.

[0018]width (long side) -- 2r -- the height (shorter side) of the rectangular wire of a rectangular cross section with a cross-sectional area equal to a wire -(pi/2) r -- about -- it is set to 1.57r. Therefore, from using the rectangular wire of such a rectangular cross section as a wire rod of a swirl type coil, as compared with the case where the wire of a circular section is used, distance between a power transmission part and a receiving part can be shortened, and electric power which can be transmitted can be largely done as a result.

[0019]What is necessary is for a cross-sectional area to be equal to a wire, and just to lengthen height (the length of a major axis) comparatively compared with width (the length of a minor axis) to make a number of turns very larger than the case of a wire. In this case, although distance between a power transmission part and a receiving part cannot be shortened, since a number of turns increases dramatically, magnetic flux is made largely, and electric power which can be transmitted can be largely done as a result.

[0020]

[Mode for carrying out the invention]Next, with reference to Drawings, it describes in detail about the present invention.

[0021]The fundamental composition of the noncontact type transfer-of-power equipment concerning the present invention is the same as that of what was shown in Fig.2, and the point of difference with the former is in the swirl type coil used for it. Therefore, below, it describes only about a swirl type coil and omits about the description of noncontact type transfer-of-power equipment.

[0022]The swirl type coil 30 concerning the 1 embodiment of the present invention is shown in Fig.1. In Fig.1, (a) is a plan view and (b) is a cross sectional view. Although spirally manufactured the wire rod 31 by winding ******, as it is shown in Fig.1 (b), the rectangular wire with that rectangular sectional shape is being used for the illustrated swirl type coil 30 as this wire rod 31. As this wire rod (rectangular wire) 31, a self welding wire is used as usual.

[0023]For example, as the wire rod (rectangular wire) 31, width (the length of a minor axis) presupposes that height (the length of a major axis) considered the rectangular wire of pi-r as use by r so that Fig.1 may show. That is, the major axis direction of the wire rod 31 is making it extend in the direction orthogonal to the plane where the swirl type coil 30 is wound. The cross-sectional area of this rectangular wire 31 is equal to it of above-mentioned conventional wire 31'. However, since the width r is a half of the width 2r of wire 31', the rectangular wire 31 can make the number of turns wound on the same region twice wire 31'. As a result, although the distance d between the power transmission part 10 and the receiving part 20 becomes long slightly rather than the conventional thing, since a number of turns doubles, magnetic flux can be enlarged. As a

result, the electric power which can be transmitted can be enlarged conventionally.
[0024]Thus, by making rectangular sectional shape of the wire rod 31 which constitutes the swirl type coil 30, it becomes possible to improve a space factor and to roll it efficiently, and an inductance value can be enlarged. On the contrary, when the case of wire 31' and the size of magnetic flux said-**, the rectangular wire 31 can suppress current small in circuit, and it can reduce copper loss as a result.
[0025]As mentioned above, although the preferable embodiment was mentioned as the example and described about the present invention, it cannot be overemphasized that various change is possible within limits which do not limit the present invention to the embodiment mentioned above, and do not deviate from the summary of the present invention. For example, the sectional shape of the wire rod which constitutes the number of turns of a swirl type coil and it of not limiting to the thing of the embodiment mentioned above is natural. For example, sectional shape may be square. In order to increase a number of turns, width may also make height (the length of a major axis (long side)) comparatively long (the length of a minor axis (shorter side)).
[0026]
[Effect of the Invention]As described above, since sectional shape of the wire rod which constitutes the swirl type coil used for it was made rectangular, the noncontact type transfer-of-power equipment concerning the present invention can be efficiently rolled as compared with the wire of the conventional circular section. As compared with the wire of a circular section, the rectangular wire of a rectangular cross section has a good space factor, and an inductance value can be enlarged. When the size of magnetic flux is the same, the current which the direction of a rectangular wire sends as compared with a wire can be suppressed small, and there is also an advantage that copper loss is mitigable.

[Translation done.]

TECHNICAL FIELD

[Field of the Invention]The present invention relates to the swirl type coil used for noncontact type transfer-of-power equipment and it.

[Translation done.]

PRIOR ART

[Description of the Prior Art]As this kind of noncontact type transfer-of-power equipment, applicant of this application has already proposed a "noncontact charger" which can charge a rechargeable battery by non-contact (for example, refer to the publication-number-No. 231586 gazette). In this noncontact charger, electric power is transmitted to non-contact from the power transmission side to the power receiving side using an electromagnetic induction action.
[0003]Conventional noncontact type transfer-of-power equipment is shown in a figure. In Fig.2, (a) is a cross sectional view and (b) is a plan view of a power transmission part. Illustrated noncontact type transfer-of-power equipment is provided with the power transmission part 10 and the receiving part 20 which were arranged oppositely by carrying out prescribed distance d alienation mutually.
It is equipment which transmits electric power to the receiving part 20 by non-contact from the power transmission part 10.

[0004]The power transmission part 10 contains the power transmission side soft magnetism material 11 and the power transmission side swirl type coils [two or more (an illustrated example two pieces)] 12 and 13 mounted on this power transmission side soft magnetism material 11. Similarly, the receiving part 20 contains the power receiving side soft magnetism material 21 and the power receiving side swirl type coils [two or more (an illustrated example two pieces)] 22 and 23 mounted on this power receiving side soft magnetism material 21. A ferrite is used as soft magnetism material.
[0005]In the power transmission part 10, the power transmission side swirl type coils 12 and 13 are wound so that the direction of the magnetic flux generated mutually may become reverse, and they are connected in series. And each end of the power transmission side swirl type coils 12 and 13 is connected to like and illustrated AC power supply (for example, commercial alternating current power) 15. In the receiving part 20, the power receiving side swirl type coils 22 and 22 are arranged so that it may oppose with the power transmission side swirl type coils 12 and 13, respectively, they are wound so that direction of the current generated by change of the magnetic flux generated with the power transmission side swirl type coils 12 and 13 may turn into a uniform direction, and they are connected in series.
[0006]In the noncontact type transfer-of-power equipment of such composition, the electric power transmitted to the receiving part 20 from the power transmission part 10 is determined in the size and the distance d of magnetic flux. That is, the electric power transmitted, so that magnetic flux is large becomes largely, and the electric power transmitted becomes largely, so that the distance d is short. The size of magnetic flux is determined with the current and the number of turns which flow into a swirl type coil. That is, magnetic flux becomes largely, so that current is large, and magnetic flux becomes largely, so that there are many numbers of turns. Therefore, what is necessary is just to enlarge the current which passes many numbers of turns for the distance d short, in order to enlarge the electric power transmitted.
[0007]Direction of magnetic flux when the current I is sent through direction of the arrow of a figure is shown in Fig.2 (b). Namely, as for the sign, the sign with which the sign shown by x" in "O shows the direction of downward magnetic flux -" in "O from the paper side upper part

shows the direction of upward magnetic flux from the paper side lower part. The arrow A of Fig.2 (a) shows direction of magnetic flux.

[0008]In such noncontact type transfer-of-power equipment of composition, Supposing it sends the current I as shown in the figure at the power transmission side swirl type coils 12 and 13 of the power transmission part 10, the magnetic flux A generated with the power transmission side swirl type coils 12 and 13. the power transmission side swirl type coil 12 -> power transmission side soft magnetism --- material 11 -> power transmission side swirl type coil 13 -> power receiving side swirl type coil 23->, since it passes along the closed magnetic circuit which comprises the course of an order which is called swirl type coil 12 as for a power receiving side soft magnetism material 21 -> power receiving side swirl type coil 22 -> power transmission side, Magnetic flux can be prevented from leaking outside. Therefore, even if the power receiving side soft magnetism material 21 is approached and it arranges electronic parts, these electronic parts are not heated by the above-mentioned magnetic flux.

[0009]Conventional swirl type coil 30' used for the above-mentioned noncontact type transfer-of-power equipment is shown in Fig.3. In Fig.3, (a) is a plan view and (b) is a cross sectional view. Conventional swirl type coil 30' is using the wire with that circular sectional shape as this wire rod 31', as it is shown in Fig.3 (b), although spirally manufactured wire rod 31' by winding ******. A self welding wire is used as this wire rod (wire) 31'. The "self welding wire" refers to the line which covered copper wire with the insulator layer and covered the insulator layer in the self welding layer further here.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention]As described above, since sectional shape of the wire rod which constitutes the swirl type coil used for it was made rectangular, the noncontact type transfer-of-power equipment concerning the present invention can be efficiently rolled as compared with the wire of the conventional circular section. As compared with the wire of a circular section, the rectangular wire of a rectangular cross section has a good space factor, and an inductance value can be enlarged. When the size of magnetic flux is the same, the current which the direction of a rectangular wire sends as compared with a wire can be suppressed small, and there is also an advantage that copper loss is mitigable.

[Translation done.]

TECHNICAL PROBLEM

[Problem to be solved by the invention]As mentioned above, in conventional noncontact type transfer-of-power equipment, Since wire rod (wire) 31' with circular sectional shape is used as swirl type coil 30' used for it, there is a problem that it cannot do largely the inductance value of swirl type coil 30' since DETTO space has the bad SUTEPESU factor.
[0011]Therefore, the problem of the present invention has a good space factor, and there is in providing noncontact type transfer-of-power equipment provided with the swirl type coil which can do an inductance value largely.
[0012]There are other problems of the present invention in providing noncontact type transfer-of-power equipment provided with the swirl type coil which suppresses the current to send small and can reduce copper loss.

[Translation done.]

MEANS

[Means for solving problem]According to the present invention, are noncontact type transfer-of-power equipment which is provided with the power transmission part and receiving part which separated mutually and were arranged oppositely, and transmits electric power to the aforementioned receiving part by non-contact from the aforementioned power transmission part, and each of the aforementioned power transmission part and the aforementioned receiving part Soft magnetism material, Noncontact type transfer-of-power equipment, wherein the sectional shape of the wire rod which constitutes the aforementioned swirl type coil in the aforementioned noncontact type transfer-of-power equipment containing two or more swirl type coils mounted on this soft magnetism material is substantially rectangular is obtained.
[0014]According to the present invention, in the swirl type coil used for noncontact type transfer-of-power equipment, a swirl type coil, wherein the sectional shape of the wire rod which constitutes the aforementioned swirl type coil is substantially rectangular is obtained.
[0015]In the above-mentioned noncontact type transfer-of-power equipment and the above-mentioned swirl type coil, it is preferable that the aforementioned wire rod had a major axis and a minor axis, and the major axis direction of the aforementioned wire rod has extended in the direction orthogonal to the plane where the aforementioned swirl type coil is wound.

[Translation done.]

OPERATION

[Function]The difference with a wire with circular sectional shape and a rectangular wire with rectangular sectional shape is described. Supposing the radius of a wire is r, the cross-sectional area is pi-r^2, and height and width are equal to the diameter 2r. Suppose that the sectional shape of a rectangular wire is square. in this case, a length of one side of the rectangular wire of the square cross section at the time of considering it as the same cross-sectional area as the wire of a circular section -- root pi-r -- about -- it is 1.77r and becomes shorter than the diameter 2r of a wire. That is, as compared with the wire of a circular section, the direction of the rectangular wire of a square cross section becomes short also with height and width. Therefore, from using the rectangular wire of such a square cross section as a wire rod of a swirl type coil, as compared with the case where the wire of a circular section is used, the number of turns of the swirl type coil in the same region is increased, and distance between a power transmission part and a receiving part can also be shortened. As a result, electric power which can be transmitted can be done largely.
[0017]on the other hand -- height (long side) -- 2r -- the width (shorter side) of the rectangular wire of a rectangular cross section with a cross-sectional area equal to a wire -(pi/2) r -- about -- it is set to 1.57r. Therefore, from using the rectangular wire of such a rectangular cross section as a wire rod of a swirl type coil, as compared with the case where the wire of a circular section is used, the number of turns of a swirl type coil is increased, and electric power which can be transmitted can be largely done as a result.
[0018]width (long side) -- 2r -- the height (shorter side) of the rectangular wire of a rectangular cross section with a cross-sectional area equal to a wire -(pi/2) r -- about -- it is set to 1.57r. Therefore, from using the rectangular wire of such a rectangular cross section as a wire rod of a swirl type coil, as compared with the case where the wire of a circular section is used, distance between a power transmission part and a receiving part can be shortened, and electric power which can be transmitted can be largely done as a result.
[0019]What is necessary is for a cross-sectional area to be equal to a wire, and just to lengthen height (the length of a major axis) comparatively compared with width (the length of a minor axis) to make a number of turns very larger than the case of a wire. In this case, although distance between a power transmission part and a receiving part cannot be shortened, since a number of turns increases dramatically, magnetic flux is made largely, and electric power which can be transmitted can be largely done as a result.
[0020]
[Mode for carrying out the invention]Next, with reference to Drawings, it describes in detail about the present invention.
[0021]The fundamental composition of the noncontact type transfer-of-power equipment concerning the present invention is the same as that of what was shown in Fig.2, and the point of difference with the former is in the swirl type coil used for it. Therefore, below, it describes only about a swirl type coil and omits about the description of noncontact type transfer-of-power equipment.
[0022]The swirl type coil 30 concerning the 1 embodiment of the present invention is shown in Fig.1. In Fig.1, (a) is a plan view and (b) is a cross sectional view. Although spirally manufactured

the wire rod 31 by winding ******, as it is shown in Fig.1 (b), the rectangular wire with that rectangular sectional shape is being used for the illustrated swirl type coil 30 as this wire rod 31. As this wire rod (rectangular wire) 31, a self welding wire is used as usual.

[0023]For example, as the wire rod (rectangular wire) 31, width (the length of a minor axis) presupposes that height (the length of a major axis) considered the rectangular wire of pi-r as use by r so that Fig.1 may show. That is, the major axis direction of the wire rod 31 is making it extend in the direction orthogonal to the plane where the swirl type coil 30 is wound. The cross-sectional area of this rectangular wire 31 is equal to it of above-mentioned conventional wire 31'. However, since the width r is a half of the width 2r of wire 31', the rectangular wire 31 can make the number of turns wound on the same region twice wire 31'. As a result, although the distance d between the power transmission part 10 and the receiving part 20 becomes long slightly rather than the conventional thing, since a number of turns doubles, magnetic flux can be enlarged. As a result, the electric power which can be transmitted can be enlarged conventionally.

[0024]Thus, by making rectangular sectional shape of the wire rod 31 which constitutes the swirl type coil 30, it becomes possible to improve a space factor and to roll it efficiently, and an inductance value can be enlarged. On the contrary, when the case of wire 31' and the size of magnetic flux said-**, the rectangular wire 31 can suppress current small in circuit, and it can reduce copper loss as a result.

[0025]As mentioned above, although the preferable embodiment was mentioned as the example and described about the present invention, it cannot be overemphasized that various change is possible within limits which do not limit the present invention to the embodiment mentioned above, and do not deviate from the summary of the present invention. For example, the sectional shape of the wire rod which constitutes the number of turns of a swirl type coil and it of not limiting to the thing of the embodiment mentioned above is natural. For example, sectional shape may be square. In order to increase a number of turns, width may also make height (the length of a major axis (long side)) comparatively long (the length of a minor axis (shorter side)).

[Translation done.]

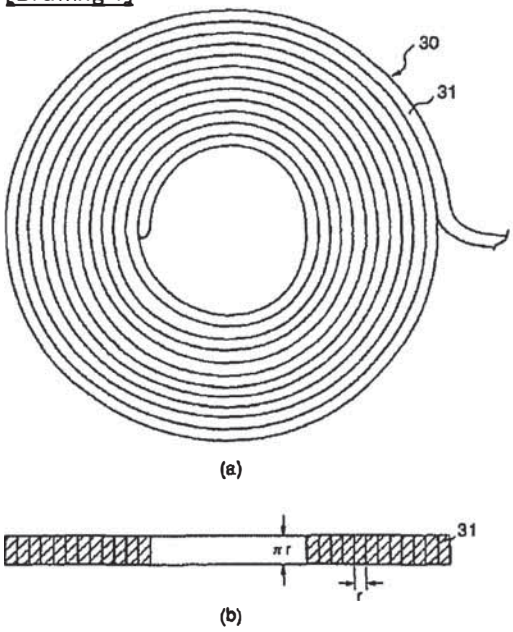
DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]It is a figure showing the swirl type coil used for the noncontact type transfer-of-power equipment by the 1 embodiment of the present invention, and (a) is a plan view and (b) is a cross sectional view.
[Drawing 2]It is a figure showing the schematic structure of conventional noncontact type transfer-of-power equipment, and (a) is a cross sectional view and (b) is a plan view of a power transmission part.
[Drawing 3]It is a figure showing the swirl type coil used for conventional noncontact type transfer-of-power equipment, and (a) is a plan view and (b) is a cross sectional view.
[Explanations of letters or numerals]
10 Power transmission part
11 Soft magnetism material
12 and 13 Swirl type coil
20 Receiving part
21 Soft magnetism material
22 and 23 Swirl type coil
30 Swirl type coil
31 Wire rod (rectangular wire)

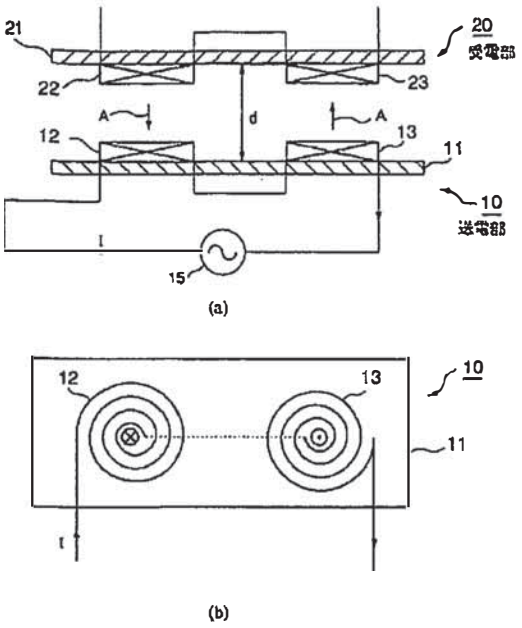
[Translation done.]

DRAWINGS

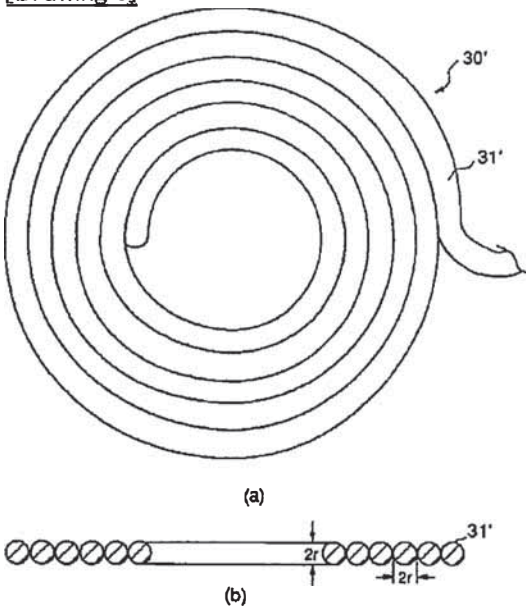
[Drawing 1]



[Drawing 2]



[Drawing 3]



[Translation done.]

Espacenet

Bibliographic data: JP2004047701 (A) — 2004-02-12

PLANAR MAGNETIC ELEMENT FOR NONCONTACT CHARGER

No documents available for this priority number.

Inventor(s): FUKUDA YASUTAKA; KOHIKI HIDEAKI; ECHIZENYA KAZUHIKO ± (FUKUDA YASUTAKA, ; KOHIKI HIDEAKI, ; ECHIZENYA KAZUHIKO)

Applicant(s): JFE STEEL KK; KAWATETSU MINING ± (JFE STEEL KK, ; KAWATETSU MINING CO LTD)

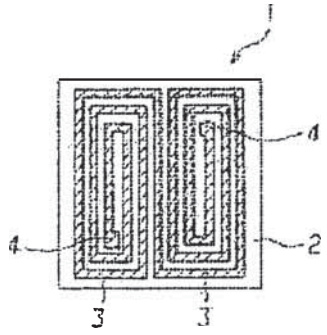
Classification: - international: ***H01F27/255; H01F27/28; H01F38/14;*** (IPC1-7): H01F27/255; H01F27/28; H01F38/14
- cooperative:

Application number: JP20020202514 20020711

Priority number (s): JP20020202514 20020711

Abstract of JP2004047701 (A)

PROBLEM TO BE SOLVED: To particularly suppress local heating of a planar surface magnetic element and to perform a large reduction in thickness, and to improve a charging efficiency in the planar magnetic element placed on a noncontact charger. ; SOLUTION: In the planar magnetic element for the noncontact charger of the structure, in which a spiral planar coil is embedded in one side surface of a magnetic layer, a plurality of planar coils are disposed in series on the same planar surface. ; COPYRIGHT: (C)2004,JPO



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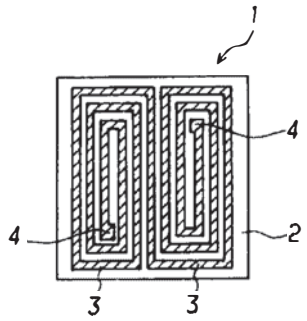
最終頁に続く

(54)【発明の名称】非接触充電器用平面磁気素子

(57)【要約】
【課題】非接触充電器に搭載される平面磁気素子に関し、特に該平面磁気素子の局所的な発熱を抑え、かつ、大幅な薄型化と充電効率向上を達成する。
【解決手段】磁性層の片面に、スパイラル型の平面コイルを埋設した構造となる非接触充電器用平面磁気素子であって、同一平面上に複数個の平面コイルを直列に配置してなる。
【選択図】　図１



【特許請求の範囲】
【請求項１】
磁性層の片面に、スパイラル型の平面コイルを埋設した構造となる非接触充電器用平面磁気素子であって、
同一平面上に複数個の平面コイルを直列に配置してなることを特徴とする非接触充電器用平面磁気素子。
【請求項２】
前記磁性層がフェライト磁粉から構成され、
前記磁性層中のフェライト磁粉の体積密度が２５ｖｏｌ　％以上であることを特徴とする請求項１に記載の非接触充電器用の平面磁気素子。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】
本発明は、非接触充電器に搭載される平面磁気素子に関し、特に該平面磁気素子の局所的な発熱を抑え、かつ、大幅な薄型化と充電効率向上を達成するものである。
【０００２】
【従来の技術】
近年の情報技術の普及に伴い、携帯電話や電子情報端末等の小型化、薄型化、軽量化が急速に進み、Ｌｉイオン電池やニッケル水素電池のような２次電池駆動の電源が多用されるようになってきている。
しかしながら、携帯機器は人体の近くに常備されることが多く、充電用の接点が露出した形では信頼性に問題を生じる恐れがあり、非接触式の充電システムが要望されている。
【０００３】
これまで、非接触充電システムとしては、主にシェーバーや電動歯ブラシなどの水回りの機器に用いられてきたが、最近では、例えば特開平２０００－７８７６３号公報に記載のように携帯電話やＰＨＳ　などの携帯用電子機器にも用いられるようになってきている。また、特に薄型のものとして、カード型非接触給電装置の例をあげることができる（Ｋａｎａｉ　ｅｔ　ａｌ．：ＩＥＥＥ　ＡＰＥＣ　Ｒｅｃｏｒｄ．ＰＰ．１１５７－１１６２（２０００）、金井ら：電気学会マグネティクス研究会ＭＡＧ－００－１５０等参照）。
【０００４】
このような非接触充電システム（非接触給電装置）における磁気素子としては、従来、フェライト板やアモルファス薄帯上に銅線を巻き回した構造、あるいは空心コイル構造を採用してきた。
しかしながら、これら従来の磁気素子には、構造上、次に述べるような問題があった。
（１）　コイル厚が１ｍｍ程度でかつ寸法が数ｃｍ角と大きいため、占有面積や体積が大きく、機器の小型化、薄型化を阻害する。
（２）　送電側からの磁束がコイル中を横切るため、受電コイル内で発生する渦電流による損失が大きい。
【０００５】
ところで、極薄型のコイルとしては、印刷法やシート法で形成したフェライト磁性膜を用いた平面型の磁気素子が知られている（特開平１１－２６２３９号公報等参照）。この平面型の磁気素子は、まず、フェライト粉にバインダを混ぜた磁性ペーストをＳｉ基板上に印刷、焼成することによって高抵抗のフェライト磁性膜を形成し、次に、　この膜上にコイルパターンをめっき法などで形成した後、さらにその上に磁性膜を形成して製作される。そして、薄型化はもちろん、コイル損失を効果的に抑制することに成功している。
【０００６】
【発明が解決しようとする課題】
しかしながら、かかる構造の磁気素子では、コイルの両側に磁性体を配置しているため、外部への磁束の取り出しおよび外部からの磁束の取り込みが充分とはいえず、受送電コイル間の磁束が充分に相互のコイルを横切らない。そのため、非接触充電器用としては充分

な能力を発揮することができず、本発明が対象とする非接触充電器用平面磁気素子として適用することができなかった。

【０００７】

本発明は、非接触充電器に搭載される平面磁気素子について、その更なる小型化、薄型化を可能とし、良好な充電効率を実現する非接触充電器用の平面磁気素子を提供するものである。

更に、本発明は、上記の非接触充電器に搭載される平面磁気素子において、局所的な発熱を抑え、一段の効率の向上を実現するものである。

【０００８】

【課題を解決するための手段】

本発明者らは、上記目的を達成すべく鋭意研究を重ね、磁性層の片面に、スパイラル型の平面コイルを埋設して平面磁気素子を形成するとともに、　さらに、当該平面コイルを複数個に分割形成し、直列接続することで所期の目的が有利に達成されることを見出した。

【０００９】

すなわち、本発明は、磁性層の片面に、スパイラル型の平面コイルを埋設した構造となる非接触充電器用平面磁気素子であって、同一平面上に複数個の平面コイルを直列に配置してなることを特徴とする非接触充電器用平面磁気素子によって上記課題を解決したのである。

また、本発明は、前記磁性層がフェライト磁粉から構成され、前記磁性層中のフェライト磁粉の体積密度が２５ｖｏｌ　％以上であることを好適とする。

【００１０】

【発明の実施の形態】

図１、図２に基づき、本発明の非接触充電器用平面磁気素子の好適な実施の形態について説明する。

平面コイルとしては、スパイラル状、ミアンダ状等の形状があるが、スパイラル状とすることがインダクタンスを大きくすることができ、本発明において好適である。

【００１１】

図１の平面磁気素子１は、磁性層２の片面に２つのスパイラル型の平面コイル３を直列に配置したものであり、平面コイル３の巻き線方向が逆向きとなるように配置している。こうすることで、隣り合ったコイル線間の磁気結合をおおきくすることができ、特に好適である。

また、図２に示すように、４つの平面コイル３を磁性層２の片面に配置して平面磁気素子１を構成するようにしてもよい。この場合、図示のように平面コイルの所定の端子間を配線５で接続し、直列接続となす。

【００１２】

このように、平面磁気素子１に形成する平面コイル３を分割して形成・配置し、直列に接続することで、コイルのターン数を分割することができ、コイルに集中して発生する局所的な発熱を分散することが可能となる。

また、１つのコイル内のコイル線を短くすることができ、直流抵抗を低減できる。さらに、平面コイルのコイルに囲まれた中窓の面積を大きくとることが可能となり、相対的にコイル中を横切る磁束を低減することができ、発熱を抑えて、受電効率を向上できる。

【００１３】

一方、比較のため図３に示すように、磁性層２の片面に１つのスパイラル型の平面コイルのみを形成した構成とすると、発熱が１つのコイルに集中することになり、また、平面コイル中のコイル線の長さが長くなって直流抵抗が増してしまう。更に、コイルに囲まれた中窓の面積を大きくとることもできない。

なお、磁性層中のフェライト磁粉としては、ＮｉＺｎフェライトを好適とする。平面コイルのコイル線間にフェライト磁性樹脂を充填し、磁性層を形成するには、フェライト磁粉と樹脂バインダの混合物をスクリーン印刷法で刷り込むなどの方法があり、容易に達成することができる。

【００１４】
本発明の平面磁気素子は、図４に示すように、非磁性の基板７、例えば、Ｓｉ基板、アルミナ基板等に絶縁樹脂層６を介して平面コイル３を形成し、この非磁性の基板７側が送電装置１０側となるように配置することで非接触充電を行うようにする。
また、図５に示すように、フェライト基板８上に平面コイル３を形成し、コイル線間に磁性層２を充填して形成するようにしてもよい。この場合、平面コイル３の表面を絶縁樹脂層６で被膜する。
【００１５】
なお、送電装置１０は、本発明の平面磁気素子と同じ平面コイルを採用しても良く、また、図４、図５に示すように巻線コイルとしても良い。どの方式を採用するかは、送電条件等によって適宜選択することができる。ただし、送電側コイルは、図４、図５に示すように、受電側の平面磁気素子中の平面コイルに対向する配置に一致させる配置とすることを好適とする。
【００１６】
次に、　磁性層がフェライト磁粉から構成され、前記磁性層中のフェライト磁性粉の体積密度を２５ｖｏｌ　％以上とすることを好適とする点について説明する。
フェライト磁粉の体積密度を２５ｖｏｌ　％以上とするのは、２５ｖｏｌ　％未満であると、　充電器側の送電コイルと機器本体側の受電コイル間の磁気的な結合、すなわち、次式に示す結合係数ｋが小さくなり、　充分な充電特性が得られないからである。
【００１７】
$k = M / (L_1 \times L_2)^{1/2}$
ここで、Ｍ：相互インダクタンス（Ｈ）
L_1　：送電コイルの自己インダクタンス（Ｈ）
L_2　：受電コイルの自己インダクタンス（Ｈ）
なお、このような磁性層は、所望の組成のフェライト磁粉をエポキシ樹脂などのバインダで固着して形成することができる。
【００１８】
また、この体積密度は、磁気素子全体において、必ずしも同一である必要はなく、磁性層、中窓およびコイル線間など、場所に応じて１種または２種以上の体積密度の磁性体を用いることができる。
また、本発明において、磁性層の厚みを５～５００　μｍ程度とすることが好ましい。例えば、フェライト磁粉の体積密度の調整により、適切な磁性層の厚みを調整することができるが、この厚みが５μｍに満たないと送電側からの磁束の取り込み効果が乏しくなり、一方、５００　μｍを超えると磁気素子が厚くなって機器の薄型化を阻害するからである。
【００１９】
なお、本発明の平面磁気素子は、　コイルを形成したままの状態でそのまま使用しても構わないが、表面を保護するために、図５に示すように、コイル形成側に、エポキシ樹脂、ポリイミド樹脂などの絶縁樹脂やガラス等の非磁性でかつ電気的絶縁体からなる保護被膜である絶縁樹脂層６を被覆することが有利である。また、図４に示すように、当該絶縁樹脂層６に加えて、　アルミナ等のセラミックスやシリコンなど非磁性の薄い板状の非磁性の基板７で覆うことは、強度を確保する上で有効である。
【００２０】
【実施例】
本発明の平面磁気素子の代表的な製造方法を説明する。なお、以下に記載の寸法等の具体的数値は、代表的な構成を例示するものであり、　何ら数値を限定するものではない。
（１）　Ｓｉ基板上にＮｉ－Ｚｎ系のフェライトペーストをスクリーン印刷・焼成することで４０μｍ厚となるように形成する。
（２）　その上に、ポリイミド樹脂を塗布し、さらにＣｕシード層を０．５　μｍ厚として成膜する。

（３） その上に、レジストを塗布し、例えば、片側１０ターン、両側で計２０ターンの平面コイルパターンを露光・現像し、レジストフレームを形成する。
（４） 上記レジストフレーム内に、電気めっき法でＣｕを析出させる。
（５） レジスト剥離後、エッチングにより不要なＣｕシード層を除去する。
（６） フェライト磁粉をエポキシ樹脂に混ぜたペーストを、スクリーン印刷法にて、形成した平面コイルの線間および中窓に充填・熱硬化する。

【００２１】

以上の工程で、図４に例示の平面磁気素子が完成する。また、フェライト基板上に、上記と同様にＣｕを形成して平面コイルとなし、その線間および中窓にフェライト磁粉をエポキシ樹脂に混ぜたペーストを充填・熱硬化させ、最後に、保護被覆として絶縁樹脂層を形成することで、図５に例示する平面磁気素子を完成することができる。

【００２２】

次に、図１および図４に例示のように、２つの平面コイルを直列接続して形成した本発明の平面磁気素子（以下、本発明例とよぶ。）を製作し、その特性評価を行った結果について説明する。
なお、比較のため、図３に示す平面コイルを１つとした平面磁気素子（以下、比較例とよぶ。）を製作して同様の特性評価を実施している。

【００２３】

フェライト組成は、すべて、Fe_2O_3：４９ ｍｏｌ％、ＺｎＯ：２８ ｍｏｌ％、ＮｉＯ：２８ ｍｏｌ％の組成とした。
まず、Ｓｉ基板上に上記組成のフェライトペーストを印刷後、焼成し、４０μｍ厚のフェライト層を形成した。この上に、ポリイミド樹脂をスピンコートによって３μｍ厚に成膜した後、無電解めっき法で０．５ μｍ厚のＣｕをシード層として全面に成膜した。その上に、レジストの塗布・露光・現像処理を行い、スパイラル形状の平面コイル形成用のレジストフレームを形成した。この後、電気Ｃｕめっきを行い、レジスト剥離後、不要のＣｕシード層をエッチング除去した。完成した平面コイルは、厚さ８０μｍ、片側１５ターン、両側で計３０ターンである。次に、フェライト磁粉の体積率を６０ｖｏｌ ％としたエポキシ樹脂ペーストの充填を行い、熱硬化させて磁性層を形成し、本発明例の平面磁気素子を完成させた。

【００２４】

一方、上記と同じ製法で比較例の平面磁気素子を作成した。比較例の平面コイルは、２０ターンのものを１つとした。
送電装置側は、それぞれの平面コイルに対応する送電コイルを配置して形成した。それぞれの送電コイルは、焼結フェライトコアに導線をコイルに巻いて形成した。送電装置の駆動周波数は１００ ｋＨｚ、送受電コイル間のギャップを２ｍｍに設定した。得られた特性の比較を表１に示す。

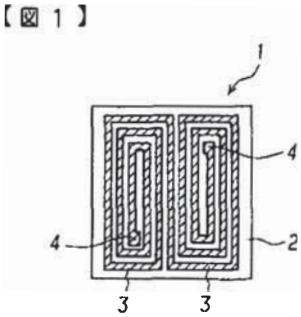
【００２５】

【表１】

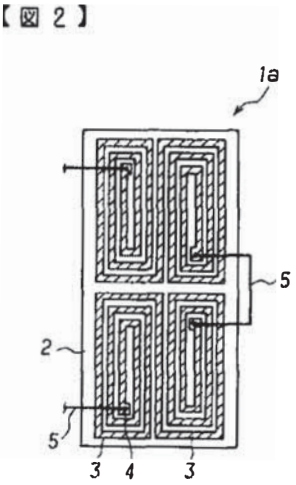
	誘起電圧（V）	ｺｲﾙ直流抵抗（Ω）	ΔT （℃）
本発明例	6	0.8	30
比較例	5	1.0	40

【００２６】
表１から明らかなように、比較例に比べて、本発明例では、その誘起電圧が上回っており、また、コイル直流抵抗が小さくなっている。また、発熱による昇温（ΔＴ）についても比較例よりも本発明例の方が小さくなっており、本発明の効果は明らかである。
【００２７】
【発明の効果】
本発明によれば、きわめて薄型化され、充電効率の高い非接触充電器用磁気素子を得ることができ、局所的な発熱も抑えることができるようになった。
【図面の簡単な説明】
【図１】本発明の非接触充電器用平面磁気素子の模式平面図である。
【図２】本発明の別形態の非接触充電器用平面磁気素子の模式平面図である。
【図３】１つの平面コイルで構成した非接触充電器用平面磁気素子（比較例）の模式平面図である。
【図４】本発明の非接触充電器用平面磁気素子と給電装置の模式断面図である。
【図５】構造の異なる本発明の非接触充電器用平面磁気素子と給電装置の模式断面図である。
【符号の説明】
１、１ａ、１ｂ　非接触充電器用平面磁気素子
２　磁性層
３　平面コイル
４　端子
５　配線
６　絶縁樹脂層
７　非磁性の基板（Ｓｉ基板、アルミナ基板）
８　フェライト基板
１０　送電装置
１１　フェライトコア
１２　巻線コイル

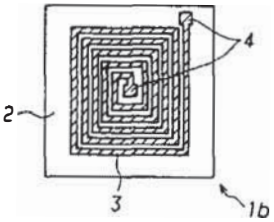
【図１】


1
4
4
2
3
3

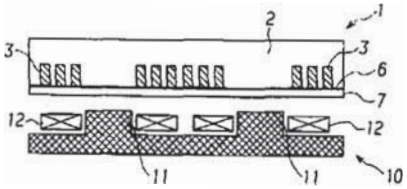
【図２】


1a
5
2
5
3
4
3

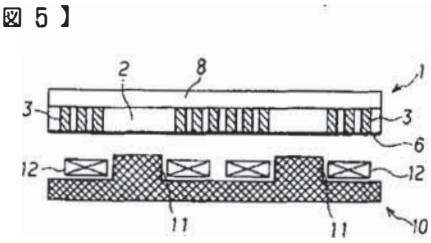
【図３】


4
2
3
1b

【図４】


2
1
3
3
6
7
12
12
11
11
10

【図５】


2
8
1
3
3
6
12
12
11
11
10

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(54) PLANAR MAGNETIC ELEMENT FOR NONCONTACT CHARGER

(57)Abstract:
PROBLEM TO BE SOLVED: To particularly suppress local heating of a planar surface magnetic element and to perform a large reduction in thickness, and to improve a charging efficiency in the planar magnetic element placed on a noncontact charger.
SOLUTION: In the planar magnetic element for the noncontact charger of the structure, in which a spiral planar coil is embedded in one side surface of a magnetic layer, a plurality of planar coils are disposed in series on the same planar surface.