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MANUFACTURE OF PHOTO-ELECTRIC CELLS

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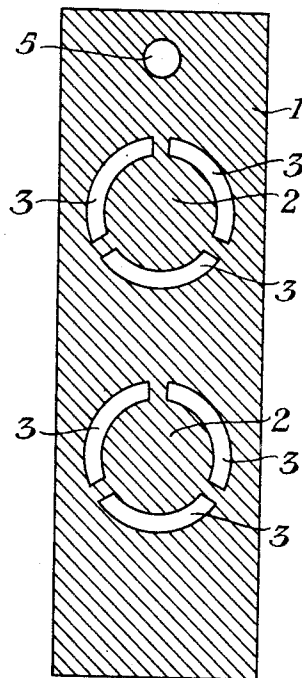


Fig. 1.

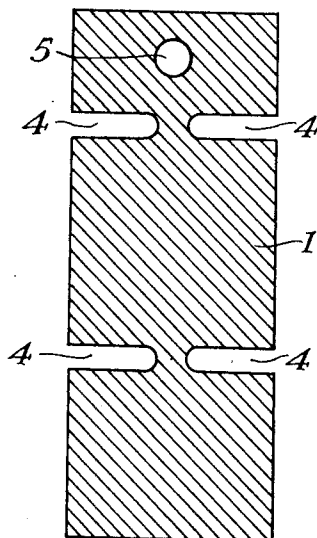


Fig. 2.

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UNITED STATES PATENT OFFICE

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MANUFACTURE OF PHOTO-ELECTRIC CELLS

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mesne assignments, to The Union Switch &
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tion of Pennsylvania

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2 Claims. (Cl. 136—89)

This invention relates to the manufacture of photo-electric cells of the dry surface contact type and more particularly to cells of this character comprising a relatively thin disc or plate of cuprous oxide coated with a layer of gold or other suitable metal, the invention having for its object certain improvements in the process of manufacture whereby a more efficient sensitive and durable cell may be obtained.

10 The invention is illustrated by way of example in the accompanying drawing Figures 1 and 2 of which are views showing one stage in the process and manufacture of the cells in accordance with a proposed form of the invention.

15 Referring now to the drawing the plates or discs of cuprous oxide are obtained by oxidizing a strip 1 of metallic copper which has previously been divided into a number of areas 2 each corresponding to a single disc or plate of the required size and shape, the areas 2 being almost completely separated from each other and from the remainder of the strip by punching or slotting as indicated at 3 in Figure 1 or at 4 in Figure 2. The strip 1 thus formed comprising the several discs or plates 2 connected to one another by the portion of the strip not removed is suspended by means of an aperture 5 at one end of the strip in an electric furnace in which it is subjected to a temperature of approximately 1000° C. for a period of approximately 48 hours after which the strip is transferred to a second furnace and subjected to a temperature of approximately 520° C. for a period of approximately 2 hours the strip being subsequently cooled in still air.

35 The method of oxidation above described is found to produce a satisfactory proportion of discs or plates which are plane, homogeneous and crystalline in structure, the conversion of the metal into oxide being complete throughout the thickness of the strip 1.

40 The discs or plates 2 of oxide are then separated from the remainder of the oxidized strip and are treated in the following manner for the removal of the layer of cupric oxide formed on the surface of the cuprous oxide during the process of oxidation.

45 The discs or plates are first subjected to the action of boiling citric acid which is found to remove the cupric oxide and to reduce the outer surface of the cuprous oxide to the form of metallic copper, the treatment being continued until the whole surface of the disc or plate is covered with a uniform layer of reduced copper. This layer is non-adherent or loosely adherent and can be readily removed by washing in water.

The disc or plate 2 is then immersed in a saturated solution of sodium cyanide thereby imparting a particularly smooth surface to the cuprous oxide which is found to be of importance in order to prevent subsequent deterioration of the cell in service. The cyanide solution also serves to neutralize any acid retained in the body of the cuprous oxide as a result of the previous stage of the process.

50 The disc or plate is then removed from the cyanide solution and thoroughly washed with distilled water, being finally dried in air at a relatively low temperature.

55 One side of the disc or plate is then coated with a thin layer of graphite preferably in the form of "Aquadag" and is subsequently coated with a relatively thick layer of gold or other suitable metal so as to form a terminal contact for the photo-electric element.

60 A photo-electric contact layer of gold is then applied to the opposite surface of the disc or plate which is to be subjected to the action of light this being preferably effected by a sputtering operation and it should be observed that the thickness of this layer has a definite critical value for which the operation of the device as a photo-electric cell has a maximum efficiency. The thickness of the layer is dependent upon the dimensions, distance apart and nature of the anode and cathode employed and the nature and pressure of the gas in the presence of which the sputtering operation is effected the thickness of the layer being also dependent upon the impressed voltage and the duration of the sputtering operation. In a particular case it was found that a layer of suitable thickness for maximum efficiency was obtained by continuing the sputtering operation for 2¼ minutes with a current of 40 milli-amperes in air at a pressure of 0.1 mm.

65 The element is finally completed by coating the surface of the disc or plate to be illuminated or the whole disc or plate with a transparent layer of shellac or celluloid which not only serves to protect the photo-electric contact layer of gold and the boundary or contact surface between this layer and the cuprous oxide from injury or deterioration but also prevents or reduces reflection of the light from the upper surface of the layer of gold and thus assists its penetration of the photo-electric boundary or contact surface.

70 It will be understood that the invention is not limited to the use of the particular process or reagents above described and that variations or modifications may be adopted without exceeding the scope of the invention.

Having thus described our invention what we claim is:

1. A process for the manufacture of a photo-electric cell of the dry surface contact type comprising a disc of cuprous oxide coated with a layer of suitable metal such as gold characterized by that the disc of oxide is treated with hot citric acid to remove the cupric oxide and to reduce the surface of the cuprous oxide to metallic copper in a readily removable condition.
2. A process for the manufacture of a photo-electric cell of the dry surface contact type comprising a disc of cuprous oxide coated with a layer of suitable metal such as gold, characterized by treating the disc of oxide with hot citric acid to remove the cupric oxide and to reduce the surface of the cuprous oxide to metallic copper in a readily removable condition, and subsequently treating the disc with a solution of sodium cyanide with the object of imparting a smooth surface to the oxide.

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