

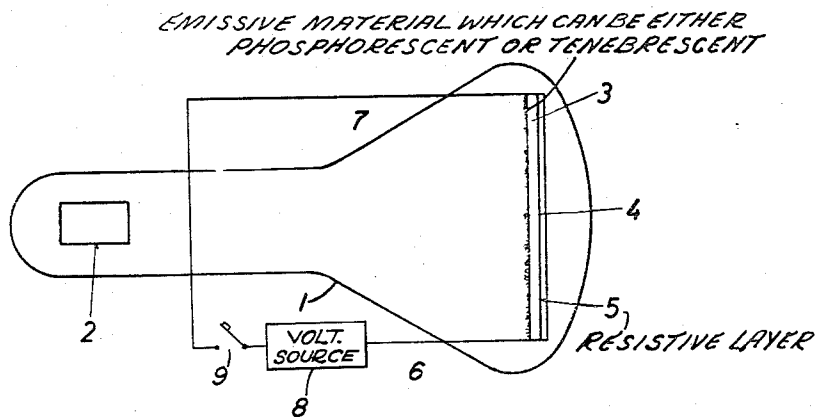
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STORAGE TUBE

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1

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## STORAGE TUBE

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4 Claims. (Cl. 313—92)

For the purpose of storing electric signals there are used cathode ray tubes which, depending on their respective field of application, are equipped with different kinds of fluorescent screens.

Image screens are known, consisting of phosphorescent luminous substances and in which the portions that are hit by an electron beam have an afterglow effect which last for some time after the excitation. The reason for this resides in the fact that crystal electrons, which are excited by the electron beam, are lifted into impurities of the crystal, where they remain until being accidentally released from the impurity by an energy quantum of the heat radiation and, under the emission of light, are forced to return to the original energy level.

The viewing of a phosphorescent image is only possible in the dark, because its light intensity is very small.

Furthermore there are known image screens, substantially consisting of an alkali-halide which, upon being bombarded by an electron beam, produces a tenebrescence phenomena, in the the portions hit by the electron beam change their colour towards dark. Accordingly, in this case the image will only become visible when the screen is being illuminated from the outside. The time of storage of these types of image screens is longer than with the phosphorescent types of image screens. By means of a new energy supply, e.g. by radiation with a visible light, or by heating the crystalline layer, the change in colour may be eliminated again.

The article appearing in the "Zeitschrift für Naturforschung," 1955, pages 620-630 by P. Dobrinski and H. Hinrichs describes the luminescence of potassium chloride activated with silver. It is discussed that NaCl-Ag crystals radiated by X-rays display the phenomenon of phosphorescence.

For many applications it is advantageous to provide a storage tube, with a screen image which is visible in the light as well as in the dark. Such screen properties are very useful e.g. for wide-range displays in the direction-finding- and radar-technique. For example, when an observer only uses the radar equipment as an auxiliary means, and when the direct viewing or inspection of the surroundings during night-time requires a permanent or continuous dark-adaptation of the human eye, then every kind of illumination of the tube will act disturbingly. On the other hand, during the day-time a bright image screen is by all means desirable. A tube combining both of these possibilities would render a re-adaptation of the eye, which takes several minutes, or a superfluous time-wasting and circumstantial exchange of the tube.

The present invention provides a storage tube featuring both of these advantageous properties. The storage tube according to the invention is provided with a screen on which the image recorded by an electron beam contrasts with the screen within a bright surrounding by being amplified on a bright background, while appearing in the dark as a phosphorescent image. Accordingly, the storage screen is not only featured by a tenebrescence phe-

2

nomena, but also, by phosphorescent phenomena. This possibility results from the discovery that an alkali-halide activated with particular metals exhibit fluorescents when heated. As a luminous substance there are suitable alkali-halides, such as potassium chloride, which may be activated by traces of foreign substances, such as thallium, titanium, manganese, copper, uranium, lead or silver. Further it has proved to be very advantageous, to artificially increase the number of lattice defects, serving as the traps for the secondary electrons. This may be accomplished e.g. by an evaporation of the luminous layer in a micro-crystalline form, or else by way of ion bombardment.

Instead of activating the luminous substance there may also be employed a double-layer screen, which is composed of corresponding substances. Thereby one of these layers displays tenebrescence, and the other one phosphorescence. A controlling of the desired screen property may be accomplished by a corresponding arrangement of the screens and by varying the accelerating voltage.

In the following the invention will be described in particular with reference to an exemplified embodiment shown in the accompanying drawing:

In this drawing the storage tube is shown in a sectional representation. The envelope is denoted by 1, and the gun system (or beam generating system) is denoted by 2. Reference numeral 3 designates a mica disk carrying the screen substance 4. On the side of the mica disk not facing the cathode there is arranged a transparent resistive layer or coating 5, e.g. of  $\text{SnO}_2$ , and which, through the contacts 6 and 7, is connected with a source of voltage 8 controlled by switch 9, thus effecting a heating of the mica disk by a passage of current. On the side of the mica disk facing the cathode there is evaporated the screen substance, which is activated with a corresponding foreign substance. Upon being hit by the electron beam, the screen, within a bright surrounding, will display a change in colour toward bluish-violet. If the screen is not illuminated from the outside then, upon heating of the mica disk, there will appear the same image as a luminous phosphorescent picture.

While we have described above the principles of our invention in connection with specific apparatus, it is to be clearly understood that this description is made only by way of example and not as a limitation to the scope of our invention as set forth in the objects thereof and in the accompanying claims.

What is claimed is:

1. In a cathode ray tube comprising a screen and a source of energy, a layer of energy responsive material mounted on said screen which exhibits the properties of phosphorescence in a first state and tenebrescence in a second state, and means for heating said layer to selectively change the state of said material to respond to said source of energy whereby said screen will either phosphoresce or tenebresce.

2. In a cathode ray tube the combination as in claim 1 wherein said layer consists of a mixture of an alkali halide and a material from a group consisting of thallium, titanium, manganese, copper, uranium, lead or silver.

3. A cathode ray tube comprising a screen, a source of energy, a layer of energy responsive material which exhibits the properties of phosphorescence in a first state and tenebrescence in a second state applied to one surface of said screen, a resistive layer applied to the other surface of said screen, means for applying a source of voltage to said resistive layer so as to cause said energy responsive material to change from said second state to said first state.

4. A cathode ray tube comprising a mica disc, a

3

source of energy, a layer of energy responsive material comprising a mixture of alkali halide and a material from a group consisting of thallium, titanium, manganese, copper, uranium, lead or silver, which exhibits the properties of phosphorescence in a first state and tenebrescence in a second state applied to one surface of said mica disc, a layer of tin oxide applied to the other surface of said mica disc, and means for applying a source of voltage to

4

said tin oxide so as to cause said energy responsive material to change from said second state to said first state.

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5