Dec. 4, 1951 J. G. W. MULDER ET AL 2,577,352

DEVICE COMPRISING A GLOW DISCHARGE TUBE

Filed Dec. 22, 1948

Fig. 1.

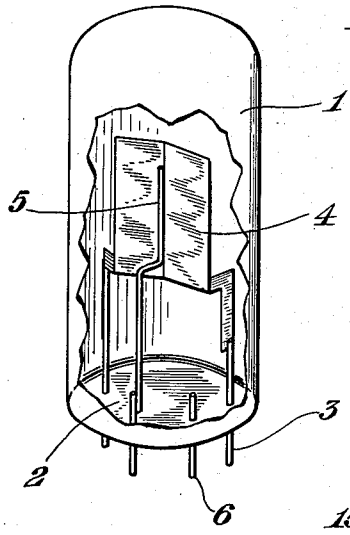
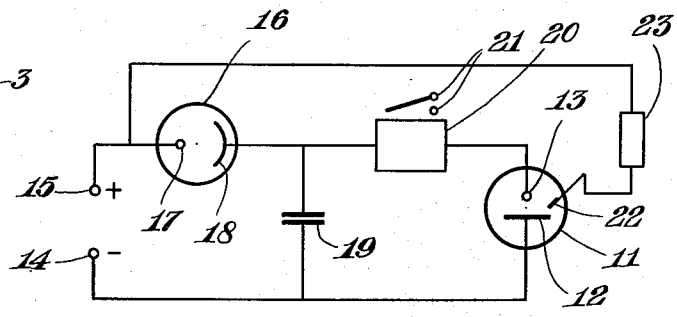


Fig. 2.



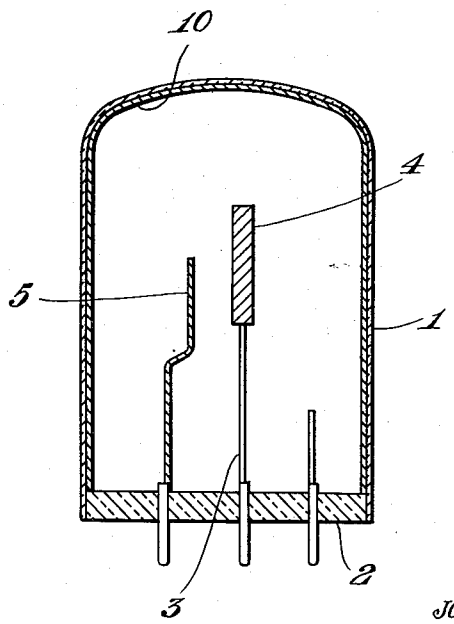


Fig. 3.

INVENTORS.
JOHANNES GIJSBERTUS WILHELM MULDER
FRANS MICHEL PENNING.
BY
AGENT.

Patented Dec. 4, 1951 2,577,352

UNITED STATES PATENT OFFICE

2,577,352

DEVICE COMPRISING A GLOW DISCHARGE TUBE

Johannes Gijsbertus Wilhelm Mulder and Frans Michel Penning, Eindhoven, Netherlands, assignors to Hartford National Bank and Trust Company, Hartford, Conn., as trustee

Application December 22, 1948, Serial No. 66,634
In the Netherlands January 14, 1948

3 Claims. (Cl. 313—188)

1

This invention relates to a device comprising a glow discharge tube as the active element. The cathode of this tube consists of a metal having a melting point higher than 1400° C., and its wall is substantially entirely coated with a visible layer of such a metal. Such a tube of the method and manufacture thereof forms the subject matter of copending application Serial No. 728,530 filed February 14, 1947.

These tubes have already been proposed by us by reason of their extremely constant properties. For many uses it may, however, be objectionable that, presumably due to the high degree of purity of the interior of the discharge tube which purity results from the action which takes place on cathode disintegration and metal layer formation, and which purity is maintained due to the hindering of impurity development from the glass of the tube by the visible metal layer and further since the tube is usually in complete darkness, considerable delay of ignition occurs. This delay can be avoided by applying high voltages, it is true, but this usually entails serious disadvantages in the circuit-arrangement.

According to the invention, in a device having as an active element a glow discharge tube, the cathode of which consists of a metal having a melting point exceeding 1400° C. and substantially the entire wall of which tube is coated with a visible layer of such metal, thus tube is provided with at least one auxiliary electrode, between which auxiliary electrode and a main electrode or a second auxiliary electrode, an auxiliary current is caused to flow which lies in the Townsend area of the glow-discharge characteristic curve.

We have found that by the said low auxiliary currents the constancy of the properties of the tube is practically not affected. The ignition voltage is slightly reduced, it is true, but it retains substantially the same constancy. The properties as a stabilization tube are not at all altered.

In glow discharge tubes it is known per se to strike an auxiliary discharge for avoiding delay of ignition, this auxiliary current being generally given such a value as to produce at the same time a strong decrease in ignition voltage. However, the latter is undesirable for many uses and will not induce the use of an auxiliary current in the aforesaid tubes having constant properties.

In order that the invention may be clearly understood and readily carried into effect it will now be described more fully by reference to the accompanying drawing, given by way of example, in which Fig. 1 is a perspective view of the tube suitable for a device according to the invention, and Fig. 2 shows a circuit-arrangement comprising such a tube, and Fig. 3 is a cross-sectional view of the tube illustrating the relation of the metal coating to the tube element.

2

In Fig. 1 the reference numeral 1 designates the glass wall (partly broken away) of the discharge tube. Into the flat bottom 2 four chrome-iron pins are sealed of which those designated 3 carry the cathode 4 consisting of a slightly V-shaped sheet of molybdenum. The anode consists of a piece of molybdenum wire 5 which is also carried by a chrome-iron pin and placed at a distance of 0.5 to 0.8 mm. from any of the cathode wings. The gas filling consists of neon and 1% of argon at a pressure of 30 mm. With a current of approximately 2.5 μ amp., both the front and the back of the cathode is covered with the glow. The ignition voltage is 120 v. $\pm$ some tenths of a volt if the auxiliary anode does not carry current and the delay may amount to many seconds. If a current of 1 to 5 μ amp. flows in the auxiliary anode the ignition voltage of the tube is 115 ± 0.5 volts. In this event delay of ignition no longer occurs. The layer of metal on the inner wall of the discharge tube is not shown in the drawing for the sake of clearness.

In Fig. 2 a glow discharge tube is designated 11, the cathode 12 and the anode 13. The terminals 14 and 15 of the direct current network are connected to the cathode of the glow discharge tube and the anode 17 respectively of the photo-electric cell 16. The cathode of the latter is designated 18. Upon exposure of the photo-electric cell 16 the condenser 19 is charged from the mains to the voltage at which the glow discharge tube 11 breaks down. In connection with the value of the condenser 19 a relay 20 is so chosen as to attract its armature and close the contacts 21 due to the current flowing upon breakdown of the discharge tube 11. The auxiliary anode 22 is connected, across the resistance 23, to the postive terminal 15 of the mains, so that a constant current of 2.5 μ amp. constantly passes over the auxiliary anode. Delay of ignition does not occur in the tube 11. The device may be used for measuring quantities of light.

In Fig. 3 the metal coating on the inner wall of the tube is designated by the numeral 10.

What we claim is:

1. A circuit arrangement comprising a glow discharge tube having a layer of metal of visible thickness coating substantially the entire wall thereof and having electrodes including an

anode and a cathode of metal, the said metal of said layer and of said cathode having a melting point in excess of 1400° C., an auxiliary electrode in said discharge tube in spaced relationship with said anode and said cathode, the said discharge tube having an operating characteristic between said cathode and said anode in the glow discharge region and between said auxiliary electrode and one of said electrodes in the Townsend discharge region, means to apply a potential between said auxiliary electrode and one of said electrodes, said potential having a magnitude producing an auxiliary current between said auxiliary electrode and said one electrode having a value effecting the said Townsend discharge in the said tube, and means to apply a potential between said anode and said cathode to effect a glow discharge in said tube said latter potential having a value sufficient to initiate the said glow discharge between the said anode and said cathode in the absence of the said auxiliary discharge.

2. A circuit arrangement comprising a glow discharge tube having a layer of metal of visible thickness coating substantially the entire inner wall thereof and having electrodes including an anode and a cathode of metal, the said metal of said layer and of said cathode having a melting point in excess of 1400° C., an auxiliary electrode in said discharge tube in spaced relationship with said anode and said cathode, the said discharge tube having an operating characteristic between said cathode and said anode in the glow discharge region and between said auxiliary electrode and one of said electrodes in the Townsend discharge region, a source of a potential, a voltage dropping resistor, means connecting said

source through said resistor between said auxiliary electrode and one of said electrodes, said resistor having a value at which the magnitude of the voltage between said auxiliary electrode and said other electrode effects a Townsend discharge in said tube, a charging condenser connected between said cathode and said anode of said discharge tube, and a switching means connecting said source across said condenser whereby in the condition where said switch is closed said condenser charges to a magnitude of potential effecting a glow discharge in said tube said latter potential having a value sufficient to initiate said glow discharge between the said anode and said cathode in the absence of the said auxiliary discharge.

3. An arrangement as in claim 2 where said switching means is constituted by a photo-electric cell.

JOHANNES GIJSBERTUS WILHELM MULDER.
FRANS MICHEL PENNING.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,893,638	Schmierer	Jan. 10, 1933
1,898,046	Geffcken et al	Feb. 21, 1933
2,275,242	Adam	Mar. 3, 1942

FOREIGN PATENTS

Number	Country	Date
156,664	Great Britain	Apr. 6, 1922