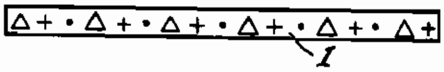
PUBLISHED
MAY 25, 1943.
BY A. P. C.

P. GÖRLICH
LIGHT SENSITIVE LAYERS
Filed April 22, 1940

Serial No.
331,054

Fig. 1



Δ = Sb
+ = O
• = Cs

Fig. 2

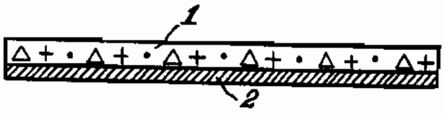


Fig. 3

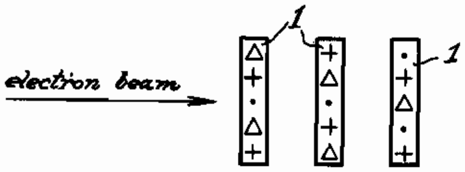


Fig. 4

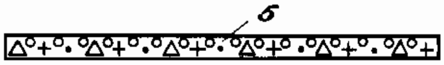
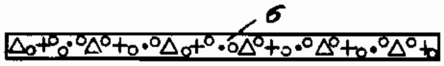


Fig. 5

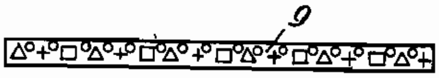


∘ = Ag

Fig. 6

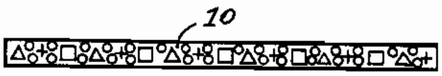
Fig. 7

Fig. 8



Δ = Sb
+ = O
□ = Li
∘ = Ag

Fig. 9



INVENTOR.
Paul Görlich
BY
Singer, Ehlert, Stern & Carlberg
ATTORNEYS

Published May 25, 1943

Serial No. 331,054

ALIEN PROPERTY CUSTODIAN

LIGHT SENSITIVE LAYERS

Paul Görlich, Dresden, Germany; vested in the Alien Property Custodian

Application filed April 22, 1940

The invention relates to improvements in light sensitive layers of the type described in my United States Patent No. 2,122,860 issued on the 5th day of July 1938 and particularly is directed to a novel employment and modification of this light sensitive layer.

According to my previous invention the light sensitive layer is used as a photo electric cathode in photo electric tubes and consists of a bismuth or antimony layer and a caesium or rubidium layer alloyed together. Such an alloyed light sensitive layer is extremely sensitive in the visible range of the spectrum and may be produced in thin and thick layers which are pervious and impervious to light respectively.

One object of the present invention is to employ the above mentioned alloyed light sensitive layer as secondary electron emitting means.

Another object of the invention is to apply the above mentioned alloyed layer to the electrodes from which the secondary electrodes are to be released.

It is also an object of the invention to employ the above mentioned alloyed layer in the shape of foils which preferably are mounted in spaced relation one after another so as to serve in an electron multiplier tube as secondary electron emitting electrodes.

Another object of the invention is to make the foils of such a thickness that the rear face of the foils produces a maximum emission of secondary electrons when the primary electrons strike the front face of the foils.

Still another object of the invention is to increase the light sensitiveness of the above mentioned alloyed layer by incorporating in the same additionally conductive particles of pure metal, for instance made of silver.

Another object of the invention is to produce an alloyed light sensitive layer of the above mentioned type in which the caesium or rubidium layer is substituted by a lithium layer. Lithium has the advantage that its thermic emission is very small so that its current in the dark zone of the spectrum is also very small. At the same time, however, the sensitiveness is greater than that of the light sensitive layers of the prior art. The incorporation of pure metallic particles, as silver, in the alloyed layers of antimony and lithium or bismuth and lithium increases the light sensitiveness still more.

The drawing illustrates diagrammatically various alloyed light sensitive layers and secondary electron emitting layers of the present invention:

Fig. 1 illustrates a self-supporting secondary electron emitting foil without any carrier.

Fig. 2 illustrates a secondary electron emitting layer applied to a carrier which serves as electrode.

Fig. 3 illustrates the arrangement of a plurality of foils as serving as secondary electron emitting electrodes in a secondary electron multiplier.

Fig. 4 illustrates an alloyed light sensitive layer with pure metallic particles on its surface.

Fig. 5 illustrates an alloyed light sensitive layer with pure metallic particles distributed throughout the entire body of the layer.

Fig. 6 illustrates the layer of Fig. 4 applied to a carrier of silver.

Fig. 7 illustrates an alloyed layer of antimony and lithium.

Fig. 8 illustrates an alloyed layer of antimony and lithium with pure metallic particles on its surface, and

Fig. 9 illustrates an alloyed layer of antimony and lithium with pure metallic particles distributed throughout the layer.

Fig. 1 illustrates an alloyed layer 1 composed of antimony and caesium, which according to my U. S. Patent No. 2,122,860 is produced by precipitating by evaporation a caesium layer upon an antimony layer, which latter was previously treated with oxygen, and then subjecting the two superposed layers to a special treatment, for instance a heat treatment, which causes the two layers to alloy together. The light sensitive layer so produced according to the present invention is used for secondary electron emitting purpose.

According to Fig. 2 the light sensitive layer 1 is applied to an electrode 2 which in a secondary electron multiplier is used for releasing secondary electrons, or as illustrated in Fig. 3, a number of the layers 1 is used preferably in the form of foils arranged in spaced relation, one after another, to serve as secondary electron emitting electrodes. The use of self-supporting foils has the advantage that the entire number of primary electrons is exploited, which is not possible when grids or mesh-works are employed as secondary electron emitting electrodes. It is advisable and forms an important part of the invention to make the foils of such a thickness that the secondary electrons obtained on the rear face of the foils is a maximum when the primary electrons strike the front face of the foils.

In order to increase the light sensitiveness of the above mentioned layers, and thereby increase also their value as secondary electron emitting medium, the present invention proposes to incorporate in the alloyed layer pure particles of a foreign metal. Silver has been found to be exceptionally useful for this purpose. The use of silver particles does not only increase the light sensitiveness of the layer, but also increases the electric conductivity of the layer in transverse direction.

The pure metallic particles may be incorporated in the alloyed layer in various manner. For instance, the alkali metal-bismuth alloy layer or the alkali metal-antimony alloy layer, as the case may be, is produced first and thereupon a coating of silver is precipitated by evaporation upon the alloy layer. The silver presumable enters by itself into the alloy layer, however, this action may be accelerated or enhanced by an additional heat treatment. A layer of this type is illustrated in Fig. 4 and is designated with 5.

It is also possible to precipitate first the silver layer or another metallic layer upon the antimony layer or the bismuth layer and then apply the alkali metal layer, whereupon the alloy is produced by a heat treatment. In this manner a layer 6 as illustrated in Fig. 5 is obtained.

Fig. 6 illustrates the layer 5 arranged on a metallic carrier 7, consisting for instance of silver. This last named arrangement is of advantage when the alloyed layer of the present invention is employed as secondary electron emitting electrodes, for it is to be suspected that the secondary electrons are released from the deep interior of the layer and that therefor any additional belated delivery of electrons is of importance.

In Fig. 7 an alloyed light sensitive layer 8 is illustrated in which the caesium or rubidium layer is substituted by lithium. When lithium is used the thermic emission is very small, so that only a very small current in the dark range of the spectrum is produced, since this current depends principally upon thermic emission. The current in the dark range of alloyed bismuth-lithium layers is about of the same size as the corresponding dark range current of hydrated potassium layers. At the same time, however, the alloyed bismuth-lithium layer has a higher light sensitiveness as the heretofore known layers.

If the sensitiveness of the layer 8 is to be increased, this can be done in similar manner as described in connection with the Figs. 4 and 5 by incorporating pure metallic particles, as for instance silver, in the alloy. According to Fig. 8 the surface of the antimony-lithium layer 9 has incorporated therein pure silver particles, while Fig. 9 illustrates an antimony-lithium layer 10 which has pure silver particles distributed throughout its entire body.

For the same reason as mentioned with reference to Fig. 6, the layer 9 or 10 may be applied to a metallic carrier, for instance of silver, to enhance the utility of the alloyed layer as secondary electron emitting substance.

Obviously, the alloyed antimony-lithium layer, with or without the pure metallic particles therein, may be employed in the form of self-supporting foils, as shown in Fig. 3, to serve as secondary electron emitters in secondary electron amplifiers.

Furthermore, the layers of the invention may also be used for thermic emission.

PAUL GÖRLICH.