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PHOTOCONDUCTIVE DEVICE AND METHOD
OF MAKING IT

Vilmos Ervin Burg, Karlsruhe-Baden, Germany,
assignor to Telefunken Gesellschaft für Draht-
lose Telegraphie m. b. H., Berlin, Germany, a
corporation of Germany

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My invention relates to light responsive devices of the photoconductive type, such as selenium, thalofide, and similar cells, and to methods of making such devices.

The object of my invention is to provide photoconductive cells which are of higher power and capable of handling greater loads, which have greater sensitivity, particularly to red rays and which are in general an improvement on such cells heretofore used, and also to provide methods of making such cells.

In accordance with my invention the light sensitive or photoconductive substance is improved by the addition of tellurium or sulfur in proper amounts, or silver may be added by an improved method, and improved electrode material with which the photoconductive substance is in contact is provided.

It is known in the art that selenium or thalofide cells have inherently a certain sensitiveness to red rays which, in fact, is far higher than that of the alkali photo cell, and this property has led to the tendency to replace alkali cells which operate in some cases unsatisfactorily because of their lack of responsiveness to red rays, by selenium or other devices more responsive to red rays.

According to the present invention I have found that by suitable additions the sensitivity to red rays of selenium, thallium compounds and the like in light-responsive devices can be markedly increased by suitable additions, and in accordance with my invention I add to the light responsive substance in these devices, over and above known admixtures, or even without other admixtures, the metal tellurium or compounds, such as tellurides, of the metal tellurium, though in amounts not over 5%. By these additions I produce a light responsive substance particularly suitable for use in the manufacture of high power cells capable of standing a load of 5 watts and even more.

It is also known in the art that silver in small quantities is incorporated in light-sensitive devices such as selenium cells or the like, with the object of causing a more rapid change or transition from the state of equilibrium prevailing in the resistance in unilluminated state to the state resulting from irradiation, in other words, in order to reduce the sluggishness of the cell, but that cells thus made with silver additions exhibit less sensitivity. At the same time it is found that the cells thus manufactured with silver salt incorporation possess also a relatively low power, particularly since it is difficult to obtain cells by the above method adapted to control currents larger than 20 milliamps.

Now, I have discovered that this drawback can be overcome, and in accordance with my invention, in the preparation of the cells I add free sulfur in amounts not over 1%, in which case metallic additions, such as silver, may under certain circumstances be dispensed with. However, additions of metal as well as sulfur may be desirable in some cases, as the metal affects also the power of these sulfured cells in a typical manner, or instead of the sulfur and metals, metallic sulfides could be used for incorporation. It is thus readily possible to build cells capable of handling currents of 50 milliamps and over.

It has been known for a long while that metals especially silver may be added in comparatively slight amounts, say, up to ½% to selenium, for the purpose of diminishing its inertia in action. It is likewise known to use, in lieu of silver or similarly acting metals, the selenides of the metals. However, it has been discovered that by the methods heretofore used it is impossible to insure a uniform distribution of these extremely small additions throughout the entire mass of the selenium. In fact, perfect homogeneity of the mass and thus readily reproducible and constant light responsive substances are unattainable in this manner.

Now according to my invention this drawback is obviated and light responsive substances of particularly high sensitivity and load-carrying capacity are obtained by making the metallic additions in the form of metal salts which are soluble in some suitable solvent, such as water or organic solvents, these solutions being added to the selenium to make a paste or dough. It is in this way an easy matter to uniformly grind together with the selenium even very small quantities of additions in the form of a dilute solution, and to thereupon evaporate to complete dryness with constant stirring the selenium dough or paste. Among the salts preferably used for this purpose are nitrates such as silver nitrate or else nickel chloride, or the metallic intermediates resulting in the Grignard reaction, and the like. Either before or after evaporation to dryness the metal may be reduced or isolated from its compounds by suitable physical treatment, such as heating, or by chemical treatment, such as treatment with suitable gases, solutions, or the like.

In the manufacture of selenium cells, thalofide cells and the like in which the light responsive substance is in contact with electrodes metals must be used for the electrodes which will not undesirably affect the properties of the light-responsive substances owing to and as a consequence of chemical re-actions. The metals mostly

and preferably used in the past are platinum, platinized or platinum plated wires, or alloys of noble metals. In addition a number of commercial or technical alloys have been used for the electrodes, but have caused more or less impairment in the quality of the cell as a result of chemical re-actions.

In accordance with my invention these disadvantages are avoided by making the electrodes especially wires or contact surfaces of tungsten or molybdenum or alloys thereof, which have proved to be highly suitable because between these electrodes and the photoelectric substance of the cell no re-action at all takes place, or else the reaction is of such a nature that the quality of the cell is not at all impaired as a consequence of the re-action. I have furthermore discovered that nickel, cobalt, manganese and chromium or their alloys may be used as electrodes that are advantageous for the same reasons.

Claims:

1. A light-sensitive device comprising selenium containing metallic sulfides.

2. The method of incorporating in selenium a small amount of additive metal which consists in mixing with the selenium a solution of a readily decomposable inorganic compound of the additive

metal, and decomposing said compound to produce said additive metal in finely divided form.

3. The method of incorporating in selenium a small amount of additive metal which consists in mixing with the selenium a solution in an organic solvent of a readily decomposable inorganic compound of the additive metal, and decomposing said compound to produce said additive metal in finely divided form.

4. The method of incorporating in selenium a small amount of additive metal which consists in mixing with the selenium a readily decomposable compound of the additive metal in solution, evaporating the mixture to dryness, and decomposing said compound to produce finely divided additive metal intimately and uniformly distributed throughout the selenium.

5. The method of incorporating in selenium a small amount of additive metal which consists in mixing with the selenium a readily decomposable compound of the additive metal in solution, evaporating the mixture to dryness, and decomposing said compound to produce finely divided additive metal intimately and uniformly distributed throughout the selenium and melting the selenium containing the additive metal.

VILMOS ERVIN BURG.