United States Patent

Jeffries

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[54] HIGH CONTRAST DISPLAY FOR ELECTRON BEAM SCANNER

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[73] Assignee: **Northrop Corporation,** Beverly Hills, Calif.

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[52] **U.S. Cl.** .....**313/109,** 313/92 R

[51] **Int. Cl.** **H01j 1/70,** H01j 63/02

[58] **Field of Search**.....313/85 S, 69 R, 65 R

[56] **References Cited**

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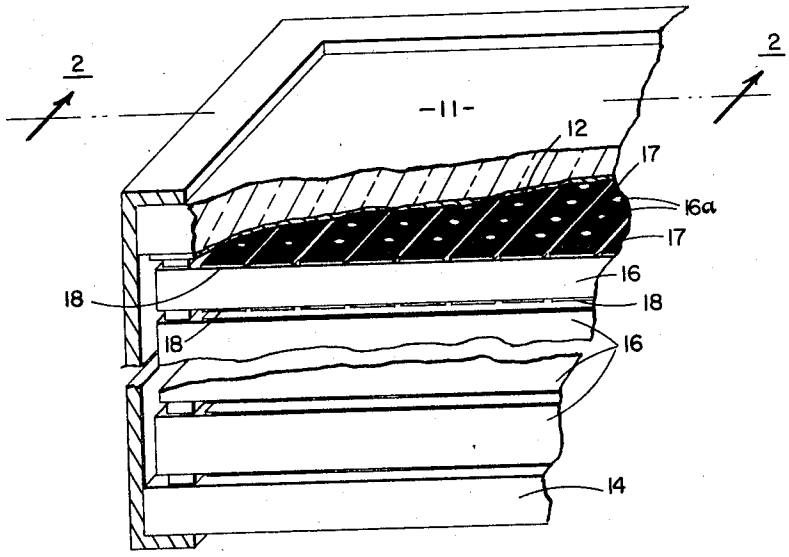
[57] **ABSTRACT**

An electron beam scanner has a broad surfaced target and an area cathode with control electrodes sandwiched therebetween for controlling the electron flow between the cathode and the target. The target comprises a transparent plate member having a phosphorescent coating thereon which emits light through the transparent plate in response to electrons incident thereon, electrons being passed from the cathode to the target through channels formed by alined apertures in the control electrodes. The surface of the control electrode directly opposite the phosphorescent coating on the target is light absorbent such that substantially all of the light passing through the target plate or reflected from the outer surface thereof is absorbed.

4 Claims, 3 Drawing Figures



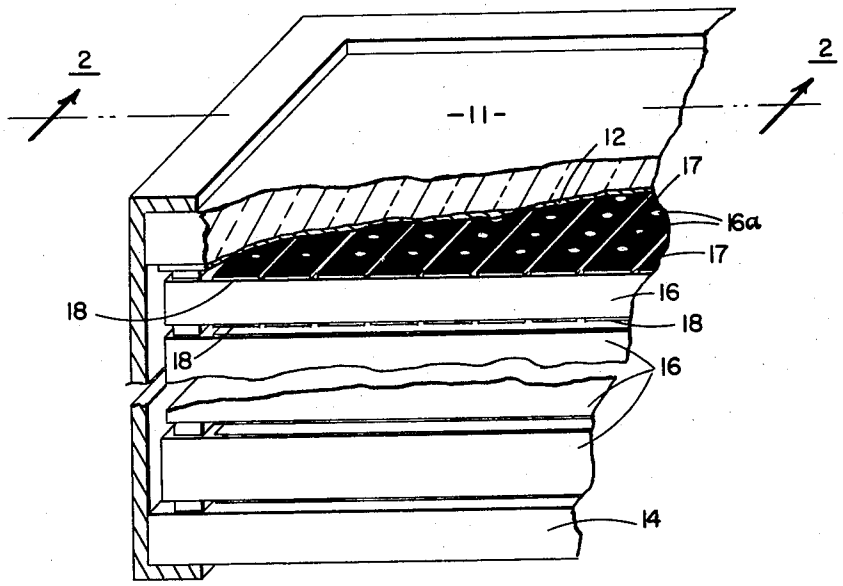


FIG. 1

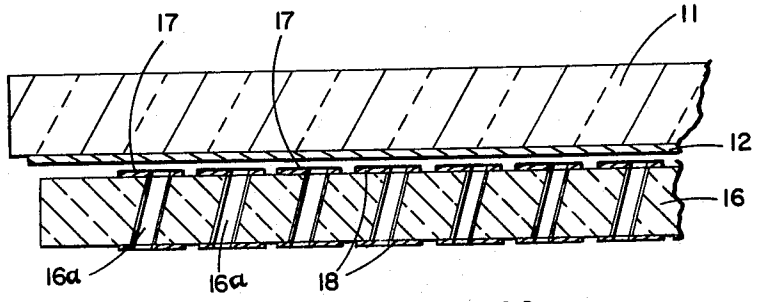


FIG. 2

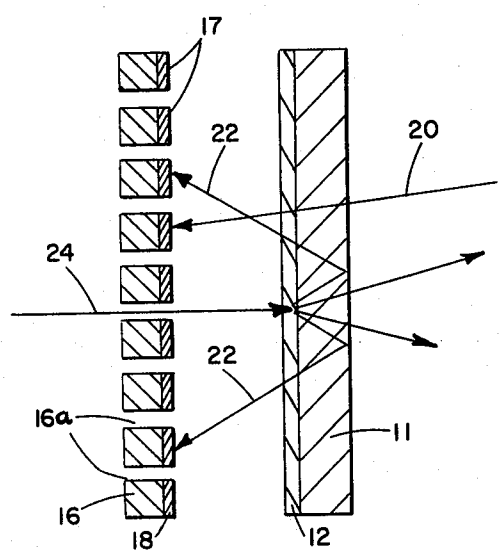


FIG. 3

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HIGH CONTRAST DISPLAY FOR ELECTRON BEAM SCANNER

This invention relates to phosphorescent display targets for electron beam scanners and more particularly to a light absorbing surface for improving the contrast in such displays.

In electron beam optical display devices such as cathode ray tubes utilizing phosphor targets, a significant loss of contrast is encountered due to ambient light being reflected from the phosphor. Most conventional CRT phosphor targets are white or light colored so that a large percentage of ambient light falling on the front of the phosphor is reflected back to the viewer. To alleviate this loss of contrast in conventional cathode ray tubes, a thin film transparent phosphor has been used in some cases, this phosphor having a thin black opaque backing layer deposited thereon. The backing layer thus operates to absorb either any reflected or ambient light incident on the phosphor. The backing layer in this implementation, however, is located between the electron beam and the phosphor, and thus the electrons must pass therethrough which causes a significant amount of energy loss and a reduction of phosphor brightness.

The device of this invention provides means for absorbing reflected and ambient light incident on the light-emitting material without any significant attenuation of the electron beam in view of the fact that the electron beam does not pass through the absorbing medium. The device of this invention is particularly adapted to operate in an electron beam scanning device having an area cathode and a broad surfaced target, in between which are sandwiched a plurality of control electrode plates for controlling the electron beam, the control electrodes having apertures therein forming electron beam channels, such as described in U.S. Pat. No. 3,408,532, issued Oct. 29, 1968, assigned to Northrop Corporation, the Assignee of the present application.

It is therefore the principal object of this invention to enable improved contrast in an optical target display for an electron beam scanner.

Other objects of this invention will become apparent from the following description taken in connection with the accompanying drawings, of which:

FIG. 1 is a perspective view of one embodiment of the device of the invention,

FIG 2 is a cross-sectional view taken along the plane indicated by 2—2 in FIG 1, and

FIG 3 is a schematic view illustrating the operation of the device of the invention.

Briefly described, the device of the invention comprises a light absorbing surface which is positioned in spaced relationship and opposite to the surface of the back portion of a light-emitting phosphor on the target. The phosphor is placed in a thin optically light transmissive layer on the back surface of the transparent target plate. The light absorbing surface is located on the electrodes of a control electrode plate adjacent to the target plate and having apertures therein for channeling electrons to the target surface. Thus, the electrons pass through the apertures in the control plate to the target without being affected by the light absorbing layer. Ambient and reflected light passes through the light transmissive phosphor and is absorbed by the light absorbing surface of the control electrode plate so that it has minimal effect on the target image.

Referring now to FIGS 1 and 2, one embodiment of the device of the invention is illustrated. The details of the electron beam scanning device are illustrated and described only briefly in view of the fact that a complete description thereof is contained in the aforementioned U.S. Pat. No. 3,408,532, which is incorporated herein by reference.

Target plate 11 which may be of a transparent material such as glass, has a phosphorescent coating 12 on the inner surface thereof, this coating being a thin light transmissive film which may be deposited on the surface by techniques such as vacuum evaporation or chemical vapor deposition. A typical such coating would be of zinc sulfide containing an activator such as arsenic. Cathode 14 provides an area source of electrons. Sandwiched between cathode 14 and the target are a plurality of control electrode plates 16 which have apertures 16a formed therein for channeling the flow of electrons between the cathode and the target. Control electrode plates 16 have conductive electrodes 18 formed on the broad surfaces thereof for controlling the scanning of the electron beam in response to digital control signal, as explained fully in the aforementioned patent. Control plate 16*a* has a light absorbing surface 17 covering substantially the entire broad surface area thereof. This end result may be achieved in various manners, such as, for example, black anodizing the control electrodes 18, or where the electrodes are of gold, by depositing gold black by using a poor vacuum in the deposition process, or otherwise coating the electrodes with a light absorbing material.

Referring now to FIG 3, the operation of the device of the invention is illustrated. As can be seen, ambient light indicated by arrow 20 passes through the light transmissive phosphor 12 and is absorbed by the absorptive surface 17. Also, any light reflected by the surface of transparent target plate 11 as indicated by arrows 22, also passes through the light transmissive phosphor and is absorbed by surface 17. The electron beam indicated by arrow 24 passes through the apertures in control plate 16*a* and thus is not affected by the light absorbing surface. In this manner, ambient and reflected light is absorbed behind the light-emitting phosphor so that its effect on the target image is minimized and maximum contrast of this image is obtained.

The device of this invention thus enables high contrast and brightness efficiency in an optical display device such as utilized in an electron beam scanner. Ambient and reflected light is efficiently absorbed, this end result being achieved without attenuating the target electron excitation beam.

I claim:

1. An electron beam scanning device comprising

a gas evacuated sealed casing member,

an electron source mounted within said casing member,

a target member mounted within said casing member opposite said electron source,

said target member being transparent and having a light transmissive coating on one of the broad surfaces thereof for emitting light in response to the impingement of electrons thereon,

a power source connected between said target member and said electron source for providing an electron accelerating potential therebetween,

a plurality of dynode members sandwiched between said electron source and said target member for controlling the flow of electrons therebetween,

said electron source, said target member and said dynode members being alined opposite each other,

said dynode members each having a plurality of conductive coded finger portions which are insulated from each other,

said dynode members further each having a plurality of aperture means formed therein for channeling the flow of electrons between said electron source and said target member,

the dynode member closest to said target member having a broad surface with said finger portion thereon facing directly opposite and substantially parallel to said broad surface of the target member, said last mentioned finger portion being light absorbing so as to absorb light impinging on said target member coating and passing therethrough to said finger portion, and control means for selectively applying an electron accelerating potential to at least one of the finger portions of each of said dynode members and an electron repelling potential to the others of the finger portions of each of said dynode members, whereby said dynode members cause an electron beam from said electron source to said target member to be addressed in response to said control means.

2. The scanning device of claim 1 wherein the finger portions are anodized with a light absorbing coating.

3. The scanning device of claim 1 wherein said finger portions are gold black.

4. The scanning device of claim 1 wherein said coating comprises a thin transparent phosphor film.

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