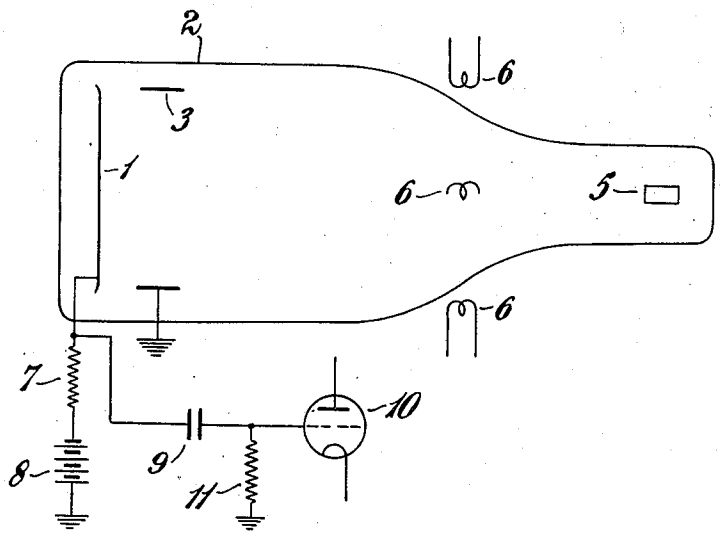
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PICTURE TRANSMITTER

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PICTURE TRANSMITTER

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This invention relates to cathode ray tube television transmitting apparatus of the kind in which there is employed a photo-sensitive screen of the kind exhibiting the photo-electric conduction effect. Such kinds of transmitting tubes are known, but difficulty has been experienced in the past owing to the unsatisfactory properties exhibited in use. Tubes of the kind in question suffer, firstly, owing to the lack of sensitivity, secondly, owing to undue lag in electrical response to varying illumination, and thirdly, due to the so-called "tilting effect." The tilting effect is manifested in the picture signals, obtained when scanning the screen in the well known way under the control of oscillations of saw-tooth wave form, by these signals having super-imposed upon them a saw-tooth wave so that the picture signals generated when scanning a line of constant brightness are such as should correspond to a line having a progressively changing brightness along its length.

There are numerous substances which exhibit the photo-conductive effect, and I have ascertained that improved results are obtained by employing zinc selenide as the photo-conductive material. According to the invention, therefore, a cathode ray television transmitting tube comprises a conductive screen coated with a material exhibiting a photo-conductive effect and which is adapted to receive an image of the object to be transmitted, a cathode ray gun for developing a cathode ray beam, means for causing the beam to scan the screen and an electrode for collecting secondary electrons liberated from the screen, characterised by the fact that the photo-conductive material with which the screen is coated comprises zinc selenide. Various constructions of screens for use with the material stated will be hereinafter described.

In order that the said invention may be clearly understood and readily carried into effect, the same will now be more fully described with reference to the accompanying drawing which illustrates diagrammatically a cathode ray transmitting tube suitable for use with the invention.

In the drawing, the reference numeral 1 indicates a screen which may be made in the manner hereinafter referred to, the screen being disposed within an evacuated envelope 2 of suitable form, and adjacent to the screen is disposed a collecting electrode 3, which serves to collect secondary electrons liberated from the screen when the latter is scanned by a cathode ray beam generated in known manner from a cathode ray gun 5, indicated diagrammatically, the beam being focused by one or more focusing electrodes in known manner. The cathode ray beam is caused to scan the image projected on the screen 1 by suitable means indicated at 6 and comprising coils which generate suitable magnetic fields for deflecting the beam or comprising plates by which electrostatic fields are formed for the same purpose. The arrangement so far described is similar to the construction of a transmitting tube known as an "Iconoscope" with the exception that the mosaic screen of the latter tube is replaced by a screen exhibiting the photoconductive effect. The screen 1 is connected through a resistance 7 and a source of potential 8 to earth and through a condenser 9 to the control grid of an amplifying valve 10, which is provided in the usual way with a leak 11 to earth.

The screen 1 in accordance with the present invention is coated with zinc selenide. The use of zinc selenide as the photo-conductive material enables improved results to be obtained when using a tube such as is shown in the drawing in that the defects hereinbefore referred to are reduced.

In preparing the screen 1, the photo-conductive material, after suitable grinding is deposited upon a metal backing. Usually the metal backing is formed by coating an insulating sheet such as mica with a metallic layer such as platinum deposited by a cathode sputtering process liquid silver (a suspension of colloidal gold and colloidal palladium in a vapourisable medium such as lavender oil) or nickel coated in turn with a thin layer of gold.

The sensitive material may be deposited by spraying sublimation, settling from suspension or by chemical action between suitable substances spread upon the backing surface. It is important that the coating should be uniform and this has been found difficult of achievement with the spraying method, and hence the preferred method is to deposit the material by settling from a suspension in a liquid.

When the screen is prepared by settling from suspension it is preferred to allow the material to settle on to a metal disc instead of on to a metallised piece of mica.

A number of different arrangements are possible. Thus the optical image may be cast upon the side of the screen bearing the sensitive material or the backing may be transparent and the optical image may be cast on the sensitive material through the backing. In the latter case the optical axis of the image projector and the mean

direction of the scanning beam may both be normal to the screen.

Whilst it is found that the use of zinc selenide reduces the defects hereinbefore referred to, it is desirable for the purpose of still further reducing these defects to employ an appropriate potential difference between the screen 1 and the collecting electrode 3, a satisfactory striking velocity of the beam which is dependent upon the potential difference between the screen 1 and the cathode ray gun 5, and sufficient current in the scanning beam.

It is found that over the lower ranges of positive values of the potential difference between the screen 1 and the collecting electrode 3, that is to say, those values in which the collecting electrode is positive with respect to the screen, the sensitivity increases with an increase in such potential difference. Above a certain value, which is about 50 volts, the increase in sensitivity is not pronounced. The lag, however, increases for a given beam current as the potential difference between the screen 1 and the collecting electrode 3 is increased. It is therefore, desirable that such potential difference should have as low a value as possible consistent with satisfactory sensitivity. However, the "tilting" effect is greater with low values of the potential difference between the screen 1 and the collecting electrode 3 than with higher values thereof. For these reasons it is necessary in cases where it is desirable to avoid "tilting" effect whilst at the same time maintaining the lag as low as possible consistent with satisfactory sensitivity, to make a compromise between the values of the potential difference between screen 1 and the collecting electrode 3, which afford optimum individual results. It is found that for such compromise the maximum potential difference is about 50 volts, a potential difference of 5–10 volts being preferred. In the drawing it will be seen that the collecting electrode 3 is at a positive potential with respect to the screen 1 to which is applied negative potential from battery 8 and at a predetermined value a positive pulse will be generated when the screen is scanned, but by arranging the electrode 3 to be at a negative potential with respect to the screen 1 a response in the opposite direction can be generated.

The desired lag can be made substantially zero by maintaining the electrode 3 and the screen 1 at substantially the same potential. For example, by omitting the source of potential 8, the screen 1 can be maintained at earth potential corresponding to the potential of the electrode 3. It will, of course, be appreciated from the above that when lag is reduced to substantially zero, the "tilting" effect correspondingly increases and sensitivity decreases, but such effect in certain cases may not be disadvantageous.

In determining the scanning beam current the following factors must be taken into consideration. It is found that the lag decreases with increase in beam current, at least over a wide range of beam current, and the background disturbance, that is to say, unwanted signals appearing in the picture signal output, increases with increase in beam current. The beam current when using the transmitting tube in accordance with the invention has been found to lie between 1 and 10 microamperes.

With a constant scanning beam current, the lag has been found to decrease with increase in the striking velocity of the scanning beam, such striking velocity as aforesaid being determined by the potential difference between the electron gun 5 and the screen 1. The thickness of the layer of the zinc selenide applied to the screen 1 also to some extent determines the required striking velocity and with a layer having a thickness of the order of one to three times 10^{-4} cms. the optimum striking velocity is found to be about 1–2 kilovolts. Preferable, it should be arranged that the diameter of the scanning spot be larger than the thickness of the coating, and in a case in which scanning is accomplished in 400 lines, the diameter of the scanning spot may be of the order of two to three times 10^{-2} cms. and in such case it will be observed that the coating thickness above-mentioned is small compared with this spot diameter.

I claim:

1. A television system comprising a cathode ray tube having a conductive signal plate having on its surface a non-photoemissive layer of photoconductive material comprising zinc selenide, said tube having included therein a source for producing a concentrated electron beam and an electron collecting electrode located intermediate the signal plate and the electron source, an output impedance conductively connected to the signal plate, means for projecting an optical image upon the photoconductive layer of the signal plate to vary its photoconductivity in proportion to the intensity of the optical image and thereby producing an electrical counterpart of the optical image, means for establishing a substantially uniform normal potential difference between substantially the entire area of the signal plate and the collecting electrode, said potential difference being less than fifty volts whereby an optimum ratio of sensitivity of the photoconductive layer to the lag effect is obtained, means for traversing the area of the photoconductive layer of the signal plate by the concentrated electron scanning beam to scan the electrical counterpart of the optical image as developed on the signal plate and thereby releasing from the signal plate to the collecting electrode secondary electrons in substantial proportion to the light of the optical image at the area scanned, and means for deriving from the output impedance a signal voltage representing the scanned optical image.

2. A television system comprising a cathode ray tube having a conductive signal plate having on its surface a non-photoemissive layer of photoconductive material comprising zinc selenide, said tube having included therein a source for producing a concentrated electron beam and an electron collecting electrode located intermediate the signal plate and the electron source, an output impedance conductively connected to the signal plate, means for projecting an optical image upon the photoconductive layer of the signal plate to vary its photoconductivity in proportion to the intensity of the optical image and thereby producing an electrical counterpart of the optical image, means for establishing a substantially uniform normal potential difference between substantially the entire area of the signal plate and the collecting electrode, said potential difference being less than fifty volts whereby an optimum ratio of sensitivity of the photoconductive layer to the lag effect is obtained, means for focusing the concentrated electron scanning beam at its point of impact on the photoconductive signal plate so that its diameter is greater than the thickness of the said photoconductive layer, means for traversing the area

of the photoconductive layer of the signal plate by the concentrated electron scanning beam to scan the electrical counterpart of the optical image as developed on the signal plate and thereby releasing from the signal plate to the collecting electrode secondary electrons in substantial proportion to the light of the optical image at the area scanned, and means for deriving from the output impedance a signal voltage representing the scanned optical image.

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