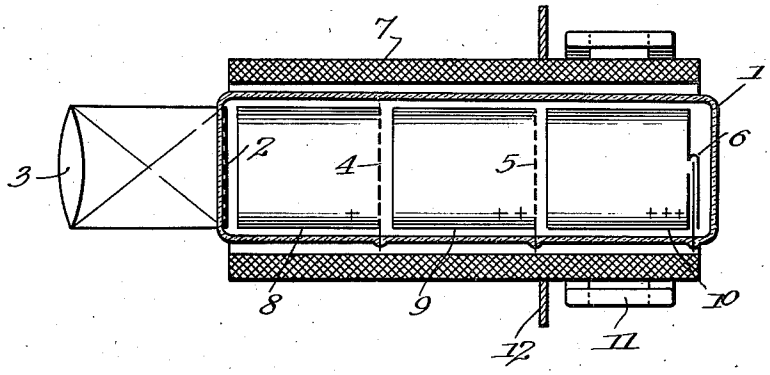
Jan. 14, 1941. W. REICHEL ET AL 2,228,402

PICTURE TRANSMITTER

Filed Feb. 11, 1937

Fig. 1.



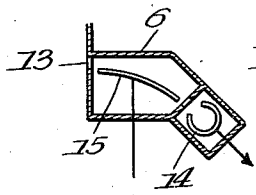
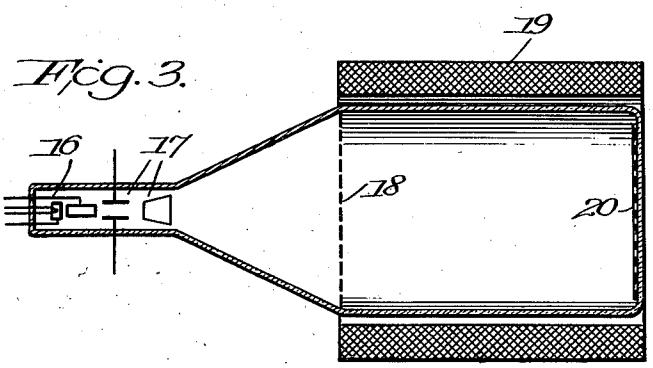


Fig. 2.

Fig. 3.



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PICTURE TRANSMITTER

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In Germany February 24, 1936

3 Claims. (Cl. 178—7.2)

The invention is related to television devices in which use is made of an electron image. Such an electron image may be obtained by either projecting an optical image on a photo-cathode and translating it there into a corresponding distribution of electrons, or by putting it together point by point by means of an amplitude modulated cathode ray.

The first case is used, for instance, in the known Farnsworth dissector tubes, in which an optical image is projected on a plane photo-cathode and the electrons leaving the cathode are guided past a target disposed in a distant plane by means of deflecting fields, so that a resolution of the image is obtained. The part of the cathode ray beam striking the target is very small and cannot be amplified without considerable difficulty, by the usual means. Therefore, a preamplification by secondary emission is used at the target. The construction of such preamplifiers of satisfactory efficiency involves great technical difficulties.

In the known Braun tubes an electron image is produced by the cathode ray in the plane of the fluorescent screen which is made visible by the luminescence of the screen. The increase of the velocity of the beam, and therewith the intensity of the received image, is limited by the fact that the ray which produces the image must be deflected, and that the intensity of the deflection fields at too high a velocity of the beam would have to be impractically large.

According to the invention, these difficulties are eliminated by amplifying the electron image itself by means of secondary emission. For this purpose, a secondary emitting surface, for instance, a grid, foil, plate, mosaic or a combination of these elements is disposed in the picture plane of the first electron optical system, which picture plane is at the same time the object plane for a second electron optical system. This reproduction can be repeated several times.

The drawing shows embodiments of the invention.

Figure 1 shows a cross-section of a television transmitting tube, according to the invention.

Figure 2 shows a cross-section through the target of such a tube.

Figure 3 shows a receiver tube.

The tube 1 of Figure 1 contains a photo-cathode 2, upon which an image of the object to be transmitted is projected by means of an optical system 3. The electrons liberated from the photo-cathode 2 are accelerated in the direction of a foil 4. The electron image of the photo-cathode is focused on the foil by means of a coil 7. Secondary electrons are liberated from the foil 4, and this amplified electron image is reproduced on the foil 5 by means of an electric field between the foil 4 and the foil 5, as well as by means of the field of the coil 7. A great number of secondary electrons is again liberated from the foil 5, and the electron image in this plane is focused in the plane of a target 6 and is guided past this target by means of deflecting fields. The signal current so obtained is a multiple of that in the known dissector tube.

The transparent photo-cathode 2, preferably consists of a grid. The photo electrons liberated from the side facing the light source are pulled through the grid into the first reproducing stage. Thus, a transparent photo-cathode is obtained, which is formed in the same manner as a solid cathode and the lifetime and constancy of which, however, is greater than that of thin translucent photo surfaces.

The focusing of the electron images is effected preferably in the known manner by means of coaxial longitudinal coils which are combined in a coil 7. Each of the foils is held at a more positive potential than the foregoing foil, and it is advisable to provide wall coatings 8, 9 and 10, which improve the accelerating electric field. The deflection in the last stage is accomplished by means of the coils 11. It is advisable to prevent any influence of the deflecting field on the stage next to the last by a ferro-magnetic screen 12, disposed between the two last reproduction stages. This may also be accomplished by placing the deflecting coils at a sufficient distance from the last secondary amplifying picture plane.

The electron current entering the scanning aperture consists of the secondary electrons of the last stage and of electrons of higher velocities from the foregoing stages, which passed the secondary emitting foil without striking. These electrons are not focused in the plane of the target because they have traveled through different distances with a high velocity; therefore, they would cause a blurring of the image. An electrostatic or magnetic transverse field is applied between the scanning aperture 13 and the collector 14, according to Figure 2, in order to prevent these electrons from being collected. This transverse field allows electrons of only a certain velocity to arrive at the collector 14. An electrode 15, for instance, is provided for this purpose, which filters out the desired electrons.

The receiving tube as shown in Figure 3, contains a normal electron gun 16 and a deflecting

system 17, which guides the electron beam across a secondary emitting foil or a grid 18. The secondary electrons emitted are pulled through the grid 18 by means of an electrostatic acceleration field and are focused in the plane of the picture screen 20 by means of a coil 19. The electrons arriving in the plane 20 are superior in number and velocity to those arriving in the plane 18, so that a considerable increase in intensity of the picture is obtained.

If solid plates are used instead of foils or mesh works, care must be taken, for instance by application of a magnetic field, that the secondaries emitted by the plate are separated from the primaries traveling in the opposite direction.

An enlargement or reduction in size of the electron images may be also obtained.

We claim:

1. Apparatus for television transmission comprising means for producing an electron image which varies in electron distribution in accordance with the elemental areas of a subject being televised, means for amplifying the elemental areas of said image simultaneously as a unit and maintaining said elemental areas in substantially their proper locations in said electron image, and means for scanning said image in its amplified state.

2. Apparatus for television transmission comprising means for producing an electron image which varies in electron distribution in accordance with the elemental areas of a subject being televised, means comprising a plurality of spaced alined secondary electron emissive grids, each of an area to receive said electron image for amplifying the elemental areas of said image simultaneously as a unit and maintaining said elemental areas in substantially their proper locations in said electron image, and means for scanning said image in its amplified state.

3. Apparatus for television transmission comprising means for producing an electron image which varies in electron distribution in accordance with the elemental areas of a subject being televised, means comprising at least one stage of electron multiplication including a secondary electron emissive screen of an area sufficient to receive said image for amplifying the elemental areas of said image simultaneously as a unit and maintaining said elemental areas in substantially their proper locations in said electron image, electromagnetic means for scanning said image in its amplified state, and means for shielding said stage of electron multiplication from the effects of said electromagnetic scanning means.

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