

Aug. 5, 1941.

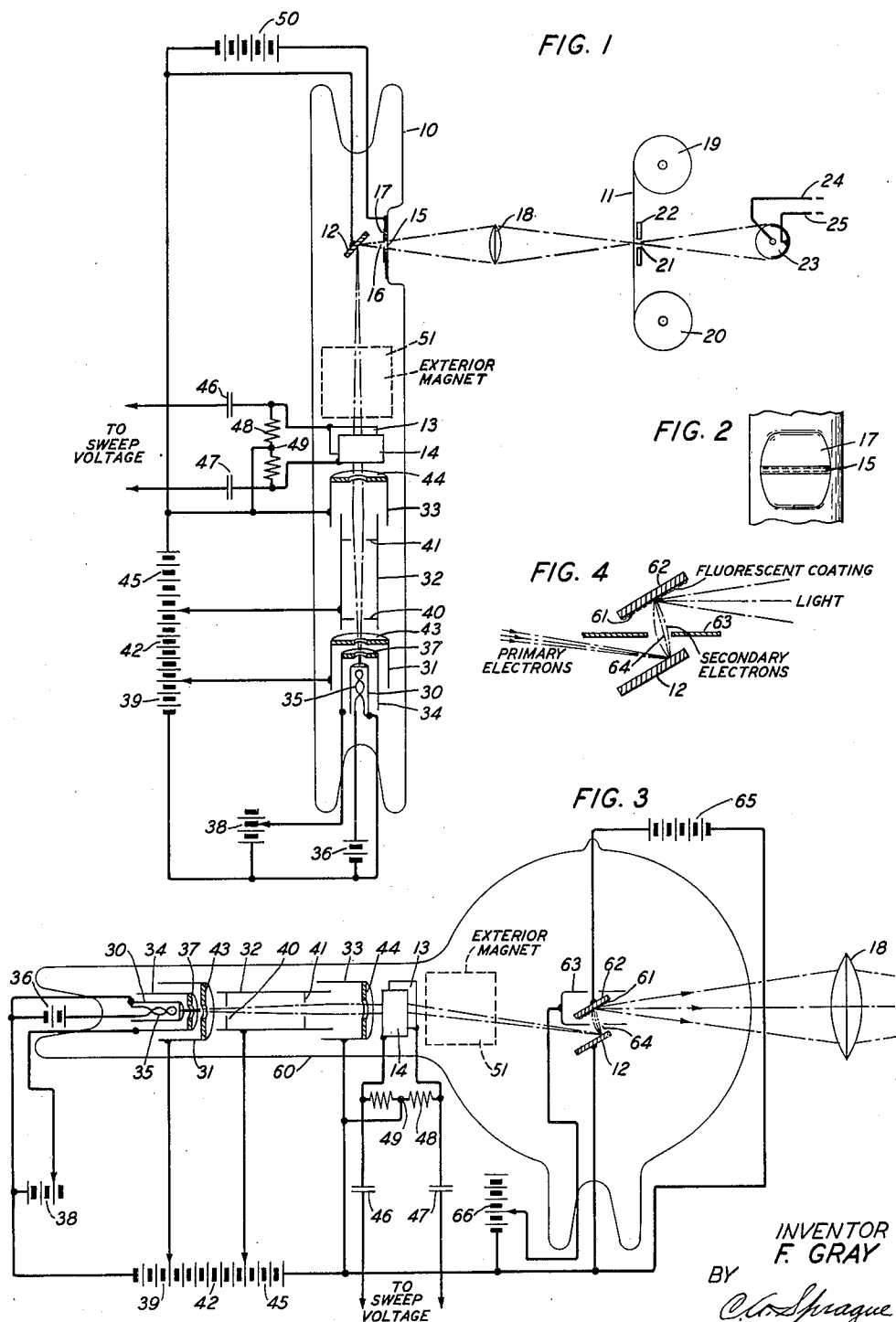
F. GRAY

2,251,332

CATHODE RAY DEVICE

Filed March 31, 1938

2 Sheets-Sheet 1



INVENTOR
F. GRAY

BY
C. C. Sprague
ATTORNEY

Aug. 5, 1941.

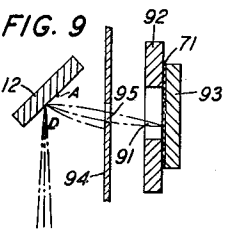
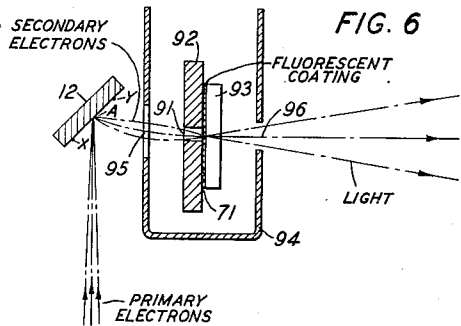
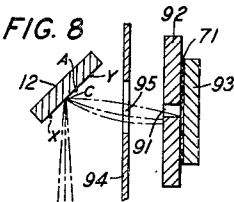
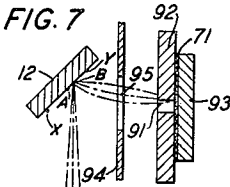
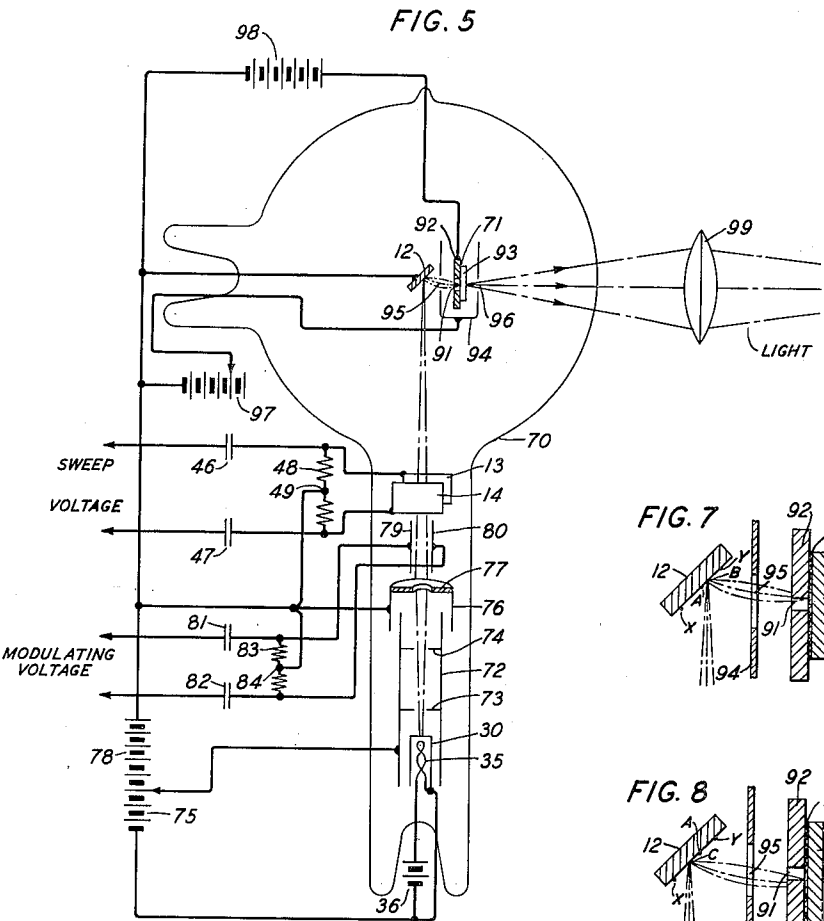
F. GRAY

2,251,332

CATHODE RAY DEVICE

Filed March 31, 1938

2 Sheets-Sheet 2



INVENTOR
F. GRAY
BY
C. Sprague
ATTORNEY

UNITED STATES PATENT OFFICE

2,251,332

CATHODE RAY DEVICE

Frank Gray, New York, N. Y., assignor to Bell
Telephone Laboratories, Incorporated, New
York, N. Y., a corporation of New York

Application March 31, 1938, Serial No. 199,192

23 Claims. (Cl. 250—27)

This invention relates to electro-optical devices and more specifically to cathode ray tubes in which secondary electrons are generated and utilized.

A cathode ray tube is known in which a beam of primary electrons impinges upon a target to cause the emission of secondary electrons which are formed into a beam and caused to scan a fluorescent screen. The present invention in certain aspects relates to an improvement in devices of this character.

It is an object of this invention to provide novel and useful forms of cathode ray tubes of the type utilizing a beam of secondary electrons generated by the cathode beam and methods of and means for controlling and utilizing such beams of secondary electrons.

In accordance with the invention, in one embodiment thereof, shown by way of example, there is provided a cathode ray device comprising an electron gun for generating a beam of primary electrons, a target in the path of the beam which is made of or has a coating of material which will emit secondary electrons when bombarded with primary electrons from the beam, this target being mounted at an angle with respect to the axis of the electron gun, a pair of deflecting plates for causing the beam to pass over the successive elemental areas of an elemental line of the target, and a fluorescent screen in a plane parallel to the axis of the primary electron gun and closely adjacent the target, said screen being positively polarized with respect to the target by means of a source of potential which is connected to a metallic coating on the screen, the coating having an elongated aperture therein. Secondary electrons are attracted by the metallic coating to cause the successive elemental areas of an elemental line of the screen adjacent the aperture in the metallic coating to fluoresce, thus providing a moving source of light for scanning successive elemental areas of a moving picture film. Due to the fact that the beam is deflected while it is moving at low velocity, only relatively small deflecting voltages are required. An intense beam can be attained at the fluorescent screen if the target is formed of or coated with a material which emits a number of secondary electrons for each primary electron bombarding it and if the metallic coating on the screen is placed at a high positive potential with respect to the target. If the target and screen are close together, no electron lens system is required to focus the secondary electron beam other than the slitted

metallic coating which acts as an accelerating electrode. The intensity of the secondary electron beam may be controlled by varying the voltage applied between the cathode of the electron gun and a control cylinder surrounding the cathode.

In a modification of the above embodiment the fluorescent screen is mounted on a glass member located parallel to the secondary emitting target and in such a position that the axis of the light emitted from the fluorescent screen substantially coincides with the axis of the primary electron gun. The screen member is preferably shielded from the secondary emitting target by a metallic member having an aperture therein through which the secondary electrons pass on their way to the fluorescent screen. In order to cause the axis of the emitted wedge of light to coincide with the axis of the electron gun, an exterior magnet is used to give a preliminary deflection to the beam of primary electrons.

In another embodiment of this invention, the primary electron beam is modulated by deflecting it in a direction transverse to the scanning direction in order to control the number of secondary electrons which pass through the aperture in the shield surrounding the composite screen consisting of a slitted metallic plate and a glass member having a fluorescent coating thereon.

The invention will be more readily understood from the following description taken in connection with the accompanying drawings forming a part thereof in which:

Fig. 1 shows an electro-optical device for scanning a moving picture film for television transmission embodying a cathode ray tube utilizing secondary emission of electrons;

Fig. 2 is a view looking toward the fluorescent screen of the cathode ray tube of Fig. 1;

Fig. 3 shows a modification of the device shown in Fig. 1;

Fig. 4 is an enlarged view of a portion of the tube shown in Fig. 3;

Fig. 5 shows another cathode ray tube employing secondary emission in which a different method of modulating the primary electron beam is used;

Fig. 6 is an enlarged view of the target portions of the cathode ray tube shown in Fig. 5; and

Figs. 7 to 9, inclusive, show the relationship between the secondary electron beam and the target portions shown in Fig. 6.

Referring more particularly to the drawings,

Fig. 1 shows a cathode ray device 10 for scanning a moving film 11 for television transmission. The device 10 comprises a gas-tight container enclosing an electron gun for producing a moving beam of primary electrons and for focussing and accelerating this beam toward a target 12 which is mounted in the end of the tube 10 remote from the electron gun, and means such as a pair of deflecting plates 13, 14 for deflecting the beam along a predetermined linear path of the target 12. In a wall of the tube there is a layer of fluorescent material 15 which is entirely covered, with the exception of a narrow linear gap 16, by a coating 17 of metallic material. If desired, the fluorescent material 15 may fill only the gap 16 and the metallic coating be arranged adjacent the wall of the tube. External to the tube 10 is mounted a suitable lens system, which is represented by way of example as a single convex lens 18, for focussing an image of the linear fluorescent screen 15 upon the moving film 11 which is caused to move in a direction transverse to the movement of the light beam on the fluorescent strip 15 by means of reels 19 and 20 actuated by suitable driving mechanism (not shown). The moving beam of light from the screen 15 passes through the aperture 21 in the mask 22, after having been modulated by the light-tone values of the successively scanned elemental areas of the object on the film 11, to a photoelectric cell 23 which is connected by terminals 24, 25 to any appropriate television transmission circuit (not shown).

The electron gun arrangement in the tube 10 comprises a cathode 30, a first anode 31, a second anode 32, and a third anode 33. Between the cathode 30 and the first anode 31 and directly surrounding the cathode 30 is placed a control element 34.

The cathode 30 is heated by a heater element 35 which is supplied with heating current from a source of direct potential 36. The cathode 30 is preferably coated with a thin layer of electron emissive material.

The control element 34 preferably comprises a cylindrical member having an apertured diaphragm 37 opposite the end of the cathode 30 near the first anode 31. The control element 34 is preferably placed at a negative potential with respect to the cathode by an adjustable source of direct potential 38.

The first anode 31 comprises a cylindrical member having an apertured disc 43 at the end thereof remote from the cathode 30. The first anode 31 is placed at a potential which is positive with respect to that of the cathode by means of a suitable source of direct potential 39.

The second anode 32 preferably comprises a metallic cylindrical member having two apertured diaphragms 40 and 41 therein. The second anode 32 is placed at an appropriate positive potential with respect to the potential of the first anode 31 by means of a source of direct potential 42.

The third anode 33 comprises a cylinder having an apertured diaphragm 44 therein. This anode is placed at a positive potential with respect to the potential of the second anode 32 by means of the source 45. The relative potentials of the three anodes and of the cathode and control member, and the spacings and aperture sizes thereof are so chosen that the electrons are focussed into a fine spot at the target 12.

This beam of primary electrons is caused to move back and forth in a line at right angles to

the plane of Fig. 1 by means of a sweep voltage applied between the pair of plates 13 and 14. This sweep voltage, preferably from a saw-toothed wave form generator (not shown), is applied to the plates by means of coupling condensers 46 and 47. A high resistance 48 is connected between the plates, the mid-point 49 of which is connected to the third anode 33. Any suitable saw-toothed generator may be used but it is preferable that it be a generator of a balanced sweep wave. Such a generator and the advantages thereof are disclosed in Patent 2,178,464, issued October 31, 1939, to M. W. Baldwin, Jr. By applying a balanced sweep voltage to the balanced circuit comprising capacities 46 and 47 and the resistance 48, the mid-point of which is connected to the anode 33, defocussing of the beam by the sweep voltage is prevented.

A source of potential 50 is applied between target 12 and the conducting coating 17 in such a manner that the coating 17 is placed at a high positive potential with respect to that of the target 12. This causes the secondary electrons emitted from the target 12 to be accelerated toward the aperture 16 containing the fluorescent material 15. Thus, if the primary beam is caused to scan a single line of the target 12, the secondary "beam" scans the linear fluorescent screen 15, thus generating a moving beam of light which is focused by the optical system 18 upon the moving film 11. The film 11 is either moved continuously, in which event the screen is scanned on a slight bias to take account of the movement of the film or else proper gear movement is provided to cause the film 11 to move intermittently between successive scanings of the various elemental lines. The light from the screen 15 is thus modulated by the tone values of the successively scanned elemental areas of the film 11 and directed upon photocell 23 or other appropriate pick-up device where it is converted into image signals which may be conducted by means of lines 24 and 25 to an appropriate output circuit which includes biasing means for the photocell anode.

In order to direct the secondary beam to the approximate center of the screen 15, an exterior magnet 51 may be used. This magnet shifts the position of the scanning path of the primary beam on the angularly arranged target 12 and thus shifts the secondary beam along the axis of the tube.

Referring now to the modification shown in Figs. 3 and 4, the means for forming and deflecting the electron beam in the tube 60 of Fig. 3 are similar to those in the tube 10 of Fig. 1. In Figs. 3 and 4, however, the target and screen are modified so that the axis of the wedge of light emitted from the fluorescent screen 61, which is coated or otherwise mounted on a base member 62 of metal, substantially coincides with the axis of the primary electron gun. The target 12 is displaced from the axis of the primary electron gun in order that the center line of the fluorescent screen 61 may lie on this axis. The primary beam is deflected upon the target 12 by means of the exterior magnet 51. The metal plate 62 is placed at a high positive potential with respect to the potential of the target 12 by means of source 65 and the shield 63 is placed at a potential somewhere between that of the target 12 and the plate 62 by means of a source 65. The region surrounding the aperture 64 in the shield 63 thus serves to define a cylindrical electron lens which

focuses the secondary electrons emitted from the target 12 to a spot on the fluorescent coating 61. This spot gives rise to a moving light beam which is focused by means of the lens system 13 as in and for the purpose of the arrangement shown in Fig. 1.

In the tube 70 shown in Fig. 5 the intensity of the secondary beam impinging upon the fluorescent screen 71 is modulated in accordance with the deflection imparted to the beam of primary electrons. For this reason the electron beam forming and deflecting systems are slightly different from those shown in Figs. 1 and 3. Due to the fact that the electron beam is modulated by deflecting the primary electrons, the primary electron gun is simplified by the removal of the control element 34 and the first and second anodes are combined into a single cylindrical structure 72 which comprises the first anode of the gun in Fig. 5. This cylinder 72 has apertured diaphragms 73 and 74 therein and a portion of the cylinder surrounds the cathode 30. The first anode is placed at a positive potential with respect to the cathode 30 by means of the source of potential 75.

The second anode 76 comprises a cylinder having an apertured diaphragm 77 therein. This anode, which is similar to the third anode 33 in Fig. 1, is placed at a positive potential with respect to the first anode 72 by means of the source 78. The relative potentials of the anodes 72 and 76, the spacings therebetween, and the sizes of the apertures in the diaphragms are so chosen that the electrons from the cathode 30 are focused to a fine spot on the target 12 which is made of or has a layer of secondary emitting material.

This primary electron beam is deflected in a line which is substantially perpendicular to the plane of Fig. 5 by means of a sweep voltage applied between the pairs of plates 13 and 14 in a manner similar to that described in Fig. 1. The beam of primary electrons is also deflected from left to right in the plane of Fig. 5 by means of modulating signals applied between the pair of plates 79 and 80 through coupling condensers 81 and 82. A high resistance 83 is connected between the plates, the mid-point 84 of which is connected to the second anode 76. The circuit shown in Fig. 5 is suitable when the modulating signal is balanced with respect to a fixed potential but it is obvious that the arrangement of this invention is equally adaptable to the situation where one of the plates 79 and 80 is connected to a point of fixed potential such as, for example, the potential of the second anode 76, and the other plate allowed to swing in potential in accordance with the variations of the modulating voltage.

As the electrons of the primary beam strike the target 12, secondary electrons are emitted and directed through the slit opening 91 in the metal plate 92 to strike the fluorescent coating 71 which is mounted on a glass supporting plate 93. The secondary beam is focused by the electric fields at the shield 94 which has an opening for the passage of the secondary electrons and is placed at a potential intermediate that of the target 12 and the metal plate 92 by means of a source of potential 97. The source 97 is not as large as the source 98 which places the plate 92 at a high positive potential with respect to that of the target 12. The shield 94 also has an opening 96 for the passage of light from the fluorescent screen.

Reference will now be made to Figs. 6, 7, 8 and 9 in order to more fully explain the operation of the tube shown in Fig. 5. Fig. 6 is an enlarged view of the target 12 and the fluorescent coating 71 when the primary beam is deflected into a position corresponding to maximum signal strength. Figs. 7, 8 and 9 show the relation of the secondary beam to these elements for positions of the primary beam corresponding to less than maximum signal strength.

The secondary beam may be modulated in two ways with the set-up shown in Fig. 5. First, consider that the aperture 95 in the screen 94 is made large enough so that if the secondary beam is moved anywhere within the range from X to Y (Fig. 6) the full secondary beam will pass through the aperture 95. The aperture 91, however, in the plate 92 is made so small that when the primary beam is only in one position, that is, the position shown in Fig. 6, substantially all of the electrons in the secondary beam pass through the aperture 91. If it is moved above or below the point A shown in Fig. 6 as, for example, to the point B shown in Fig. 7 or the point C in Fig. 8, only a small portion of the secondary beam passes through the opening 91 and the light on the fluorescent screen is correspondingly reduced. This method of operation is based on the discovery that the paths of the secondary electrons are independent of the angle of incidence of the primary beam, and that they are determined by the point at which the secondary electrons are generated on the target and by the electric fields existing between the target and electrode 94, and between the electrodes 94 and 92. Considering that the primary beam is moved from the point X to the point Y through all intermediate points, the beam of secondary electrons moves successively from a position where all of the electrons are impinging upon the lower portion of the plate 92, through a position (Fig. 8) where some of the secondary electrons pass through the opening 91 and part impinge upon the lower portion of plate 92, through a position where substantially all of them pass through the aperture 91 to the fluorescent coating 71 (Fig. 6), through a position where a part impinge upon the upper portion of the plate 92 and a part pass through the opening 91 (Fig. 7), and finally to the position where all of them impinge upon the upper portion of the plate 92. It will be apparent that the modulating curve is substantially a probability curve and either half of this curve may be used in practice, proper biasing supplied by any suitable means such as, for example, a battery connection between the plates 79 and 80. Such an arrangement is shown in Patent 2,168,760, issued August 8, 1939, to C. J. Calbick. With the proper bias, all of the motion of the beam is from the point representing no impingement of the secondary beam upon fluorescent screen 71, which point may be to the left or right of the center point as desired, depending upon the polarity of the biasing means applied between the plates 79 and 80, to the central point representing full impingement of the secondary beam upon the screen 71.

In the second arrangement for modulating the secondary electron beam (see Fig. 9), the aperture 95 in the screen 94 is made small and the aperture 91 in the plate 92 is made relatively large. In this arrangement all of the secondary electrons which get through the aperture 95 will also get through the aperture 91 but the primary

beam must be in such a position, corresponding to the central point A shown in Fig. 9 for the entire secondary beam to pass through the opening 95. In the position D shown in Fig. 9 only a portion of the secondary beam passes through the aperture 95, the remaining portion of the secondary beam impinging upon the lower part of the shield 94. Movement of the primary beam above and below the point D will vary the number of electrons passing through the aperture 95 and hence the intensity of the spot on the fluorescent screen 71.

With either method of modulation, the light emitted by the fluorescent coating 71 is dependent upon the number of secondary electrons which reach the coating 71. This light is focussed by a lens system represented by the single lens 99 to make a track record on a moving film or, if desired, it may be used to project an image on a screen when the light beam is also moved in a transverse direction from that caused by the sweep voltage applied between the plates 13 and 14 by any suitable means, such as by mirrors. It will be apparent from the description above that the modulating voltage applied between the plates 79 and 80 has substantially no effect on the movement of the moving light beam emitted from the fluorescent coating 71; this voltage serves merely to modulate the intensity of the light beam.

It will be apparent that other modifications may be made in the invention as above disclosed, the scope of which is indicated by the appended claims.

What is claimed is:

1. A cathode ray device comprising means for generating a beam of primary electrons, a target for said beam capable of emitting secondary electrons upon being impacted by said beam of primary electrons, means for causing said beam to scan said target along a substantially linear path, and an accelerating electrode for said secondary electrons in close proximity to said target, said electrode having a linear opening therein parallel to said linear path through which opening the secondary electrons pass.

2. A cathode ray device comprising means for generating a beam of primary electrons, a target for said beam capable of emitting secondary electrons upon being impacted by said beam of primary electrons, means for causing said beam to scan said target along a substantially linear path, an accelerating electrode for said secondary electrons in close proximity to said target, said electrode having a linear opening therein parallel to said linear path through which opening the secondary electrons pass, and a coating of fluorescent material adjacent said linear opening.

3. A cathode ray device comprising means for generating a beam of primary electrons, a target for said beam capable of emitting secondary electrons upon being impacted by said beam of primary electrons, the center of said target being displaced from the axis of said primary beam generating means, means for deflecting said beam so that it impinges upon said target, means for causing said beam to scan said target along a linear path, and a metal plate parallel to said target, said plate having a coating of fluorescent material thereon.

4. A cathode ray device comprising means for generating a beam of primary electrons, a target for said beam capable of emitting secondary electrons upon being impacted by said beam of pri-

mary electrons, the center of said target being displaced from the axis of said primary beam generating means, means for deflecting said beam so that it impinges upon said target, means for causing said beam to scan said target along a linear path, and a metal plate located parallel to said target in such a position that its center is located substantially on the axis of said primary beam generating means for receiving said secondary electrons.

5. A cathode ray device comprising means for generating a beam of primary electrons, a target for said beam capable of emitting secondary electrons upon being impacted by said beam of primary electrons, the center of said target being displaced from the axis of said primary beam generating means, means for deflecting said beam so that it impinges upon said target, means for causing said beam to scan said target along a linear path, a metal plate parallel to said target, and a metallic screen having an aperture therein for the passage of secondary electrons from the target to the metal plate, said screen having at least a portion thereof between said target and said metal plate.

6. In a cathode ray device, means for generating a beam of primary electrons, a target capable of emitting secondary electrons upon being impacted by said beam of primary electrons, a plate having an aperture therein adjacent said target, said aperture being of such size that substantially all of said secondary electrons pass through it when the primary beam is in a certain position but small enough so that the number of electrons passing through said aperture decreases as the primary beam is moved to one side or the other of this certain position, and a fluorescent screen adjacent said aperture for receiving the secondary electrons which pass through said aperture.

7. In a cathode ray device, means for generating a beam of primary electrons, a target capable of emitting secondary electrons upon being impacted by said beam of primary electrons, a metal plate having an aperture therein adjacent said target, said aperture being of such size that substantially all of said secondary electrons pass through it when the primary beam is in a certain position but small enough so that the number of electrons passing through said aperture decreases as the primary beam is moved to one side or the other of this certain position, a screen member between said metal plate and said target, said screen having an aperture therein large enough to allow the entire beam of secondary electrons to pass therethrough for all positions of the primary beam within a predetermined range of movement.

8. In a cathode ray device, means for generating a beam of primary electrons, a target capable of emitting secondary electrons upon being impacted by said beam of primary electrons, a diaphragm having an aperture therein adjacent said target, said aperture being of such size that substantially all of said secondary electrons pass through it when the primary beam is in a certain position but small enough so that the number of electrons passing through said aperture decreases as the primary beam is moved to one side or the other of this certain position, a screen member between said metal plate and said target, and means for placing said target, plate and screen at such relative potentials that the secondary electrons from said target are focussed into a beam.

9. The method of varying the intensity of a

beam of light in a cathode ray device having means for generating a primary beam of electrons, a target which emits secondary electrons when the primary beam impinges thereon, and a member upon which said secondary beam impinges which comprises the step of moving said secondary beam with respect to an aperture adjacent said member to vary the number of secondary electrons passing through said aperture in accordance with the deflection of said primary beam in accordance with signals.

10. In a cathode ray device, means for generating a beam of primary electrons, a target capable of emitting secondary electrons upon being impacted by said beam of primary electrons, a diaphragm having an aperture therein, and means acting upon said primary beam of electrons for varying the position of said beam of secondary electrons with respect to said aperture.

11. A cathode ray device comprising means for generating a beam of primary electrons, a target for said beam capable of emitting secondary electrons upon being impacted by said beam of primary electrons, means for forming the secondary electrons into a beam, a screen, an apertured diaphragm adjacent said screen and means for varying the number of secondary electrons which reach said screen by varying the position of said secondary beam with respect to the aperture in said diaphragm in accordance with the deflection of said primary beam in response to signals.

12. A cathode ray device comprising an evacuated container enclosing means for generating a beam of primary electrons, a target for said beam capable of emitting secondary electrons upon being impacted by said beam of primary electrons, means for causing said beam to scan said target along a substantially linear path, a conducting coating on a flattened portion of said container which portion is adjacent said target, said conducting coating having a linear opening therein parallel to the scanned linear path on said target, and a coating of fluorescent material adjacent said linear opening.

13. The combination of elements as in claim 12 characterized in that the target is mounted at an angle with the axis of the means for generating the beam of primary electrons, and the flat portion of the container is in a plane which is substantially parallel to a plane which contains said axis.

14. A cathode ray device comprising means for generating a beam of primary electrons, a target for said beam capable of emitting secondary electrons upon being impacted by said beam of primary electrons, said target being mounted at an angle with respect to the axis of the means for generating the beam of primary electrons, means for causing said beam to scan said target along a substantially linear path, a metallic electrode adjacent said target which has a linear opening therein substantially parallel to said linear path, said electrode being mounted in a plane which is substantially parallel to a plane containing the axis of said means for generating the beam of primary electrons, and a coating of fluorescent material adjacent said linear opening.

15. In a cathode ray device, a stationary metallic member having a longitudinal aperture therein, and a source which produces a stream of electrons which stream effectively moves in a direction transverse to an axial line drawn through the longitudinal aperture at right angles to the plane of the metallic member, whereby the number of electrons passing through said aperture is

varied in accordance with the movement of said source of electrons.

16. The combination of elements as in claim 15 characterized in that the source is a source of secondary electrons.

17. The combination of elements as in claim 15 characterized in that the source comprises a target member for a beam of primary electrons which member emits secondary electrons.

18. The combination of elements as in claim 15 characterized in that the source comprises a target member which emits secondary electrons when impacted by a beam of primary electrons, said target being set at an angle to said axial line.

19. In a cathode ray device, means for generating a beam of primary electrons, a target for said beam, means for causing a relatively large deflection in one direction along said target, means for causing a relatively small deflection of said beam along said target in a transverse direction in accordance with signals, an electrode member adjacent said target member, said electrode member having a longitudinal aperture therein in such position that the number of secondary electrons emitted by said target which pass through said aperture is varied in accordance with the transverse movement of said beam of primary electrons in accordance with said signals.

20. In combination, a baffle member having an aperture therein, a moving source of secondary electrons, and means for directing said electrons toward an aperture in said baffle in such a manner that the number of electrons which pass through the baffle will depend upon the position of the source of electrons.

21. In a cathode ray device, means for generating a beam of primary electrons, a target capable of emitting secondary electrons upon being impacted by said beam of primary electrons, and a plate having an aperture therein adjacent said target, said aperture being of such size that substantially all of said secondary electrons pass through it when the primary beam is in a certain position but small enough so that the number of electrons passing through said aperture decreases as the primary beam is moved to one side or the other of this certain position.

22. The method of producing a modulated current which comprises generating a beam of primary electrons, utilizing said beam to generate a beam of secondary electrons, directing said secondary beam repeatedly and continuously along a generally linear path, acting upon said primary beam of electrons to slightly vary the position of said beam of secondary electrons in a direction transverse to the longitudinal axis of said path, and continuously selecting and utilizing a portion of said secondary beam in accordance with said transverse variations thereof.

23. In a cathode ray device, means for generating a primary beam of electrons, a target for said beam having an extended surface upon which said beam impinges and which emits secondary electrons as the result of the impingement thereon of said beam, means for changing the direction of said primary beam of electrons by different amounts to cause the position of its region of impingement on said target to change, means for directing said secondary electrons away from said target in the form of a beam the axis of which for every position of the primary beam extends in the same general direction as for the other positions whereby said beam of secondary electrons is shifted laterally as the direction of said primary beam is changed, a baffle structure

spaced from said target in the general direction of travel of said secondary beam and having a boundary part in position to permit a portion at least of said beam of secondary electrons to pass by said part for one position of the region of impingement of said primary beam on said target

and a portion at least of said beam of secondary electrons to be intercepted by said baffle structure for a different position of said region, and means for receiving the electrons from said beam of secondary electrons which pass said baffle structure.

FRANK GRAY.