

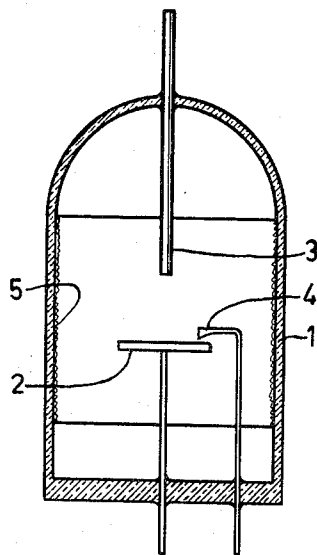
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G. J. M. AHSMANN ETAL

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GASEOUS GLOW-DISCHARGE TUBE WITH MONOCRYSTALLINE METAL CATHODE

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3,209,197
GASEOUS GLOW-DISCHARGE TUBE WITH MONO-CRYSTALLINE METAL CATHODE
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7 Claims. (Cl. 313-221)

This invention relates to gaseous glow-discharge tubes for use as active elements in electric circuits, more particularly voltage stabilizer tubes, in which a visible layer of the cathode material is present on the wall surrounding the discharge path.

Gaseous glow-discharge tubes of the above-mentioned kind are known for their favourable properties, namely with regard to their constant burning and striking voltages, so that the use of glow-discharge stabilizing tubes in circuits upon which high requirements are imposed and so-called triggering tubes satisfying narrow tolerances has considerably widened. A main condition for such tubes is that the cathode material has a melting point higher than 1400° C.

Among cathode materials having a melting point higher than 1400° C., molybdenum is preferred because of the ease with which the coating on the wall of the tube may be obtained by atomization of the cathode surface and because of the constancy of the properties of the tube.

Such tubes show differences of from 2% to 3% which is objectionable if close tolerances are required. Although by careful selection a tube meeting the required tolerance may be found, it is more desirable, for interchangeability, to have a tube which can fit closer tolerances.

A principal object of our invention is to provide a gaseous glow-discharge tube which has a voltage rating meeting closer tolerances.

Another object of our invention is to provide a gaseous glow-discharge tube employing metals other than molybdenum for the coating.

Still another object of our invention is to provide a gaseous glow-discharge tube using a cathode material having a melting point below 1400° C.

These and further objects of our invention will appear as the specification progresses.

According to our invention, in a gaseous glow-discharge tube for use as an active element in an electric circuit, more particularly in a voltage stabilizer tube in which a visible layer of the cathode material is present on the wall surrounding the discharge path, the cathode consists of a metal plate in monocrystalline form. The divergences of such cathodes are less than in polycrystalline cathodes, and the constancy is distinctly better.

In tubes according to the invention, in contradistinction to known tubes with an atomized coating on the wall, it is also possible to use cathode materials having a melting point lower than 1400° C.

It has also been found that metals of cubic structure have very constant properties, such as copper and nickel, which have a cubic face-centered structure, and tungsten, which has a cubic space-centered structure.

Since copper, as a metal, has poor gettering properties, it is preferable to provide on the wall, in addition to the atomized coating of copper, an atomized coating of a better gettering metal, such as molybdenum or zirconium, which may be effected, for example, by atomizing the anodes or another electrode of the glow-discharge tube which consists of such a metal.

The invention will be described in detail with reference to the accompanying drawing which shows a glow-discharge tube according to the invention.

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The figure shows an envelope 1 of the tube, a cathode 2 which consists of a monocrystalline plate, an anode 3 which consists of a molybdenum rod, and an auxiliary anode 4 which consists of a molybdenum wire. The tube is filled with neon at a pressure of 40 mms. of mercury. The atomized coating on the wall is indicated by 5. For the various cathode materials this tube yielded the results following from the table below for the normal voltage drop of the cathode.

Cathode	Crystal Directions			Polycrystalline
	1, 0, 0	1, 1, 0	1, 1, 1	
Cu	143.6	143.7	150.0	148±5
Ni		136.1		136

When nickel or tungsten is used as a cathode, atomization of the anode is not required, but in the case of a copper cathode such atomization is highly desirable to prevent a decline in the constant properties.

While we have thus described our invention with reference to specific embodiments, other modifications thereof will be readily apparent to those skilled in this art without departing from the spirit and scope of the invention which is defined in the appended claims.

What is claimed is:

1. A gaseous glow-discharge tube comprising an envelope containing an ionizable gaseous medium, anode and cathode electrodes within said envelope, said cathode consisting of a monocrystalline metal, and a coating of visible thickness of the metal of said cathode on the inner wall of said envelope.

2. A gaseous glow-discharge tube comprising an envelope containing an ionizable gaseous medium, anode and cathode electrodes within said envelope, said cathode consisting of a monocrystalline metal having a cubic crystal structure, and a coating of visible thickness of metal of said cathode on the inner wall of said envelope.

3. A gaseous glow-discharge tube comprising an envelope containing an ionizable gaseous medium, anode and cathode electrodes within said envelope, said cathode consisting of monocrystalline copper, the surface of said plate being parallel to one of the crystal planes (1,1,1), (1,1,0) and (1,0,0) and a coating of visible thickness of the metal of said cathode on the inner wall of said envelope.

4. A gaseous glow-discharge tube comprising an envelope containing an ionizable gaseous medium, anode and cathode electrodes within said envelope, said cathode electrode consisting of monocrystalline nickel, the surface of said cathode being parallel to one of the crystal planes (1,1,1), (1,1,0) and (1,0,0) and a coating of visible thickness of the metal of said cathode on the inner wall of said envelope.

5. A gaseous glow-discharge tube comprising an envelope containing an ionizable gaseous medium, anode and cathode electrodes within said envelope, said cathode electrode consisting of monocrystalline copper, the surface of said cathode being parallel to one of the crystal planes (1,1,1), (1,1,0) and (1,0,0) and a coating of visible thickness of the cathode metal and a gettering metal on the inner wall of said envelope.

6. A gaseous glow-discharge tube comprising an envelope containing an ionizable gaseous medium, anode and cathode electrodes within said envelope said cathode electrode consisting of monocrystalline copper, the surface of said cathode being parallel to one of the crystal planes (1,1,1), (1,1,0) and (1,0,0), a coating of visible thickness of the cathode metal on the inner wall of said

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envelope and a further coating of visible thickness of molybdenum on the inner wall of said envelope.

7. A gaseous glow-discharge tube comprising an envelope containing an ionizable gaseous medium, anode and cathode electrodes within said envelope, said cathode electrode consisting of monocrystalline copper, the surface of said plate being parallel to one of the crystal planes (1,1,1), (1,1,0) and (1,0,0), a coating of visible thickness of the cathode metal on the inner wall of said envelope, and a further coating of visible thickness of zirconium on the inner wall of said envelope.

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10 RALPH G. NILSON, *Examiner*.

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,209,197

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Gerardus Josephus Marie Ahsmann et al.

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 2, lines 32 and 38, after "metal", each occurrence, insert -- selected from the group consisting of nickel and copper --.

Signed and sealed this 12th day of April 1966.

(SEAL)

Attest:

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Attesting Officer

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Commissioner of Patents