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(71) Applicant: **T.S.E Co., Ltd.**
Busan 46026 (KR)

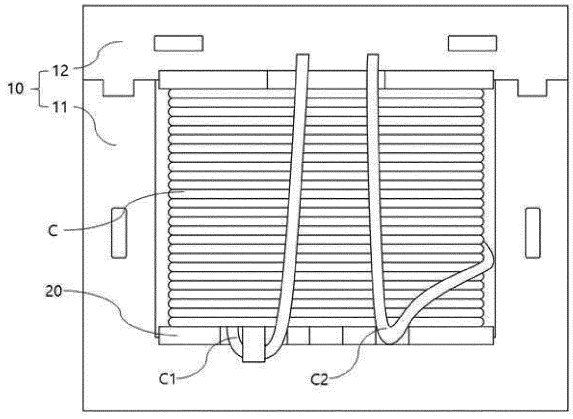
(72) Inventor: **CHA, Wha Jun**
Busan 48298 (KR)

(74) Representative: **Gulde & Partner**
Patent- und Rechtsanwaltskanzlei mbB
Wallstraße 58/59
10179 Berlin (DE)

(54) REACTOR FOR REDUCING HARMONIC WAVES

(57) The present invention relates to a reactor for reducing harmonics, and more specifically, a reactor for reducing harmonics that is capable of providing a structure of a bobbin wherein one end of a coil is spaced apart from the other end of the coil, while the coil is being wound compactly around a limited space of the bobbin, thereby ensuring high L and resistance values even in an appropriate size thereof to satisfy the Class D European standards.

FIG 1.



EP 4 071 775 A1

Description

[Technical Field]

[0001] The present invention relates to a reactor for reducing harmonics, and more specifically, a reactor for reducing harmonics that is capable of having a mounting groove and a projection formed on a bobbin around which a coil is wound to allow one end of the coil to be spaced apart from the other end thereof, thereby preventing a short circuit from occurring.

[Background Art]

[0002] An alternating voltage and an alternating current are sinusoids, but input current to a rectifier, inverter, etc. is a distorted wave that is distorted in waveform, not sinusoids. The distortion wave means that frequency components having an integer multiple of the fundamental frequency of 50 or 60 Hz are overlaid on the fundamental frequency to cause distortion in waveform, and the high frequency components overlaid on the fundamental frequency are called harmonics. The third order harmonic is the third multiple of the fundamental frequency, and the fifth order harmonic is the fifth multiple of the fundamental frequency. The harmonic distortion is generated by the load of a power system, the non-linear characteristics of equipment, and most of power electronic devices using a switching operation of a power semiconductor device.

[0003] The harmonic distortion causes power loss and quality degradation, and due to the lost power, overheating of equipment and a conductor and malfunctions of a motor and equipment may occur, thereby having problems of a transformer and power distribution. Accordingly, the harmonic regulation is adopted to efficiently operate power generation equipment by country. According to IEC/EN 61000-3:2014 of Europe, the existing Class A standard is changed to Class D standard on July 2017 to strictly regulate harmonic emission.

[0004] To reduce the harmonics emitted, an active Power Factor Controller (PFC) is adopted to control a current pulse width, or a passive PFC is adopted to suppress the peak value of charging current by means of a reactor and to enlarge a conduction angle, so that a waveform of input current at an alternating current side becomes close to the sinusoids.

[0005] If it is desired to reduce the harmonics by means of the reactor, inductance (L value) as well as series resistance (R value) have to be made to given levels, thereby extending a charging section and reducing harmonic components according to attenuation and resonance characteristics. However, if the number of turns of a coil is increased to raise the L value, the resistance value of the reactor becomes high. In this case, however, the reactor is increased in size to cause negative functions such as the increase of power consumption, and therefore, there is a need to ensure high L and R values in the reactor with an appropriate size.

[0006] In the case where the coil is wound in a limited space to achieve high L value, however, the coil collectedly puts together in the condense space so that current may not flow to a designed length, a short circuit may occur to raise the current within a circuit, heat may be generated from an electric wire to cause fire dangers, and substrate circuit elements may not be resistant to current intensity and thus burned.

[Prior Art Documents]

[Patent Literature]

[0007]

(Patent literature 1) Korean Patent Application Laid-open No. 10-1999-017745
(Patent literature 2) Korean Patent No. 10-0996979

[Disclosure]

[Technical Problem]

[0008] Accordingly, the present invention has been made in view of the above-mentioned problems occurring in the related art, and it is an object of the present invention to provide a reactor for reducing harmonics that is capable of providing a structure of a bobbin wherein one end of a coil is spaced apart from the other end of the coil, even while the coil is being wound compactly around a limited space of the bobbin, thereby ensuring high L and resistance values even in an appropriate size thereof to satisfy the Class D European standard.

[0009] It is another object of the present invention to provide a reactor for reducing harmonics that is capable of providing a structure of a core wherein a coupling way of two core parts is improved to allow a central portion of one core part to be spaced apart from the other core part to form a given air gap, thereby ensuring desired L and resistance values.

[0010] The technical problems to be achieved through the present invention are not limited as mentioned above, and other technical problems not mentioned herein will be obviously understood by one of ordinary skill in the art through the following description.

[Technical Solution]

[0011] To achieve the above-mentioned problems, there is provided a reactor for reducing harmonics according to the present invention that is provided with a bobbin structure in which one end of a coil is mounted on a mounting groove, so that current flows to the coil to the wound shape, thereby causing no short circuit and ensuring desired L and resistance values.

[0012] Hereinafter, the present invention will be explained in detail.

[0013] According to the present invention, there is provided a reactor for reducing harmonics including: a core formed of a plurality of stacked silicon steel sheets and having an E-shaped core part and an I-shaped core part coupled to top of the E-shaped core part, both ends of the E-shaped core part being contactedly coupled to both ends of the I-shaped core part, and the central portion of the E-shaped core part being spaced apart from the I-shaped core part by a given air gap; and a bobbin having an accommodation hole formed on the inner peripheral surface thereof correspondingly to the central portion of the core to be press-fitted to the central portion of the core and a winding part and edge parts disposed on the outer peripheral surface thereof, the winding part being adapted to wind a coil therearound and the edge parts being adapted to hold the position of the coil C wound, wherein the edge part of the bobbin has a mounting groove extending to the outer peripheral surface of the winding part to mount one end of the coil wound.

[0014] According to the present invention, the E-shaped core part and the I-shaped core part are coupled to each other by means of the insertion of protrusions into coupling grooves.

[0015] According to the present invention, the bobbin may have a projection formed outwardly from the edge part on which the mounting groove is formed, and one end of the coil passes through the mounting groove from the outer peripheral surface of the winding part, is wound around the projection, and is then seated on the outer peripheral surface of the bobbin.

[0016] According to the present invention, the bobbin may have a guide groove formed on one surface of the edge part on which the mounting groove is formed to guide the mounting position of the other end of the coil that corresponds to the mounting groove.

[0017] According to the present invention, the winding part around which the coil is wound may be surrounded by an insulation sheet, and one end and the other end of the coil are connected correspondingly to lead wires on the outside of the insulation sheet by means of soldering.

[0018] According to the present invention, the bobbin may have mounting grooves symmetrically formed on one surface of the edge part to mount one end and the other end of the coil, respectively and electrode pins located on one surface of the edge part on which the mounting grooves are formed to wind one end and the other end of the coil drawn from the mounting grooves, the electrode pins being connected to one end of the other end of the coil by means of soldering.

[0019] According to the present invention, the bobbin may have projections symmetrically formed outwardly from the edge part on which the mounting grooves are formed, and one end and the other end of the coil pass through the mounting grooves from the outer peripheral surface of the winding part, are wound around the projections and the electrode pins sequentially, and are then connected to the electrode pins by means of soldering.

[0020] According to the present invention, the reactor for reducing harmonics may further include a cover adapted to surround the outsides of the core and the bobbin.

[Advantageous Effects]

[0021] According to the present invention, the reactor for reducing harmonics is configured to have the mounting groove and the projection formed on the bobbin around which the coil is wound to mount one end of the coil thereon, so that one end of the coil is spaced apart from the other end of the coil, and even though the coil is wound compactly in a limited space of the bobbin, accordingly, there are no fire dangers due to a short circuit.

[0022] According to the present invention, in addition, the reactor for reducing harmonics is configured to allow the coil to be systematically wound around the bobbin through the mounting groove and the projection formed on the bobbin, so that the coil can be compactly wound, without any short circuit, and high L and resistance values can be ensured even in an appropriate size thereof to thus satisfy the Class D European standard.

[0023] According to the present invention, further, the reactor for reducing harmonics is configured to allow the E-shaped core part and the I-shaped core part to be fastened to each other by means of the coupling groove and the protrusion to form the desired air gap in design, thereby enhancing the reliability of the product.

[0024] The effectiveness of the invention is not limited as mentioned above, and it should be understood to those skilled in the art that the effectiveness of the invention may include another effectiveness as not mentioned above from the detailed description of the present invention.

[Brief Description of Drawings]

[0025]

FIG. 1 is a front view showing a reactor for reducing harmonics according to one embodiment of the present invention,

FIG. 2 is a front view showing a coupling relation of a core of the reactor for reducing harmonics according to the present invention.

FIG. 3 is a partially enlarged view showing a bobbin of the reactor for reducing harmonics according to the present invention to express the form of the coil C wound around the bobbin.

FIGs. 4a and 4b are front and sectional views showing the bobbin of the reactor for reducing harmonics according to the present invention to express a coupling relation between the coil and lead wires.

FIG. 5 is a perspective view showing a bobbin of a reactor for reducing harmonics according to another embodiment of the present invention.

[Mode for Invention]

[0026] The terms used in the present invention are to be given their ordinary and customary meaning to a person of ordinary skill in the art, and are not to be limited to a special or customized meaning unless expressly so defined herein. It should be noted that the use of particular terminology when describing certain features or aspect of the disclosure should not be taken to imply that the terminology is being re-defined herein to be restricted to include any specific characteristics of the features or aspects of the disclosure with which that terminology is associated.

[0027] All terms used herein, including technical or scientific terms, unless otherwise defined, have the same meanings which are typically understood by those having ordinary skill in the art. The terms, such as ones defined in common dictionaries, should be interpreted as having the same meanings as terms in the context of pertinent technology, and should not be interpreted as having ideal or excessively formal meanings unless clearly defined in the specification.

[0028] Hereinafter, an explanation of the present invention will be given in detail. Before the present invention is disclosed and described, it is to be understood that the disclosed embodiments are merely exemplary of the invention, which can be embodied in various forms. Those skilled in the art will envision many other possible variations within the scope of the present invention. In the description, the thicknesses of the lines or the sizes of the components shown in the drawing may be magnified for the clarity and convenience of the description. The term "reactor for reducing harmonics" used in the specification is simply called "reactor".

[0029] FIG. 1 is a front view showing a reactor for reducing harmonics according to the present invention, wherein a bobbin 20 around which a coil C is wound and a core 10 are coupled to each other, and FIG. 2 is a front view showing a coupling relation of the core 10 of the reactor for reducing harmonics according to the present invention. FIG. 3 is a partially enlarged view showing the bobbin 20 of the reactor for reducing harmonics according to the present invention to express the form of the coil C wound around the bobbin 20, and FIGs. 4a and 4b are front and sectional views showing the bobbin 20 of the reactor for reducing harmonics according to the present invention to express a coupling relation between the coil C and lead wires 40.

[0030] The present invention relates to a reactor for reducing harmonics that is capable of satisfying the reinforced European standards for harmonic generation limitations, and as shown in FIG. 2, the reactor for reducing harmonics according to the present invention includes a core 10 and a bobbin 20 around which a coil C is wound.

[0031] The core 10 is formed of a plurality of stacked silicon steel sheets, and as shown in FIGs. 1 and 2, the core 10 is largely divided into an E-shaped core part 11 and an I-shaped core part 12 coupled to top of the E-shaped core part 11. Both ends of the E-shaped core part 11 are contactedly coupled to both ends of the I-shaped core part 12, and the central portion of the E-shaped core part 11 is spaced apart from the I-shaped core part 12 to form an air gap G therebetween. If the air gap G is large, the L value becomes low, and contrarily, if the air gap G is short, the L value becomes high. Accordingly, the air gap G is a factor having an influence on the L value, and so as to ensure desired L value, it is important to form the air gap G as designed. The number of stacked silicon steel sheets on top of each other, the widths of the E-shaped core part 11 and the I-shaped core part 12, and the size of the air gap G formed by the separation of the central portion of the E-shaped core part 11 from the I-shaped core part 12 are determined by calculating the L value and the resistance value according to the capacity of the reactor.

[0032] As designed, further, the core 10 is made by stacking the silicon steel sheets, and the E-shaped core part 11 and the I-shaped core part 12 have to be made to have the shapes and widths as designed. As mentioned above, the size of the air gap G has an influence on the L value, and accordingly, there is a need to couple the E-shaped core part 11 and the I-shaped core part 12 to each other so as to achieve the desired air gap G in design. According to the present invention, the E-shaped core part 11 has coupling grooves 13 formed on both ends thereof, and the I-shaped core part 12 has protrusions 14 protruding from both ends thereof, so that through the insertion of the protrusions 14 into the coupling grooves 13, they are coupled to each other. Accordingly, the central portion of the E-shaped core part 11 is spaced apart from the I-shaped core part 12 to form the desired air gap G, thereby providing the core 10 configured to be capable of ensuring the desired L and resistance values and improving the reliability of the product. As shown in FIG. 2, in specific, the coupling grooves 13 are formed on both ends of the E-shaped core part 11, and the protrusions 14 are formed on both ends of the I-shaped core part 12, so that the protrusions 14 are inserted into the coupling grooves 13. Contrarily, of course, protrusions (not shown) are formed on both ends of the E-shaped core part 11, and coupling grooves (not shown) are formed on both ends of the I-shaped core part 12, so that the protrusions are inserted into the coupling grooves.

[0033] The bobbin 20 around which the coil C is wound has an accommodation hole 21 (See FIG. 5) formed on the inner peripheral surface thereof to correspond to the central portion of the E-shaped core part 11, so that the accommodation hole 21 is press-fitted to the central portion of the core 10. In this case, the central portion of the E-shaped core part 11 and the accommodation hole 21 of the bobbin 20 desirably come into close contact with each other, without any gap formed by their separation, to prevent generation of noise when the reactor operates.

[0034] Further, the bobbin 20 has a winding part 22

and edge parts 23 disposed on the outer peripheral surface thereof. The winding part 22 means a portion of the outer peripheral surface of the bobbin 20, where the coil C is wound. The edge parts 23 are located on top and underside of the winding part 22 and extend outwardly from both sides of the winding part 22 to hold the position of the coil C wound around the winding part 22. The widths of the edge parts 23 are determined to allow the distance between both ends of the edge parts 23 to correspond to the central portion of the E-shaped core part 11, so that the edge parts 23 come into close contact with the central portion to prevent generation of noise when the reactor operates and to suppress defective products from being made due to vibrations.

[0035] Further, the bobbin 20 has a mounting groove 23a formed inwardly from the edge part 23 to mount one end C1 of the coil C wound, as shown in an enlarged portion A of FIG. 3. As one end C1 of the coil C is predrawn from the edge part 23 through the mounting groove 23a, it is spaced apart from the other end C2 of the coil C and the bottom of the coil C wound behind (See an area a-a' of FIG. 3A), so that without any short circuit, the coil C can be compactly and systematically wound.

[0036] Moreover, the bobbin 20 has a projection 23b formed outwardly from the edge part 23 on which the mounting groove 23a is formed, as shown in an enlarged portion B of FIG. 3, and one end C1 of the coil C drawn through the mounting groove 23a is wound around the projection 23b and then seated on the outer peripheral surface of the bobbin 20. Accordingly, one end C1 of the coil C is spaced apart from the other end C2 of the coil C and the bottom of the coil C wound behind (See the area a-a' of FIG. 3A), and further, when one end C1 of the coil C is seated on the outer peripheral surface of the bobbin 20 for next wiring, it is seatedly wound around the projection 23b, so that it can be stably spaced apart from the bottom of the coil C wound. Contrarily, in the case where one end C1 of the coil C is seated on the outer peripheral surface of the bobbin 20, without any projection 23b, the separation distance between one end C1 of the coil C and the bottom of the coil C wound is not stably kept, thereby causing a failure and a short circuit during manufacturing and working processes. In addition, the projection 23b has to be formed on the side of the mounting groove 23a so that it can compactly and stably fix one end C1 of the coil C, and further, a fixing groove 23c is formed on the opposite side to the mounting groove 23a with respect to the projection 23b to fix a seating position of one end C1 of the coil C on the outer peripheral surface of the bobbin 20. The fixing groove 23c has a lower depth than the mounting groove 23a so that the thickness of the coil C wound can be considered. That is, the fixing groove 23c has a lower depth by the thickness of the coil C wound than the mounting groove 23a.

[0037] Further, the bobbin 20 has a guide groove 23d formed on one surface of the edge part 23 on which the mounting groove 23a is formed to guide the mounting position of the other end C2 of the coil C that corresponds to the mounting groove 23a, as shown in an enlarged portion C of FIG. 3. Accordingly, the other end C2 of the coil C is seated on the outer peripheral surface of the bobbin 20, while being spaced apart from one end C1 of the coil C, thereby suppressing a short circuit and a defective product from being generated. The guide groove 23d is formed on the same surface as the edge part 23 on which the mounting groove 23a is formed so as to perform next wiring, but in this case, the guide groove 23d is spaced apart from the mounting groove 23a to the maximum so as to prevent one end C1 of the coil C from coming into contact with the other end C2 of the coil C.

[0038] As shown in FIGs. 4a and 4b, further, one end C1 and the other end C2 of the coil C are connected correspondingly to lead wires 40 to perform wiring. In this case, an insulation sheet 30 is wound around the winding part 22 around which the coil C is wound, and one end C1 and the other end C2 of the coil C are connected to the lead wires 40 on the outside of the insulation sheet 30 by means of soldering, as shown in FIG. 4a. In this case, as shown in FIG. 4b, each lead wire 40 is put into the double insulation sheet 30 to completely prevent the short circuit of the coil C from occurring. Even though not shown, an insulation tape is wound around the bobbin 20 after the coil C has been wound and connected to the lead wires 40, thereby stably maintaining the structure of the bobbin 20.

[0039] Additionally, the reactor for reducing harmonics according to the present invention is connected to a substrate by means of not only the lead wires 40 but also pins, and a reactor for reducing harmonics according to another embodiment of the present invention will be explained with reference to FIG. 5. FIG. 5 is a perspective view showing a bobbin 20 of the reactor for reducing harmonics according to another embodiment of the present invention.

[0040] According to another embodiment of the present invention, mounting grooves 23a are symmetrically formed on one surface of the edge part 23 to mount one end C1 and the other end C2 of the coil C, and electrode pins 40' are located on one surface of the edge part 23 on which the mounting grooves 23a are formed to wind one end C1 and the other end C2 of the coil C drawn from the mounting grooves 23a. After that, one end C1 and the other end C2 of the coil C wound around the electrode pins 40' are connected to the electrode pins 40' by means of soldering. In this case, the coil C is directly connected to the substrate by means of the electrode pins 40, thereby enabling the reactor to be more directly located in the substrate.

[0041] According to another embodiment of the present invention, further, projections 23b are symmetrically formed outwardly from the edge part 23 on which the mounting grooves 23a are formed, and one end C1 and the other end C2 of the coil C pass through the mounting grooves 23a from the outer peripheral surface of the winding part 22 and are wound around the projections

23b and the electrode pins 40 sequentially. After that, one end C1 and the other end C2 of the coil C wound around the electrode pins 40' are connected to the electrode pins 40' by means of soldering. Through the formation of the projections 23b, as mentioned above, one end C1 and the other end C2 of the coil C are turnedly wound from the bottom of the coil C wound and thus stably spaced apart from the bottom of the coil C wound, thereby preventing a short circuit or a manufacturing failure from occurring.

[0042] In addition, the contents as explained in one embodiment of the present invention may be applied to another embodiment of the present invention except the wiring process if there is no contradiction therebetween, which is obvious to a person having ordinary skill in the art.

[0043] Moreover, the reactor for reducing harmonics according to one embodiment or another embodiment of the present invention may further include a cover (not shown).

[0044] In specific, the reactor for reducing harmonics according to the present invention includes the cover adapted to surround the outsides of the core 10 and the bobbin 20 to protect the core 10 and the bobbin 20 around which the coil C is wound from the outside. Even though not shown, a band may be additionally needed to fix the reactor to the substrate, and other parts, which are not explained in the description, may be further provided.

[0045] The foregoing description of the embodiments of the invention has been presented for the purpose of illustration; it is not intended to be exhaustive or to limit the invention to the precise forms disclosed. Persons skilled in the relevant art can appreciate that many modifications and variations are possible in light of the above teachings. It is therefore intended that the scope of the invention be limited not by this detailed description, but rather by the claims appended hereto.

[Explanations of Reference Numerals]

[0046]

10: Core
11: E-shaped core part
12: I-shaped core part
13: Coupling groove
14: Protrusion
20: Bobbin
21: Accommodation hole
22: Winding part
23: Edge part
23a: Mounting groove
23b: Projection
23c: Fixing groove
23d: Guide groove
30: Insulation sheet
40: Lead wire
40': Electrode pin
50: Cover
C: Coil
C1: One end of coil
C2: The other end of coil
G: Air gap

Claims

1. A reactor for reducing harmonics comprising:

   a core formed of a plurality of stacked silicon steel sheets and having an E-shaped core part and an I-shaped core part coupled to top of the E-shaped core part, both ends of the E-shaped core part being contactedly coupled to both ends of the I-shaped core part, and the central portion of the E-shaped core part being spaced apart from the I-shaped core part by a given air gap; and
   a bobbin having an accommodation hole formed on the inner peripheral surface thereof correspondingly to the central portion of the core to be press-fitted to the central portion of the core and a winding part and edge parts disposed on the outer peripheral surface thereof, the winding part being adapted to wind a coil therearound and the edge parts being adapted to hold the position of the coil C wound,
   wherein the edge part of the bobbin has a mounting groove extending to the outer peripheral surface of the winding part to mount one end of the coil wound.

2. The reactor for reducing harmonics according to claim 1, wherein the E-shaped core part and the I-shaped core part are coupled to each other by means of the insertion of protrusions into coupling grooves.

3. The reactor for reducing harmonics according to claim 1, wherein the bobbin has a projection formed outwardly from the edge part on which the mounting groove is formed, and one end of the coil passes through the mounting groove from the outer peripheral surface of the winding part, is wound around the projection, and is then seated on the outer peripheral surface of the bobbin.

4. The reactor for reducing harmonics according to claim 1, wherein the bobbin has a guide groove formed on one surface of the edge part on which the mounting groove is formed to guide the mounting position of the other end of the coil that corresponds to the mounting groove.

5. The reactor for reducing harmonics according to claim 1, wherein the winding part around which the coil is wound is surrounded by an insulation sheet,

and one end and the other end of the coil are connected correspondingly to lead wires on the outside of the insulation sheet by means of soldering.

6. The reactor for reducing harmonics according to claim 1, wherein the bobbin has mounting grooves symmetrically formed on one surface of the edge part to mount one end and the other end of the coil, respectively and electrode pins located on one surface of the edge part on which the mounting grooves are formed to wind one end and the other end of the coil drawn from the mounting grooves, the electrode pins being connected to one end of the other end of the coil by means of soldering.

7. The reactor for reducing harmonics according to claim 6, wherein the bobbin has projections symmetrically formed outwardly from the edge part on which the mounting grooves are formed, and one end and the other end of the coil pass through the mounting grooves from the outer peripheral surface of the winding part, are wound around the projections and the electrode pins sequentially, and are then connected to the electrode pins by means of soldering.

8. The reactor for reducing harmonics according to claim 1, further comprising a cover adapted to surround the outsides of the core and the bobbin.

FIG 1.

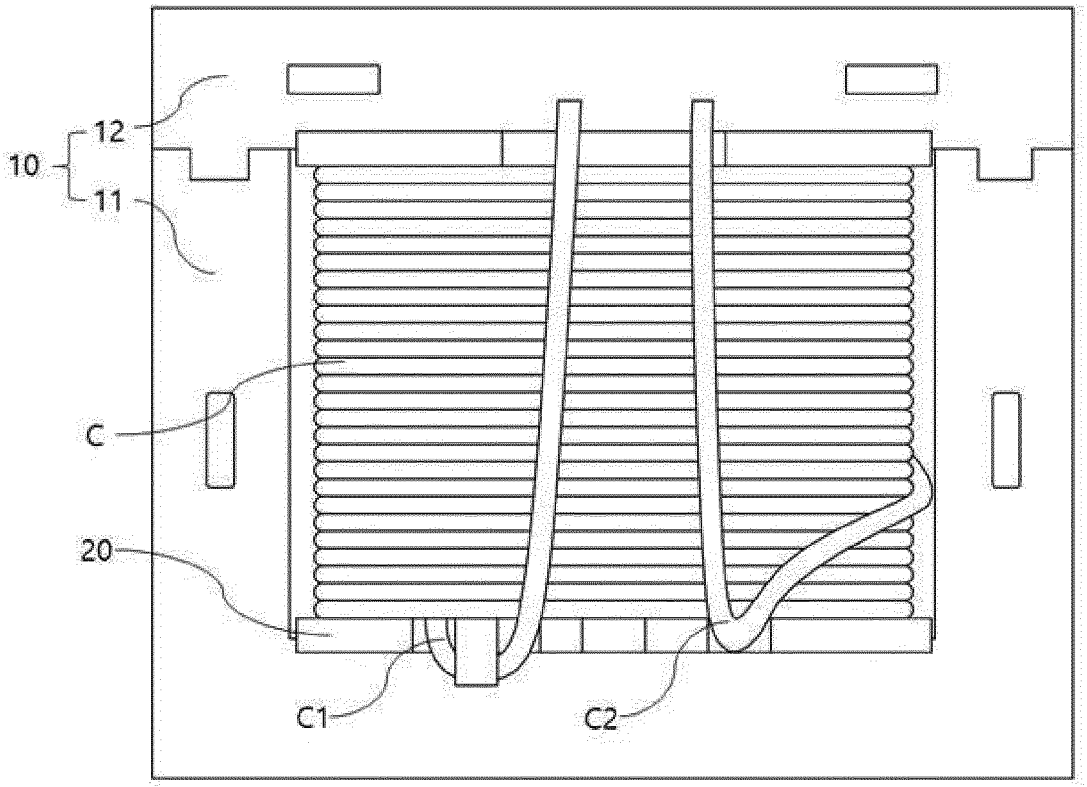


FIG 2.

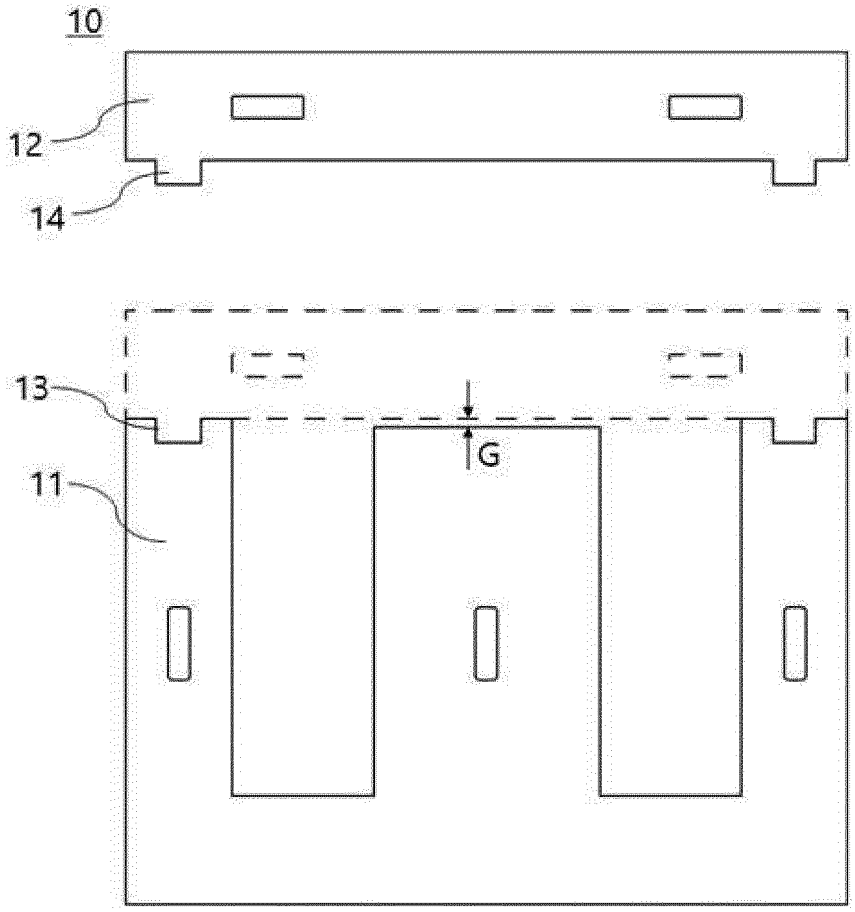


FIG 3.

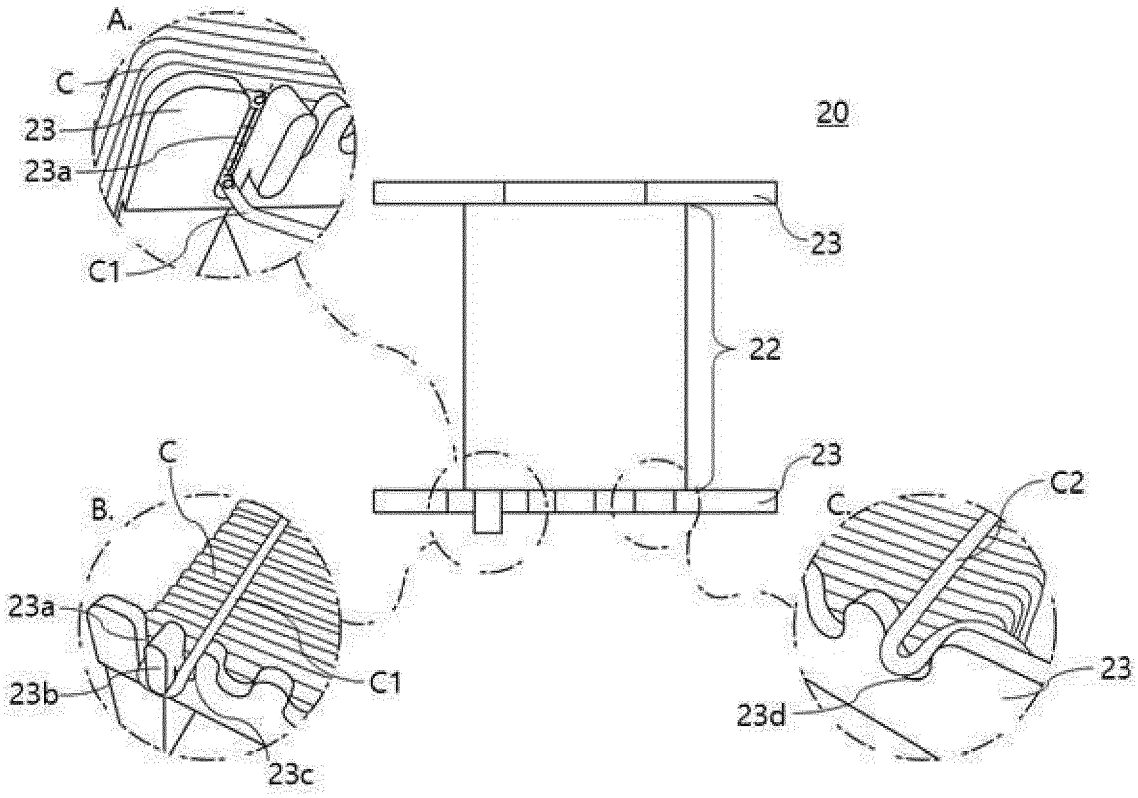


FIG 4.

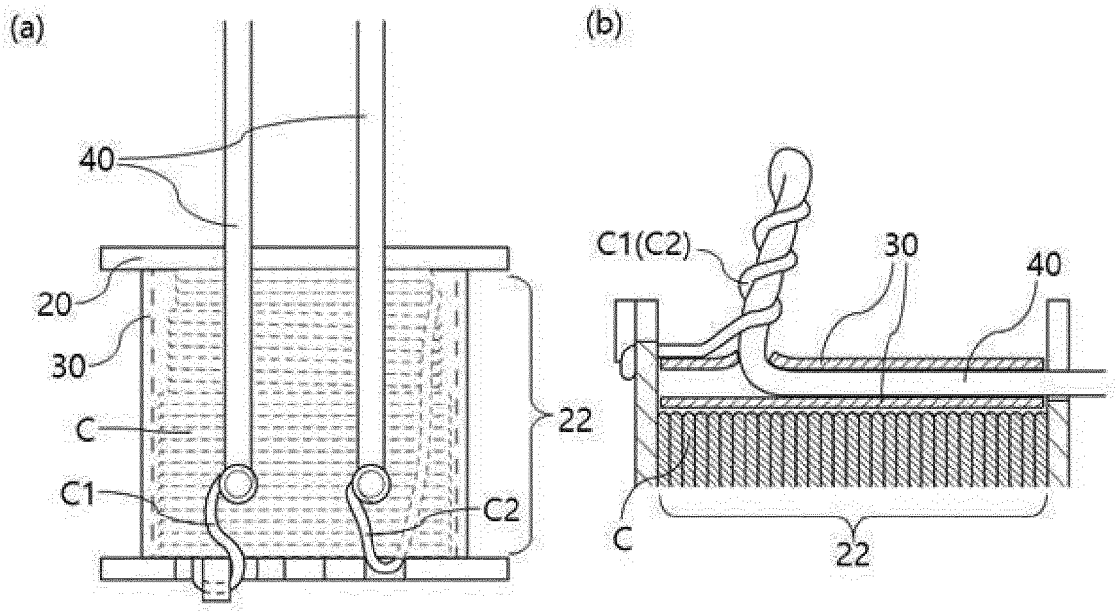
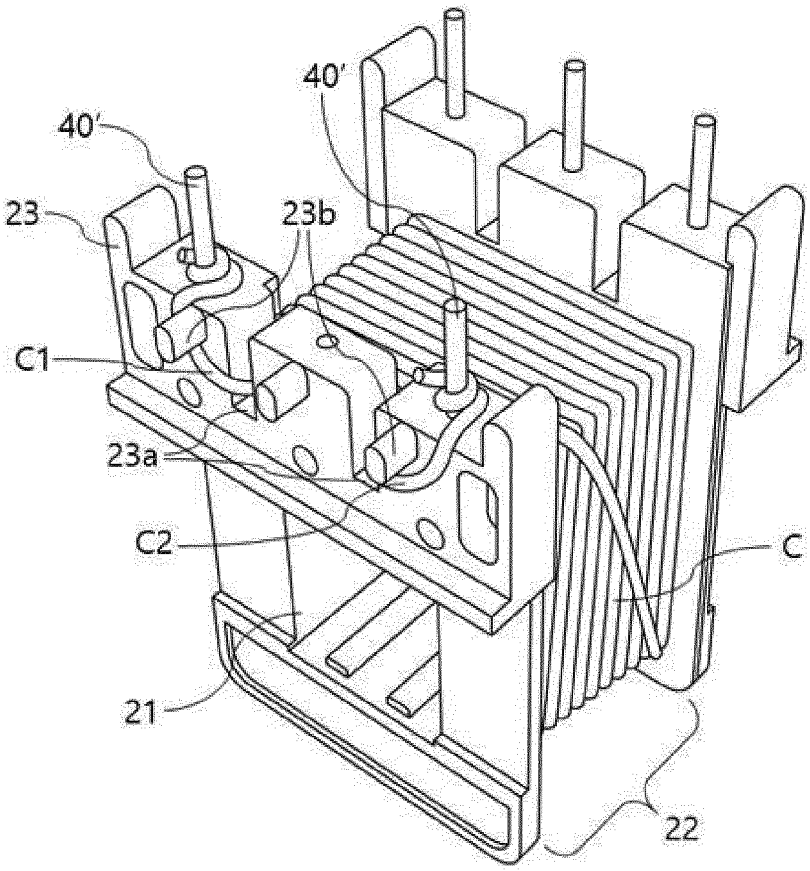


FIG 5.



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2020/012700

A. CLASSIFICATION OF SUBJECT MATTER

H01F 27/34(2006.01)i; **H01F 37/00**(2006.01)i; **H01F 27/02**(2006.01)i; **H01F 27/32**(2006.01)i; **H01F 27/24**(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H01F 27/34(2006.01); H01F 19/04(2006.01); H01F 27/24(2006.01); H01F 27/28(2006.01); H01F 27/29(2006.01); H01F 27/32(2006.01); H01F 3/14(2006.01); H01F 30/00(2006.01); H01F 41/12(2006.01)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models: IPC as above
Japanese utility models and applications for utility models: IPC as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS (KIPO internal) & keywords: 리액터(reactor), 코어(core), 보빈(bobbin), 단락(short), 홈(groove), 돌출(protrusion), 가이드(guide)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	KR 10-2069450 B1 (TSE CO., LTD.) 22 January 2020 (2020-01-22) See abstract, claims 1-2 and figures 2-3.	1-8
Y	JP 2011-044672 A (TDK CORP.) 03 March 2011 (2011-03-03) See abstract, paragraphs [0010], [0025]-[0029] and [0052], claim 1 and figures 1-21.	1-8
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☐ Further documents are listed in the continuation of Box C. ☑ See patent family annex.

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/KR2020/012700

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