July 3, 1956 H. G. LUBSZYNSKI ET AL 2,753,483

TELEVISION TRANSMISSION TUBES

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FIG. 1.

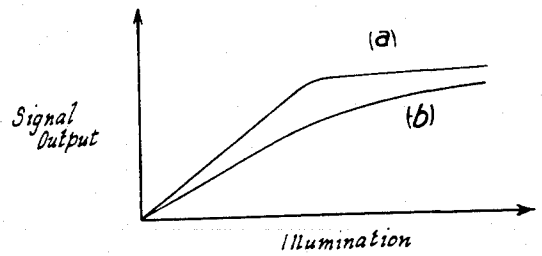


FIG. 2.

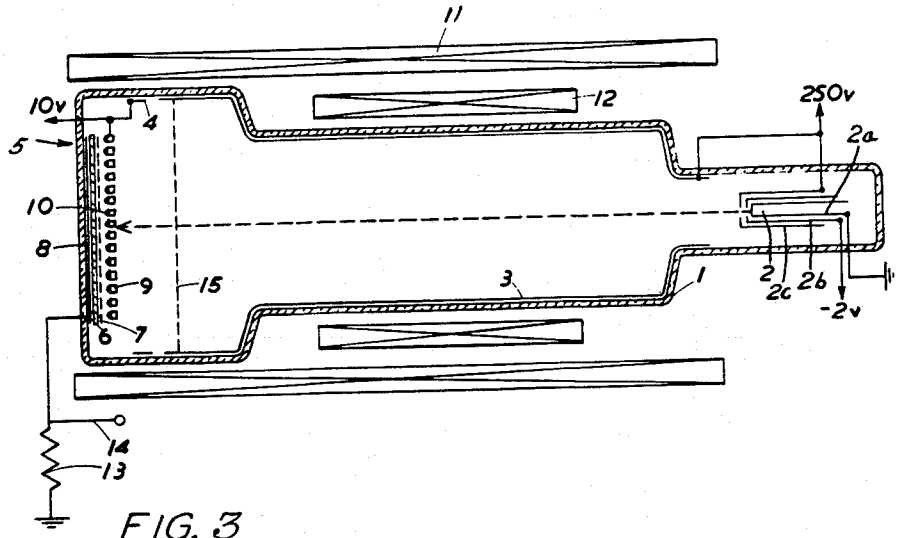
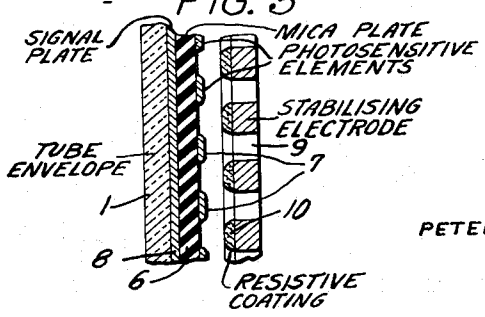


FIG. 3



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TELEVISION TRANSMISSION TUBES

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2 Claims. (Cl. 315—11)

This invention relates to television or like pick-up tubes of the kind adapted to operate with cathode potential stabilisation.

A television pick-up tube of this kind comprises a target, elemental areas of which are capable of acquiring different potentials when an electron or light image is projected on the target, and means for producing a beam of electrons which can be caused to scan said target, the tube being so arranged that on operation, the beam is caused to approach the target with a low velocity whereby on scanning the target the latter is periodically restored to a datum potential corresponding substantially to the potential of the source of the electrons which form the beam. In British patent specification No. 657,666 and U. S. A. patent specification No. 2,507,958, there is described a tube of this kind in which an electrode, which is pervious to electrons, is provided at the scanned side of the target. In operation of the tube, this electrode is maintained at a potential which is a few volts positive with reference to said source of the beam electrons, and when maintained at such a potential it is capable of preventing elemental areas of the target from being charged to such high potentials, due to intense illumination (by the light or electron image), that the beam of electrons on scanning said target would be liable to release one or more secondary electrons for each incident electron in the scanning beam. If this occurs the beam will not restore the elemental areas to said datum potential and the charge on the areas may increase with a consequent risk of the tube becoming unstable in its operation. The electrode referred to therefore acts as a stabilising electrode and as such it will be referred to hereinafter and in the claims. However, when a stabilisation electrode is provided, although increased stability is obtained, the characteristic relating the signal output of the tube to the illumination of the target tends to be of the form shown at (*a*) in Figure 1, the signal output above a value corresponding to the potential applied to the stabilising electrode (as represented by the horizontal portion of the characteristic) remaining substantially constant for increasing illumination of the target. This effect is undesirable since it represents a loss of detail in the bright parts of the scene being televised.

The object of the present invention is to mitigate this disadvantage.

According to the present invention there is provided a television or like pick-up tube of the kind adapted to operate with cathode potential stabilisation, and including a charge storage target, means for generating a beam of electrons for scanning said target, and a stabilising electrode at the scanned side of and spaced from the target, said electrode comprising a conductive open-mesh-screen of low electrical resistance provided at least on the side facing said target with a conductive coating of relatively high electrical resistance.

On operation of the tube, with appropriate positive potential applied to the conductive structure of the electrode, the action of the resistive coating is to depress locally the potential at the surface of the stabilising electrode opposite illuminated elements, due to the collection of electrons by the said coating from the target and the consequent current flow to the conductive structure. This effect counteracts the above mentioned undesirable effect and tends to cause the signal output-illumination characteristic to approach the horizontally asymptotically.

In order that the said invention may be clearly understood and readily carried into effect, the same will now be more fully described with reference to the accompanying drawings.

Figure 1 illustrates characteristic curves explanatory of the invention, the curve (*a*) having been already referred to,

Figure 2 illustrates apparatus embodying a television pick-up tube according to one example of the invention, and

Figure 3 is a sectional view of a fragment of the end of the tube showing in greater detail the construction of the target thereof.

Referring to the drawing, the apparatus illustrated in Figure 2 comprises a television pick-up tube of the kind which is adapted to operate with cathode potential stabilisation and comprises an evacuated glass envelope **1** in which is provided in known manner an electron gun **2**, wall anode **3**, decelerating electrode **4**, and target **5**. The gun comprises a cathode **2***a*, control electrode **2***b*, and anode **2***c* of conventional construction. The target **5** comprises a mica sheet **6** provided on the side facing the gun **2** with a mosaic screen in the form of a multiplicity of discrete photosensitive element **7**, for example of antimony sensitised with caesium, while the other side of the mica sheet has applied thereto a transparent conductive film **8** serving as the signal plate of the tube. The target **5** is made by first applying the conductive film **8** on one side of the mica sheet **6**, mounting the sheet **6**, with the film deposited thereon, in position before the end wall of the tube, and subsequently providing the mosaic screen on the other side of the mica sheet **6**, which side now faces the gun end of the tube. In front of the mosaic screen **7** and parallel thereto is disposed a stabilising electrode comprising a fine-pitch conductive open-mesh-screen shown diagrammatically at **9** having applied to the sides of its filaments facing the mosaic screen **7** a slightly conductive resistive coating **10** formed of a leaky dielectric material such for example as a coating of slightly conductive glass. The envelope **1** is enclosed in known manner by an axial focussing solenoid **11**, and the apparatus also comprises deflecting coils diagrammatically indicated at **12** for deflecting the electron beam from the gun **2** in mutually perpendicular directions at line and frame frequency respectively. A load resistance **13** is connected to the signal plate, the signal output of the device being obtainable from across the resistance **13** by means of the lead **14**.

To operate the apparatus potentials such as shown in the drawing are applied to the various electrodes of the tube. The mesh **9** is shown as having a potential of 10 volts applied to it, but this potential may be varied somewhat, say between 10 and 14 volts. The potential applied to the decelerating electrode may also vary in dependence upon the tube construction and may be between 5 and 20 volts. As shown in the drawing the electrode **4** is maintained at the same potential as the mesh **9**. A light image of the scene to be televised is projected through the end wall of the tube, the signal plate **8** and the mica sheet **6** and is focussed on the mosaic

screen **7**. It releases photo-electrons from the elements of the latter in numbers dependent upon the brightness of elemental areas of the light image and so charges the elements positively, the majority of the photo-electrons being collected by the stabilising electrode **9**, **10**. The stabilising electrode tends to prevent the elements of the mosaic screen **7** from charging to a more positive potential than that at which it is itself maintained. This potential is predetermined so that the electron beam from the gun **2** cannot release secondary electrons from the mosaic screen **7** in such numbers as to prevent the screen from being stabilised at the potential of the cathode **2***a* of the gun. Moreover, the photo-electrons from the elements of the mosaic screen are mostly collected by areas of the coating **10** opposite the respective elements and flow through the coating to the conductive mesh **9** by which they are dispersed. This electron current depresses locally the potential at the surface of the coating **10** facing the mosaic screen, the amount by which the potential is depressed at a particular area of the coating **10** tending to increase the more highly illuminated is the respective elemental area of the screen **7**. This means that in comparison with the case represented by Figure 1 (*a*) assuming that the same potential is applied to the stabilising mesh, the stabilising mesh will fail to saturate the photo-electron current released from the mosaic elements when said elements are at a lower potential and the signal output will thereafter tend to approach asymptotically to its maximum level as indicated by the characteristic curve (*b*) in Figure 1. The maximum signal output in this case is lower than in the case represented by Figure 1 (*a*) but this can be compensated for, if desired, by increasing somewhat the potential applied to the stabilising electrode.

A mesh **15** may, if desired, be disposed as shown with its plane transverse to the axis of the tube near the target end of the wall anode **3**, for the purpose of inhibiting the passage of positive ions from the gun **2** to the target **5**, the mesh **15** being connected within the envelope **1** to the wall anode **3** so that it is maintained at wall anode potential.

The surface of the coating **10** facing the mosaic screen **7** forms a capacitance with the metal surface of the mesh **9** and it is necessary that the time constant of this capacitance and the resistance of the coating should not be longer than a few times the period in which a complete scanning traversal is executed by the beam from the gun **1**, so as to avoid lag in the effect of the stabilising electrode **9**, **10**. Moreover, the resistivity of the coating **10** should be such that the potential drop across the coating is of the order of a few volts. For example, if the scanning period of the apparatus is $\frac{1}{25}$ second, and the aforesaid time constant is chosen to be $\frac{1}{10}$ second, then for a mesh having an area of 15.4 cm.^{2} and a 50 per cent shadow ratio, the material for the coating **10** may for example have a specific inductive capacity of about 5, a resistivity of about 2.5×10^{11} ohm. cm. and a thickness of about $\frac{1}{10,000}$ cm.

What we claim is:

1. An image pick-up tube of the kind adapted to operate with cathode potential stabilisation, including a charge storage target, means for generating a beam of electrons for scanning said target, and a stabilising electrode extended before and spaced from the scanned side of said target for collecting electrons released from said target, said electrode comprising a conductive open-mesh-screen of low electrical resistance having a conductive layer of relatively high electrical resistance on the side nearer said target.

2. Television transmitting apparatus embodying a pick-up tube comprising a charge storage target, and means including a source of electrons for producing a low-velocity electron-beam, circuit connections for scanning said beam over said target to stabilise said target approximately at the potential of said electron source, a stabilising mesh electrode in said tube extended before and spaced from the scanned side of the target for collecting electrons released from the target, and means for polarising said electrode at a potential predetermined to limit the potential to which the target may charge and prevent an increase in potential when the target is scanned due to the release of secondary electrons therefrom, said electrode comprising an open-mesh-screen of low electrical resistance having a layer of conductive material of relatively high electrical resistance on the side nearer said target.

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