Aug. 23, 1932. L. DE FOREST 1,873,558

GASEOUS DISCHARGE DEVICE

Original Filed July 13, 1929

Fig. 1.

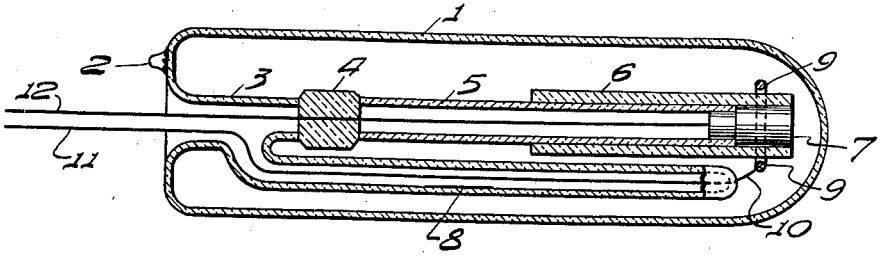


Fig. 2.

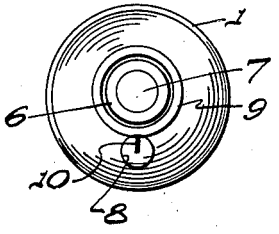
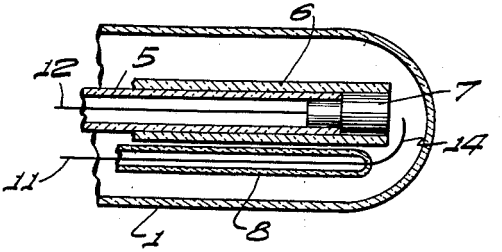


Fig. 3.



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UNITED STATES PATENT OFFICE

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GASEOUS DISCHARGE DEVICE

Original application filed July 13, 1929, Serial No. 377,937. Divided and this application filed December 1, 1930. Serial No. 499,365.

This invention relates in general to gas filled electron discharge devices particularly designed for photographic recording of fluctuating currents and especially for photographic sound recording.

The present application is a division of my application filed July 13th, 1929, Serial No. 377,937.

One of the objects of this invention is the provision of a gaseous discharge device which has a longer life as compared with devices of this type now known.

Another object of this invention involves the construction of an electron discharge device which is not subject to blackening of the glass walls of the enclosing envelope.

A still further object of this invention is the provision of a device of this type so constructed that after operation for a few hours its operation becomes stable and the amount of light given off under any excitation is practically constant.

An additional object of this invention is to provide an electron discharge device of such construction that the cathode absorbs the gases contained within the envelope and the materials therein to a less degree than is now commonly experienced.

A still further object of the invention is to employ a cathode in devices of this of molybdenum.

These and other objects as will appear from the following disclosure are secured by means of the device of this invention.

This invention resides substantially in the combination, construction, arrangement, and relative location of parts, all as will be described in greater detail hereinafter.

Referring to the drawing:

Figure 1 is a longitudinal cross-sectional view through one form of device embodying the principles of this invention.

Figure 2 is an end elevational view of the device; and

Figure 3 is a sectional view of a modified form of device.

Heretofore any gaseous discharge devices as known when employed for sound recording purposes and the like have a short useful life, usually of only a few hours' duration. This short life is due chiefly to blackening of passes due to the deposition on the interior of the glass containing vessel of metallic particles torn off by the discharge from the surface of the electrodes or electrode. It is also due in part to the gradual absorption of gases by the electrodes or by the insulating material in the tube. This invention has to do with the construction of gaseous discharge devices which avoids the aforementioned difficulties and furnishes a discharge tube which has an indefinite life, the light from which after a few hours' use, attains a definite stable value and remains practically constant.

Some of the advantages of a device of this nature, which is known in the art as a photon, are derived from the fact that a cathode made of molybdenum is employed. Other features which produce the advantages of this invention lie in the fact that the cathode is surrounded by an envelope of insulating material and is so constructed that it may be placed very close to the rounded, smooth end or window of the glass vessel. In addition, the end of the cathode is polished so that it acts as a mirror, thereby somewhat increasing the illuminating efficiency of the discharge device. By employing molybdenum as the cathode metal and by shaping it so that the outer surface thereof is flat and set opposite and close to the window end of the tube it has been found that the glass does not become blackened as the molybdenum does not lose any of its particles that otherwise would be shot off from the surface of the cathode and to a great extent deposited upon the glass. This particular feature in the glow tube for photographically recording sound, is of great importance, as the glass end or window of the tube must be kept as clear and transparent as possible. It is therefore desirable that a metal be used, not to absorb gas, but to prevent blackening of the glass end or window of the tube.

Referring to the drawing, the elements of the discharge tube are enclosed within a glass envelope 1 which is sealed off in the usual manner at 2 after being evacuated and filled, as is well known in the art, with a

suitable gas, or mixture of gases. The vessel or envelope 1 has a reentrant stem 3 provided with the press 4. This press supports a small glass tube 5 (exaggerated in size in the drawing) which is enclosed at its outer end by a cylinder of insulating material which overhangs the end of the glass tube. This cylinder of insulating material may be made of porcelain, isolantite, crowlite, or the like material. Fitting within the end of the insulating sleeve 6 is the cathode 7 made in the form of a plug which is of molybdenum in the best form. Extending from the stem tube 3 and formed integrally therewith is a hollow tube 8 lying parallel to the central axis of the envelope. Extending through this tube is a lead-in-wire 11 which connects to a short length of platinum wire 10 sealed in the end thereof. Separated by the platinum wire 10 and encircling the insulating sleeve 6 at a short distance from the end thereof is the anode or second electrode 9 in the form of a ring. The lead wire 12 passes through the press 4 and is connected to the cathode 7 of the device. With a gas of suitable pressure within the envelope and a proper current excitation impressed across the leads 11 and 12 a luminous gas discharge is formed between the cathode and the anode up close to the end wall of the vessel 1. As is well known in this art, the end of the vessel is rounded in form and made as smooth and clear as possible so that accurate transmission of the light is secured therethrough. The end of the cathode 7 for best performance is polished to give a mirror-like surface.

In the modified form of device shown in Fig. 3 the anode 14 consists of a single view curved around and terminating short of the end surface of the cathode 7. The discharge then occurs between curved anode wire 14 and the cathode 7. It is important that the cylinder of insulating material 6 in both cases fit tightly over the glass tube 5 so that an electrical discharge can never take place from the lead-in wires within the insulating cylinder 6. As is clear from the drawing the anode ring 9 is very close to the exterior surface of the insulating sleeve but is actually out of contact therewith. In actual construction the cathode is within one-eighth to three-sixteenths of an inch of the interior of the glass envelope and the anode ring approximately one-quarter of an inch from the forward end of the insulating sleeve 6. If desired large lead-in wires can be employed, particularly the wire 12, so as to properly conduct away the heat from the discharge which is generated at the cathode surface. The lead-in wires, where they pass through the seals, will of course conform to any standard practice whereby an airtight connection is secured.

It has been found that tantalum and molybdenum are the best materials for the cathode. When tantalum is used there is no observable deposition upon or blackening of the glass envelope even after many hours of constant use, although when molybdenum is employed a slight blackening does occur. However, either of the above metals are greatly superior to any other material commercially available for cathode construction. In addition the absorption of the gases contained in the envelope by the cathode is much less when molybdenum is used than when ordinary metals, such as nickel, iron, and the like are employed. Platinum can be advantageously employed as cathode material but the expense involved would be unnecessarily great.

From the foregoing disclosure it will be apparent that I have devised a new and novel construction in electron discharge devices which employ certain principles of construction and operation which may assume other physical forms than those disclosed in the drawing for purposes of illustration. I do not, therefore, desire to be strictly limited to the disclosure as given for purposes of illustration but rather to the scope of the appended claims.

What I seek to secure by United States Letters Patent is:

1. A glow tube for photographically recording sound, including a transparent glass envelope and a molybdenum cathode mounted in the envelope and having a flat surface disposed opposite and close to the light emitting end of the envelope.

2. A glow tube for photographically recording sound as claimed in claim 1, wherein the flat surface of the cathode is highly polished.

3. A glow tube as claimed in claim 1, wherein the cathode is a double diametered cylindrical member, the larger base end of which is flattened and polished.

In testimony whereof I affix my signature.

LEE DE FOREST.