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PICTURE-TRANSLATING TUBE

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Fig. 1

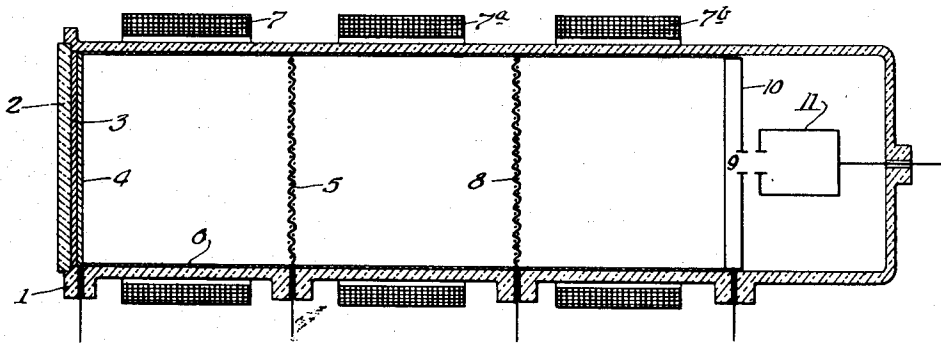
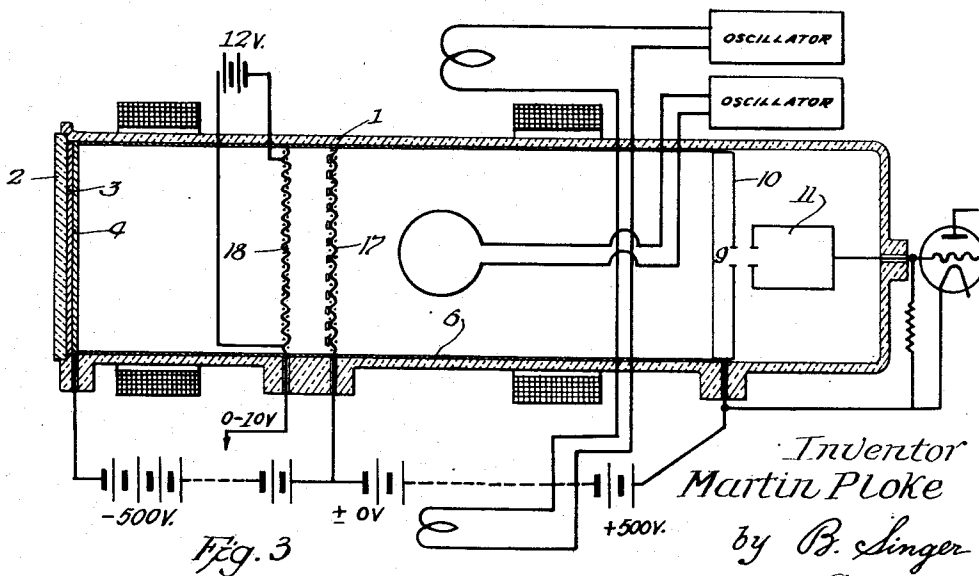
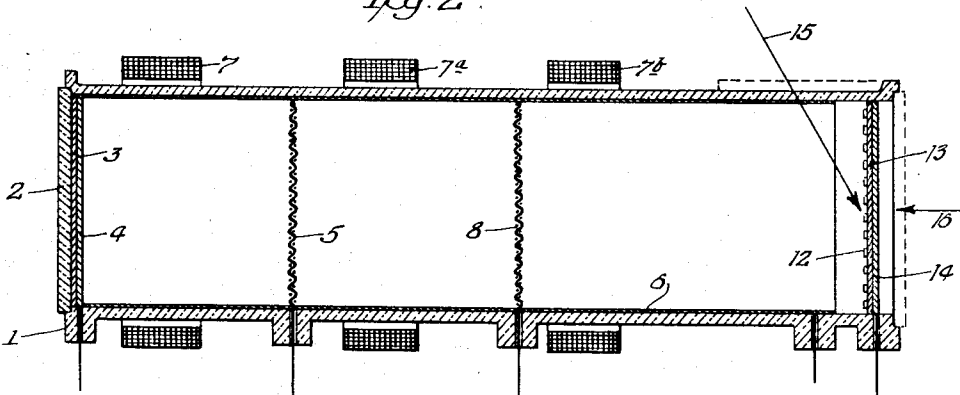


Fig. 2



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PICTURE-TRANSLATING TUBE

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3 Claims. (Cl. 250-166)

The present invention relates to devices for converting light pictures into electron pictures.

The art of television already knows of a process for converting light pictures into electron pictures. The advantage of such a conversion resides in the fact that an electron picture may be scanned by means having no inertia whatsoever, while the means for scanning a light picture always involves the employment of inertia masses. By applying the laws of the geometric optics of electrons, it is possible to obtain by the employment of a picture translator of the present invention a far reaching conversion of light pictures into electron pictures without any noticeable flaws or defects. Furthermore, it has been proven by experiments that it is feasible to produce a light picture from a solid body, which light picture is self-illuminating, because the secondary electrons emitted from said light picture are combined in one picture plane.

It is also known that a primary electron may effect a secondary emission of more than one electron, provided the kinetic energy of the primary electron is of such value that it exceeds the emitting power of the solid body.

The principal object of the invention is to convert first a light picture into an electron picture and then to convert this electron picture into a secondary electron picture, which conversion may be repeated a number of times. It is also an object of the invention to subject the secondary electron picture thus produced, and which corresponds to the original light picture, to a scanning operation, if for instance it is desired to transmit the picture by television.

Another object of the invention is to produce a picture translator particularly for the transmission of pictures in television. In this novel picture translator a secondary electron picture corresponding to a light picture is scanned. It is to be understood that the novel feature resides in, that the electron picture is produced by secondary electrons which are emitted by a solid body on which the primary electron picture is produced which latter has been formed by the conversion of a light picture. This secondary electron picture, which is scanned, may also be a picture of the electrons of a cathode ray tube, which electrons are under the control of the electrons emitted by said solid body.

In the drawing:

The Figs. 1, 2 and 3 illustrate in longitudinal section and diagrammatically each a different embodiment of a picture translator in accordance with the present invention.

The translator tube of the various embodiments illustrated in the drawing comprises an envelope 1 which is closed at one end by a transparent photo-cathode. This photo-cathode may consist for instance, of a clear glass plate 2 having on one side a very thin metallic coating 3 on which is deposited a photo electrically responsive layer 4. The layer 4 may be formed of caesium and silver oxide. The picture to be transmitted is projected by optical means upon the transparent photo-cathode. The photo-electrons which are then emitted from the photo-cathode are combined in the plane of the grid anode 5 to form an electron picture. For producing this electron picture any well known electronic optical means may be employed. The customary homogeneous electric field between the photo-cathode and the grid anode 5 may be produced by providing the inner face of the envelope 1 with a metallic coating 6 having a high ohmic resistance.

The envelope 1 is made advisably of some ceramic material or some other porcelain-like substance.

For the purpose of focusing the picture in the plane of the anode 5 an axially extended magnetic coil 7 surrounds the envelope 1. It may be of advantage, however, to employ a short coil in place of the long coil 7, since a shorter coil permits to vary the size of the electron picture to make it larger or to reduce it. Instead of a short magnetic coil, however, an electric lens may be employed, for instance, in the shape of two coaxial cylinders arranged opposite each other.

The grid anode 5 may consist of wire gauze of extremely fine mesh. The secondary electrons emitted from this grid anode 5 are combined to form a secondary electron picture, which either is projected onto a grid anode 8 or is dissected into picture points. The concentration of the secondary electrons to form said secondary electron picture is effected by employing electronic optical means 7^a.

By now converting the secondary electron picture again, by employing electronic optical means 7^b, the intensity of illumination of the first electron picture and also that of the light picture projected onto the photo-cathode, is further amplified. Upon converting an electron picture into a secondary electron picture, care must be taken that the accelerating potential between the grid anodes is selected in such manner, that each primary electron striking the grid anode releases a plurality of secondary electrons.

The dissection of the electron picture is effected by applying deflecting fields for acting upon

the final or ultimate secondary electron picture. These fields may be located outside the envelope and cause a movement of the secondary electron picture back and forth over to the aperture of the anode 10. The electrons passing through the aperture 9 of this anode 10 are received by the collector 11 or output anode respectively as illustrated in Fig. 1.

The dissection of the electron picture into picture points may also be effected as illustrated in Fig. 2. According to this modification the final secondary electron picture from the electrode 8 is projected onto a plate 13. This plate 13 comprises an insulating base having on one side a screen composed of numerous comminuted photoelectric cathodes 12, each of said minute cathodes consisting of silver and caesium oxide. The other side of this plate 13 is provided with a metallic layer 14. The picture produced by charging the photocathode screen is then scanned by an electron beam. This scanning may be effected by a beam which strikes the photocathode side of the plate 13 directly as indicated by the arrow 15, or by a beam which has to pass through the layer 14 and through the insulating plate 13 before reaching the photocathodes 12 as indicated by the arrow 16. In scanning the picture on the plate 13 by an electron beam which passes through the plate 13, it is, of course, essential that the insulating plate 13 and the metal layer 14 are to be dimensioned and are of such character that the electron beam can pass through these layers in order to reach and scan the screen composed of said minute individual photoelectric cathodes 12.

Fig. 3 illustrates a picture translator in which the grid anode 17 is made up in a manner slightly different from that previously shown in the Figs. 1 and 2. Furthermore, in this modification a cathode 18 is positioned in front of the grid anode 17.

In this last modification, electrons are emitted from the photo-cathode of the tube by the light of the object represented in the picture. These electrons are concentrated by the previously mentioned electronic optical means to form on the grid anode 17 an electron picture. This grid anode 17 is made up of a wire netting occupied by a great number of minute photoelectric elements composed of caesium and silver oxide. The individual photoelectric elements are now charged up differently according to varying intensity of light striking the same. In opposition to this grid anode 17, there is located a cathode 18 consisting of a very fine wire netting. This netting constitutes a high emission cathode. Such a cathode emits, when heated, electrons even though it is heated without being illuminated thereby, and remains dark. The cathode 18 has a slightly higher potential than the grid anode 17. The electrons emitted by the cathode 18 are accelerated towards the anode 10, whereby each of the individual photoelectric elements upon the grid anode 17 controls the electronic stream. In this manner there may be produced by the employment of electronic optical means an electron picture in the plane of the anode 10, and this electron picture may be moved back and forth across the aperture 9 of the anode 10 by employing electric or magnetic fields, so as to dissect said picture into picture points. The

dissection of the electron picture into picture points may also be effected in the same manner as has been described with respect to Fig. 2.

This picture translator, according to the present application, may advantageously be used for the transmission of pictures in television systems. It is of particular advantage whenever pictures of low light intensity are to be transmitted by television. The picture translator, may also be employed as an enlarger for pictures, whereby the loss in intensity light which usually accompanies an enlargement of a picture may be compensated for by the amplification of the secondary electrons. In particular it is feasible to select certain portions of the light picture projected onto the photo-cathode for enlargement, while employing secondary electron amplification.

What I claim as my invention is:

1. A picture translating tube comprising within an envelope, a photocathode at one end of said envelope, a grid electrode provided with a multiplicity of individual minute photoelectric cathodes positioned in a single plane at a distance from said photo-cathode and adapted to be charged by the primary electrons emitted from said photo-cathode when a light picture is produced upon the same, an incandescible high emission cathode mounted between said photocathode and said grid electrode, said incandescible cathode together with said grid electrode being adapted to produce an electron picture of increased light intensity, and an electrode at the other end of said envelope on which said last mentioned electron picture is projected.

2. A picture translating tube comprising within an envelope, a photo-cathode at one end of said envelope, a grid electrode provided with a multiplicity of individual minute photoelectric cathodes positioned in a single plane at a distance from said photo-cathode, and adapted to be charged by the primary electrons emitted from said photo-cathode when a light picture is produced upon the same, an incandescible high emission cathode mounted between said photocathode and said grid electrode, said incandescible cathode together with said grid electrode being adapted to produce an electron picture of increased light intensity, an apertured anode at a greater distance from said photo-cathode than said grid electrode and an output anode adjacent and behind, said apertured anode and in axial alignment with the aperture thereof.

3. A picture translating tube comprising within an envelope, a photo-cathode at one end of said envelope, a grid electrode provided with a multiplicity of individual minute photoelectric cathodes positioned in a single plane at a distance from said photo-cathode, and adapted to be charged by the primary electrons emitted from said photo-cathode when a light picture is projected upon the same, an incandescible high emission cathode mounted between said photo-cathode and said grid electrode, said incandescible cathode together with said grid electrode being adapted to produce an electron picture of increased light intensity, and a photocathode screen at a greater distance from said photo-cathode than said grid electrode and in the focal plane of said last mentioned electron picture.

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