

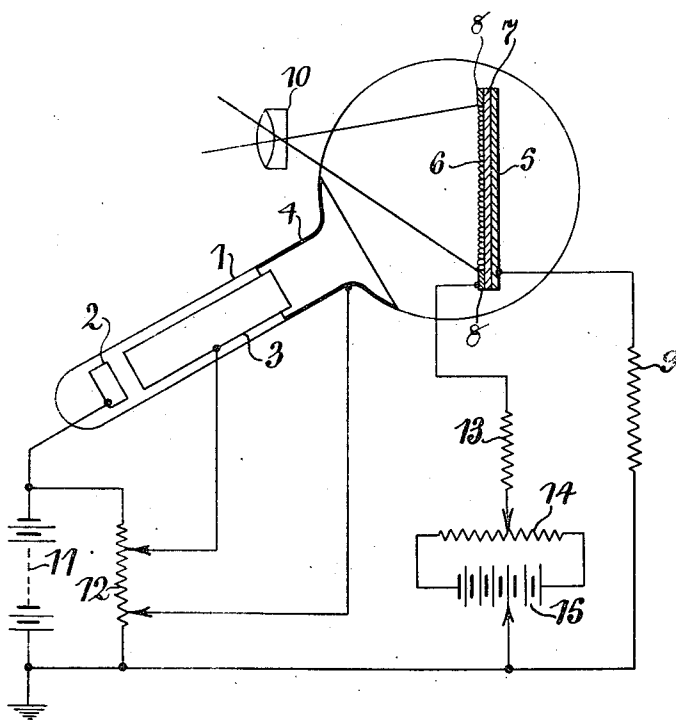
Jan. 2, 1940.

J. D. McGEE ET AL

2,185,601

ELECTRONIC IMAGE INDICATING DEVICE

Filed June 5, 1936



INVENTORS
JAMES DWYER MCGEE
GEORGE STANLEY PERCIVAL FREEMAN
WILLIAM STEWART BROWN
BY- *H. S. Brown*
ATTORNEY

UNITED STATES PATENT OFFICE

2,185,601

ELECTRONIC IMAGE INDICATING
DEVICE

James Dwyer McGee, George Stanley Percival
Freeman, and William Stewart Brown, London,
England, assignors to Electric & Musical In-
dustries Limited, Middlesex, England

Application June 5, 1936, Serial No. 83,642
In Great Britain June 6, 1935

11 Claims. (Cl. 178—7.2)

The present invention relates to iconoscopes and like devices. A tube of the type known by the trade name "Iconoscope" is a cathode ray tube having a mosaic screen composed of a multiplicity of conducting photo-electrically sensitive elements insulated from one another and from a common signal plate. An image to be transmitted is formed upon the photo-electrically sensitive elements and these elements are periodically scanned by a cathode ray to bring them to a datum potential.

The present invention is also concerned with other forms of cathode ray tube employing a mosaic screen or the equivalent thereof. For example the elements of the mosaic screen need not be photo-electrically sensitive in which case an electrostatic image is formed thereon, for example as described in English Specification No. 442,666. The mosaic screen in this case may be in the form of a sheet of mica or other material of high resistance in directions parallel to the plane thereof.

It is an object of the present invention to provide new or improved devices of the so-called "Iconoscope" or like type; a further object is to provide circuit arrangements for utilising devices according to the invention.

The present invention accordingly provides an electronic image transmitting tube comprising a mosaic screen and a cathode ray gun for furnishing a narrow beam of electrons which can be caused to scan said screen, wherein said mosaic screen is provided, on the scanned side thereof, with a border of conducting material. When a tube according to the invention is employed in a television transmitter, the use of masks at the receiver for shielding the edge of the picture may be avoided, or the centering of the picture with respect to such a mask may be made less critical.

The invention further provides a cathode ray tube according to the preceding paragraph, wherein said mosaic screen comprises a multiplicity of conducting elements insulated from one another and from a signal plate, the capacity of the conducting border to the signal plate being much greater than the capacity of any of said elements to the signal plate. The conducting elements may be photo-electrically sensitised upon the scanned side thereof. A sheet of insulating material such as mica may be provided for insulating the border and conducting elements from the signal plate, and the border may be constituted by a coating of a metallic paint such as liquid silver.

The invention also provides a circuit arrange-

ment comprising a cathode ray tube according to the preceding paragraph, wherein means are provided for giving the border a biasing potential relative to the signal plate; the magnitude of the biasing potential is preferably made adjustable, and the border may be connected to a point in a source of potential through a resistance.

The invention will be further described, by way of example, with reference to the accompanying drawing, which shows diagrammatically a circuit arrangement according to the invention, embodying an electronic image transmitting tube constructed in accordance with the invention.

Referring to the drawing, the cathode ray image transmitting tube comprises an evacuated envelope 1 containing a cathode 2, an electron gun comprising a first anode 3 and a second anode 4, and a mosaic screen comprising a signal plate 5 having associated with it a plurality of mutually insulated photo-electric elements 6; the latter are insulated from the signal plate, and in the arrangement shown are formed on the front surface of a sheet 7 of mica which is backed by the signal plate 5.

The mosaic elements 6 do not extend to the region opposite the edge of the signal plate 5, and a border 8 of conducting material is arranged around the mosaic elements, the border being opposite to the parts of the signal plate which are not covered by the mosaic, and having a relatively large capacity to the signal plate. The border is preferably of substantially uniform width, and extends completely round the edge of the mosaic screen.

The border 8 is preferably formed of a material which is not appreciably photo-electric, and the material known as liquid silver is found to be suitable; liquid silver is a suspension of colloidal gold and colloidal palladium in a medium, such as lavender oil, which readily vapourises on the application of heat. Liquid silver may be applied to a part to be coated in the same way as a paint, the part being then baked to remove the dispersive medium. Any other suitable conducting material may, if desired, be employed to form the border.

Another way in which the border can be formed is as follows: In one known method of constructing a mosaic screen, a mica sheet has formed upon it a large number of small discrete areas of metallic silver, these areas are oxidised and the oxidised areas are brought into contact with metallic caesium, for example in the form of a vapour, to form a plurality of photo-electric ele-

ments. The border can be formed by treating the edges of the silvered mica sheet so as to leave a border of unoxidised silver, and for this purpose the edges can be covered during oxidation and exposure of the sheet to caesium by means of a suitable mask, or the whole of the sheet can be treated to form photo-electric elements, the elements at the edges being then exposed in vacuo to an intense beam of radiation or of electrons so as to remove the oxygen and caesium from the edges, leaving an unoxidised silver border.

The mask employed in one of the methods discussed above may be in the form of a sheet of insulating material having a rectangular aperture therein, and this apertured sheet may be hinged to the edge of the mica sheet which is to be formed into a mosaic screen. Alternatively, the signal plate and the silvered mica sheet constituting the mosaic screen may be held together in manufacture by a frame having flaps formed thereon, the flaps being arranged to cover the edges of the silvered mica sheet during oxidation and activation by caesium, and being hingedly mounted so that they can be swung away to expose a border of unoxidised silver.

When a tube of the kind described is employed in transmitting a picture, the signal plate 5 is earthed through a resistance 9, hereinafter referred to as a signal resistance; the border will be assumed, at this stage of the description, to be unconnected. An optical image of the object of which an image is to be transmitted is projected upon the mosaic screen by means of lens system 10. The cathode 2 is maintained at a suitable negative potential relative to earth by means of battery 11, and the anodes 3 and 4 are connected to points at suitable positive potentials, relative to the cathode, by potential divider 12 shunted across battery 11. Any known or suitable means (not shown) are provided for causing the cathode ray from the electron gun to scan both the border 8 and the mosaic elements 6, and the operation is believed to be as follows:

As the beam moves across the mosaic screen, it causes secondary emission from the mosaic elements, the potential of each element in turn becoming rapidly more positive, due to loss of secondary electrons, until it reaches a potential at which the number of secondary electrons lost is equal to the number of primary electrons received. The secondary emission is initially greatest from mosaic elements which have been exposed to parts of the picture to be transmitted which are completely black, since these elements have lost substantially no photoelectrons, and accordingly have a negative potential relatively to elements which have been exposed to brighter parts of the picture. Each element has a small capacity to the signal plate, and a change in the potential of the element causes a pulse of current to flow in the signal resistance, this pulse having a maximum amplitude in the positive sense for black parts of the picture.

In the interval between successive scans, the potential of each element tends to fall due to the receipt of secondary electrons from neighboring elements. However, during the interval, the element is also losing photo-electrons to an extent determined by the intensity with which it is illuminated, the loss of photo-electrons causing the potential of the element to increase. The change in potential of the element, and hence the potential reached by the time it is next

scanned, is accordingly dependent on the intensity of illumination.

When, however, the beam reaches the border, it scans a conductive surface having a relatively large capacity to the signal plate; the border accordingly does not become positive so rapidly as the mosaic elements, and secondary electrons are thus emitted in greater numbers. The pulse of current set up in the signal resistance when scanning the border is thus usually found not to correspond exactly to black level in the picture signals, but to have in general, an amplitude greater than the pulses corresponding to picture black, being, in fact, in the opposite or blacker-than-black sense relative to the picture signals.

Now when the scanning beam strikes the border, on account of the relatively large loss of secondary electrons which takes place, the border is left at a positive potential relative to the signal plate, and it may accordingly collect stray electrons during the scanning of the mosaic. The signals generated in the signal resistance by these stray electrons are in the opposite sense to the picture signals developed in scanning the mosaic. The collection of stray electrons by the border thus tends to reduce the picture signal amplitude.

This reduction of amplitude may be substantially avoided by ensuring that the signals due to the scanning of the border have an amplitude substantially equal to that of signals corresponding to black parts of the picture. For this purpose, the border is connected through a resistance 13 of a value high compared to that of the signal resistance to an adjustable point in a source of potential constituted by a potential divider resistance 14 in parallel with a battery 15, the latter having its mid-point earthed; the border is connected to a suitable point in the potential divider, and with such an arrangement, the static potential of the border may be made positive or negative relative to earth, as desired.

The rate at which the border loses secondary electrons is adjusted by varying its static potential until an adjustment is achieved such that the signals produced by scanning the border correspond in amplitude to signals representing picture black. In this condition, when the beam is moving over the border, the latter receives as many primary electrons as it emits secondaries, and reverse-phase signals due to the arrival at the border of stray electrons are found to be negligible.

Although the invention has been described with particular reference to electronic image transmitting tubes in which the beam scans a mosaic screen of photo-electric elements, it is to be understood that it is not so limited, but, as has been stated, is also applicable to other forms of tube.

Many further modifications of the invention, within the scope of the appended claims, will occur to those versed in the art.

We claim:

1. An electronic image transmitting tube including a mosaic screen comprising a signal plate and a multiplicity of conducting elements insulated from one another and from the signal plate, a cathode ray gun for furnishing a narrow beam of electrons adapted to scan said screen, said screen having on the scanned side thereof a border of conducting material, the capacity of the conducting border to said signal plate being greater than the capacity of any of said elements

to said signal plate, and means for maintaining said border at a definite potential relative to the potential of said signal plate.

2. An electronic image transmitting tube as in claim 1, wherein the said conducting elements are photo-electrically sensitised upon the scanned side thereof.

3. An electronic image transmitting tube as in claim 1 wherein a sheet of insulating material is provided for insulating said border and said conducting elements from said signal plate.

4. An electronic image transmitting tube as in claim 1, wherein said conducting elements are photo-electrically sensitised upon the scanned side thereof and a sheet of insulating material is provided for insulating said border and said conducting elements from said signal plate.

5. An electronic image transmitting tube as in claim 1 wherein said border is constituted by a coating of a metallic paint.

6. An electronic image transmitting tube as in claim 1 wherein said border is constituted by a coating of liquid silver.

7. A circuit arrangement including electronic image transmitting tube, comprising a mosaic screen having a signal plate and a multiplicity of conducting elements insulated from one another and from the signal plate, a cathode ray gun for furnishing a narrow beam of electrons adapted to scan said screen, said screen having on the scanned side thereof a border of conducting material, the capacity of the conducting border to said signal plate being greater than the capacity of any of said elements to said signal plate, means for deriving from said signal plate impulses caused by scanning the said mosaic screen and means for applying to said border a biasing potential relatively to the said signal plate.

8. A circuit arrangement according to claim 7, wherein the means for affording a biasing po-

tential are adjustable for varying the magnitude of the biasing potential.

9. A circuit arrangement according to claim 7, wherein said means for affording a biasing potential is connected through a resistance to said border.

10. A circuit arrangement according to claim 7, wherein said means for affording a biasing potential comprise a source of current, a resistance connected across the poles of said source and an adjustable tapping point in engagement with said resistance and connected to said border through another resistance.

11. A television system comprising an electronic image transmitting tube having included therein means including an electron source for developing a cathode ray scanning beam, a layer of insulating material for supporting from one side thereof the mosaic electrode, and a conducting signal plate supported from the opposite side of the insulating material, a layer of conducting material supported from the same side of the insulating material as the mosaic elements and forming the border portion of the complete electrode, the capacity of the conducting border to the signal plate being greater than the capacity of any of the elements of the mosaic to the signal plate, means for illuminating the mosaic electrode with a light image of a subject, means for producing between the electron source and the signal plate a potential difference such that the signal plate is positive relative to the electron source, means for biasing the conducting border portion surrounding the electrode elements of the mosaic relative to the signal plate, said mosaic and the conducting border being adapted to be scanned by the developed scanning beam.

JAMES DWYER MCGEE.

GEORGE STANLEY PERCIVAL FREEMAN.
WILLIAM STEWART BROWN.