April 1, 1958 J. C. MOERKENS 2,829,310

GAS OR VAPOR DISCHARGE TUBE DEVICE

Filed March 11, 1955

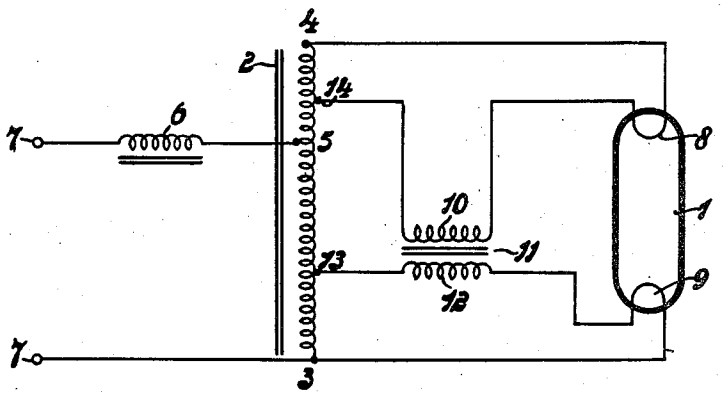

Fig. 2

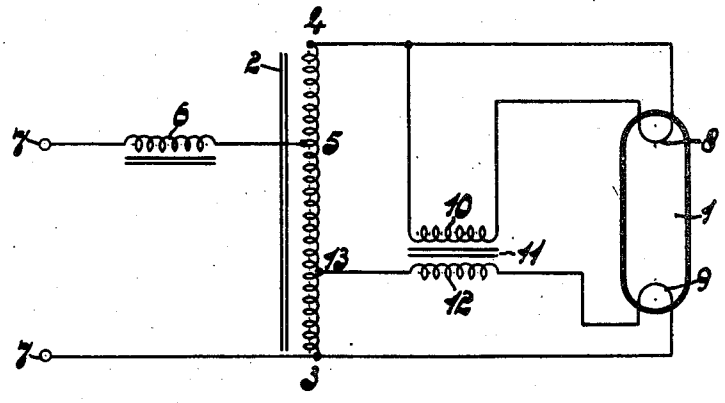

Fig. 1

INVENTOR
JOZEF CORNELIS MOERKENS
BY Fred W. Voigt
AGENT

United States Patent Office

2,829,310

Patented Apr. 1, 1958

2,829,310

GAS OR VAPOR DISCHARGE TUBE DEVICE

Jozef Cornelis Moerkens, Eindhoven, Netherlands, assignor, by mesne assignments, to North American Philips Company, Inc., New York, N. Y., a corporation of Delaware

Application March 11, 1955, Serial No. 493,592

Claims priority, application Netherlands March 12, 1954

5 Claims. (Cl. 315—98)

The invention relates to a device or circuit arrangement comprising a gas and/or vapor discharge tube, which is provided with two filament electrodes fed by a filament current transformer.

In the known devices of this kind each filament electrode is connected to its own secondary winding of the filament current transformer.

If, for example due to an excessively high transition resistance between a contact of the tube holder and a tube contact, the filament current circuit of one of the filament electrodes is interrupted, and the discharge current circuit, however, has remained intact, the tube is capable of igniting with one cold filament electrode. This is harmful to the lifetime of the tube.

The invention has for its object the elimination of this disadvantage.

According to the invention one of the filament electrodes is connected in series with the primary winding of an auxiliary transformer to a secondary winding of the filament current transformer and the other filament electrode is connected to the secondary winding of the auxiliary transformer. The secondary winding of the auxiliary transformer is isolated for D. C. from the primary winding. The auxiliary transformer is of a type which has a no-load impedance substantially greater than its full-load impedance.

In this case the other filament electrode may be connected through a secondary winding of its own of the filament current transformer to the secondary winding of the auxiliary transformer.

In order that the invention may be readily carried into effect, it will now be described more fully with reference to the drawing, wherein:

Fig. 1 is a schematic diagram of an embodiment of the device of the present invention; and

Fig. 2 is a modification of the embodiment of Fig. 1.

In Fig. 1, reference numeral 1 designates a gas or vapor discharge tube, for example a 20 watt fluorescent lamp of about 60 cms. in length and about 3.5 cms. in internal diameter, which, in normal operation, absorbs a current of about 0.36 ampere at a tube voltage of about 60 volts.

The tube 1 is connected to a secondary supply winding 3—4 of a transformer 2, represented in this case by an autotransformer, of which the primary winding 3—5 is connected in series with a choke 6 to an alternating voltage supply source 7—7 of about 110 volts and for example 50 or 60 cycles per second frequency.

The tube 1 comprises two filament electrodes 8 and 9, which are constituted by a helical tungsten wire, coated by a substance which is highly electron-emissive at an increased temperature.

The tube 1 may be provided, on the inner side of the outer side of the discharge vessel, with a conductive coating to facilitate the ignition.

The electrode 8 is connected to the secondary winding 10 of an auxiliary transformer 11, of which the primary winding 12 is connected in series with the electrode

9 to a secondary filament current winding 3—13 of the transformer 2. The transformer 2 is represented in the present case by a combined filament-current and supply transformer.

When the normally operating device is connected to the supplying source voltage, the electrodes 8 and 9 are caused to assume rapidly the emissive temperature at a mean electrode voltage of about 10 volts and a mean filament current of about 0.4 ampere, since the resistance of tungsten is lower at the ambient temperature than at the emissive temperature. The tube ignites after about 0.7 second at the voltage of the winding 3—4 of about 140 volts.

If the filament current circuit of the electrode 9 is interrupted, the filament electrode 8 is not traversed by current, since the primary current circuit of the auxiliary transformer 11 is interrupted. The tube can thus not ignite in this case.

However, if the filament current circuit of the electrode 8 is interrupted, the electrode 9 is traversed by a filament current of only about 25 milliamperes. This is insufficient for the electrode 9 to assume the emissive temperature. Consequently, in this case the tube does not ignite.

It should be noted, in the interest of clarity, that the auxiliary transformer 11 was constructed as a core transformer without an air gap, having a core diameter of 13 x 17 mms., 450 turns of copper wire of 0.22 mm. in diameter for the primary winding 12 and 450 turns of copper wire of 0.22 mm. in diameter for the secondary winding 10. The zero load impedance of the auxiliary transformer 11, at a connection voltage of 40 volts, was about 1600 ohms and at a connection voltage of 25 volts and a secondary full load of 0.4 ampere it was about 62 ohms.

Since the filament electrode 9 in series with the primary winding 12 of the auxiliary transformer 11 is connected to the filament current winding 3—13, the winding 3—13 is proportioned for a higher voltage than in the case of direct supply to the filament electrode 9. This may be advantageous in the event of an interruption of the filament current circuit of the electrode 9 or of the filament current circuit of the electrode 8, which circuit is coupled therewith by way of a transformer, since an interruption can be overcome by the said higher voltage more readily than in the case of a direct supply to the filament electrodes.

Even in the event of a short-circuit of one of the filament electrodes, the filament current transformer 2 is overloaded to a lesser extent than in the case of direct supply to the filament electrodes.

The combined filament current and supply transformer 2 was constructed as a core transformer without an air gap, having a core diameter of 20 x 23 mms., 1250 turns for the secondary supply winding 3—4, 320 turns for the secondary filament current winding 3—13 and 780 turns for the primary winding 3—5.

It should be noted that subsequent to the ignition of the tube 1 the voltage across the supply winding 3—4 drops from about 140 volts to about 60 volts, the voltage across the primary winding 3—5 from about 90 volts to about 39 volts and that across the filament currrent winding 3—13 from about 40 volts to about 17 volts. The current traversing the choke 6, which has an impedance of about 145 ohms, is, in the normal operational conditions, about 0.14 ampere prior to ignition and about 0.55 ampere subsequent to ignition. The current passing through each of the windings 10 and 12 of the auxiliary transformer 11 is about 0.4 ampere prior to ignition and about 0.12 ampere subsequent to ignition.

Fig. 2 shows a device in which the electrode 8 is connected through a filament current winding 4—14 of its

own to the secondary winding **10** of the auxiliary transformer **11**.

If one of the filament current circuits has an interruption, the other filament current circuit is traversed only by a low current of for example 25 milliamperes, since the transformer **11** occupies the zero load position due to the interruption. The said low current is insufficient for the electrode in the uninterrupted filament current circuit to assume the emission temperature. Therefore in case of an interruption of one of the filament current circuits the tube does not ignite.

In the case of an interruption of one of the filament current circuits, for example in the circuit of the electrode **8**, the voltage of the corresponding filament current winding **4—14** and the voltage of the other filament current winding **3—13** occur across this interruption. The latter voltage is transferred by the auxiliary transformer **11** to the area of the interruption. The sum of the said voltages is more capable of passing bridging the interruption than one of these voltages alone.

The auxiliary transformer **11** may have the same dimensions as that of the device shown in Fig. 1; the winding **3—13** is proportioned for a lower voltage in the present case, since it feeds in this case only one filament electrode.

While the invention has been described by means of specific examples and in specific embodiments, I do not wish to be limited thereto, for obvious modifications will occur to those skilled in the art without departing from the spirit and scope of the invention.

What is claimed is:

1. A circuit arrangement comprising an electric discharge device having first and second electrodes of filamentary type, a transformer having a primary winding and a secondary winding in D. C. isolation from said primary winding, a source of filament voltage for energizing said first electrode, means for connecting said source, said first electrode and said primary winding in series circuit arrangement, and means for connecting said secondary winding in series with said second electrode, said transformer having a no-load impedance substantially greater than its full-load impedance whereby interruption of current flow to either of said electrodes prevents ignition of said device.

2. A circuit arrangement comprising an electric discharge device having first and second electrodes of filamentary type, means for applying a voltage to said electrodes comprising a first transformer having an input section and a plurality of output sections, means for applying a voltage to said input section and means for connecting one of said output sections to said electrodes, a second transformer having a primary winding and a secondary winding in D. C. isolation from said primary winding, means for connecting said primary in series circuit arrangement with said first electrode and another of said output sections, and means for connecting said secondary winding in series with said second electrode, said second transformer having a no-load impedance substantially greater than its full-load impedance whereby interruption of current flow to either of said electrodes prevents ignition of said device.

3. A circuit arrangement comprising an electric discharge device having first and second electrodes of filamentary type, an autotransformer having a pair of input terminals, a pair of output terminals and a tapping point interposed between said output terminals, means for applying a voltage to said input terminals, means for connecting said output terminals to said electrodes, a second transformer having a primary winding and a secondary winding in D. C. isolation from said primary winding, means for connecting said primary winding in series circuit arrangement with said first electrode between said tapping point and one of the output terminals of said autotransformer, and means for connecting said secondary winding in series with said second electrode, said second transformer having a no-load impedance substantially greater than its full-load impedance whereby interruption of current flow to either of said electrodes prevents ignition of said device.

4. A circuit arrangement comprising an electron discharge device having first and second electrodes of filamentary type, a transformer having a primary winding and a secondary winding in D. C. isolation from said primary winding, a source of filament voltage for energizing said first electrode, a source of filament voltage for energizing said second electrode, means for connecting said first-mentioned source, said first electrode and said primary winding in series circuit arrangement, and for connecting said second-mentioned source, said second electrode and said secondary winding in series circuit arrangement, said transformer having a no-load impedance substantially greater than its full-load impedance whereby interruption of current flow to either of said electrodes prevents ignition of said device.

5. A circuit arrangement comprising an electric discharge device having first and second electrodes of filamentary type, an autotransformer having a pair of input terminals, a pair of output terminals and a pair of tapping points interposed between said output terminals, means for applying a voltage to said input terminals, a second transformer having a primary winding and a secondary winding in D. C. isolation from said primary winding, means for connecting said primary winding in series circuit arrangement with said first electrode between one of said output terminals and one of said tapping points, and means for connecting said secondary winding in series circuit arrangement with said second electrode between the other of said output terminals and the other of said tapping points, said second transformer having a no-load impedance substantially greater than its full-load impedance whereby interruption of filament current flow to either of said electrodes prevents ignition of said device.

References Cited in the file of this patent

UNITED STATES PATENTS

2,268,512	McCarthy	Dec. 30, 1941
2,284,407	Edwards	May 26, 1942

FOREIGN PATENTS

589,571	Great Britain	June 24, 1947