Nov. 25, 1958 J. T. McNANEY 2,862,144

SIMPLIFIED SYSTEM FOR CHARACTER SELECTION IN A SHAPED BEAM TUBE

Filed March 21, 1958

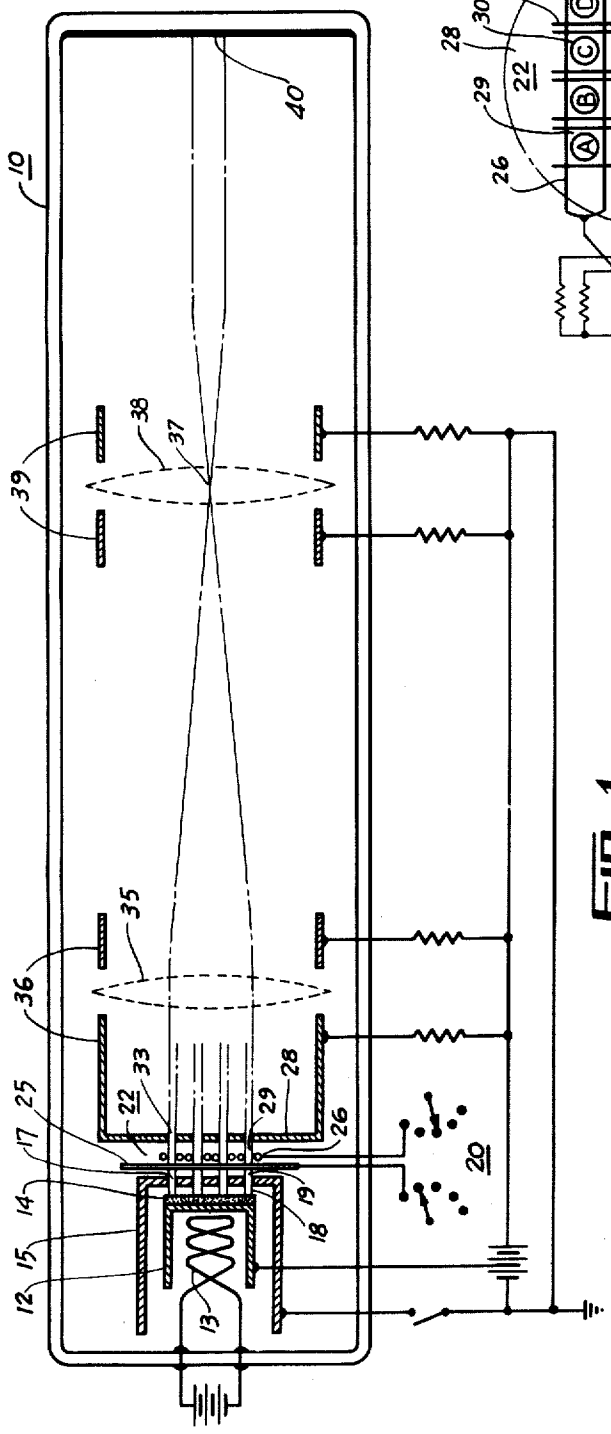

FIG-1

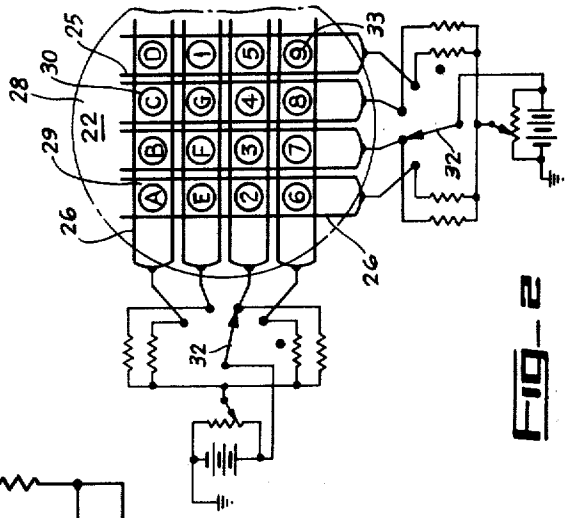

FIG-2

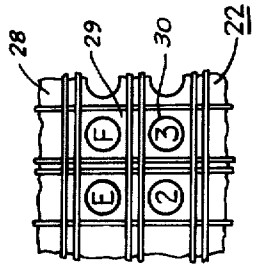

FIG-3

INVENTOR.
JOSEPH T. McNANEY

BY

Egon W. Mueller

ATTORNEY

United States Patent Office 2,862,144
Patented Nov. 25, 1958

2,862,144

SIMPLIFIED SYSTEM FOR CHARACTER SELECTION IN A SHAPED BEAM TUBE

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

Application March 21, 1958, Serial No. 722,919

5 Claims. (Cl. 315—30)

This invention relates generally to the art of cathode ray tubes. More particularly, the invention relates to a cathode ray tube in which an electron beam has its cross section shaped into predetermined information symbols.

Cathode ray tubes of this type are well known in the art as exemplified by my patents U. S. 2,735,956 and 2,761,988. In shaped beam tubes of the type shown in the aforestated patents, a rather complex electro-optical system is necessary to generate and control the electron beam in the shaping process. The electron beam is preferably projected along an axis and deflected from that axis to illuminate a desired opening in the beam shaping member. Thereupon, it is necessary to reconverge the electron beam to the axis and at the same time to image the cross section of the electron beam at a desired focal point. The electron beam may also be shaped into a plurality of cross sections one of which is then selected through an aperture for display upon a target. Here, too, relatively complex control of the electron beam is required. Both of the aforestated approaches to the selective shaping of an electron beam require considerable length in the stem or neck of a cathode ray tube to perform all of these operations upon the electron beam. Also, the aforestated techniques use high velocity electron beams. The power requirements of influencing high velocity electron beams is rather great and therefore large capacity power supplies are ordinarily necessary to drive tubes of the aforestated type.

The present invention overcomes many of the deficiencies aforestated and is considered rather simple in construction and control. The invention includes several structures positioned in spaced apart relation with respect to the cathode, but in close proximity thereto, in the path of the electron emission. The cathode is preferably provided with a multi-apertured grid which aids to effect the projection from the emitting surface of the cathode of a plurality of individual electron beams. Positioned in the path of the beams and in proximity of the grid is a beam shaping member which has defined therethrough a plurality of stencil-like character cutouts for imparting a complementary shape to the electron beam illuminating the particular character shape. Intermediate the grid and the beam shaping member is preferably positioned a means for establishing certain potential conditions to select part of the beam or one of the beams to pass therebeyond, the means is exemplified as a control conductor network. The network may include a plurality of conductors positioned in quadrature with each other so as to define a plurality of openings. These openings desirably are in alignment with one of the apertures in the grid as well as one of the stencil-like character shaped cutouts in the beam shaping member. Potential is supplied to the network so that only a single opening defined by the crossing conductors receives a positive potential sufficient to permit passage of a desired electron beam therethrough. The rest of

the network may be at a neutral or negative potential sufficient to prevent passage of the slow moving electrons therethrough. The passing of the electron beam through a desired opening will cause illumination of the complementarily aligned cutout in the beam shaping member, and, thereby select the information symbol desired to be projected onto the target or screen of the tube.

It should be noted that in controlling the electron beam while its electrons are traveling at a relatively low velocity simplifies control which is relatively easily accomplished. Further, since it is not necessary to deflect the electron beam away from any axis, and, since the entire structure is rather small and generally positioned at or near the axis of a tube, the problems of deflecting an electron beam and redirecting it to axis are almost totally lacking. The power requirements necessary to accomplish desired selection as well as further control of the electron beam may also be minimal, as electrostatic voltages may be utilized in the subsequent lensing of the cross section of the electron beam and deflection thereof, if desired.

In addition to the objects and advantages aforestated, it is an object of the present invention to provide a simple and unique construction for the selection and control of an information symbol in a shaped beam tube.

It is another object of the invention to provide a new and simplified tube construction capable of responding to simple analog voltage signals for displaying desired information symbols.

It is another object of the invention to provide a shaped beam tube of minimal physical size and dimension.

It is another object of the invention to effect the shaping of the electron beam at an area at which the electron beam has a relatively low electron velocity.

It is another object of the invention to provide a shaped beam tube in which a relatively small beam shaping member may be utilized so that the shaped beams selected lie closely adjacent to the axis of the tube.

Objects and advantages other than those set forth above will be apparent when read in connection with the accompanying specification and drawings, in which:

Figure 1 is a view in schematic of a shaped beam tube embodying the instant invention;

Figure 2 is an enlarged view of the control conductor net-work and the beam shaping member all as shown in Figure 1;

Figure 3 is an enlarged partial view of Figure 2.

Adverting to Figure 1 there is shown a simplified version of a shaped beam tube **10**. The shaped beam tube **10** is evacuated, and has positioned at one end of thereof a cathode **12**. Cathode **12** may preferably be indirectly heated by a powered heating element **13**. From a surface **14** of cathode **12** electron emission is generated and projected through an apertured control grid **15**. While the present invention basically envisages the mere generation of an electron beam of uniform density and subsequent control of that beam, the exemplified embodiment preferably shows a plurality of apertures **17** formed in control grid **15**. The formation of a number of apertures aids in the breaking up of the electron beam **18** into a plurality of individual electron beams **19**. It should be understood, however, that the aforestated is merely an embodiment of the invention utilized to best exemplify the invention, but the invention is not limited to the breaking up of the primary beam **18** into a plurality of such individual electron beams, but includes generation and use of a single large electron beam. As is well known in the art, the control grid **15** may, through the application of more negative voltages than the cathode **12**, from a power or

potential source 20, selectively controls emission from the surface 14 of the cathode 12.

A means 22 may be positioned in the path of the beam immediately adjacent the control grid for establishing predetermined potential conditions under control of the potential source 20, so as to permit only a selected portion of the beam 18, or, only one of the individual electron beams 19, to pass therethrough and therebeyond for subsequent action upon the beam by the means 28 in the path of that beam for shaping the beam into desired cross sectional shape. Means 22 is exemplified in the present invention as including a first plurality of conductors 25 and a second plurality of conductors 26 which conductors may be collectively referred to as a control conductor net-work. The first plurality of conductors 25 is disposed immediately adjacent and in quadrature with the first plurality of conductors. Selectively connected to these conductors is the voltage source 20. As exemplified in Figure 2, the conductors may normally establish a condition preventing the electron beam from passing therebeyond which may be a neutral potential or a potential more negative than the beam. However, upon the application of voltages more positive than the beam to specific coincidence points a portion of the electron beam 18 or a selected individual electron beam 19 will be passed through the means 22 onto the subsequent means 28 for shaping the beam.

It should be understood that the invention encompasses utilization of a means 22 to establish a voltage at a desired point sufficient to permit passage of the appropriate portion of the electron beam therebeyond such point of coincidence. Several constructions differing from those exemplified may be utilized, such as actual cross over of the conductors wherein the beam passes over the cross over point itself. The exemplified embodiment shows openings 29, through which, by application of sufficient potential more positive than the beam coincidence may be established at an opening such as shown in Figure 2 at the "O" position 30. Such coincidence and application of potential will permit passage of that portion of the beam through opening 30 on its path toward the beam shaping member 28.

Desired change of potential may be effected for example, by rotary switches 32 shown in detail in Figure 2, whereby coincidence may be established at any desired point in the network of conductors 22. The beam shaping member 28 positioned adjacent network 25, 26, is in the path of the beam and is provided with a plurality of stencil-like cutouts 33 which are capable of correspondingly shaping the cross section of the electron beam into a cross sectional shape corresponding to that of the cutout 33. It should be noted that the creation of the electron beam, the selection of the portion of the electron beam to be shaped, and projection thereof onto the beam shaping member are all accomplished at or adjacent the generating point of the electron beam so as to utilize the beam in its low electron velocity state. When the beam is in the low velocity state, it is simpler to control and deflect, therefore, small amounts of power will alter its course, or to prevent its penetration of a potential field.

After the beam is shaped into its desired cross section, it may be acted upon by an electron lens 35, established by electrostatic elements 36 for example, and imaged at a cross over and focus point 37. A lens 38 positioned so as to act adjacent focus point 37 is exemplified by electrostatic elements 39. Lens 38 images the beam cross section onto the target 40 for display thereon and viewing.

In operation then, an electron beam is generated by cathode 12 at its surface 14 under the influence of the indirect heater 13. The electron beam 18 is created, and may, if desired, be shaped into individual electron beams 19 through the apertures 17 of grid 15. All except one of the selected individual electron beams is repelled by the network of conductors 22. The one beam is attracted by a positive voltage established at one of the selected cross over or coincidence points to permit that portion of the electron beam to pass therethrough to illuminate the aligned and corresponding cutout portion 33 in the beam shaping member 28. It may be stated that preferably the apertures 17, openings 29 and cutout portions 33 are positioned in longitudinal alignment for ease and simplicity of operation and design. The electron beam so selected is shaped by the cutout portion 33 into a desired configuration and imaged by lens 35 onto the focus or cross over point 37. There, the lens 38 further images the cross section onto the screen 40 for visual display thereon.

While certain preferred embodiments of the invention have been specifically disclosed, it is understood that the invention is not limited thereto as many other variations will be readily apparent to those skilled in the art and the invention is to be given its broadest possible interpretation within the terms of the following claims.

I claim:

1. In an evacuated shaped beam tube comprising a cathode for generating an electron beam, a control grid adjacent the cathode and in the path of the beam for control of the electron beam, means in the path of the beam so passed for shaping that beam into desired cross-sectional shape, target means for responding to impingement of the beam thereon positioned at an end of the tube opposed from the cathode, and means positioned in the path of the beam intermediate the control grid and the means for shaping the beam for establishing predetermined potential conditions to permit only a selected portion of the beam to pass therebeyond to be subsequently shaped into a single cross-sectional shape through the means for shaping the beam.

2. In a shaped beam tube apparatus wherein an electron beam is generated and projected at one end of the tube toward an electron responsive target at the other end of the tube, including a beam shaping member positioned in the path of the beam for shaping the cross section of the beam into corresponding information symbols the improvement comprising a control conductor network positioned in the path of the generated beam intermediate the one end of the tube and the beam shaping member for controlling the beam so as to permit only a portion of the beam to project through the beam shaping member forming one selected information symbol at a time.

3. In a shaped beam tube apparatus wherein an electron beam is generated and projected at one end of the tube for impingement upon an electron responsive target at the other end of the tube, the electron beam comprising a plurality of individual electron beams, including a beam shaping member positioned in the path of the beam for shaping the cross section of one of the plurality of individual electron beams into a corresponding information symbol the improvement comprising means positioned in the path of the plurality of individual electron beams intermediate the one end of the tube and the beam shaping member for controlling the beam therethrough so as to permit only one of the plurality of individual electron beams to project therethrough onto the beam shaping member, said beam shaping member forming said one individual electron beam into one selected information symbol at a time.

4. In an evacuated shaped beam tube comprising a cathode for generating an electron beam, a control grid adjacent the cathode and in the path of the beam for control of the electron beam, said grid presenting a plurality of apertures therethrough to aid in formation of and to pass the beam, a first plurality of conductors, and a second plurality of conductors disposed adjacent and in quadrature with the first plurality of conductors, said first plurality of conductors defining with said second plurality of conductors at plurality of openings, said openings being

adjacent, but spaced apart from and generally in alignment with said apertures, said openings further being positioned in the path of the beam, means connected with said first and second plurality of conductors for energizing a desired cross over of the first and second plurality of conductors to pass the electron beam solely through a selected one of the openings and preventing the remainder of the electron beam from penetrating any openings other than the selected one, means in the path of the beam so passed for shaping that beam into desired cross-sectional shape, and target means for responding to impingement of the beam thereon positioned at an end of the tube opposed from the cathode.

5. In an evacuated shaped beam tube comprising a cathode for generating an electron beam, a control grid adjacent the cathode and in the path of the beam for control of the electron beam, said grid presenting a plurality of apertures therethrough to aid in formation of and to pass the beam, a first plurality of conductors, and a

second plurality of conductors disposed adjacent and in quadrature with the first plurality of conductors, said first plurality of conductors defining with said second plurality of conductors a plurality of openings, said openings being positioned in the path of the beam, adjacent but spaced apart from an generally in alignment with said apertures, means connected with said first and second plurality of conductors for energizing a desired cross over of the first and second plurality of conductors to pass the electron beam beyond the conductors solely through a selected one of the openings, a beam shaping member in the path of the beam so passed for shaping that beam into desired cross-sectional shape, said beam shaping member having a plurality of stencil-like cutouts, said cutouts being in longitudinal alignment with said apertures and said openings, and target means for responding to impingement of the beam thereon positioned at an end of the tube opposed from the cathode.

No references cited.

Notice of Adverse Decision in Interference

In Interference No. 91,319 involving Patent No. 2,862,144, J. T. McNaney, SIMPLIFIED SYSTEM FOR CHARACTER SELECTION IN A SHAPED BEAM TUBE, final judgment adverse to the patentee was rendered Apr. 19, 1962, as to claims 2 and 3.

[*Official Gazette March 30, 1965.*]