Feb. 27, 1940. E. SCHWARTZ ET AL 2,191,590

TELEVISION APPARATUS

Filed Nov. 6, 1936

Fig. 1.

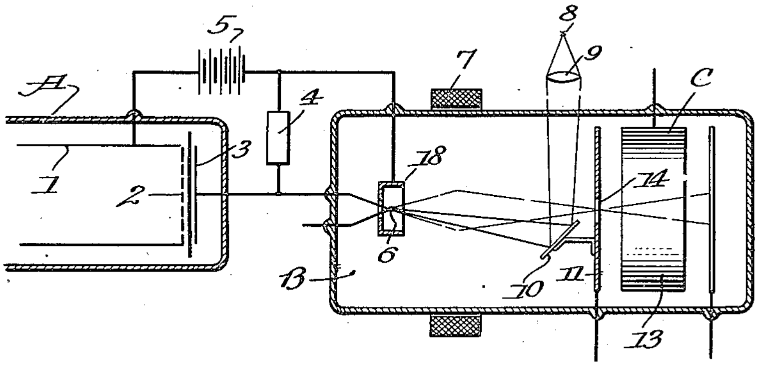


Fig. 2.

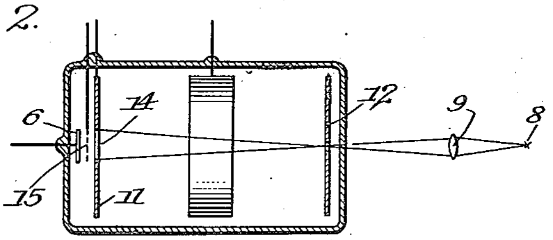
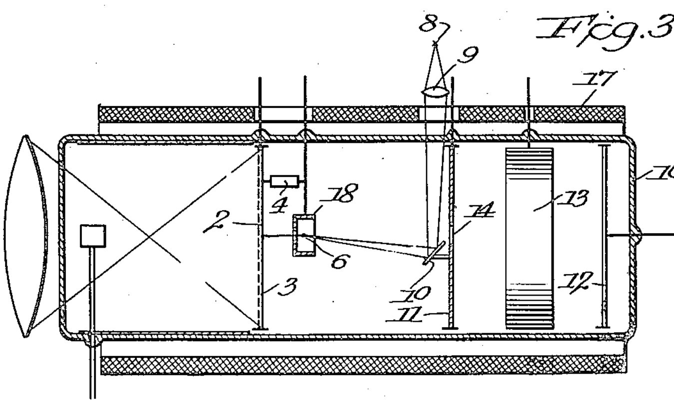


Fig. 3.



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2,191,590

TELEVISION APPARATUS

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5 Claims. (Cl. 250—150)

The present invention relates to an arrangement which permits combining an image analyzer with an electron multiplier. Such a combination is of importance since the image analyzer does not fulfill those exact accumulator requirements which it is theoretically supposed to fulfill, and since the subsequently necessary amplification of the image analyzer signals is preferably effected in an amplifier of which the first stages are as free as possible from crackling tube noises which at most are equal to those of the image analyzer per se. Such amplifiers, free from crackling tube noises, are usually operated by means of electron multiplier arrangements. The combination of image analyzer and multiplier is difficult to secure because the signal currents of the image analyzer flowing as displacement currents in the conductor must again be converted into free electron currents in order to be able to engender the secondary emission effect in the electron multiplier. The conversion of galvanic conduction currents into currents of free electrons by means of electric glow discharges is not serviceable in this connection because the incandescent cathode required positively introduces a screen effect. A further difficulty resides in the fact that the free electron currents which are set free by the signal currents of the image analyzer must be directed towards a small surface, the inlet point of the electron multiplier.

In accordance with the invention a tube is attached to the image analyzer, which tube contains a photo-cathode of which the emission is controlled by the signal currents of the image analyzer. Such photo-cathodes, as is well known, have a smaller crackling tube noise effect than incandescent cathodes. The electrons emanating from this photo-cathode are multiplied in an attached multiplying tube. The photo-cathode which is energized by a constant light source may be of point-like type and may be delineated on a diaphragm by an electron lens, the said diaphragm forming the inlet opening for the multiplier, or it may be disposed directly in the vicinity of this inlet opening. Any radiation of desired wave length may be used for energizing the photo-cathode, e. g. even Roentgen ray radiation.

Embodiments of the invention are schematically illustrated in the drawing wherein:

Fig. 1 shows the combination of an image analyzer with a multiplier.

Fig. 2 illustrates a further embodiment of the multiplier.

Fig. 3 shows a tube which combines the image analyzer and the multiplier in one housing.

In Fig. 1, A indicates an image analyzer of ordinary construction, B is the discharge tube of the invention, whereas C represents the electron multiplier which is combined with the discharge tube B to form a single vacuum tube.

The image analyzer comprises an anode 1 and a photo-electric mosaic 2 from which the displacement currents flow to signal plate 3 and thence across resistance 4 back to battery 5. Whereas normally the voltage drop in resistance 4 is coupled to an ordinary amplifier tube, in accordance with the present invention the voltage drop is applied across resistance 4 to the Wehnelt cylinder 18 and the cathode 6 of the discharge tube B. The cathode 6 is not, as customary, activated to produce thermionic electron emission, but is provided with a coating of caesium or other alkali earth metal. The cathode is energized to the emitting point by means of a constant light source 8 which is projected by a lens 9 and mirror 10 onto cathode 6. The mirror may be located in vacuo and fastened to one of the electrodes of the discharge tube B. The electron lens, which is here indicated as a magnetic collector coil 7, delineates the cathode 6 on the anode diaphragm 14. Behind the diaphragm 14 there is disposed an electron multiplier of known type. Such a multiplier is shown and described in detail in the Philo T. Farnsworth Patents Nos. 2,071,515 and 2,071,517, issued February 23, 1937. In these patents there is shown a method of causing an electron cloud to oscillate back and forth between two secondarily emissive cathodes, producing an amplified stream at each impact on the cathodes, and being focused during successive passages by a magnetic focusing coil. After each impact, the electron cloud is accelerated toward the opposite cathode by a charge on a cylindrical accelerating anode placed midway of the cathodes, and the final velocity before each cathode impact sufficient to produce secondaries is insured by an alternating potential built up on cathodes themselves through a resonant circuit connecting them, as described in detail in the patents referred to above. In the figures, the secondarily emissive cathodes are represented by the electrodes 11 and 12 and the accelerating anode by the annular electrode 13. The photo-cathode 6, the saturation current of which is determined by the luminosity of the light source 8, emits an electron current which is modulated by the signal voltage at the Wehnelt cylinder 18.

This varies the number of primary electrons shot into the multiplier.

In accordance with Fig. 2 the electrons which emanate from the photo-cathode are not gathered by a separate collector coil and shot into the multiplier, but they issue through an opening 14 directly into the space between the electrodes 11 and 12. The control is effected by a grid 15 which is used in lieu of the Wehnelt cylinder 18 of Fig. 1.

In Fig. 3, the image analyzer is combined with the multiplier into one housing 16. The optical image is thrown on the mosaic surface 2, to the metallic rear side 3 of which the cathode 6 is attached. The resistance 4 may likewise be disposed inside the tube between the cathode 3 and Wehnelt cylinder 18. The electron ray produced by cathode 6 passes through diaphragm 14 into the multiplier, as shown in Fig. 1. The entire tube may be disposed inside a common collector coil 17 adapted to produce an image of the cathode 6 and the cathode of the image analyzer in the ratio of 1:1.

We claim:

1. In combination with a dissector and an alternating current multiplier, means for energizing said multiplier from said dissector comprising a photo-emissive cathode axially alined with said multiplier, means for constantly illuminating said cathode, a Wehnelt cylinder disposed about said cathode, an entry port to said multiplier in registry with said cathode, and means for energizing said Wehnelt cylinder from the output of said dissector.

2. In combination with a dissector and a multiplier having an envelope enclosing two opposed cathodes and a cylindrical anode intermediate thereof positioned symmetrically about the axis of said envelope, means for utilizing the output of said dissector to control said multiplier, comprising a photo-cathode disposed in said envelope in axial alinement with said multiplier cathodes, a beam aperture formed through one of said cathodes alined with said photo-cathode, means for directing a constant intensity light upon said photo-cathode, means for focusing photoemission therefrom on said cathode aperture, a control electrode disposed about said photo-cathode, and means for energizing said control electrode from said dissector.

3. An electron multiplier energizable by photoemission, comprising an evacuated cylindrical envelope having a pair of opposed secondarily emissive multiplier cathodes, a cylindrical anode therebetween, an aperture formed through one of said cathodes, a photoemissive cathode within said envelope alined with said aperture, a control electrode disposed about said photoemissive cathode, an external source of constant intensity light, means for focusing such light upon said photo-cathode, means for focusing photoemission from said photo-cathode upon said multiplier cathode aperture, and means for leading a signal potential to said control electrode.

4. An evacuated cylindrical insulating envelope, an image dissector disposed within one end of said envelope, an alternating current multiplier adapted to be energized by photoemission disposed within the opposite end thereof, an apertured entrance to said multiplier, a photo-cathode disposed between said dissector and multiplier in registry with said apertured entrance, an external source of constant intensity light, means for focusing light therefrom upon said photo-cathode, a control electrode about said photo-cathode, means for energizing said control electrode from said dissector, and means for focusing emission from said photo-cathode upon said apertured multiplier entrance.

5. In combination, an electron multiplier, a photo-cathode, means for continuously energizing said photo-cathode to the point of emission of electrons, means for guiding electrons from said photo-cathode to said electron multiplier, and means for modulating the flow of electrons to said electron multiplier in accordance with signals.

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