April 27, 1965 W. R. SLOAN 3,181,026

CHARACTER GENERATING TUBE

Filed Nov. 1, 1960 2 Sheets-Sheet 1

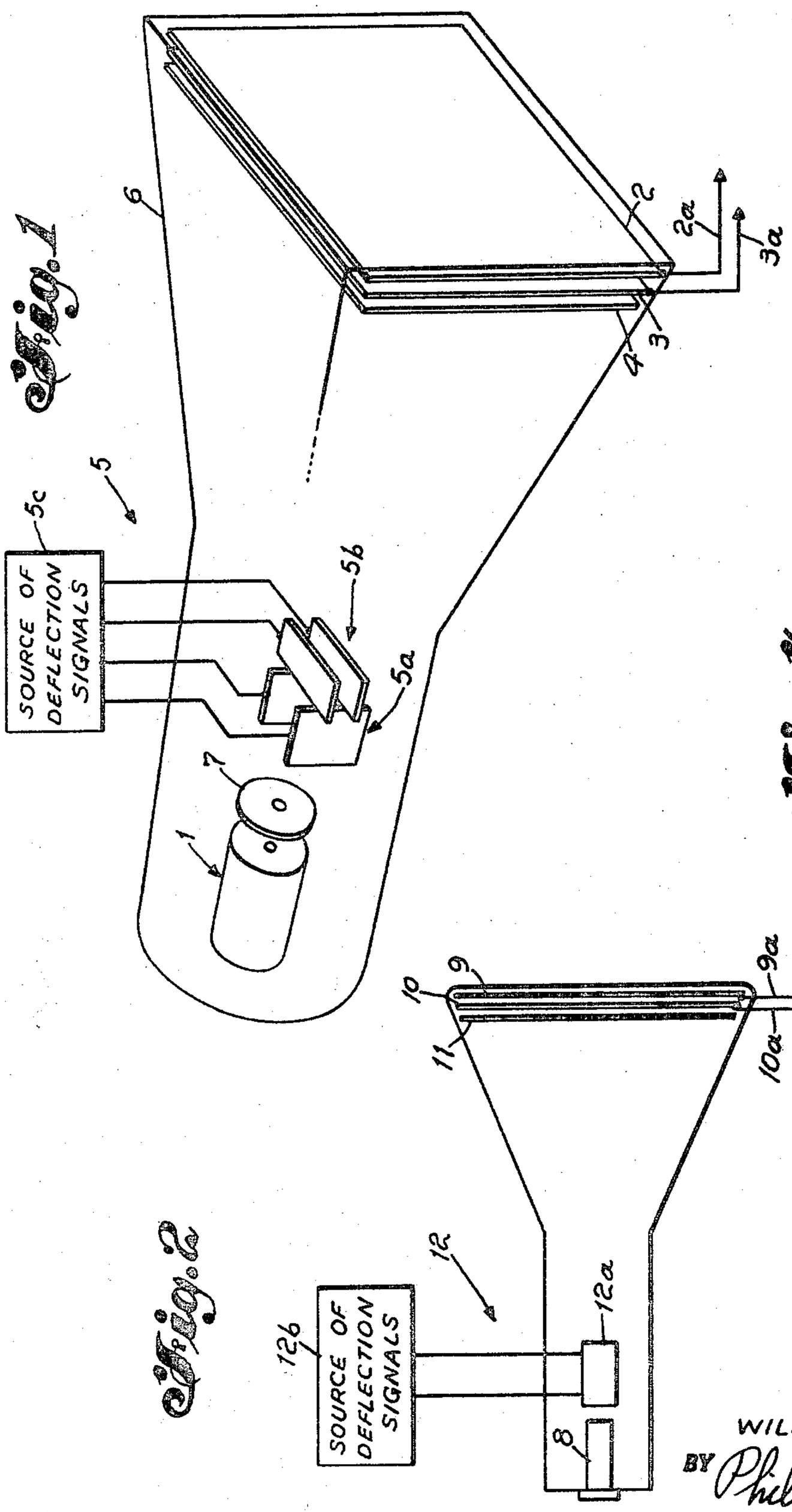

Fig. 1

Fig. 2

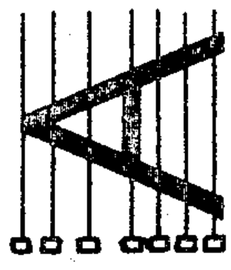

Fig. 3

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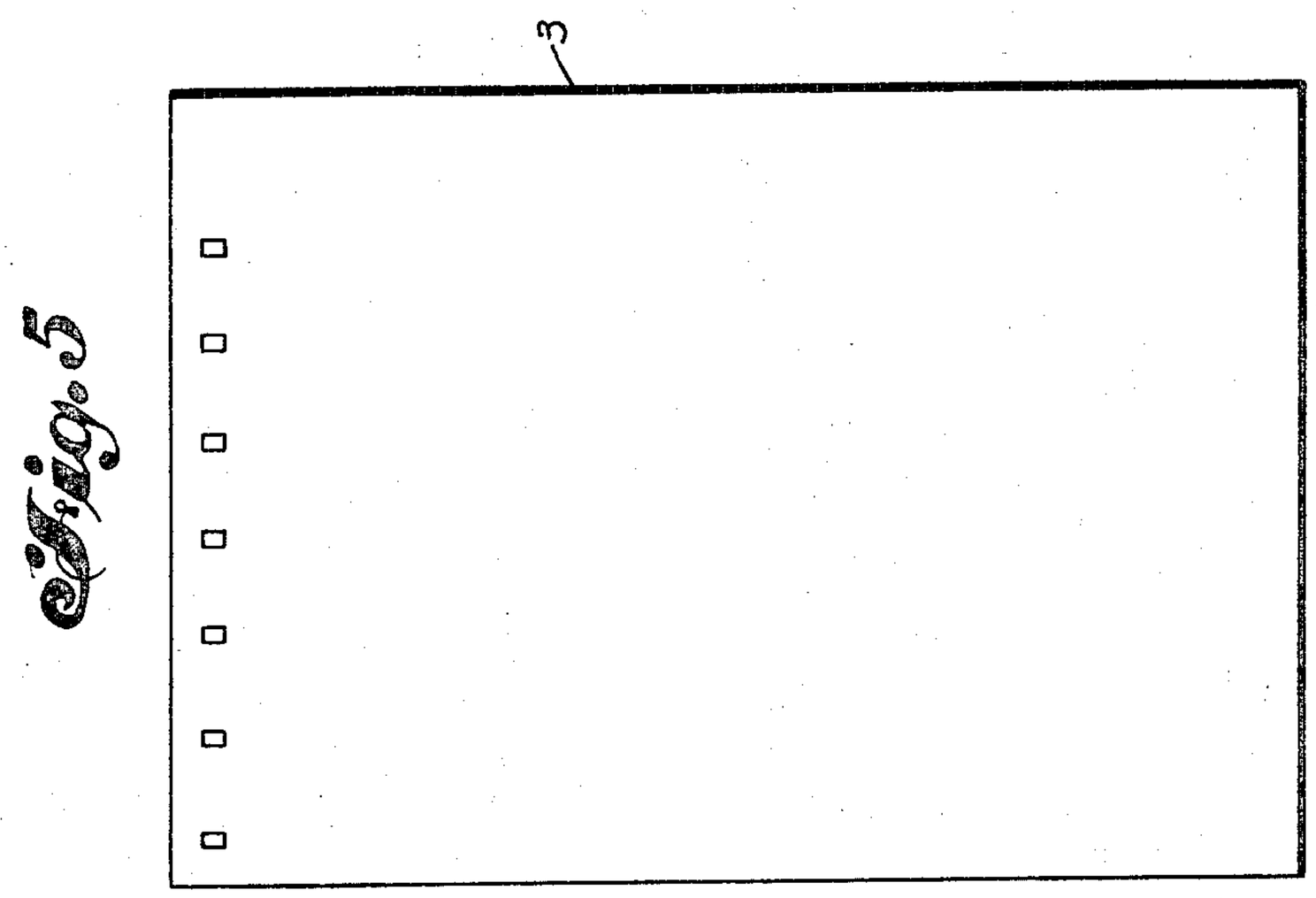

Fig. 5

Fig. 4

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CHARACTER GENERATING TUBE

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The present invention relates to character generating tubes, and more particularly to a character generating tube for producing output signals related to predetermined shapes of characters.

A common method of generating signals related to given shapes, such as alpha-numeric characters, is to have the desired characters disposed on a plate of a cathode ray tube, such as by apertures or inked portions in the shape of the characters located on a conductive plate, and scanning a desired character in the horizontal and vertical direction. An anode or collector positioned behind or adjacent to the conductive plate receives the scanning beam which has been modulated by the apertured or inked portions of the scanned area of the conductive plate. This described method requires that the character be scanned in both the horizontal and vertical direction and therefore necessitates horizontal and vertical deflection voltages or currents as well as positioning signals to position the beam to the desired character on the plate.

An object of the present invention is to provide an improved character generating tube producing character shape intelligence in the form of separate synchronizing and information signals with a high signal to noise ratio.

In accordance with the present invention a character generating tube is provided wherein character shapes as well as synchronizing indicia are disposed on a first masking plate in the form of apertures, the apertures representing the two dimensional character shape arranged in a single line. A scanning beam is deflected across the single line representing a desired character thereby producing sync and character information signals. A second masking plate mounted behind the first masking plate also contains sync apertures such that the information signals are removed and the sync signals pass through to a collector. Alternatively, the second masking plate may contain character shape apertures instead of sync apertures such that the sync signals are removed thereat and the character shape signals pass through to the collector.

The present invention is explained with reference to the drawings in which:

FIG. 1 is a perspective view of a preferred embodiment of a character generating tube in accordance with the principles of the present invention;

FIG. 2 is a schematic of another embodiment of a character generating tube in accordance with the principles of the present invention;

FIG. 3 is an illustration of the manner in which a character shape is arranged in a single coordinate;

FIG. 4 is an illustration of a masking plate used in the present invention;

FIG. 5 is an illustration of another masking plate used in the present invention.

Referring to FIG. 1, a radiant beam tube for generating character information signals is shown comprising a radiant beam source **1**, means **2** responsive to radiant beam source **1** to produce signals in response thereto, means **3** responsive to said radiant beam to produce signals in response thereto, means **3** having apertures therein in a given arrangement to permit the passage of the radiant beam to means **2**, modulating means **4** to modulate the radiant beam, and a deflection system **5** to deflect the radiant beam with respect to modulating means **4**.

More particularly, within evacuated tube **6** an electron gun **1** and a focus electrode **7** produce a pencil electron

beam which is deflected by horizontal deflection plates **5***a*, and vertical deflection plates **5***b*, in accordance with control signals from source of deflection control signals **5***c* in a manner similar to conventional cathode ray tubes. Deflection means **5** is shown as an electrostatic system, but it is understood that any suitable known deflection system may also be employed. Deflection means **5** deflects the electron beam from electron gun **1** across an electrode **4** in a manner to be more fully explained.

Electrode **4** is a modulating device which modulates the electron beam in accordance with desired character and sync information. Another electrode **3** receives portions of the modulated electron beam from electrode **4** while permitting other portions of the beam to pass on to a collector **2**. Electrodes **3** and **4** function as masking plates and contain apertures related to the character shapes and sync indicia to be generated.

The present invention includes an improved scheme for arranging the character shapes and sync indicia on the electrodes of the tube. In FIG. 3 the character "A" is shown in conventional form. Heretofore the desired characters would be represented in conventional form on a plate of the tube and scanned in both the horizontal and vertical direction. If however the conventional character is considered as being made up of a series of horizontally disposed segments, the shape of the character could be rearranged in a single line composed of the horizontal segments arranged end to end. In FIG. 3, character "A" is divided into seven (for purposes of illustration) segments, each segment being identified by a sync indicia shown as a white box. When arranged end to end, the character shape is represented by black indicia of varying length and position within equal spaces determined by the sync indicia.

FIGS. 4 and 5 illustrate how the character "A" may be arranged on electrodes **3** and **4**. FIG. 4 illustrates electrode **4** of FIG. 1 having character shape "A" arranged thereon in a manner explained in reference to FIG. 3. Electrode **4** is preferably a conductive material of a suitable metal such as Kovar or stainless steel having apertures therein represented by the white and black boxes of the illustration. The white boxes represent sync information and the black boxes represent character shape information for clarity in explanation; however, it is understood that both white and black boxes represent physical apertures in the electrode. It is to be understood that a plurality of characters may be horizontally arranged in like manner on the electrodes, limited only by the number of characters desired or the dimensions of the electrodes. Because of the high resolution afforded by the use of apertures, the apertures themselves may be made very small.

When it is desired to generate any given character arranged on the electrodes, the electron beam is vertically positioned at the left edge of electrode **4** in line with the apertures representing said character, and the beam is then deflected horizontally across the apertures. It is noted that only one positioning signal is required to select a given character, and only one sweep signal is required to generate the character.

As the electron beam from gun **1** is deflected across electrode **4**, the beam will pass through the apertures, thereby being modulated by the sync and character shape information. A second masking plate electrode **3** is positioned behind electrode **4** and receives the portions of the electron beam passing through the apertures. As shown in FIG. 5, electrode **3** also contains apertures located in the same physical position on electrode **3** as are the sync apertures located on electrode **4**. As the electron beam passes through the sync and character shape apertures of electrode **4**, the beam portions passing through the character shape apertures will strike elec-

trode 3 while the beam portions passing through the sync apertures will also pass through the apertures of electrode 3 and strike collector 2. The character shape signals are removed from electrode 3 via output lead 3*a* and the sync signals are removed from collector 2 via output lead 2*a*.

It is understood that electrode 3, as an alternate embodiment, may contain apertures located in the same physical position as are the character shape apertures of electrode 4 such that the sync beam portions passing through electrode 4 will strike electrode 3 and be removed as electrical signals while the character shape beam portions will pass through to collector 2 where they also will be removed as electrical signals.

The output signals on leads 2*a* and 3*a* represent the shape of desired characters arranged in serial fashion with the sync signals determining the points at which the character shape signals are to be rearranged to form conventional character shapes. The present invention is useful as an alpha-numeric character generator and the output signals on leads 2*a* and 3*a* can be used as inputs to storage devices, or display devices such as magnetic tape systems or illuminated displays. The output signals have the advantage that the character shape signals and the sync signals are separated. Other advantages of the present invention are that the use of apertured electrodes results in a high signal to noise ratio, and that the single line arrangement of the character shape on electrode 4 necessitates only one positioning signal and only a single sweep signal for scanning the character.

Referring to FIG. 2, another embodiment of the present invention is shown comprising a light beam source 8, first photoconductive member 9 responsive to the light beam from source 8, second photoconductive member 10 having apertures therein in a first given arrangement to permit the passage of given portions of the light beam to photoconductive means 9, a light opaque member 11 having apertures therein in a second given arrangement to permit the passage of given portions of the light beam to photoconductive member 10, and a deflection system 12 to deflect the light beam across the apertures of light opaque member 11.

Light beam source 8 may be a source of ordinary incandescent light producing a small diameter pencil beam. Deflection means 12 may include a light deflecting device 12*a*, such as a prism or mirror, and a source of deflection control signals 12*b* for physically moving prism device 12*a* to position the light beam from source 8. An alternative deflection scheme, not shown, might be to have source 12*b* directly position source 8 to provide the scanning mode of the light beam. Photoconductive plate 9, photoconductive plate 10, and opaque plate 11, are located with respect to each other in a manner similar to collector 2, electrode 3, and electrode 4 respectively, in FIG 1. Plate 9 is a light to electrical converter and is preferably a thin sheet of photoconductive material. Plate 10 is similar to plate 9 with the exception that apertures are located in a manner identical to plate 3 of FIG. 5. Plate 10 should be light opaque. Plate 11 should be light opaque but need not be photoconductive. Plate 11 contains apertures located in a manner identical to plate 4 of FIG. 4.

In operation, the light beam from source 8 is deflected in a horizontal line across the apertures of plate 11 which are related to the character desired to be produced in a manner similar to that described in connection with FIG. 3. The light beam portions passing through the apertures of plate 11 will fall on plate 10, the character shaping portions causing output signals from lead 10*a* and the sync portions passing through to plate 9 causing sync signals to be produced on lead 9*a*. The components of FIG. 2 are shown enclosed in a tube envelope, but this is not a necessity since an evacuated atmosphere is not required.

It is seen from the above discussion that a new and useful character generating device has been developed for producing output signals related to the shapes of selected characters. The invention has the advantages of a high signal to noise ratio, high speed, only a single deflection signal is required for scanning, the synchronizing and character signals are maintained separate, and wide tolerances are permitted in the deflection signals and the beam dimensions.

While I have described above the principles of my invention in connection with specific apparatus, it is to be clearly understood that this description is made only by way of example and not as a limitation to the scope of my invention as set forth in the objects thereof and in the accompanying claims.

I claim:

1. A radiant beam tube for generating character information signals comprising a radiant beam source, first means responsive to said radiant beam to produce signals in response thereto, second means responsive to said radiant beam to produce signals in response thereto mounted intermediate said beam source and said first responsive means and having apertures therein in a given arrangement permitting passage of said radiant beam to strike said first responsive means, modulating means mounted intermediate said second responsive means and said beam source to modulate said radiant beam and having apertures therein permitting passage of given portions of said radiant beam to strike said second responsive means, said modulating means apertures being divided into aligned groups, the apertures of different said groups varying in size and position in accordance with the shape of selected portions of a character arranged serially and which if connected together would form a predetermined contiguous character, and a deflection system mounted intermediate said modulating means and said beam source to deflect said radiant beam across said aligned groups of apertures in said modulating means to produce signals forming said portions of said predetermined character.

2. A radiant beam tube for generating character information signals comprising a radiant beam source, first means responsive to said radiant beam to generate signals in response thereto, second means responsive to said radiant beam to produce signals in response thereto mounted intermediate said beam source and said first responsive means and having apertures therein in a given arrangement permitting passage of given portions of said radiant beam to strike said first responsive means, a masking means mounted intermediate said beam source and said second responsive means and having aligned apertures therein permitting the passage of given portions of said radiant beam to strike said second responsive means, said masking means apertures including a first group spaced and sized in conformance with selected segments of a character and together forming a complete character and a second group dividing said first group into separate portions each for different said selected segments, and a deflection system mounted intermediate said beam source and said masking means to deflect said radiant beam across said groups of aligned apertures of said masking means to produce signals forming said segments of said character.

3. A radiant beam tube according to claim 2 wherein said first group of apertures forming said character are equal in one dimension to form a common line and vary in a second dimension along said line in accordance with the shape of said character and position thereon, and said second group of apertures comprise synchronizing apertures spaced at equal intervals along said common line in said second dimension.

4. A radiant beam tube according to claim 3 wherein said given arrangement of said apertures in said second responsive means includes apertures arranged in the same relative positions therein as the synchronizing apertures in said masking means.

5. A radiant beam tube according to claim 2 wherein said radiant beam source is a light beam source.

6. A radiant beam tube according to claim 2 wherein said radiant beam source is an electron beam source.

7. An electron beam tube for generating character information signals comprising an electron beam source, a collector responsive to said electron beam to produce electrical signals in response thereto, a first electrode mounted intermediate said beam source and said collector, said first electrode responsive to said electron beam to produce electrical signals and having apertures therein in a first given arrangement permitting passage of given portions of said electron beam to strike said collector, a second electrode mounted intermediate said beam source and said first electrode and having apertures therein arranged along a common line to permit successive scanning by said electron beam and the passage of portions of said electron beam to strike said first electrode, said apertures in said second electrode including one group sized and spaced in accordance with selected segments of a character and together forming a complete character and a second group of synchronizing apertures dividing said first group into equal portions each for different selected segments, a deflection system mounted intermediate said beam source and said second electrode to deflect said electron beam in a predetermined manner across said apertures of said second electrode to produce signals forming said segments of said character, and means to remove said signals from said collector and said first electrode.

8. A radiant beam tube according to claim 7 wherein said first group of apertures forming said character are equal in one dimension and vary in a second dimension in accordance with the shape of said character and position thereon, said second group of apertures are spaced at equal intervals along said common line in said second dimension, and said first given arrangement of said apertures in said first electrode includes apertures arranged

in the same relative position as said synchronizing apertures in said second electrode.

9. A light beam tube for generating character information signals comprising a source of light beam, first photoconductive means responsive to said light beam to produce electrical signals in response thereto, a first light opaque photoconductive member mounted intermediate said source and said photoconductive means and responsive to said light beam to produce electrical signals, said first light opaque member having apertures therein in a first given arrangement to permit the passage of given portions of said light beam to strike said first photoconductive means, a second light opaque member mounted intermediate said source and said first opaque photoconductive member, said second light opaque member having aligned apertures therein permitting the passage of given portions of said light beam to strike said first light opaque member, said aligned apertures being divided into groups varying in size and position in accordance with the shape of selected portions of a character arranged serially and which if connected together would form a predetermined contiguous character, a deflection system mounted intermediate said source and said second light opaque member to deflect said light beam across said apertures of said second light opaque member, and means to remove said signals from said first photoconductive means.

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