Oct. 24, 1967 O. F. HAMANN 3,349,269

ASTIGMATIC LENS ARRANGEMENT FOR CATHODE RAY TUBES

Filed Nov. 29, 1963

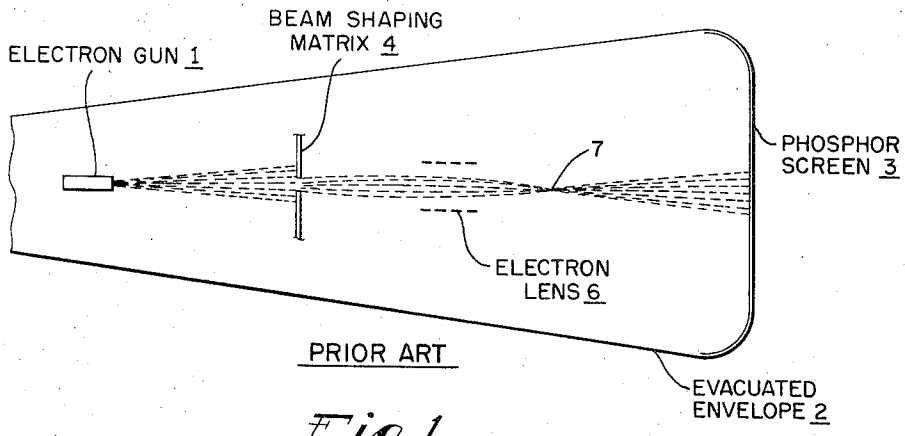


Fig. 1

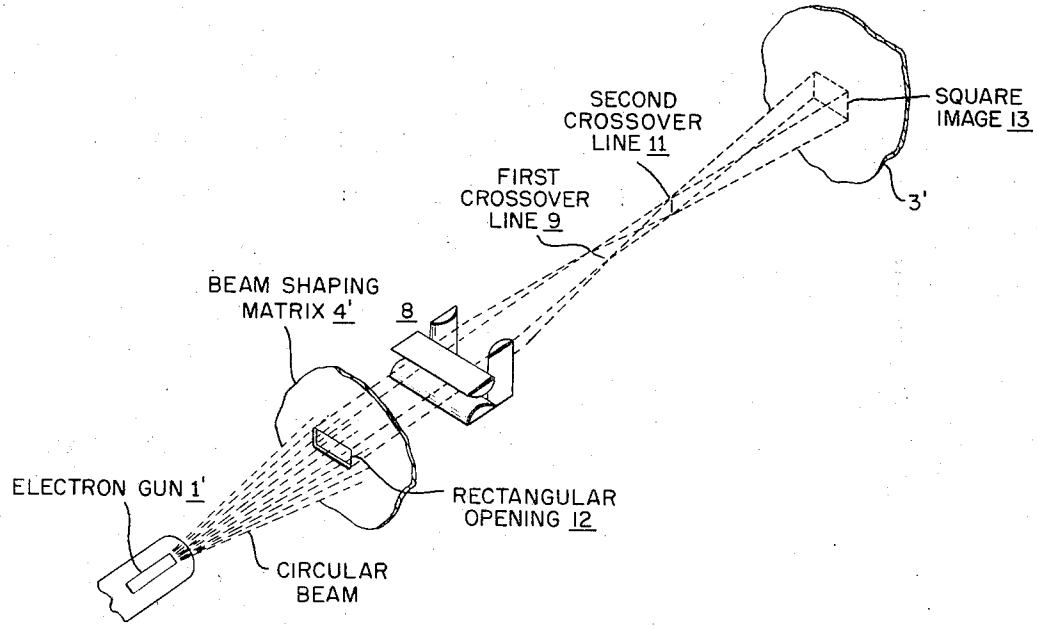


Fig. 2

INVENTOR.
OMER F. HAMANN

BY
Robert L. Mathars

ATTORNEY

United States Patent Office

3,349,269

Patented Oct. 24, 1967

3,349,269

ASTIGMATIC LENS ARRANGEMENT FOR CATHODE RAY TUBES

Omer F. Hamann, La Jolla, Calif., assignor, by mesne assignments, to Stromberg-Carlson Corporation, Rochester, N.Y., a corporation of Delaware

Filed Nov. 29, 1963, Ser. No. 327,006

2 Claims. (Cl. 313—78)

The present invention relates to shaped-beam tubes for converting electrical data into visible characters or symbols indicative of said data.

A shaped-beam tube includes an electron gun for generating a beam of electrons, a beam shaping matrix, a phosphor screen for visual readout together with electron lenses and deflection circuitry for controlling the positioning of the beam both at the phosphor screen and at the beam shaping matrix. The beam is directed at a particular cross-point on the beam shaping matrix by beam deflection circuitry which, in effect, will select the particular character or symbol to be projected upon the screen. After the beam emerges from the beam shaping matrix, it passes through an electron lens which causes the beam to converge to a crossover point and to thereafter diverge at a small angle before impinging upon the phosphor screen. It has been found that the characters produced upon the face of the phosphor screen are limited in brightness by space charge effects at the beam crossover point. The present invention reduces this space charge effect by causing the electron beam to cross over its separate perpendicular lines, each situated in a separate focal plane perpendicular to the longitudinal axis of the tube and each positioned between the beam shaping matrix and the phosphor screen. Since the electrons cross over along separate lines rather than at one point, the space charge effect is greatly reduced and the resultant image is brighter and clearer than those images produced by the aforesaid prior art method. This is accomplished by utilizing an astigmatic lens device in place of the usual type of convergent electron lens.

It is the principal object of the present invention to provide a new and improved shaped-beam tube for producing very bright and clear images upon the face of the tube.

Other objects and advantages of the invention will become apparent as the following description proceeds and the features of novelty which characterize the invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

For a better understanding of the invention, reference may be had to the accompanying drawing, in which:

FIG. 1 shows a portion of the prior art shaped-beam tube; and

FIG. 2 discloses a particular embodiment of the present invention.

FIG. 1 schematically discloses an electron gun **1** situated within an evacuated envelope **2**, which envelope is coated with a phosphor screen **3**. A beam shaping matrix **4** is utilized to shape or form the beam. The beam is directed at various cross-points of the beam shaping matrix by deflection circuitry, not shown, to select the particular character to be displayed. The beam thereafter is focused by electron lens **6** at focal point **7** which constitutes a space charge region since the electrons are bunched together at this point. The electrons diverge at a small angle and are directed at some particular point on phosphor screen **3** by deflection circuitry, not shown. A partial degradation of the image is caused by the high concentration of electrons in the space charge region at point **7**. A

substantial improvement in brightness and resolution is achieved by utilizing an astigmatic electron lens device represented by cylindrical lenses **8** disclosed in FIG. 2. The astigmatic lens device may be thought of as two sets of cylindrical lenses, as shown in the drawings, although any astigmatic electron lens device known in the art which causes the beam to be focused at separate perpendicular lines each situated in a separate focal plane perpendicular to the longitudinal axis of the tube would attain the desired results. High brightness and resolution are attained because the electrons are not clustered at a particular point, but are spaced out along a line.

The matrix image or the shape of the characters formed upon shaping matrix **4** will have to be distorted or "compressed" in the vertical direction to compensate for the variation in object and image distances. In the absence of such compression, the characters would be stretched vertically because the distance from the first crossover line **9** to screen **3'** is greater than the distance between the second crossover line **11** and screen **3'**. For example, a rectangular opening **12** would be formed in beam shaping matrix **4'**, if it is desired to produce a square image **13** upon screen **3'**.

While there has been shown and described a specific embodiment of the invention, other modifications will readily occur to those skilled in the art. It is not, therefore, desired that this invention be limited to the specific arrangement shown and described, and it is intended in the appended claims to cover all modifications within the spirit and scope of the invention.

What is claimed is:

1. In a shaped-beam tube, an electron beam generator, means for shaping said beam to form a symbol, a screen for receiving an image of said symbol, and an astigmatic electron lens device positioned between said means for shaping said beam and said screen for focusing said beam, said astigmatic electron lens device including first and second pairs of partial cylindrical lens members, said lens members of each pair having their cylindrical surfaces opposed on opposite sides of the beam path, the axes of said lens members of said first pair being transverse to the axes of said lens members of said second pair and to the beam path.

2. In a shaped-beam tube having a longitudinal axis, an electron beam generator, means for shaping said beam to form a symbol, a screen for receiving an image of said symbol, and an astigmatic electron selection lens device positioned between said means for shaping and said screen for focusing said beam in separate perpendicular lines each situated in a separate focal plane substantially perpendicular to said longitudinal axis between said means for shaping said beam and said screen, said astigmatic electron lens device including first and second pairs of partial cylindrical lens members, said lens members of each pair having their cylindrical surfaces opposed on opposite sides of the beam path, the axes of said lens members of said first pair being transverse to the axes of said lens members of said second pair and to the beam path.

References Cited

UNITED STATES PATENTS

2,986,668	5/1961	Haflinger et al.	313—78
2,986,669	5/1961	Koda	313—86
2,988,660	6/1961	Corpew	313—86

DAVID J. GALVIN, *Primary Examiner.*

VINCENT LAFRANCHI, *Assistant Examiner.*