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STORAGE PROJECTION TUBE

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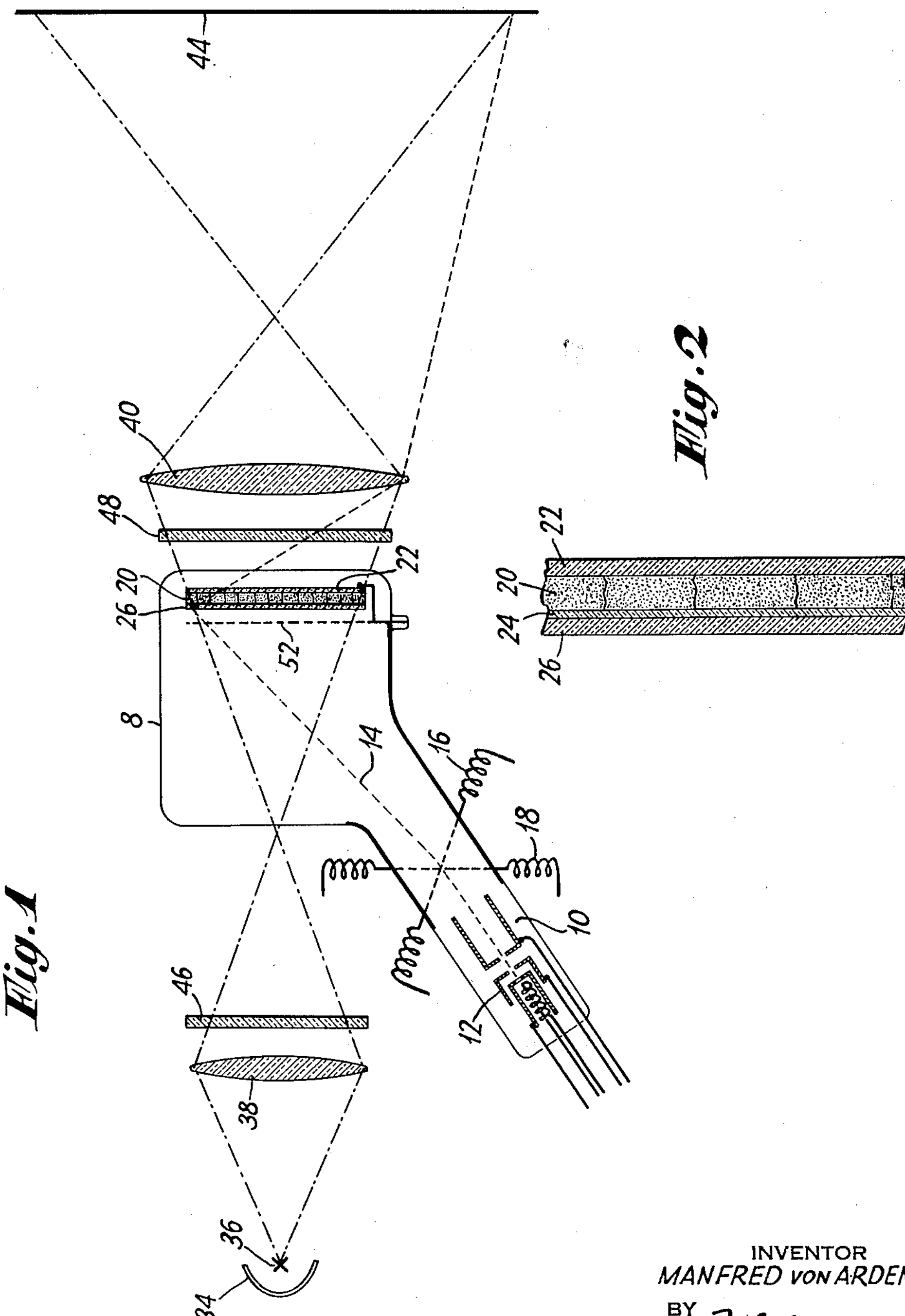

INVENTOR
MANFRED VON ARDENNE
BY H. G. Grover
ATTORNEY

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STORAGE PROJECTION TUBE

Manfred von Ardenne, Berlin, Germany

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2 Claims. (Cl. 178—7.5)

This invention relates to an improvement in television receiving tubes of the cathode ray type wherein a projected image may be produced. Examples of such tubes are shown and described in my patent applications Serial #292,017 filed August 16, 1939, and Serial #307,573, filed Dec. 5, 1939.

In these applications, and particularly in the first named application, cathode ray tubes have been disclosed in which, by the aid of polarized light, charge distributions are rendered visible upon (piezo-electric) crystal screens or surfaces. In research work done with different types of crystals and crystal sections (as disclosed in the application Serial #307,573) it has been shown that the doubling of the electro-optic effect theoretically is to be expected. Furthermore, in an arrangement discussed in application Serial #292,017, a reflecting (mirroring) crystal layer may be conveniently used in practice. It has been ascertained that with potentials of an order of magnitude of 5000 volts extremely strong or bright images have been produced, sufficient to carry into practice arrangements of the invention with moderately elaborate (circuit) means. However, in connection with the said practical experiments, a certain disadvantage and difficulty was found to exist in the arrangements previously disclosed which is to be obviated by the invention disclosed herein.

It has been found that the secondary emission properties which are present when the crystal type is fixed, and when the crystal surface is directly struck by electrons, is extremely undesirable. In the case of zinc blende (sphalerite) in particular it has been found that even with higher potentials (say, above 5000 volts) a stronger secondary emission is present, with the result that the charging of the crystal surface required for the creation of light control necessitates the use of extraordinarily high voltage electron beams. Accordingly, it is the object of the present application to obviate the use of high voltage beams, and it has been found to be essentially more advantageous to coat or film the crystal screen, upon the face thereof turned towards the scanning electron beam, with a very tenuous skin or layer of optical clearness. The secondary electron emissive characteristic of this film or skin may be adapted to the requirements in electrical respect. It is then feasible to choose and make the crystal screen only on the basis of the optimum size or value of its electro-optic effect, regardless of charging and storing conditions, while, inversely, the electronic circuit of the receiving tube can be chosen so as to possess optimum qualities. The improvements obtainable by separating the two conditions according to the present invention, as may be inferred from what precedes, result primarily in a reduction of the anode or accelerating potential for the scanning cathode ray beam, and thus in an appreciable saving in circuit means.

The present invention may be best understood by referring to the drawing, wherein:

Figure 1 represents the present invention as applied to a television receiving tube of the projection type, and

Figure 2 shows a detailed enlargement of the crystal plate.

In the drawing, and particularly in Figure 1 thereof, is shown a cathode ray tube 8 in which is positioned a gun structure 10 for producing a narrow focused beam of electrons. The intensity of the beam of electrons is determined by the potential of the control electrode 12. Also positioned in the tube is a crystal plate which comprises a support plate 22, a layer of crystals 20, and a layer or film of transparent material 26 which has a predetermined secondary electron emissive characteristic. Positioned in front of the crystal plate is an electron accelerating screen 52 for producing rapid acceleration of the electrons which constitute the beam in the vicinity of the crystal plate. The cathode ray beam 14 which is generated by the gun structure 10 is caused to be deflected over the crystal plate by means of the horizontal and vertical deflecting means 16 and 18 respectively.

A source of light 36 is provided, and the light which originates from the source is directed toward the receiving tube by means of the reflector 34. The light is passed through a lens 38 and a polarizing screen 46 before being projected upon the crystal plate 20. Positioned on the other side of the receiving tube is a still further polarizing screen 48 and lens system 40, in order to focus the produced optical image upon a receiving screen 44 in an anlarged manner.

As described in the above mentioned application, the amount of light which is permitted to pass through the crystal plate is determined by the charge which the various elements of the crystal plate have assumed in accordance with the intensity of the scanning cathode ray beam, and the light rays as so modulated are finally projected upon the screen 44 where the enlarged and intensified television image is reproduced.

The crystal plate is shown in detail in Figure 2 and as stated above, includes a support 22 upon which is positioned a layer of crystals 20 which may be prepared and arranged in the manner suggested in application Serial No. 307,573, referred to above. The layer 26 which is preferably light transparent and which has a predetermined secondary emissive characteristic, is attached to the layer of crystals 20 by means of cement or some other adhesion material 24. The thickness of the material 24 should be maintained as thin as possible yet sufficiently thick to ensure close contact between the layer or film 26 and the crystal layer 20.

The layer or film 26 which is applied upon the anterior face of the crystal plate, for electrical and optical reasons, is so applied that there exists optical contact between the surface of the layer and the crystal layer 20. If necessary, such contact may be obtained by means of a clear transparent substance 24 which will be stable in vacuum, such as, for instance, a waterglass. The layer 26 must possess high insulating qualities and may consist of a glass or vitreous layer. Alternatively, mica platelets or scales of similarly clear transparent substances may be used. The thickness of the film or layer 26 should be maintained as thin as possible, and it is only necessary that its thickness be sufficient to exceed the depth to which the scanning cathode ray beam penetrates the layer. Excessive thicknesses of the layer should be avoided, for, on the one hand, this would tend to enlarge the smallest possible picture unit diameter, and on the other hand, the electro-optically active field intensity would be diminished. The thickness of the layer 26 should therefore be determined in accordance with the intensity of the scanning cathode ray beam which is to be used in the tube.

When the film or layer 26 is made, for instance, from standard glass stock, the secondary emissive characteristics increase gradually with increase in beam accelerating potential until a value of unity is reached, when the accelerating potential is between 3000 and 5000 volts. Since a secondary emission ratio of greater than unity is desired, and preferably since it is desirable to operate the beam at such potential as to produce maximum secondary emission, secondary anode accelerating potentials of the order of from 8000 to 15,000 volts may be necessary, depending upon whether the light is to be transmitted through the crystal once, or whether a reflection arrangement is to be used and the light is transmitted through the crystal twice, as suggested in Figure 12 of application Serial #292,017.

In order to produce tubes with any degree of uniformity, it is necessary that the secondary emissive properties of the film or layer 26 be maintained as uniform as possible, and in order to maintain such uniformity, great care must be exercised in initially preparing the surface of the layer of crystals 20 and also in determining the thickness of the cementing substance 24, as well as the thickness of the layer 26.

From the above it may be seen that a new and improved television receiving tube of the projection type has been developed, and that through the use of such a tube very enlarged and intense television images may be produced.

Various alterations and modifications may be made in the present invention without departing from the spirit and scope thereof, and it is desired that any and all such modifications be considered within the purview of the present invention except as limited by the hereinafter appended claims.

I claim:

1. A television receiving system comprising a cathode ray tube having means therein for generating a beam of electrons, a target area, means for deflecting the beam of electrons to cause the same to scan the target area, said target area comprising a transparent support base, a layer of crystals of substantially uniform thickness positioned on said base, and a translucent film of insulating material positioned upon the crystal layer, said film of material having a predetermined uniform secondary electron emissive characteristic whereby charge conditions are produced on the target area as a result of the scanning operation, means for directing polarized light upon the target area, and means including a polarizing screen for focusing the polarized light transmitted through the target area upon an image screen whereby an image may be produced upon the image screen in accordance with the rotation of the plane of polarization of the crystal layer as a result of modulations of the scanning cathode ray beam.

2. A television system comprising a cathode ray tube, a target area in said tube, means including a gun structure for producing a focused beam of electrons and for directing the same against said target area, means for deflecting the cathode ray beam in mutually perpendicular directions to scan the target area, said target area comprising a translucent conducting support base, a crystal layer of zinc blende positioned upon the support base, said crystal layer having a variable plane of polarization in accordance with the electrostatic potential impressed thereon, a film of insulating material attached to the crystal layer, said film having a predetermined uniform secondary electron emissive characteristic of a ratio greater than the unity whereby charge conditions are produced on the target area as a result of the scanning operation, means for directing polarized light upon the target area, and means including a polarizing screen for focusing the light transmitted through said target area upon an image screen whereby an optical image may be produced on the image screen in accordance with the rotation of the plane of polarization of the crystal layer as a result of modulations of the scanning cathode ray beam.

MANFRED VON ARDENNE.