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TELEVISION PROJECTION TUBE

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Fig. 3

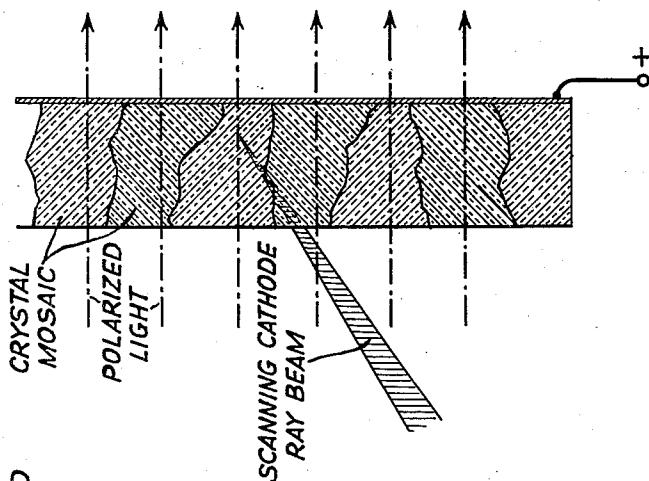


Fig. 2

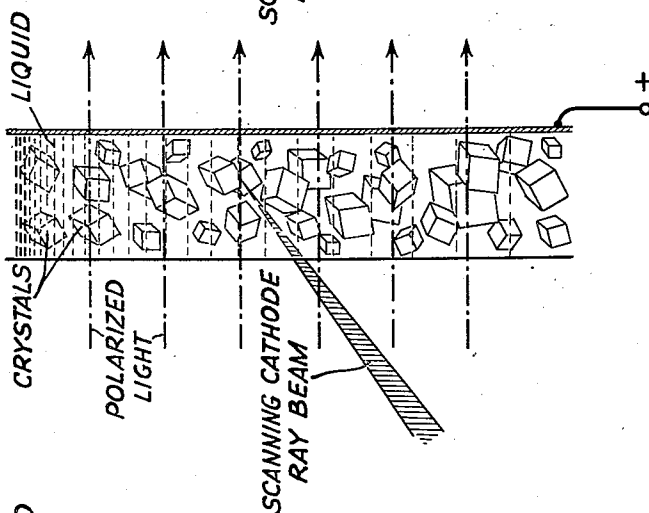
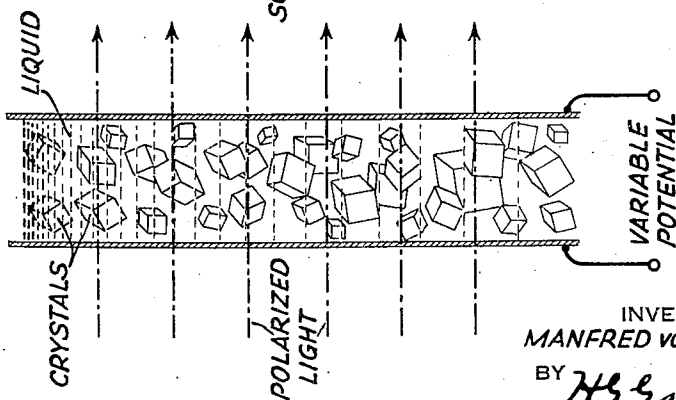


Fig. 1



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TELEVISION PROJECTION TUBE

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GermanyApplication December 5, 1939, Serial No. 307,573
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5 Claims. (Cl. 178—7.5)

This invention relates to television projection tubes of the cathode ray type wherein image storage is utilized and is an improvement on the system and device shown and described in patent application Serial No. 292,017 filed August 26, 1939.

The above mentioned application shows and describes methods and arrangements serving for storing on a crystal screen or electrode, in a distribution according to the image, field or charge intensities of the order of 10^5 volts and for periodically extinguishing the charge distributions for the reproduction of images in movement. Furthermore, the application reveals arrangements to render visible these distributions of the field or charge intensities, namely by controlling the intensity of powerful light beams.

The present invention deals primarily with the second part of the entire device disclosed in the aforementioned application, namely with the improved arrangements serving for rendering visible the distribution of the field or charge intensities as produced in accordance with the television image.

Figs. 1 and 2 are diagrams showing the action of prior art screens on polarized light.

Fig. 3 is a cross section view of applicant's screen.

Experiments which have been carried out with Seignette salt plates showed that the electro-optical effect referred to in the application is distinctly formed in the direction of the electrical field. This condition could be ascertained after the cut-out crystal plane was chosen at right angle to the crystallo-graphic axis and furthermore after the layers have been applied directly to the surface of the crystal.

In the case where field potentials of the order of 4000 volts are employed the luminous intensity is still so low when Seignette salt is used that a practical and commercially satisfactory device cannot be readily constructed.

A substantially more favorable condition is provided if in accordance with the subject matter of this invention the crystal screen is formed by sulphide of zinc or zinc blende crystals, or by a corresponding single-crystal layer. With this type of crystal the effect in the direction of the field is thirty times higher than in the case of the Seignette salt. Furthermore there exists the very important advantage from an electrical point of view namely that the dielectric constant of blende is lower by approximately one order than the corresponding constant of Seignette salt. Finally the complete zero inertia of the ac-

tual effect should be mentioned which is explained by the direct action of the field upon the electron spheres. Also the more favorable insulating property of this type crystal is of particular advantage to the establishment and storage of the distribution of the field intensity.

It should be remarked that the natural fluorescence of the blende crystals creates no disturbance of the image control proposed in the aforesaid application; this fluorescence may even have a beneficial effect since it contributes to the effect and color of the projection light. Eventually, however, crystals may be employed which create but little fluorescent effect.

While the Seignette salt plates are available in sizes of 10×10 cm., since sulphide disks of this size are commercially not as yet obtainable. A searching into the possibilities of producing large crystals synthetically has shown that the principal difficulties do not exist since in the flues of zinc ovens, zinc sulphide crystals up to 25 cm. in diameter were found. The difficulty in the synthetic production lies in the fact that the melted zinc sulphide mass must be maintained for a long time at the high conversion temperature of 1050° . However, there is hope that the time required for the forming of the crystals can be shortened by added substances and that eventually through the use of sulphur dioxide and by cooling the surface of the vessel, large size crystals may be quickly formed. As compared with the Seignette salt, the zinc sulphide plates or crystals have the important advantage that they will withstand the heating necessarily required in the production of vacuum tubes.

In order to obtain the luminous intensity of the image points with field intensities that are as low as possible the following orientation of the crystal layer will be chosen: The plane of the crystal screen cut-out shall be parallel to a side of the cube of the crystal for instance parallel to the plane (001).

It has been ascertained that for a certain crystal layer the (linear) Kerr constant $k=0.00024$. This constant furnishes a brightness potential of the order of 10,000 volts which can be easily obtained in accordance with the methods disclosed in the above mentioned application.

The quantitative analysis shows that the intensity of the luminosity is independent of the thickness of the crystal layer. The minimum thickness of the crystal layer is limited by the probability of electric breakdown and the maximum thicknesses of the crystal is limited in view of the increase of the natural double diffraction.

As already proposed in connection with the aforementioned application, the latter effect may be compensated by means of a condenser plate having a corresponding thickness and area so that complete darkness exists in the absence of an applied electrical field. In order that this darkening action exists throughout the entire surface of the crystal screen, care must be exercised in order to insure that the crystal screen will not be mechanically deformed because of the heat generated during the cutting process or during surface polishing process. The same care must be exercised during the heating processes which are associated with the manufacture of the electron ray tube. The grinding process and polishing process can be avoided where natural split faces of the crystal are utilized.

In view of the fact that when polarization filters are used with the said crystals, 50 to 60% of the light will be absorbed, and since rather considerable intensities of light are used, it is furthermore proposed to insert between the source of light and the first polarizing filter a special glass plate of large surface which absorbs the heat rays, or to insert a liquid heat absorbing screen or to cool the polarization filter, or filters.

In cases where a reflecting crystal layer is used, it may be desirable to interpose between the conducting surface layer of the crystal plate and the reflecting plane a further medium which through its optical properties so varies the components or plane of the polarized light that during the return of the light beam no compensation of the effect takes place but instead an increase of the effect occurs. This auxiliary medium may, for example, be in the form of an optical micro screen for producing a 90° rotation in the plane of polarization of the light.

The production of large crystal screens from zinc sulphide for the control of light beams is not absolutely necessary since it is possible to construct large screens in the fashion of a mosaic of a multiplicity of small crystals or plates. In the construction of such screens, joints should be avoided which are wider than 10% of the diameter of the image point or picture element in order to avoid disturbances or distortion of the image. The individual crystals in the latter case would have to be suitably cemented onto the carrier plate. Slight differences in the thicknesses of the individual crystal plates of which the mosaic is constructed cause no disturbances or distortion of the image since as already pointed out, the brightness depends solely on the applied potential.

It is obvious that aside from zinc blende other optically clear crystals may be considered for producing the crystal screen according to the invention. As it has been pointed out, the superiority of the zinc sulphide crystal over the Seignette salt crystal it is not the magnitude of

the piezoelectric effect which plays the decisive role but solely the magnitude of the electro-optical effect in the direction of the field lines resulting from the superposition of the double diffraction effect and the effect of rotation of the plane of polarization.

I claim:

1. A television receiving tube of the image projection type comprising a screen, an electron gun structure for generating a beam of electrons for scanning the screen, means for projecting a source of polarized light on the screen, said screen comprising a thin plate of crystalline sulphide of zinc with the crystal plane parallel to the plane of the screen and with the joints between the individual crystals being less than ten percent of the size of a picture element.

2. A television receiving tube of the image projection type comprising an image producing screen, an electron gun structure for generating a beam of electrons adapted for systematically scanning said screen, means for projecting a source of polarized light on the screen, said screen comprising a mosaic of thin crystalline sulphide zinc elements, the joints between the individual elements being less than 10% of the size of a picture element, whereby the screen may modulate the polarized light projected therethrough in accordance with the intensity of the scanning beam of electrons.

3. A television receiving tube of the image projection type comprising a screen, an electron gun structure for generating a beam of electrons for scanning the screen, said beam of electrons being adapted to be modulated in intensity in accordance with received picture signals, means for projecting polarized light on the screen, said screen comprising a thin plate of crystalline sulphide of zinc material with the crystal plane of the material parallel to the plane of the screen and with the joints between the individual crystals being less than ten percent of the size of a picture element, whereby the polarized light projected through the screen may be modulated in accordance with the intensity of the scanning beam of electrons.

4. A polarized light modulating screen for a receiving tube comprising a thin plate of crystalline sulphide of zinc material with the crystal plane of the material positioned parallel to the plane of the screen and with the joints between the individual crystals being less than ten percent of the size of a picture element.

5. A polarized light modulating screen for a television receiving tube comprising a mosaic of thin crystalline sulphide zinc elements, the joints between the individual elements being less than ten percent of the size of a picture element.

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