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TELEVISION PICKUP TUBE

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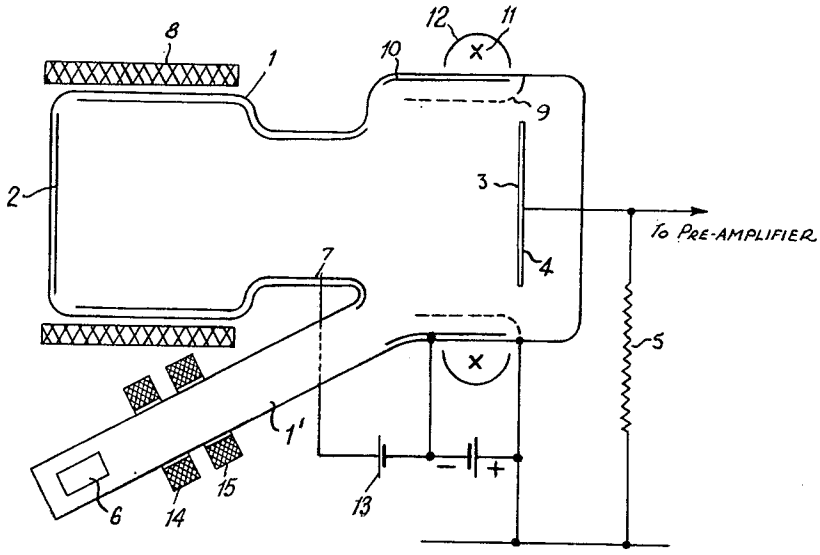

Inventor
Richard Theile
By
Emery, Holcombe & Blair
Attorney

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TELEVISION PICKUP TUBE

Richard Theile, Cambridge, England, assignor to Cathodeon Limited, Cambridge, England, a British company

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The present invention relates to television pick-up tubes of the kind employing high velocity scanning, such as of the types known as iconoscopes and image iconoscopes. Such tubes suffer from various disadvantages, particularly the generation of spurious signals, insufficient collection by the collector electrode of the tube of secondary electrons emitted from the storage surface of the tube, and redistribution effects due to secondary electrons emitted from the storage surface being redistributed over that surface. It is known to improve the operation of such tubes by irradiating the inside of the tube with a biasing light, and this method is already practiced with tubes of the iconoscope type.

The reason for the improvement is not yet clearly understood in the art, but as a result of practical experience with these tubes and of further theoretical investigation, it appears that the improvement is due to the collection by positively charged parts of the storage surface of photo-electrons released by the biasing light from the photo-sensitive coating which is produced on the wall of the tube during the sensitization of the photo-electric storage mosaic in the case of tubes of the iconoscope type, or the photo-cathode in the case of tubes of the image iconoscope type. This collection of photo-electrons by the storage surface tends to equalize the non-uniformity of the redistribution of the secondary electrons over the storage surface, and also tends to reduce the effect known as "flare," by tending to neutralize the positive charge resulting from the scanning on the bottom zone of the storage surface. The efficiency of the improvement obtained in this way is very low because only a small part of the photo-electrons released by the biasing light can reach the storage surface, owing to their low initial velocity.

The present invention has for its object to increase the efficiency of the improvement obtained by irradiating the tube with a bias light, and consists in the provision of means for accelerating towards the storage surface the photo-electrons released from the irradiated photo-sensitive wall coating or surface, whereby a greater proportion of the released photo-electrons can reach the storage surface. However, the acceleration should be such that the photo-electrons will reach the storage surface with a relatively low velocity so that they are able to charge that surface negatively.

The invention also consists in a television

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pick-up tube of the kind employing high velocity scanning, in which a photo-sensitive surface is provided adjacent the storage surface, together with means for illuminating the photo-sensitive surface, and wherein the collector electrode for collecting the secondary electrons released from the storage surface is interposed between the latter and the photo-sensitive surface and is arranged to be maintained at a positive potential relatively to the photo-sensitive surface.

According to a feature of the invention, the collector electrode is perforated, so that the photo-electrons released from the photo-sensitive surface reach the storage surface through the perforations in the collector electrode and are accelerated towards the storage surface by reason of the collector electrode being maintained at a more positive potential than the photo-sensitive layer.

In order that the invention may be more clearly understood, an embodiment thereof will be described by way of example with reference to the accompanying drawing, which shows diagrammatically a pick-up tube of the image iconoscope type modified according to the present invention.

Referring to the drawing, the pick-up tube comprises an evacuated envelope 1 containing a semi-transparent photo-cathode 2 adjacent one end of the tube and a storage target spaced therefrom and arranged parallel to the photo-cathode 2. The target may comprise a mica sheet 3, of which the surface facing the photo-cathode 2 constitutes the storage surface of the target. That surface may be coated with a material to make it highly secondary emissive. The sheet 3 is backed with a continuous conductive layer 4 forming the signal plate which is connected externally of the envelope 1 to a load resistor 5, across which the signal potentials are developed and fed into a signal preamplifier. Photo-electrons released from the photo-cathode 2 under the influence of an optical image projected thereon are accelerated towards the storage surface 3 by the wall coating 7 which is maintained at a positive potential by connection to a source of potential such as battery 13, and are focussed upon the storage surface by the field of an image focussing coil 8 surrounding the envelope 1. The storage surface 3 is scanned in a line raster by a high velocity beam generated by an electron gun 6 in an inclined side tube 1' of the main envelope 1, the side tube 1' being surrounded by the necessary coils

14 and 15 for focussing and deflecting the beam. A collector electrode 9 is arranged in the envelope 1 for collecting secondary electrons emitted from the storage surface 3 both by the incident primary photo-electrons from the photo-cathode 2 and by the incident electrons from the scanning beam. The construction and mode of operation of the tube as so far described is conventional and well known in the art.

However, whereas in the conventional construction the collector electrode 9 is usually in the form of an internal conducting coating on the wall of the envelope 1, according to this invention the collector electrode 9 is constructed of a coarse mesh conductor which is of cylindrical shape and is mounted surrounding the storage surface 3 and spaced a small distance from the internal surface of the envelope 1 which is coated with a photo-sensitive layer 10.

The latter is irradiated by a light source 11, shown provided outside the envelope 1. The source 11 may be of annular form surrounding the envelope 1 and layer 10, or an annular array or group of light sources may be similarly arranged. Precaution must be taken to avoid light from the source 11 from falling onto the photo-cathode 2, in order to avoid any additional noise component. Accordingly, the source 11 is preferably provided with suitable means such as a shield or light guides 12 or the like in order to confine the illumination to the photo-sensitive layer 10.

A potential difference is maintained between the mesh 9 and the photo-sensitive layer 10, so that the mesh is positive with respect to the photo-sensitive layer and accelerated photo-electrons emitted from the irradiated layer 10. The value of this potential difference (which may, for example, be 5–8 volts) is within the range for which the secondary emission ratio of the storage surface 3 will be less than unity; that is to say, photo-electrons from the irradiated layer 10 impinge upon the storage surface 3 with such velocities that the ratio of the number of secondary electrons released from the storage surface to the number of arriving photo-electrons is less than unity, whereby the storage surface is negatively charged.

The mesh aperture of the electrode 9 and the distance between it and the photo-sensitive layer 10 are made of suitable values to produce a small field penetration factor, so that the equilibrium potential of the storage surface 3 resulting from the scanning is mainly determined by the mesh potential. On the other hand, sufficient photo-electrons must be capable of penetrating through the mesh 9 and landing on the storage surface in order to produce the wanted negative charge.

The photo-emission from the photo-sensitive layer 10 may be made non-uniform, for example, by illuminating the layer 10 non-uniformly along its length as shown by the position of source 11 or along its circumference, in order to obtain the desired charging of the storage surface. For example, the illumination may be more intense at the zone of the layer 10 which will irradiate the bottom zone of the storage surface 3 with photo-electrons, in order to compensate for "flare."

If desired, and especially when using intermittent film projection in telecine transmission, the photo-sensitive layer 10 may be only intermittently illuminated, for example, during only the flyback periods of the scanning beam, preferably the frame flyback periods, so that the storage surface will be charged negatively only during these flyback periods. This intermittent illumination may be effected by obturating the light source 11 by rotating or vibrating shutters or similar devices. For example, a shutter 16 may be rotated by motor 17 and drive shaft 18 alternatively, as the light source, one or more cathode ray tubes or gas discharge tubes may be employed, the light output of which can be pulsed and controlled by feeding thereto suitable voltage or current pulses to operate the tube or tubes during the flyback periods.

Whilst the particular embodiment described applies the invention to a tube of the image iconoscope type, the invention may be applied similarly to a tube of the iconoscope type, the photo-electrons from the layer 10 in that case irradiating the photo-sensitive mosaic target of the iconoscope instead of the secondary emitting target of the image iconoscope.

I claim:

1. In a television pick-up tube of the high velocity scanned type, the combination with a charge storage surface capable of storing energy in the form of a charge pattern corresponding to the light distribution in an optical image, of a source of photo-electrons in the vicinity of said surface adapted to release photo-electrons in that vicinity, means for illuminating said source to cause it to release photo-electrons, a collector electrode in the vicinity of said storage surface for collecting electrons released from said storage surface, said collector electrode being disposed between said source and said storage surface, and means for maintaining said collector electrode at a positive potential relatively to said source for accelerating photo-electrons released from said source towards said storage surface.

2. In a television pick-up tube of the high velocity scanned type, the combination with a charge storage surface capable of storing energy in the form of a charge pattern corresponding to the light distribution in an optical image, of a source of photo-electrons in the vicinity of said surface adapted to release photo-electrons in that vicinity, means for illuminating said source to cause it to release photo-electrons, a collector electrode in the vicinity of said storage surface for collecting electrons released from said storage surface, said collector electrode being interposed between said source and said storage surface and being of perforate construction to allow photo-electrons released from said source to pass through said electrode, and means for maintaining said collector electrode at a positive potential relatively to said source for accelerating photo-electrons released from said source towards said storage surface.

3. A television pick-up tube comprising an evacuated envelope having within it a photo-cathode upon which a light image is adapted to be directed to release photo-electrons from said photo-cathode, a target spaced from said photo-cathode and comprising a secondary electron emitting storage surface facing said photo-cathode and forming elemental condensers with a signal plate backing said storage surface, means for accelerating and focussing photo-electrons released from said photo-cathode to impact upon said storage surface whereby to eject secondary electrons from said surface to form a charge pattern thereon corresponding to the light distribution in the light image, means for scan-

ning said surface with a high velocity electron beam to discharge said surface to equilibrium potential, a collector electrode in the vicinity of said surface for collecting secondary electrons emitted from said surface, a photo-electric surface in the vicinity of said storage surface for releasing photo-electrons towards said storage surface, means for illuminating said photo-electric surface to cause it to emit photo-electrons, and means for accelerating photo-electrons released from said photo-electric surface on to said storage surface whereby to eject secondary electrons from said surface in such ratio to the incident photo-electrons as to charge said surface negatively.

4. A television pick-up tube comprising an evacuated envelope having within it a photo-cathode upon which a light image is adapted to be directed to release photo-electrons from said photo-cathode, a target spaced from said photo-cathode and comprising a secondary emitting storage surface facing said photo-cathode and forming elemental condensers with a signal plate backing said storage surface, means for accelerating and focussing photo-electrons released from said photo-cathode to impact upon said storage surface whereby to eject secondary electrons therefrom to form a charge pattern thereon corresponding to the light distribution in the light image, means for scanning said surface with a high velocity electron beam to discharge said surface to equilibrium potential, a collector electrode in the vicinity of said surface for collecting secondary electrons emitted from said surface, a photo-electric surface in the vicinity of said storage surface for releasing photo-electrons towards said storage surface, means for illuminating said photo-electric surface to cause it to emit photo-electrons, said collector electrode being spaced close to said photo-electric surface and disposed in the path of photo-electrons released from said photo-electric surface and having a mesh construction to allow released photo-electrons to pass therethrough, and means for maintaining said collector electrode at a positive potential relatively to said photo-electric surface for accelerating photo-electrons released from said photo-electric surface on to said storage surface whereby to eject secondary electrons from said surface in such ratio to the incident photo-electrons as to charge said surface negatively.

5. A television pick-up tube as defined in claim 4, and further comprising means for shielding said photo-cathode from light from said illuminating means.

RICHARD THEILE.

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