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CATHODE-RAY TUBE

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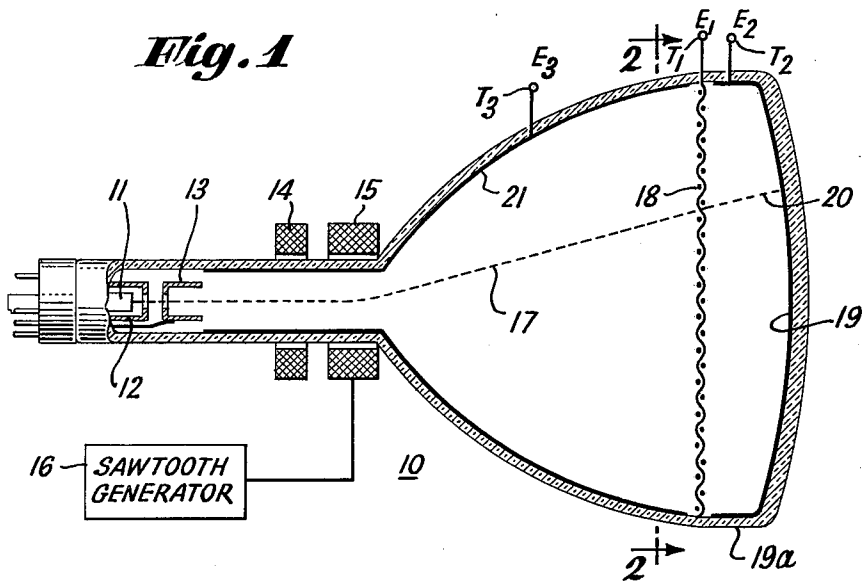
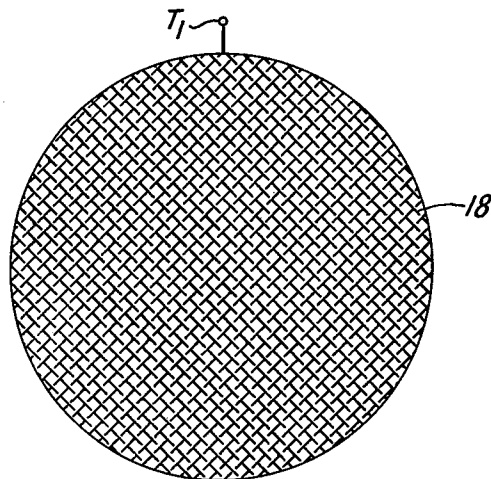


Fig. 2



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CATHODE-RAY TUBE

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This invention relates to cathode-ray tubes.

Conventional cathode-ray tubes, whether they use electrostatic or electromagnetic deflection, require relatively large amounts of power to drive their deflection systems. When these tubes are used in conjunction with efficient electronic circuits, such as those employing transistors, the power required to deflect the electron beam becomes a substantial percentage of the total input power to the equipment. It has been found, for example, that in a transistorized television receiver using a conventional cathode-ray tube about 70% of the total input power is used to drive the deflection system. This has resulted in the need for comparatively heavy batteries which require frequent recharging thereby impairing the usefulness of the receiver.

Accordingly, it is a principal object of this invention to provide an improved cathode-ray tube wherein relatively small amounts of power are required to drive the deflection system.

A further object is to provide a cathode-ray tube in which the brightness of the picture is maintained at a high level although the power needed to drive the deflection system is relatively low.

Another object is to minimize defocusing and changes in picture size resulting from variations in the high voltage supply to the phosphor screen.

Still another object is to provide a cathode-ray tube utilizing post-deflection acceleration which has excellent deflection sensitivity.

The present invention comprises a monochrome cathode-ray tube in which post-deflection acceleration is achieved by placing a wire mesh having high electron transparency between the beam deflection apparatus and the phosphor screen of the tube. The entire wire mesh is maintained at a uniform positive D.-C. voltage having a magnitude substantially lower than that of the D.-C. voltage applied to the phosphor screen. Electrons are emitted in the direction of the phosphor screen by an electron gun assembly and then deflected by an electrostatic or electromagnetic field while being simultaneously accelerated by the positive voltage on the aquadag coating and the wire mesh. Since the voltage on the wire mesh is relatively low, the power required to drive the deflection yoke is proportionally small. After the electrons reach the mesh, they are accelerated toward the phosphor screen by the high voltage existing between the screen and mesh to produce the desired brightness.

The above objects of and the brief introduction to the present invention will be more fully understood and further objects and advantages will become apparent from a study of the following description in connection with the drawing, wherein:

FIG. 1 is a schematic diagram of a cathode-ray tube embodying the invention; and

FIG. 2 is a cross-sectional view of the tube of FIG. 1 showing the surface of the wire mesh.

Referring now to FIG. 1, there is shown a cathode-ray tube 10 having a conventional electron gun assembly consisting of a cathode 11, control grid 12, anode 13, and focusing coil 14. An electromagnetic deflection yoke 15, energized from a sawtooth generator 16, surrounds the neck of tube 10. The current through yoke 15 produces a transverse magnetic field which deflects the electrons emitted by cathode 11 through an angle determined by the magnitude and direction of the yoke

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current. These electrons are accelerated along a path, such as 17, toward a wire mesh 18 having a terminal T_1 maintained at a positive voltage E_1 with respect to the cathode. Wire mesh 18 is mounted perpendicular to the longitudinal axis of cathode-ray tube 10 and is spaced from the screen 19 of the curved cathode-ray tube by a distance which is relatively short when compared with the total length of the tube. The openings in the mesh each have an area approximately equal to the area of the electron beam.

The inside of screen 19 is coated with an aluminized phosphor maintained at a positive potential E_2 by a voltage connected to a terminal T_2 , voltage E_2 having a magnitude several times higher than E_1 . The high voltage produced by the voltage difference E_2 minus E_1 , acting over the region between mesh 18 and screen 19, causes the electrons impinging on mesh 18 to be rapidly accelerated along the path 20 thereby producing a bright spot on the screen 19. A cathode-ray tube screen having a wrap-around conducting cylindrical edge 19a is preferred for this application, since it has been found that the effect of the collimating action of the screen-to-mesh electric field on the deflection of the electron beam is thereby minimized.

Deflection of the electron beam across the screen 19 is obtained by passing a current which increases linearly with time through the coils of the deflection yoke 15. The current in the deflection yoke 15 required to produce a given deflection is approximately proportional to the square root of the accelerating voltage and, therefore, the power used in producing the linear deflection current is directly proportional to the wire mesh voltage E_1 . Thus, by introducing the low potential wire mesh 18 between the deflection yoke 15 and the high voltage screen 19, the electrons are deflected using relatively little deflection coil power. The electrons are then accelerated to high speeds in the region between the screen 19 and wire mesh 18. The ratio of the deflection coil power required with wire mesh 18 in the tube to that required without the mesh is approximately E_1 divided by E_2 . It has been found that excellent performance is obtained with a spacing between mesh 18 and screen 19 of about one inch, a screen voltage (E_2) equal to 12 kv., and a mesh voltage (E_1) of about 4 kv. The power required for deflection under these conditions is about one third of the power required without mesh 18. It shall be understood that the values stated above are merely typical and are not intended to limit the invention in any way.

FIG. 2 is a cross-sectional view of cathode-ray tube 10 showing the surface of wire mesh 18. This mesh, which may be made from woven metal gauze, be produced by electroforming, or punched from a thin stainless steel sheet, is maintained at a uniform potential over its entire surface by the voltage E_1 applied to terminal T_1 . The openings in the mesh are square, the center to center distance being typically about .01 inch. While the size and shape of the openings are not critical, the spacing of the openings should not be so large as to produce discernible patterns or shadows on the phosphor screen 19. In addition, as shown in FIG. 2, the mesh 18 is placed in the cathode-ray tube 10 so that the wires comprising it are at an angle of about 45° with respect to the horizontal scanning axis in order to minimize moire patterns.

I have found that if the voltage gradient between the screen 19 and mesh 18 does not exceed 8 kv. per inch, that the secondary emission from mesh 18 is negligible. Under these conditions, the aquadag coating 21 on the inside of the tube structure may be maintained at the same potential as mesh 18 by connecting terminal T_3 directly to terminal T_1 or by extending the aquadag coat-

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ing so that it electrically contacts mesh 18. If a voltage gradient higher than 8 kv. per inch is applied between the mesh and screen then some secondary emission may occur. In this case the aquadag coating 21 may be operated at a somewhat higher potential than mesh 18 in order to collect stray electrons emanating from the mesh and prevent them from striking phosphor screen 19. In addition, secondary emission may be reduced by coating the wire mesh 18 with graphite. The aluminized phosphor screen 19 may be coated with a suitable substance, such as beryllium, in order to reduce the effect of secondary electrons.

Focusing and deflection both occur in the portion of the tube where the accelerating potential is due to the voltage on the aquadag coating and the wire mesh 18. Variations in the high voltage supply of the phosphor screen 19 have little effect on the picture size and no effect on the focus due to the shielding effect of the mesh 18. It is a relatively simple matter to maintain good regulation of the voltage on mesh 18 since the current drawn by the high transparency mesh is a small percentage of the total beam current.

As many changes could be made in the above construction and many different embodiments could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. A monochrome cathode-ray tube comprising

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- (a) electron beam projecting means mounted at one end of said tube,
- (b) a screen having a phosphor coating located at the other end of said tube, said screen being maintained at a positive potential with respect to said electron beam projecting means;
- (c) electromagnetic deflection means surrounding the longitudinal axis of said tube, said electromagnetic deflection means being mounted adjacent said electron beam projecting means,
- (d) a conductive coating affixed to the inner surface of said tube, said conductive coating being spaced from said screen and extending toward said electron beam projecting means, and
- (e) a single conducting mesh mounted between said screen and said conductive coating, said conducting mesh having its surface substantially perpendicular to the longitudinal axis of said tube.

2. Apparatus as defined in claim 1, wherein said conducting mesh comprises first and second groups of spaced parallel conductors, said first and second groups of conductors being arranged perpendicularly to each other and being conductively joined to form an equipotential surface.

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