

Aug. 30, 1938.

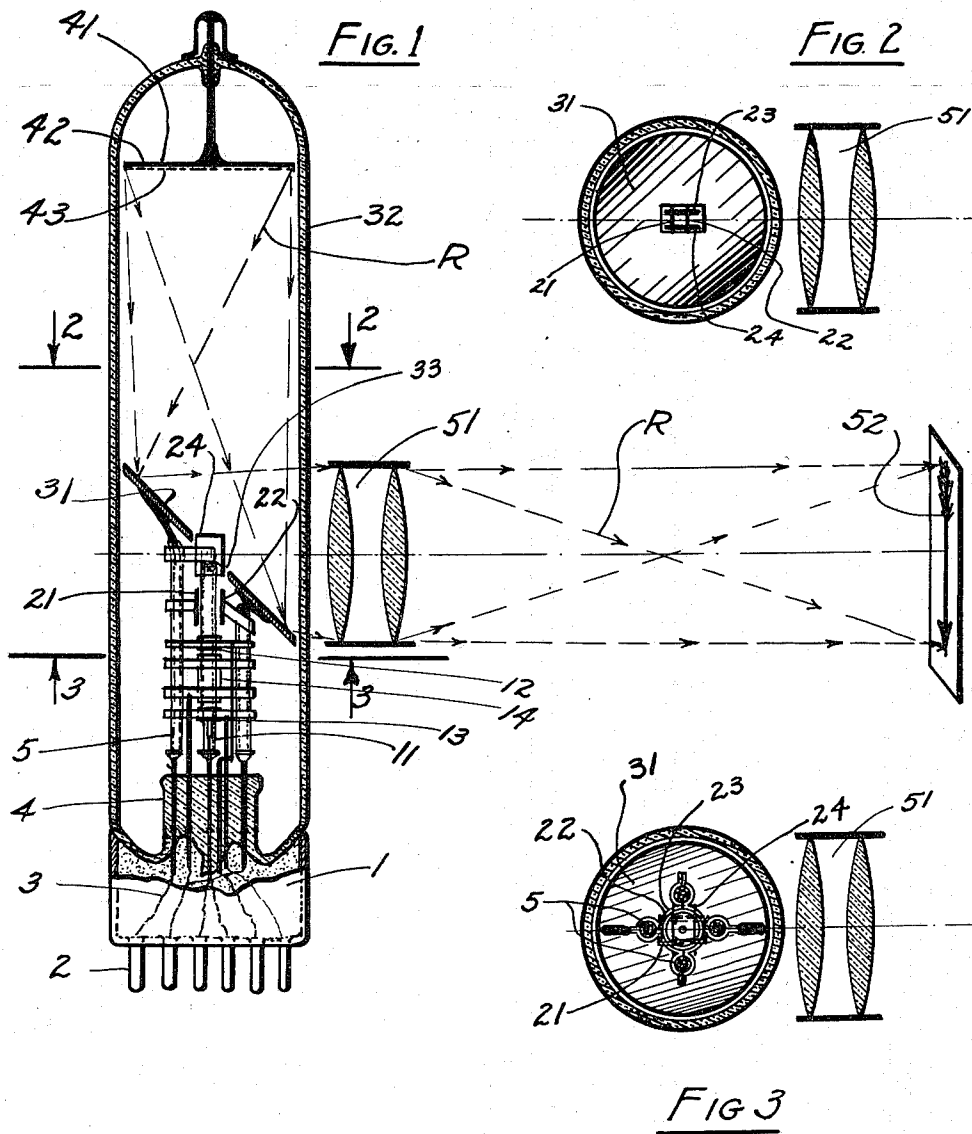
R. D. EATON

2,128,632

ELECTRONIC DEVICE

Original Filed Oct. 20, 1934

2 Sheets-Sheet 1



Inventor .

Roland D. Eaton

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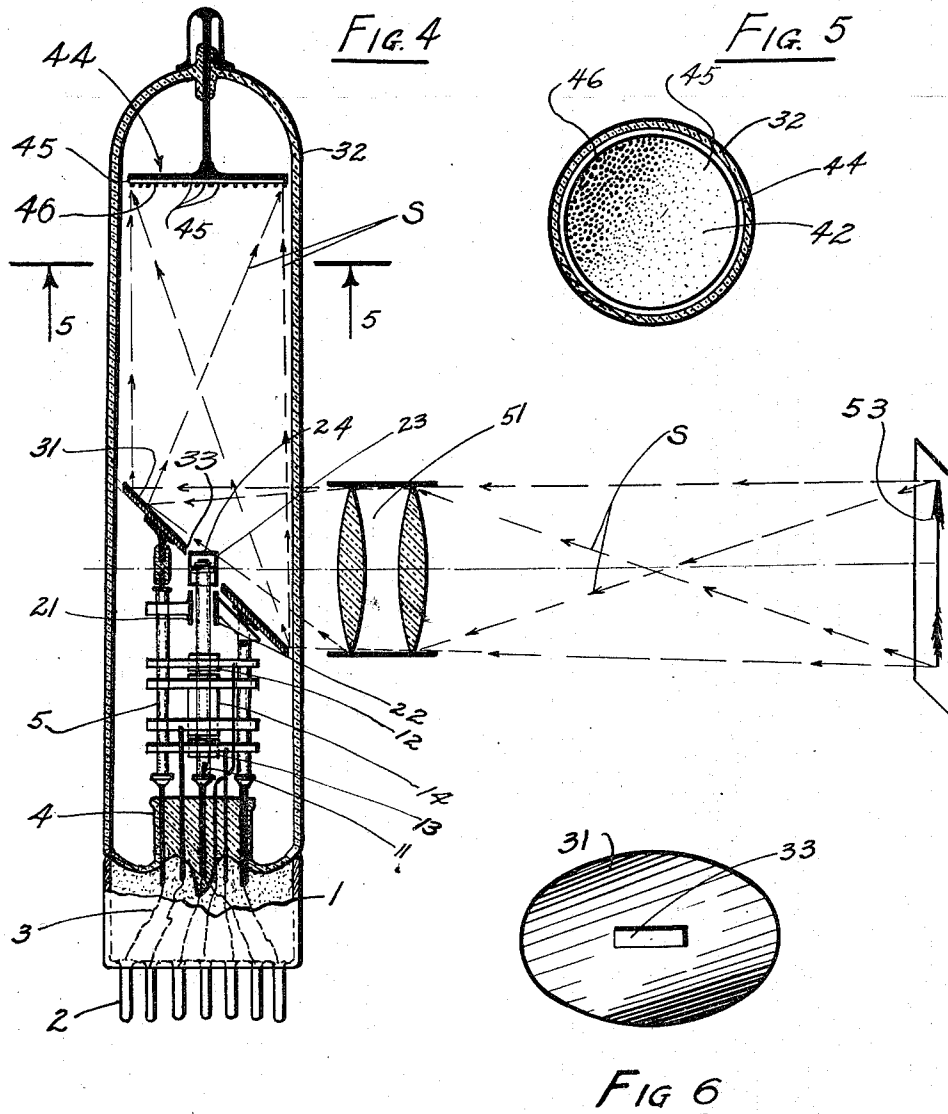
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Inventor

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UNITED STATES PATENT OFFICE

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ELECTRONIC DEVICE

Roland D. Eaton, Cambridge, Mass., assignor, by direct and mesne assignments, of one-third to Jules A. Perrault and one-tenth to Charles H. Hawes, both of Boston, Mass., ninety fifteen-hundredths to Frank C. Stanton, Allston, Mass., one-sixth to Ida W. Glover, and one one-hundred-fiftieth to Grace W. McGann, Providence, R. I.

Original application October 20, 1934, Serial No. 749,140. Divided and this application November 6, 1935, Serial No. 48,526

5 Claims. (Cl. 178—7.7)

This invention relates to electronic devices, and especially to the correlation of cathode ray beams and light rays, for the purpose of sending or receiving images, as for example in television or oscillographic work.

It is one of the principal objects of my invention to provide a cathode ray tube of compact size which permits transmission or reception of images whose size can be chosen within certain practical limits quite regardless of the size of that element of the tube which correlates cathode ray beam and light beam, and therefore regardless of the size of the tube itself; the image size being controlled outside of the tube.

In another aspect of my invention, I am providing a very compact cathode ray tube (a satisfactorily working model is about nine inches long and two inches in diameter, and produces images of the size of the commercial three inch tube) which can be mounted in vertical position as any amplifier tube, eliminating cumbersome cabinets and protecting devices, and permitting convenient design and easy operation of light focusing devices.

Still another feature of my invention is the possibility of using fluorescent screen on metallic surfaces which provide a brilliancy of about three to four times of the heretofore used screen applied to glass surfaces.

I obtain those results by arranging within the tube a reflecting element which receives from, or transmits to an opaque translation element a light beam and has a portion which is transparent for a cathode ray beam penetrating it on its course to the translation element—as a fluorescent or a photoelectric screen. Preferably, I arrange this electron transparent portion quite removed from focal points of the light ray beam, so that it does not appreciably influence the optical image and merely acts like a "stop" diaphragm, or flows or bubbles, in a lens system.

These and other objects, aspects and advantages of my invention will be apparent from the following description, by way of example, of two practical embodiments thereof. The description refers to drawings in which,

Fig. 1 is a longitudinal section through a reception cathode ray tube according to my invention;

Fig. 2 is a cross section on line 2—2 of Fig. 1;

Fig. 3 is a cross section on line 3—3 of Fig. 1;

Fig. 4 is a longitudinal section, similar to Fig. 1, of a sending tube or iconoscope made according to my invention;

Fig. 5 is a section on line 5—5 of Fig. 4; repre-

senting the photoelectric mosaic as seen from the mirror; and

Fig. 6 is a view of the mirror used in the new device.

The general construction of my cathode ray tube is quite similar for reception and sending tubes and both modifications will therefore be described together, and the differences pointed out at the proper places.

Referring now to the drawings, 1 is a tube base with contact prongs 2 connected to wire 3 leading in conventional manner through a press 4 to the supporting structure or frame 5 built up mainly of glass rods in conventional manner.

Mounted on frame 5 is a so-called electron gun comprising in well known manner a cathode 11, a focusing anode 12, and focusing elements 13 and 14.

Frame 5 supports further deflecting plates 21 and 22 and, at right angles thereto, deflector plates 23 and 24. These plates supply variable electric fields and, in well known manner, cause a cathode ray beam suitably formed and focused on the translation element to scan that element.

Preferably near the deflection elements is arranged a reflector 31, at an angle of about 45° to the axis of the cathode ray tube, and supported, as shown, by frame 5. Mirror 31 which fills, with a small clearance, the entire tube envelope, 32 of circular cross section is therefore of elliptical shape as shown in Fig. 6. It has a central slot 33 which is large enough to permit unobstructed movement of the cathode ray beam over the entire translation surface and preferably also surrounds deflector plates 23 and 24 (Fig. 2).

Supported by envelope 32 is translating electrode 41. In the case of the reception tube shown in Figs. 1 to 3, this electrode consists of a metal disk 42 covered at the inside with fluorescent material 43 such as willimite (an ortho-silicate).

In the case of a sending tube or iconoscope as shown in Figs. 4 to 6, the translating element consists of a metallic plate 44, an insulating layer 45 and a multitude of spots 46 consisting of photoelectric material, for example, caesium.

In either instance an optical system 51 is suitably mounted outside the tube. In the case of the reception tube of Fig. 1, the system 51 receives the light rays emitted by the fluorescent electronic screen 43 and reflected by mirror 31 as indicated by rays R, and focuses them upon a screen 52.

In the case of an iconoscope as for example shown in Fig. 4, the light rays S coming from

object 53 are focused by system 51 upon electronic screen 45—46, the light beam portion between 51 and the screen being deflected by mirror 31 in the general direction of the cathode ray beam.

5 It will be noted that slot 33 is not in focus and therefore does not affect the pattern or definition of the optical image but merely somewhat cuts down the amount of overall illumination, like the stop of a conventional objective.

10 The operation of a device according to my invention is as follows. The electrons coming from cathode 11 are focused on the anode screen by means of elements 12 and 14, whereas grid 13 controls the intensity of the electron beam. The
15 electron pencil passing between deflector plates (or equivalent elements for example magnetic fields) may be moved in well known manner in a predetermined path by a sweep circuit and scan the translating screen. The electronic beam
20 passes freely through slot 33, and is unaffected by any optical structure.

In the case of the reception tube shown in Fig. 1, the electron beam produces a fluorescent image upon screen 43, which image is reflected by mirror
25 31 through the tube wall 32 towards lens system 51, which focuses on screen 52. It will now be understood that an image of size limited only by the intensity of the light coming from the fluorescent screen can be produced in this manner
30 by means of a small tube of the simplest possible form.

In the instance of the sending tube shown in Fig. 4, the light beam S comes from object 53 and is projected upon screen 45—46 in a manner now
35 needing no further explanation and affects each photoelectric spot proportionally to the light intensity of the particular portion of the image on the photoelectric screen. The electron beam sweeping over the screen 46 acts as a movable
40 electrode removing the charge of the spot from plate 44 of condenser 44—45—46 which it strikes—in a manner well known in the art.

This application is a division of application, Ser. No. 749,140, filed Oct. 20, 1934.

45 I claim as my invention:

1. An electronic device comprising means emitting an electron beam, screen means in the path of said beam, and light reflecting means between said beam emitting means and said screen
50 means inclined to the axis of said beam and hav-

ing portions on opposite sides of and defining a surface surrounding said beam, for deflecting a light beam coming from or going to the screen means.

2. An electronic device comprising an electron 5 gun, deflector plates and a screen in the path of the beam coming from said gun, and a mirror between said gun and said screen inclined to the axis of the beam and surrounding the same for reflecting light coming from or going to the
10 screen.

3. An electronic device comprising means emitting an electron beam, screen means in the path of said beam, light reflecting means between said beam emitting means and said screen means
15 inclined to the axis of said beam and having portions on opposite sides of and defining a surface surrounding said beam for deflecting a light beam coming from or going to the screen means, and an optical lens system arranged in said light
20 beam for substantially focusing an image on said screen means.

4. An electronic device comprising means emitting an electron beam, electronic screen
25 means in the path of said beam, light reflecting means between said beam emitting means and said screen means inclined to the axis of said beam and having portions on opposite sides of and defining a surface surrounding said beam, for
30 deflecting a light beam coming from or going to the electronic screen means, optical screen means, and an optical lens system arranged in said light beam for focusing light coming from one of said screen means on the other screen means.

5. An electronic device comprising an electron 35 gun, translating electronic screen means in the path of the beam coming from said gun, a mirror between said gun and said electronic screen means inclined to the axis of the beam and having an opening for the beam for reflecting a
40 light beam coming from or going to the electronic screen means, optical screen means, and an optical lens system arranged in said light beam for focusing light coming from one of said screen means on the other screen means, said mirror and
45 said screen means being spaced substantially to avoid focusing of said opening on the screen means receiving said light beam.

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