

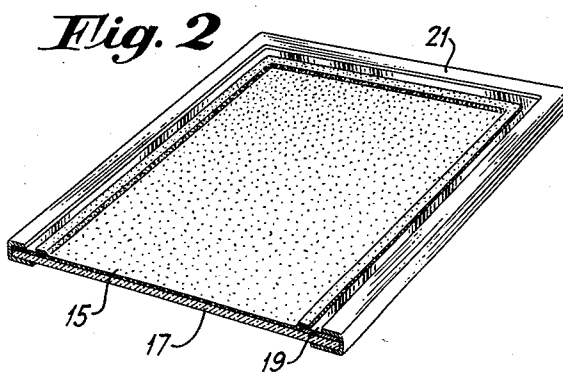
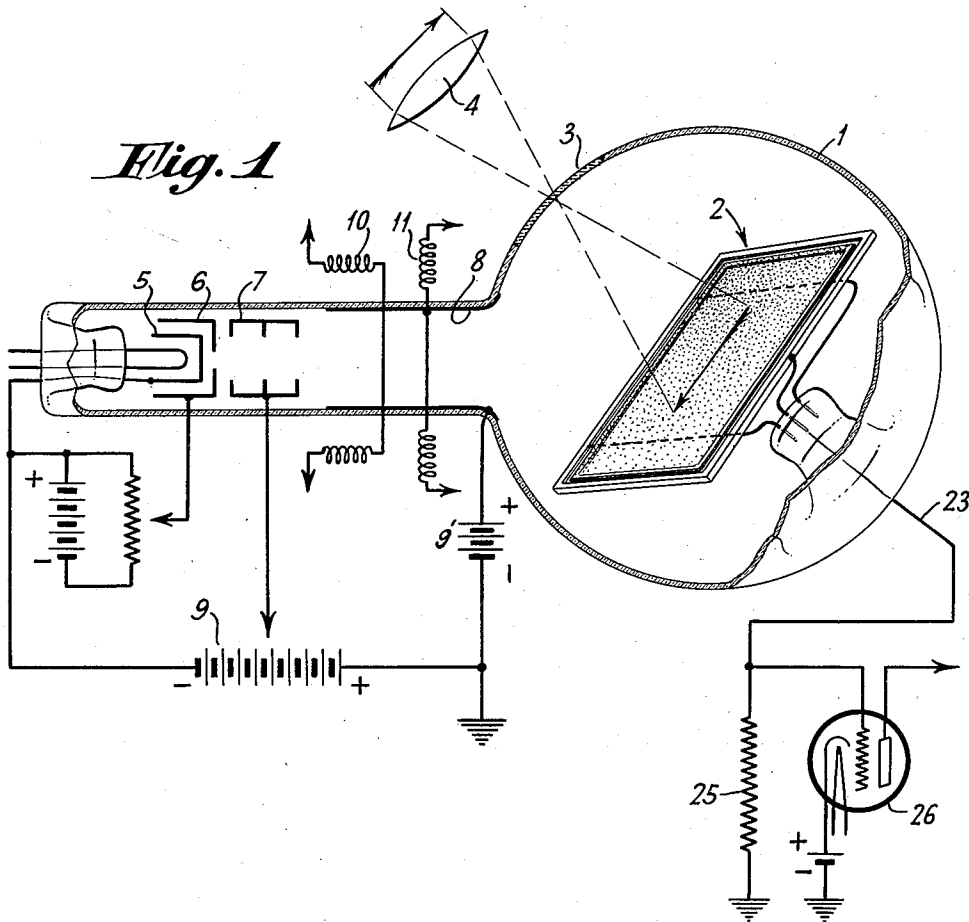
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TELEVISION TRANSMITTING APPARATUS

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TELEVISION TRANSMITTING APPARATUS

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My invention relates to picture or television transmitting apparatus and particularly to cathode ray tubes for transmission of infra-red light images of objects, such as are obtained when objects are viewed through fog and haze.

The transmission of images of objects viewed through fog and haze is difficult and unsatisfactory with the usual form of cathode ray transmitter tube in which an optical image of an object of which a picture is to be transmitted is formed upon the front surface of a target or mosaic electrode consisting in general of an insulating sheet with a great number of discrete photo-electrically sensitive elements on the front surface and a conductive coating on the other surface, the front or illuminated surface being scanned by a cathode ray beam to generate picture signals. The effectiveness of such a transmitter with infra-red light or radiation is limited by the photoelectric properties of available materials. Furthermore, all wavelengths in the infra-red spectrum are not equally effective in passing through fog and haze. Much depends on the particle size of the material in the air which causes absorption or scattering of the light from the object. For light transmission with slight dispersion or attenuation the wave-length of the incident light or radiation from the object viewed must be large in comparison with the particle size. Since much of the attenuation of the light is due to scattering it has been found necessary to use a wavelength on which the light transmission is near unity in order to get sharpness of detail, hence for dense fog the light waves must be at least ten microns long. This wavelength is far outside the range of photo-electric sensitivity of even such a material as caesium.

It is an object of my invention to provide a television device which will produce satisfactory picture signals from infra-red light images, and especially from images of objects viewed through fog and haze. To this end I project an infra-red light optical image on a screen consisting of a thin continuous film of a conductor having high thermo-electric power, and deposited on a support having low specific heat and low heat transmission, and scan the film with a cathode ray beam to generate picture signals, which are electrical impulses representative of the light values of elemental areas of the image. The picture signals may be amplified and applied to a cathode ray type of receiving tube to produce a visible reproduction of the image on the film.

Other objects, features, and advantages of my

invention will appear from the following description taken in connection with the accompanying drawing, in which

Figure 1 is a diagrammatic view illustrating one form of my television device; and

Figure 2 is a diagrammatic view partially in section showing in enlarged detail a portion of the structure shown in Figure 1.

Referring to Figure 1 the tube comprises a highly evacuated envelope or bulb 1 with a tubular arm or neck section enclosing a conventional type electron gun and a spherical section enclosing a flat screen or target 2 so positioned that its front surface may be scanned by a beam of electrons from the electron gun, and also may have projected upon it the image to be transmitted. Since the image is produced principally by infra-red light or radiation having a wave-length of at least ten microns and the usual glasses do not transmit as well as desired wave-lengths greater than three microns, I prefer to provide in the wall of the bulb 1 in registry with the target 2 a window 3 with transmission characteristics such that infra-red rays of the desired wavelength may pass through the window to the target 2. The window may be made of material such as a crystal of potassium chloride, which is capable of transmitting light or energy of the desired wavelength. Other materials, such as quartz, or crystals of rock salt or of fluoride may be used for this purpose, depending on the transmission characteristics desired. The image, if desired, may be focused on the target 2 by a lens system 4 made of similar materials and mounted in front of the window.

The electron gun assembly of the conventional type comprises a cathode 5, a control electrode 6 connected to the usual biasing battery, and a first anode 7 maintained positive with respect to the cathode 5. The electron stream leaving the first anode 7 is accelerated and is also concentrated into an electron scanning beam focused on the front surface of the target 2 by a second anode 8, preferably a conductive coating on the surface of the envelope 1 near the neck of the bulb. The first anode 7 and second anode 8 are maintained at the desired positive potentials with respect to the cathode 5 by batteries 9 and 9'. Conventional deflection means, such as deflection coils 10 and 11 may be used to sweep the beam in a horizontal and vertical plane, respectively, to scan the target. It is obvious that conventional electrostatic deflection plates may be substituted for the deflection coils if desired.

In accordance with my invention, the target or

screen electrode surface which is scanned by the electron beam and on which the image to be transmitted is formed is a very thin continuous film 15 of a conductor of high thermo-electric power such as germanium. Localized potential differences appear in this film as a result of temperature differences in different elemental areas of the optical image on the film surface, and as a result picture signals may be obtained when the surface is scanned by the electron beam.

The target electrode, as best shown in Figure 2, preferably comprises an insulating base 17 of material having low heat capacity and low heat conductivity, such as a thin sheet of mica, preferably about two one thousandths of an inch thick, with the front surface coated with the thin film 15 of germanium which I have found gives good results. Other metals having similar thermo-electric properties, such as antimony, and bismuth may be used for this purpose. These metals have a thermoelectric power greater than 50 with reference to platinum at normal room temperature (20° C.), this value being computed in the generally accepted manner as shown in Table 1 on page 214 of the International Critical Tables, first edition, Volume VI (McGraw Hill, New York city, 1929). To facilitate the electrical connection of the film of germanium on the target electrode to the output circuit the mica base 17 preferably has a strip or border 19 of metal of good electrical conductivity extending around its periphery and over the surface of the base for approximately one quarter inch to electrically engage the film 15 and a metal frame 21 extending around the edge of the mica base and in electrical connection with the strip 19. A lead 23 extending from the frame 21 through the wall of the envelope 1 connects the germanium film 15 through an impedance 25 to the second anode 8.

In making the target electrode, I prefer as the first step to apply the metal border or strip 19 to the edge of the mica sheet 17, which may conveniently be done by painting a border on the mica sheet with liquid compounds of platinum or of silver followed by baking to remove any binder or volatile substances.

The next step in preparing the target electrode is to mask a portion of the metallized border on one side of the electrode, and then coat this side of the mica with the thin film 15 of metal such as germanium having high thermo-electric power. The film should be thin enough to have low heat conductivity, and has a surface in which the change of secondary electron emission with change in film voltage is high. This coating process may conveniently be done in a vacuum chamber containing a tungsten filament coated with aluminum oxide and carrying some of the metal with which the mica sheet is to be coated. By heating the filament the metal is evaporated, and it deposits on the mica as a thin uniform film. The metal film on the mica should be thin enough to have low heat conduction along the surface of the film yet, thick enough to produce appreciable variations in voltage in response to sudden changes in temperature. For example, in a tube made and exhausted by conventional methods of cathode ray tube manufacture, I have used a germanium film which on clear mica was translucent and had a light transmission of about 1% of incident light produced by a tungsten filament at incandescence.

I do not desire to be restricted to any particular theory of operation, but it seems probable that when there is an image or light pattern on the

screen each elemental area of the metallic film reaches a temperature dependent on the incident energy on that area thereby forming a thermal pattern which is a replica of the image or light pattern, and that the ability of an elemental area to emit secondary electrons upon bombardment by a cathode ray depends on the temperature of that area. Under different values of incident energy the elemental areas of the metallic film will reach different temperatures, the rapidity of the change in temperature being determined by the thermal conduction and radiation of the film. In this way different elemental areas of the film become secondary electron emitting to different degrees, determined by the temperature each area attained by reason of the incident energy from the image. The film does not emit photoelectrons and is not photoemissive to any perceptible degree, the electrons which are emitted being secondary electrons emitted only under the influence of the cathode ray beam and controlled in intensity by the thermal pattern generated on the film by the image or light pattern focused or formed thereon. The emitted secondary electrons are collected by the second anode 8, and variations in the secondary electron flow from the film as it is scanned by the cathode ray beam provide the utilization current for the device which flows through the impedance 25 to ground and the second anode 8. The voltage drop produced by the current flow in the impedance corresponds to the picture signals, and may be impressed across the input of the translating device 26, further amplified, and applied to a transmitting network in a manner well known in the art.

From the foregoing description it will be apparent that various other modifications may be made in my invention without departing from the spirit and scope thereof and I desire, therefore, that only such limitations shall be placed thereon as are necessitated by the prior art and set forth in the appended claims.

I claim:

1. An image forming screen for a cathode ray television transmitting tube comprising a thin sheet of material having low specific heat and low heat transmission, and a film of germanium forming a coating on one surface of said sheet.
2. An image forming screen for a cathode ray television transmitting tube comprising a thin sheet of mica, and a translucent film of germanium on one surface of said sheet.
3. An image forming screen for a cathode ray television transmitting tube comprising a sheet of mica approximately two thousandths of an inch in thickness, a translucent film of germanium on one surface of said sheet and a frame for maintaining said sheet coplanar.
4. A cathode ray television transmitting tube comprising an envelope having a light transmitting portion, a sheet of material having low specific heat and low heat transmission, a continuous film of metal having negligible photosensitivity having a thermoelectric power greater than 50 at 20° C. with respect to platinum on one surface of said sheet to produce a thermal pattern in response to a light pattern projected on said film, a lead electrically connected to said film, means for generating a cathode ray beam and scanning said film with said beam, and an anode adjacent said film.
5. A cathode ray television transmitting tube comprising an envelope having a light transmitting portion, a non-photosensitive secondary electron emitting screen of a continuous film of metal

selected from the group consisting of germanium, bismuth, and antimony, and exposed to said envelope portion to produce a thermal pattern in response to a light pattern projected on said film, 5 a lead extending outside the tube and electrically connected to said film, means for generating a cathode ray beam, means for scanning said film with said beam, and an anode adjacent said screen to collect secondary electrons emitted by 10 said screen.

6. A cathode ray television transmitting tube having a light transmitting portion, a sheet of

material having low specific heat and low heat transmission exposed to said portion, a film of germanium on one surface of said sheet to produce a thermal pattern in response to a light pattern projected on said film, a lead electrically connected to said film, an electron gun directed to 5 said film and including an anode adjacent said film for generating a cathode ray beam, and means for scanning said film with said cathode ray beam. 10

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