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(54) **INDUCTOR ASSEMBLY AND SPEAKER**

(57) Disclosed are an inductor and a speaker. The inductor assembly includes: an inductor and a current regulating device. The inductor includes a first coil and a second coil, wherein the first coil is configured to, after being connected to an operating circuit, enable the second coil to generate an induced current; two ends of the second coil are connected to the current regulating device in series by means of conducting wires, and the current regulating device is configured to regulate the magnitude of the induced current generated by the second

coil. In the inductor assembly provided in the present disclosure, a first coil, a second coil, and a current regulating device are provided, and two ends of the second coil are connected to the current regulating device in series by means of conducting wires. After the first coil is connected to a working circuit, the second coil is enabled to generate an induced current. When the inductance of the inductor in the inductor assembly needs to be changed, it is only necessary to adjust the current regulating device, and the operations are simple.

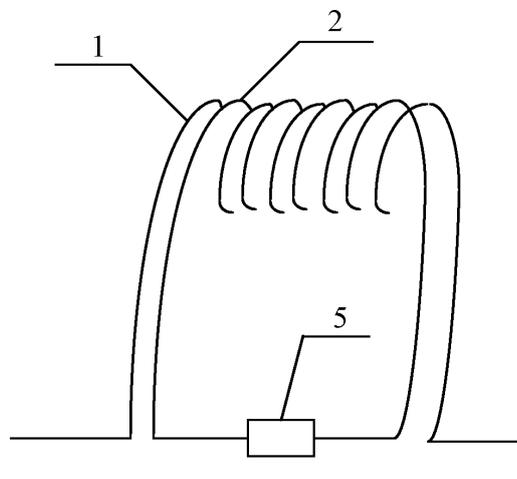


FIG. 1

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## Description

**[0001]** This application claims priority to Chinese Patent Application No. 201810067576.8, filed on January 24, 2018 and entitled "ADJUSTABLE INDUCTOR ASSEMBLY AND SPEAKER", the entire contents of which are incorporated herein by reference.

## TECHNICAL FIELD

**[0002]** The present disclosure relates to the field of electrical devices, and more particularly, relates to an inductor assembly and a speaker.

## BACKGROUND

**[0003]** An inductor is an element configured to convert electrical energy into magnetic energy and store the magnetic energy, which is an important part of the power system. In the power system, with a large number of non-linear loads being connected, problems such as voltage fluctuations and harmonic pollution may be caused. In order to solve these problems, the inductance of the inductor shall be adjusted during the operation.

**[0004]** An inductor that uses a saturation inductance method to adjust the inductance is provided in related art. The inductor includes a core, a first coil and a second coil which are wound on the core. The first coil is configured to be connected to an operating circuit (the current in the operating circuit is an alternating current), which enables the second coil to generate an induced current. When the inductance of the inductor needs to be adjusted, it is necessary to apply direct current to the second coil, and constantly change a magnitude of the direct current, so as to change a saturation degree of the core, then change a magnitude of the inductance of the first coil, and adjust an inductance of the inductor.

**[0005]** The inventors have found at least the following problems in the related art:

**[0006]** In the related art, when the magnitude of the inductance of the inductor is changed, it is necessary to apply direct current to the second coil, and constantly change the magnitude of the direct current, and the operation is complex.

## SUMMARY

**[0007]** Embodiments of the present disclosure provide an inductor assembly and a speaker, which may solve the above-mentioned technical problems. The technical solutions are as follows:

**[0008]** In one aspect, embodiments of the present disclosure provide an inductor assembly. The inductor assembly includes an inductor and a current regulating device;

wherein the inductor includes a first coil and a second coil; wherein the first coil is configured to, after being connected to an operating circuit, enable the second coil to gen-

erate an induced current; and two ends of the second coil are connected to the current regulating device in series by means of conducting wires, and the current regulating device is configured to regulate the magnitude of the induced current generated by the second coil.

**[0009]** Optionally, the first coil and the second coil are both air-core coils; and

the second coil is wound on the first coil; or the first coil is wound on the second coil; or the first coil and the second coil are co-wound.

**[0010]** Optionally, the inductor further includes a magnetic circuit core;

wherein the first coil and the second coil are both wound on the magnetic circuit core.

**[0011]** Optionally, the magnetic circuit core includes a closed magnetic circuit core; wherein

the first coil is wound on the closed magnetic circuit core, and the second coil is wound on the first coil; or the second coil is wound on the closed magnetic circuit core, and the first coil is wound on the second coil; or the first coil and the second coil are co-wound on the closed magnetic circuit core.

**[0012]** Optionally, the closed magnetic circuit core is one of a ring-shaped core, a double-C-shaped core with notches butted against each other, and a ring-shaped core with a slit on a side wall.

**[0013]** Optionally, the magnetic circuit core includes an open magnetic circuit core; wherein

the first coil is wound on the open magnetic circuit core, and the second coil is wound on the first coil; or the second coil is wound on the open magnetic circuit core, and the first coil is wound on the second coil; or the first coil and the second coil are co-wound on the open magnetic circuit core.

**[0014]** Optionally, the open magnetic circuit core is a rod-shaped core.

**[0015]** Optionally, the current regulating device includes a variable resistor or a rectifier switching device.

**[0016]** Optionally, the rectifier switching device includes an insulated gate bipolar transistor, or a thyristor, or a triode.

**[0017]** In another aspect, embodiments of the present disclosure provide a speaker. The speaker includes a frequency divider;

wherein the frequency divider includes the above-mentioned inductor assembly.

**[0018]** In the inductor assembly according to the embodiments of the present disclosure, a first coil, a second coil, and a current regulating device are provided, and two ends of the second coil are connected to the current regulating device in series by means of conducting wires. After the first coil is connected to an operating circuit, the second coil is enabled to generate an induced current. When an inductance of the inductor in the inductor assembly needs to be changed, only the current regulating device needs to be regulated, and the operations are simple.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0019]** In order to describe the technical solutions in the embodiments of the present disclosure more clearly, the following briefly introduces the accompanying drawings required for describing the embodiments. Apparently, the accompanying drawings in the following description show merely some embodiments of the present disclosure, and a person of ordinary skill in the art may also derive other drawings from these accompanying drawings without creative efforts.

FIG. 1 is a schematic structural circuit diagram of an inductor assembly according to an embodiment of the present disclosure;

FIG. 2 is a schematic structural circuit diagram of an inductor assembly according to an embodiment of the present disclosure;

FIG. 3 is a schematic structural circuit diagram of an inductor assembly according to an embodiment of the present disclosure;

FIG. 4 is a schematic structural circuit diagram of an inductor assembly according to an embodiment of the present disclosure;

FIG. 5 is a schematic structural circuit diagram of an inductor assembly according to an embodiment of the present disclosure

FIG. 6 is a schematic structural circuit diagram of an inductor assembly according to an embodiment of the present disclosure; and

FIG. 7 is a schematic structural diagram of a triode according to an embodiment of the present disclosure.

**[0020]** reference numerals and denotations thereof:

- 1 -first coil,
- 2-second coil,
- 3-variable resistor,
- 4-closed magnetic circuit core,
- 5-current regulating device, and
- 6-open magnetic circuit core.

## DETAILED DESCRIPTION

**[0021]** For clearer descriptions of the objects, technical solutions and advantages in the present disclosure, the present disclosure is described in detail below in combination with the accompanying drawings.

**[0022]** An inductor is an element configured to convert electrical energy into magnetic energy and store the the magnetic energy, and is widely used in life. When the inductor is used, it is often necessary to adjust the inductance of the inductor.

**[0023]** For the adjustment of the inductance of the inductor, a thyristor-controlled transformer (TCT) principle is adopted for adjustment in related art I. However, because the structure of the transformer is too complicated,

it is of poor practicability. In related art II, the saturation inductance method is configured for adjustment. The inductor used in this method includes an core, a first coil and a second coil which are wound on the core. During the adjustment process, apply direct current to the second coil, and constantly change the magnitude of the direct current, so as to change the saturation degree of the core, and then change the magnitude of the inductance of the first coil. This method will cause current flowing through the inductor to be distorted or generate harmonics.

**[0024]** In the embodiment of the present disclosure, the induced current generated by the second coil is configured to change a magnitude of a reverse magnetic flux by changing a magnitude of the current flowing through the second coil, so as to realize linear adjustment of the inductance of the inductor. The adjustment process is simple, and the air-core inductor, and the closed-loop magnetic circuit inductor may all be linearly adjusted, which not only responds quickly, but also does not distort a waveform of the current flowing through the first coil.

**[0025]** Taking the closed-loop magnetic circuit inductor as an example, the principle of the adjustment process is explained as follows: the closed-loop magnetic circuit inductor includes a first coil, a second coil and a closed magnetic circuit core. When  $I_1 N_1 = I_2 N_2$ , in an ideal state, the magnetic flux of the closed magnetic circuit core is zero. In the formula,  $I_1$  is the current in the first coil,  $N_1$  is the number of turns of the first coil,  $I_2$  is the current in the second coil, and  $N_2$  is the number of turns of the second coil. At this moment, when the magnitude of the current in the second coil is changed, a magnetic flux generated by the second coil and the magnetic flux generated by the first coil cancel each other, and the magnetic flux of the closed magnetic circuit core is also changed, such that the inductance of the first coil is changed, thus the adjustment of the inductance of the inductor is achieved.

**[0026]** In this regard, in one aspect, an embodiment of the present disclosure provides an inductor assembly. As shown in FIG. 1, the inductor includes an inductor and a current regulating device 5. The inductor includes a first coil 1 and a second coil 2, wherein the first coil 1 is configured to, after being connected to an operating circuit, enable the second coil 2 to generate an induced current; two ends of the second coil 2 are connected to the current regulating device 5 in series by means of conducting wires, and the current regulating device 5 is configured to regulate the magnitude of the induced current generated by the second coil 2.

**[0027]** The first coil 1 is connected to the operating circuit (it may be understood that the current applied at this moment to the first coil 1 is an alternating current), which enables the second coil 2 to generate an induced current. When the inductance of the inductor in the inductor assembly needs to be changed, the current regulating device 5 is configured to regulate a magnitude of

current in the second coil 2, and then a magnitude of a magnetic flux of the second coil 2 is changed. At this moment, an inductance of the inductor in the inductor assembly is regulated. Here, the "operating circuit" refers to the circuit where a load is disposed.

**[0028]** In the inductor assembly according to the embodiment of the present disclosure, a first coil 1, a second coil 2, and a current regulating device 5 are provided, and two ends of the second coil 2 are connected to the current regulating device 5 in series by means of conducting wires. After the first coil 1 is connected to an operating circuit, the second coil 2 is enabled to generate an induced current. When the inductance of the inductor in the inductor assembly needs to be changed, only the current regulating device 5 needs to be regulated, and the operations are simple.

**[0029]** It should be noted that inductors with various structures are all applicable to the inductor assembly according to the embodiment of the present disclosure, and the following is optional:

**[0030]** As an example, both the first coil 1 and the second coil 2 may be arranged as air-core coils, and the second coil 2 is wound on the first coil 1. Alternatively, the first coil 1 is wound on the second coil 2. Alternatively, the first coil 1 and the second coil 2 are co-wound.

**[0031]** With this arrangement, the inductor assembly may be applied to occasions with a wide range of frequencies, ensuring that most audio frequencies may pass through smoothly.

**[0032]** Here, the term "co-wound" refers to that the first coil 1 and the second coil 2 are mixed and co-wound to form a layer of air-core coils (in each of the above-mentioned situation in which the second coil 2 is wound on the first coil 1, or the first coil 1 is wound on the second coil 2, the first coil 1 and the second coil 2 form two layers of air-core coils). In a possible implementation, two wires are placed side by side for winding. With reference to FIG. 1, it may be seen that in the above-mentioned layer of air-core coils, the wires belonging to the first coil 1 are arranged alternately with the wires belonging to the second coil 2.

**[0033]** As another example, as shown in FIG. 1, the inductor assembly further includes a magnetic circuit core. The first coil 1 and the second coil 2 are both wound on the magnetic circuit core.

**[0034]** In an optional embodiment, the magnetic circuit core includes a closed magnetic circuit core 4, and the first coil 1 and the second coil 2 are both wound on the closed magnetic circuit core 4, for example, as shown in FIG. 2. Optionally, the winding methods of the first coil 1 and the second coil 2 mentioned above may be as follows: the first coil 1 is wound on the closed magnetic core 4, and the second coil 2 is wound on the first coil 1; or the second coil 2 is wound on the closed magnetic circuit core 4, and the first coil 1 is wound on the second coil 2; or the first coil 1 and the second coil 2 are co-wound on the closed magnetic circuit core 4. The embodiment of the present disclosure does not limit the winding method

of the first coil 1 and the second coil 2. For example, as shown in FIG. 3, the first coil 1 and the second coil 2 may be wound respectively at different positions on the closed magnetic circuit core 4.

**[0035]** In this embodiment, the first coil 1 is connected to the operating circuit to enable the second coil 2 to generate the induced current. When it is necessary to change the inductance of the inductor in the inductor assembly, the current regulating device 5 is configured to regulate the magnitude of the current in the second coil 2, and then the magnitude of the magnetic flux of the closed magnetic circuit core 4 is changed. At this moment, the inductance of the inductor in the inductor assembly is regulated. By this arrangement, it is ensured that the magnetic resistance of the inductor is small and the magnetic induction intensity is large.

**[0036]** The closed magnetic circuit core 4 may be in various structures. For example, the closed magnetic circuit core may be a ring structure, or a double-C-shaped structure with notches butted against each other, or a ring structure with a slit on the side wall, or the like.

**[0037]** As yet another example, the inductor assembly further includes an open magnetic circuit core 6. The first coil 1 is wound on the open magnetic circuit core 6, and the second coil 2 is wound on the first coil 1. Alternatively, the second coil 2 is wound on the open magnetic circuit core 6, and the first coil 1 is wound on the second coil 2. Alternatively, the first coil 1 and the second coil 2 are co-wound on the open magnetic circuit core 6. For the schematic diagram of the winding methods, reference may be made to FIG. 4.

**[0038]** The first coil 1 is connected to the operating circuit to enable the second coil 2 to generate the induced current. When it is necessary to change the inductance of the inductor in the inductor assembly, the current regulating device 5 is configured to regulate the magnitude of the current in the second coil 2, and then the magnitude of the magnetic flux of the open magnetic circuit core 6 is changed. At this moment, the inductance of the inductor in the inductor assembly is regulated. By this arrangement, it is ensured that the magnetic resistance of the inductor is small and the magnetic induction intensity is large.

**[0039]** The embodiment of the present disclosure does not limit the structure of the open magnetic circuit core 6. For example, the open magnetic circuit core 6 may be a rod-shaped structure.

**[0040]** In an optional embodiment, the current regulating device 5 includes a variable resistor 3 or a rectifier switching device. Next, the variable resistor 3 and the rectifier switching device are described respectively:

**[0041]** The variable resistor 3: the variable resistor 3 is a resistor whose resistance may be adjusted. As shown in FIG. 5, the second coil 2 may be connected in series to the variable resistor 3 through wires (or another optional connection method), then the total resistance of the circuit where the second coil 2 is disposed is equal to the sum of the resistance of the second coil 2 and that

of the variable resistor 3. When the inductance of the inductor needs to be adjusted, the resistance value of the variable resistor 3 is adjusted, so as to change the total resistance of the circuit where the second coil 2 is disposed, thereby changing the current of the circuit where the second coil 2 is disposed. Afterwards, the magnetic flux of the second coil 2 is changed, and the inductance of the first coil 1 is changed accordingly. At this moment, the inductance of the inductor is regulated.

**[0042]** The rectifier switching device: optionally, the rectifier switching device includes an insulated gate bipolar transistor, or a thyristor, or a triode.

**[0043]** The insulated gate bipolar transistor (IGBT): it is a semiconductor element with a switching function. The application circuit of the IGBT is shown in FIG. 6 in which D1, D2, D3, D4, and D5 all represent diodes, C represents a capacitor, and  $L_1$  represents an inductor. In FIG. 6, the IGBT and D5 are connected in parallel, and the IGBT and D5 in parallel are configured as a first element, then the first element and the inductor  $L_1$  are connected in series to form a first sub-circuit. The first sub-circuit is connected in parallel to the capacitor C to form a branch circuit. After the first coil 1 is connected to the operating circuit, two ends of the second coil 2 are connected in series to the branch circuit by D2 and D3 when the direction of the current  $I_2$  in the second coil 2 is the direction shown in FIG. 6. Accordingly, when the direction of the current  $I_2$  in the second coil 2 is opposite to the direction shown in FIG. 6, two ends of the second coil 2 are connected in series to the branch circuit through D1 and D4. It can be seen that the second coil 2 is always connected in series to the branch circuit, that is, the circuit where the second coil 2 is disposed is always a closed circuit.

**[0044]** Further, the switching state of the IGBT may be changed by a computer. When the IGBT is switched from the on state to the off state, the value of the current in the circuit where the second coil 2 is disposed decreases; when the IGBT is switched from the off state to the on state, the value of the current in the second coil 2 is increased. Therefore, by regulating the switching frequencies of the IGBT by a computer, the switching states of the IGBT may be switched regularly, and the value of the current in the circuit where the second coil 2 is disposed will be changed accordingly, thus the effective value of  $I_2$  is changed, and the current of the circuit where the second coil 2 is disposed may be adjusted. Therefore, the magnetic flux of the second coil 2 is changed, and the inductance of the first coil 1 is changed accordingly. At this moment, the inductance of the inductor is regulated.

**[0045]** It should be noted that, as shown in FIG. 6, the function of the capacitor C is that when the switching state of the IGBT is changed, the capacitor may enable the current in the circuit where the second coil 2 is disposed to change, thereby preventing the current waveform of the circuit where the second coil 2 is disposed from being changed. The functions of the inductor  $L_1$  are

to prevent the generation of a surge current and protect the IGBT. At the moment when the first coil 1 is connected to the operating circuit, a peak current, which is a surge current, is generated in the second coil 2. After the first coil 1 is connected to the operating circuit, the induced current generated by the second coil 2 is configured as a steady-state current, and the value of the surge current is greater than that of the steady-state current. Thus, damages may be caused to the IGBT. Therefore, in this embodiment,  $L_1$  is configured to prevent the generation of the surge current to protect the IGBT.

**[0046]** In addition, the thyristor is also a semiconductor element with a switching function. Moreover, the principle of regulating the inductance of inductor by a thyristor is the same as that by an IGBT, which is not repeated herein.

**[0047]** The Triode: the schematic diagram of the triode is shown in FIG. 7 in which B, C and E are the three electrodes of the triode respectively. The current from C to E is expressed as  $I_c$ , the current from B to E is expressed as  $I_b$ , and the value of  $I_c$  changes as the value of  $I_b$  changes. Therefore, the two electrodes C and E may be connected to the two ends of the second coil 2 respectively, and then the current in the circuit where the second coil 2 is disposed is  $I_c$ . After that,  $I_c$  is indirectly controlled by controlling  $I_b$  such that the magnetic flux of the second coil 2 is changed, and the inductance of the first coil 1 is also changed accordingly. At this moment, the inductance of the inductor is regulated.

**[0048]** In another aspect, the embodiment of the present disclosure provides a speaker which includes a frequency divider. The frequency divider includes the above-mentioned inductor assembly.

**[0049]** It can be understood by those skilled in the art that the speaker also has the above advantages of the inductor assembly. By using the inductor assembly provided in the present disclosure, a user may regulate the inductance according to his or her own preference, such that the frequency divider may better divide the frequencies of the speaker and make the response frequencies of the speaker become wider.

**[0050]** The structure of the speaker is common in the art, and it is also common in the art to provide a frequency divider and an inductor assembly in the speaker. For example, a reference may be made to patents such as the application No. CN00240314.5 entitled HIGH-FIDELITY SPEAKER.

**[0051]** Described above are merely embodiments of the present disclosure, and are not intended to limit the protection scope of the present disclosure. Any modifications, equivalent substitutions or improvements that are made within the spirit and principle of the present disclosure should all be included in the protection scope of the present disclosure.

**Claims**

1. An inductor assembly, comprising: an inductor and a current regulating device (5); wherein the inductor comprises: a first coil (1) and a second coil (2); wherein the first coil (1) is configured to, after being connected to an operating circuit, enable the second coil (2) to generate an induced current; and two ends of the second coil (2) are connected in series to the current regulating device (5) by a conducting wire, and the current regulating device (5) is configured to regulate a magnitude of the induced current generated by the second coil (2).
2. The inductor assembly according to claim 1, wherein the first coil (1) and the second coil (2) are both air-core coils; and the second coil (2) is wound on the first coil (1); or the first coil (1) is wound on the second coil (2); or the first coil (1) and the second coil (2) are co-wound.
3. The inductor assembly according to claim 1, wherein the inductor assembly further comprises a magnetic circuit core; wherein the first coil (1) and the second coil (2) are both wound on the magnetic circuit core.
4. The inductor assembly according to claim 3, wherein the magnetic circuit core comprises a closed magnetic circuit core (4); wherein the first coil (1) is wound on the closed magnetic circuit core (4), and the second coil (2) is wound on the first coil (1); or the second coil (2) is wound on the closed magnetic circuit core (4), and the first coil (1) is wound on the second coil (2); or alternatively, the first coil (1) and the second coil (2) are co-wound on the closed magnetic circuit core (4).
5. The inductor assembly according to claim 4, wherein the closed magnetic circuit core (4) is one of a ring-shaped core, a double-C-shaped core with notches butted against each other, and a ring-shaped core with a slit on a side wall.
6. The inductor assembly according to claim 3, wherein the magnetic circuit core comprises: an open magnetic circuit core (6); wherein the first coil (1) is wound on the open magnetic circuit core (6), and the second coil (2) is wound on the first coil (1); or the second coil (2) is wound on the open magnetic circuit core (6), and the first coil (1) is wound on the second coil (2); or the first coil (1) and the second coil (2) are co-wound on the open magnetic circuit core (6).
7. The inductor assembly according to claim 6, wherein the open magnetic circuit core (6) is a rod-shaped core.
8. The inductor assembly according to any one of claims 1 to 7, wherein the current regulating device (5) comprises a variable resistor (3) or a rectifier switching device.
9. The inductor assembly of claim 8, wherein the rectifier switching device comprises an insulated gate bipolar transistor, or a thyristor, or a triode.
10. A speaker, comprising a frequency divider, wherein the frequency divider comprises the inductor assembly as defined in any one of claims 1 to 9.

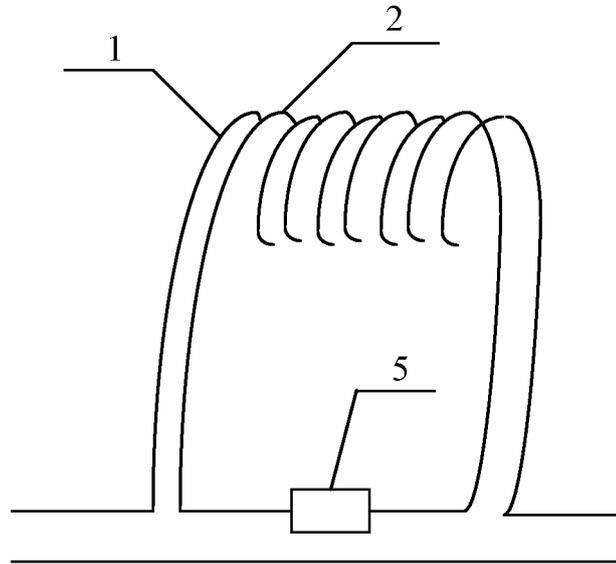


FIG. 1

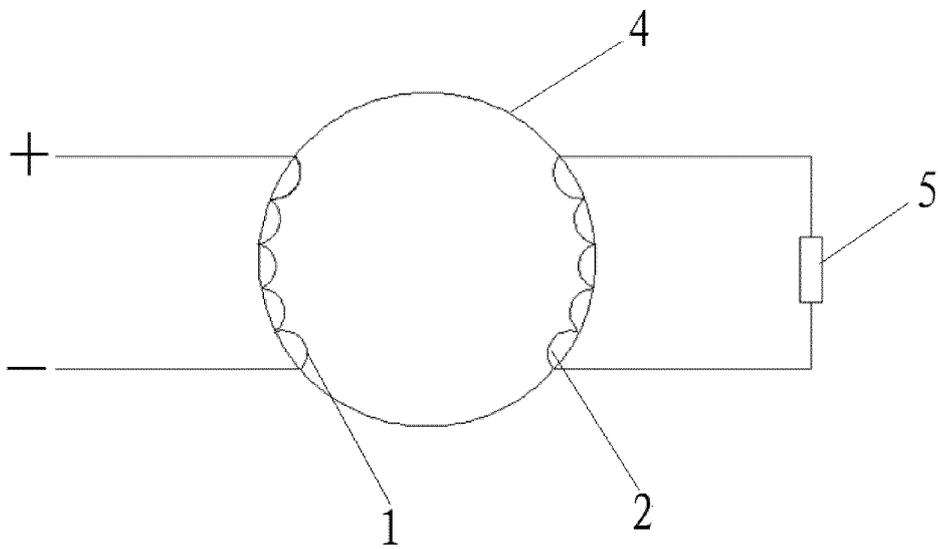


FIG. 2

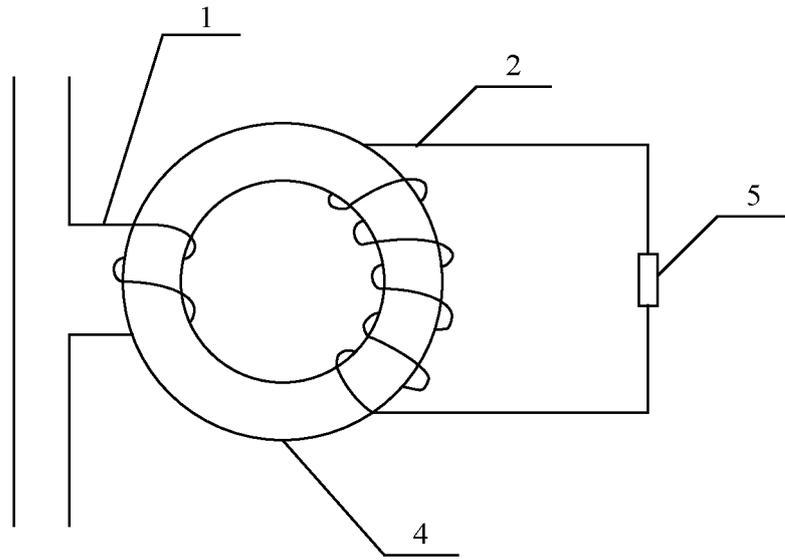


FIG. 3

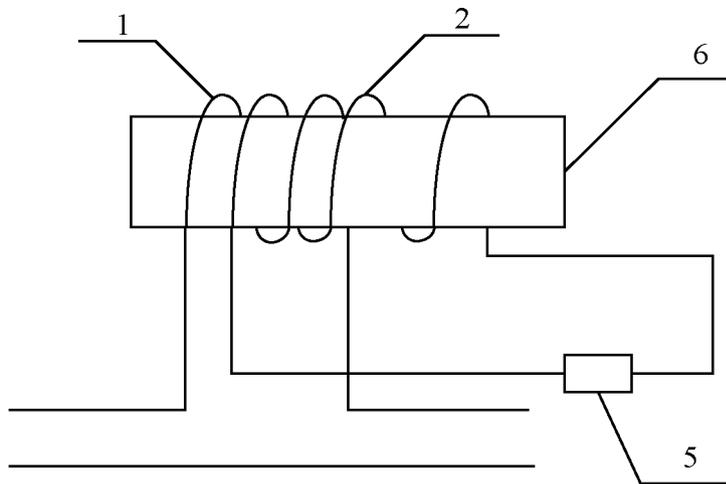


FIG. 4

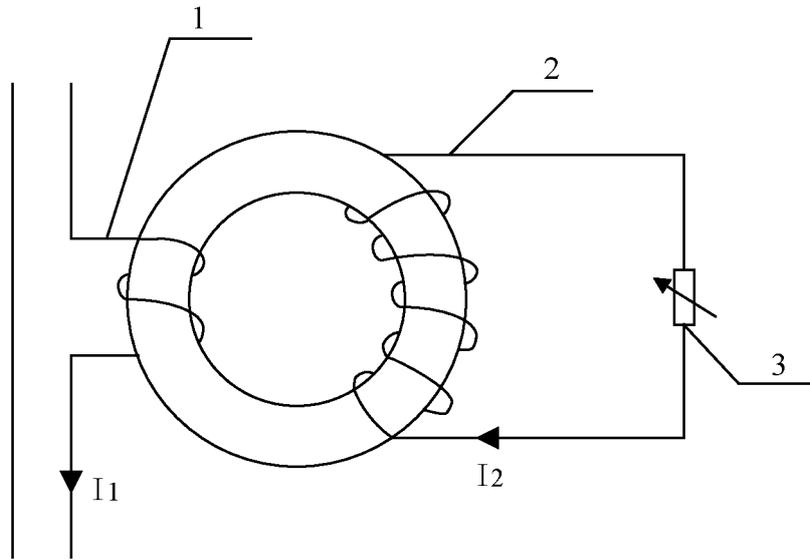


FIG. 5

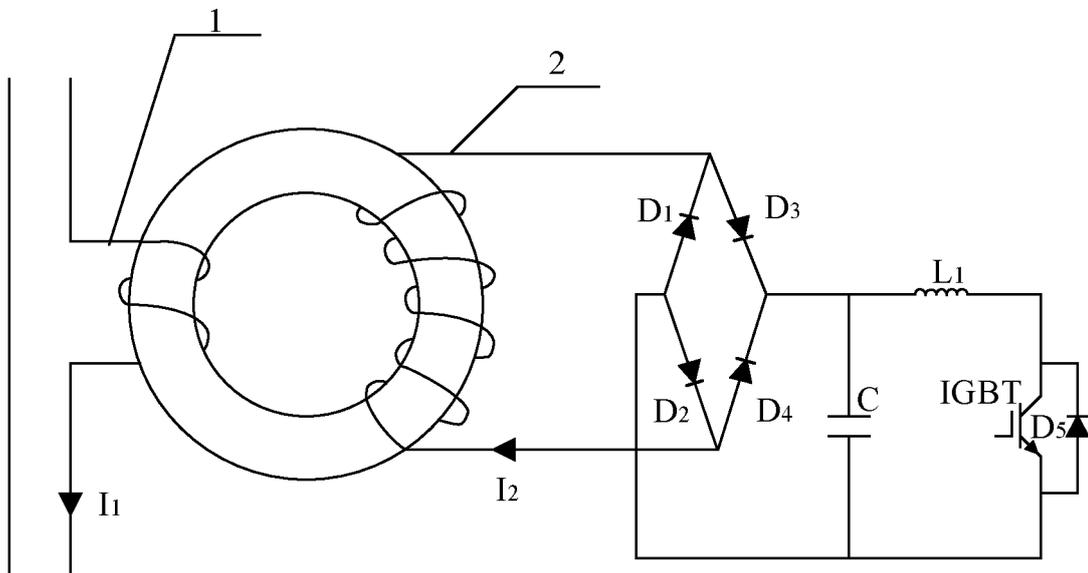


FIG. 6

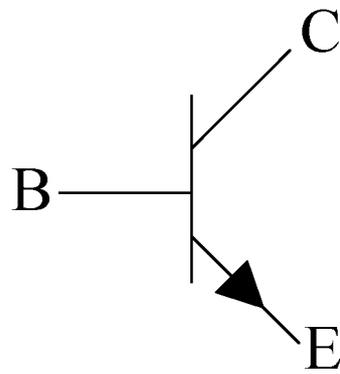


FIG. 7

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2019/072866

5	<b>A. CLASSIFICATION OF SUBJECT MATTER</b>	
	H01F 27/40(2006.01)i; H01F 27/28(2006.01)n; H01F 21/12(2006.01)n	
	According to International Patent Classification (IPC) or to both national classification and IPC	
	<b>B. FIELDS SEARCHED</b>	
10	Minimum documentation searched (classification system followed by classification symbols)	
	H01F	
	Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched	
15	Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)	
	VEN; CNABS; CNKI: 可变, 可调, 可控, 电感器, 电阻, 线圈, 绕组, 晶闸管, 晶体管, 三极管, 音箱, 分频器, inductor, resistor, adjustable, thyristor, resistance, igbt, winding, sound, coil, controllable, variable	
	<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>	
20	Category*	Citation of document, with indication, where appropriate, of the relevant passages
	PX	CN 108447665 A (BEIJING JINKE HUA YE CHECKING AND CONTROL TECHNOLOGY CO., LTD.) 24 August 2018 (2018-08-24) entire document
		Relevant to claim No.
		1-8, 10
25	X	JP 2004140165 A (MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD.) 13 May 2004 (2004-05-13) description, paragraph [0030], and figures 1-3
		1-9
	Y	JP 2004140165 A (MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD.) 13 May 2004 (2004-05-13) description, paragraph [0030], and figures 1-3
		10
30	Y	CN 2455028 Y (LIANG, YAOHUI) 17 October 2001 (2001-10-17) figure 1
		10
	A	CN 203311972 U (HARBIN UNIVERSITY OF SCIENCE AND TECHNOLOGY) 27 November 2013 (2013-11-27) entire document
		1-10
35	A	CN 202759249 U (DALIAN SECOND TRANSFORMER GROUP CO., LTD.) 27 February 2013 (2013-02-27) entire document
		1-10
	<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.	
40	* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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	Date of the actual completion of the international search	Date of mailing of the international search report
	29 March 2019	10 April 2019
50	Name and mailing address of the ISA/CN	Authorized officer
	State Intellectual Property Office of the P. R. China No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088 China	
55	Facsimile No. (86-10)62019451	Telephone No.

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International application No.  
**PCT/CN2019/072866**

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C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 5-182837 A (MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD.) 23 July 1993 (1993-07-23) entire document	1-10



**REFERENCES CITED IN THE DESCRIPTION**

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**Patent documents cited in the description**

- CN 201810067576 [0001]
- CN 00240314 [0050]