Feb. 13, 1940. D. SCHENK 2,189,998

TUBE ELECTRODE

Filed July 16, 1936

Fig. 1a

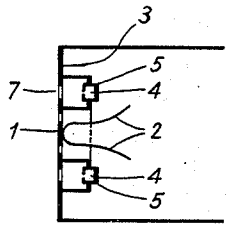


Fig. 1b

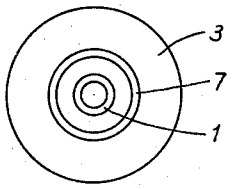


Fig. 3

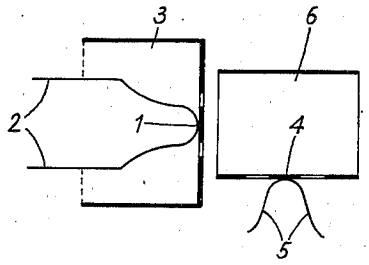
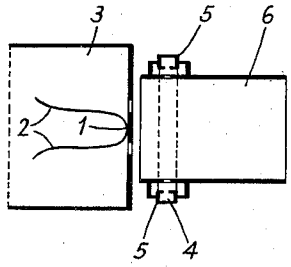


Fig. 2



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TUBE ELECTRODE

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Application July 16, 1936, Serial No. 90,837
In Germany July 29, 1935

5 Claims. (Cl. 250—27.5)

This invention relates to tube electrodes and in particular to a new, useful, and improved electron emitting cathode for use in electron discharge tubes.

This invention is concerned with a method and means adapted to operate electron-optic discharge vessels whose cathodes operated either upon the heating or photo-electric principle are to be imaged upon a fluorescent screen by the aid of electrons issuing therefrom. The cathodes are here activated frequently by the application of a very tenuous metallic coat or film, say, of barium or caesium, especially where an investigation of the structure of the cathode material is concerned. These thin metallic films, however, are of but short life. In fact, they are subject to destruction due to vaporization and also ionic bombardment, and the result is that the entire cathode and thus also the discharge tube itself are rapidly rendered unserviceable.

Now, this drawback may be obviated by that, according to the idea underlying the present invention, the electron-emissive material is constantly and uninterruptedly replenished by the fact that, during the very operation of the tube, it is produced upon an auxiliary electrode whence it is transferred onto the cathode to be investigated or to be imaged by virtue of evaporation. The life of the cathode is thereby greatly increased, for it depends no longer upon the quantity of active material placed upon it, but upon the supply of material capable of being accommodated upon the auxiliary electrode.

A number of embodiments adapted to practice this method according to the invention are illustrated by way of example in the attached drawing, in which—

Figs. 1*a* and 1*b* show one embodiment of the invention, and

Fig. 2 and Fig. 3 show modifications of the invention.

The active metal vapor is preferably produced by the heating of the auxiliary electrode or else by virtue of electrolysis. What is important in all arrangements is that the auxiliary electrode carrying a supply of active material is so disposed in the electron-optic discharge tube that the fields of potential prevailing between the cathode and the rest of the electrodes constituting a lens system will not be disturbed.

Figs. 1*a* and 1*b* show in side and front elevation a cathode arrangement of the kind serviceable, for instance, for electron-optic structure investigations. The cathode 1 which is to be examined, by the use and aid of lens electrodes (or electrodes possessing lenticular actions) is to be imaged upon a fluorescent screen (also not shown). The cathode is here of the incandesced type. The heating current is supplied to it at 2. In order to insure a constant potential field, the cathode, as known from the prior art, is surrounded by a ring or shield 3 which is kept at cathode potential. This ring has an annular slit 7 below which the auxiliary electrode 4 of groove shape is disposed which serves to accommodate the supply of electron-emissive material. The said annular groove is heated by means of a current supplied at ends 5, 5. The groove 4 itself is connected at one point with the shield 3 so that it is substantially at the same potential as the shield.

Fig. 2 shows an arrangement in which the groove-shaped auxiliary electrode 4 surrounds the anode 6 (auxiliary anode, gun, or accelerator anode) in the form of a ring and has the same voltage as the anode 6. Through a slit provided in the cylindrical shell of the anode, the electron-emissive material, when electrode 4 is heated by means of an electric current supplied at 5, flows into the interior of the cylindrical anode or gun, whence it is able to reach the cathode.

Another exemplified embodiment is illustrated in Fig. 3 of the annexed drawing. In this instance, a small area is recessed in the anode 6 which area is replaced by the auxiliary electrode 4 which also is here of planar form. The storage or supply electrode also in the present instance is at anode potential, and it is heated by the aid of a current supplied at 5, 5. Also in this arrangement the potential field set up between the cathode 1 and the gun 6 will not be influenced by the accommodation in the assembly of the supply electrode 4.

The evaporable material consists preferably of a light metal compound which is capable of being decomposed thermally with great ease, more particularly an alkali metal compound. Among the various substances suitable for this purpose, caesium hydride has proved especially convenient because it undergoes thermal decomposition only at a slow rate and thus furnishes a uniform and slow stream of vapor.

In a great many instances it is suitable to choose electrolytic decomposition rather than thermal decomposition. The supply electrode is then preferably in the form of a small cup or of a groove into which projects a second electrode which latter is subject to a voltage having a

polarity opposite to that of the former electrode.

The invention and its practical utility is not restricted to a heated cathode, in fact, it offers the same advantages also in the case of photocathodes, say, caesium cathodes.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. An electron emitter comprising an apexed filamentary heater, a disk affixed to the apex of the heater, a cylindrical shield electrode planarly closed at one end and positioned coaxially with the axis of said disk, said electrode having its planar end apertured and lying in the same plane as the disk, and storage means spaced from said disk holding an easily decomposable metallic compound positioned symmetrically about the disk, said storage means being adapted to deposit emissive material onto said disk by decomposition of the stored metallic compound.

2. An electron emitter comprising an apexed filametary heater, a disk affixed to the apex of the heater, a cylindrical electrode planarly closed at one end and positioned coaxially with the axis of said disk, said electrode having its planar end apertured and lying in the same plane as the disk, storage means positioned coaxially with the axis of said disk for holding an easily decomposable metallic compound and means for electrolytically decomposing the metallic compound.

3. An electron emitter comprising an apexed filamentary heater, a disk affixed to the apex of the heater, a cylindrical electrode planarly closed at one end and positioned coaxially with the axis of said disk, said electrode having the planar end apertured and lying in the same plane as the disk, storage means positioned coaxially with the axis of said disk for holding an easily decomposable metallic compound and electrical heating means for decomposing the metallic compound.

4. An electron emitter comprising an apexed filamentary heater, a disk member operatively associated with said heater and having thereon an electron emissive material, a cylindrical shield electrode substantially embracing said disk member, and at least one holding means positioned adjacent said disk and containing an easily decomposable metallic compound, said electron emissive material and said metallic compound being independently spaced apart whereby decomposition of said metallic compound deposits emissive material onto said disk member.

5. Apparatus in accordance with claim 4 wherein there is provided in addition means for decomposing the metallic compound.

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