May 15, 1934. A. L. WILLIAMS 1,959,073

PHOTO-ELECTRIC CELL

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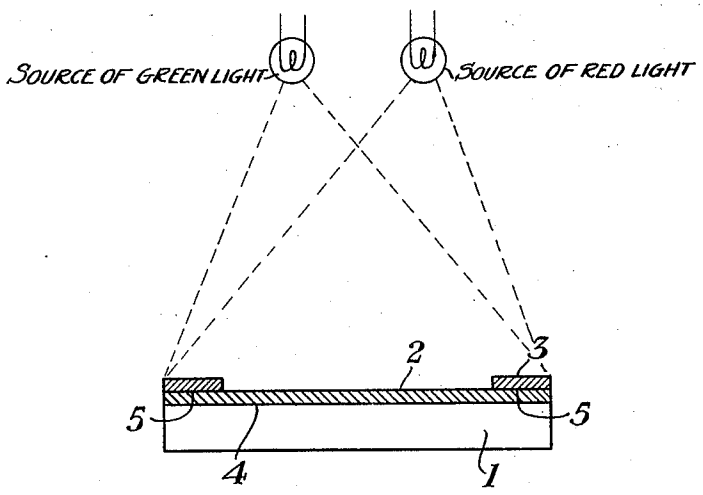


Fig. 1.

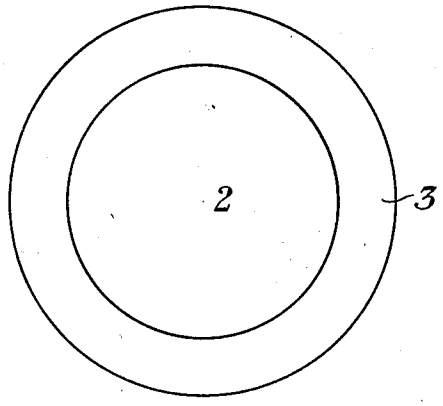


Fig. 2.

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PHOTO-ELECTRIC CELL

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1 Claim. (Cl. 136—89)

This invention relates to photo-electric cells of the kind comprising a photo-sensitive element of the dry surface contact type and has for its object to provide an improved photo-electric cell of this character.

When a so-called second class conductor such for instance as cuprous oxide is in relatively intimate contact with a conductor such as a metal for instance copper or gold an electro-motive force is found to be generated when the combination is subjected to the action of light, the generation of electro-motive force being believed to occur at the boundary or contact surface of the two conductors and tending to cause a flow of current from the conductor of lower specific resistance to that of higher specific resistance, for instance from the copper or gold to the cuprous oxide through this boundary or contact surface.

According to the principal feature of the invention the cell comprises a second class conductor or conductor in photo-electric contact with more than one conductor or second class conductor respectively, the cell being responsive to light of different wave lengths or ranges of wave lengths according to whether the light traverses a second class conductor or not in order to reach the boundary or contact surface at which the electro-motive force is generated, this conductor being in the form of a relatively thin plate or layer adapted to transmit light corresponding to a portion of the spectrum dependent upon the nature of the conductor.

According to a further feature of the invention, the second class conductor is arranged to be in relatively intimate contact over a portion only of one of its surfaces with a conductor of lower specific resistance and in contact over another portion of its opposite surface with a second conductor of lower specific resistance, so that the boundary or contact surface on one side of the second class conductor is subject to the action of light transmitted through the portion of the conductor which is not in contact with the conductor on the opposite side. The direction in which the electro-motive force is generated when one surface of the cell is exposed to light will thus be different for light of different colors dependent upon which of the two boundary or contact surfaces receives the light after transmission through the conductor or second class conductor.

The invention is illustrated by way of example in the accompanying drawing Figures 1 and 2 of which are views in sectional elevation and plan respectively of one form of photo-sensitive element for a photo-electric cell embodying the invention, the vertical dimensions of the various elements being shown as greatly exaggerated for the sake of clearness.

Referring now to the drawing it will be seen that the photo-sensitive element consists of a thin plate or disc 1 of copper, the upper face of which is coated with a layer 2 of cuprous oxide preferably formed directly thereon by a heating operation. An annular zone of the upper face of the oxide layer 2 is coated with a layer 3 of gold formed by sputtering or in any other suitable manner, the remainder of this face of the oxide layer 2 being left clear.

The annular zone 3 of applied gold and the copper plate or disc 1 form the terminals of the element and assuming that a beam of light is directed upon the upper face of the element the operation is as follows.

If the light is of a wave length or lengths corresponding to the red end of the spectrum, the rays of light are intercepted by the layer of gold 3 but are transmitted through the thin layer of cuprous oxide 2 over the clear portion of the upper face of the element and pass to the boundary or contact surface 4 between the oxide 2 and the copper plate or disc 1 thereby generating an electro-motive force in a direction tending to cause a flow of current within the element from the copper 1 to the oxide 2. If however the light is of a wave length or lengths corresponding to the green portion of the spectrum, the rays of light are intercepted by the layer 2 of cuprous oxide over the clear portion of the upper face of the element but are transmitted through the layer of gold 3 to the boundary or contact surface 5 between this layer and the layer of cuprous oxide thereby generating an electro-motive force in a direction tending to cause a flow of current from the gold 3 to the oxide 2, that is to say, in the opposite direction to that corresponding to red light.

It will be observed that the selective action is due to the fact that cuprous oxide in the form of a thin film is translucent to red light and that gold in a thin layer is translucent to green light.

The cell is thus responsive to either red or green light and generates an electro-motive force in one direction or the other according to the color of the light to which it is subjected, and the sensitiveness or response of the cell to the different colors may evidently be varied as desired by varying the relative areas of the annular zone 3 of applied gold and of the remaining clear portion of the upper face of the element, or by varying the relative thickness of the layers of gold and cuprous oxide or by both variations.

In addition to the photo-electric action above described, there will in general be a rectifying action at the boundaries or contact surfaces 4, 5 which is different for different conducting or semi-conducting materials and the modification of the magnitude of the photo-electric effect obtained due to the rectifying action may be utilized in adjusting the selective response of the device as will be understood without further explanation.

It will be understood that other conductors and second class conductors than those above mentioned may be utilized having regard to their photo-electric properties and translucency to light of different colors.

Although I have herein shown and described only one form of photo-electric cell embodying my invention, it is understood that various changes and modifications may be made therein within the scope of the appended claims without departing from the spirit and scope of my invention.

Having thus described my invention, what I claim is:

A device capable of functioning as a generator of electric current comprising copper having a layer of cuprous oxide permeable to light formed thereon and integral therewith, and an uncovered layer of gold permeable to light in intimate contact with only a portion of the free surface of said oxide, means for at times supplying to the free surfaces of said oxide and said gold light of such wave length as to be transmitted by the oxide to the junction of the copper and the oxide but to be intercepted by the gold and at other times supplying to said free surfaces light of such wave length as to be transmitted by the gold to the junction of the gold and the oxide but to be intercepted by the oxide, said device being characterized by the fact that when light strikes the junction of the copper and the oxide an electric current is caused to flow across such junction from the copper to the oxide whereas when light strikes the junction of the gold and the oxide an electric current is caused to flow across such junction from the gold to the oxide.

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