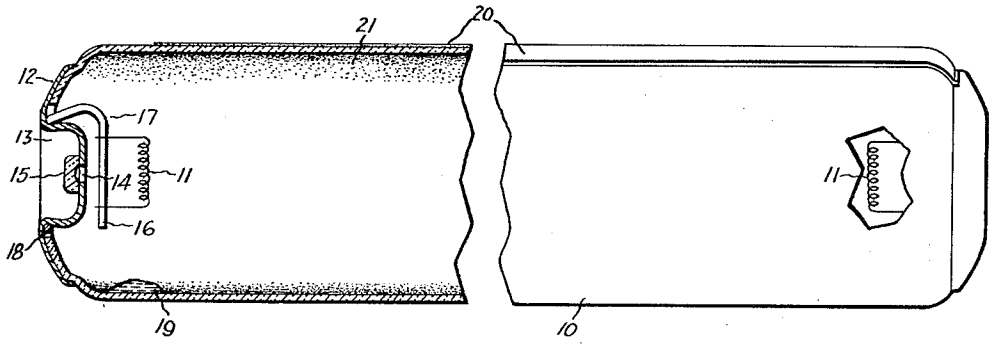
Oct. 4, 1938. W. A. ROBERTS 2,132,273

FLUORESCENT MATERIAL

Filed Oct. 6, 1936



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Patented Oct. 4, 1938 2,132,273

UNITED STATES PATENT OFFICE

2,132,273

FLUORESCENT MATERIAL

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Application October 6, 1936, Serial No. 104,239

13 Claims. (Cl. 134—47)

My invention relates to the composition and manufacture of luminous materials, more particularly fluorescent materials, which become luminous under the action of electric discharges. This case is a continuation-in-part of my application Serial No. 75,782, filed April 22, 1936.

One of the objects of my invention is to provide such materials which are highly efficient in converting impinging radiant energy into fluorescent light. Another object is to obtain a crystal structure in the material which improves its adaptability for application to the glass surface of enclosures of electric discharge devices.

It has been known that calcium tungstate has the property of fluorescing with a blue light. This material has heretofore been prepared by heating together calcium oxide and tungstic oxide in the proper chemical proportions to produce calcium tungstate. To this was also added a small amount of an "exciter" such as lead to increase the efficiency of the material.

According to my invention, an improved blue fluorescing material may be made by heating together calcium oxide or a calcium compound, such as calcium carbonate, which will decompose when heated in the air to give calcium oxide at a temperature lower than that required to form the fluorescent material; tungsten oxide, tungstic acid or some material which decomposes when heated in the air to give tungstic oxide at a temperature lower than that required to form the fluorescent material; and an exciter such as a soluble lead compound, preferably lead acetate.

The proportions of the calcium compound and tungstic oxide are preferably such that from one to ten per cent more calcium oxide is used than is required by the chemical formula $CaWO_4$. This produces a mixture which gives greater fluorescence when subjected to ultra-violet radiations of 2537 angstroms than does the ordinary compound. The lead is added as a soluble salt in an amount such that lead is present in the quantity of 0.5% to 1.5% of the total weight.

Mixtures of twenty-one parts of CaO, seventy-nine parts of WO_3, and about 1.0% of lead, by weight, gave approximately fifteen to twenty per cent more light than $CaWO_4$.

The drawing is a side elevation, partly in section, of a form of lamp in which the above-described materials may be used, the particular lamp illustrated being described and claimed in the U. S. patent application of George E. Inman, Serial No. 75,772, filed April 22, 1936.

Referring to the drawing, the lamp comprises a tubular glass container 10 having a pair of thermionic electrodes 11 at the ends thereof. Each of said electrodes 11 consists of a filament of refractory wire, preferably tungsten, coiled on a mandrel, also preferably of tungsten, a portion of this coil on mandrel (shown as a single line in the drawing) being coiled again into a spiral as shown in the drawing and this spiral portion being covered with an electron emitting material such as barium oxide. The ends of the container 10 are closed by discs 12 of a metal or alloy, such as a chrome-iron alloy, sealed directly to the ends of the container. The discs 12 are of the type described and claimed in U. S. patent application of Harold D. Blake, Serial No. 3,334, filed January 24, 1935, and comprise recesses 13 which increase in diameter and are adapted to be engaged by holders having clip portions which snap into the said recesses. One of the discs 12 has an opening 14 at the center of the recess 13 through which the container 10 is exhausted and filled with a suitable gas or gases, the said opening 14 being subsequently sealed by the residue 15 of the glass exhaust tube. The electrode 11 is attached to the transversely extending end portion 16 of a support wire 17, the other end 18 of which encircles the boss formed at the inside of the disc 12 by the recess 13. The container 10 has a starting gas therein such as argon and a quantity 19 of vaporizable metal, preferably mercury. During the operation of the device the electrically excited mercury vapor emits visible and ultra-violet light. For ease of starting, a strip 20 of conductive material such as a metal powder or graphite is applied to the container 10 and is in contact with one of the discs 12 and extends to a position adjacent the electrode 11 at the opposite end of the container.

The inner surface of the container 10 has applied thereto a coating 21 of the luminescent material described above. The coating 21 may be applied to the surface of the container by means of a binder, or it may be embedded in the glass itself by heating the glass to its softening point or, if the powdered material is fine enough, it will adhere when it is merely dusted into the container. Among the various binders which may be used are glycerin; glycerin and twenty per cent of boric acid; phosphoric acid alone or diluted with acetone or alcohol; potassium silicate; an ester of glycerin with boric acid; castor oil or mineral oil; or an inorganic resin such as that sold under the name of "Stacol" by the Glyco Products Co., Inc., of Brooklyn, N. Y. During the operation of the lamp the ultra-violet rays striking the luminescent material are transformed thereby into visible

light rays which complement and supplement the spectrum of the visible light emitted by the electrically excited gaseous atmosphere. Efficiencies of 22 lumens per watt have been obtained with a lamp of the type described using materials of the type comprising my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A fluorescent material for electric discharge lamps comprising calcium oxide and tungstic oxide, the calcium oxide being in excess of the amount required by the chemical formula $CaWO_4$.

2. A fluorescent material for electric discharge lamps comprising calcium oxide, tungstic oxide and a small quantity of an exciter, the calcium oxide being in excess of the amount required by the chemical formula $CaWO_4$.

3. A fluorescent material for electric discharge lamps comprising calcium oxide, tungstic oxide and a small quantity of lead, the calcium oxide being in excess of the amount required by the chemical formula $CaWO_4$.

4. A fluorescent material for electric discharge lamps comprising calcium oxide and tungstic oxide, the calcium oxide being present in an amount of from one to ten per cent more by weight than is required by the chemical formula $CaWO_4$.

5. A fluorescent material for electric discharge lamps comprising calcium oxide, tungstic oxide and a small quantity of an exciter, the calcium oxide being present in an amount of from one to ten per cent more by weight than is required by the chemical formula $CaWO_4$.

6. A fluorescent material for electric discharge lamps comprising calcium oxide, tungstic oxide and a small quantity of lead, the calcium oxide being present in an amount of from one to ten per cent more by weight than is required by the chemical formula $CaWO_4$.

7. A fluorescent material for electric discharge lamps comprising by weight approximately twenty parts of CaO and eighty parts of WO_3.

8. A fluorescent material for electric discharge lamps comprising by weight approximately twenty parts of CaO, eighty parts of WO_3 and a small quantity of an exciter.

9. A fluorescent material for electric discharge lamps comprising by weight approximately twenty parts of CaO, eighty parts of WO_3 and a small quantity of lead.

10. A fluorescent material for electric discharge lamps comprising by weight approximately twenty parts of CaO, eighty parts of WO_3 and up to two parts of lead.

11. A fluorescent material for electric discharge lamps comprising calcium oxide and tungstic oxide and up to about one and a half per cent by weight of an exciter to increase the luminosity of the material when excited, the calcium oxide being present in an amount of from one to ten per cent more by weight than is required by the chemical formula $CaWO_4$.

12. A fluorescent material for electric discharge lamps comprising calcium oxide and tungstic oxide and up to about one and a half per cent by weight of lead to increase the luminosity of the material when excited, the calcium oxide being present in an amount of from one to ten per cent more by weight than is required by the chemical formula $CaWO_4$.

13. A fluorescent material for electric discharge lamps comprising by weight approximately twenty parts of CaO, eighty parts of WO_3 and about one per cent by weight of lead.

WILLARD A. ROBERTS.