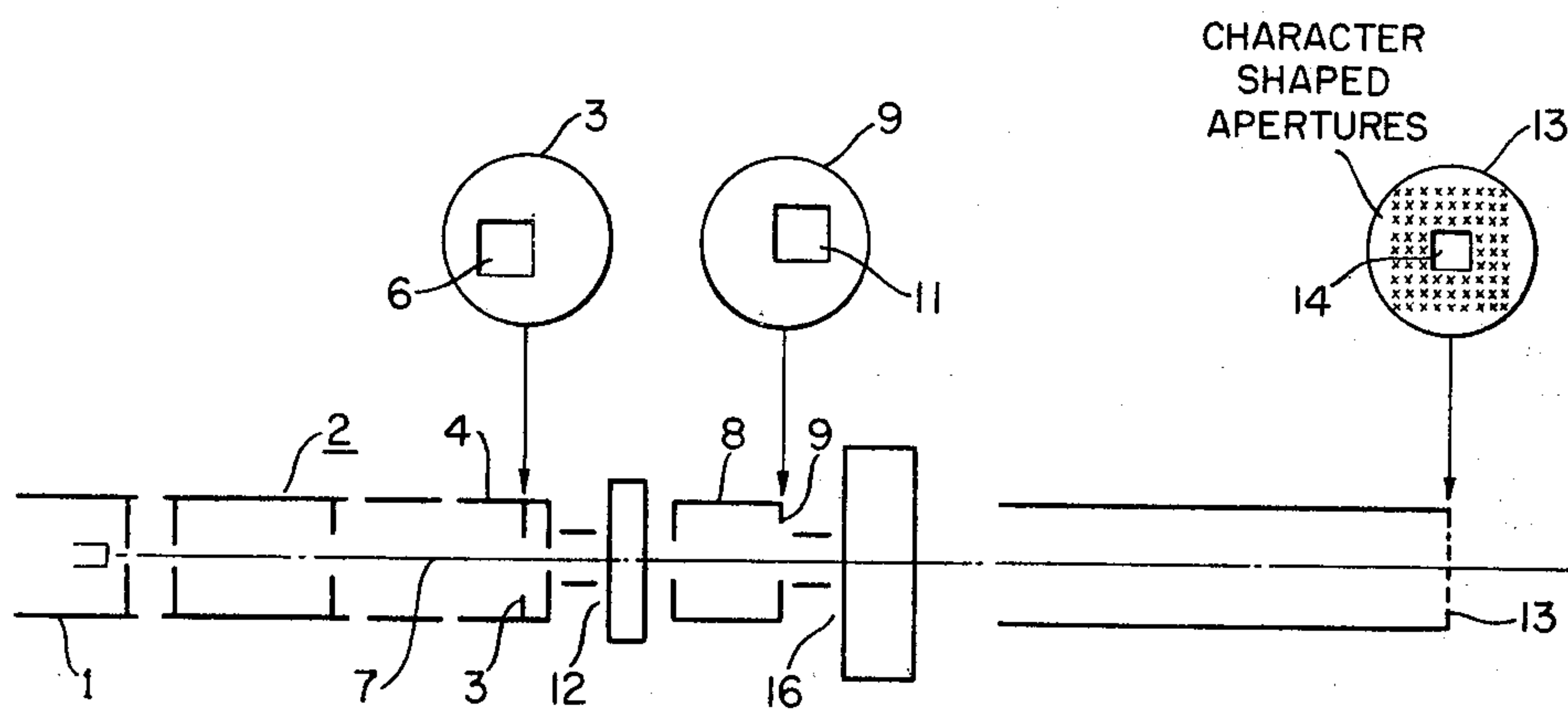


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ELECTRON GUN CONSTRUCTION FOR SHAPED-BEAM CATHODE-RAY
TUBES PROVIDING VARIABLE BEAM SIZE
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ELECTRON GUN CONSTRUCTION FOR SHAPED-BEAM CATHODE-RAY TUBES PROVIDING VARIABLE BEAM SIZE

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The present invention relates to electron guns and more specifically to electron guns for use in a shaped-beam cathode-ray tube.

Shaped-beam cathode-ray tubes utilize a barrier or matrix having character-shaped apertures formed therein for selectively shaping or extruding electron beams having cross sections which correspond to particular characters to be displayed at various positions on the face of the tube. United States Patent No. 2,735,956 to J. T. McNaney discloses such a system. Since it is desirable to provide for the generation of numerous characters, the sizes of the character-shaped apertures formed in the matrix must necessarily be fairly small and thus the cross section of the beam directed at the matrix must be small in order to prevent the spurious formation of pieces of characters formed by apertures adjacent to the selected aperture. It has been found that the optimum shape of the beam directed at the matrix to eliminate such spurious character formation takes the form of a square rather than an oval, as was formerly the case in the prior art. In certain of these shaped-beam tubes, it is often desirable to spot write data, such as radar sweeps or irregular curves, in addition to character writing. However, a higher intensity beam is required for spot writing than is required for character display, since the spot beam often sweeps across a relatively large area of the screen in a given time interval while a character shaped-beam remains stationary to excite only one area of the phosphor upon the screen. Therefore, it is desirable to focus a larger beam on the screen to produce a higher intensity spot for the spot writing mode of operation than the aforesaid beam having a small cross section which is directed at a character-shaped aperture for the character mode of operation. This is because a larger beam contains more electrons which may be concentrated or focused to yield the higher intensity spot beam. In other words, in prior art systems the intensity of the beam in the spot writing mode of operation had to be compromised by the focusing requirements upon the matrix in the character writing mode which requirement restricted the beam cross section at the matrix.

Accordingly, it is a principal object of the present invention to provide an improved electron gun utilized in a shaped-beam tube, which electron gun selectively generates a relatively large cross sectional beam for spot writing or, in the alternative, generates a relatively small cross sectional beam for writing in the character mode.

It is a further object of the present invention to provide an improved electron gun utilized in a shaped-beam tube which generates a beam having an optimum shape so that the character aperture center-to-center spacing within the matrix may be reduced to a minimum and more characters may be provided for in any particular shaped-beam tube.

Other objects and advantages of the present invention will become apparent upon studying the preferred embodiment of the invention disclosed in the sole figure.

In accordance with the present invention, a special electron gun is provided within a shaped-beam cathode-ray tube to selectively produce a first beam having a small cross sectional area which is directed at various char-

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acter-shaped apertures at certain times for operating in the character writing mode and to produce, in the alternative, a second beam having a larger cross sectional area which is directed at and passes through a relatively large noncharacter-shaped aperture at other times for operating in the spot writing mode. It is desirable to restrict the cross sectional area of the first beam to prevent "spill over" into adjacent nonselected character-shaped apertures while it is desirable to increase the size of the second beam for operating in the spot writing mode so that the focused spot beam, which sweeps across at least portions of the screen, has a greater intensity than the stationary beam which impinges upon the screen in the character writing mode.

The sole figure discloses an electron gun 1, positioned adjacent to conventional beam focusing means 2. Beam limiting barrier 3 contains square aperture 6 which appears, as shown, when viewed along longitudinal axis 7. It should be understood that the size of aperture 6 in beam limiting barrier 3 has been greatly exaggerated in order to facilitate the comprehension of the present invention. In actual practice, the aperture would be around .05 inch on a side. A shield 8 is provided having another beam limiting barrier 9 mounted thereon, which barrier has a square aperture 11 formed therein, as shown. It should be noted that square apertures 6 and 11 are in a noncongruent but overlapping relationship with respect to longitudinal axis 7. For special characters, rectangular apertures may be utilized. A pair of deflecting electrodes 12 are positioned between the aforementioned beam limiting barriers, as shown, for shifting the position of the square beam emerging from barrier 3 with respect to aperture 11 of the barrier 9. A character shaping barrier or matrix 13 is positioned, as shown, and has character-shaped apertures formed therein which are represented by X's. Character matrix 13 also has a large noncharacter-shaped aperture 14 formed therein for passing an electron beam utilized in the spot writing mode of operation. Conventional selection plates 16 are shown positioned between beam limiting barrier 9 and matrix 13 for affecting the selection of the various characters in a manner well known in the art. All of the structure to the right of matrix 13 for focusing and directing the shaped-beam at various positions on the screen is conventional and is not shown in the figure. Such structure may be found in the aforementioned McNaney patent.

The aforesaid small cross sectional, collimated, square, beam which is utilized in the character writing mode of operation is produced by merely directing the beam along the longitudinal axis of the tube until the beam is deflected by selection plates 16 to affect the selection of a particular character. The electron beam passing along the longitudinal axis of the tube will have a small square cross sectional area when arriving at selection plates 16, since the overlapping areas of square apertures 6 and 11 are quite small with regard to longitudinal axis 7. It is obvious from the inspection of the geometry of apertures 6 and 11 that the small square beam will be centrally positioned with respect to selection plates 16 and will be collimated. As mentioned hereinbefore, a larger beam is desired where the beam is to pass through aperture 14 for the spot writing mode of operation. Under these conditions, a small voltage is applied to both sets of deflection plates 12 to shift the square beam emerging from aperture 6 diagonally off-center so that a greater portion of the beam passes through aperture 11 than was the case in the character writing mode of operation disclosed hereinbefore. Matrix 13 will be positioned so that this large beam passes through aperture 14 and not through any character-shaped apertures. This larger beam is thereafter focused by conventional focusing means, not shown, and sweeps

a portion of the tube in the spot writing mode of operation. Since the beam cross sectional area is therefore much greater for the spot writing mode compared to the character writing mode, the intensity of the spot writing beam will be greater as is desired.

While I have shown and described a specific embodiment of my invention, other modifications will readily occur to those skilled in the art. I do not, therefore, desire my invention to be limited to the specific arrangement shown and described, and I intend in the appended claims to cover all modifications within the spirit and scope of my invention.

What is claimed is:

1. In a shaped-beam cathode-ray tube for operating in both the character writing mode and the spot writing mode, the combination comprising a first beam shaping barrier having a plurality of character-shaped apertures formed therein for shaping an electron beam in the character writing mode of operation and a noncharacter-shaped aperture for shaping an electron beam which is utilized in the spot writing mode of operation, a second beam limiting barrier having a first rectangular aperture formed therein, a third beam limiting barrier having a second rectangular aperture formed therein, said first rectangular aperture being in an overlapping but noncongruent relationship with said second rectangular aperture about an axis substantially perpendicular to the planes of both said second and third beam limiting barriers, means for producing a beam of electrons and for causing at least a portion of said beam to be passed through said first rectangular aperture, means positioned between said second and third beam limiting barriers for selectively shifting the position of the beam shaped by said first aperture with respect to said second aperture to increase the size of the beam passed by said second aperture for operating in the spot writing mode and for decreasing the size of the beam passed by said second aperture for operating in the character writing mode of operation, means situated between said first beam shaping barrier and said third beam limiting barrier for causing the beam passing through said third beam limiting barrier to be directed at selected character-shaped apertures for operating in the character writing mode or to be passed through said noncharacter-shaped aperture for operating in the spot writing mode.

2. In a shaped-beam cathode-ray tube for operating in both the character writing mode and the spot writing mode, the combination comprising a first beam shaping barrier having a plurality of character-shaped apertures formed therein for shaping an electron beam in the character writing mode of operation and a noncharacter-shaped aperture for shaping an electron beam which is utilized in the spot writing mode of operation, a second beam limiting barrier having a first square aperture formed therein, a third beam limiting barrier having a second square aperture formed therein, said first square aperture being in an overlapping but noncongruent relationship with said second square aperture about an axis substantially perpendicular to the planes of both said second and third beam limiting barriers, means for producing a beam of electrons and for causing at least a portion of said beam to be passed through said first square aperture, means positioned between said second and third beam limiting barriers for selectively shifting the position of the beam shaped by said first aperture with respect to said second aperture to increase the size of the beam passed by said second aperture for operating in the spot writing mode and for decreasing the size of the beam passed by said second aperture for operating in the character writing mode of operation, means situated between said first beam shaping barrier and said third beam limiting barrier for causing the beam passing through said third beam limiting barrier to be directed at selected character-shaped apertures for operating in the character writing mode or to be passed through said

noncharacter-shaped aperture for operating in the spot writing mode.

3. In a shaped-beam cathode-ray tube for operating in both the character writing mode and the spot writing mode, the combination comprising a first beam shaping barrier having a plurality of character-shaped apertures formed therein for shaping an electron beam in the character writing mode of operation and a noncharacter-shaped aperture for shaping an electron beam which is utilized in the spot writing mode of operation, said noncharacter-shaped aperture being larger than individual ones of said character-shaped apertures, a second beam limiting barrier having a first rectangular aperture formed therein, a third beam limiting barrier having a second rectangular aperture formed therein, said first rectangular aperture being in an overlapping but noncongruent relationship with said second rectangular aperture about an axis substantially perpendicular to the planes of both said second and third beam limiting barriers, means for producing a beam of electrons and for causing at least a portion of said beam to be passed through said first rectangular aperture, means positioned between said second and third beam limiting barriers for selectively shifting the position of the beam shaped by said first aperture with respect to said second aperture to increase the size of the beam passed by said second aperture for operating in the spot writing mode and for decreasing the size of the beam passed by said second aperture for operating in the character writing mode of operation, means situated between said first beam shaping barrier and said third beam limiting barrier for causing the beam passing through said third beam limiting barrier to be directed at selected character-shaped apertures for operating in the character writing mode or to be passed through said noncharacter-shaped aperture for operating in the spot writing mode.

4. In a shaped-beam cathode-ray tube for operating in both the character writing mode and the spot writing mode, the combination comprising a first beam shaping barrier having a plurality of character-shaped apertures formed therein for shaping an electron beam in the character writing mode of operation and a noncharacter-shaped aperture for shaping an electron beam which is utilized in the spot writing mode of operation, said noncharacter-shaped aperture being larger than individual ones of said character-shaped apertures, a second beam limiting barrier having a first square aperture formed therein, a third beam limiting barrier having a second square aperture formed therein, said first square aperture being in an overlapping but noncongruent relationship with said second square aperture about an axis substantially perpendicular to the planes of both said second and third beam limiting barriers, means for producing a beam of electrons and for causing at least a portion of said beam to be passed through said first square aperture, means positioned between said second and third beam limiting barriers for selectively shifting the position of the beam shaped by said first aperture with respect to said second aperture to increase the size of the beam passed by said second aperture for operating in the spot writing mode and for decreasing the size of the beam passed by said second aperture for operating in the character writing mode of operation, means situated between said first beam shaping barrier and said third beam limiting barrier for causing the beam passing through said third beam limiting barrier to be directed at selected character-shaped apertures for operating in the character writing mode or to be passed through said noncharacter-shaped aperture for operating in the spot writing mode.

5. In a shaped-beam cathode-ray tube for operating in both the character writing mode and the spot writing mode, the combination comprising a first beam shaping barrier having a plurality of character-shaped apertures formed therein for shaping an electron beam in the character writing mode of operation and a noncharacter-shaped aperture for shaping an electron beam which is utilized

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in the spot writing mode of operation, a second beam limiting barrier having a first aperture formed therein, a third beam limiting barrier having a second aperture formed therein, said first aperture being in an overlapping but noncongruent relationship with said second aperture about an axis substantially perpendicular to the planes of both said second and third beam limiting barriers, means for producing a beam of electrons and for causing at least a portion of said beam to be passed through said first aperture, means positioned between said second and third beam limiting barriers for selectively shifting the position of the beam shaped by said first aperture with respect to said second aperture to increase the size of the beam passed by said second aperture for operating in the spot writing mode and for decreasing the size of the beam passed by said second aperture for operating in the character writing mode of operation, means situated between said first beam shaping barrier and said third beam limiting barrier for causing the beam passing through said third beam limiting barrier to be directed at selected character-shaped apertures for operating in the character writing mode or to be passed through said noncharacter-shaped aperture for operating in the spot writing mode.

6. In a shaped-beam cathode-ray tube for operating in both the character writing mode and the spot writing mode, the combination comprising a first beam shaping barrier having a plurality of character-shaped apertures formed therein for shaping an electron beam in the character writing mode of operation and a noncharacter-shaped aperture for shaping an electron beam which is utilized in the spot writing mode of operation, said noncharacter-shaped aperture being larger than individual ones of said character-shaped apertures, a second beam limiting barrier having a first aperture formed therein, a third beam limiting barrier having a second aperture formed therein, said first aperture being in an overlapping but noncongruent relationship with said second aperture about an axis substantially perpendicular to the planes of both said second and third beam limiting barriers, means for producing a beam of electrons and for causing at least a portion of said beam to be passed through said first apertures, means positioned between said second and

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third beam limiting barriers for selectively shifting the position of the beam shaped by said first aperture with respect to said second aperture to increase the size of the beam passed by said second aperture for operating in the spot writing mode and for decreasing the size of the beam passed by said second aperture for operating in the character writing mode of operation, means situated between said first beam shaping barrier and said third beam limiting barrier for causing the beam passing through said third beam limiting barrier to be directed at selected character-shaped apertures for operating in the character writing mode or to be passed through said noncharacter-shaped aperture for operating in the spot writing mode.

7. In a shaped-beam cathode-ray tube for operating in both the character writing mode and the spot writing mode, the combination comprising a beam shaping barrier having a plurality of character-shaped apertures and a noncharacter-shaped aperture formed therein, beam generating means for producing a beam of electrons of substantially greater cross-sectional size than the area occupied by any character-shaped aperture and directing said beam of electrons toward said barrier, and beam control means positioned between said beam generating means and said barrier for selectively controlling the cross-sectional area of said beam including means for effecting selective interception of a portion of said beam only at such time as said beam is to be directed to a character-shaped aperture to reduce the size thereof to approximately the size of a character-shaped aperture.

8. The combination defined in claim 7 wherein said beam generating means generates a beam of square cross-section.

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