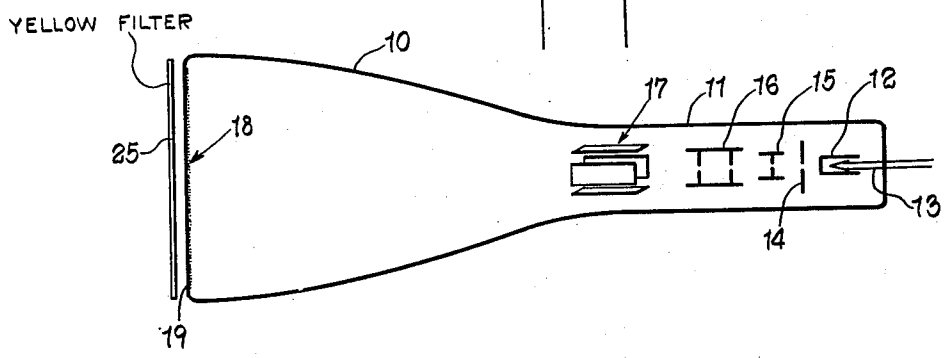
April 20, 1954 E. R. JERVIS 2,676,113

COMPOSITE SCOTOPHOR-PHOSPHOR CATHODE-RAY TUBE SCREEN

Filed April 25, 1952

Fig. 1.



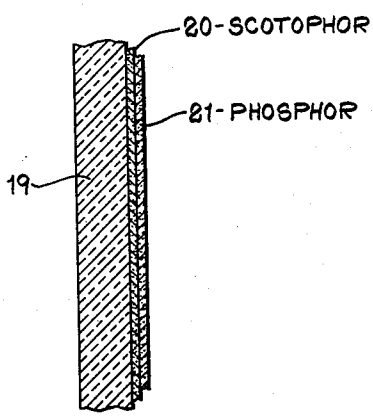


Fig. 2.

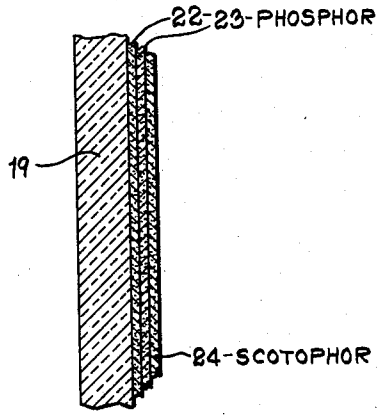


Fig. 3.

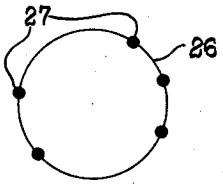


Fig. 4.

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UNITED STATES PATENT OFFICE

2,676,113

COMPOSITE SCOTOPHOR-PHOSPHOR CATHODE-RAY TUBE SCREEN

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3 Claims. (Cl. 117—33.5)

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This invention relates to cathode ray tubes and more particularly it relates to the luminescent screens for such tubes.

A principal object of the invention relates to a cathode ray tube having a luminescent screen which is a composite of scotophor and phosphor material.

A feature of the invention relates to a cathode ray tube having a screen which can be used to produce selectively either a bright trace or dark trace without materially affecting the efficiency of either trace as a light source.

Another feature relates to a cathode ray tube having a screen which can produce a scotophoric trace in response to slowly varying signals, and can also produce a fluorescent trace in response to transients or rapidly varying signals.

A further feature relates to a cathode ray tube which is specially designed to produce easily readable luminescent displays under varying conditions of external illumination, and under varying conditions of signal persistence.

A still further feature relates to the novel organization, arrangement and relative location of parts which cooperate to provide an improved oscillograph tube of the cathode ray type.

Further features and advantages not particularly enumerated will be apparent after a consideration of the following detailed description and the appended claims.

In the drawing,

Fig. 1 is a longitudinal plan view of a cathode ray tube according to the invention.

Fig. 2 is a magnified cross-section of part of the luminescent screen of Fig. 1.

Fig. 3 is a magnified view similar to that of Fig. 2, showing a modification of the screen structure.

Fig. 4 shows a typical composite trace obtainable with the screen of Figs. 1, 2 and 3.

Referring to Fig. 1, there is shown in schematic form a cathode ray tube having the usual enclosing bulb or envelope 10. Suitably mounted within the neck portion 11 of the tube is an electron emitting cathode 12 with its heater element 13 for developing a beam of electrons; a beam intensity control electrode or grid 14 to which the signals are applied; first accelerating anode 15; second accelerating anode 16; and the usual beam deflecting elements or plates 17 for causing the focused electron beam to execute any desired trace or scanning pattern over screen 18. The various electrodes above-described are connected in the well known manner to suitable potentials for causing the electrons to be

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focused into a small spot on the screen 18, and the electric signals to be translated into corresponding luminescent displays on screen 18 are applied to the grid 14.

In accordance with the invention the screen 18 is a composite of scotophor material and of fluorescent phosphor material. The term scotophor is well known in the art and is used herein to designate crystals of the alkali metal halides, or halogen salts of the alkali metals. Thus, as shown in enlarged sectional detail in Fig. 2, the flattened glass end wall 19 of tube 10 has a coating 20 of scotophor crystals preferably, although not necessarily, potassium chloride. Superposed on the scotophor layer 20 is a layer 21 of fluorescent phosphor material such, for example, as a suitable metal activated zinc sulfide or a mixture of zinc sulfide and any other well known phosphor. For example, layer 21 may be a metal activated zinc-beryllium silicate or any other well known fluorescent phosphor having the property of high intensity light translation and rapid light decay.

The scotophor layer 20 may be first applied by evaporating the scotophor material on to wall 19, and then the phosphor 21 can be sprayed over the scotophor layer. If the fluoroescent phosphor 21 is of the low persistence kind, such as is well known in the art and referred to as a P–1 type phosphor, it can be mixed in powdered form with the scotophor material also in powdered form, both contained in a suitable liquid vehicle which can be readily evaporated. This composite scotophor-phosphor material can be sprayed or otherwise coated on to the wall 19, and then heated to drive off the solvents or liquid vehicles, thus firmly attaching the composite material to wall 19. Preferably the composite scotophor-phosphor material is applied by spraying since that enables the particles of both scotophor and phosphor to be uniformly mixed and evenly distributed on the wall 19.

In some cases it is highly desirable to be able to use a phosphor of long persistence characteristic. Thus, as shown in Fig. 3, the phosphor instead of being constituted of a single layer may comprise the base layer 22 and the overlayer 23. Either one or both layers 22, 23 may be a phosphor of the type well known in the art and designated as a P–7 slow decay phosphor. The scotophor layer 24 can then be applied over the phosphor layer 23. In the embodiment of Fig. 3 it is preferred to apply the various layers by spraying rather than as a suspension.

A screen prepared in any of the manners de-

scribed above is capable of use under a wide variety of ambient external illuminations. For example, if the screen is to be viewed in bright daylight, a suitable yellow filter 25 (Fig. 1) can be interposed in front of the screen 18 and the dark trace which is produced as a result of the cathode ray beam scanning the scotophor layer, will produce a dark trace record with excellent contrast. On the other hand, if the screen 18 is to be viewed in darkness or semi-darkness, the fluorescent trace on the fluorescent phosphor layer stands out because of its brightness efficiency.

Furthermore, the tube is also useful where the signals applied to grid 14 vary greatly in duration. For example, in direction finding or radar systems using a scanning antenna, the signal response picked up by the antenna may be only momentary. Thus, as shown in Fig. 4, the trace 26 may represent the scanning pattern of the antenna such as is used in pulse-position plan indicators in radar systems. Under such use when an object is struck by the radar beam, the pip represented by the points 27 is of greater brightness than the remainder of the trace. In other words, the trace 26 can represent slowly varying signals applied to the grid 14, and the spots 27 will then represent rapidly varying or momentary conditions or transients applied to the grid 14. Therefore, by darkening the screen either by means of an interposed yellow filter 25 or by shielding the screen 18 from external light, the fast bright trace alone will be seen. However, by turning on external illumination, the slow decay dark trace produced in the scotophor material will reveal the slow movement or signal variation and will keep on the screen a record of the fast or non-repeating transients.

Various changes and modifications may be made in the disclosed embodiments without departing from the spirit and the scope of the invention.

What is claimed is:

1. A display screen for cathode ray tubes and the like comprising a mixture of scotophor material and fluorescent phosphor material, and a light transparent support to which said mixture is applied.

2. A display screen for cathode ray tubes and the like comprising a mixture of alkali metal halide crystals and a fluorophor, and a transparent backing to which said mixture is attached.

3. The method of making a display screen for cathode ray tubes and the like which comprises mixing a powdered scotophor with a powdered fluorophor in a liquid vehicle, spraying the mixture on to a support, and then heating the support to evaporate said liquid vehicle.

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