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(71) Applicant: **Barikhan, Yousef Husni**
20090 Segrate (Milan) (IT)

(72) Inventor: **Barikhan, Yousef Husni**
20090 Segrate (Milan) (IT)

(74) Representative: **Modiano, Guido, Dr.-Ing. et al**
Modiano & Associati SpA
Via Meravigli, 16
20123 Milano (IT)

(54) Electronic starting device for fluorescent discharge lamps and the like,having improved characteristics

(57) An electronic starting device (1) for fluorescent discharge lamps, highpressure lamps and the like which is meant to be connected downstream of at least one discharge lamp (2) which is connected to the AC supply mains by means of a ballast (3), the particularity of which is the fact that it comprises a rectifier bridge (5) which is connected to first pins of the at least one lamp, a Zener diode (6) and a first resistor (7) which are series-connected to the rectifier bridge, and a circuit portion which is constituted by a first capacitor (8) and a second capacitor (11) to which a second resistor (9) and a third resistor (12) are respectively parallel-connected, a diac (13) which is series-connected to the second capacitor (11), and a third capacitor (14) to which a fourth resistor (15) is parallel-connected, switching means (10) being provided which are connected to the circuit portion and to the rectifier bridge, the switching means being connected to the diac (13) by means of a first terminal, to the first capacitor (8) by means of a second terminal and to the rectifier bridge (5) by means of a third terminal, the third capacitor (14) and the fourth resistor (15) being connected between the first terminal and the second terminal.

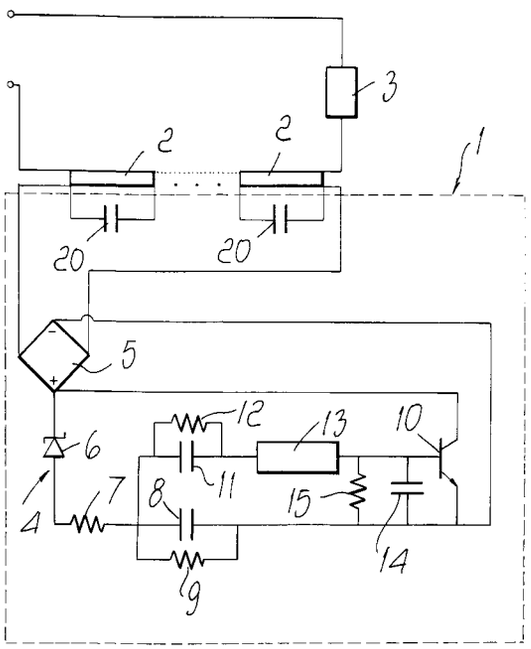

FIG.1

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Description

[0001] The present invention relates to an electronic starting device for fluorescent, high-pressure discharge lamps and the like having improved characteristics.

[0002] More particularly, the invention relates to an automatic starting device for fluorescent lamps and for high-pressure lamps and the like of any power level.

[0003] It is known that fluorescent and high-pressure lamps require, in order to light up, a device for automatic starting, known as starter, which allows to preheat the cathodes (filaments) of the lamps and therefore allow them to light up.

[0004] In practice, the starter is arranged downstream of a ballast which is connected to the mains voltage and to a pin of the lamp to be lit and allows to feed from the ballast to the filaments of the lamp an overvoltage which is capable of gradually starting the discharge in the fluorescent lamp (for example a neon tube) in order to light it.

[0005] Then, when the steady-state voltage during the operation of the lamp is lower than the mains voltage, the starter switches off and remains inactive throughout the time during which the lamp is normally lit.

[0006] Conventional lighting devices generally use a glow-discharge starter or a thermal starter or an electronic starter.

[0007] The latter type of starter is the one that provides the best characteristics for modern lamps.

[0008] However, in order to light a fluorescent lamp it is necessary to provide a suitable ballast and a starter for each lamp. If one wishes to light two or more lamps arranged in series, it is therefore necessary to provide an equal number of ballasts in addition to corresponding lighting devices.

[0009] This of course entails high costs due to the presence of a plurality of ballasts and starters, additional overall dimensions and, last but not least, problems in the disposal of a larger number of ballasts and starters when they need to be replaced.

[0010] It is therefore evident that the need is felt to light a plurality of fluorescent lamps arranged mutually in series without having to resort to a ballast and a starter for each lamp.

[0011] The aim of the present invention is to provide a lighting device for fluorescent lamps and the like which allows to resort to a single starter to light a plurality of fluorescent lamps arranged mutually in series.

[0012] Within the scope of this aim, an object of the present invention is to provide a lighting device for fluorescent lamps and the like which allows substantially instantaneous lighting of the series-connected fluorescent lamps.

[0013] Another object of the present invention is to provide a lighting device for fluorescent lamps and the like which not only allows to light the lamps (even low-pressure lamps) substantially instantaneously but also allows to preserve the durability of said lamps and of the ballast for long periods.

[0014] Another object of the present invention is to provide a lighting device for fluorescent lamps and the like which further allows to extend the life of the ballast with respect to what occurs in conventional lighting devices.

[0015] Another object of the present invention is to provide a lighting device for fluorescent lamps and the like which is highly reliable, relatively easy to produce and at competitive costs.

[0016] This aim, these objects and others which will become apparent hereinafter are achieved by an electronic starting device for fluorescent discharge lamps, high-pressure lamps and the like which is meant to be connected downstream of at least one discharge lamp which is connected to the AC supply mains by means of a ballast, characterized in that it comprises a rectifier bridge which is connected to first pins of said at least one lamp, a Zener diode and a first resistor which are series-connected to said rectifier bridge, and a circuit portion which is constituted by a first capacitor and a second capacitor to which a second resistor and a third resistor are respectively parallel-connected, a diac which is series-connected to said second capacitor, and a third capacitor to which a fourth resistor is parallel-connected, switching means being provided which are connected to said circuit portion and to said rectifier bridge, said switching means being connected to said diac by means of a first terminal, to said first capacitor by means of a second terminal and to said rectifier bridge by means of a third terminal, said third capacitor and said fourth resistor being connected between said first terminal and said second terminal.

[0017] Further characteristics and advantages of the invention will become apparent from the description of preferred but not exclusive embodiments of the device according to the invention, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

Figure 1 is a circuit diagram of the device according to the present invention;
Figure 2 is a circuit diagram illustrating in greater detail the connection between the fluorescent lamps and the corresponding capacitors;
Figure 3 is a circuit diagram of a second embodiment of the device according to the invention; and
Figure 4 is a circuit diagram of a third embodiment of the device according to the invention.

[0018] With reference to the above figures, the starting device according to the present invention, generally designated by the reference numeral 1, is parallel-connected to one or more fluorescent lamps or high-pressure lamps and the like 2, which are mutually series-connected. In turn, the lamps 2 are connected to the supply mains by means of a ballast 3.

[0019] The starting device comprises a starter, gen-

erally designated by the reference numeral 4, which is connected in parallel to the lamps 2 to be lit.

[0020] In a first embodiment, the device according to the invention provides for the lighting of at least one lamp 2 by means of the starter 4, which comprises a diode rectifier bridge 5 which is connected to a pin of the lamps 2; a Zener diode 6 is connected to the positive terminal of said bridge and is provided with a first series-connected resistor 7. A first capacitor 8 is series-connected to the first resistor 7 and has a second resistor 9 parallel-connected thereto. The first capacitor 8 is connected to switching means which are preferably constituted by a bipolar transistor 10 or by an IGBT.

[0021] In the case of a transistor, the capacitor 8 (with the parallel-connected resistor 9) is connected to the emitter terminal of the transistor. The following components are connected to the base terminal of the transistor 10: a second capacitor 11, with a third resistor 12 parallel-connected thereto; a diac 13, which is series-connected to the capacitor 11; and a third capacitor 14, which is parallel-connected to the diac 13 and has a fourth resistor 15 parallel-connected thereto.

[0022] The capacitor 14 is therefore connected between the base terminal and the emitter terminal of the transistor 10, in which the collector terminal is connected to the positive node of the diode bridge 5 and the emitter terminal is connected to the negative node of the diode bridge.

[0023] If a plurality of lamps 2 are present, said lamps are mutually series-connected by means of a single pin, whereas the other pin of the lamps is connected to the diode bridge 5.

[0024] The presence of the first, second and third capacitors, designated by the reference numerals 8, 11 and 14 respectively, allows the device according to the invention to light the fluorescent lamps 2 instantaneously (in less than two seconds). In particular, the starting of the lamps 2 is activated progressively, first on one lamp and then on the other.

[0025] The switching of the switching means 10 at a high frequency (35 kHz or higher) causes an interruption of the current in the ballast 3, producing successive short high-voltage fronts (1.2 kV or more) which first heat the filaments of the fluorescent lamps 2 and then light in succession the two lamps as the starting conditions become increasingly favorable due to the progressive heating of the filaments (cathodes) of the lamps.

[0026] Lighting is substantially simultaneous. The capacitor 14 allows to eliminate radio reception noise.

[0027] Preferably, another capacitor 20 is provided which is arranged in parallel to each one of the lamps 2 (Figure 2).

[0028] As an alternative to the transistor 10, it is possible, as mentioned, to use an IGBT (particularly in the case of one or two lamps 2); in this case it is not necessary to use capacitors 20 in parallel to the lamps. It is instead convenient to increase the capacitance of the capacitors 8, 11 of the starter 4 and it is possible to series-connect the lamps 2 to each other, using both pins of the lamps for the connection (Figure 3).

[0029] If IGBTs 10 are used with more than two lamps, it is necessary to use capacitors 20 in parallel to said lamps.

[0030] In the case of more than two lamps, it is sufficient to provide a capacitor on the first lamp of the set and on the last lamp of the set (Figure 4).

[0031] Figure 2 is a detail view of the connection of the capacitors 20 to one pin of the lamps 2, while the other pin is connected at one end to the starter 4 and provides the connection, at the other end, between the lamps 2 arranged in series.

[0032] The current that flows through the capacitors 20 allows to heat the filaments of the lamps 2 and therefore to light the two lamps in succession as the heating of said filaments gradually increases, accelerating their lighting with respect to conventional starting devices.

[0033] With the circuit according to the invention it is therefore possible to use a single starter 4 and a single ballast to light a plurality of lamps arranged mutually in series.

[0034] The ballast, of the electromechanical type, must of course be chosen with a power rating which is adequate for the power of the lamps to be lit.

[0035] This allows not only to reduce the costs of additional ballasts and starters, which are no longer necessary, but also to extend the life of the lamps by virtue of the particular circuital execution of the lighting device. The device further allows to avoid unpleasant flickering of the light and the blackening of the lamps proximate to the terminals.

[0036] The device according to the invention can also be provided with a conventional thermal protection if the lamps fail to light.

[0037] In practice it has been observed that the device according to the invention fully achieves the intended aim and objects, since it allows to light substantially instantaneously a plurality of conventional lamps arranged mutually in series, using a single ballast and a single starter, protecting the durability of the lamps (and of the ballast), which is extended with respect to the life of lamps that use conventional lighting devices to start them.

[0038] The device thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the inventive concept; all the details may also be replaced with other technically equivalent elements.

[0039] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. An electronic starting device for fluorescent discharge lamps, high-pressure lamps and the like which is meant to be connected downstream of at least one discharge lamp which is connected to the AC supply mains by means of a ballast, characterized in that it comprises a rectifier bridge which is connected to first pins of said at least one lamp, a Zener diode and a first resistor which are series-connected to said rectifier bridge, and a circuit portion which is constituted by a first capacitor and a second capacitor to which a second resistor and a third resistor are respectively parallel-connected, a diac which is series-connected to said second capacitor, and a third capacitor to which a fourth resistor is parallel-connected, switching means being provided which are connected to said circuit portion and to said rectifier bridge, said switching means being connected to said diac by means of a first terminal, to said first capacitor by means of a second terminal and to said rectifier bridge by means of a third terminal, said third capacitor and said fourth resistor being connected between said first terminal and said second terminal.

2. The device according to claim 1, characterized in that said switching means comprise a bipolar transistor, said first, second and third terminals being the base terminal, the emitter terminal and the collector terminal of said bipolar transistor respectively.

3. The device according to claim 2, characterized in that the emitter terminal and the collector terminal of said bipolar transistor are respectively connected to the negative node and to the positive node of said rectifier bridge.

4. The device according to claim 2, characterized in that it comprises a capacitor which is parallel-connected to said at least one lamp.

5. The device according to claim 1, characterized in that it is parallel-connected to a plurality of lamps which are mutually connected in series, at least the first lamp and the last lamp of said plurality of lamps being provided with a respective capacitor which is parallel-connected thereto.

6. The device according to claim 5, characterized in that said rectifier bridge is connected to a respective first pin of said first and last lamps of said plurality of lamps, the series connection of said lamps being provided by means of a second pin of said lamps.

7. The device according to claim 1, characterized in that said switching means comprise an IGBT.

8. Use of a lighting device according to one or more of the preceding claims, for lighting fluorescent lamps and high-pressure lamps.

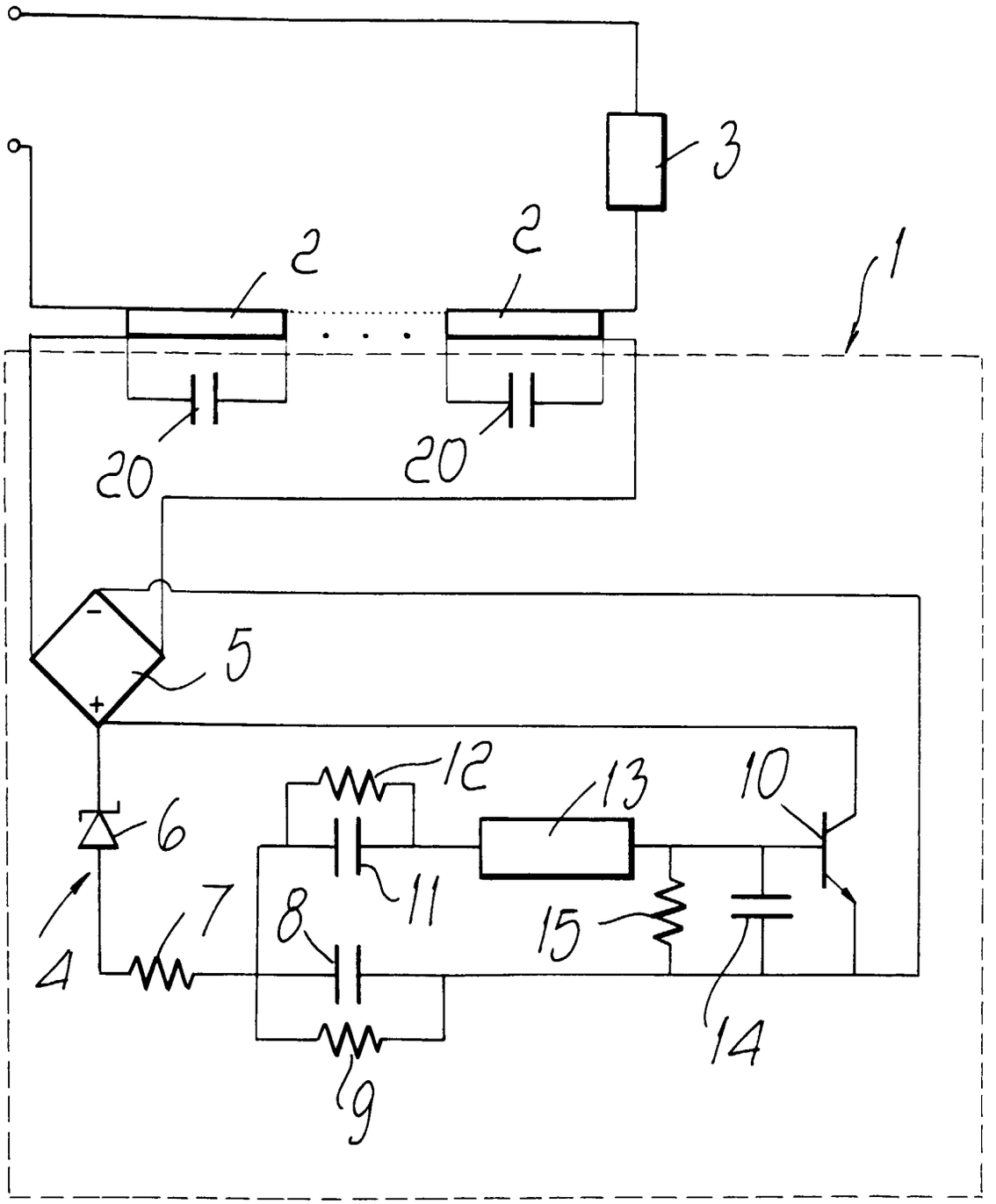

FIG. 1

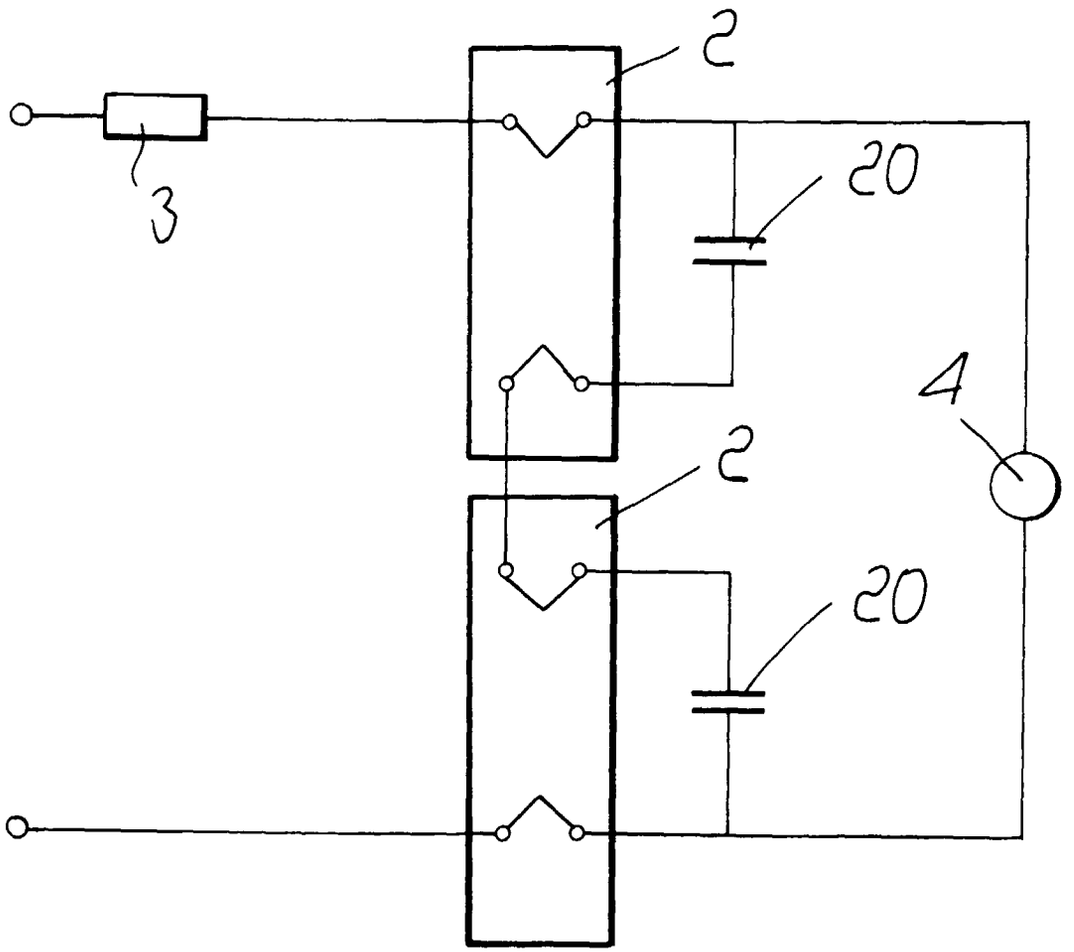

Fig. 2

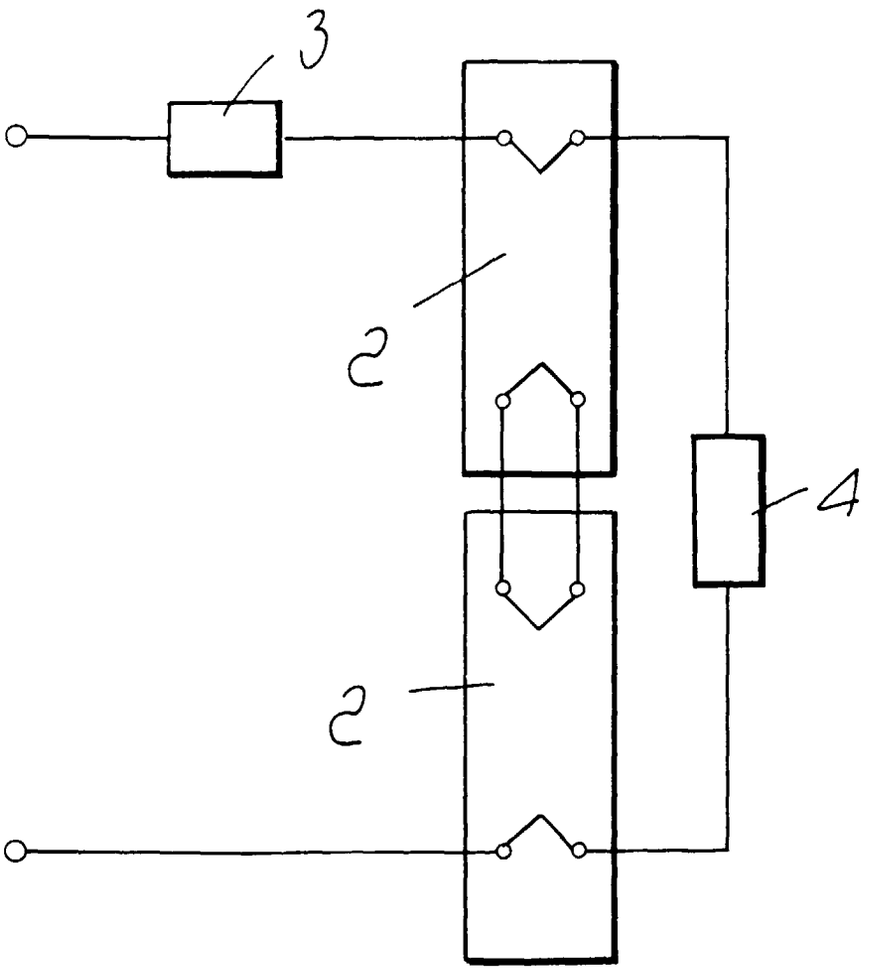

FIG. 3

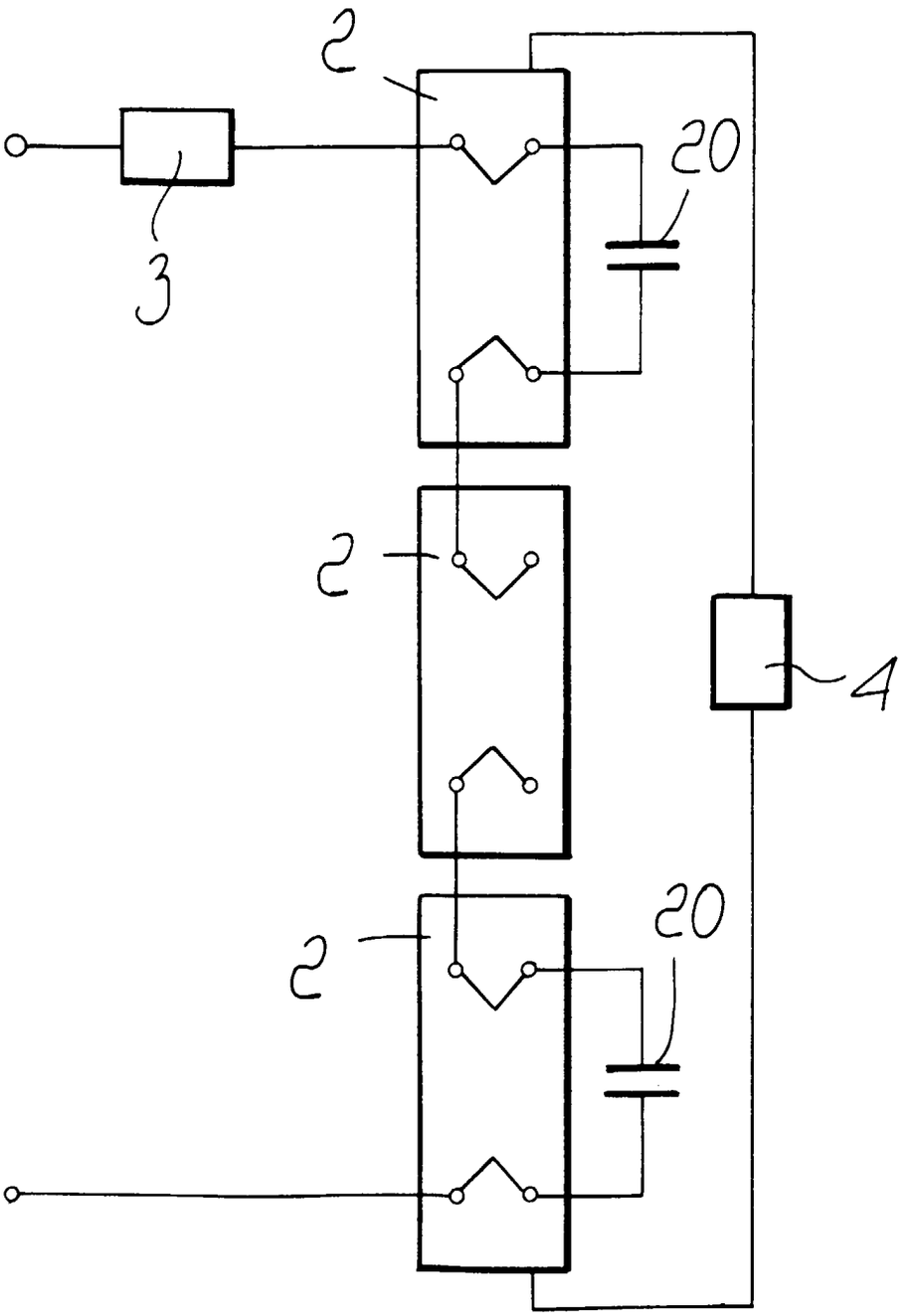

Fig. 4

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Application Number
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	7 October 1999	Albertsson, E

CATEGORY OF CITED DOCUMENTS

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