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DISTRIBUTOR TUBE CONSTRUCTION

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Fig. 1.

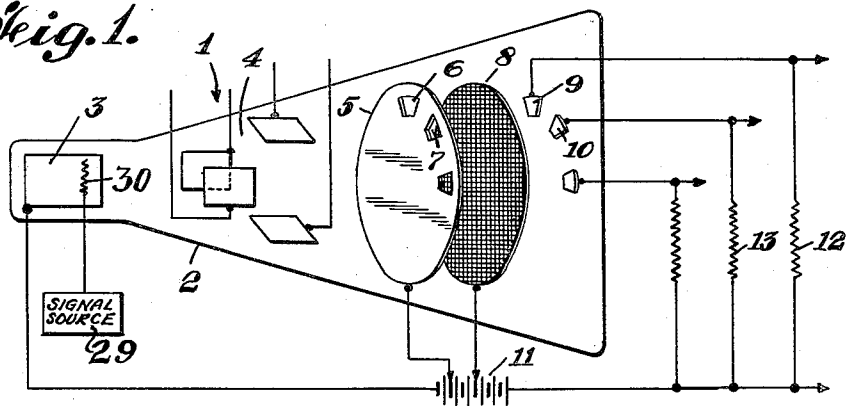


Fig. 2.

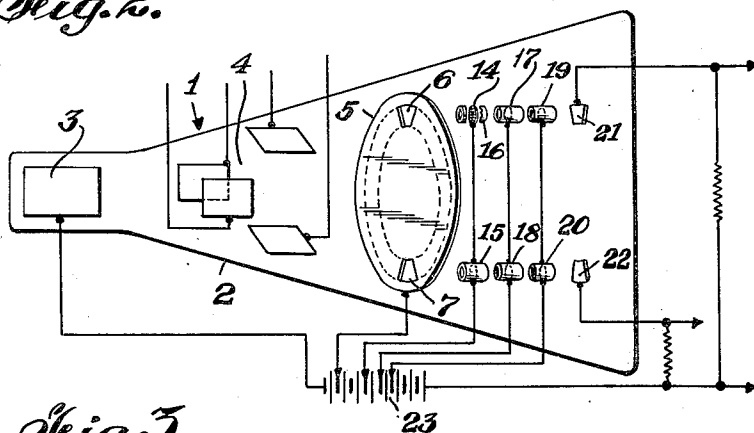
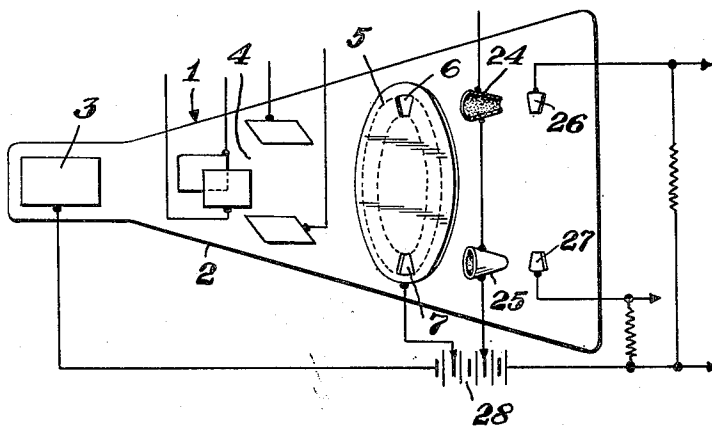


Fig. 3.



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DISTRIBUTOR TUBE CONSTRUCTION

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12 Claims. (Cl. 315—12)

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This invention relates to distributor tube construction particularly the type using secondary electron emissive electrodes.

Heretofore, there has been proposed cathode ray tube distributors in which the beam is deflected to pass through openings in an aperture plate and strike secondary emissive target elements, the aperture plate itself serving as the collector. The aperture plate also serves to collect primary electrons of the beam when they are not being directed through the apertures in said plate toward the target electrodes to thus prevent unwanted secondary emission and other undesirable effects in the tube. Since the aperture plate serves as the collector for secondary electrons emitted from the target elements, the aperture plate is at a higher positive potential than the target elements, thus producing a field which is in a reverse direction and opposes the flight of the primary electrons in the beam towards the target elements. Likewise the secondary electrons also move in a direction to produce a similar reverse field. These fields under certain circumstances, may be sufficiently great to prevent at least a part of the electron beam from passing through the aperture plate thus causing skipping or may result in a defocussing of the electron beam with danger of cross-talk as other deleterious effects, before it passes through said plate.

An object of the present invention is the provision of an improved distributor tube of the cathode ray type using secondary electron emission electrodes, particularly one avoiding the foregoing defects.

In accordance with a feature of the present invention, the aperture plate is used solely as a shield with a single or plurality of secondary electron emitting electrodes arranged behind the apertures and the collector electrodes arranged behind the secondary emitting electrodes. Consequently when proper voltage is applied to said device, the fields are such as to accelerate the primary electrons causing them to pass readily through the aperture plates and to remain focussed. Additional means are employed in accordance with another feature of the present invention to prevent the secondary emitting electrons from interacting in the various channels.

The above-mentioned and other features and objects of this invention will become more apparent and the invention itself, though not necessarily defined by said features and objects, will be best understood by reference to the following description of embodiments of the invention

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taken in connection with the accompanying drawings, wherein:

Fig. 1 is a schematic diagram of a distributor tube embodying my invention, indicating the application of the potentials to the secondary emitting and collector electrodes; and

Figs. 2 and 3 are schematic diagrams of modified forms of a distributor tube embodying my invention.

Referring now to Fig. 1, the distributor tube 1 may include an evacuated envelope 2, within which is arranged an electron gun 3 for producing an electron beam which is preferably deflected by means of a set of deflection plates 4. An aperture plate 5 is arranged in front of the beam and preferably has a plurality of apertures 6, 7, etc. which are so arranged that as the beam is deflected, it passes from one aperture to the other. The apertures may be arranged in a circle and the beam may likewise be deflected in a circle by applying suitable voltages to the deflection plates such as for example, by applying voltages of the same frequency but 90° out of phase separately to the horizontal and vertical deflection plates respectively. Behind the aperture plate 5 may be mounted a foraminous member, for example in the form of a screen 8, which is suitably coated with a high ratio secondary electron emitting material so as to form a secondary emitting electrode and adapted to emit electrons when the beam passes through the aperture plate and strikes portions of the surface thereof. On the other side of the screen 8 opposite the side on which the aperture plate is arranged, are mounted a plurality of collector electrodes or anodes 9, 10, etc., each of said anodes being aligned with one of the apertures in aperture plate 5. Thus for example, anode 9 is aligned with aperture 6 and anode 10 is aligned with aperture 7. When the beam passes through aperture 6, it strikes the screen 8 giving off secondary electrons which are collected by anode 9, the spacing between the anodes being such that anode 10 will pick up substantially none of these electrons.

The anodes 9 and 10 are maintained at higher positive potentials than the screen 8 in order that the emitted secondary electrons be collected by said anodes. This is indicated by the connection of source 11 with its positive side to the anode and its negative side to the screen. Each of the anodes is connected to the source 11 through separate resistors 12, 13, etc.

Referring to Fig. 2, instead of a single screen 8 behind the aperture plate 5, there is provided

a plurality of screens 14, 15, etc., equal in number to the number of apertures, the number of collecting anodes, and the number of distributing channels. Each of the screens 14, 15, etc., is surrounded by a shield which may be in the form of a cylinder 16, the cylinder 16 serving to focus and direct the secondary electrons in a line and prevent them from moving out of the path assigned to their channel. To produce higher amplification, additional screens such as 17, 18, etc., may be arranged behind screens 14, 15, etc., in line therewith so as to be struck by the secondary electrons emitted by the first row of screens including 14, 15 and to emit a greater amount of electrons. Screens 17, and 18 etc., are likewise surrounded by shields similar to cylinder 16. Additional rows of screens, as many as are found practicable, may likewise be arranged behind screens 17 and 18 in line therewith, as indicated at 19 and 20, all of the screens are coated with a suitable secondary emissive material. Collector anodes 21, 22, etc., are arranged in line with their associated screens. Because of the concentration of the secondary electrons due to the shields, the tendency toward cross-talk is reduced. High amplification is obtained because of the number of secondary emitting electrodes aligned with each aperture in the aperture plate each adding to the total output current reaching each anode. Proper direct current potentials are applied from any suitable source 23.

While in the foregoing two distributor tubes, screens coated with secondary emissive materials have been utilized, it will be apparent that other secondary emitting arrangements may be employed. For example, referring now to Fig. 3, there is arranged behind the aperture plate 5 a plurality of aligned hollow truncated cones or funnels 24, 25, etc., equal in number to the number of apertures as for example, with cones 24 and 25 aligned with apertures 6 and 7 etc. The inner surfaces of the truncated hollow cones are coated with a suitable high ratio secondary emitting electron material adapted to be impinged upon as the beam passes through the apertures of said plate 5 and causing the emission of secondary electrons which are picked up by anodes 26, 27, etc., one for each of the channels, each anode being aligned with its secondary emitting cone. Suitable potentials are applied as indicated from any suitable source 28 so as to cause the secondary electrons to pass from the rear end of the cone toward the anode.

It will be seen, in each of the embodiments shown, that the field is in a direction such as to accelerate the primary electrons so that there is no difficulty in regard to the primary electrons passing through their aperture. The primary electron beam is not defocussed but tends to be maintained in focus because of the direction of the field. Signals to be distributed may be applied from a signal source 29 to the grid 30 in the gun 3 and the distributed outputs are taken from output resistors 12, 13, etc.

While I have described above the principles of my invention in connection with specific apparatus, and particular modifications thereof, it is to be clearly understood that this description is made only by way of example and not as a limitation on the scope of my invention.

I claim:

1. A distributor tube construction comprising an evacuated envelope having mounted therein means for producing an electron beam, means

for deflecting said beam along a path defining a given closed curve, beam control means positioned to intercept the beam intermittently along its closed path to pass said beam only at predetermined deflection angles, secondary electron emitting means mounted for impingement by the beam passed at said angles and a plurality of separate mutually spaced output anodes each mounted in an array having a shape similar to that of said closed curve to receive secondary emitted electrons from said secondary electron emitting means as the beam reaches a corresponding one of said angles.

2. A distributor tube construction according to claim 1 wherein said beam control means is mounted between the beam producing means and the secondary electron emitting means.

3. A distributor tube construction according to claim 1 wherein said secondary emitting means is mounted between said anodes and said beam control means.

4. A distributor tube construction according to claim 1 wherein said beam control means is mounted between the beam producing means and secondary electron emitting means, and said secondary emitting means is mounted between said anodes and said beam control means.

5. A distributor tube construction according to claim 1 wherein said secondary electron emitting means is comprised of a metallic foraminous member coated with high ratio secondary electron emitting material and having the anodes mounted adjacent thereto to different portions of the surface thereof.

6. A distributor tube construction according to claim 1 wherein said secondary electron emitting means is comprised of a plurality of screens each aligned with one of said anodes.

7. A distributor tube construction according to claim 1 wherein said secondary electron emitting means is comprised of a plurality of funnel-shaped members each mounted in front of one of said anodes and having the interior surface thereof coated with a high ratio secondary electron emitting material.

8. A distributor tube construction comprising an evacuated envelope having mounted therein means for producing an electron beam, means for deflecting said beam along a generally circular path, an aperture plate mounted to intercept the beam intermittently and having a plurality of circularly disposed apertures therein through which the beam passes as it is deflected over the apertured plate along said circular path, secondary electron emitting means mounted in line with the apertures and adapted to be impinged upon by the primary electrons of the beam as they pass through said apertures, and a plurality of anodes mounted in a generally circular array behind said secondary electron emitting means and each aligned with one of said apertures and adapted to collect the secondary electrons emitted by said secondary electron emitting means in response to the passage of said beam through a corresponding one of said apertures.

9. A distributor tube construction according to claim 8 wherein said secondary electron emitting means is comprised of a screen coated with high ratio secondary electron emitting material, and mounted between said anodes and said apertured plate.

10. A distributor tube construction according to claim 8 wherein said secondary electron emitting means includes a plurality of rows of screens, each row consisting of a plurality of small screens

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each aligned with one of the apertures, each of the screens coated with a high ratio secondary electron emitting material.

11. A distributor tube construction according to claim 8 wherein said secondary electron emitting means includes a plurality of rows of screens, each row consisting of a plurality of small screens each aligned with one of the apertures, each of the screens coated with a high ratio secondary electron emitting material, and further including shielding means arranged around each of said screens to prevent the secondary electrons from moving out of the path leading to their corresponding anode.

12. A distributor tube construction according to claim 8 wherein said secondary electron emitting means is comprised of a plurality of funnel-shaped hollow members each having their interior surface coated with a high ratio secondary electron emitting material with the larger end of

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each funnel facing toward the corresponding aperture of said plate and the smaller end facing toward the associated anode.

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