My invention relates to image dissectors, and particularly to an image dissector designed to teleview moving picture film and operable by infra-red radiation.

Among the objects of my invention are: To provide a simple and efficient image dissector for television use; to provide a more powerful dissector tube for televiewing motion picture film; to provide means for utilizing infra-red radiations in television transmission from moving picture film; to provide means for increasing the power output of dissector tubes; to provide means for utilizing thermionically active material in television dissector tubes; to provide means for adapting dissector tubes to televising scenes which may be intensely illuminated by infra-red radiation; to provide means for analyzing a variable density electron discharge; to provide means for collecting portions of a thermionic discharge having an intensity proportional to the intensity of the infra-red radiations incident upon the area emitting those portions of the discharge.

Briefly my invention comprises utilizing a thermionically active coating as the electron generating surface in a television dissector tube.

Other objects of my invention will be apparent or will be specifically pointed out in the description forming a part of this specification, but I do not limit myself to the embodiment of the invention herein described, as various forms may be adopted within the scope of the claims.

In the drawing, the figure shows a sectional schematic diagram of my invention used in conjunction with a moving picture film to be televised.

The general construction of dissector tubes has been fully explained in my patent application Serial No. 50,119, and in my United States Patent Nos. 2,087,533, 2,100,541, 2,135,149 and 2,153,818, and referred to in various other of my issued and pending cases.

These previous developments in electron image dissectors have been in many cases directed toward the use of photoelectric surfaces to produce photoelectrons. Total picture area currents which may be produced by this method are necessarily small, on the order of a few microamperes, and the production of useful television signals therefore involves considerable amplification.

In the present invention, I utilize as a cathode thermionically responsive material instead of photoelectric material, and have been able to produce within my dissector tube picture area currents of the order of milliamperes, with similar quality of reproduction, and a consequent decreased necessity for amplification of the signal current produced by the tube, because of the greater emission per elementary area.

Due to the nature of infra-red radiations, it is intended that the invention herein described be applied only to those uses wherein the scene to be televised may be subjected to intense heat. The low intensity of infra-red radiation at ordinary temperatures is not sufficient to produce television signals unless special means of high amplification are used, such as those described in my patent application entitled "Radiation frequency converter," Serial No. 65,464, filed February 24, 1936, now United States Patent No. 2,107,782, issued Feb. 8, 1938.

The detailed operation of my invention may be better understood by reference to the drawing.

In the figure is shown a dissector tube 1 schematically arranged to teleview pictures from a motion picture film 2. The dissector tube 1 comprises an evacuated envelope 4 of Pyrex glass or similar insulating and heat resisting material, cylindrical in form, with planar ends 5 and 6. A cup-shaped cathode 7 is formed within envelope 4, covering the planar end wall 6 and extending a short distance along the cylindrical surface of the envelope 4. Cathode 7 is formed of material which is an active emitter of electrons under the influence of infra-red radiations, such as caesium on silver or caesium-silver oxide sensitized to maximum thermionic emission, and it may be opaque to visible light. A connecting stem 8 is sealed into and through cathode 7, whereby electrical connection thereto may be made outside the envelope 4.

Within the dissector tube, near the end opposite cathode 7, is sealed an anode stem 10 projecting diametrically across the tube and supported by a stem 11 extruded from the wall of envelope 4. Anode stem 10 is formed from a closed cylinder of conducting material, having an aperture 12 disposed therethrough in alignment with the axis of tube 1 and facing cathode 7. Lead 14 sealed through stem 11 provides electrical connection to anode stem 10. Within anode stem 10, and supported centrally thereof by glass stem 11, is disposed collecting anode 15, comprising a straight wire of secondarily emissive conducting material such as coated nickel, and extending through the glass supporting stem to form its own connecting lead.

An electromagnetic focusing coil 18 is disposed 55.
about envelope 4 between the cathode and anode members. A current source such as a battery 18 provides the magnetic field necessary to protect the proper degree of focusing of the electron stream emitted from cathode 7 as later described.

Scanning coils 17 and 19, shown schematically, are provided, fed by saw-tooth oscillators 20 and 21 respectively, to properly traverse the electron image past aperture 12, in order to successively scan each elementary area thereof.

A source of infra-red radiation, such as an arc 22, or other suitable means of providing intense radiant energy is disposed behind a condensing lens system 24, shown schematically, in alignment with an aperture guide 25 over which film 2 is traversed by suitable driving means, not shown in the drawing.

Before the irradiated portion of film 2, aligned with arc 22 and the longitudinal axis of the dissector tube, is an objective lens system 26, arranged to focus the infra-red image of film 2 upon the exterior of cathode 7. Additional infra-red lamps 27 and 29 may be focused on cathode 7 to provide a polarizing heat, so that all the energy of the varying infra-red image projected on cathode 7 may be used in the region of maximum sensitivity and emissivity.

Cathode 7 is grounded and the negative lead of a battery 30 is connected thereto. The positive side of battery 30 is connected to anode stem 10, and connection is made through tap 31 on battery 30 and a resistor 32 to the anode 15, so that a difference of potential exists between the anode 15 and anode stem 10, although both are positive relatively to the cathode 7.

In operation, the infra-red source 22 projects an image, focused by lens system 26, of the film 2 upon the back of cathode 7, which thereupon creates an electron image of film 2 by emitting electrons from its entire surface, corresponding in number at each element of area to the strength of the radiation falling thereon. These electrons are attracted toward the anode elements 16 and 15 by the high positive potential thereon. The negative charges on all the elements of the moving stream tend to spread it out, but the magnetic field created by solenoid 16 counteracts the tendency and causes the intensity of each elementary area of the electron image to remain unchanged as the stream passes along the tube toward the anode.

The entire electron stream is deflected by the currents set up in scanning coils 17 and 19 by the saw-tooth oscillators 20 and 21 so that each element of the electrical image may in turn pass aperture 12, and the electrons constituting such elements of the image may enter the aperture and strike anode 15. A larger number of electrons will be emitted from the anode, due to its secondarily emissive qualities, than strike it, and since the anode stem 10 is positive relatively to the anode 15, these secondaries will be attracted to it, and a circulating current flow set up through part of battery 30, through resistor 32, and through anode 15, in addition to the return to cathode 7. The varying charges thus set up on condenser 34 are communicated by lead 35 to suitable transmission circuits, and provide the television signal which may be used to reproduce the image of film 2 in accord with practice known to those skilled in the art.

My dissector tube will also operate with an anode embodiment which acts as a collector only, and does not emit secondaries; in such case, anode 15 may be either negative or positive relatively to the anode stem 10.

Various modifications and different proportions will suggest themselves to those skilled in the art, all within the scope of the appended claims, and it is obvious that my cathode may be used in other types of dissector tubes.

I claim:

1. An electron image dissector comprising an evacuated envelope containing an opaque thermionically emissive cathode, means for differentially heating one side of said cathode, an aperture shielding anode having a collecting anode therein, focusing means adapted to restrain the electronic elements of an image thermionically produced on the opposite side of said cathode in accordance with the heating of the other side to mean rectilinear paths, scanning means adapted to pass successive elements of said image past said anode aperture, means to extract said successive image elements to said collecting anode, and means for utilizing said attracted elements to produce television signals.

2. An image dissector comprising an evacuated cylindrical envelope, an apertured anode therein, an anode within said apertured anode, an opaque thermionically emissive cathode upon one end of said cylinder, means external of said envelope for directing a polarizing radiation upon the envelope side of said cathode, means for focusing an electron image produced on the opposite side of said cathode in accordance with an optical image focused thereon with said polarizing radiation, means for attracting said image toward said anodes, means for deflecting successive elements of said image past said apertured anode, means for collecting said successive image elements upon said anode, and means for utilizing said collected image elements to initiate a television signal.

3. In an image dissector means for producing an electron image comprising an opaque cathode film capable of emitting electrons at a relatively low temperature, means for directing an optical image high in infra-red against one side of said film, and means for withdrawing an electron image from the other side of said film.

4. In an image dissector means for producing an electron image comprising an envelope having deposited on a wall thereof an opaque thin film of a material capable of emitting electrons at a relatively low temperature, means for directing an optical image high in infra-red against the film through said envelope wall, and means for withdrawing an electron image thermionically produced by said optical image from the opposite side of said film facing the envelope interior.

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