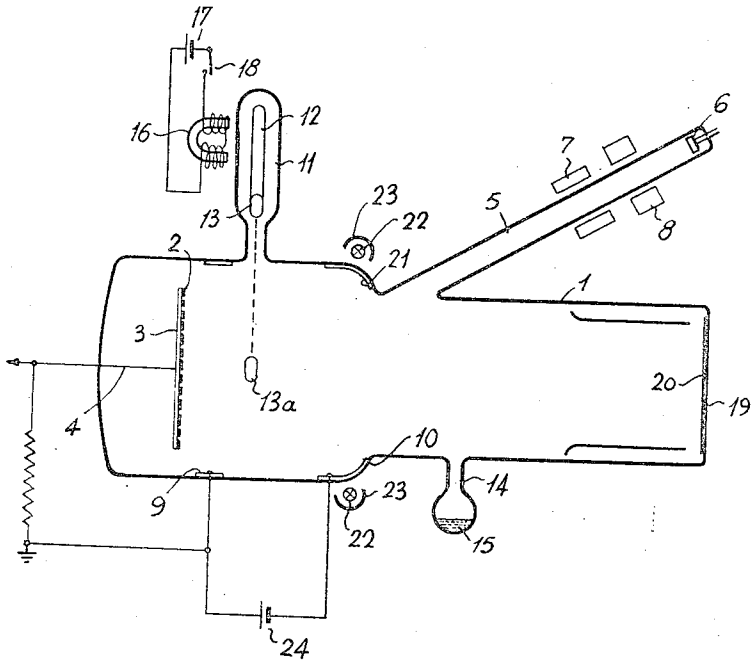
Jan. 26, 1954

G. B. F. GOFF

2,667,600

TELEVISION PICKUP TUBE

Filed Nov. 27, 1951



Inventor

GEORGE BERNARD FRANCIS GOFF

By

Emery Holcombe & Blair

Attorney

Patented Jan. 26, 1954

2,667,600

UNITED STATES PATENT OFFICE

2,667,600

TELEVISION PICKUP TUBE

George Bernard F. Goff, Cambridge, England, assignor to Cathodeon Limited, Cambridge, England, a British company

Application November 27, 1951, Serial No. 258,347

5 Claims. (Cl. 315—11)

1

The present invention relates to television pick-up tubes, and is an improvement in or modification of the invention forming the subject of copending patent application Serial No. 163,658, now Patent No. 2,622,226.

In the specification of the above application is disclosed a method and means for improving the operation of pick-up tubes of the kind employing high velocity scanning, and particularly such tubes of the image iconoscope type, by releasing photo-electrons from a suitably illuminated photo-sensitive surface in the vicinity of the storage surface of the tube, and accelerating the photo-electrons towards the storage surface so as to strike it with such velocity as to cause emission from the storage surface of secondary electrons in such ratio to the incident photo-electrons as to charge the storage surface negatively, the acceleration of the photo-electrons being effected by means of the collector electrode provided in the tube for collecting the secondary electrons released from the storage surface, this collector electrode being interposed between the storage and the photo-sensitive surfaces and being maintained at a positive potential relatively to the photo-sensitive surface. In the embodiment of tube described, the photo-sensitive surface is in the form of an annular internal wall coating on the tube envelope and the collector electrode, also of annular form, is mounted opposite the photo-sensitive coating, and by reason of that arrangement the collector electrode is of a perforated construction in the form of a coarse mesh in order to allow the photo-electrons released from the photo-sensitive coating to reach the storage surface through the perforations in the collector.

According to the present invention, both the photo-sensitive surface and the collector electrode are provided in the form of annular internal wall coatings on the tube envelope, the collector coating being interposed, on the envelope wall, between the storage surface and the photo-sensitive coating which is suitably spaced from the storage surface for that purpose.

The present invention also consists in a television pick-up tube of the image iconoscope type having a storage surface and a photo-cathode spaced apart in parallel relation in the tube envelope, and a collector electrode in the form of an annular internal wall coating on the envelope in the vicinity of the storage surface, wherein a photo-sensitive surface is provided in the form of an annular internal wall coating on the envelope in the vicinity of the storage surface but so that the collector coating is interposed, on the envelope wall, between the storage surface and the photo-sensitive coating, and an annular light source or annular array or group of light sources is arranged around the envelope for illuminating the photo-sensitive coating, the collector electrode being arranged to be maintained at a positive potential relatively to the photo-sensitive coating so as to accelerate photo-electrons released from the photo-sensitive coating towards the storage surface.

2

According to a feature of the invention, in a tube as described in the last preceding paragraph the envelope has two cylindrical end portions, containing the storage surface and photocathode respectively, which are connected by an intermediate cylindrical neck portion of reduced diameter so that the end portion containing the storage surface has an internal annular corner or shoulder where it joins the neck portion, and the photo-sensitive coating is provided on that corner or shoulder, thus facing substantially towards the storage surface.

The illumination of the photo-sensitive coating should be such that the whole of the storage surface is irradiated with the photo-electrons. The illumination may be substantially uniform in order to cause a correspondingly uniform photo-emission and negative charging of the storage surface. However, the intensity and/or distribution of illumination may be made adjustable to enable the intensity and distribution of the photo-emission and charging of the storage surface to be controlled and adjusted as desired. Preferably, several lamps, such as of the "peanut" or "festoon" types, are provided around the envelope, together with means such as potentiometers or switches for controlling the lamps individually or in any desired combinations for adjusting the intensity and/or distribution of illumination.

According to a feature of the present invention, in the manufacture of a tube of the image iconoscope type embodying this invention, the photo-sensitive coating is formed simultaneously with the formation of the photocathode by introducing material (which is eventually to be activated and sensitised to form the photo-cathode on an end wall of the envelope remote from the storage surface) into the envelope in the vicinity of the storage surface and evaporating the material so that it is caused to deposit a coating on the said end wall and also another coating around a portion of the envelope wall in the vicinity of the storage surface, the two coat-

ings thereafter being simultaneously made photo-sensitive.

With an envelope having an intermediate neck portion as described, the material to be evaporated is introduced into the end portion of the envelope containing the storage surface and the material is evaporated from there along the envelope so as to deposit a coating on the remote end wall of the other end portion which is to contain the photocathode. In so evaporating the material, some part of the vapour is caused to be trapped by and to deposit a coating upon the above-mentioned corner or shoulder of the portion of the envelope containing the storage surface.

In order that this invention may be more clearly understood, reference will now be made to the accompanying drawing which shows one specific embodiment thereof by way of non-limiting example.

In the figure, which illustrates one mode of manufacture, the tube is provided with an antimony caesium photo-cathode. The tube has a main evacuated envelope 1 containing the target electrode comprising a charge-storage surface 2 and a signal plate 3 sealed into the tube with appropriate output lead 4. The target, as shown in the drawing, is mounted at one end portion of the tube which is also provided with an inclined side tube 5 containing a scanning-beam electron gun 6, the deflection coils 7 and 8 being provided for the application as scanning potentials for causing the electron beam set up by the gun 6 to scan the target electrode in a conventional raster. The tube also contains a collector electrode 9 which is formed by depositing a ring of conductive material on the interior wall of the envelope 1 in known fashion in the vicinity of the target 2 and between the target and a shoulder 10 on the envelope 1 that forms a boundary between the end of the envlope carrying the target and a constricted opposite end portion.

The envelope is also provided with a small temporary side tube 11 sealed to the portion of the envelope 1 containing the target electrode and positioned between the target and the shoulder 10. This side tube 11 contains a slidable carrier 12 of magnetic material which carries at its lower end a predetermined charge 13 of material intended to form the base for the photo-cathode of the tube: in this case the material is antimony. The envelope has sealed to it also a further temporary side tube 14 containing a predetermined charge 15 of caesium.

The side tube 11 has associated with it a magnet 16 which may be an electro-magnet energised by a source of D. C. potential 17 under the control of the switch 18, as shown, or it may be a permanent magnet. The magnet is arranged so that it can control movement of the magnetic carrier 12 and therefore the magnet can be used to move the carrier containing the charge 13 of antimony into the envelope so that the charge 13 takes up the position shown at 13a.

By the application of heat, for example, by high-frequency induction methods or even direct electrical heating through suitable flexible leads, the antimony charge is caused to be evaporated through the constricted part of the envelope 1 to deposit a film of antimony on the far wall 19, there to form a photo-cathode 20, and also on to the shoulder 10 of the envelope, there to form a coating 21. After evaporation of the material, the carrier is removed by manipulation of the magnet 16 back into the side tube 7, whereupon the latter is sealed-off in close proximity to the main envelope wall without destroying the tubes' vacuum.

The side tube 14 containing the charge of caesium is then baked whereby the caesium is distilled from the side tube 14, thus causing the caesium vapour to react with the deposited antimony to render the surfaces of the photo-cathode 20 and the surface 21 light-sensitive. The side tube 14 is then sealed-off and removed without destroying the vacuum of the tube.

The activated surfaces 20 and 21 may be then further sensitised by the addition of controlled amounts of oxygen.

In order to provide electrons for suitably biassing the target electrode, as above described, there is arranged an annular group of lamps 22 and reflectors 23 around the shoulder 10 of the envelope 1 that carries internally the photo-sensitive coating 21. These lamps are connected to a suitable electrical circuit, the connections of which are obvious and need not be illustrated. Advantageously, the plurality of lamps 22 is controlled in groups by means of suitable variable resistors or the like whereby their intensity may be controlled so as to illuminate to a more or less degree any selected portion of the coating 21.

If desired, the groups of lamps 22 may be replaced by an annular source of light in an annular reflector.

In order to enable the collector electrode to act as an accelerator electrode for the electrons emitted by the photo-sensitive surface 21, it is held at a higher potential than said surface 21 and this is schematically illustrated in the drawing by the connection between those two surfaces of a source of potential 24.

In addition to the defects specifically discussed in application Serial No. 163,658, which television pick-up tubes of the kind in question suffer, such tubes have the further defect that the output video signal contains no components containing intelligence regarding the mean value of the light level of the light image. This is due to the requirement that, since the storage surface is insulated, the mean target current must equal zero over the frame period and, therefore, in order that any intelligence may be generated, it is necessary that the output signal waveform should include both positive and negative departures from this mean zero value. Since, therefore, the output signal is not uni-directional in relation to the zero value which is available as a reference during the line blanking period, it is not possible to use this reference level for purposes of D. C. restoration. However, by charging the storage surface negatively in the manner described herein and in the aforesaid application and, in particular, by effecting such negative charging during blanking periods of the scanning beam, and especially during the frame blanking periods, the storage surface may be biassed negatively sufficiently to ensure, by reason of the fact that the mean target current must equal zero over the frame period, that the output video signal obtained during scanning is uni-directional in character, i. e., it contains D. C. components and hence information regarding the mean value of light level of the light image being transmitted, thus facilitating D. C. restoration.

I claim:

1. A television pick-up tube of the image iconoscope type and comprising a storage surface and a photo-cathode spaced apart in parallel relation within the tube envelope, in which said en-

velope comprises two cylindrical end portions respectively containing the storage surface and the photo-cathode, said first end portion being of larger diameter than said second portion so that said end portion containing the storage surface has an internal annular corner or shoulder where it joins the second portion, a photo-sensitive coating as an annular coating on said shoulder facing substantially towards said storage surface, and a collector electrode in said first portion and also in the form of an annular wall coating located between said photo-sensitive surface and said storage surface, means for illuminating said photo-sensitive surface, and means for maintaining said collector electrode at a positive potential relative to said photo-sensitive surface whereby electrons released from said photo-sensitive surface under the influence of light from said illumination means are accelerated towards said storage surface.

2. A tube as claimed in claim 1, comprising means for adjusting the intensity and distribution of photo-emission from said photo-sensitive surface.

3. A tube as claimed in claim 2, in which the illumination comprises a plurality of small electric lamps arranged around said shoulder of said envelope, and means for controlling said lamps in any desired combination.

4. A television pick-up tube of the image iconoscope type and comprising a storage surface and a photo-cathode spaced apart in parallel relation within the tube envelope, in which said envelope comprises first and second end portions respectively containing the storage surface and the photo-cathode, said end portions being connected together by a neck portion of smaller diameter than the first said end portion containing the storage surface so that the said first end portion has an internal annular shoulder where it joins the neck portion, a photo-sensitive

coating as an annular coating on said shoulder facing substantially towards said storage surface, and a collector electrode in said first portion and also in the form of annular wall coating located between said photo-sensitive surface and said storage surface, means for illuminating said photo-senstive surface, and means for maintaining said collector electrode at a positive potential relative to said photo-sensitive surface whereby electrons released from said photo-sensitive surface under the influence of light from said illumination means are accelerated towards said storage surface.

5. A television pick-up tube of the image iconoscope type and comprising a storage surface and a photo-cathode spaced apart in parallel relation within the tube envelope, in which said envelope comprises first and second portions respectively containing the storage surface and the photo-cathode, said end portions being connected together by a neck portion of smaller diameter than the first said end portion containing the storage surface so that the said first end portion has an internal annular shoulder where it joins the neck portion, a photo-sensitive coating as an annular coating on said shoulder facing substantially towards said storage surface, and an annular collector electrode in said first portion located between said photo-sensitive surface and said storage surface.

GEORGE BERNARD F. GOFF.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
2,121,356	Knoll	June 21, 1938
2,281,638	Sukumlyn	May 5, 1942
2,368,884	Schade	Feb. 6, 1945