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MEANS FOR OBTAINING A SENSING SIGNAL FOR A SERVO-CONTROLLED COLOR TELEVISION VIEWING TUBE

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Fig. I.

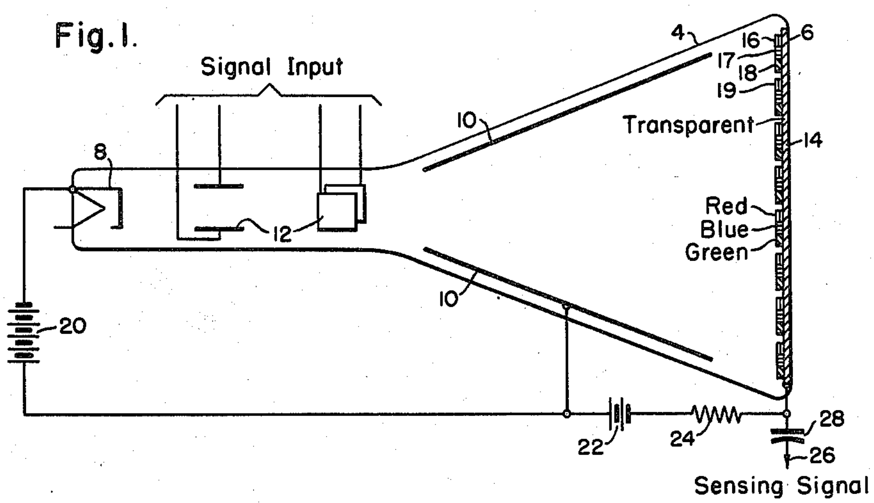


Fig. 2.

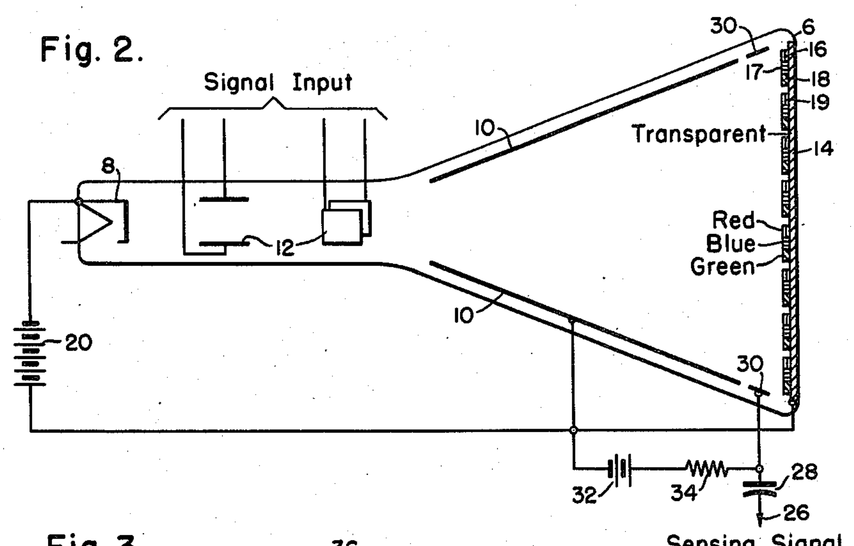
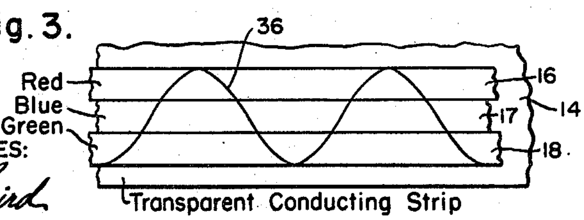


Fig. 3.



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MEANS FOR OBTAINING A SENSING SIGNAL FOR A SERVO-CONTROLLED COLOR TELEVISION VIEWING TUBE

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3 Claims. (Cl. 315—12)

My invention relates to television tubes and, more particularly, to means for obtaining a sensing signal from a phosphor screen of a television tube.

It is an object of my invention to provide an improved color television tube and circuit therefor.

Another object of my invention is to provide a cathode ray tube and circuit producing a reliable sensing signal.

Still another object of my invention is to provide a cathode ray tube having a plurality of strips of phosphor material near an end thereof and having means for producing a change in secondary electron emission when the cathode ray leaves the desired path.

Still another object of my invention is to provide a color television tube having a plurality of phosphor strips whereby the secondary emission from any group of strips is different from the secondary emission of the strips immediately adjacent thereto.

An ancillary object of my invention is to provide means for registering the secondary emission produced in the region of said phosphor strip.

The novel features which I consider characteristic of my invention are set forth with more particularity in the appended claims. The invention, however, with respect to both the organization and the operation thereof, together with other objects and advantages may be best understood from the following description of specific embodiments when read in connection with the accompanying drawing, in which:

Figure 1 is a schematic showing of an apparatus built in accordance with one embodiment of my invention wherein the tube anode serves as the secondary emission collector;

Fig. 2 is a schematic showing of an apparatus built in accordance with another embodiment of my invention wherein a secondary emission collector electrode is provided which is separated from the anode; and

Fig. 3 is a schematic showing of a method of scanning which might be employed in accordance with the embodiments shown in Figs. 1 and 2.

In accordance with my invention, I provide an evacuated envelope 4 having an end plate 6 of transparent material. This end plate 6 comprises the picture area of the tube. At the opposite end of the tube 4 from the end plate 6, an electron gun 8 is provided for producing a stream of electrons. The electron gun is a device well known in the art and will not be described in detail here. Between the electron gun 8 and the end plate 6, there is located inside the tube envelope 4 an anode 10. Between the electron gun 8 and the anode 10 in accordance with principles well known in the art, deflection electrodes 12 are placed so as to effect, in accordance with a signal, a horizontal or vertical acceleration in the electron beam which is produced by the electron gun and accelerated by the field between the electron gun and the anode. By means of the deflection electrodes 12, in accordance with principles well known in the art, the electron beam may be caused to scan the viewing area. Fastened to the inside of the envelope 4 at the viewing end of the tube is a layer of electrically conducting transparent material 14, which covers substantially all of that end of the tube envelope 4. This electricaly conducting transparent material 14 may be any of several materials which are well known in the art, such as the transparent conducting glass produced by Pittsburgh Plate Glass Company under the trade name Nesa. Coated on the inside of the transparent conducting coating 14 are a large number of strips 16, 17, 18 of a phosphor material. In the drawing, only a few such strips are shown, but these strips are meant to be indicative of the organization of the much larger number of strips which would actually be employed in practice. These strips of phosphor material 16, 17, and 18 are organized in accordance with one embodiment of my invention so that a first strip 16 comprises a phosphor material capable of producing red light in response to electrons impinging thereon, such as zinc phosphate:Mn. A second phosphor strip 17 is provided adjacent the first phosphor strip and is capable of producing a blue light when electrons impinge thereon. An example of this second phosphor would be zinc sulfide:Ag. A third phosphor strip 18 is provided adjacent the second phosphor strip which is capable of emitting green light. By way of example, the third phosphor material might be comprised of zinc orthosilicate:Mn. A fourth strip 19 is located parallel to the third strip 18 but separated a substantial distance therefrom so that a strip of the transparent conducting coating 14 is exposed between the third phosphor strip 18 and the fourth phosphor strip 19. The strip of exposed transparent material 14 between the third strip 18 and the fourth strip 19, therefore, has a different coefficient of secondary emission from the coefficient of either the third strip 18 or the fourth strip 19.

In some instances, it may be desirable to employ a mixture of a phosphor and another material such as Ag_2O having a high secondary emission coefficient.

In the embodiment shown in Fig. 1, a high voltage source of potential 20 is connected between the electron gun 8 and the anode 10, and a low voltage source of potential 22 in series with a resistance 24 is connected between the anode 10 and the transparent conducting layer 14. An output terminal 26 for the sensing signal is connected through a condenser 28 to the transparent conducting layer 14.

In the operation of the apparatus shown in Fig. 1, electrons produced by the electron gun 8 are accelerated by the anode 10 so as to impinge on the screen comprising the phosphor strips 16 to 19 and the transparent conducting layer 14. The electrons which have been formed in a beam of small cross-sectional area by the electron gun 8 are deflected by the deflection electrodes 12 in accordance with an input signal so that the point at which the electron beam impinges on the screen is caused to scan the screen. The electron beam is preferably caused to scan the first phosphor strip 16 first and then scan the second phosphor strip 17.

The path of the scanning beam is preferably sinusoidal as, for example, is shown by the curve 36 in Fig. 3. Let us assume now that the third phosphor strip is being scanned. As the beam scans the third phosphor strip 18, it may leave its desired course and move over onto the strip of exposed transparent conducting material between the third phosphor strip 18 and the fourth phosphor strip 19. If this occurs, the number of secondary electrons emitted per unit time will change.

The secondary electrons emitted by the screen are attracted toward the anode 10 since the anode 10 is more positive than the transparent conducting layer 14. These electrons impinging on the anode 10 cause a current pulse between the anode 10 and the transparent conducting layer 14. When the scanning beam ceases to scan the third phosphor strip 18 and starts to scan the strip of exposed transparent material 14, there will be a change in the number of the secondary electrons impinging on the anode 10 per unit time because of the difference in secondary emission coefficients of the third strip 18 and the transparent material 14. This change in the number of secondary electrons striking the anode 10 per unit time causes a change in the current between the anode 10 and the transparent conducting layer 14. A pulse of current is thus produced which changes the output through the condenser 28. Thus, the current pulses which pass out through the condenser 28 comprise a sensing signal which indicates the position of the scanning beam. This sensing signal may then be employed to correct the potenials applied to the deflection electrodes so as to cause the electron beam to change its direction.

In the embodiment shown in Fig. 2 a separate secondary emission collector electrode 30 is provided for collecting the electrons emitted by the screen in response to electrons impinging thereon. The secondary electron collector 30 is connected to the anode 10 through a source of potential 32 and a resistance 34 in series. A change in the number of secondary electrons impinging on the collector electrode 30 will produce a change in the current across the resistance 34. An output pulse is therefore produced which varies in response to variations in the secondary emission.

A system as described herein has a particular advantage—that a very high ratio of sensing signal current to "noise" current may be obtained. For example let us assume that the secondary emission coefficient of the three phosphors which are separated periodically by a strip of exposed conducting material is so chosen that the number of electrons per unit time impinging on the phosphor is equal to the secondary emission electrons leaving the phosphors per unit time. Under these conditions, the current through the conducting layer adjacent the phosphors will be zero when the electrons of the scanning beam are impinging on the phosphor. If the secondary emission coefficient of the exposed conductive strip is any quantity other than one, that is, if either more or less electrons leave the conductive strip per unit time than impinge thereon, a current will flow between the conductive strip and the electron gun. Thus, the ratio of current from the conductive strip to current from the phosphors will be equal to a finite quantity divided by zero. The ratio of the currents is therefore infinite.

In accordance with another embodiment of my invention, the fourth phosphor strip 19 may be composed of the same materials as the first phosphor strip 16. However, the phosphor materials are so chosen that each strip has a secondary emission coefficient when bombarded with electrons, which is susbtantially different from the secondary emission coefficients of the strips immediately adjacent thereto. For example, the third phosphor strip 18 is so chosen that a secondary emission coefficient is substantially different from either the secondary emission coefficient of the second phosphor strip 17 or the secondary emission coefficient of the exposed area of the transparent conducting material 14 located between the third phosphor strip 18 and the fourth phosphor strip 19.

It is understood also that the strip of exposed transparent conducting material 14 could be eliminated and the phosphor strips 16 to 18 so chosen that one of the strips of phosphor, as, for example, the green strip 18, has a different coefficient of secondary emission from the red and blue strips 16, 17. A different pulse would, therefore, be produced when the electron beam impinges on the green strip 18 from that produced when it impinges on the red or blue strips 16 or 17.

Although I have shown and described specific embodiments of my invention, I am aware that other modifications thereof are possible. My invention, therefore, is not to be restricted except insofar as is necessitated by the prior art and the spirit of the invention.

I claim as my invention:

1. In combination, a cathode ray tube having therein near an end thereof a layer of transparent conducting material, a first phosphor strip of a first phosphor material capable of emitting light of a first wave length, a second phosphor strip capable of emitting light of a second wave length adjacent said first strip, a third phosphor strip capable of emitting light of a third wave length in response to electrons impinging thereon adjacent said second strip, a fourth phosphor strip capable of emitting light of said first wave length extending parallel to said third phosphor strip but being separated therefrom by a substantial distance, output means responsive to the secondary emission of electrons produced by bombardment of said phosphors and the area between said third phosphor and said fourth phosphor with high velocity electrons.

2. In combination, a television tube having therein near an end thereof a layer of transparent conducting material, a first phosphor strip on said layer capable of emitting light of a first frequency, a second phosphor strip on said layer capable of emitting light of a second frequency, a third phosphor strip on said layer capable of emitting light of a third frequency, a fourth phosphor strip coated on said layer parallel to said third phosphor strip but separated therefrom by a substantial distance which is capable of emitting light of said first frequency, a secondary emission collector ring located inside said tube near said layer, means for maintaining said secondary collector at a higher potential than said layer, means for obtaining a signal responsive to the rate at which secondary electrons impinge on said secondary collector.

3. A television picture tube comprising an electron gun, an anode, a collector electrode, said collector electrode comprising a transparent conducting material, means for maintaining the potential of said anode above the potential of said collector electrode and said gun, a first strip of phosphor capable of emitting light of a first frequency coated on said collector electrode, a second strip of phosphor capable of emitting light of a second frequency coated on said collector electrode adjacent to said first strip, a third strip of phosphor material capable of emitting light of a third frequency coated on said collector electrode adjacent said second strip, a fourth strip of phosphor coated on said collector electrode parallel to said third strip but separated therefrom by a substantial distance and capable of emitting light of said first frequency, said second phosphor having a different secondary emission coefficient from said first phosphor and said third phosphor, and all of said phosphors having a different coefficient of secondary emission from the coefficient of the region between said third phosphor strip and said fourth phosphor strip, means for obtaining a signal from said anode which is responsive to the rate at which secondary electrons impinge thereon.

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