

April 29, 1969

D. J. PUGH ETAL

3,441,768

CHARACTER GENERATOR

Filed June 15, 1966

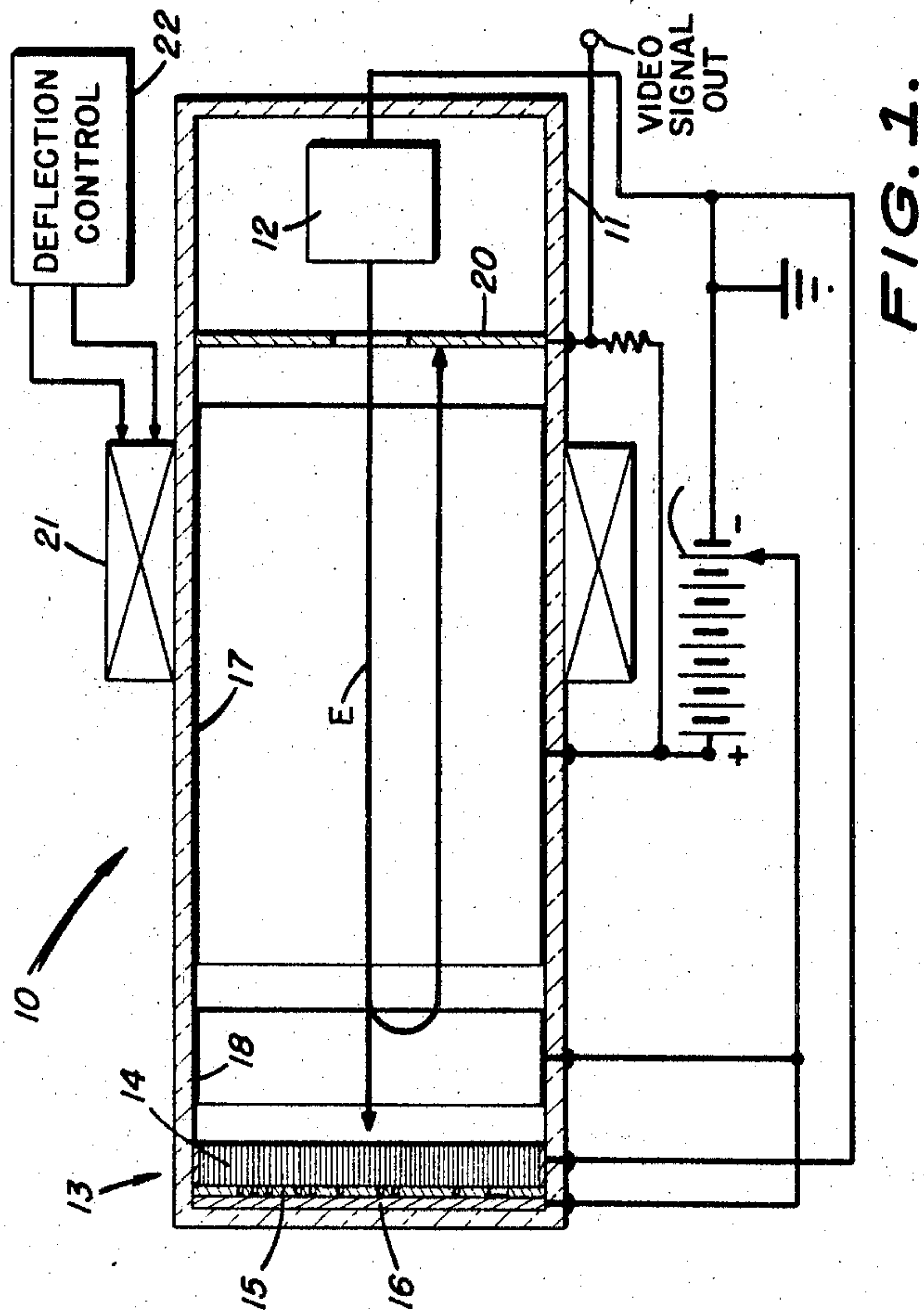


FIG. 1.

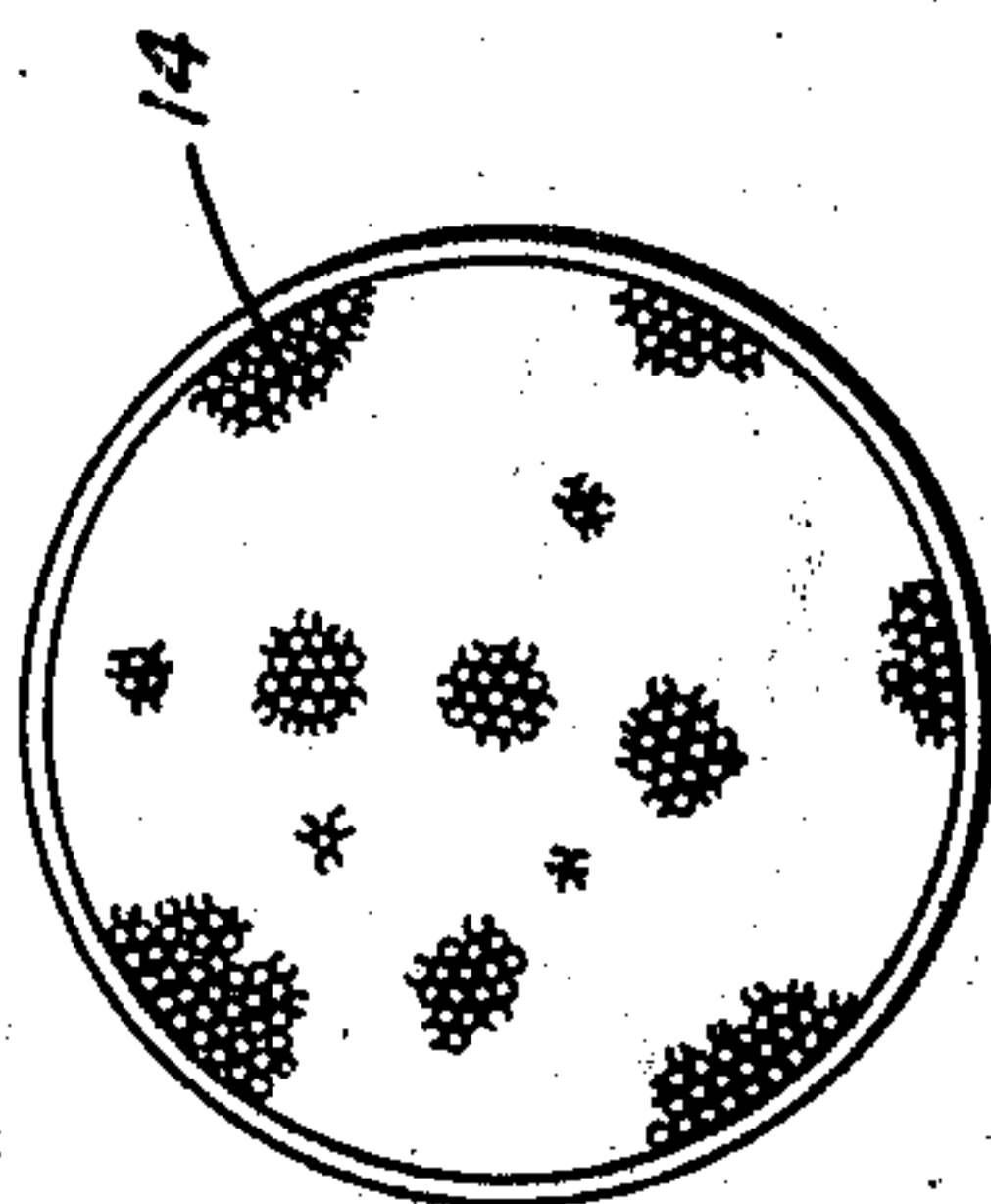


FIG. 2.

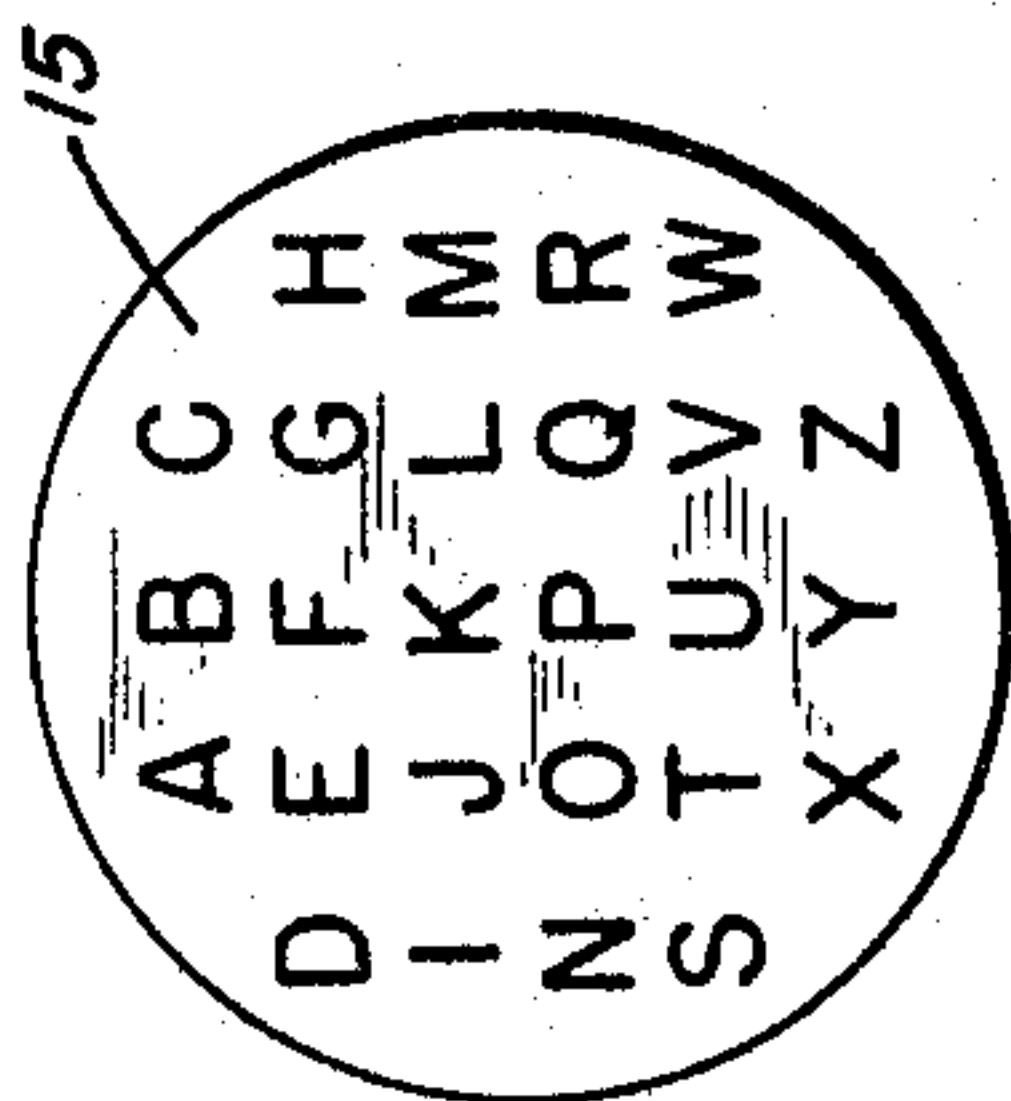


FIG. 3.

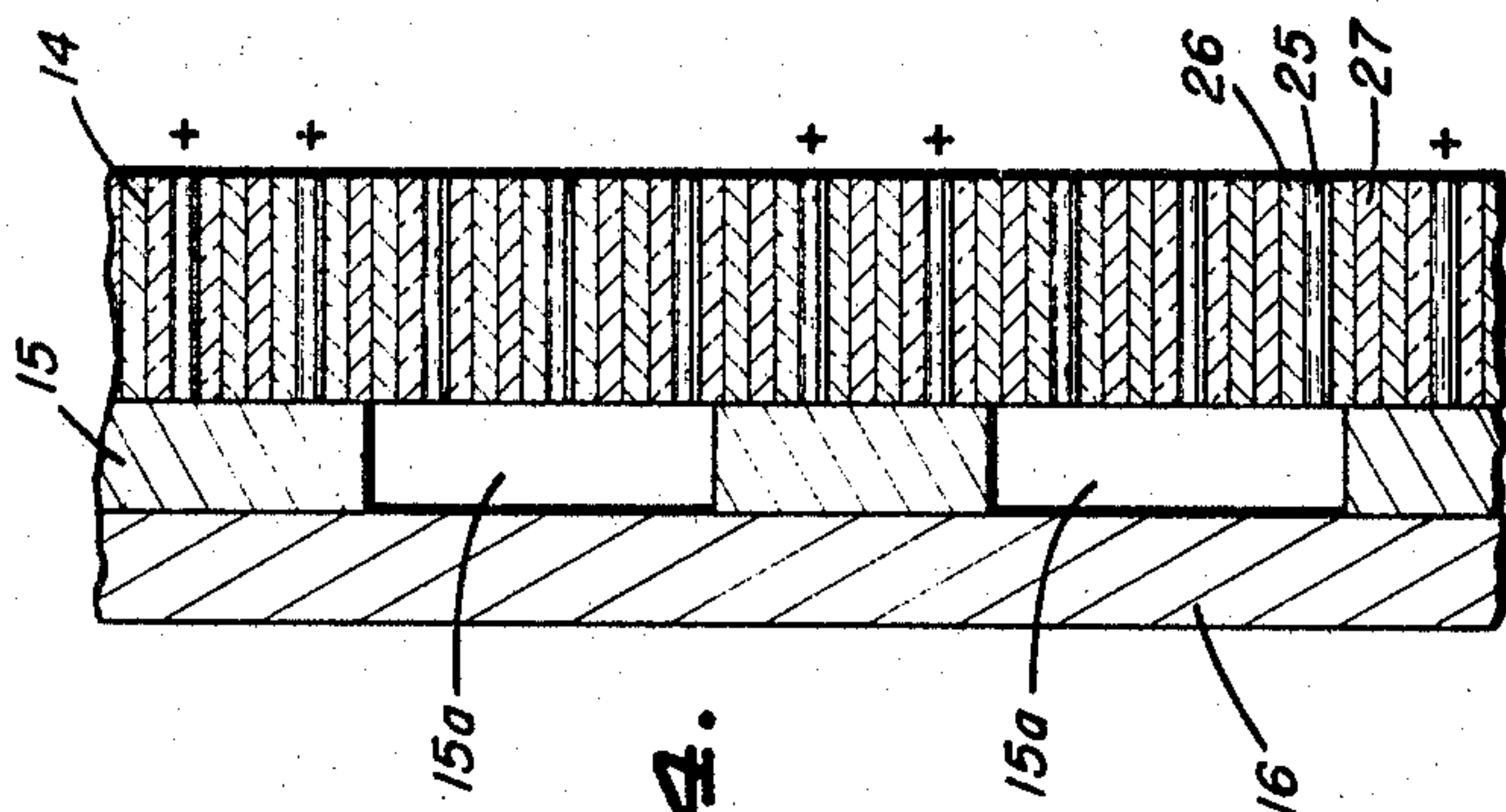


FIG. 4.

DONALD J. PUGH
BILL C. KNISLEY
INVENTORS

BY *Dicke & Craig*
ATTORNEYS

1

3,441,768

CHARACTER GENERATOR

Donald J. Pugh and Bill C. Knisley, San Diego, Calif.,
assignors to Stromberg-Carlson Corporation, Rochester,
N.Y., a corporation of Delaware

Filed June 15, 1966, Ser. No. 557,701

Int. Cl. H01j 31/48

U.S. Cl. 313—68

8 Claims

ABSTRACT OF THE DISCLOSURE

An electron discharge device for generating a signal representative of selective characters or symbols wherein a charge pattern on a composite target is converted to an electrical signal representative of the characters or symbols, the composite target including a pin face plate and character matrix in contact therewith.

This invention relates in general to electron discharge devices, and more particularly, to a means for generating video signals representing selective characters, including the letters of the alphabet, numerals, punctuation marks and other symbols and indicia which may be used for display purposes or for other uses.

Direct viewing character tubes wherein an electron beam is caused to intercept a selective character shaped aperture in a matrix prior to impingement on a phosphor screen for display of characters and other indicia is well known; however, where an electrical signal representing a character or other symbol is required for remote display or operation of diverse equipment, difficulty is encountered in converting the visual display into an electrical signal of satisfactory quality.

In addition, other special discharge devices which are known provide for character generation having an output signal representing a selected character while also providing visual display; however, these devices are constructed so that the character matrix plates cannot be readily changed after the tube is evacuated and sealed, and have therefore proved generally unsatisfactory for many applications.

It is therefore an object of the instant invention to provide a device for generating a signal representative of selective characters or symbols, which device eliminates, or substantially overcomes, the deficiencies inherent in prior art devices of a similar nature.

It is another object of the instant invention to provide a device for generating a signal representative of selective characters or symbols which is highly sensitive and efficient in operation.

It is another object of the instant invention to provide a character generator of the type described which is of simple construction, providing for economic manufacture thereof, and is reliable and trouble-free in use.

These and other objects, features and advantages of the instant invention will become more apparent from the following detailed description of the invention, when taken in conjunction with the accompanying drawings, which illustrate one embodiment of the instant invention, and wherein:

FIGURE 1 is a schematic diagram of an electron discharge device in accordance with the instant invention;

FIGURE 2 is a plan view, partially in detail, of the pin face electrode utilized in conjunction with the instant invention;

FIGURE 3 is a plan view of an aperture matrix utilized in conjunction with the instant invention; and

FIGURE 4 is a partial sectional view of the target assembly which forms part of the instant invention.

2

In brief, the invention provides an electron discharge device of the cathode ray type wherein an electron beam of low velocity is projected toward a target consisting of a pin face having a charge pattern generated across the surface thereof in the form of the characters or symbols to be generated by the device. The low velocity electron beam is modulated by the charge pattern as it approaches the immediate vicinity of the pin face target in accordance with the character or symbol of the charge pattern which is scanned, a deflection system being provided to select under control of an exterior selection signal one or more of the available characters or symbols provided on the charge pattern. The low velocity beam is caused to reach substantially zero velocity in the vicinity of the target, where it is modulated by the charge pattern thereon and is returned by the electrostatic field in the device back in the direction of the cathode to be collected on a collector electrode. The signal derived from the collector electrode is thus in the form of video signal modulated in accordance with the symbol or character that is scanned.

Referring now to the drawings, and particularly to FIGURE 1 thereof, an electron discharge device in accordance with the instant invention is represented generally at 10, having a generally cylindrical glass envelope 11 which is evacuated in the well-known manner. The particular shape of the envelope 11 is not a particular part of the instant invention, and could be provided in any form which will accommodate the electrodes required by the invention and facilitate the operation of the device.

The evacuated envelope 11 contains an electron beam generating device 12 which preferably takes the form of a conventional electron gun construction, including a conventional cathode, control grids, and anodes necessary to generate and project an electron beam E along the tube envelope 11 toward a target 13 consisting of a pin face 14, a matrix 15 contacting the pin face plate 14 and an electrically conductive plate electrode 16 in contact with the other face of the matrix 15 and connected to a suitable potential. As illustrated in FIGURE 1, the target assembly 13 is positioned at the extreme end of the envelope 11 opposite to the beam generating means 12, and is sealed to the glass walls of the envelope 11 with suitable electrical connections to the plate electrodes 16 and the pin face 14 preferably extending directly out of the side walls of the envelope 11. Of course, other arrangements for supplying electrical potentials to these and the other electrodes of the device may be adopted without departing from the spirit and scope of the invention.

An electrically conducting coating 17 on the inside surface of the envelope 11 serves as an accelerating anode for the electron beam E and is connected to the positive side of DC voltage source 19 to provide the necessary relative potential with the beam generating means, which is connected to ground potential, to accelerate the beam along the axis of the evacuated envelope in the direction of the target assembly 13. Although not specifically illustrated in the drawings, a magnetic field generating means may be provided along the exterior of the envelope in concentric relationship to the accelerating anode 17 to provide an axial magnetic field within the tube envelope to focus the electron beam E from the beam generating means 12 to a small spot on the target assembly 13. However, as will be apparent from the following discussion, since extreme accuracy of alignment of the beam between the generating means 12 and the target assembly 13 is unnecessary under most circumstances, the provision of such a magnetic field generating means in connection with the instant invention is optional.

The device of the instant invention provides for protection of the electron beam E into the vicinity of the

target assembly 13 such that through application of the proper potentials to electrodes 17 and 18 the velocity of the beam in the vicinity of the target assembly 13 will become substantially zero. At this point, a modulation of the beam is effected and the beam is then returned along substantially the same path as it traveled from the beam generating means 12 to a point where it is intercepted by a collector electrode 20. In order to reduce the velocity of the electron beam E in the vicinity of the target assembly 13, a decelerating ring in the form of a conductive coating 18 on the inner surface of the envelope 11 between the target assembly 13 and the anode 17 is provided. The decelerating ring 18 is connected to a source of positive potential which is much lower than than the voltage to which the accelerating anode 17 is connected so that a deceleration of the beam as it passes from the area of the accelerating anode 17 to the area of the decelerating ring 18 and target assembly 13 occurs.

The pin face 14 is provided with a conductive back-ground which is preferably connected to ground potential along with the cathode in the beam generating means 12 so that in the absence of a charge pattern on the pin face 14, the electron beam E will return along substantially the same path as taken from the beam generating means 12 due to the voltage gradient produced between the pin face 14 and the decelerating ring 18 and anode 17 and will be intercepted by the collector electrode 20. However, if a charge pattern is placed upon the surface of the pin face 14 facing the beam generating means 12 and the beam is scanned across this charge pattern, in the areas of the pin face surface where the pins are charged to a positive potential, electrons from the beam E will be drawn to the pin face and therefore will be removed from the beam so that an appreciably smaller number of electrons will return to the collector electrode 20. As the beam passes over areas of the pin face 14 containing pins which are not externally charged, substantially all of the electrons from the beam will return to the collector electrode 20 so that as the beam is swept over the charge pattern a modulated signal is collected by the collector electrode 20, which signal represents the pattern over which the beam has passed.

As seen in FIGURE 2, the pin face 14 preferably consists of a plurality of closely spaced minute conductive pins which are electrically insulated from one another so that each pin may carry its own selective charge potential. A charge pattern is created on the surface of the pin face 14 by providing a matrix 15 containing apertures therein representing various characters and symbols, such as the letters of the alphabet, numerals, punctuation marks, etc., in contact with the surface of the pin face 14 so that a potential applied to the matrix 15 by conductive plate 16 is transferred to all of the pins in the pin face 14 which contact the matrix 15.

As is apparent, those pins which intercept the spaces in the matrix 15 representing the various characters or symbols will receive a negative potential from the beam, while pins contacting the matrix plate are held at a positive potential. The result is the creation of a charge pattern across the surface of the pin face 14 facing the beam generating means 12 with the various characters and symbols provided therein appearing as negatively charged areas.

As the beam generated and projected by the beam generating means 12 reaches the vicinity of the pin face 14 at zero velocity, it is modulated by the charge pattern on the pin face so that the returning beam intercepted by the collector electrode 20 represents the character or characters over which the beam has been directed. In order to provide selection of one or more of the characters or symbols in the charge pattern provided on the surface of the pin face 14, a magnetic deflection system 21 including a deflection control circuit 22 is provided on the exterior of the cathode ray device so that the beam may be horizontally and vertically deflected to cover any one

or any group or symbols in the charge pattern. While a magnetic deflection system is provided in the illustrated embodiment, it is apparent that the deflection of the beam to scan one or more characters in the charge pattern can also be effected with equal facility and response by an electrostatic deflection system of known construction providing orthogonally disposed electrostatic deflection plates.

While any known pin face construction having a plurality of closely spaced minute conducting pins disposed in insulated relationship to one another may be effectively utilized with the instant invention, a particular pin face construction has been used with particularly advantageous results with the instant invention. Looking to the partial sectional view of the target assembly 13 illustrated in FIGURE 4, the plate electrode 16 is seen to be in electrical contact with the matrix 15 having apertures 15a therein forming the various characters and symbols to be generated by the device in accordance with the invention. In contact with the face of the matrix 15 opposite to that of the plate electrode 16, is the pin face 14 which consists of a plurality of minute conducting pins 25 surrounded by a jacket 26 of electrically insulating material, such as glass, which jacket 26 is in turn surrounded by a sleeve 27 of conductive material, such as copper, stainless steel, or other suitable conductive metal. The conductive sleeves 27 in the pin face 14 are in electrical contact with adjacent conductive sleeves 27 of other pin assemblies in the pin face, so that the pin face 14 effectively consists of a metallic conductive disc formed by the interconnected electrically conductive sleeves 27 having a plurality of apertures therein into which the insulating glass jackets 26 containing the pins 25 are inserted.

With this construction, the pins 25 are accurately positioned and evenly spaced over the surface of the pin face 14 and are electrically insulated from the conductive portion of the disc which may be connected to ground potential along with the cathode of the beam generating means 12 thereby providing the reference potential for the positive charges applied to selective pins by way of the plate electrode 16 and matrix 15. Thus, in the absence of a charge pattern applied to the pin face 14 by the plate electrode 16 and matrix 15, a substantial portion of the surface of the pin face 14 will be at ground potential providing the necessary field gradient in combination with the decelerating ring 18 for return of the electron beam in its entirety to the collector electrode 20.

Since the charge pattern which is generated across the surface of the pin face 14 is derived from direct contact by the individual pins 25 with a positive voltage source by way of plate electrodes 16 and matrix 15, a high accuracy of representation of the characters to be generated by the device in accordance with the invention is provided for purposes of modulating the electron beam thereby providing a continuous dependable response with high resolution and accuracy not heretofore attainable in character generating devices of much less simplicity. In addition, by providing proper spacing of the characters on the matrix 15, extreme accuracy in the deflection system 21 and deflection control 22 is not necessary, thereby eliminating a need for special means for controlling the linearity of the path of the electron beam generating means 12 to the target assembly 13. However, as indicated above, if a large number of characters or symbols are provided on the matrix 15 requiring accurate control of the path of the electron beam due to the close spacing of these symbols, a magnetic field generating means (not shown) may be disposed about the envelope 11 of the discharge device to create an axial magnetic field guiding the electron beam along a linear path as determined by the deflection means 21.

It is also within the contemplation of the invention to provide a matrix 15' made of electrically insulating material and having the apertures thereof in the form of characters or symbols filled with a metal of good electrical

conductivity. In this case, the positive potential from plate electrode 16 will be transferred only to pins 25 in contact with the conductive fillings. The charge pattern produced on the surface of the pin face plate 14 will then appear as positive characters on an uncharged background. The disadvantage with this arrangement is that a negative signal is generated at collector electrode 20.

Although only one embodiment of the invention has been disclosed and described herein, it is to be expressly understood that various changes and substitutions may be made therein without departing from the spirit of the invention as well understood by those skilled in the art. For example, other pin face constructions than the one specifically disclosed and illustrated herein may be utilized in accordance with the invention, as well as other types of collector electrodes for the returning electron beam, for example, an electron multiplier collector electrode arrangement of the type well known in the art. Reference, therefore, will be had to the appended claims for a definition of the limits of the instant invention.

We claim:

1. A character generator in the form of an electron discharge device capable of generating a video signal representing a selective character or symbol, comprising:
 an evacuated envelope,
 target means positioned at one end of said envelope providing a charge pattern including a plurality of characters or symbols on one face thereof,
 beam generating and projecting means within said envelope for projecting an electron beam along the axis thereof toward said one face of said target means, and
 output means operatively associated with said target means for providing a signal representative of said charge pattern,
 said target means including aperture matrix means for creating said charge pattern, a pin face plate in contact with said aperture matrix means, and means for applying a predetermined potential to said aperture matrix means.

2. A character generator in the form of an electron discharge device capable of generating a video signal representing a selective character or symbol, comprising:
 an evacuated envelope,
 target means positioned at one end of said envelope providing a charge pattern including a plurality of characters or symbols on one face thereof,
 beam generating and projecting means within said envelope for projecting an electron beam along the axis thereof toward said one face of said target means, and
 output means operatively associated with said target means for providing a signal representative of said charge pattern,
 said target means being provided as a composite element including aperture matrix means for creating said charge pattern, a pin face plate having a plurality of conductive pins insulatively supported so as to be evenly spaced across the surface thereof, said aperture matrix means being in contact with the side of said pin face plate opposite said beam generating and projecting means, and means for applying a predetermined potential to said aperture matrix means such that said predetermined potential is applied to all pins contacting said aperture matrix means.

3. A character generator as defined in claim 2 wherein said aperture matrix means is in the form of a conductive electrode having a plurality of apertures therein in the shape of selected characters or symbols.

4. A character generator as defined in claim 3 wherein the apertures in said aperture matrix means are of sufficient size to each intercept a plurality of conductive pins in said pin face plate.

5. A character generator as defined in claim 2 wherein said aperture matrix means is in the form of an electrode of insulating material having a plurality of apertures therein in the shape of selected characters or symbols, said apertures being filled with an electrically conductive material.

6. A character generator as defined in claim 2 further including electron beam deflection means for scanning said electron beam over a selected one of the character charge images on said target means.

7. A character generator in the form of an electron discharge device capable of generating a video signal representing a selective character or symbol comprising:
 an evacuated envelope;

target means positioned at one end of said envelope providing a charge pattern including a plurality of characters or symbols on one face thereof,
 beam generating and projecting means within said envelope for projecting an electron beam along the axis thereof toward said one face of said target means,

electrode means positioned between said beam generating and projecting means and said target means for decelerating said electron beam to zero velocity at a point in proximity to said target means and for returning said electron beam in the direction of said beam generating and projecting means, and

collector means in the vicinity of said beam generating and projecting means for collecting the returning electron beam,

said target means including aperture matrix means for creating said charge pattern so as to effect modulation of said electron beam as it comes into proximity with said target means,

said target means being in the form of a composite construction including a pin face plate having a plurality of conductive pins insulatively supported within a conductive ground plane so as to be evenly spaced across the surface thereof, said aperture matrix means being in contact with the side of said pin face plate opposite said beam generating and projecting means, and means for applying a positive potential to said aperture matrix means such that said positive potential is applied to all pins contacting said aperture matrix means.

8. A character generator as defined in claim 7 wherein said means for applying a positive potential to said aperture matrix means includes a positive voltage source, said ground plane of said pin face plate and said beam generating means being connected to ground potential.

References Cited

UNITED STATES PATENTS

2,015,570	9/1935	Sabbah et al.	313—83	XR
2,925,507	2/1960	Keeran	315—21	XR
2,964,672	12/1960	Nixon	315—21	
2,976,447	3/1961	McNaney.		
3,284,658	11/1966	Winfield.		

RODNEY D. BENNETT, JR., *Primary Examiner.*

MALCOLM F. HUBLER, *Assistant Examiner.*

U.S. Cl. X.R.

315—21; 340—324.1; 313—86