

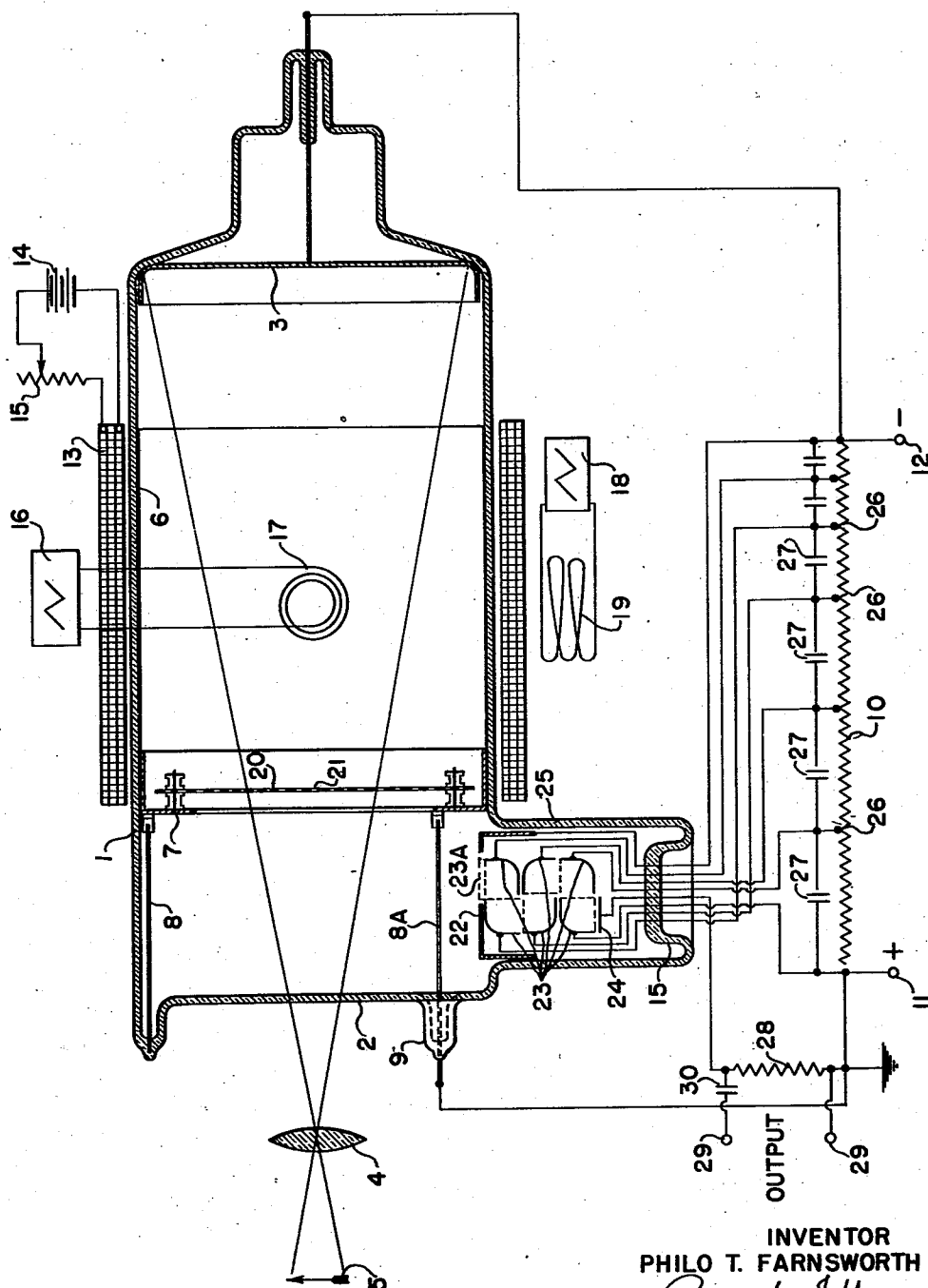
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DISSECTOR TUBE

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DISSECTOR TUBE

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This invention relates to television picture signal generating tubes and particularly relates to signal generating tubes of the image dissector type.

Image dissector tubes conventionally used comprise an evacuated cylindrical envelope having a plane optical window at one end thereof and including a photoelectric cathode adapted to have an optical image focused thereon at the opposite end. Electron-optical lens means are provided for producing an electron image corresponding to at least a portion of the optical image in a plane within the evacuated envelope as well as deflecting means for scanning the electron image in two dimensions. A tubular metallic shield is disposed at the end of the envelope near the optical window between the latter and the photoelectric cathode, and is so arranged that its axis intersects the longitudinal axis of the evacuated envelope. This shield has a minute scanning aperture facing the photoelectric cathode and is positioned in the plane of the electron image. When the electron image is scanned across the scanning aperture, electrons of an elemental area of the electron image corresponding in size to the scanning aperture pass therethrough and enter the space within the tubular shield. Inside the tubular shield there is provided an electron collector disposed either directly in back of the scanning aperture or at the output end of an electron multiplier, which amplifies by secondary emission the electron stream passing the scanning aperture. The electron collector is connected to an output circuit in which a train of television picture signals is developed. Such tubes are well known in the art and their fundamental operating principles are disclosed in the United States Patents No. 1,773,980, No. 1,970,036 and No. 1,968,330 granted to Philo T. Farnsworth.

In the use of such image dissector tubes for transmission of pictures of persons or outdoor scenes, an optical lens system of comparatively short focal length is used which is placed closely adjacent to the optical window of the image dissector tube. Since the tubular shield with the scanning aperture is also close to the optical window it does not cast a shadow upon the photoelectric cathode, although it is disposed in the path of the light, but merely detracts an inappreciable amount of the light focused upon the cathode. However, when using the image dissector tube in connection with a moving picture projector for television transmission of moving picture films, optical lens systems of longer focal length must be used. In such an arrangement

the apertured shield is therefore no longer closely adjacent to the lens system and casts a shadow upon the photoelectric cathode of the dissector tube. It has been proposed to prevent the formation of such a shadow by arranging the dissector tube in such a manner with respect to the optical lens system of the moving picture projector that an angle is formed between the optical axis of the lens system and the longitudinal axis of the dissector tube envelope. However, in such an arrangement portions of the optical image projected on the photoelectric cathode are defocused since the plane of the cathode is no longer perpendicular with respect to the optical axis of the lens system. In addition thereto the shape of the projected image becomes trapezoidal and a distortion of the image, commonly referred to in the art as keystone distortion, is introduced.

Another measure for preventing a shadow to be cast by the apertured shield upon the cathode is to displace the shield laterally so that its axis no longer intersects the longitudinal axis of the dissector tube envelope and is thereby placed outside of the light path. This arrangement, however, has the disadvantage that the electrical and magnetic fields for developing and deflecting the electron image are no longer symmetrical, which gives rise to distortion of the transmitted image.

It is an object of the present invention, therefore, to provide a new and improved image dissector tube suitable for use in connection with moving picture projections for television transmission of moving picture films.

In accordance with the present invention there is provided a television picture signal generating tube comprising an evacuated envelope including a photoelectric cathode so positioned as to have an optical image focused thereon. There are also provided means cooperating with the cathode when energized to produce an electron image corresponding to at least a portion of the optical image in a plane remote from the cathode, and a means disposed in the plane of the electron image and in the path of the light of the optical image for intercepting all but a minute area of the electron image. A means for collecting the electrons of the minute area of the electron image is arranged outside the light path of the optical image to prevent casting of a shadow upon the photoelectric cathode.

For a better understanding of the invention, together with other and further objects thereof, reference is had to the following description, taken in connection with the accompanying

drawing, and its scope will be pointed out in the appended claims.

In the accompanying drawing the single figure shows a schematic diagram of an image dissector tube embodying the present invention, connected in circuit for generation of television picture signals.

Referring now more particularly to the single figure of the drawing, there is provided an evacuated envelope 1 having a plane optical window 2 at one end thereof and including a plane photoelectric cathode 3 at the other end thereof. A lens system schematically indicated at 4 is provided to project an optical image of a moving picture film frame indicated by an arrow 5 upon the photoelectric cathode 3. A portion of the inner wall of the evacuated envelope 1 is provided with a conductive coating 6 having a ring-shaped electrode 7 conductively connected thereto. The ring-shaped electrode 7 is supported by means of supporting rods 8 and 8A, the latter of which is extended to the exterior of the evacuated envelope through a seal 9.

For the purpose of supplying a unidirectional operating potential between the cathode 3 and the anode formed by wall coating 6 and ring-shaped electrode 7, there is provided a voltage divider 10 to whose terminals 11 and 12 a source of unidirectional voltage is connected in the polarity indicated in the drawing.

For the purpose of forming an electron image corresponding to the optical image projected upon the cathode 3, there is provided a magnetic focusing coil 13 concentrically surrounding the evacuated envelope 1 and to which a unidirectional current is supplied by a battery 14, or any other suitable source, by way of a variable resistor 15. In order to effect deflection of the electron image in two dimensions there are provided scanning wave generators 16 and 18 with scanning coils 17 and 19 respectively, all of conventional construction. A diaphragm of light transparent material 20 having a centrally located scanning aperture 21 is disposed in the plane of the electron image and supported by the ring-shaped electrode 7 as shown. The diaphragm 20 can be made of any suitable light-transparent material which is non-permeable to electrons, and preferably comprises a solid sheet of mica or glass provided with a central aperture.

For the purpose of multiplying by secondary-electron emission the electrons passing through the scanning aperture 21, there is provided an electron multiplier comprising a shield 22, a plurality of secondary-electron-emitting electrodes 23 and an electron collector 24. This electron multiplier is housed in a protrusion 25 of the envelope 1. The shield 22, secondary-electron-emitting electrodes 23 and electron collector 24 are held at increasingly positive steady potentials by means of taps 26 arranged on the voltage divider 10, whereby the potential of shield 22 is the same as that of the cathode 3, and the potential of the electron collector 24 is the same as that of the wall coating 6 and electrode 7. Taps 26 are connected by condensers 27 adapted to by-pass the television picture signal frequencies. The opening of the multiplier structure is covered by a screen 23A connected to the second secondary-electron-emitting electrode, thereby producing in cooperation with the shield 22 an electron-optical lens suitable for proper guidance of the electrons into the multiplier.

The output circuit in which a train of tele-

vision picture signals is developed comprises an output resistor 28 connected between the electron collector 24 and the positive terminal of the voltage divider 10, which latter is connected to ground. The television picture signals are developed across a pair of output terminals 29, coupled to the output resistor 28 by means of a coupling condenser 30.

Referring now to the operation of the tube connected in circuit as described, an optical image of the arrow 5, indicating an illuminated film frame of a moving picture film, is projected upon the photoelectric cathode 3 by means of the optical system 4. An electron image corresponding to at least a portion of the optical image is produced in the plane of the diaphragm 20 by the cooperation of the electrostatic accelerating field between the wall coating 6 and ring-shaped electrode 7 and the photoelectric cathode 3, and the coaxial magnetic field produced by the focusing coil 13. The electron image is scanned in two directions across the scanning aperture 21 by means of the magnetic fields developed by the scanning wave generators 16 and 18 with scanning coils 17 and 19, respectively. All but a minute area of the electron image is intercepted by the diaphragm 20, while the electrons of this minute area pass through the scanning aperture 21 into the space between diaphragm 20 and the optical window 2. Electrons striking the inner wall of the optical window 2 charge the same to a negative potential which, when developed, decelerates the electrons passing the scanning aperture 21. The electron-optical lens formed by the electrostatic field due to the potentials of the screen 23A and the shield 22 guides the electrons into the electron multiplier structure in which they impact successive ones of the secondary-electron-emitting electrodes 23 and are multiplied at each impact. The multiplied electron stream is collected by the electron collector 24 and flows through the output resistor 28 across which a train of television picture signals is developed.

From the foregoing it follows that there has been provided an image dissector tube adapted for use with optical lens systems of relatively long focal length which is free from any shadow cast upon the photoelectric cathode by the electron collector and electron multiplier.

While there has been described what is at present considered the preferred embodiment of the invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention, and it is, therefore, aimed in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the invention.

I claim:

1. A television picture signal generating tube comprising an evacuated envelope including a photoelectric cathode adapted to have focused thereon an optical image, means for cooperating with said cathode when energized to produce an electron image corresponding to at least a portion of said optical image in a plane remote from said cathode, means disposed in the plane of said electron image and in the path of the light of said optical image for intercepting all but a minute area of said electron image, and a photoelectron-collecting target disposed within said envelope outside of said light path for collecting the photoelectrons of said minute area of said electron image.

2. A television picture signal generating tube comprising an evacuated envelope including a photoelectric cathode adapted to have focused thereon an optical image, means for cooperating with said cathode when energized to produce an electron image corresponding to at least a portion of said optical image in a plane remote from said cathode, means transparent to light disposed in the plane of said electron image and in the path of the light of said optical image for intercepting all but a minute area of said electron image, and means disposed within said envelope outside of said light path for collecting the electrons of said minute area of said electron image.

3. A television picture signal generating tube comprising an evacuated envelope having an op-

tical window at one end and including a photoelectric cathode adapted to have focused thereon an optical image disposed at the other end thereof, means for cooperating with said cathode when energized to produce an electron image corresponding to at least a portion of said optical image in a plane remote from said cathode, a diaphragm of light transparent material disposed in the plane of said electron image between said optical window and said cathode provided with a centrally located aperture for intercepting all but a minute area of said electron image, and means disposed within said envelope outside of said light path for collecting the electrons of said minute area of said electron image.

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