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CHARGE STORAGE TELEVISION TUBE

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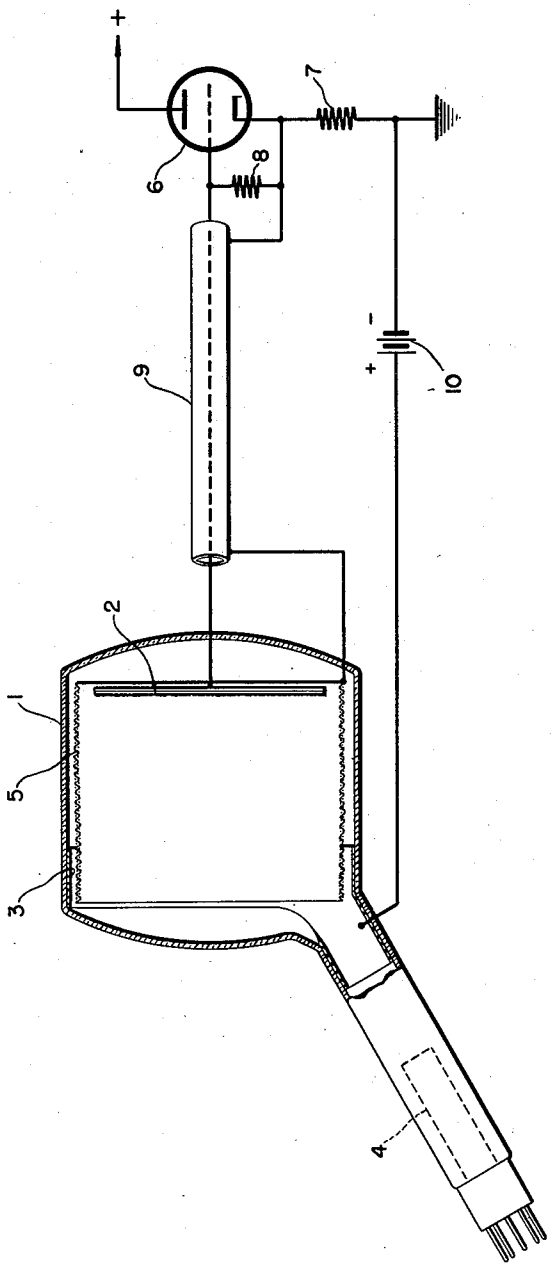

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CHARGE STORAGE TELEVISION TUBE

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5 Claims. (Cl. 178—7.2)

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This invention relates to television transmitting systems and more particularly to systems of this character employing image analyzing tubes of the charge storage type.

In television transmitting systems wherein video signals are generated as representative of a television subject, it is always a problem to generate these signals in such a manner that the signal-to-noise ratio will be as large as possible. Many television transmitting systems employ image analyzing tubes of the charge storage type. Such tubes include the iconoscope, the orthicon and the image-orthicon. In tubes of this character the signal voltages developed in the output circuits thereof, vary approximately directly as the magnitude of the load impedance. However, in generating the video signals, there will also be developed signals generally classed as noise signals which are the result of thermal electron emission. It is known that the thermal noise signal voltages vary approximately as the square root of the load impedance. Therefore, in order to maintain as high a ratio as possible between the video signal voltages and the thermal noise signal voltages, it is the practice to employ a load impedance which has a relatively high value.

However, when a high impedance load circuit is coupled to the output terminals of an image analyzing tube such as an iconoscope, it has been found that the inherent interelectrode capacitance of the tube which exists at the output terminals has a shunting effect upon the load impedance device. As a consequence, the high frequency components of the signal voltages derived from the iconoscope, are attenuated in the output circuit. Usually it is the practice to equalize the frequency response of the device at some subsequent point in the amplifier which is coupled to the image analyzing tube. In order to achieve the overall effect of a relatively high signal-to-noise ratio, it is necessary that the equalization effected have a relatively high order of magnitude, which in a typical case, is approximately 100 to 1. In producing the necessary equalization it has been found that in many instances, the shot noise in the first amplifier stage is sufficiently accentuated to completely mask the thermal noise effects. When this is the case it is seen that the advantage which is sought to be gained by the use of a high impedance load circuit, is largely lost.

In order to overcome these difficulties it has been proposed heretofore to shield the image analyzing tube externally. Such an expedient has been found to be effective to reduce the

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capacitance of the device which exists externally of the tube. However, the external shielding has no effect whatever upon the internal interelectrode capacitance of the tube. This capacitance is represented principally by that which exists between the signal plate of the mosaic electrode and the electron collecting electrode.

It, therefore, is an object of this invention to provide an image analyzing tube of the charge storage type having an electrode structure of such a character to reduce the effective internal capacitance of the tube.

Another object of the invention is to provide an image analyzing tube of the charge storage type having an electrostatic shielding electrode located between the mosaic electrode and the collector.

Still another object of the invention is to provide, in a television transmitting system, a charge storage image analyzing tube in which an electrostatic shielding electrode is interposed between the mosaic electrode and the collector and in which the shielding electrode is coupled to a video signal amplifier in a manner to reduce the effective internal capacitance of the output circuit electrodes of the tube.

In accordance with this invention, there is provided a charge storage type of image analyzing tube having the conventional electrode complement of a mosaic electrode and a collector. The tube is additionally provided with an electrostatic shielding electrode which is pervious to electrons and which is located between the mosaic electrode and the collector. In a preferred form of the invention the shielding electrode has a cylindrical configuration and is arranged in such a manner that the axis of the cylindrical shielding electrode is perpendicular to the plane of the mosaic electrode. Further, in accordance with this invention, the signal plate of the mosaic electrode and the collector are coupled conventionally to the input circuit of a vacuum tube amplifier which may be provided with an impedance device connected in circuit with its cathode. The shielding electrode is coupled to the cathode circuit of the amplifier tube in such a manner as to reduce the effective capacitance between the mosaic electrode and the collector, whereby to enable the development of video signal voltages having a relatively high signal-to-noise ratio.

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

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

The single figure of the drawing is a diagrammatic representation of an illustrative form of the invention.

Having reference now to the drawing, there is shown in diagrammatic form an image analyzing tube of the charge storage type such as an iconoscope 1. The iconoscope is provided with the usual mosaic electrode 2. The mosaic electrode comprises a signal plate upon which is mounted an insulator, such as a mica sheet, on the outer surface of which is formed the photoelectric mosaic structure. Also the tube is provided with the usual collector anode 3 in the form of a wall coating. In the neck of the tube there is provided an electron gun 4 by means of which the mosaic may be scanned for the development of the video signals. In addition the tube electrode structure includes an electrostatic shielding member 5. This electrode may be in the form of a structure of parallel wires or a screen mesh or the like. It preferably has a cylindrical form and is open at, at least, one end. It is placed in the tube in such a manner that the axis of the cylinder is perpendicular to the plane of the mosaic electrode. Futhermore, it is mounted so that it substantially completely isolates electrostatically the signal plate of the mosaic from the collector. Whether it is made of parallel wires or a screen formation is a matter of choice so long as it is pervious to electrons. In this manner, the collector 3 is able to perform its function of collecting electrons emitted by the mosaic electrode 2. It also is necessary that the end of the screen grid 5, which is adjacent to the neck of the tube, is open so that it does not impede the electron scanning beam emanating from the gun 4. The opposite end of the cylindrical screen structure may be open or closed as desired.

The output circuit of the iconoscope is coupled to the signal plate of the mosaic electrode 2 and to the collector 3. In the output circuit of the device there is provided an amplifier tube 6 which has an anode coupled to a source of positive potential as indicated. The control grid and cathode circuits of the tube 6 are coupled to the output terminals of the iconoscope. The cathode of the amplifier tube is connected through an impedance device such as a resistor to ground. A grid leak resistor 8 is connected between the control grid and cathode of the tube 6. The amplifier tube is coupled to the iconoscope by means of a co-axial transmission line 9. The center conductor of the transmission line is connected at one end to the signal plate of the mosaic electrode 2 and at the other end of the control grid of the amplifier tube 6. The outer conductor of the transmission line is connected at one end to the shielding electrode 5 and at the other end to the cathode of the tube 6. A source of collector anode voltage, such as indicated by a battery 10, is connected with its negative terminal to ground and its positive terminal to the collector anode 3.

Referring now to the operation of the illustrative embodiment of the invention, so far as the generation of the video signals is concerned, it functions in a conventional manner. An optical image of the television subject is projected on to the photo-sensitive surface of the mosaic electrode tube and, by means of the electron beam developed by the gun 4, the mosaic electrode is scanned, whereby to successively restore the discrete areas of the electrode to an equilibrium potential. The electrons which are liberated from the mosaic electrode as a result of its scansion by the beam, are collected by the anode 3 in the usual manner.

There are developed video signal voltages between the mosaic electrode 2 and the collector anode 3 which are impressed upon the input circuit of the amplifier tube 6 for amplification and subsequent use as the modulating voltages for a carrier wave. The shielding electrode 5 does not materially impede the flow of electrons from the mosaic electrode of the collector. Nevertheless, by reason of its location in the tube relative to these two electrodes, it serves to electrostatically shield one from the other. As a consequence, the otherwise inherent capacitance between the mosaic electrode and the collector is effectively reduced. As a result, the capacitance which is effectively connected in shunt with the output circuit impedance, is reduced to the point where there is little attenuation of the high frequency components of the generated video signals. The output circuit impedance includes that represented by resistors 7 and 8 and the effective impedance produced by the tube 6 as a result of the degenerative action effected by means of the cathode resistor 7. The value of the output circuit impedance, therefore, may be relatively high so as to realize a more favorable signal-to-noise ratio and yet without rendering the device susceptible to the deleterious effects of attenuating the high frequency signal components. There is no need in such a case to provide in the video signal amplifier for as much equalization of the frequency response as in the case of prior art devices wherein the signals are subject to considerable attenuation of the high frequency components. Shot noise effects present in the amplifier tube 6 are not appreciably accentuated.

It has been found, in a particular instance of a conventional iconoscope not having the shielding electrode structural arrangement in accordance with the present invention, that the capacitance existing between the signal plate of the mosaic electrode and the electron collector, was about 7 micromicrofarads. When such a tube was provided with a shielding electrode in accordance with the instant invention, it was found that the effective capacitance between these two electrodes was reduced to 2.5 micromicrofarads. It should be obvious from these data that an improved tube having incorporated therein the shielding facilities described, is capable of operating in such a manner that video signals may be generated so as to have a much higher signal-to-noise ratio than in previous arrangements.

While there has been described what, at present, is 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, therefore, it is aimed in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. In a television transmitting system, a charge storage image analyzing tube having a photo-electric mosaic electrode and a collector anode, a shielding electrode mounted within said tube between said mosaic electrode and said collector anode, an amplifier tube having an input circuit including a cathode and a control grid,

means coupling said mosaic electrode and said collector anode to said input circuit, and means coupling said shielding electrode to the cathode end of said input circuit.

2. In a television transmitting system, an iconoscope having a photo-electric mosaic electrode, a collector anode spaced from said mosaic electrode, a shielding electrode mounted within said tube between said mosaic electrode and said collector anode, an amplifier tube arranged as a cathode follower and having an input circuit including a control grid and a cathode, means coupling said mosaic electrode and said collector anode to said input circuit, and means coupling said shielding electrode to the cathode of said vacuum tube.

3. In a television transmitting system, an iconoscope having a photo-electric mosaic electrode, including a signal plate, a collector anode in the form of a conducting wall coating spaced from said mosaic electrode, a screen grid electrode having a cylindrical form mounted within said tube surrounding said mosaic electrode and positioned between said mosaic electrode and said collector anode, an amplifier tube having at least a cathode and a control grid, a resistor connected between said cathode and ground, a co-axial transmission line having a center conductor coupling the signal plate of said mosaic electrode and said control grid and an outer conductor coupling said screen grid electrode and said cathode, and a source of potential coupled between said collector anode and ground.

4. In a television transmitting system, an iconoscope having a photo-electric mosaic electrode, including a signal plate, a collector anode in the form of a conducting wall coating spaced from said mosaic electrode, a screen electrode having a cylindrical form mounted within said tube surrounding said mosaic electrode and positioned between said mosaic electrode and said collector anode, an amplifier tube having at least a cathode and a control grid, a resistor connected in circuit with said cathode, a transmission line having a first conductor coupling the signal plate of said mosaic electrode and said control grid and a second conductor coupling said screen electrode and said cathode, and a source of potential coupled between said collector anode and the cathode circuit of said vacuum tube.

5. In a television transmitting system, an iconoscope having a photo-electric mosaic electrode, including a signal plate, a collector anode spaced from said mosaic electrode, a shielding electrode mounted within said tube between said mosaic electrode and said collector anode, an amplifier tube having an anode, a cathode and a control grid, a resistor connected in circuit with said cathode, a source of positive potential coupled to said amplifier tube anode, means including a first conductor coupling the signal plate of said mosaic electrode and said control grid, means including a second conductor coupling said shielding electrode and said cathode, and means including a source of potential coupling said collector anode and the cathode circuit of said vacuum tube.

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