

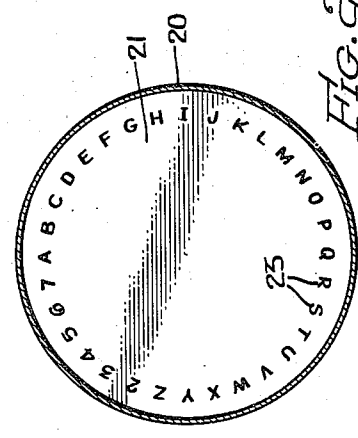
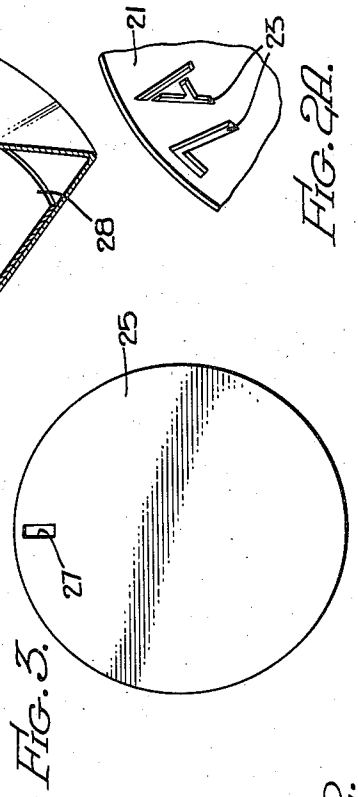
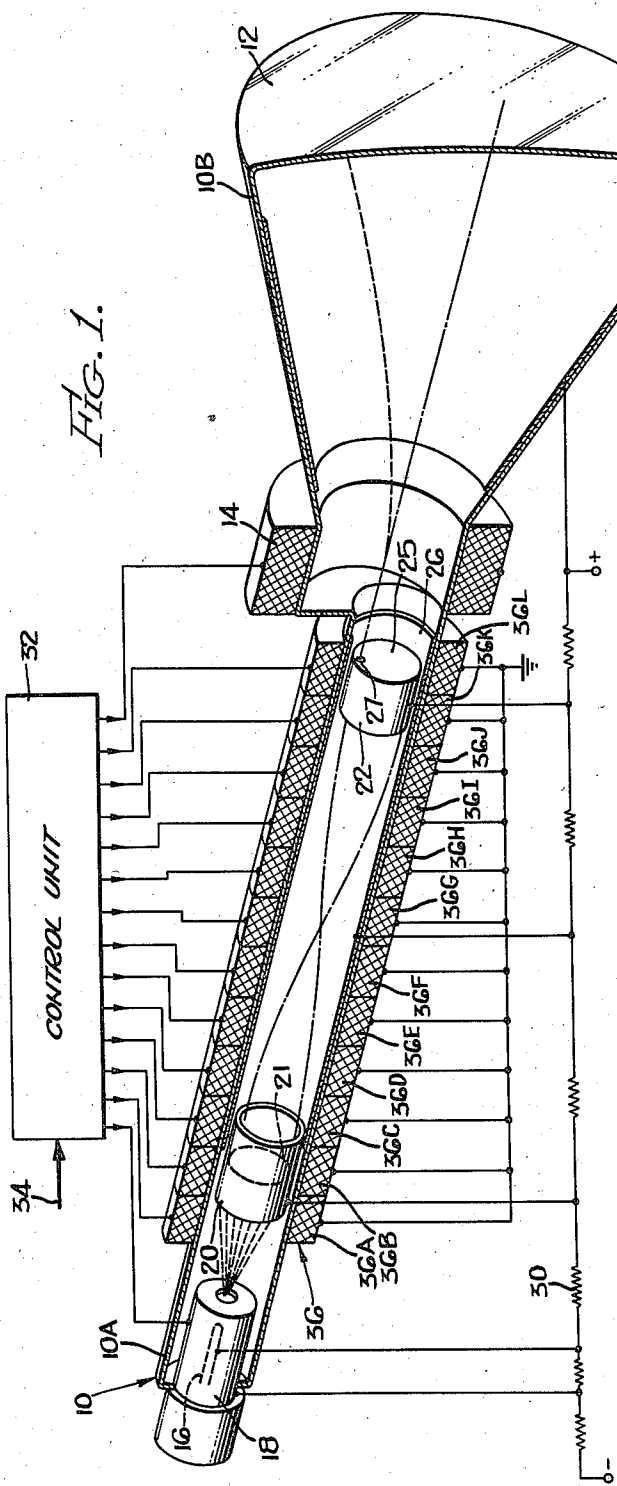
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BEAM SELECTION SYSTEM

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1

2,826,716

BEAM SELECTION SYSTEM

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6 Claims. (Cl. 315—13)

This invention relates to cathode-ray apparatus and, more specifically, to improvements in cathode-ray apparatus for producing cathode-ray images having predetermined character shapes.

A species of cathode-ray tubes has been developed for producing character shapes, such as letters, numerals, or symbols upon the screen of the cathode-ray tube without utilizing scanning techniques nor generating complex electrostatic fields which, when applied to the electron beam, causes the beam to scribe a path on the target in accordance with the desired character. Broadly, the principle underlying this class of cathode-ray tubes is that within an evacuated vessel a beam of electrons is generated and directed toward a target, and interposed in the path of the beam is a member having the character-shaped openings therein through which the electron beam is directed. These character shapes may be symbols, numerals, or any desired type of shape. Passage of the beam through an opening of this member results in its being shaped accordingly. Patent No. 2,761,988 to this inventor describes and claims a species of this type of cathode-ray tube.

One arrangement of character-shaped beam selection is to selectively direct a rather sharply focused electron beam onto the aperture of a beam-shaping member which has a plurality of different apertures, each of which has the shape of a character. The beam thereafter emerges from the selected aperture having a cross-sectional configuration corresponding with the shape of the aperture. In tubes utilizing this principle, close control over the diameter of the electron beam must be provided in order to prevent the beam from overlapping adjacent apertures and thereby reducing the effectiveness of the tube. Spacing between adjacent apertures in the beam-shaping member must likewise be controlled and a minimum spacing must be maintained which limits the minimum usable physical size of the beam-shaping member for a given size of apertures. There are also registration problems which must be solved.

Another arrangement for selecting the electron beam having a desired character shape is to superimpose a broad electron beam upon a plurality of apertures in the shaping member simultaneously. As a result, a bundle of differently shaped electrons are simultaneously produced. A selection member is provided in the form of a disc having an aperture centrally disposed thereof. This aperture size is sufficient to allow only one of the character-shaped beams to pass through. The other character-shaped beams are intercepted by this selection member. Means are provided for moving the plurality of character-shaped beams until only a desired one passes through the aperture. Deflection means are provided on the other side of this selection member to direct the selected character-shaped beam to a desired portion of the cathode-ray tube screen.

An object of the present invention is to provide a novel and improved character-shaped beam selection system.

2

Another object of the present invention is to provide an improved, simple character-shaped beam selection system.

In the character-shaped beam selection systems briefly described above, the character-shaped beam occurs off the deflection axis of the tube and structure must be provided for directing the beam to the deflection axis of the tube before deflection can occur.

A further object of the present invention is to provide a system which in the process of character selection directs the selected beams along the deflection axis of the tube.

Still a further object of the present invention is to provide an improved shaped-beam-selection apparatus wherein the beam-spiraling effects of a magnetic lens which occur in selecting and referencing a desired beam to the deflection axis of the tube are controlled.

Yet another object of the present invention is to provide a novel and simple system of beam selection which is not subject to the effects of the spherical aberrations normally experienced in electron optical systems.

These and other objects of the present invention are achieved by providing cathode-ray tube apparatus wherein two axes exist. One is termed the selection axis and the other is deflection axis. In the selection-axis portion of the tube there is provided the usual means for generating a beam of electrons. These are permitted to fall upon a shaping member which comprises a plate having a plurality of character-shaped apertures which are disposed in a circle having as its center the selection axis. A plurality of character-shaped electron beams are formed which are shaped in accordance with the apertures in the plate and which are in a circle having the selection axes as the center. Spaced from the shaping plate is a selection plate which consists of a plate having an aperture substantially aligned with the circumference of the circle about which the character-shaped beams are disposed.

The size of the aperture in the selection plate is sufficient to enable one of the character-shaped beams to pass therethrough. Means are provided for revolving the plurality of character-shaped beams around the selection axis until a desired one of the beams can pass through the aperture. The remaining beams are intercepted by the plate. Following the selection plate there is provided deflection means which can direct the selected character-shaped beams to a desired portion of the cathode-ray tube screen. The deflection axis for the deflecting beams is substantially aligned with the selecting aperture in the selecting plate. As a result, the selected beam is already at the deflection axis of the tube, and no auxiliary apparatus is required for bringing it there.

The novel features that are considered characteristic of this invention are set forth with particularity in the appended claims. The invention itself, both as to its organization and method of operation, as well as additional objects and advantages thereof, will best be understood from the following description when read in connection with the accompanying drawings, in which:

Figure 1 is an isometric view in section of an embodiment of the invention;

Figure 2 is a view of the character-shaping plate employed in the embodiment of the invention;

Figure 2A is an enlarged fragmentary view illustrating one of the characters of the plate; and

Figure 3 is a view of the selecting plate employed in the embodiment of the invention.

Reference is now made to Figure 1, which shows a perspective sectional representation of an embodiment of the invention. This includes a cathode-ray type of tube which comprises an envelope 10 of suitable mate-

rial. This envelope has two sections. The first section 10A, wherein the electron beam-generating means are enclosed, has what may be termed a selection axis which is offset from the axis of the second portion 10B of the tube at a distance determined in a manner to be described. The second portion of the tube contains the screen 12. The deflection yoke 14 is positioned at one end of the second portion of the tube envelope which is adjacent the first portion of the tube envelope. Its axis coincides with the deflection axis of this portion of the tube.

The first portion of the tube includes a source of electrons 16 within the control grid 18. This is followed by an accelerating electrode 20 and a selection electrode 22. Anodes 26 and 28 serve as the acceleration anodes and may be the conventional aquadag coatings about the interior surface of the vessel. As shown in Figure 1, these anodes, together with the other elements associated with the container 10, are connected to suitable operating potentials provided by a voltage divider 30, which is connected across a source of voltage, not shown. Signals to the control grid 18 and to the deflection yoke 14 are obtained from a control unit 32, which converts digital signals from an incoming line 34 into the analog voltages required for controlling both the intensity and the deflection of the electron beam.

In operation, electrons generated at the cathode are directed through the accelerating electrode 20 and at the selecting electrode 22. The accelerating electrode 20 includes a beam-shaping member therein 21. As shown in Figures 2 and 2A, the beam-shaping member 21 comprises a plate having a plurality of character-shaped apertures 23. These character-shaped apertures are disposed around the circumference of a circle, the axis of which coincides with the deflection axis of the first portion of the tube. The electrons beamed from the cathode are directed at this plate, which serves the function of breaking this beam into a plurality of small beams, each of which has the shape of one of the apertures in the member 21. This bundle of character-shaped beams is directed at the selection member 22, which, as shown in Figure 3, has a plate 25 with an aperture 27. The size of this aperture is sufficient to enable one of the character-shaped beams to pass therethrough. The location of this aperture is aligned with the circumference of the circle, around which the character-shaped apertures are disposed.

For standby operation, a plurality of the character-shaped beams will fall upon the selection member, but only the character A will pass through the aperture. The control grid enables this to be blanked out when it is not needed. Means are provided for revolving the character-shaped beam about the selection axis so that a desired one of the character-shaped beams will pass through the selection plate aperture. The remaining beams are blocked by the selection plate. An electron lens 36, consisting of a plurality of separate induction coils 36A through 36L, serves the purpose of both imaging the plurality of character-shaped electron beams on the selection plate 25 and revolving the character-shaped beams clockwise or counterclockwise as required to permit a desired one of them to pass through the selection aperture.

In the process of beam selection, signals which can be digital code signals, are applied over the input 34 to the control unit 32. The control unit 32 can serve the function of a digital-to-analog conversion of these signals to establish currents through the various coils of lens 5 for providing the extent of rotation of the plurality of character-shaped beams required to select the desired one of these character-shaped beams. Under zero-signal input conditions, coils of lens 5 are energized in a manner which allows the shaped beams to appear in the plane of the selection member 25 and in relation to the aperture 27 for the selection of the letter 'A'. An

angular deviation from these conditions in either a clockwise or a counterclockwise direction is achieved by disturbing a differential current flow in the system of the coil windings 36. Since the combination of the coils do not represent an infinitely long coil, controlled rotational effects are achieved through an essentially balanced condition of magnetic forces between the coils.

In the process of beam selection, these magnetic forces are rearranged within the section of the tube between the plane defined by the aperture plate 21 and the plane defined by the selection plate 25, so that the electron beams may be allowed to deviate from a path somewhat parallel to the axis, after leaving the plane of plate 21, and are again returned to a path parallel to the axis just prior to reaching the plane of plate 25. This rearrangement of magnetic forces is effected, for example, through adjustment of the current to the coils 36A through 36L. Coils 36C, D, E, and F may provide selection spiral, and coils 36G, H, I, and J may provide reference control in response to input signal current to these coils. Coils 36A and B and coils 36K and L serve as trim windings for the dynamically controlled coils.

Considering now the second portion of the tube 10B, it can be seen that the deflection axis is offset from the selection axis by an amount equal to the radial dimension of the aperture 27 from the selection axis. When a beam has passed through the aperture 27, it will follow a path along the deflection axis. At the deflection plane the deflection yoke 14 is used to deflect the beam toward the areas of the screen 12 at which it is wished to position the character. It will thus be seen that a minimum of both selection structure as well as a minimum of deflection structure is required. The process of character-beam selection results in the selected beam being directed along the deflection axis of the tube. Beam focus, beam selection, and axial referencing of the beams is all obtained by the common lens system which is external to the tube. Furthermore, with the arrangement shown herein, the character beam-selection system is entirely independent of the source from which the cross sectionally formed beams are derived. Further, spherical aberration which is normally experienced in electron optical systems is avoided.

It should be noted that the source of character-shaped beams existing in the plane of the aperture plate 21 may be derived in a variety of different ways. For example, they can be derived photo-emissively from a plane or a light-sensitive cathode, or from discrete thermo-emissive surfaces, or from apertures in the shape of characters through which electrons from any type of desired primary source have been directed.

While certain embodiments of the invention have been specifically disclosed, it is understood that the invention is not limited thereto, as many 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 a selected shaped-beam cathode-ray tube, the improvement comprising means for generating a plurality of circularly disposed character-shaped electron beams, a selection plate positioned in the path of said plurality of electron beams and having an aperture therein of a size to pass only one of said character-shaped electron beams, the aperture of said selection plate being substantially aligned with the circumference of the circle of said circularly disposed character-shaped beams, and means for revolving all said character-shaped electron beams until a desired one of said shaped beams passes through the aperture of said selection plate.

2. In a selected shaped-beam cathode-ray tube having an electron beam generating means in one end of said tube and a screen at the other end, the improvement comprising an aperture plate having a plurality of character-shaped apertures disposed around the circum-

5

ference of a circle, means for directing a beam of electrons from said generating means at said aperture plate to provide a plurality of character-shaped electron beams disposed circularly, a selection plate spaced from said aperture plate and in the path of said plurality of shaped beams and having an aperture therein of a size to pass only one of said character-shaped electron beams, the aperture of said selection plate being on the circumference of the circle of said circularly disposed character-shaped electron beams, and means for revolving all said circularly disposed character-shaped electron beams until a desired one of said shaped beams passes through the aperture of said selection plate.

3. In a selected shaped-beam cathode-ray tube having an electron beam generating means in one end of said tube and a screen at the other end, the improvement comprising an aperture plate having a plurality of character-shaped apertures disposed around the circumference of a circle, means for directing a beam of electrons from said generating means at said aperture plate to provide a plurality of character-shaped electron beams disposed circularly, a selection plate spaced from said aperture plate and in the path of said plurality of shaped beams and having an aperture therein of a size to pass only one of said character-shaped electron beams, the aperture of said selection plate being on the circumference of the circle of said circularly disposed character-shaped electron beams, means for revolving all said circularly disposed character-shaped electron beams until a desired one of said shaped beams passes through the aperture of said selection plate, and means for deflecting said desired one of said shaped beams to a desired portion of said screen, said means for deflecting having its axis substantially coincident with the aperture of said aperture plate.

4. In a selected shaped-beam cathode-ray tube as re-

6

cited in claim 3 wherein said means for revolving all said circularly disposed character-shaped beams includes a plurality of induction coils disposed axially and adjacent each other between said aperture plate and said selection plate, and means for applying current to said plurality of coils to obtain the amount of revolution of said plurality of shaped beams required for permitting a desired one of said plurality of electron beams to pass through said deflection plate aperture.

5. In combination a tube envelope having a first portion disposed about a first axis and a second portion disposed about a second axis displaced from said first axis, said first portion including means for generating a plurality of character-shaped electron beams disposed around the circumference of a circle having said first axis as its center, a selection plate positioned in the path of said plurality of electron beams and having an aperture therein of a size to pass only one of said character-shaped electron beams, said aperture being substantially aligned with the circumference of said circle, means for revolving all said character-shaped electron beams until a desired one of them passes through said aperture, a screen in the second portion of said tube envelope, and means for deflecting the electron beam passing through said aperture to a desired portion of said screen, said means for deflecting having said second axis as a center, said second axis being aligned with said aperture.

6. In the combination recited in claim 5 wherein said means for generating a plurality of character-shaped beams includes means for generating a beam of electrons, an aperture plate having a plurality of character-shaped apertures disposed around the circumference of said circle, and means for directing a beam of electrons from said generating means at said aperture plate to provide said plurality of character-shaped beams.

No references cited.