

Description

[0001] The present invention relates to a starting device for inert gas-filled tubes, lamps and the like.

[0002] It is known that two types of power supply are currently used to start inert gas-filled tubes, for example neon tubes used for decorating luminous signs.

[0003] The first one of these power supplies is a conventional transformer with a large number of turns. This accordingly entails weight problems, caused mostly by the laminated core, and insulation problems, owing to the large number of turns, in addition to dissipation and cost problems.

[0004] The second known solution uses elements which raise the mains frequency from 50 Hz to tens of kHz or more. This entails particular precautions and connections, radio-frequency noise, and insulation.

[0005] A third solution provides for a device which comprises at least one first and second section for rectifying/boosting the AC mains voltage, suitable to rectify the AC voltage and boost it; the sum of the output voltages of the first section and of the second section is used to supply the inert gas-filled tube or tubes.

[0006] The above-proposed solution, although being an improvement over the first two cited solutions, nonetheless entails the drawback of having a very low power factor and is therefore commercially unusable.

[0007] The aim of the present invention is to provide a starting device for inert gas-filled tubes and the like which allows to have a sufficiently high power factor.

[0008] Within the scope of this aim, an object of the present invention is to provide a starting device for inert gas-filled tubes and the like which reduces the insulation, bulk and weight problems of known solutions.

[0009] Another object of the present invention is to provide a starting device for inert gas-filled tubes and the like whose modularity characteristics allow the series or parallel connection of a plurality of similar devices.

[0010] Another object of the present invention is to provide a starting device for inert gas-filled tubes and the like which provides optimum operation also in the presence of supply voltage drops.

[0011] Another object of the present invention is to provide a starting device for inert gas-filled tubes and the like which is highly reliable, relatively easy to manufacture and at competitive costs.

[0012] This aim, these objects and others which will become apparent hereinafter are achieved by a starting device for inert gas-filled tubes and the like, comprising at least one first section and one second section for boosting the mains AC supply voltage, whose output is connected to at least one inert gas-filled tube to be supplied, characterized in that it comprises voltage rectifier means which are arranged between the supply mains and said first and second booster sections and are connected to the terminals of said at least one tube to be

supplied, means for insulating the first and second booster sections after the tube has been started being provided in order to allow a high power factor of the device.

[0013] 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, in block form, of a first embodiment of the device according to the present invention; and

Figure 2 is a circuit diagram which illustrates, with portions shown in dashed lines, additional elements with respect to the first embodiment, which accordingly define additional embodiments of the device according to the present invention.

[0014] With reference to the above figures, the device according to the present invention, generally designated by the reference numeral 1, comprises rectifier means 4 which are connected to at least one first booster section and to at least one second booster section, designated by the reference numerals 2 and 3 respectively.

[0015] Each one of the first and second booster sections 2 and 3 is suitable to boost the output voltage of the rectifier means 4 so as to have a DC voltage whose value is equal to the one that is present in the other section and has the opposite sign. Accordingly the output nodes of the two sections 2 and 3 have two identical and opposite voltage values, respectively. The supply voltage fed to the terminals A and B of the device according to the invention, thus rectified and boosted and given by the sum of the voltage values present at the output nodes of the two sections 2 and 3, supplies at least one inert gas-filled tube 6 or a plurality of inert gas-filled tubes 6.

[0016] Each booster section 2 and 3 is composed of a plurality n of booster stages formed by diodes 7 and capacitors 8-13 for the section 2 and capacitors 14-19 for the section 3.

[0017] The number of booster stages can be chosen according to the voltage level to be obtained in output. Accordingly, the number of stages shown in Figure 1 is merely an example, since it must be related to the length of the inert gas-filled tube to be supplied.

[0018] Resistors 20 are arranged in parallel to each one of the capacitors 8-13 in the section 2.

[0019] The rectifier means 4 are conveniently constituted by a rectifier bridge which is formed by four diodes and is provided with a first resistor 21 to protect the capacitors of the booster sections 2 and 3.

[0020] A second resistor 22 is arranged between the input terminal A of the device according to the invention and a terminal of the rectifier bridge 4, while a fusi-

ble element 23 is arranged between the input terminal B of the device according to the invention and the terminal of the rectifier bridge 4 that is opposite with respect to the terminal to which the resistor 22 is connected.

[0021] A third resistor 24 is connected between the output of the second booster section 3 and the tube or lamp 6 which must be started by the device according to the invention.

[0022] The capacitors 8-13 of the first booster section 2 have high values in order to allow starting of the tube or lamp 6, while the capacitors 14-19 of the second booster section 3 have very low values.

[0023] The resistor 24 is used to insulate the lamp or tube 6 with respect to the booster section 3 when the lamp or tube is on.

[0024] A plurality of diodes D1-D2...Dn are provided between the positive terminal of the rectifier bridge 4 and the resistor 24 in order to insulate the rectifier bridge 4 from the starting voltage of the booster sections 2 and 3 toward the resistor 24.

[0025] The resistors R are arranged in parallel to the diodes D1-D2...Dn.

[0026] The negative terminal of the rectifier bridge 4 closes the circuit on the lamps or tubes 6.

[0027] The sum of the voltages generated by the booster sections 2 and 3 allows to provide the starting voltage of the tube or tubes 6 and then, with the section 2 alone, also the initial energy required to maintain stable operation.

[0028] Once the tube 6 has been stably started, energy is supplied to it only by the rectifier bridge 4, which has no capacitive loads.

[0029] Figure 2 is a circuit diagram which shows, in dashed lines, additional elements with respect to those provided in Figure 1, which accordingly constitute additional embodiments of the circuit according to the invention.

[0030] In particular, a fourth resistor 25 can be connected directly between the input terminal A of the circuit and the first booster section 2 and is meant to insulate the booster, minimizing its transfer of power to the lamps or tubes 6, in order to allow a high overall power factor of the power supply.

[0031] For this purpose it is convenient to provide a fifth resistor 26 connected between the first booster section 2 and the positive terminal of the rectifier bridge 4, upstream of the diodes D1...Dn.

[0032] Finally, another embodiment of the circuit according to the invention provides for a sixth resistor 27 which is connected between the resistor 26 and the diodes D1...Dn.

[0033] After the tube has been started, the resistors 22 and 27 adjust the current in the tube or tubes optionally arranged in series.

[0034] The circuit thus conceived allows, in the steady state, after the tubes have been started, by insulating the booster section with a highly reactive impedance, to provide high power factor values (for example

higher than 0.8). The insulation of the booster (booster sections 2 and 3) in the steady state by means of the resistors 25 and 26, with a consequent low transfer of energy to the started lamps or tubes, also allows, by means of an appropriate selection of the dimensions of the resistor 26, to limit the discharge of the cells of the booster, avoiding the introduction of flicker in the light delivered by the lamp. This occurs also at low mains voltages, when the voltage delivered by the first booster section 2 prevails over the voltage delivered by the bridge 4.

[0035] The resistors 22 and 24 are the only power-dissipating elements of the system and the current required by the lamp or tubes 6 is adjusted, in the steady state, predominantly by the value of said resistors.

[0036] The tubes or lamps connected in series are thus supplied with a DC voltage with a residue of AC voltage, and this reduces the strobe effect, as mentioned.

[0037] 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.

[0038] 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

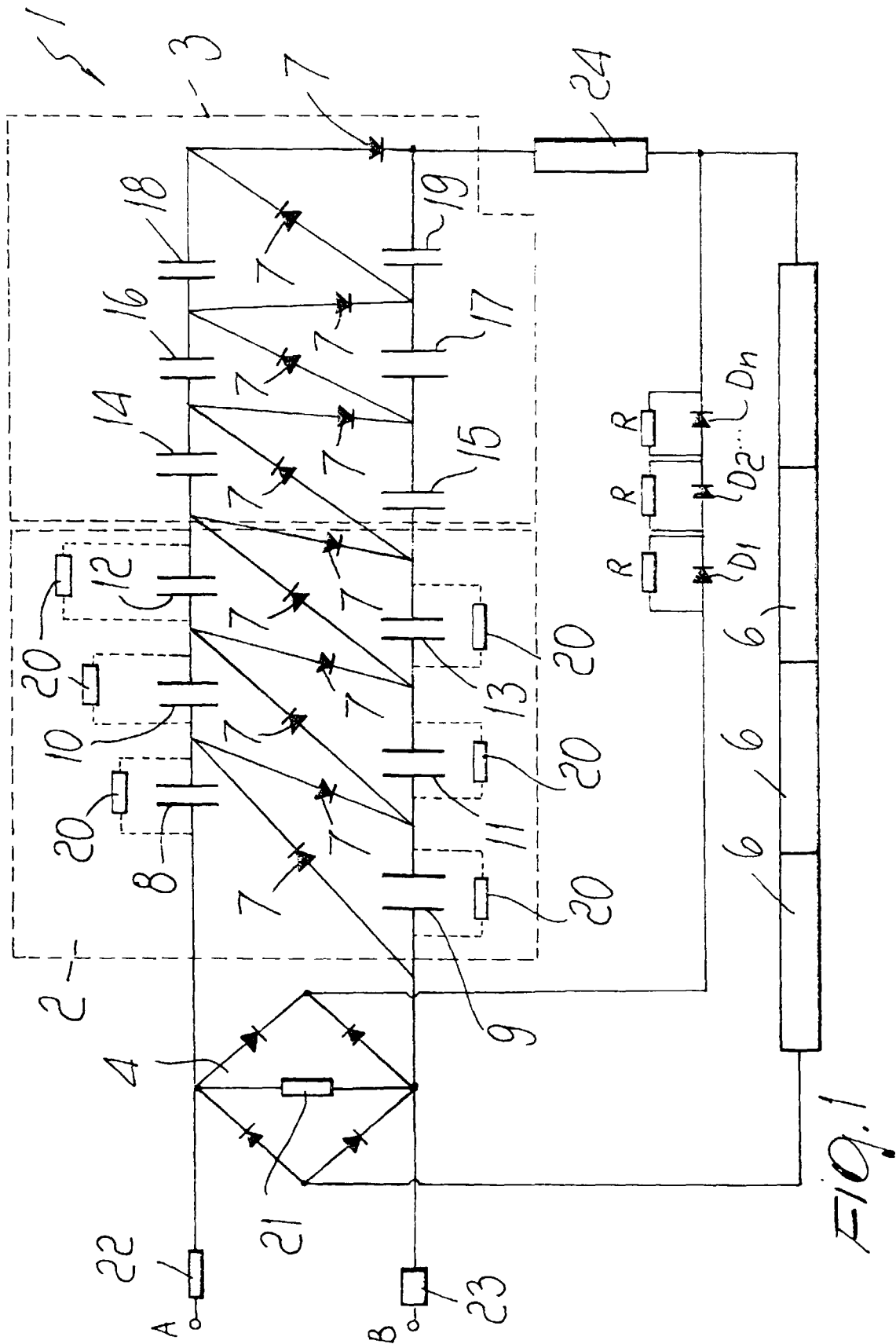
1. A starting device for inert gas-filled tubes and the like, comprising at least one first section and one second section for boosting the mains AC supply voltage, whose output is connected to at least one inert gas-filled tube to be supplied, characterized in that it comprises voltage rectifier means which are arranged between the supply mains and said first and second booster sections and are connected to the terminals of said at least one tube to be supplied, means for insulating the first and second booster sections after the tube has been started being provided in order to allow a high power factor of the device.
2. The device according to claim 1, characterized in that said rectifier means comprise a rectifier bridge which is connected to said power supply mains with a first terminal and with a second terminal, a first resistor being connected between said first and second terminals of said rectifier bridge.
3. The device according to claim 2, characterized in that it comprises a second resistor, which is con-

nected between said first terminal of the rectifier bridge and said supply mains, and a fusible element, which is connected between said second terminal of the rectifier bridge and said supply mains.

4. The device according to one or more of the preceding claims, characterized in that it comprises a third resistor which is connected between said second booster section and an electrode of said at least one tube to be supplied. 5
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5. The device according to one or more of the preceding claims, characterized in that it comprises a plurality of diodes which are connected between a positive terminal of said rectifier bridge and said at least one tube to be supplied, said diodes being provided with a corresponding number of resistors in parallel. 15
6. The device according to one or more of the preceding claims, characterized in that it comprises a fourth resistor which is connected between a terminal of said supply mains and said first booster section. 20
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7. The device according to one or more of the preceding claims, characterized in that it comprises a fifth resistor which is connected between said first booster section and the positive terminal of said rectifier means. 30
8. The device according to one or more of the preceding claims, characterized in that it comprises a sixth resistor which is connected to an intermediate point between said fifth resistor and said plurality of diodes. 35
9. The device according to one or more of the preceding claims, characterized in that each one of said first and second booster sections comprises at least one voltage booster stage. 40
10. The device according to one or more of the preceding claims, characterized in that said at least one voltage booster stage of each one of said booster sections comprises diodes and capacitors. 45
11. The device according to one or more of the preceding claims, characterized in that the diodes of said at least one booster stage of said first section are orientated in the opposite direction with respect to the diodes of said at least one booster stage of said second section. 50
12. The device according to one or more of the preceding claims, characterized in that the number of booster stages of said first section is equal to the number of booster stages of said second section. 55

13. The device according to one or more of the preceding claims, characterized in that the capacitors of said first booster section have discharging resistors parallel-connected thereto.

14. The device according to one or more of the preceding claims, characterized in that the value of the capacitors of said first booster section is a few orders of magnitude higher than the value of the capacitors of said second booster section.
15. The device according to one or more of the preceding claims, characterized in that it comprises a plurality of tubes which are mutually series-connected and are meant to be supplied by said device.



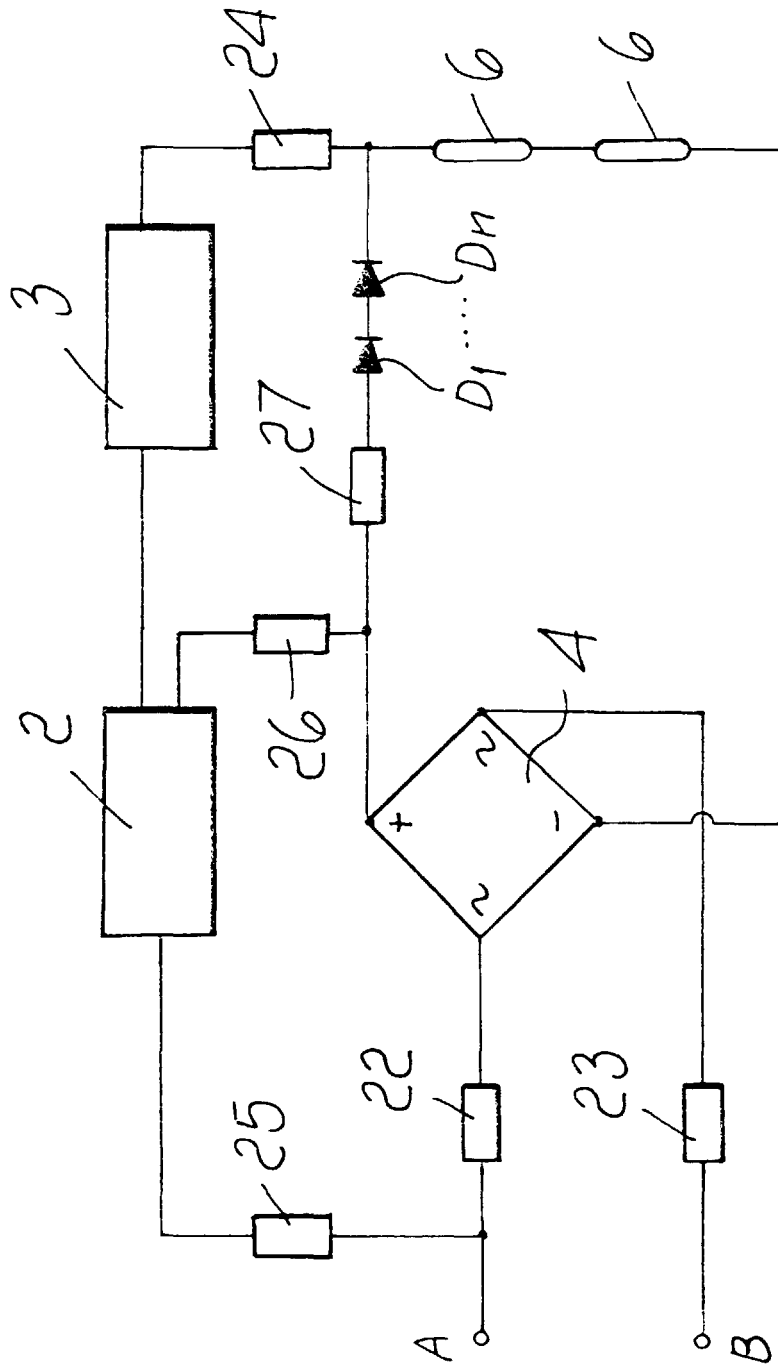


Fig. 2



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 98 83 0678

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	WO 95 02311 A (KADESUM LIMITED ; ZHENPING LU (CN)) 19 January 1995 * page 5, line 16 - page 8, line 10; figure 2 *	1-15	H05B41/00
E	US 5 856 916 A (BONNET ANDRE) 5 January 1999 * the whole document *	1-15	
A	CN 1 110 464 A (JIANG YUHONG) 18 October 1995 * abstract *	1-15	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			H05B
The present search report has been drawn up for all claims			
Place of search MUNICH		Date of completion of the search 10 March 1999	Examiner Villafuerte Abrego
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 98 83 0678

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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10-03-1999

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WO 9502311 A	19-01-1995	CN 1079282 A	08-12-1993
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82