

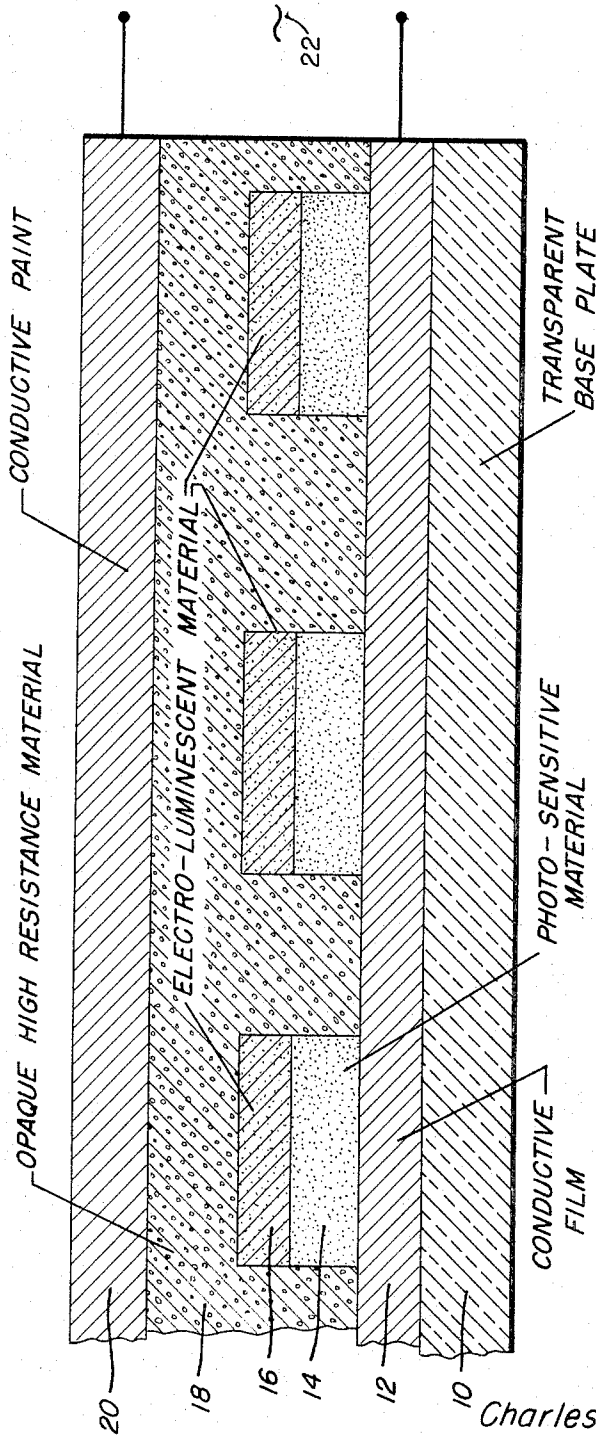
Feb. 6, 1968

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3,368,099

ELECTROLUMINESCENT HALF-TONE IMAGE CELL

Filed Aug. 27, 1965



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ELECTROLUMINESCENT HALF-TONE IMAGE CELL

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Filed Aug. 27, 1965, Ser. No. 483,382

4 Claims. (Cl. 313-108)

ABSTRACT OF THE DISCLOSURE

An electroluminescent device having a high electrical resistance material applied to a composite of an electroluminescent coating attached to a previously exposed and developed photosensitive substrate. Electrically conductive coatings attached to the opposite surfaces of the composite enable an operating potential to be applied causing the electroluminescent material to electroluminesce.

This invention relates to devices incorporating electroluminescent material and more particularly to an improved technique for making an electroluminescent image from a photographic image.

The phenomenon of electroluminescence is now well known, and a variety of devices constructed to provide a support generally of a transparent nature for electrically conductive layers insulated from one another and separated by a layer of electroluminescent material have been proposed. Means must be provided in each of these devices for applying an electric current to the conductive layers to produce a voltage drop or an electric field sufficient to cause luminescence in the electroluminescent material. It is also imperative that at least one of the electrically conductive layers in such devices be composed of a transparent material so that the light emitted by the electroluminescent material when energized may pass out through the transparent conductive layer and the transparent support in order that it may be usefully employed.

Important applications of the phenomenon of electroluminescence include the illumination of instrument dials, panels, plotting boards and the like, particularly suited for many uses aboard ships and aircraft, and in other installations having large numbers of indicators. It has further been proposed to construct image reproducing devices, or electroluminescent signs, which may in a simple form consist essentially of contiguous layers of an electroluminescent material and a photo-conductive material sandwiched between electrodes across which a difference in potential is established to render the device operative. Selective illumination of the photo-conductive material in the latter case, that is the imposition of a light image upon it, causes corresponding selected areas of the electroluminescent layer to emit light thus producing a luminescent image in the latter.

It is the purpose, therefore, of this invention to provide an improved technique of fabricating such electroluminescent signs.

Another object of this invention is to provide a novel method for making an electroluminescent image from a photographic image.

Additionally, it is an object of the present invention to provide a new and improved electroluminescent device wherein means are provided for making an electroluminescent image from a photographic image.

The exact nature of this invention, together with the above and other objects and advantages thereof, is set forth in more technical detail in the following description

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when considered in connection with the accompanying single sheet of drawing and wherein the sole figure illustrates an enlargement in section of an electroluminescent half-tone image cell constructed in accordance with the invention.

Referring now to the drawing, there is shown a light-transmitting support panel 10 which is fabricated of highly transparent material such as glass, or a transparent polymer or plastic material, with the front and back surfaces of the panel in parallel relation and polished to provide smooth optical surfaces. The support plate 10 is provided on its upper surface, in the particular arrangement illustrated in the drawing, with a transparent electrode 12, as for example, an electro-conductive metal oxide coating, such as tin oxide, on which is superimposed a layer of a photosensitive material, such as Kodak KPR. This photosensitive film 14 is then exposed to a light image produced with a positive transparency of a half-tone dot impression of the image desired. The photosensitive material is then developed in an appropriate solvent, trichloroethylene in the case of KPR, and is air-dried only.

The image is then coated with a layer 16 of dry phosphor capable of electroluminescence, which is subsequently wetted with an excess of the developing solvent, thereby forming a slurry of phosphor. This slurry is allowed to air-dry and is then baked in an oven at about 100° C. until it is very dry. Thereafter, the excess phosphor is shaken off, and the surface of the image is wiped and air-blown until phosphor is left only in the parts of the image where the KPR or other photosensitive material remains. The layer 16 may consist of any of the electroluminescent phosphors known to the art, for instance, an electroluminescent zinc sulfide copper-activated phosphor or a zinc sulfide-zinc oxide copper and manganese-activated phosphor.

Backing the layer 16 of electroluminescent material and surrounding the parts of the image which it covers is a layer 18 of opaque, high electrical resistance material, such as barium titanate in a suitable binder, as epoxy or melamine, applied just thick enough to insure rendering the image opaque. After curing this coating, a back counter electrode 20 of silver paint or other suitable conducting material is applied for enabling an operating potential to be applied to the electroluminescent layer whereby it is caused to become luminescent.

In operation, connection of an alternating current source 22 of audio frequency and intermediate voltage, for example, on the order of 100 to 500 volts, depending upon the thickness of the cell layer, to both the transparent tin oxide film 12 and the back silver paint electrode 20 causes the phosphor particles 16 to electroluminesce. Since these particles are located only at points at which there were white dots in the positive image transparency, the luminescing cell appears as a positive image when turned on, and as a plain opaque surface when turned off.

It is obvious that a novel method of and means for producing an electroluminescent image from a photographic image has been provided which will greatly enhance the value of the electroluminescent devices to those skilled in the art. Having thus described the invention, it is to be understood that the foregoing disclosure relates to only a preferred embodiment of the invention including specific materials and that this has been by way of an illustrative example and not in order to limit the invention thereto. The scope of the invention is to be determined by the appended claims which are intended to cover any modifications falling within its true spirit and intent.

What is claimed is:

1. An electroluminescent device comprising:

a transparent base plate,

a transparent conductive film on one side of said base plate,

a plurality of sites on said conductive film formed by exposing a coating thereon of photosensitive material to a light image produced with a positive transparency of a half-tone dot impression and developing the exposed coating in a solvent so as to leave a plurality of sites of photosensitive material only where there were white dots in the positive image transparency,

a layer of electroluminescent material on each of said sites only, wetting the coating with an excess of developing solvent, and baking the coating until very dry,

a coating of an opaque, high resistance material on each of said electroluminescent material-coated sites,

a coating of conductive material backing said opaque material,

and means for providing an alternating current to said conductive films.

2. The electroluminescent device of claim 1 wherein said electroluminescent material is an electroluminescent phosphor selected from the group consisting of luminescent zinc sulfide-copper-activated phosphor, zinc sulfide-zinc oxide-copper-activated phosphor, and zinc sulfide-zinc oxide-manganese-activated phosphor.

3. The electroluminescent device of claim 1 wherein said first electrode is comprised of a tin oxide coating on a transparent base plate,

said second electrode is a silver paint,

and said opaque material is barium titanate.

4. The method of making an electroluminescent image from a photographic image comprising the steps of:

applying a transparent conductive film to one side of a transparent base plate,

coating said transparent film with a photosensitive material,

exposing the photosensitive coating to a light image produced with a positive transparency of a half-tone dot impression of the image desired,

developing the exposed coating of photosensitive material and allowing it to air-dry,

coating only the parts of the image where the photosensitive material remains with a dry electroluminescent material,

wetting the coating with an excess of developing solvent, and baking the coating until very dry,

applying a coating of an opaque, high electrical resistance material thick enough to render the image opaque,

coating the opaque material with a conductive film, whereby upon connection of an alternating current source to the conductive films, the electroluminescent particles will be caused to electroluminesce.

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