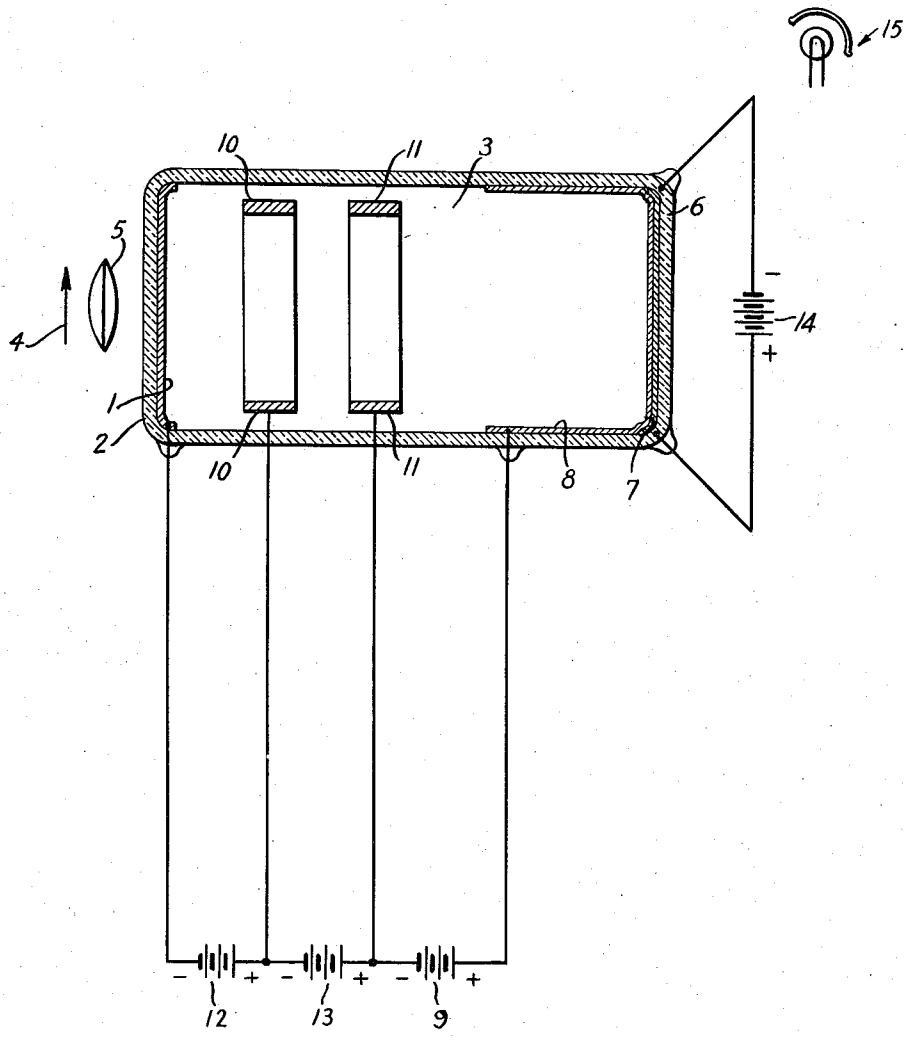
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IMAGE CONVERTER TUBE

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IMAGE CONVERTER TUBE

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2 Claims. (Cl. 313—92)

1

This invention relates to new and useful improvements in image converter tubes and more particularly to screens for such tubes.

One well known use of image converter tubes is to reproduce a picture of a poorly illuminated object on a viewing screen. This is accomplished by focusing whatever light comes from the object onto a photocathode which releases a flood of electrons varying in density in accordance with the light distribution from the object. Accelerating and focusing means are provided within the tube to direct the electrons towards a fluorescent screen where a visible image is produced by the impinging electrons. Usually the density and velocity of the electron flood are low, despite the use of sensitive photocathodes and strong accelerating means, and the image produced on the fluorescent screen is not sufficiently bright.

Various suggestions have been made for overcoming this shortcoming of image converter tubes. According to one, the electrons released from the cathode are multiplied by secondary emission to increase the brightness of the image as, for example, described in British Patent No. 460,579 to Szegho and Lance.

One of the disadvantages of the above is that the tube is unnecessarily complicated as a result of the need for means for producing secondary electrons.

According to the invention these and other disadvantages of image converter tubes have been overcome and the tube which is the subject of this invention is as simple as any image converter tube, yet produces bright clear images of even the most poorly illuminated objects.

This is accomplished by replacing the conventional fluorescent screen with a screen which is cumulatively responsive to electron impingement.

The length of time a fluorescent screen is exposed to electron impingement, except for the initial short excitation period, does not vary its luminous output. However, in the case of a cumulatively responsive screen it is possible to improve the brightness of an image produced thereon simply by lengthening the exposure time.

Such a screen may be formed out of the so-called ionic crystals which when struck by electrons develop a deposit of opaque material. The density of this deposit on any given area of the screen varies directly with the density and velocity of the electrons and grows with impingement time. The opacity of the screen will, therefore, be enhanced the longer it is bombarded. The electrons instead of producing light on the screen produce darkness, tenebrescence. The most satisfactory screens have been made of potassium chloride and are frequently referred to as scotophor screens.

2

The decay time of such a screen may run from hours to days and therefore, it is possible to make a semi-permanent recording of an object. However, if this is not desirable, according to another feature of the invention it is possible to erase an image produced on the screen by applying heat or an electric field to the screen. In this way as soon as the usefulness of one image has ceased, the screen may be wiped clean of it and made ready for another image.

According to a feature of the invention, an image may be produced in the darkness without employing visible light. In this case a special photocathode is used which is sensitive to infrared light used to illuminate the object. Such a photocathode is the so-called caesiated silver surface or other special emitters of great sensitivity. The image may be projected onto a viewing surface or it can be seen directly on the screen of the tube as a black-white pattern. If there is insufficient ambient light to illuminate the screen, light from an auxiliary source may be used for this purpose.

The invention will now be described in greater detail, reference being had to the accompanying drawing which shows, by way of example, one embodiment of the invention.

A semi-transparent photocathode 1 is mounted on end wall 2 of image converter tube 3. Light from an object 4 may be focused by lens 5 through end wall 2 upon photocathode 1. End wall 6 of tube 3 carries a screen 7 which is cumulatively responsive to electron impingement. As the exposure time of screen 7 to the electrons emitted from photocathode 1 is increased, the brightness of the image on the screen improves. The screen may be formed of ionic crystals such as potassium chloride. An aluminum film 8 may cover the screen and also part of the side walls of tube 3. Film 8 receives positive potential from source 9 and functions as an accelerating electrode for the photoelectrons and as a collecting anode for slow-moving electrons.

Two pairs of electrodes 10 and 11, to which positive potentials are applied from sources 12, 13, are situated between photocathode 1 and screen 7, and accelerate and focus the photoelectrons emitted from cathode 1; instead of electrostatic means electromagnetic coils may be used for focusing.

In certain cases the decay time of the screen

may be too long and therefore, it is advisable to use heating means such as a source of current 14 which is connected by suitable leads to end wall 6, to erase the image on the screen. Wall 6 may be formed of conductive glass or have a conductive layer supporting the screen to which is connected source 14. However, other ways of erasing screen 7 may be employed.

A poorly illuminated object 4 may be illuminated by infra-red light and projected by lens 5 onto a semi-transparent photocathode 1. The electrons emitted from photocathode 1 are distributed according to the distribution of the light values of object 4. An electric field which is set up on rings 10 and 11 and on aluminum film 8, accelerates the electrons so that they travel through tube 3 towards end wall 6 where they produce an image of gradually increasing clarity. Naturally there will come a point in the exposure time of the screen to the electrons when increasing definition and clearness give way to obscurity because the screen becomes completely covered by the opaque deposits. Therefore, after the image is sufficiently clear on the screen the electron impingement should be discontinued, as by masking or turning the photocathode away from the object.

Since the image produced on screen 7 is a

dark trace and needs illumination from an external source, such a source of light, generally indicated at 15, may be provided and positioned to shine on end wall 6 and illuminate screen 7.

What is claimed is:

1. In an image converter tube for producing still images of objects, a photocathode exposed to light rays emanating from the object, a screen comprising ionic crystals aligned with said photocathode and cumulatively responsive to the impingement of electrons therefrom, means for accelerating and focusing the electrons onto the screen and means connected to said screen for erasing an image from the screen.

2. The device according to claim 1, and in which the ionic crystals comprise potassium chloride.

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