

VOLTAGE BOOSTER, PARTICULARLY FOR IGNITING INERT GAS-FILLED
TUBES AND THE LIKE

Technical Field

The present invention relates to a voltage booster, particularly for igniting inert gas-filled tubes and the like.

Background Art

Two types of power supply are conventionally used to
5 ignite inert gas-filled tubes, for example neon tubes used for decoration or for luminous signs by the meter.

The first one of these power supplies is a conventional transformer with a large number of turns in the secondary winding. This entails weight problems, caused
10 mainly by the lamination core, and insulation problems, owing to the large number of turns of the secondary winding, in addition to dissipation and cost problems.

The second conventional solution uses elements that raise the mains frequency from 50 Hz to approximately 28
15 KHz. This entails the adoption of particular precautions and connections, radiofrequency noise, induction and insulation problems, and a limited reduction in the volume and weight with respect to the above mentioned transformer.

From DE-4016684 A1 is known a device for the ignition
20 of a fluorescent tube provided with a starter device.

Now a starter device has the consequence that at the ignition, the very low resistance and the high consumption allow a reverse flow in the electrolytical capacitors, damaging their polarization. Furthermore a tube with such a
25 feeding polarizes the gas on one side only after a few operative hours, which brings about a loss of 70% of the

light emission. In order to avoid the said reverse flow, the value of the ballast resistor has to be increased, which brings about a doubling of the consumption and to a lower light emission yield.

- 5 EP-A-0041027 describes another device for the ignition of fluorescent lamps, whose major disadvantage is the fact that when the tube is switched off, the capacitor of the voltage-multiplying stages remains charged, preventing the immediate re-ignition of the tube after its switch-off.

Disclosure of the Invention

- 10 A principal aim of the present invention is therefore to provide a voltage booster, particularly for igniting inert gas-filled tubes and the like, that is capable of eliminating circuitry complexity of such conventional solutions.

- 15 Within the scope of this aim, an object of the present invention is to provide a voltage booster, particularly for igniting inert gas-filled tubes, that eliminates radiofrequency noise.

- Another object of the present invention is to provide
20 a voltage booster, particularly for igniting inert gas-filled tubes, that has a considerably lower consumption than conventional solutions.

- Another object of the present invention is to provide a voltage booster, particularly for igniting inert gas-
25 filled tubes, that has modularity features which allow the series or parallel connection of a plurality of similar devices.

- Another object of the present invention is to provide a voltage booster, particularly for igniting inert gas-

filled tubes, that is highly reliable, relatively easy to manufacture, and at competitive costs.

Last but not least, it is a principal object of the present invention to provide a voltage booster such as to be able to be immediately re-ignited upon switching off.

This aim, these objects, and others which will become apparent hereinafter are achieved by a voltage booster, particularly for supplying power to inert gas-filled tubes, comprising voltage rectifier-multiplier means circuitally arranged between AC mains and said tube, said rectifier-multiplier means being formed of at least one first and one second stages, a plurality of such stages forming a section; a plurality of sections being provided which are in symmetrical arrangement between each other, a limiting resistance being circuitally arranged in series connection between said rectifier-multiplier and said tube, characterized in that said voltage booster has sufficient sections so as to supply a voltage which is sufficient to ignite said tube, and is directly connected to said tube (without having recourse to starter means), resistive means being connected in parallel to the capacitors of said stages, so that said capacitors can discharge at the switch off of the igniting circuit.

Brief Description of the Drawings

Further characteristics and advantages of the invention will become apparent from the following detailed description of a preferred but not exclusive embodiment of the device according to the invention, illustrated only by way of non-limitative example in the accompanying drawing, wherein the only figure is a circuit diagram of the device

according to the invention.

Ways of carrying out the Invention

With reference to said only figure, the device according to the invention comprises a first voltage rectifier and multiplier section 100 and a second voltage
5 rectifier and multiplier section 200; each section is adapted to rectify and multiply the input AC voltage so as to have, in each section, a DC voltage value that is equal to that of the other section but has the opposite sign. Therefore, two identical and opposite voltage values are
10 obtained at the output nodes A and B of the two sections 100 and 200.

The voltage thus rectified and multiplied, produced by the sum of the voltage values that are present at the nodes A and B, supplies the inert gas-filled tube 22, with the
15 interposition of a resistor 21 between the node A and a first cathode of the tube 22.

In detail, each rectifier-multiplier section 100 and 200 comprises a number n , larger than one, of multiplier stages constituted by diodes 9 and capacitors 1-8 for the
20 section 100 and by diodes 19 and capacitors 11-18 for the section 200. The number of multiplier stages can be chosen according to the output voltage level to be obtained. Therefore, the number of stages shown in the figure is merely an example, since it must be correlated to the
25 length of the inert gas-filled tube to be powered.

Resistors 10 are parallel-connected to each one of the capacitors 1-8 in the section 100 and to each one of the capacitors 11-18 in the section 200.

The mains voltage input terminals 20 supply the first

section 100 and the second section 200.

The two sections 100 and 200 are symmetrical with respect to one another, that is to say, the number and the values of the diodes, of the capacitors, and of the
5 resistors must be identical for the two sections.

The only difference between the two sections 100 and 200 is that the diodes 9 of the first section 100 are orientated in the opposite direction with respect to the diodes 19 of the section 200; therefore, the voltage
10 produced by the section 100 is opposite to the voltage produced by the section 200.

The capacitive values of the capacitors 1-8 and 11-18 decrease from the mains voltage input terminals to the output terminals of the two sections 100 and 200.

15 The figure also shows nodes C, D and A', B', C, and D' in addition to the already described nodes A and B.

The device shown in the figure, according to the invention, has modularity features, since it is possible to connect a plurality of similar devices in series, in
20 parallel, or in series/parallel, by virtue of a connection provided at the nodes A, B, C, and D on one side and A', B', C' and D' on the other side.

With reference to the only figure, operation of the device according to the invention is as follows.

25 The mains AC voltage is supplied to the two sections 100 and 200, where it is rectified and multiplied according to the number of rectifier-multiplier stages that are present in said sections.

A fuse 23 is series-connected with one of the two AC
30 mains lines, in order to protect the device in case of

short-circuit. The power of the fuse 23 must be adapted to the power of the device.

Owing to the symmetry of the two sections 100 and 200 and to the different orientation of the diodes 9 with respect to the diodes 19, the voltage that forms at the node A of the section 100 is equal in value to the voltage that forms at the node B of the section 200 but has the opposite sign, and therefore the sum of the resulting voltages, which is fed to the inert gas-filled tube 22, is provided between these two nodes.

This feature of different orientation of the diodes 9 and 19 eliminates the strobe effect produced by the capacitors 1-8 and 11-18, which produces the flickering of the light in the inert gas-filled tube 22.

For example, in the merely exemplifying case of the number of stages shown in the figure, the voltage at the node A is approximately 2000 V positive and the voltage at the node B is approximately 2000 V negative, with a mains power supply of 220 V. Accordingly, 4000 V DC are available when idle. An argon tube 22 with a length of approximately 3 meters ignites at this value and, in the steady state, it produces 1800 V at its cathodes, this voltage being maintained by the capacitors 1, 2, 3, and 11, 12, 13.

The low-capacitance capacitors 4-8 and 14-18 lose their charge, since they are series-connected, until zero to a few volts are present on the last capacitors (8 and 18). This feature entails a voltage drop of a few volts across the resistor 21.

The resistors 10 discharge the capacitors 1-8 and 11-18 if the circuit is disconnected without a load.

The modularity of the above described circuit configuration of the device according to the invention allows to obtain, in output, the desired voltage and current levels. The series connection of a plurality N of
5 devices according to the invention in fact allows to obtain, in output, a voltage that is increased by N times with respect to the mains supply voltage. The parallel connection of N devices instead allows to obtain N currents in output. Finally, it is also possible to provide a
10 series/parallel connection.

In practice it has been observed that the device according to the invention fully achieves the intended aim, since it allows to provide a DC supply of appropriate voltage to an inert gas-filled tube, without resorting to a
15 transformer or a frequency-raising device, with consequent advantages in terms of safety, bulk, weight, cost, and consumption.

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

In practice, the materials employed, so long as they are compatible with the specific use, as well as the
25 dimensions, may be any according to the requirements and the state of the art.

CLAIMS

1 1. A voltage booster, particularly for supplying power
2 to inert gas-filled tubes, comprising voltage rectifier-
3 multiplier means circuitally arranged between AC mains and
4 said tube (22), said rectifier-multiplier means being
5 formed of at least one first and one second stages, a
6 plurality of such stages forming a section; a plurality of
7 sections being provided which are in symmetrical
8 arrangement between each other, a limiting resistance (21)
9 being circuitally arranged in series connection between
10 said rectifier-multiplier and said tube (22), characterized
11 in that said voltage booster has sufficient sections so as
12 to supply a voltage which is sufficient to ignite said tube
13 (22), and is directly connected to said tube (22) (without
14 having recourse to starter means), resistive means (10)
15 being connected in parallel to the capacitors (1,2,3,4,5,6,
16 7,8;11,12,13,14,15,16,17,18) of said stages, so that said
17 capacitors (1,2,3,4,5,6,7,8;11,12,13,14,15,16,17,18) can
18 discharge at the switch off of the igniting circuit.

1 2. A device according to claim 1, characterized in
2 that said at least one voltage rectifier-multiplier stage
3 of each one of said two sections comprises diodes (9;19)
4 and capacitors (1,2,3,4,5,6,7,8;11,12,13,14,15,16,17,18).

1 3. A device according to claim 1, characterized in
2 that a resistor (21) is inserted between the output of said
3 first rectifier-multiplier section (100) and a first
4 cathode of said inert gas-filled tube (22).

1 4. A device according to claim 1, characterized in
2 that the number of rectifier-multiplier stages of said



3 first section (100) is equal to the number of rectifier-
4 multiplier stages of said second section (200).

1 5. A device according to claim 1, characterized in
2 that the values of the diodes (9;19), of the capacitors
3 (1,2,3,4,5,6,7,8;11,12,13,14,15,16,17,18), and of the
4 resistors of each rectifier-multiplier stage of said first
5 section (100) are equal to the values of the same elements
6 of the corresponding rectifier-multiplier stage of said
7 second section (200).

1 6. A device according to claim 2, characterized in
2 that the values of the capacitors of said rectifier-
3 multiplier stages of said first (100) and second (200)
4 sections decrease from the input terminals to the output
5 terminals of said first (100) and second (200) sections.

1 7. A device according to claim 1, characterized in
2 that it comprises a plurality of first (100) and second
3 (200) sections that are series-connected.

1 8. A device according to claim 1, characterized in
2 that it comprises a plurality of first (100) and second
3 (200) sections that are parallel-connected.

1 9. A device according to claim 1, characterized in
2 that it comprises a plurality of first (100) and second
3 (200) sections that are series/parallel connected.