

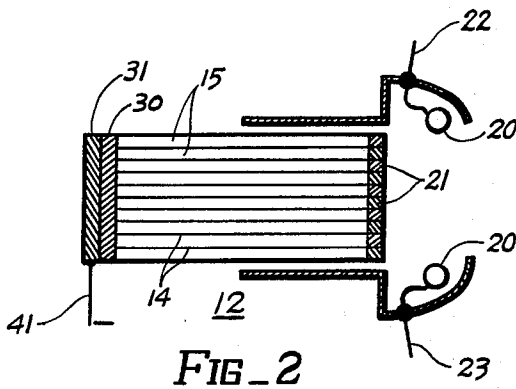
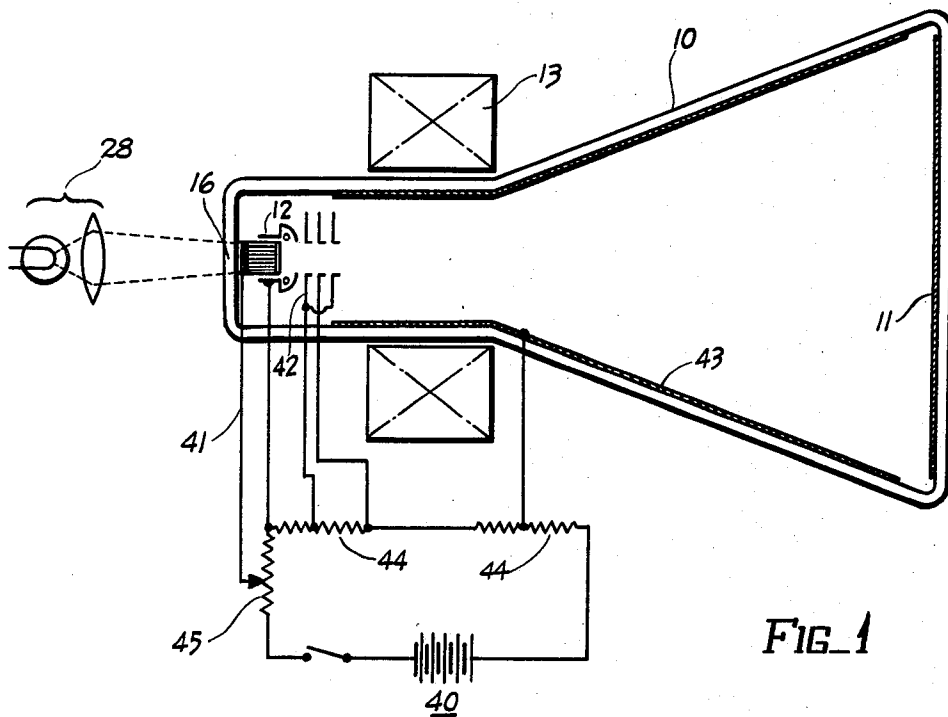
Feb. 9, 1960

J. T. McNANEY

2,924,743

ELECTRON BEAM GENERATING MEANS

Filed Aug. 24, 1956



INVENTOR.
JOSEPH T. McNANEY.
BY *George W. Mullen*
ATTORNEY.

1

2,924,743

ELECTRON BEAM GENERATING MEANS

Joseph T. McNaney, La Mesa, Calif., assignor to General Dynamics Corporation, Rochester, N.Y., a corporation of Delaware

Application August 24, 1956, Serial No. 606,060

2 Claims. (Cl. 315—10)

This invention relates generally to apparatus for selectively forming electron images having predetermined shapes, such as letters and numerals.

The apparatus of my invention is particularly suitable for displaying information at high speeds, and it may be employed with suitable recording apparatus to provide a printed record of the displayed information. If desired, the apparatus may be arranged to provide a display which is suitable for direct visual observation.

My U.S. Patent 2,735,956 discloses a cathode-ray tube which is suitable for selectively displaying images of characters on the viewing screen of the tube. In this tube the beam of electrons is employed to selectively produce beams of predetermined cross-sections by projecting the beam through character-shaped openings of a beam-forming matrix. As shown in U.S. Patent 2,730,708, and in the copending application Serial No. 604,931 filed August 20, 1956, now U.S. Patent 2,850,657, both assigned to the common assignee hereof, I have found that cathode-ray apparatus may be arranged so that the cross-sectional shape of a beam of electrons which is projected onto the screen of the tube may be controlled by means of light.

In accordance with the present invention, I provide an evacuated container having a screen, or target, located at one end and a mosaic of closely spaced thermionic electron emitters located at the other end. Selected emitters may be electrically actuated to provide electrons in the form of a shaped stream or electron beam whose cross-section is projected onto the viewing screen. A member composed of a light-sensitive material is connected to the side of the emitters which is adjacent the light source. The member serves to selectively provide a conductive path between the individual emitters and an electrically conductive element connected therewith in accordance with the area of the member which is light illuminated. Thus, the individual emitters are actuated only when the light-sensitive member provides a conductive path between selected emitters and the electrically conductive element.

The images which are to be displayed on the screen of the tube, say letters and numerals, are projected as light images on the light-sensitive material or member which in turn controls the operation of the emitters. Preferably, the images are projected through a transparent portion of the evacuated container at the end adjacent the photoconductor member.

It is an object of the present invention to provide a cathode ray tube like apparatus capable of responding to light energization.

It is an object of the present invention to provide a light responsive electron beam generating means within an evacuated container.

Other objects and advantages other than those set forth above will be apparent from the following description when read in connection with the accompanying drawings, in which:

Figure 1 shows a diagrammatic view of a preferred embodiment of the invention;

2

Figure 2 is an enlarged partial view in cross-section of the beam generating means.

Shown in Figure 1 is an evacuated container 10, shown generally in the shape of a cathode ray tube, which may be made of glass, plastic or metal or combinations thereof. For simplicity, the connections with elements inside the container are shown schematically. A target, or screen 11, such as a phosphor screen, is located at one end of the container, and a beam generating means 12 is located at the other end of the container. The other end of the container must permit light to enter therethrough and accordingly presents a light transparent portion 16 of the container.

A plurality of accelerating anodes 42 and a post accelerator 43 may be provided for accelerating and focusing the shaped electron beam derived from the generating means 12.

A conventional electromagnetic deflection system 13 may be provided for controlling and positioning the electron beam produced by the generating means 12 on the target 11.

The generating means 12 forms an electron beam by selective energizing of one or more of a plurality of mutually insulated electron emissive material, or emitters 21, such as thorium oxide or the like. Emitters 21 are generally in the form of a mosaic and are electrically insulated from one another by insulating material 14, such as enamel or other known insulators, as shown in detail in Figure 2. The individual emitter 21 is affixed to the end of a single conductor 15 which is one of a plurality of mutually insulated conductors 15. Means for heating the material or an electric heater 20 is disposed in heat transfer relation to the mosaic of emitters 21 to heat them to a suitable operating temperature. The heaters may be connected to a source of potential (not shown) for providing power to the heater through a pair of conductors 22 and 23.

A photoconductive means or member 30 composed of a light-sensitive material is connected to the free ends of the conductor 15 facing portion 16. By way of example, the member 30 may be composed of selenium, lead sulfide or cadmium sulfide or other known photoconductive materials. The members 30 serves to provide a conductive path between the individual emitters 21 and a transparent conducting element 31, in accordance with the area of the member 30 which is illuminated with light from a light source 28. The transparent conducting element 31, as well as member 30 may be constituted generally as described in Serial No. 604,931, filed August 20, 1956, now U.S. Patent 2,850,657.

Thus, the photo-sensitive member 30 serves in effect as a light-controlled conductor between the individual emitters 21 and the electrical conductive element 31. The emitters 21, in turn, project electrons toward the screen 11 only when they are electrically connected through the photoconductor 30 to a potential source 40 by way of a lead-in conductor 41 and conductive element 31.

The deflection yoke 13 is provided for directing the shaped beam toward predetermined locations on the screen 11 of the tube. Suitable potentials for the various electrodes of the tube are provided by the source of high voltage 40 and a desired voltage divider 44, which includes an adjustment potentiometer 45. A switch may be positioned intermediate source 40 and the potentiometer 45 to permit selective energization of the generating means 12, if desired.

The particular embodiment of the invention illustrated and described herein is illustrative only and the invention includes such other modifications and equivalents as may readily appear to those skilled in the art, within the scope of the appended claims.

I claim:

1. Apparatus for producing a shaped beam of electrons, comprising: an evacuated container having a light-transparent end substantially perpendicular to the axis of said container; a source of potential having a negative terminal; a sheet of light-transparent conductive material positioned on the inner surface of said light-transparent end; a connection between said sheet and said negative terminal; a layer of photoconductive material positioned in contiguous relation with said sheet in close proximity with said light-transparent end; a plurality of mutually insulated conductors, each having an end thereof in electrical contact with respective areas of said layer; a plurality of electron-emissive elements, respective ones of said elements positioned on the free ends of respective ones of said conductors—whereby a pattern of light impinging on said light-transparent end of said container is transmitted through said transparent end and said transparent conductive material to energize selected areas of said photoconductive material, said energized areas thereby providing a conductive path between said negative terminal and selected said electron-emissive elements whose electron emission forms a shaped beam of electrons.

2. A shaped beam type of cathode ray tube comprising: a cathode ray tube envelope having an axis, a light-transparent end substantially perpendicular to said axis, and a target on its face-plate; a source of potential having a negative terminal and a positive terminal; a sheet of light-transparent conductive material positioned contiguously with the inner surface of said light transparent

end of said envelope; a connection between said sheet and said negative terminal; a layer of photoconductive material positioned in contiguous relation with said sheet; a plurality of mutually insulated conductors positioned substantially parallel to said axis, each conductor having an end thereof electrically connected to said layer; a plurality of discrete islands of thermionic electron-emissive material positioned on the free ends of respective ones of said conductors; means to heat said thermionic electron-emissive material—whereby a pattern of light impinging on said light-transparent end is transmitted to energize selected areas of said photoconductive material, said energized areas thereby providing a conductive path between said source and selected ones of said islands of electron-emissive material whose electron emission forms a shaped beam of electrons; and means directing said shaped beam of electrons toward said target, said means comprising electrodes connected to said positive terminal—whereby said target may produce a pattern corresponding to said impinging light.

References Cited in the file of this patent

UNITED STATES PATENTS

25	2,495,697	Chilowsky	Jan. 31, 1950
	2,500,929	Chilowsky	Mar. 21, 1950
	2,614,235	Forgue	Oct. 14, 1952
	2,730,708	McNaney	Jan. 10, 1956
	2,777,040	Kazan	Jan. 8, 1957
30	2,782,332	Sheldon	Feb. 19, 1957
	2,850,657	McNaney	Sept. 12, 1958