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CATHODE RAY TUBE SCREEN PROCESS

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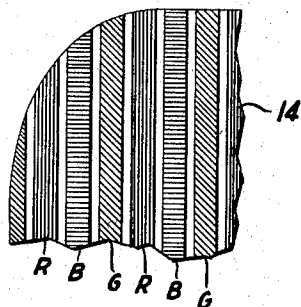


Fig. 1

Fig. 2

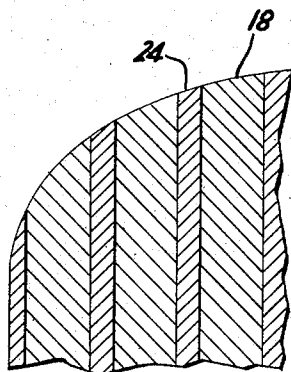
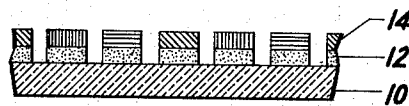
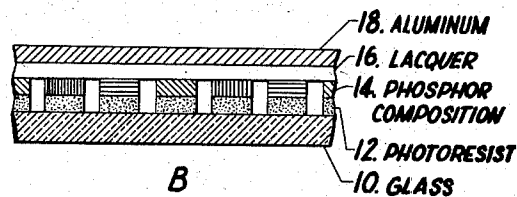


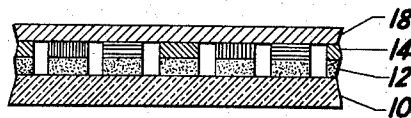
Fig. 3



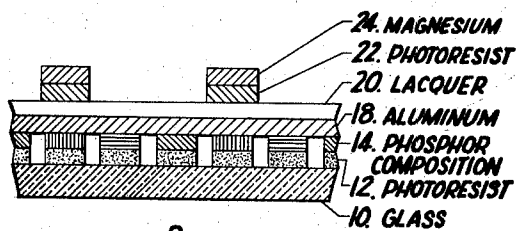
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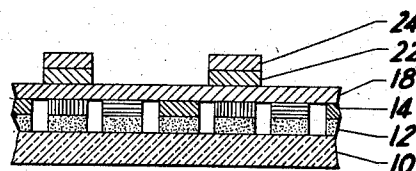
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CATHODE RAY TUBE SCREEN PROCESS

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3 Claims. (Cl. 96—35)

This invention relates to image reproduction devices and more particularly to the preparation of viewing screens for color television picture tubes.

One type of proposed television receiver for reproducing color television images employs an index type picture tube having a screen consisting of a series of parallel lines formed from fluorescent materials. The lines are arranged so that an unmodulated scanning electron beam will excite the fluorescent materials to produce a sequence of red, blue and green fluorescence repeatedly across the screen in a manner well understood in the art.

The fluorescent screen conventionally is provided with a back coating of an electron permeable film of aluminum. This film is deposited on the screen by flashing a pellet of aluminum onto a volatile lacquer coating which had previously been deposited upon the fluorescent materials by a flotation and decanting process. Indexing stripes are subsequently formed on the aluminum film to provide the secondary emissive indexing pulses necessary for the operation of a television receiver employing a picture tube of the type described above.

To provide the indexing stripes for the screen, a nitrocellulose lacquer is first applied to the aluminum film in the same manner as the previously applied lacquer coating. Thereafter, a composition comprising polyvinyl alcohol, ammonium dichromate, ethyl alcohol, and water is deposited on the back lacquer and this composition is exposed to ultra violet light through an appropriate negative to form a pattern of stripes which are positioned over one of the three phosphor color patterns. The polyvinyl alcohol and ammonium dichromate serve as the sensitized photoresist material used in the printing technique while the ethyl alcohol is a foam killing agent in addition to a drying agent. After exposure, a secondary emissive material such as a magnesium oxide and ethyl alcohol slurry is flowed onto the panel. The composition is dried and developed by means of a demineralized water wash. The screen is again dried and subsequently baked in a lehr to provide the secondary emissive indexing stripes consisting of hardened photoresist and adhering magnesium oxide material.

Picture tube screens formed in accordance with the above described process very often result in rejects due to their inability to provide adequate indexing signals. When using such a process, it is difficult to control the homogeneity and uniformity of the secondary emissive composition over the coated areas. Lack of uniformity often results in secondary emissive indexing pulses varying over such a large range of values that the pulse information cannot be adequately used to sense properly the position of the writing electron beam employed in the tube.

Accordingly, an object of the invention is to reduce the aforementioned disadvantages and to provide a

method for forming television cathode ray tube screens which is more economical than previous methods.

A further object is the provision of a method for making a cathode ray tube screen using indexing stripes which reduces the number of tube rejects.

A still further object is the provision of a method for forming indexing stripes on the back surface of a cathode ray tube screen which have uniformity of composition and provide substantially constant secondary emission from each of the indexing stripes under similar energization by an electron beam.

The foregoing objects are achieved in one aspect of the invention by the provision of a method for making a cathode ray tube screen wherein thin, uniform, secondary emissive material indexing lines are deposited on the fluorescent material layer by a vaporization process.

For a better understanding of the invention, reference is made to the following description taken in conjunction with the accompanying drawings in which Figs. 1 through 3 inclusive illustrate the steps involved in the formation of a color television picture tube screen.

In the drawings, a screen surface 10, which may be a clean dry glass face plate of a color picture tube blank, is coated with a radiant energy sensitive material 12, such as the light sensitive substance polyvinyl alcohol, sensitized with ammonium dichromate. This coating, after application, is air dried and exposed to a source of radiant energy such as ultra violet light through a negative having the desired pattern. The illustrated embodiment utilizes a negative with a large number of parallel lines. The exposure time necessary to harden the photoresist to the degree required varies with the light intensity and exposure distance factors. A phosphor slurry 14 consisting of polyvinyl alcohol, ethyl alcohol, water and a phosphor such as zinc ortho silicate, which fluoresces green is next flowed over the exposed photo-sensitive film and dried. The dried surface is then developed by washing with deionized water. The unexposed areas of the photo-sensitive film and the layer of slurry which adheres to those areas are washed away by the water while the exposed areas which have been hardened remain affixed to the panel 10. The layer thus produced is air dried, after which the entire above described process is repeated for each of the remaining color emitting blue and red phosphors, with appropriate offsetting of the screen in relation to the master pattern for each successive color pattern. Zinc sulfide is the commonly used blue fluorescent phosphor while zinc phosphate may be employed as the red fluorescent phosphor. The resulting fluorescent pattern is shown in Figs. 1 and 2A.

A volume of deionized water sufficient to cover the screen thus far produced is next introduced into the cathode ray tube bulb, and a thin coating of nitrocellulose lacquer is subsequently floated on the water. As the water is decanted from the bulb, the lacquer adheres to the glass walls of the tube blank and to the phosphor screen 14 so as to form a lacquer base 16. This lacquer coating is then dried and the inside of the bulb is coated under vacuum with an electron permeable substance such as aluminum by a flashing technique. Since it is desirable to cover only the screen area with the coating of aluminum, the walls of the bulb are cleaned to remove the aluminum film deposited thereon. The screen thus produced is shown in Fig. 2B.

The screened bulb is next baked in a lehr for approximately two hours at a temperature above 400° C. to remove any volatile impurities. During this bake-out operation, the nitrocellulose lacquer layer 16 shown in

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Fig. 2B becomes volatile and is thus removed from the screen. The screen cross-section then appears as shown in Fig. 2C.

The secondary emissive indexing stripes are next provided adjacent the aluminum layer 18 by another printing operation. Accordingly, the above described baking operation is followed by a coating of nitrocellulose lacquer 20, which is applied to the panel in the same manner as the previously applied lacquer 16. Thereafter, a coating of sensitized photoresist 22 having a composition similar to that used to produce coating 12, is deposited over back lacquer 20, and this photoresist 22 is exposed to ultra violet light through an appropriate negative to form a pattern of stripes which are positioned over the phosphor color patterns.

The photo-sensitive material pattern formed in the manner described above is next covered with a thin layer of a metal capable of being treated to possess secondary emissive properties by another flashing technique. In this process, heating electrodes carrying small pellets of the metal such as magnesium are extended into the flared portion of the tube, and the picture tube blank is evacuated to a low pressure of approximately .5 micron. The electrodes are then energized by an electric current, which causes the magnetism to vaporize and internally coat the tube walls, and the tube blank is subsequently returned to atmospheric pressure.

During the magnesium flashing operation, it has been found that the amount of magnesium needed to provide a uniform coating of sufficient thickness is very small. Excellent results have been obtained by flashing a pellet weighing about 25 milligrams. It has been found that if the flashed magnesium layer is less than .003 micron in thickness, there will be insufficient magnesium, when oxidized, to adequately produce the secondary emission necessary to maintain the indexing pulses at useable values. Conversely, if the magnesium coating is above .040 micron, the magnesium layer will not entirely oxidize, which condition again causes poor indexing characteristics.

The screen so far produced is subsequently dried and developed by means of a deionized water rinse, thus leaving a pattern of stripes, one of which is positioned over one of the group of three color phosphor line patterns as shown in Fig. 2D. These lines consist of hardened photoresist 22 and the adhering magnesium coating 24. After drying, the tube blank is baked in an oxidizing atmosphere to produce the magnesium oxide secondary emissive stripes 24, and to remove the volatile lacquer coating 20 to produce the screen shown in Figs. 2E and 3.

Cathode ray tube screens produced in accordance with the method described above provides an inexpensive process for making a cathode ray tube screen having beam indicating means formed as a part of the screen. In addition, the secondary emissive material

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providing the indicating means is uniform in composition and produces constant indexing emission over the screen areas when similarly energized by an electron beam.

While one embodiment of the invention has been shown and described, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the scope of the invention as defined by the appended claims.

What is claimed is:

1. In a process of making a screen for an image reproduction device having a viewing panel, the steps comprising forming a fluorescent material layer on said panel, depositing a sensitized light hardenable composition atop said layer, exposing said composition to light through a pattern negative from the composition coated side of said panel, vaporizing magnesium onto said composition, developing the exposed light hardenable composition and adhering magnesium pattern by removing the unexposed portions of said composition, and subsequently oxidizing said magnesium.

2. In a process of making a screen for an image reproduction device having a viewing panel, the steps comprising forming a fluorescent material layer on said panel, depositing a sensitized light hardenable composition atop said layer, exposing said composition to light through a pattern negative from the composition coated side of said panel, coating said composition with magnesium, developing the exposed light hardenable composition and adhering magnesium pattern by removing the unexposed portions of said composition, and subsequently oxidizing said magnesium.

3. In a process of making a screen for an image reproduction device having a viewing panel, the steps comprising forming a fluorescent material layer on said panel, depositing a sensitized light hardenable composition atop said layer, exposing said composition to light through a pattern negative from the composition coated side of said panel, vaporizing magnesium having a thickness of from .003 micron and .04 micron onto said composition, developing the exposed light hardenable composition and adhering magnesium pattern by removing the unexposed portions of said composition, and subsequently oxidizing said magnesium.

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