Sept. 5, 1939. P. GÖRLICH 2,172,164

PHOTOELECTRIC CATHODE

Filed June 30, 1937

Fig. 1

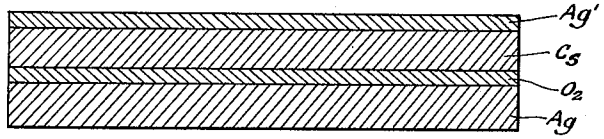


Fig. 2

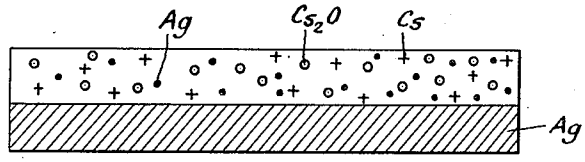


Fig. 3

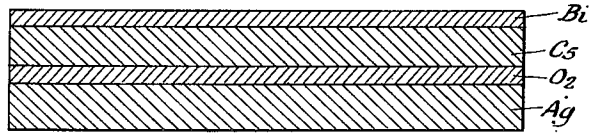
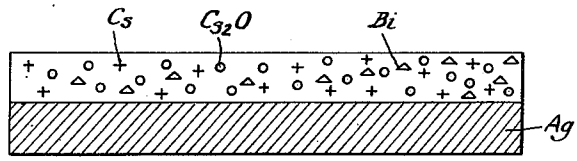


Fig. 4



Inventor
Paul Görlich
BY
B. Singer
Attorney

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PHOTOELECTRIC CATHODE

Paul Görlich, Dresden, Germany, assignor to Zeiss Ikon Aktiengesellschaft, Dresden, Germany

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In Germany July 4, 1936

9 Claims. (Cl. 250—165)

The invention relates to improvements in photoelectric cathodes and in particular is directed to a novel combination of the various layers composing the photoelectric cathode.

It is well known to produce a photoelectric cathode by depositing upon a base of silver, after the silver has been oxidised, an alkali metal as for instance caesium. After the alkali metal has been deposited in known manner by vaporisation or the like, a thin layer of silver is applied to cover the alkali metal layer. It is not clear what happens during the deposition of these layers and later what happens between these layers, but it appears that the individual parts of the layers deposited upon the silver base penetrate each other, so that upon the base there is produced a combined layer composed of Ag, Cs and Cs_2O respectively in the form of the atomically and molecularly dispersed constituents.

The object of the invention is to produce a photoelectric cathode having an increased sensitiveness over the above described well known photoelectric cathode, by employing as a covering layer for the alkali metal, which may be caesium, a coating of a metal having a low conductivity, as for instance Bi, Sb or Pb, and not as it was heretofore customary a thin coating of silver.

It is another object of the invention to employ as a covering layer for the alkali metal a metal having a lower electric conductivity than said alkali metal.

In the drawing:

Fig. 1 illustrates diagrammatically the manner of building up a photoelectric cathode as practiced heretofore.

Fig. 2 illustrates diagrammatically how the various layers of the photoelectric cathode of Fig. 1 appear to penetrate into each other.

Fig. 3 illustrates diagrammatically the manner of producing a photoelectric cathode of the present invention, and

Fig. 4 illustrates diagrammatically the mutual penetration of the various layers of the photoelectric cathode of the present invention.

Heretofore it was customary, as illustrated in Fig. 1 to deposit, for instance by vaporisation, upon an oxidized silver base Ag, whose oxide coating is designated at O_2, an alkali metal, as for instance caesium, and then to cover the alkali metal Cs with a thin silver layer Ag'. The various layers applied one after the other onto the base appear to merge or penetrate into each other, either during their application or after the same. At any rate, there will appear on the base Ag a layer in which the atomic and molecular constituents of Ag, Cs and Cs_2O are combined as indicated diagrammatically by the symbols ·,+ and o respectively.

According to the present invention the sensitiveness of this known photoelectric layer can be increased substantially by providing the alkali metal layer, in the present case the caesium layer, with a coating of a metal having a low electric conductivity, as for instance bismuth (Bi), antimony (Sb) or lead (Pb), and not with the thin silver layer heretofore applied.

The Figs. 3 and 4 illustrate by way of example a photoelectric cathode in which the caesium layer is provided with a coating of bismuth. According to Fig. 3 the base Ag consisting of a metal having a high conductivity, as silver or copper is oxidised as formerly to provide an oxide layer O_2 upon which an alkali metal is deposited, for instance Cs by vaporisation in any well known manner. Then a thin layer of bismuth Bi is applied to the Cs layer.

While heretofore the alkali metal layer of photoelectric cathode was covered with a metallic layer having a higher conductivity than said alkali metal layer, the present invention employs for the aforesaid top coating a metal having a lower conductivity than said alkali metal layer.

Fig. 4 illustrates diagrammaticaly the penetration of the various layers into each other which it appears will occur to form a new combined layer of Bi, Cs_2O and Cs as indicated with Δ, o and + respectively.

The new combination of the different layers forming a photosensitive material may also be used as a material suitable to emit secondary electrons when properly energised, for instance in secondary electron multipliers.

A photo-electric cathode according to the invention can be manufactured by any known method. One method of making a cathode as shown in Figs. 1 and 2 is described in Phys. Rev. 36, 1639 (1930) by R. L. Koller "Photoelectric Emission from Thin Films of Caesium". There is however a difference between this cathode and the cathode according to the invention. The cathode described in Phys. Rev. 36, 1639, has a surface layer made of silver, while the new cathodes surface layer is made of a metal, the conductivity of which is less than that of the alkaline layer. This metal is preferably imparted on the alkaline layer by vaporisation. Other methods of producing photo-electric cathodes are described in detail by R. Fleischer and H. Teichmann "Die lichtelektrische Zelle und ihre Herstellung", 1932.

What I claim as my invention is:

1. A photo electric cathode comprising an oxidized metal base, a layer of an alkali metal thereon, and a thin layer of metal forming the top coating of said alkali metal layer, said metal base having a higher electric conductivity than said alkali metal and said top coating having a lower electric conductivity than said alkali metal.

2. A photo electric cathode, an oxidized silver base, a layer of an alkali metal thereon, and a thin layer of bismuth forming the top coating of said alkali metal layer.

3. A photo electric cathode comprising, an oxidized silver base, a layer of an alkali metal thereon, and a thin layer of antimony forming the top coating of said alkali metal layer.

4. A photo electric cathode comprising, an oxidized silver base, a layer of an alkali metal thereon, and a thin layer of lead forming the top coating of said alkali metal layer.

5. A photo electric cathode comprising, an oxidized copper base, a layer of an alkali metal thereon, and a thin layer of bismuth forming the top coating of said alkali metal layer.

6. A photo electric cathode comprising, an oxidized copper base, a layer of an alkali metal thereon, and a thin layer of antimony forming the top coating of said alkali metal layer.

7. A photo electric cathode comprisng, an oxidized copper base, a layer of an alkali metal thereon, and a thin layer of lead forming the top coating of said alkali metal layer.

8. A photo sensitive substance adapted to be used as secondary electron emitting layer, comprising, an oxidized metal base, a layer of an alkali metal thereon, and a thin layer of a metal forming the top coating of said alkali metal layer, said metal base having a higher electric conductivity than said alkali metal and said top coating having a lower electric conductivity than said alkali metal.

9. A photo sensitive layer for photo electric tubes, comprising an oxidized metal base, a layer of an alkali metal thereon, and on top of said alkali metal layer a coating of an element of a group which comprises bismuth and antimony.

PAUL GÖRLICH.