(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 3 678 454 A1

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
08.07.2020 Bulletin 2020/28

(21) Application number: **18885968.0**

(22) Date of filing: **28.04.2018**

(51) Int Cl.:
H05B 6/44 *(2006.01)* ***H05B 6/06*** *(2006.01)*
H05B 1/02 *(2006.01)*

(86) International application number:
PCT/CN2018/085002

(87) International publication number:
WO 2019/109586 (13.06.2019 Gazette 2019/24)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(30) Priority: **08.12.2017 CN 201711297137**

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(54) **HEATING CONTROL CIRCUIT FOR INDUCTION COOKING APPLIANCE, AND INDUCTION COOKING APPLIANCE**

(57) Embodiments of the present invention provide a heating control circuit for an induction cooking appliance, and an induction cooking appliance, pertaining to the field of electronic appliances. The heating control circuit comprises two or more control circuits, wherein one of the two or more control circuits comprises two or more coil plates, while each of the other control circuits, excluding the aforementioned one control circuit, each comprise one or more coil plates, and each of the control circuits respectively comprises a voltage source, a power switch transistor, and a capacitor; one or more switches connected within the two or more control circuits and between the two or more control circuits; and a controller configured to control the power switch transistor and the one or more switches in each of the control circuits, so as to provide heating using a series-connected combination consisting of any two or more of the coil plates in the two or more control circuits. The invention achieves precision control of different heating positions in the same region.

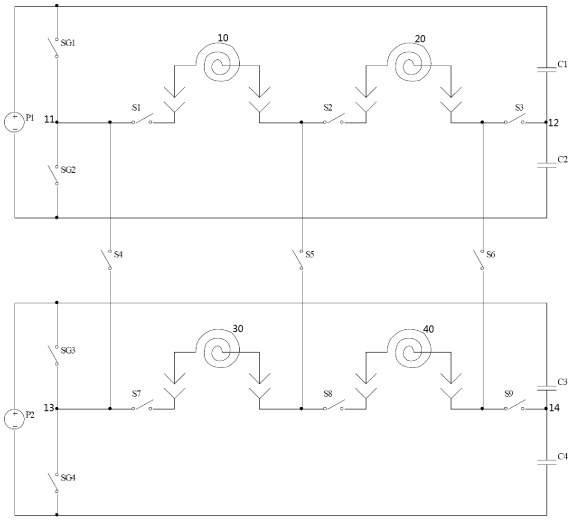

Fig. 2

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Description

Field of the Invention

[0001] The present invention relates to the field of electrical appliances and specifically relates to a heating control circuit for an electromagnetic cooking appliance and an electromagnetic cooking appliance.

Background of the Invention

[0002] An electromagnetic oven achieves a heating aim in a way that a high-power switch device (such as an IGBT (Insulated Gate Bipolar Transistor) drives a coil panel to generate an alternating magnetic field to heat a cooker in the alternating magnetic field.

[0003] In correlated technologies, one or two switch devices are adopted to control one coil panel to heat in a heating circuit, the inventor of the present invention finds that hardware (such as a resonant capacitor, a coil panel, a switch device and so on) in a circuit is not utilized to the maximum extent in such a control way.

Summary of the Invention

[0004] Embodiments of the present invention aim at providing a heating control circuit for an electromagnetic cooking appliance and an electromagnetic cooking appliance in order to solve or partially solve the above-mentioned technical problem.

[0005] In order to achieve the above-mentioned aim, an embodiment of the present invention provides a heating control circuit for an electromagnetic cooking appliance. The heating control circuit includes two or more control circuits, one control circuit of the two or more control circuits including two or more coil panels, each of other control circuits except the one control circuit in the two or more control circuits including one or more coil panels, and each of the two or more control circuits including a voltage source, power switch tubes and capacitors; one or more switches connected to insides of the two or more control circuits and between the two or more control circuits; and a controller configured to realize heating carried out by a combination of any at least two coil panels connected in series in the at least two control circuits by controlling the power switch tube and the switch.

[0006] Accordingly, an embodiment of the present invention further provides an electromagnetic cooking appliance including the above-mentioned heating control circuit.

[0007] Due to adoption of the above-mentioned technical solution, coil panels in different control circuits may be connected in series, so that precise control on different heating positions in a same region may be realized. Meanwhile, hardware in the circuits may be sufficiently utilized, and the power output performance of an electromagnetic oven is improved.

[0008] Other characteristics and advantages of the embodiments of the present invention will be described in detail in subsequent implementation ways.

Brief Description of Drawings

[0009] Accompanying drawings are provided for further understanding of the embodiments of the present invention, and constitute one part of the specification. The accompanying drawings serve to explain the embodiments of the present invention in combination with the following specific implementation ways, but do not limit the embodiments of the present invention. In the accompanying drawings:

Fig. 1 shows a schematic diagram of a combination of four coil panels;

Fig. 2 shows a heating control circuit for an electromagnetic cooking appliance according to an embodiment of the present invention;

Fig. 3 shows a heating control circuit for an electromagnetic cooking appliance according to an embodiment of the present invention;

Fig. 4 shows a heating control circuit for an electromagnetic cooking appliance according to an embodiment of the present invention; and

Fig. 5 shows a heating control circuit for an electromagnetic cooking appliance according to an embodiment of the present invention.

Detailed Description of the Embodiments

[0010] The specific implementation ways of the embodiments of the present invention are described in detail below in combination with the accompanying drawings. It should be understood that the specific implementation ways described herein are only intended to describe and explain the embodiments of the present invention, but do not limit the embodiments of the present invention. Terms such as "first", "second", "third",....., "ninth" in the present invention are only used for illustration, rather than restrictive description.

[0011] An embodiment of the present invention provides a heating control circuit for an electromagnetic cooking appliance. The heating control circuit may include two or more control circuits, one control circuit of the two or more control circuits including two or more coil panels, each of other control circuit(s) except the one control circuit in the two or more control circuits including one or more coil panels, and each of the two or more control circuits including a voltage source, power switch tubes and capacitors; one or more switches connected to insides of the two or more control circuits and between the two or more control circuits; and a controller configured to realize heating carried out by a combination of any at least two coil panels connected in series in the at least two control circuits by controlling the power switch tube and the switch. The heating control circuit provided

by the embodiment of the present invention can perform serial combination control on at least two coil panels at different positions in the same region, so that heating positions are precisely controlled. Optionally, the voltage source included in each of the two or more control circuits may be a same voltage source, wherein a negative electrode of each voltage source may be connected to a common ground wire. Optionally, the voltage source may be a single-phase voltage source or a multi-phase voltage source.

[0012] Optionally, each control circuit may include two power switch tubes and two capacitors, wherein the two power switch tubes are connected in parallel to two ends of the voltage source after being connected in series, and the two capacitors are connected in parallel to two ends of the voltage source after being connected in series. Coil panels in each control circuit are connected in series, one end of the serially connected coil panels is connected to an end point between the two power switch tubes, and the other end of the serially connected coil panels is connected to an end point between the two capacitors.

[0013] Optionally, the heating control circuit for the electromagnetic cooking appliance, provided by the embodiment of the present invention, may include a first control circuit and a second control circuit, and each of the first control circuit and the second control circuit may include two coil panels. Fig. 1 shows a schematic diagram of a combination of four coil panels. As shown in Fig. 1, the heating control circuit provided by the embodiment of the present invention may realize carried out by a combination of any two or three coil panels connected in series and may also realize heating carried out by a combination of four coil panels connected in series. For example, heating of any one combination may be realized as follows: heating of a combination of a coil panel 10 and a coil panel 20; heating of a combination of the coil panel 20 and a coil panel 30; heating of a combination of the coil panel 10 and a coil panel 40; heating of a combination of the coil panel 30 and the coil panel 40; heating of a combination of the coil panel 10, the coil panel 20 and the coil panel 30; heating of a combination of the coil panel 20, the coil panel 30 and the coil panel 40; heating of a combination of the coil panel 10, the coil panel 20, the coil panel 30 and the coil panel 40 and the like. It should be understood that the embodiment of the present invention is not limited herein, and each of the first control circuit and the second control circuit may include any number of coil panels according to a control demand.

[0014] The embodiment of the present invention will be further described below by taking the heating control circuit for the electromagnetic cooking appliance, which includes two control circuits respectively including two coil panels, as an example. Embodiments in which more control circuits and/or more coil panels are included may be realized by reasonable modification on the basis of the embodiments described as below, for example, the embodiments are realized in a way of reasonably increasing the number of the control circuits and/or increasing the number of the switches, reducing the number of the switches or modifying connection relationships of the switches.

[0015] Fig. 2 shows a heating control circuit for an electromagnetic cooking appliance according to an embodiment of the present invention. As shown in Fig. 2, the heating control circuit for the electromagnetic cooking appliance may include a first control circuit, a second control circuit and a controller (unshown in the figure), wherein the first control circuit may include a power switch tube SG1, a power switch tube SG2, a coil panel 10, a coil panel 20, a capacitor C1, a capacitor C2 and a voltage source P1; and the second control circuit may include a power switch tube SG3, a power switch tube SG4, a coil panel 30, a coil panel 40, a capacitor C3, a capacitor C4 and a voltage source P2. The voltage source P1 and the voltage source P2 may be same alternating voltage sources, and negative electrodes of the voltage source P1 and the voltage source P2 are both connected to a common ground wire. Optionally, the voltage source P1 and the voltage source P2 may be single-phase voltage sources or multi-phase voltage sources.

[0016] In the first control circuit, the power switch tube SG1 and the power switch tube SG2 are connected in parallel to two ends of the voltage source P1 after being connected in series, the capacitor C1 and the capacitor C2 are connected in parallel to two ends of the voltage source P1 after being connected in series, the coil panel 10 and the coil panel 20 are connected in series, one end of the serially connected coil panel 10 and coil panel 20 is connected to an end point 11 between the power switch tube SG1 and the power switch tube SG2, and the other end of the serially connected coil panel 10 and coil panel 20 is connected to an end point 12 between the capacitor C1 and the capacitor C2, wherein one end of the coil panel 10 is connected to the end point 11, the other end of the coil panel 10 is connected to one end of the coil panel 20, and the other end of the coil panel 20 is connected to the end point 12.

[0017] The first control circuit may further include a switch S1 connected in series between the end point 11 and one end of the serially connected coil panel 10 and coil panel 20; a switch S2 connected in series between the coil panel 10 and the coil panel 20; and a switch S3 connected in series between the end point 12 and the other end of the serially connected coil panel 10 and coil panel 20.

[0018] In the second control circuit, the power switch tube SG3 and the power switch tube SG4 are connected in parallel to two ends of the voltage source P2 after being connected in series, the capacitor C3 and the capacitor C4 are connected in parallel to two ends of the voltage source P2 after being connected in series, the coil panel 30 and the coil panel 40 are connected in series, one end of the serially connected coil panel 30 and coil panel 40 is connected to an end point 13 between the power switch tube SG3 and the power switch tube SG4, and the other

end of the serially connected coil panel 30 and coil panel 40 is connected to an end point 14 between the capacitor C3 and the capacitor C4, wherein one end of the coil panel 30 is connected to the end point 13, the other end of the coil panel 30 is connected to one end of the coil panel 40, and the other end of the coil panel 40 is connected to the end point 14.

[0019] The second control circuit may further include a switch S7 connected in series between the end point 13 and one end of the serially connected coil panel 30 and coil panel 40; a switch S8 connected in series between the coil panel 30 and the coil panel 40; and a switch S9 connected in series between the end point 14 and the other end of the serially connected coil panel 30 and coil panel 40.

[0020] The heating control circuit as shown in Fig. 2 may further include a switch S4 with one end being connected between the end point 11 and the switch S1 and the other end being connected between the end point 13 and the switch S7; a switch S5 with one end being connected between the other end of the coil panel 10 and the switch S2 and the other end being connected between the other end of the coil panel 30 and the switch S8; and a switch S6 with one end being connected between the other end of the coil panel 20 and the switch S3 and the other end being connected between the other end of the coil panel 40 and the switch S9.

[0021] The controller may realize heating carried out by a combination of the coil panels 10-40 by controlling the power switch tubes SG1-SG4 and the switches S1-S9.

[0022] The power switch tubes used in the embodiment of the present invention may be high-power switch devices such as an IGBT or a high-power relay. Optionally, the power switch tubes are unidirectional conducting devices.

[0023] The controller may control the power switch tubes SG1-SG4 and the switches S7-S9 to be turned on or turned off to enable the coil panel 10 in the first control circuit and the coil panel 40 in the second control circuit to be connected in series so as to realize heating carried out by a combination of the coil panel 10 and the coil panel 40, or to enable the coil panel 20 in the first control circuit and the coil panel 30 in the second control circuit to be connected in series so as to realize heating carried out by a combination of the coil panel 20 and the coil panel 30.

[0024] The controller may control the power switch tubes SG1-SG4 and the switches S7-S9 to be turned on or turned off so as to realize heating carried out by a combination of the coil panel 10 and the coil panel 20 in the first control circuit, and/or realize heating carried out by a combination of the coil panel 30 and the coil panel 40 in the second control circuit.

[0025] Specifically, the controller may control the heating of the combination of the coil panel 20 and the coil panel 30. In this case, within the first half cycle of one cycle of an alternating voltage, the controller may control the switch S7, the switch S5, the switch S2, the switch S3 and the power switch tube SG3 to be turned on and control the other switches and power switch tubes to be turned off so that the coil panel 20, the coil panel 30, the power switch tube SG3 and the capacitor C2 are connected in series to form a resonant circuit, and then, the flow direction of a current in the first half cycle is from a positive electrode of the voltage source P2 to the power switch tube SG3 to the switch S7 to the coil panel 30 to the switch S5 to the switch S2 to the coil panel 20 to the switch S3 to the capacitor C2 to a negative electrode of the voltage source P1. Or, optionally, within the first half cycle of one cycle of the alternating voltage, the controller may control the switch S7, the switch S5, the switch S2, the switch S6, the switch S9 and the power switch tube SG3 to be turned on and control the other switches and power switch tubes to be turned off so that the coil panel 20, the coil panel 30, the power switch tube SG3 and the capacitor C4 are connected in series to form a resonant circuit, and then, the flow direction of the current in the first half cycle is from the positive electrode of the voltage source P2 to the power switch tube SG3 to the switch S7 to the coil panel 30 to the switch S5 to the switch S2 to the coil panel 20 to the switch S6 to the switch S9 to the capacitor C4 to the negative electrode of the voltage source P2. Within the second half cycle of one cycle of the alternating voltage, the controller may control the switch S9, the switch S6, the switch S2, the switch S5, the switch S7, the switch S4 and the power switch tube SG2 to be turned on and control the other switches and power switch tubes to be turned off so that the coil panel 20, the coil panel 30, the power switch tube SG2 and the capacitor C3 are connected in series to form a resonant circuit, and then, the flow direction of a current in the second half cycle is from the positive electrode of the voltage source P2 to the capacitor C3 to the switch S9 to the switch S6 to the coil panel 20 to the switch S2 to the switch S5 to the coil panel 30 to the switch S7 to the switch S4 to the power switch tube SG2 to the negative electrode of the voltage source P1. Or, within the second half cycle of one cycle of the alternating voltage, the controller may control the switch S9, the switch S6, the switch S2, the switch S5, the switch S7 and the power switch tube SG4 to be turned on and control the other switches and power switch tubes to be turned off so that the coil panel 20, the coil panel 30, the power switch tube SG4 and the capacitor C3 are connected in series to form a resonant circuit, and then, the flow direction of the current in the second half cycle is from the positive electrode of the voltage source P2 to the capacitor C3 to the switch S9 to the switch S6 to the coil panel 20 to the switch S2 to the switch S5 to the coil panel 30 to the switch S7 to the power switch tube SG4 to the negative electrode of the voltage source P2.

[0026] The controller may further control the heating of the combination of the coil panel 10 and the coil panel 40. In this case, within the first half cycle of one cycle of an alternating voltage, the controller may control the

switch S1, the switch S5, the switch S8, the switch S9 and the power switch tube SG1 to be turned on and control the other switches and power switch tubes to be turned off so that the coil panel 10, the coil panel 40, the power switch tube SG1 and the capacitor C4 are connected in series to form a resonant circuit, and then, the flow direction of a current in the first half cycle is from the positive electrode of the voltage source P1 to the power switch tube SG1 to the switch S1 to the coil panel 10 to the switch S5 to the switch S8 to the coil panel 40 to the switch S9 to the capacitor C4 to the negative electrode of the voltage source P2. Within the second half cycle of one cycle of the alternating voltage, the controller may control the switch S3, the switch S6, the switch S8, the switch S5, the switch S1, the switch S4 and the power switch tube SG4 to be turned on and control the other switches and power switch tubes to be turned off so that the coil panel 10, the coil panel 40, the power switch tube SG4 and the capacitor C1 are connected in series to form a resonant circuit, and then, the flow direction of the current in the second half cycle is from the positive electrode of the voltage source P1 to the capacitor C1 to the switch S3 to the switch S6 to the coil panel 40 to the switch S8 to the switch S5 to the coil panel 10 to the switch S1 to the switch S4 to the power switch tube SG4.

[0027] The controller may control heating of the combination of the coil panel 10 and the coil panel 20. In this case, the controller may control the switches S1-S3 to be turned on and control the switches S4-S9 to be turned off. Within the first half cycle of one cycle of an alternating voltage, the controller may control the power switch tube SG1 to be turned on so that the coil panel 10, the coil panel 20, the power switch tube SG1 and the capacitor C2 are connected in series to form a resonant circuit, and then, the flow direction of a current in the first half cycle is from the positive electrode of the voltage source P1 to the power switch tube SG1 to the switch S1 to the coil panel 10 to the switch S2 to the coil panel 20 to the switch S3 to the capacitor C2 to the negative electrode of the voltage source P1. Within the second half cycle of one cycle of the alternating voltage, the controller may control the power switch tube SG2 to be turned on so that the coil panel 10, the coil panel 20, the power switch tube SG2 and the capacitor C1 are connected in series to form a resonant circuit, and then, the flow direction of the current in the second half cycle is from the positive electrode of the voltage source P1 to the capacitor C1 to the switch S3 to the coil panel 20 to the switch S2 to the coil panel 10 to the switch S1 to the power switch tube SG2 to the negative electrode of the voltage source P1.

[0028] The controller may control the heating of the combination of the coil panel 30 and the coil panel 40. In this case, the controller may control the switches S7-S9 to be turned on and control the switches S1-S6 to be turned off. Within the first half cycle of one cycle of an alternating voltage, the controller may control the power switch tube SG3 to be turned on so that the coil panel 30, the coil panel 40, the power switch tube SG3 and the capacitor C4 are connected in series to form a resonant circuit, and then, the flow direction of a current in the first half cycle is from the positive electrode of the voltage source P2 to the power switch tube SG3 to the switch S7 to the coil panel 30 to the switch S8 to the coil panel 40 to the switch S9 to the capacitor C4 to the negative electrode of the voltage source P2. Within the second half cycle of one cycle of the alternating voltage, the controller may control the power switch tube SG4 to be turned on so that the coil panel 30, the coil panel 40, the power switch tube SG4 and the capacitor C3 are connected in series to form a resonant circuit, and then, the flow direction of the current in the second half cycle is from the positive electrode of the voltage source P2 to the capacitor C3 to the switch S9 to the coil panel 40 to the switch S8 to the coil panel 30 to the switch S7 to the power switch tube SG4 to the negative electrode of the voltage source P2.

[0029] The controller may further realize the heating of the combination of the coil panel 10, the coil panel 20, the coil panel 30 and the coil panel 40. For example, the controller may control the switches S4-S6 to be turned off and control the switches S1-S3 and the switches S7-S9 to be turned on. Within the first half cycle of one cycle of an alternating voltage, the controller may control the power switch tube SG1 and the power switch tube SG3 to be turned on and control the power switch tube SG2 and the power switch tube SG4 to be turned off. Within the second half cycle of one cycle of the alternating voltage, the controller may control the power switch tube SG2 and the power switch tube SG4 to be turned on and control the power switch tube SG1 and the power switch tube SG3 to be turned off, so that all the coil panel 10, the coil panel 20, the coil panel 30 and the coil panel 40 may work at the same time.

[0030] It should be understood that those skilled in the art may perform simple modification or modify the control way of the controller on the basis of a circuit diagram as shown in Fig. 2, for example, the number of the coil panels in the heating control circuit may be increased or reduced or the number of the switches in the heating control circuit may be increased or reduced, so that heating of a serial combination formed by any two coil panels or any more coil panels in the heating control circuit is realized.

[0031] By means of control on heating of the combinations in various serial connection ways among the coil panels 10-40 in the above-mentioned embodiment, heating positions may be precisely controlled, and hardware in the circuit is sufficiently utilized.

[0032] Fig. 3 shows a heating control circuit for an electromagnetic cooking appliance according to an embodiment of the present invention. As shown in Fig. 3, the heating control circuit for the electromagnetic cooking appliance may include a first control circuit, a second control circuit and a controller (unshown in the figure), wherein the first control circuit may include a power switch tube SG1, a power switch tube SG2, a coil panel 10, a coil panel 20, a capacitor C1, a capacitor C2 and

a voltage source P1; and the second control circuit may include a power switch tube SG3, a power switch tube SG4, a coil panel 30, a coil panel 40, a capacitor C3, a capacitor C4 and a voltage source P2. The voltage source P1 and the voltage source P2 may be simultaneous alternating voltage sources, and negative electrodes of the voltage source P1 and the voltage source P2 are both connected to a common ground wire. Optionally, the voltage source P1 and the voltage source P2 may be single-phase voltage sources or multi-phase voltage sources.

[0033] In the first control circuit, the power switch tube SG1 and the power switch tube SG2 are connected in parallel to two ends of the voltage source P1 after being connected in series, the capacitor C1 and the capacitor C2 are connected in parallel to two ends of the voltage source P1 after being connected in series, the coil panel 10 and the coil panel 20 are connected in series, one end of the serially connected coil panel 10 and coil panel 20 is connected to an end point 11 between the power switch tube SG1 and the power switch tube SG2, and the other end of the serially connected coil panel 10 and coil panel 20 is connected to an end point 12 between the capacitor C1 and the capacitor C2, wherein one end of the coil panel 10 is connected to the end point 11, the other end of the coil panel 10 is connected to one end of the coil panel 20, and the other end of the coil panel 20 is connected to the end point 12.

[0034] In the second control circuit, the power switch tube SG3 and the power switch tube SG4 are connected in parallel to two ends of the voltage source P2 after being connected in series, the capacitor C3 and the capacitor C4 are connected in parallel to two ends of the voltage source P2 after being connected in series, the coil panel 30 and the coil panel 40 are connected in series, one end of the serially connected coil panel 30 and coil panel 40 is connected to an end point 13 between the power switch tube SG3 and the power switch tube SG4, and the other end of the serially connected coil panel 30 and coil panel 40 is connected to an end point 14 between the capacitor C3 and the capacitor C4, wherein one end of the coil panel 30 is connected to the end point 13, the other end of the coil panel 30 is connected to one end of the coil panel 40, and the other end of the coil panel 40 is connected to the end point 14.

[0035] The heating control circuit as shown in Fig. 3 may further include a single-pole double-throw switch S31 and a single-pole double-throw switch S32. The single-pole double-throw switch S31 is connected in series between the end point 11 and one end of the serially connected coil panel 10 and coil panel 20, wherein a free end *a* of the single-pole double-throw switch S31 is connected to the end point 11, one fixed end *b* of the single-pole double-throw switch S31 is connected to one end of the serially connected coil panel 10 and coil panel 20, and the other fixed end c of the single-pole double-throw switch S31 is connected between the end point 13 and one end of the serially connected coil panel 30 and coil panel 40. The single-pole double-throw switch S32 is connected in series between the coil panel 30 and the coil panel 40, wherein a free end *a* of the single-pole double-throw switch S32 is connected to the coil panel 30, one fixed end *b* of the single-pole double-throw switch S32 is connected to the coil panel 40, and the other fixed end c of the single-pole double-throw switch S32 is connected between the coil panel 10 and the coil panel 20. The controller may realize heating carried out by a combination of the coil panels 10-40 by controlling the power switch tubes SG1-SG4 as well as the switches S31 and the switch S32.

[0036] The power switch tubes used in the embodiment of the present invention may be high-power switch devices such as an IGBT or a high-power relay. Optionally, the power switch tubes are unidirectional conducting devices.

[0037] The controller may realize heating carried out by a combination of the coil panel 20 and the coil panel 30. In this case, the controller may control the free end *a* of the single-pole double-throw switch S31 to be connected to the fixed end c and control the free end *a* of the single-pole double-throw switch S32 to be connected to the fixed end *b*. Within the first half cycle of one cycle of an alternating voltage, the controller may control the power switch tube SG1 to be turned on so that the coil panel 30, the coil panel 20, the power switch tube SG1 and the capacitor C2 are connected in series to form a resonant circuit. Within the second half cycle of one cycle of the alternating voltage, the controller may control the power switch tube SG2 to be turned on so that the coil panel 30, the coil panel 20, the power switch tube SG2 and the capacitor C1 are connected in series to form a resonant circuit.

[0038] The controller may further realize heating carried out by a combination of the coil panel 10 and the coil panel 20. In this case, the controller may control the free end *a* of the single-pole double-throw switch S31 to be connected to the fixed end *b*. Within the first half cycle of one cycle of an alternating voltage, the controller may control the power switch tube SG1 to be turned on so that the coil panel 10, the coil panel 20, the power switch tube SG1 and the capacitor C2 are connected in series to form a resonant circuit. Within the second half cycle of one cycle of the alternating voltage, the controller may control the power switch tube SG2 to be turned on so that the coil panel 10, the coil panel 20, the power switch tube SG2 and the capacitor C1 are connected in series to form a resonant circuit.

[0039] The controller may further realize heating carried out by a combination of the coil panel 30 and the coil panel 40. In this case, the controller may control the free end *a* of the single-pole double-throw switch S32 to be connected to the fixed end c. Within the first half cycle of one cycle of an alternating voltage, the controller may control the power switch tube SG3 to be turned on so that the coil panel 30, the coil panel 40, the power switch tube SG3 and the capacitor C4 are connected in series

to form a resonant circuit. Within the second half cycle of one cycle of the alternating voltage, the controller may control the power switch tube SG4 to be turned on so that the coil panel 30, the coil panel 40, the power switch tube SG4 and the capacitor C3 are connected in series to form a resonant circuit.

[0040] The controller may further realize heating carried out by a combination of the coil panel 10, the coil panel 20, the coil panel 30 and the coil panel 40. For example, the controller may control the free end *a* of the single-pole double-throw switch S31 to be connected to the fixed end *b* and control the free end *a* of the single-pole double-throw switch S32 to be connected to the fixed end c. Within the first half cycle of one cycle of an alternating voltage, the controller may control the power switch tube SG1 and the power switch tube SG3 to be turned on and control the power switch tube SG2 and the power switch tube SG4 to be turned off. Within the second half cycle of one cycle of the alternating voltage, the controller may control the power switch tube SG2 and the power switch tube SG4 to be turned on and control the power switch tube SG1 and the power switch tube SG3 to be turned off, so that all the coil panel 10, the coil panel 20, the coil panel 30 and the coil panel 40 work at the same time.

[0041] It should be understood that those skilled in the art may perform simple modification or modify the control way of the controller on the basis of a circuit diagram as shown in Fig. 3, for example, the coil panels in the heating control circuit may be increased or reduced or the switches in the heating control circuit may be increased or reduced, so that the heating of a serial combination formed by any two coil panels or any more coil panels in the heating control circuit is realized.

[0042] By means of control on heating of the combinations in various serial connection ways among the coil panels 10-40 in the above-mentioned embodiment, heating positions may be precisely controlled, the number of the switch devices in the circuit is reduced, and the cost is reduced while the circuit is optimized.

[0043] Fig. 4 shows a heating control circuit for an electromagnetic cooking appliance according to an embodiment of the present invention. As shown in Fig. 4, the heating control circuit for the electromagnetic cooking appliance may include a first control circuit, a second control circuit and a controller (unshown in the figure), wherein the first control circuit may include a power switch tube SG1, a power switch tube SG2, a coil panel 10, a coil panel 20, a capacitor C1, a capacitor C2 and a voltage source P1; and the second control circuit may include a power switch tube SG3, a power switch tube SG4, a coil panel 30, a coil panel 40, a capacitor C3, a capacitor C4 and a voltage source P2. The voltage source P1 and the voltage source P2 may be simultaneous alternating voltage sources, and negative electrodes of the voltage source P1 and the voltage source P2 are both connected to a common ground wire. Optionally, the voltage source P1 and the voltage source P2 may be single-phase voltage sources or multi-phase voltage sources.

[0044] In the first control circuit, the power switch tube SG1 and the power switch tube SG2 are connected in parallel to two ends of the voltage source P1 after being connected in series, the capacitor C1 and the capacitor C2 are connected in parallel to two ends of the voltage source P1 after being connected in series, the coil panel 10 and the coil panel 20 are connected in series, one end of the serially connected coil panel 10 and coil panel 20 is connected to an end point 11 between the power switch tube SG1 and the power switch tube SG2, and the other end of the serially connected coil panel 10 and coil panel 20 is connected to an end point 12 between the capacitor C1 and the capacitor C2, wherein one end of the coil panel 20 is connected to the end point 11, the other end of the coil panel 20 is connected to one end of the coil panel 10, and the other end of the coil panel 10 is connected to the end point 12.

[0045] In the second control circuit, the power switch tube SG3 and the power switch tube SG4 are connected in parallel to two ends of the voltage source P2 after being connected in series, the capacitor C3 and the capacitor C4 are connected in parallel to two ends of the voltage source P2 after being connected in series, the coil panel 30 and the coil panel 40 are connected in series, one end of the serially connected coil panel 30 and coil panel 40 is connected to an end point 13 between the power switch tube SG3 and the power switch tube SG4, and the other end of the serially connected coil panel 30 and coil panel 40 is connected to an end point 14 between the capacitor C3 and the capacitor C4, wherein one end of the coil panel 40 is connected to the end point 13, the other end of the coil panel 40 is connected to one end of the coil panel 30, and the other end of the coil panel 30 is connected to the end point 14.

[0046] As shown in Fig. 4, the heating control circuit may further include switches S1-S4, wherein the switch S1 is connected in series between the coil panel 10 and the coil panel 20; one end of the switch S2 is connected between the switch S1 and the coil panel 20, and the other end of the switch S2 is connected between the coil panel 30 and the coil panel 40; one end of the switch S3 is connected between the other end of the coil panel 10 and the end point 12, and the other end of the switch S3 is connected between the other end of the coil panel 30 and the switch S4; and the switch S4 is connected in series between the other end of the serially connected coil panel 30 and coil panel 40 and the end point 14.

[0047] The controller may control heating of a combination of the coil panel 20 and the coil panel 30. In this case, the controller may control the switch S2 and the switch S3 to be turned on and control the switch S1 and the switch S4 to be turned off. Within the first half cycle of one cycle of an alternating voltage, the controller may control the power switch tube SG1 to be turned on so that the coil panel 30, the coil panel 20, the power switch tube SG1 and the capacitor C2 are connected in series

to form a resonant circuit. Within the second half cycle of one cycle of the alternating voltage, the controller may control the power switch tube SG2 to be turned on so that the coil panel 30, the coil panel 20, the power switch tube SG2 and the capacitor C1 are connected in series to form a resonant circuit. The controller may further control heating of a combination of the coil panel 10 and the coil panel 20. In this case, the controller may control the switch S1 to be turned on and control the switch S2 and the switch S3 to be turned off. Within the first half cycle of one cycle of an alternating voltage, the controller may control the power switch tube SG1 to be turned on so that the coil panel 10, the coil panel 20, the power switch tube SG1 and the capacitor C2 are connected in series to form a resonant circuit. Within the second half cycle of one cycle of the alternating voltage, the controller may control the power switch tube SG2 to be turned on so that the coil panel 10, the coil panel 20, the power switch tube SG2 and the capacitor C1 are connected in series to form a resonant circuit.

[0048] The controller may further control heating of a combination of the coil panel 30 and the coil panel 40. In this case, the controller may control the switch S4 to be turned on and control the switch S2 and the switch S3 to be turned off. Within the first half cycle of one cycle of an alternating voltage, the controller may control the power switch tube SG3 to be turned on so that the coil panel 30, the coil panel 40, the power switch tube SG3 and the capacitor C4 are connected in series to form a resonant circuit. Within the second half cycle of one cycle of the alternating voltage, the controller may control the power switch tube SG4 to be turned on so that the coil panel 30, the coil panel 40, the power switch tube SG4 and the capacitor C3 are connected in series to form a resonant circuit.

[0049] The controller may further realize heating carried out by a combination of the coil panel 10, the coil panel 20, the coil panel 30 and the coil panel 40. For example, the controller may control the switch S1 and the switch S4 to be turned on and control the switch S2 and the switch S3 to be turned off. Within the first half cycle of one cycle of an alternating voltage, the controller may control the power switch tube SG1 and the power switch tube SG3 to be turned on and control the power switch tube SG2 and the power switch tube SG4 to be turned off. Within the second half cycle of one cycle of the alternating voltage, the controller may control the power switch tube SG2 and the power switch tube SG4 to be turned on and control the power switch tube SG1 and the power switch tube SG3 to be turned off, so that all the coil panel 10, the coil panel 20, the coil panel 30 and the coil panel 40 may work at the same time.

[0050] By means of control on heating of the combinations in various serial connection ways among the coil panels 10-40 in the above-mentioned embodiment, heating positions may be precisely controlled, the number of the switch devices in the circuit is reduced, and the cost is reduced while the circuit is optimized.

[0051] It should be understood that those skilled in the art may perform simple modification or modify the control way of the controller on the basis of a circuit diagram as shown in Fig. 4, for example, the coil panels in the heating control circuit may be increased or reduced or the switches in the heating control circuit may be increased or reduced, so that heating of a serial combination formed by any two coil panels or any more coil panels in the heating control circuit is realized.

[0052] Optionally, in a minimum system circuit, the switch S4 in the circuit as shown in Fig. 4 may also be replaced with a conducting wire. Compared with the unreplaced circuit as shown in Fig. 4, the replaced circuit is characterized in that one end of the switch S3 is connected between the other end of the coil panel 10 and the end point 12, and the other end of the switch S3 is connected between the other end of the coil panel 30 and the end point 14, as shown in Fig. 5.

[0053] In a heating control circuit as shown in Fig. 5, a controller may control heating of a combination of a coil panel 20 and a coil panel 30. In this case, the controller may control a switch S2 to be turned on and control a switch S1, a switch S3 and a switch S4 to be turned off. Within the first half cycle of one cycle of an alternating voltage, the controller may control a power switch tube SG1 to be turned on so that the coil panel 20, the coil panel 30, the power switch tube SG1 and a capacitor C4 are connected in series to form a resonant circuit. Within the second half cycle of one cycle of the alternating voltage, the controller may control a power switch tube SG2 to be turned on so that the coil panel 30, the coil panel 20, the power switch tube SG2 and a capacitor C3 are connected in series to form a resonant circuit.

[0054] The controller may further control heating of a combination of a coil panel 10 and the coil panel 20. In this case, the controller may control the switch S1 to be turned on and control the switch S2 and the switch S3 to be turned off. Within the first half cycle of one cycle of an alternating voltage, the controller may control the power switch tube SG1 to be turned on so that the coil panel 10, the coil panel 20, the power switch tube SG1 and a capacitor C2 are connected in series to form a resonant circuit. Within the second half cycle of one cycle of the alternating voltage, the controller may control the power switch tube SG2 to be turned on so that the coil panel 10, the coil panel 20, the power switch tube SG2 and a capacitor C1 are connected in series to form a resonant circuit.

[0055] The controller may further control heating of a combination of the coil panel 30 and a coil panel 40. In this case, the controller may control the switch S2 and the switch S3 to be turned off. Within the first half cycle of one cycle of an alternating voltage, the controller may control a power switch tube SG3 to be turned on so that the coil panel 30, the coil panel 40, the power switch tube SG3 and the capacitor C4 are connected in series to form a resonant circuit. Within the second half cycle of one cycle of the alternating voltage, the controller may control

a power switch tube SG4 to be turned on so that the coil panel 30, the coil panel 40, the power switch tube SG4 and the capacitor C3 are connected in series to form a resonant circuit.

[0056] The controller may further realize heating carried out by a combination of the coil panel 10, the coil panel 20, the coil panel 30 and the coil panel 40. For example, the controller may control the switch S1 to be turned on and control the switch S2 and the switch S3 to be turned off. Within the first half cycle of one cycle of an alternating voltage, the controller may control the power switch tube SG1 and the power switch tube SG3 to be turned on and control the power switch tube SG2 and the power switch tube SG4 to be turned off. Within the second half cycle of one cycle of the alternating voltage, the controller may control the power switch tube SG2 and the power switch tube SG4 to be turned on and control the power switch tube SG1 and the power switch tube SG3 to be turned off, so that all the coil panel 10, the coil panel 20, the coil panel 30 and the coil panel 40 may work.

[0057] By means of control on heating of the combinations in various serial connection ways among the coil panels 10-40 in the above-mentioned embodiment, heating positions may be precisely controlled, the number of the switch devices in the circuit is reduced, and the cost is reduced while the circuit is optimized.

[0058] It should be understood that those skilled in the art may perform simple modification or modify the control way of the controller on the basis of a circuit diagram as shown in Fig. 5, for example, the number of the coil panels in the heating control circuit may be increased or reduced or the number of the switches in the heating control circuit may be increased or reduced, so that heating of a serial combination formed by any two coil panels or any more coil panels in the heating control circuit is realized.

[0059] Accordingly, an embodiment of the present invention further provides an electromagnetic cooking appliance which may be, for example, an electromagnetic oven, and the electromagnetic cooking appliance may include the heating control circuit in any one embodiment of the present invention. The electromagnetic cooking appliance may realize precise control on heating positions.

[0060] Optional implementation ways of the embodiments of the present invention are described in detail above in combination with the accompanying drawings, however, the embodiments of the present invention are not limited to specific details in the above-mentioned implementation ways, technical solutions of the embodiments of the present invention may be subjected to various simple modifications within the scope of technical conceptions of the embodiments of the present invention, and these simple modifications belong to the protective scopes of the embodiments of the present invention.

[0061] In addition, it should be noted that all the specific technical features described in the above-mentioned specific implementation ways may be combined in any appropriate ways under the condition that no conflicts exist. In order to avoid unnecessary repetition, various possible combination ways are not additionally described in the embodiments of the present invention.

[0062] Those skilled in the art may understand that all or parts of steps in methods in the above-mentioned embodiments may be completed by relevant hardware instructed by a program, the program is stored in a storage medium and includes a plurality of instructions for making a single chip microcomputer, a chip or a processor execute all or parts of steps of the method in each embodiment of the application. The aforesaid storage medium includes various media capable of storing program codes, such as a USB disk, a mobile hard disk, an ROM (Read-Only Memory), an RAM (Random Access Memory), a diskette , an optical disc and so on.

[0063] In addition, various different implementation ways of the embodiments of the present invention may also be optionally combined, and any one without departing from the concepts of the embodiments of the present invention should be regarded as the content disclosed by the embodiments of the present invention.

Claims

1. A heating control circuit for an electromagnetic cooking appliance, **characterized by** comprising:

   at least two control circuits, wherein each of the at least two control circuits comprises at least one coil panel, and each of the at least two control circuits comprises a voltage source, at least one power switch tube and at least one capacitor;
   at least one switch provided in the at least two control circuits and/or between the at least two control circuits; and
   a controller configured to realize heating carried out by a combination of any at least two coil panels connected in series in the at least two control circuits by controlling the power switch tube in each of the two or more control circuits and the switch.

2. The heating control circuit according to claim 1, **characterized in that** the at least two control circuits comprise a first control circuit and a second control circuit, wherein
   the first control circuit comprises a first voltage source, a first coil panel, a second coil panel, a first power switch tube, a second power switch tube, a first capacitor and a second capacitor, wherein the first power switch tube and the second power switch tube are connected in parallel to two ends of the first voltage source after being connected in series, the first capacitor and the second capacitor are connected in parallel to the two ends of the first voltage source after being connected in series, the first coil

panel and the second coil panel are connected in series, one end of the serially connected first coil panel and second coil panel is connected to a first end point between the first power switch tube and the second power switch tube, and the other end of the serially connected first coil panel and second coil panel is connected to a second end point between the first capacitor and the second capacitor; and

the second control circuit comprises a second voltage source, a third coil panel, a fourth coil panel, a third power switch tube, a fourth power switch tube, a third capacitor and a fourth capacitor, wherein the third power switch tube and the fourth power switch tube are connected in parallel to two ends of the second voltage source after being connected in series, the third capacitor and the fourth capacitor are connected in parallel to two ends of the second voltage source after being connected in series, the third coil panel and the fourth coil panel are connected in series, one end of the serially connected third coil panel and fourth coil panel is connected to a third end point between the third power switch tube and the fourth power switch tube, and the other end of the serially connected third coil panel and fourth coil panel is connected to a fourth end point between the third capacitor and the fourth capacitor.

3. The heating control circuit according to claim 2, **characterized in that**

one end of the first coil panel is connected to the first end point, the other end of the first coil panel is connected to one end of the second coil panel, and the other end of the second coil panel is connected to the second end point; and

one end of the third coil panel is connected to the third end point, the other end of the third coil panel is connected to one end of the fourth coil panel, and the other end of the fourth coil panel is connected to the fourth end point.

4. The heating control circuit according to claim 3, wherein the at least one switche comprises nine switches, wherein

a first switch is connected in series between the first end point and one end of the serially connected first coil panel and second coil panel;

a second switch is connected in series between the first coil panel and the second coil panel;

a third switch is connected in series between the second end point and the other end of the serially connected first coil panel and second coil panel;

one end of a fourth switch is connected between the first end point and one end of the first switch, and the other end of the fourth switch is connected between the third end point and the seventh switch;

one end of a fifth switch is connected between the other end of the first coil panel and the second switch, and the other end of the fifth switch is connected between the other end of the third coil panel and the eighth switch;

one end of a sixth switch is connected between the other end of the second coil panel and the third switch, and the other end of the sixth switch is connected between the other end of the fourth coil panel and the ninth switch;

a seventh switch is connected in series between the third end point and one end of the serially connected third coil panel and fourth coil panel;

a eighth switch is connected in series between the third coil panel and the fourth coil panel; and

a ninth switch is connected in series between the fourth end point and the other end of the serially connected third coil panel and fourth coil panel.

5. The heating control circuit according to claim 3, **characterized in that** the at least one switch comprises:

a first single-pole double-throw switch connected in series between the first end point and one end of the serially connected first coil panel and second coil panel, wherein a free end of the first single-pole double-throw switch is connected to the first end point, one fixed end of the first single-pole double-throw switch is connected to one end of the serially connected first coil panel and

second coil panel, and the other fixed end of the first single-pole double-throw switch is connected between the third end point and one end of the serially connected third coil panel and fourth coil panel; and

a second single-pole double-throw switch connected in series between the third coil panel and the fourth coil panel, wherein a free end of the second single-pole double-throw switch is connected to the third coil panel, one fixed end of the second single-pole double-throw switch is connected to the fourth coil panel, and the other fixed end of the second single-pole double-throw switch is connected between the first coil panel and the second coil panel.

6. The heating control circuit according to claim 2, **characterized in that**

one end of the second coil panel is connected to the first end point, the other end of the second coil panel is connected to one end of the first coil panel, and the other end of the first coil panel is connected to the second end point; and

one end of the fourth coil panel is connected to the third end point, the other end of the fourth coil panel is connected to one end of the third coil panel, and the other end of the third coil panel is connected to the fourth end point.

7. The heating control circuit according to claim 6, **char-**

acterized in that the one or more switches comprise four switches, wherein
a first switch is connected in series between the first coil panel and the second coil panel;
one end of a second switch is connected between the first switch and the second coil panel, and the other end of the second switch is connected between the third coil panel and the fourth coil panel; one end of a third switch is connected between the other end of the first coil panel and the second end point, and the other end of the third switch is connected between the other end of the third coil panel and the fourth switch; and
a fourth switch is connected in series between the other end of the serially connected third coil panel and fourth coil panel and the fourth end point.

8. The heating control circuit according to claim 6, **characterized in that** the one or more switches comprise:

a first switch connected in series between the first coil panel and the second coil panel;
a second switch, one end of the second switch being connected between the first switch and the second coil panel, and the other end of the second switch being connected between the third coil panel and the fourth coil panel; and
a third switch, one end of the third switch being connected between the other end of the first coil panel and the second end point, and the other end of the third switch being connected between the other end of the third coil panel and the fourth end point.

9. The heating control circuit according to claim 1, **characterized in that** the first voltage source and the second voltage source are from a same voltage source.

10. An electromagnetic cooking appliance, **characterized by** comprising the heating control circuit according to any one of claims 1-9.

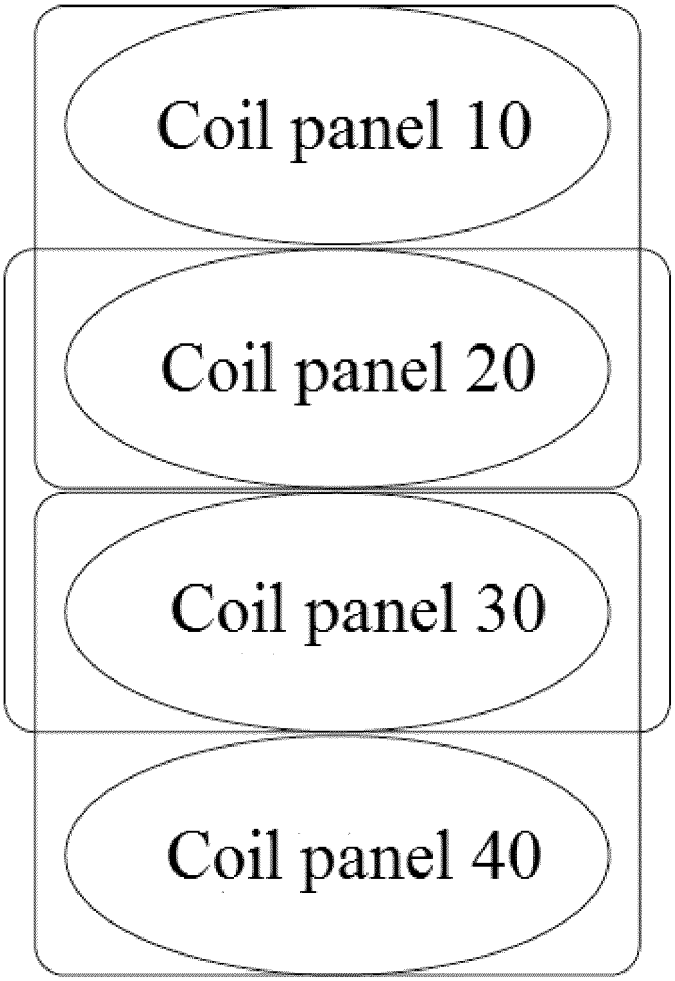
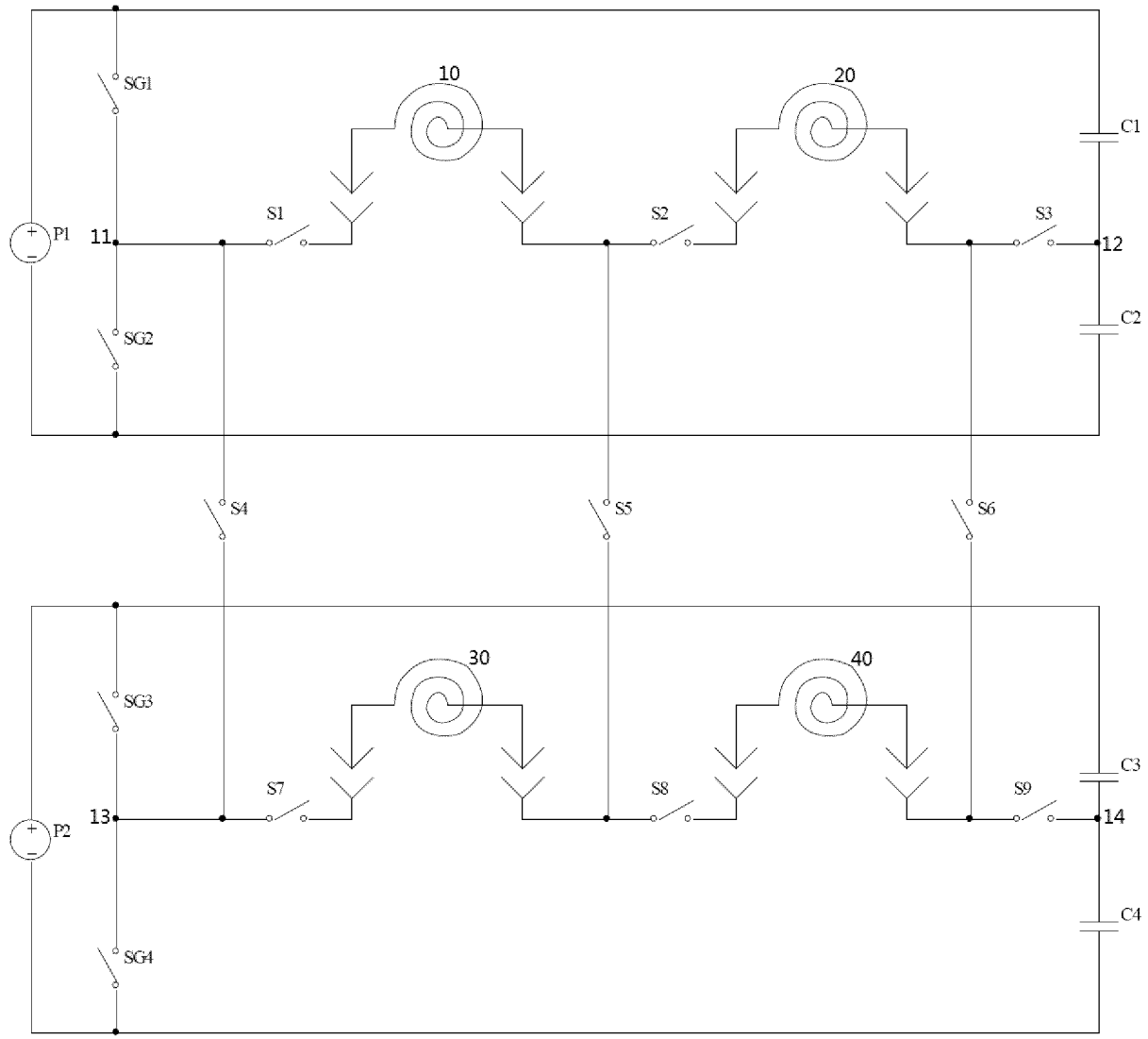


Fig. 1


SG1
10
20
C1
P1
11
S1
S2
S3
12
C2
SG2
S4
S5
S6
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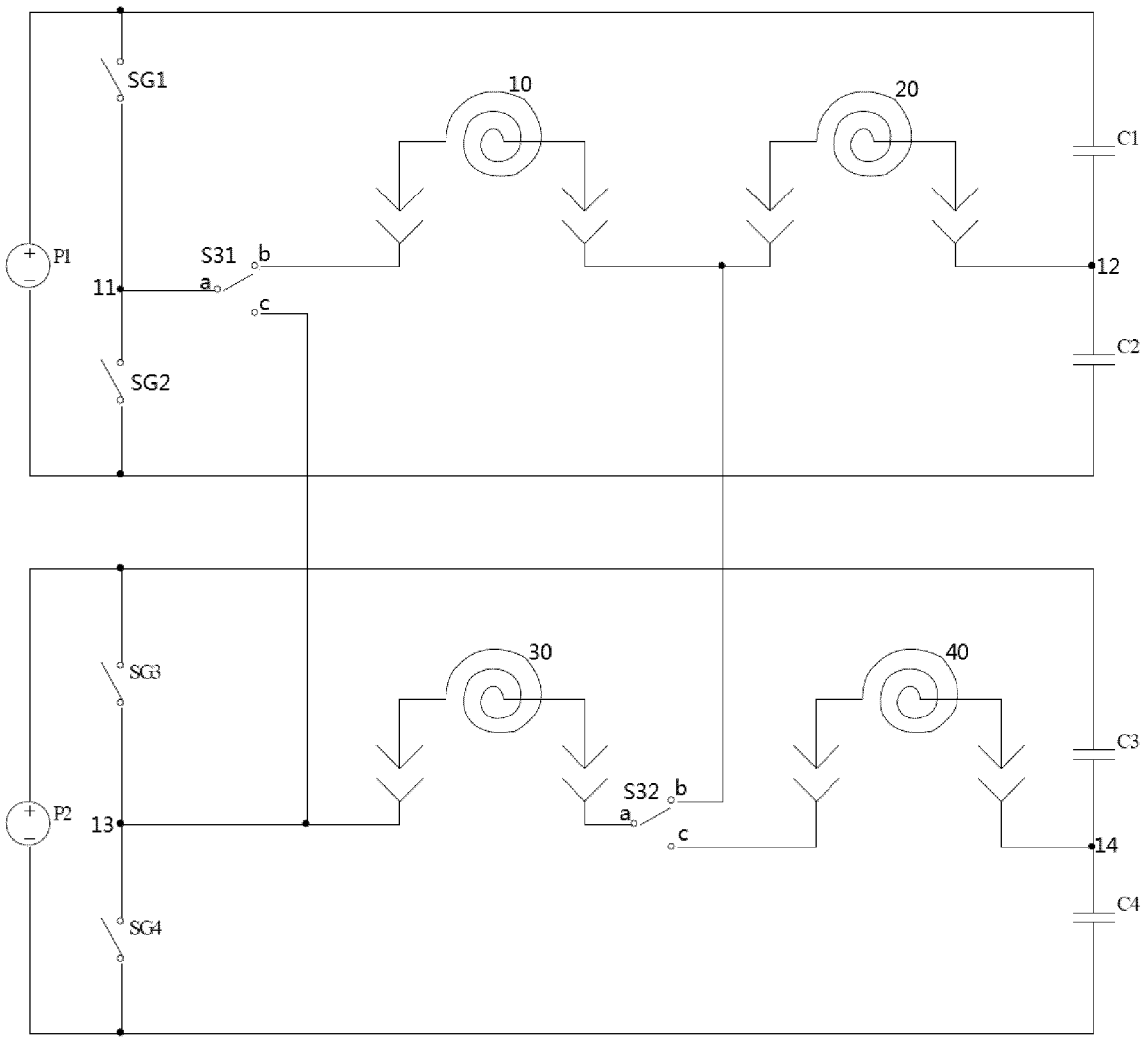
SG3
C3
S7
S8
S9
P2
13
14
C4
SG4

Fig. 2


SG1
10
20
C1
P1
S31
b
a
11
c
12
C2
SG2
SG3
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40
C3
S32
b
P2
a
13
c
14
C4
SG4

Fig. 3

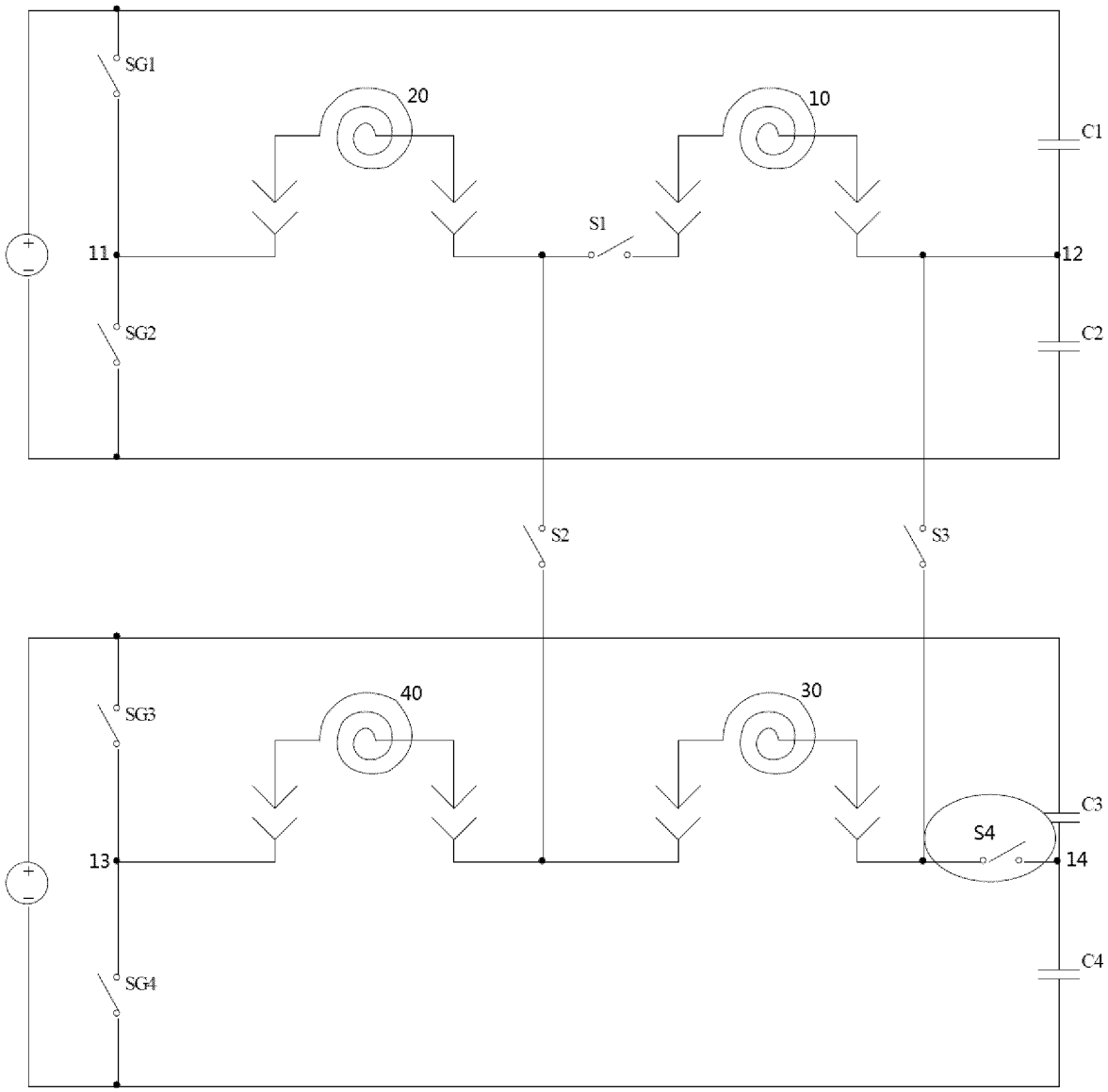

Fig. 4

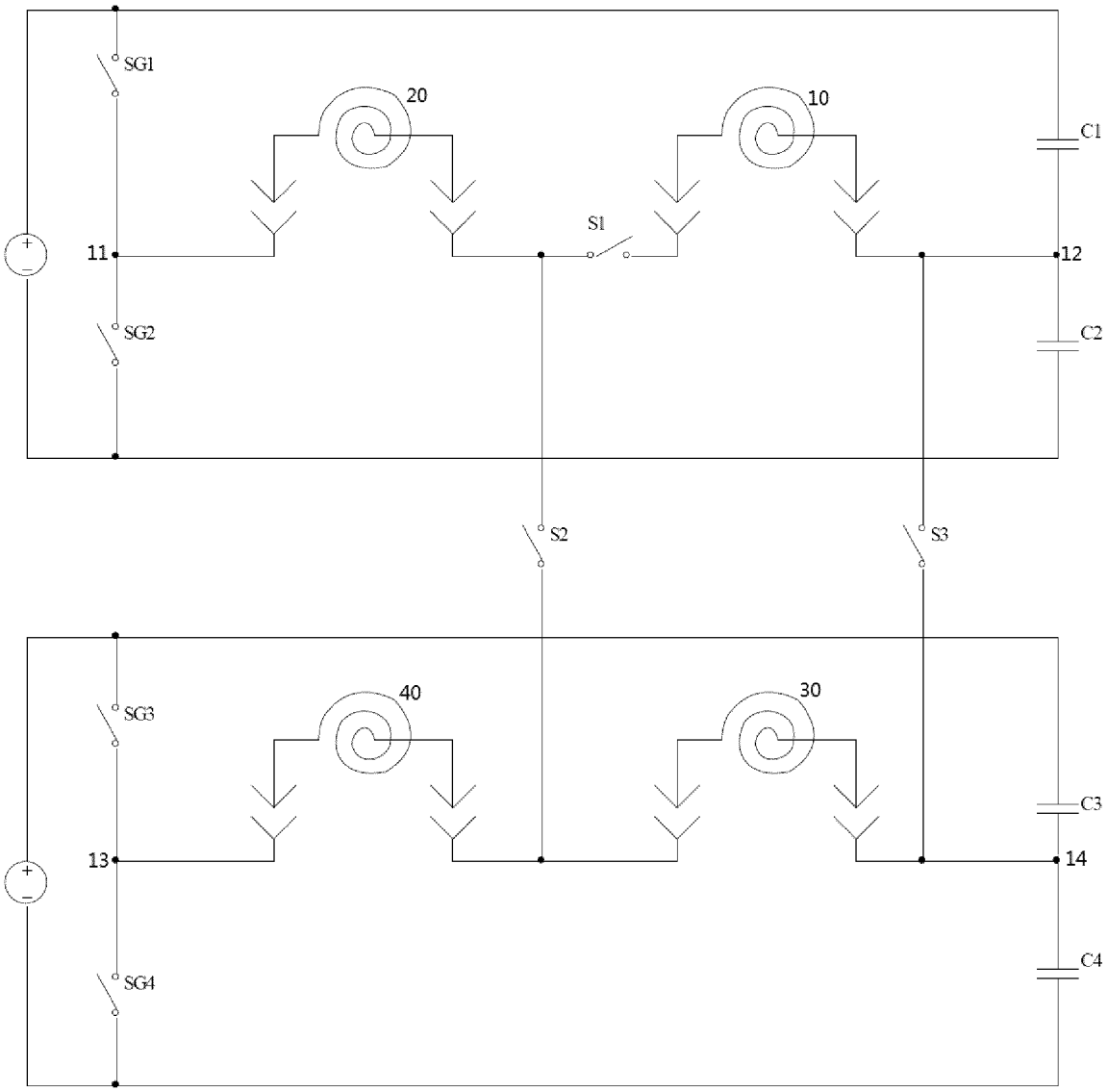

Fig. 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2018/085002

A. CLASSIFICATION OF SUBJECT MATTER

H05B 6/44(2006.01)i; H05B 6/06(2006.01)i; H05B 1/02(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)

H05B; H02M

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

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

CNABS; CNTXT, DWPI, SIPOABS: 电容, 晶体管, 两个, 线圈, 三极管, 电磁, 加热, 线圈盘, 控制, 多个, IGBT, MOS, 开关, FET, 线盘, 场效应管, capacitor, transisitor, triode, switch, coil, disk, panel, control, heat, electromagnet+

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	CN 106879095 A (FOSHAN SHUNDE MIDEA ELECTRICAL HEATING APPLIANCES MANUFACTURING CO., LTD.; MIDEA GROUP CO., LTD.) 20 June 2017 (2017-06-20) description, paragraphs 0026-0052, and figures 1-5	1, 9, 10
Y	CN 203775445 U (MIDEA GROUP CO., LTD.; FOSHAN SHUNDE MIDEA ELECTRICAL HEATING APPLIANCES MANUFACTURING CO., LTD.) 13 August 2014 (2014-08-13) description, paragraphs 0053-0058, and figure 2	1, 9, 10
A	CN 202818656 U (ZHANG, ZHENQIANG) 20 March 2013 (2013-03-20) entire document	1-10
A	CN 206506730 U (FOSHAN SHUNDE MIDEA ELECTRICAL HEATING APPLIANCES MANUFACTURING CO., LTD.) 19 September 2017 (2017-09-19) entire document	1-10
A	CN 101715256 A (HITACHI APPLIANCES, INC.) 26 May 2010 (2010-05-26) entire document	1-10
A	CN 105530719 A (SHENZHEN CHK CO., LTD.) 27 April 2016 (2016-04-27) entire document	1-10

☐ Further documents are listed in the continuation of Box C. ☑ See patent family annex.

* Special categories of cited documents:

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"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

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
27 July 2018	**09 August 2018**

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**	
Facsimile No. **(86-10)62019451**	Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2018/085002

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		CN 101715256 B	05 September 2012
		EP 2170010 B1	04 March 2015
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		JP 2010080356 A	08 April 2010
CN 105530719 A	27 April 2016	None	

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